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BASIC RESEARCH ARTICLE

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The mechanism of governments' and individuals' influence on protective behaviours during the second wave of COVID-19: a multiple mediation model

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ABSTRACT

Background: The SARS-CoV-2 virus continues to spread and resurge globally with signs of a second wave, despite actions by governments to curb the COVID-19 pandemic. However, evidence-based strategies to combat COVID-19 recurrence are poorly documented.
Objective: To reveal how governments and individuals should act to effectively cope with future waves, this study proposed a preventive model of COVID-19 resurgence.
Method: A questionnaire survey was conducted among 1,137 residents of Beijing, where the epidemic reoccurred. Structural equation model was used to explore the mechanism among government intervention, perceived efficacy, positive emotions, posttraumatic growth (PTG) and protective behaviours.
Results: Data analysis revealed that during COVID-19 resurgence, government intervention could directly and indirectly influence protective behaviours through individual factors (i.e. perceived efficacy, positive emotions), and PTG could mediate the indirect pathway to protective behaviours.
Conclusions: These findings implied that government intervention needs to be integrated with individual factors to effectively control repeated COVID-19 outbreaks.

El mecanismo de influencia de gobiernos e individuos sobre las conductas protectoras durante la segunda ola de COVID-19: un modelo de mediación múltiple

Antecedentes: El virus SARS-CoV-2 continúa propagándose y resurgiendo a nivel mundial con signos de una segunda ola, a pesar de las acciones de los gobiernos para frenar la pandemia de COVID-19. Sin embargo, las estrategias basadas en evidencia para combatir la recurrencia de COVID-19 están pobremente documentadas.
Objetivo: Para revelar cómo deben actuar los gobiernos y las personas para hacer frente de manera efectiva a futuras olas, este estudio propuso un modelo preventivo del resurgimiento de COVID-19.
Método: Se realizó una encuesta entre 1.137 residentes de Beijing, donde la epidemia volvió a ocurrir. Se utilizó un modelo de ecuación estructural para explorar el mecanismo entre la intervención del gobierno, la eficacia percibida, las emociones positivas, el crecimiento postraumático (CPT) y las conductas protectoras.
Resultados: El análisis de datos reveló que durante el resurgimiento de COVID-19, la intervención del gobierno podría influir directa e indirectamente en los comportamientos de protección a través de factores individuales (es decir, eficacia percibida, emociones positivas), y CPT podría mediar en el camino indirecto hacia los comportamientos de protección.
Conclusiones: Estos hallazgos implicaron que la intervención del gobierno debe integrarse con factores individuales para controlar de manera efectiva los brotes repetidos de COVID-19.

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COVID-19; reaparición; Intervención gubernamental; eficacia percibida; emociones positivas; crecimiento postraumático; conductas protectoras

关键词
COVID-19; 复发; 政府干预; 感知效能; 积极情绪; 创伤后成长; 保护行为

HIGHLIGHTS

- Active government interventions motivate people to take more protective behaviours.
- Posttraumatic growth is critical to cope with the repeated outbreaks.
- The integration of government and public helps to control the pandemic recurrence.

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第二波 COVID-19 期间政府和个人对保护行为的影响机制：一个多重调节模型

背景：尽管各国政府采取了遏制 COVID-19 疫情的行动，SARS-CoV-2 病毒继续在全球范围内传播和重新流行，并出现第二波疫情的迹象。然而，抗击 COVID-19 复发的循证策略却鲜有记载。
目的：为了揭示政府和个人应如何有效应对未来疫情，本研究提出了一种 COVID-19 复发的预防模型。
方法：对疫情再次发生的北京市1137名居民进行问卷调查。采用结构方程模型探讨政府干预、感知效能、积极情绪、创伤后成长（PTG）和保护行为之间的作用机制。
结果：数据分析显示，在 COVID-19 复发期间，政府干预可以通过个体因素（即感知效能、积极情绪）直接和间接影响保护行为，而 PTG 可以调节保护行为的间接途径。
结论：这些发现表明，政府干预需要与个体因素相结合，以有效控制 COVID-19 的反复爆发。

1. Introduction

The ongoing COVID-19 pandemic has led to serious damages and losses globally and caused, by 8 March 2022, 446,511,318 confirmed cases and 6,004,421deaths (WHO, 2022). During the past two years, most countries have actively carried out protective measures to contain the outbreak, including mask wearing, staying home, and social distancing (Clark et al., 2020). Effective as these measures are, the pandemic has not ended and even shows a trend of repeated waves (Middleton et al., 2020). The term 'wave of infection' has been characterised as 'a rising number of sick individuals, a defined peak and then a decline' (ABC News, 2020; BBC News, 2020a). For instance, in China, a sudden outbreak of positive cases near Xinfadi Market broke the peace of Beijing (WHO, 2020a). France and the Netherlands also encountered a more violent resurgence in August 2020 after several months of containment, with the maximum daily confirmed cases surging from 7,500–16,068 and from 1,988–3,293, respectively (WHO, 2020b; 2020c). In the second wave of the epidemic, destructiveness and fatality rate were reduced, and demographics of the afflicted shifted to a younger population (Akande et al., 2021; James et al., 2021; Saito et al., 2021; Soriano et al., 2021). However, new mutations of the coronavirus have emerged worldwide in subsequent waves, such as SARS-CoV-2 Variants B.1.351 and B.1.1.7, with increased severity and risk of reinfection (Yang et al., 2022). In addition, the psychological impact of the second wave of the epidemic left people at a higher risk for depression, anxiety and stress (Daly & Robinson, 2022; Elsayed et al., 2022; Rus Prelog et al., 2022), and researchers have even found a significant decrease in mental well-being from the first wave to further waves (Kozina et al., 2022). In general, human physical health and mental health are threatened insidiously by the recurrence of COVID-19. However, effective defense mechanisms remain unclear and urgently need to be addressed.

Upon the outbreak of COVID-19, to contain its development, we conducted a study and established a model for curtailing the pandemic (Dai et al., 2020). The model suggests that governmental measures can affect protective behaviours by improving individual perceived efficacy and positive emotions and reducing risk perception. However, this model was proposed in response to the initial COVID-19 outbreak. As COVID-19 is breaking out repeatedly and unpredictably around the world, it is urgent to further explore whether the established outcomes can be normalised in the period of recurrence as an effective measure. To this end, we further proposed an Active Interaction of Government and Individual Promoting Preventive Behaviour model (AGIB model) to investigate protective behaviours during COVID-19 epidemic recurrence. In this model, facing repeated outbreaks, the government taking constructive measures may improve individuals' perceived efficacy and positive emotions. What is worth mentioning is that, when facing long-term traumatic events, people could find benefits from adversities. Several studies have shown that most long-term survivors of cancer are able to see the good in the bad and to report positive consequences, including a better appreciation of life, a feeling of personal strength and a change of priorities (Gunst et al., 2016; Lelorain et al., 2012; Mols et al., 2009). Additionally, people who experienced natural disasters, such as earthquakes, hurricanes and floods, show positive changes and benefit from traumatic stressors (Cryder et al., 2006; Xu & Liao, 2011; Yu et al., 2010). Based on these findings, it is plausible to assume that in endless waves of the pandemic, when people have to live abnormal lives, they may gain growth, too. For instance, people could become more effective spouses and parents, since they must learn to balance work and family life during the pandemic (Rudolph et al., 2021). Lockdown and home quarantine also possibly make people cherish relationships with friends and families

more. Such benefits are commonly named as posttraumatic growth. According to the posttraumatic growth (PTG) conceptual model of positive outcomes of life crises and transitions (Schaefer & Moos, 1992; Zoellner & Maercker, 2006), individuals' perceived efficacy and positive emotions can bring positive psychological changes following traumatic events, such as appreciation of life (Zoellner & Maercker, 2006). In addition, the conceptualisation of meaning in the context of stress and coping identifies PTG as a coping strategy that can influence people's behaviour. Therefore, an important question to be explored is how this government intervention can enhance individuals' perceived efficacy and positive emotions to achieve PTG and then promote more recommended protective behaviours to control the spread of repeated outbreaks.

Positive government intervention can promote people's protective behaviours. Government intervention usually describes actions to restrict the severity or spread of the effects of the pandemic, such as releasing information timely, providing public opinion guidance and soliciting support from the mainstream media (Duan et al., 2020; ChinaDaily, 2020a). Research on COVID-19 in China revealed that government intervention measures, including providing detailed pandemic information and positive risk communication and mobilising social forces, government assistance and psychological support, were positively related to the public's adoption of protective actions (Dai et al., 2020; Duan et al., 2020). In contrast, a lack of information transparency can cause an increasing number of confirmed cases (Moon, 2020). Although many studies have examined the link between government intervention and protective behaviours, there have been few studies on the second and further waves of COVID-19. Faced with the resurgence of COVID-19, it is urgent to understand what strategies the government should adopt to mobilise the public to take effective protective action.

Perceived efficacy plays an important mediating role between government intervention and protective behaviours. First, existing studies indicate that government intervention regulates the public's perceived efficacy. Taking the H1N1 influenza epidemic as an example, the members of the public who approved of governmental policies, including the quarantining of hotel guests, had high self-efficacy (Lau et al., 2009). Second, changes in perceived efficacy can promote behavioural adjustment. In an Australian study, those who reported higher self-efficacy and response efficacy were more inclined to comply with avoidance behaviours and practice more hygiene-related behaviours (Seale et al., 2020). Whether perceived efficacy can mediate the relationship between government intervention and protective behaviours, especially in the context of repeated outbreaks of COVID-19, requires further research.

Positive emotions are important for promoting protective behaviours. First, active government intervention helps to improve people's emotional state. During the COVID-19 period, individuals who received disaster relief funds from the government had higher levels of regional belonging and pride (Kim et al., 2020). In addition, positive emotions are important predictors of behavioural engagement. It has been demonstrated in Turkish research that dispositional hope significantly and positively predicts protective behaviours (Yildirim & Arslan, 2020). Based on existing findings, we speculate that positive emotions may serve as another mediator between government intervention and protective behaviours. In the case of repeated outbreaks of epidemics, how to maintain a positive emotional state in individuals is a special issue that needs to be considered.

PTG may play a critical role in curbing repeated outbreaks of the pandemic. During the COVID-19 outbreak, the general public could generate a positive mental state despite adversities (Li et al., 2021). This positive mental state, which is defined as PTG, can be affected by individual factors and further promote health behaviours, according to theories. First, the conceptual model of positive outcomes of life crises and transitions recognises PTG as an outcome of trauma (Zoellner & Maercker, 2006). The model proposed some predictors of positive outcomes: environmental and personal system factors, which could influence cognitive appraisal processes and coping responses, and in turn affect the outcome of the crisis. The personal system includes sociodemographic characteristics and personal resources such as self-efficacy and positive emotions such as optimism and self-confidence. There is much empirical evidence to support this model. For example, studies have found that Chinese cancer survivors with higher self-efficacy are inclined to show greater PTG (Yu et al., 2014). Even during the COVID-19 period, having a higher level of self-efficacy is predictive of a resilient outcome (Robles-Bello et al., 2020). Additionally, positive emotions, including gratitude, hope and optimism, have a stable and general effect on PTG in the struggle with traumatic events, such as earthquakes and cancer (Ho et al., 2011; Yu et al., 2014; Zhou & Wu, 2016). Based on this, we are able to conclude that efficacy and positive emotions are both determinants of PTG. Second, the conceptual model of meaning in the context of repeated and sustained stress regards PTG as a coping strategy. In this model, Park and Folkman (1997) distinguish between situational (formed in the interaction with environment) and global meaning (enduing beliefs and valued goals). A traumatic event would threaten global meaning, thereby initiating the meaning-making

process. Within this framework, people could either find benefits from the traumatic event or change the situational meaning to accommodate the global meaning. Since mental processes interact with behaviours, it is plausible to presume that PTG helps people promote their behaviours. Empirically, an 8-year study demonstrated that men who perceived positive changes from their heart attacks made actual behavioural changes that decreased their risk of future heart attacks, suggesting that PTG could cause changes in health behaviours (Affleck et al., 1987). These theories and studies are enlightening in that PTG probably serves as a critical mediator between government intervention and protective behaviours, following efficacy and positive emotions. Additionally, this presents us with a problem to be solved regarding how the prediction effect works under the recurring and global COVID-19 pandemic.

To solve these problems, we conducted a study to examine the mechanism of governments' and individuals' influence on protective behaviours in the second wave of COVID-19. According to the AGIB model (Figure 1), we assume that correct guidance from the government and active cooperation with the public will effectively promote protective behaviours. Specifically, hypothesis 1 states that government intervention may positively predict the public's protective behaviours; hypothesis 2 states that perceived efficacy and positive emotions mediate the relationship between government intervention and the public's protective behaviours; hypothesis 3 states that government intervention positively predicts the public's protective behaviours through the chain mediating pathway of perceived efficacy and PTG; and hypothesis 4 states that government intervention positively predicts the public's protective behaviours through the chain mediating pathway of positive emotions and PTG.

2. Results

2.1. Correlations for all variables

Correlations among these factors are displayed in Table 1. The matrix shows that the correlation between any two factors is significant ($p < .01$). Specifically, governmental factors are positively associated with individual factors ($p < .01$). Both of them relate to the adoption of protective behaviours, including precautionary behaviours, avoidance behaviours, and disease management ($p < .01$). The three types of protective behaviours are correlated with each other significantly as well ($p < .01$).

2.2. Measurement model

The hypothesised measurement model contains 5 latent variables: government intervention, perceived efficacy, positive emotions, PTG, and protective behaviours. Each latent variable is measured by several indicators constructed based on existing theories or subscales. The latent construct of government intervention comprises transparent information, rumour refutation, positive communications, and governmental supplies. The observed variable of perceived efficacy uses self-efficacy and response efficacy. Indicators of positive emotions include gratitude, hope, responsibility, confidence, acceptance, and adaptation. PTG is measured through new possibilities, relating to others, personal strength, spiritual change, and appreciation of life. Protective behaviours have 3 observed variables: avoidance behaviours, precautionary behaviours, and disease management. The results indicated that all the values were within reasonable ranges ($\chi^2 = 705.654$, $\chi^2/df = 4.410$, RMSEA = 0.059, CFI = 0.974, TLI = 0.969, SRMR = 0.026); thus, the statistical analysis revealed a good model fit. Furthermore, we calculated the factor

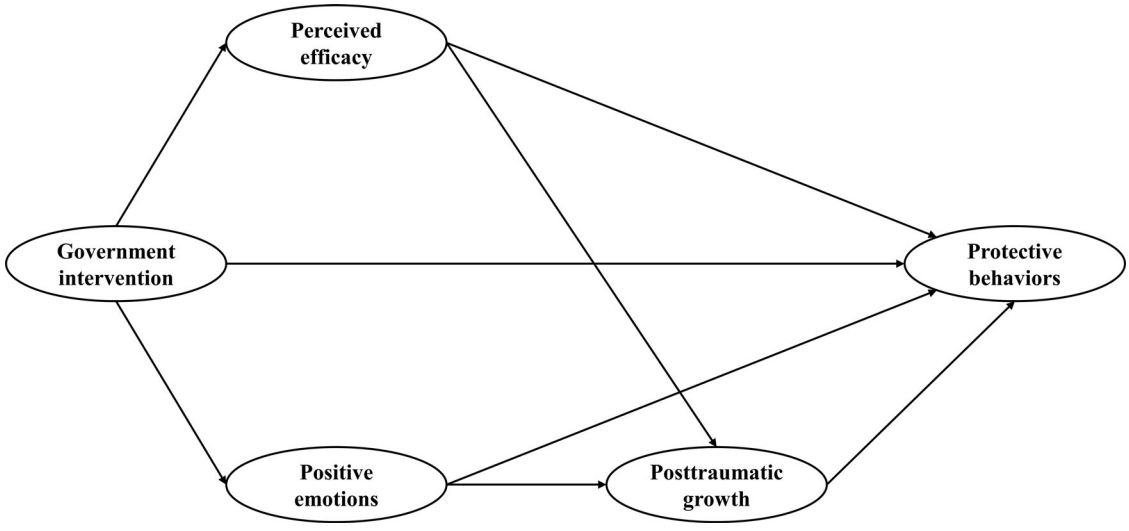

Figure 1. The hypothesised model of active interaction of government and individual promoting preventive behaviour.

Table 1. Correlation matrix of the variables.

Factors	1	2	3	4	5	6	7	8	9	10	11
1 Transparent information	1										
2 Rumour refutation	0.80**	1									
3 Positive communications	0.81**	0.81**	1								
4 Governmental supplies	0.73**	0.72**	0.76**	1							
5 Self-efficacy	0.54**	0.58**	0.58**	0.54**	1						
6 Response efficacy	0.61**	0.60**	0.62**	0.57**	0.81**	1					
7 Positive emotions	0.58**	0.62**	0.64**	0.60**	0.68**	0.70**	1				
8 Posttraumatic growth	0.57**	0.58**	0.63**	0.55**	0.69**	0.75**	0.75**	1			
9 Avoidance behaviours	0.55**	0.56**	0.58**	0.56**	0.60**	0.66**	0.66**	0.67**	1		
10 Precautionary behaviours	0.53**	0.52**	0.56**	0.54**	0.55**	0.63**	0.62**	0.63**	0.78**	1	
11 Disease management	0.49**	0.53**	0.55**	0.51**	0.58**	0.61**	0.68**	0.68**	0.70**	0.67**	1

Note: $^{**}p < .01$.

loading of government intervention, perceived efficacy, positive emotions, PTG, and protective behaviours. The results show that the factor loading is optimal, with the factor loading of government intervention, perceived efficacy, positive emotions, PTG and protective behaviours were 0.83–0.92, 0.87–0.94, 0.81–0.87, 0.81–0.85, 0.91–0.89, respectively. In general, the measurements used in the current study were of reasonably good quality.

2.3. Structural model

When evaluating the structural model, we analysed the significance of the entire AGIB model as well as the significance of the relationships and variance among the multiple factors in the model. According to the fit standards, our model fits well with the empirical data ($\chi^2 = 848.938$, $\chi^2/df = 3.329$, RMSEA = 0.045, CFI = 0.971, TLI = 0.967, SRMR = 0.042). Further, after controlling for the influence of gender, age, and other demographic variables, we found that 73.7% of the variance in protective behaviours could be explained by this model. All the direct and indirect effects on protective behaviours reached significance according to the bootstrapping results. The pathway coefficients within factors are displayed in Figure 2. First, government intervention has a direct effect on compliance with protective behaviours ($\beta = 0.17$, $p < .001$). Second, the total indirect effect in this model is significant ($\beta = 0.53$, $p < .001$). The results in Table 2 indicate that government intervention can influence engagement in behaviours through the mediation of perceived efficacy and positive emotions. Moreover, government intervention has an impact on behaviour adoption through multiple variables, with PTG mediating these paths. Specifically, government intervention was associated with behaviour adoption indirectly through perceived efficacy and PTG successively ($\beta = 0.10$, $p = .01$). Government intervention predicts behavioural engagement through the multiple mediators of positive emotions and PTG ($\beta = 0.07$, $p = .003$).

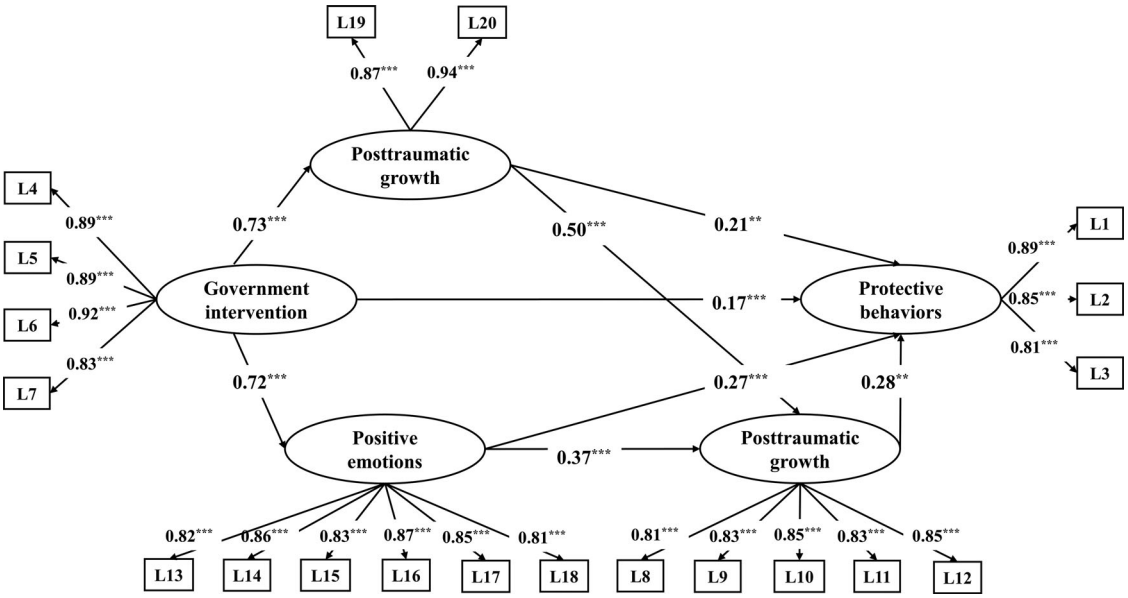

Figure 2. Standardised estimates and factor loading of the predicting model. Note: (L1: avoidance behaviour; L2: precautionary behaviour; L3: disease management; L4: transparent information; L5: rumour refutation L6: positive communications; L7: governmental supplies; L8: appreciation of life; L9: spiritual change; L10: relating to others; L11: new possibilities; L12: personal strengths; L13: gratitude; L14: hope; L15: responsibility; L16: confidence; L17: acceptance; L18: adaptation; L19: self-efficacy; L20: response efficacy). $^{**}p < .01$; $^{***}p < .001$.

Table 2. Standardised indirect effects and 95% confidence intervals.

Pathways	β	Bias-Corrected 95% CI
Government intervention → Perceived efficacy → Protective behaviours	0.15**	[0.04, 0.27]
Government intervention → Positive emotions → Protective behaviours	0.20***	[0.10, 0.29]
Government intervention → Perceived efficacy → PTG → Protective behaviours	0.10**	[0.03, 0.18]
Government intervention → Positive emotions → PTG→ Protective behaviours	0.08**	[0.03, 0.13]

Note: **$p < .01$; ***$p < .001$. CI: Confidence interval; PTG: Posttraumatic growth.

3. Discussion

This research innovatively investigated the roles of the government and individuals in curbing recurrence, based on which we proposed an AGIB model in response to the resurgence of COVID-19. Specifically, current government interventions are essential to improving individual perceived efficacy and positive emotions for combating repeated outbreaks, which, in turn, stimulates a positive mental state–PTG–and promotes protective behaviour compliance. These results revealed a sound mechanism to curtail the resurgence of COVID-19 and verified the proposed AGIB model. Practically, we also found that under unavoidable and repeated disasters, the government is expected to reinforce active guidance and inspire individual potential so that society can cope to the best of its ability.

First, government intervention can promote protective behaviours in the context of pandemic recurrence. In the current study, we observed that when the government refutes rumours timely, discloses information on the suspected and infected individuals, conveys positive messages, and provides sufficient supplies, the public engages in protective behaviours more frequently, including behaviours such as avoiding trips, washing hands, and gathering medical knowledge. Our result is consistent with previous research, in which government prevention and control and government rescue increased the likelihood of the public adopting recommended actions (Duan et al., 2020). Furthermore, another study, which was conducted in eight countries, including the U.S., revealed that government measures were not predictors of behavioural adherence by the public (Margraf et al., 2020). The reason may partly lie in the optimistic bias of the public, which could undermine individuals' motivation to engage in protective behaviours by decreasing both perceived risk and subsequent affective responses (Park et al., 2021). On the other hand, although governments are intervening in the epidemic, different measures result in divergence in compliance with protective behaviours, thereby producing diverse prediction effects. For instance, Sweden did not advocate communication of the pandemic with the public, as communication of uncertainty could raise fear (Lindstrom, 2020). Such avoidance of communication would strengthen the public's trust to the government, which in turn weakened their vigilance on the pandemic. Thus, people would take a rather relaxed approach with decreased personal effort, and no longer comply with protective behaviours as recommended (Hanson et al., 2021; Woelfert & Kunst, 2020). In the contrary, the British government failed to communicate uncertainty well with the public, weakening the public's trust in the government (Hanson et al., 2021). Meanwhile, there were diverse voices on policies and rapidly changing public health messages, only leaving the public with such confusion that they were not able to adopt correct behaviours (Hanson et al., 2021). Generally, all measures were carried out to better defend against COVID-19. However, some can yield great significance and are worth adopting, while some benefit the public little and needs to be suspended. In the new era when the pandemic is permeating our daily lives, an acknowledged and generalised defense policy should be established to face the unpredictable COVID-19 waves and natural disasters in the future. The most meaningful outcome of our research was a pandemic defense policy suitable for China, a combination of rumour refutation, positive communications, governmental supplies, and transparent information. Future research can investigate its applicability to other countries, in which it could be absorbed and modified properly to develop effective epidemic prevention and control policies best suited to the needs of other nations.

As the AGIB model suggested, we recommend that the government maintain an active coping position in defending against the recurrence of COVID-19. For example, from the very beginning of the pandemic recurrence at Xinfadi Market in Beijing, the government has constantly announced the number of confirmed cases and carried out contact tracing (ChinaDaily, 2020b), which may increase the government's credibility and make people more willing to adopt protective behaviours (Siegrist & Zingg, 2014). When a false message was spread that nearly 3000 positive results were linked to Xinfadi Market, the creator and spreader were detained by the police in Beijing to refute the rumour (ChinaDaily, 2020c). Such actions help the government foster a righteous image, promote confidence in the public, and motivate them to comply with protective behaviours (Greenhill & Oppenheim, 2017). Additionally, after the suspension of operations at Xinfadi Market, which provides large amounts of food products, six other large wholesale markets across the city moved quickly to increase their vegetable supply, and some cities in Hebei Province have taken steps to increase supplies of agricultural products to Beijing (ChinaDaily, 2020d, 2020e).

Such measures can encourage members of the public to actively improve their behaviour adoption by eliciting positive emotions (WHO Ebola Response Team et al., 2014; BBC News, 2020b), reducing the sense of insecurity and reinforcing public cohesion (Stockmann & Gallagher, 2011).

Afterwards, in early March and May 2021, a devastating second wave of COVID-19 broke out in Bangladesh and India, respectively, which were overwhelmed by a number of daily confirmed cases twenty times than of the previous average (WHO, 2021a, 2021b). The Bangladesh government implemented a nationwide intervention to fight against the second wave and closed public transport, educational institutions and other gathering sites (Daria & Islam, 2021). India received timely support from the WHO and other countries (WHO, 2021c). At present, the situations have improved in these two countries, with the number of new cases gradually decreasing. Under such circumstances, it is advised that the government continue to engage in active interventions, identify and quiet rumours, keep information transparent, keep the public informed of positive messages and offer supplies. In this way, the government can establish a sound image and increase trustworthiness to encourage frequent adherence to protective behaviours so that the resurgence can be contained effectively.

Second, government intervention could predict the adoption of protective behaviours by enhancing perceived efficacy and positive emotions in subsequent waves of the pandemic. According to the stimulus-organism-response model (SOR) (Mehrabian & Russell, 1974), external environmental factors can drive individual perception and emotions, thus influencing individual behaviour. According to this theory, repeated outbreaks of COVID-19 panic people, leaving them anxious and depressed (Mazza et al., 2020; Shechter et al., 2020; Zhou et al., 2020), while the uncertainty caused by the recurrence of the epidemic may reduce people's self-efficacy (Chen & Chen, 2020). All of these have a negative impact on epidemic prevention (Kwok et al., 2020). Current research has found that appropriate government intervention can enhance the public's positive emotions, such as hope, gratitude and confidence, improve their perceived efficacy and lead them to adopt more positive responses. This suggests that the government should increase the public's trust in government by providing transparent information and active communication, thereby reducing their sense of insecurity, enhancing the cohesion of public behaviour, and encouraging citizens to voluntarily take protective actions to fight against the epidemic.

Taking the repeated outbreaks in Beijing as an example, under the government measure of imposing a partial lockdown in the vicinity of the infected market, the public demonstrated strong belief in the government and displayed a sense of responsibility toward the collective good. They strengthened the management in residential communities regarding getting people in and out, suspended the operation of gathering places for entertainment and stayed decisively at home in this city (ChinaDaily, 2020f). Many residents volunteered to provide assistance to the locked-down communities to help maintain normalcy (ChinaDaily, 2020g). Therefore, it is recommended that the public place more emphasis on positive emotions and cultivate their efficacy to the fullest, which is beneficial to both enhancing their mental health and slowing the spread of the pandemic.

Last, government intervention can promote individuals' perceived efficacy and positive emotions to achieve greater PTG, which, in turn, is associated with more behaviour adoption in response to the resurgence of COVID-19. This result is consistent with the conceptualisation theory of PTG as the outcome of traumas and as a coping strategy. As the outcome of struggling with a crisis, PTG is predicted by self-efficacy and positive emotions. Such personal resources can exert their influence on cognitive appraisal and coping responses. Active cognitive-coping processes help people concentrate on the beneficial aspects of the resurgence of COVID-19 by employing strategies such as cognitive redefinition and positive comparisons to emphasise adaptive and favourable values. Especially in situations that are not easily resolved, the cognitive process can not only minimise the traumatic aspects of the pandemic but also bolster individuals' mood and self-esteem and confer PTG (Zoellner & Maercker, 2006). Besides, PTG can serve as a coping strategy influencing individuals' protective behaviours in the recurrent pandemic. With the meaning-making process being completed after the traumatic event, people's behaviour is likely to be motivated by perceived positive outcomes in direct relation to damaged and reconstituted beliefs (Zoellner & Maercker, 2006). Since PTG is central to promoting behavioural adherence and fighting the pandemic, it is recommended that individuals strengthen their resources for PTG as they face repeated outbreaks of COVID-19.

Although this research yielded significant progress theoretically and practically, there are still several limitations. First, considering the cross-sectional nature of the study, we are unable to empirically establish causal relationships between government intervention and protective behaviours. Thus, a cross-lagged model may be further employed to reveal a clear cause-and-effect conclusion. Second, since the results were obtained at a fixed time point, whether the relationships in the model are still effective in the long run remains questionable. Future research should retest the model and examine its robustness.

Third, it is worth noting that the scope of the current study should be treated with caution. When collecting data during the epidemic period in Beijing, all students were asked to go home and study online (ChinaDaily, 2020f), and the government advised high-risk groups such as the elderly to stay at home. These measures made adults aged 18–59, who had to work outside home, the main group in the active transmission chain and the main focus of our current research on protective behaviours during the pandemic. Although sociodemographic variables such as age were excluded, children, adolescents and the elderly, as important groups, may have their own unique characteristics in epidemic prevention. Future research should focus on these groups to achieve more reasonable and effective protection for them. Fourth, the results were reached based on a limited sample of subjects living in Beijing. However, given the worldwide resurgence, further research is required to ascertain whether the conclusions can help to contain the global pandemic on a wide scale. Accordingly, an international investigation may be needed.

4. Conclusion

In short, our study tested the mechanism of the promotion of protective behaviours, revealing the integrative role of active governmental and individual factors in the context of COVID-19 recurrence. It provides potential pathways to cope with recurrent events and has significance for theoretical innovation. Practically, this research shows that the unity of the government and individuals in actively responding to repeated outbreaks is an effective strategy for curbing the pandemic and defeating it.

5. Method

5.1. Data collection

This cross-sectional study was conducted from 25 to 29 June, 2020, by issuing an online questionnaire to the public, and a total of 1137 eligible participants living in Beijing completed the survey. The questionnaire started only after the subjects read and signed the informed consent form. The whole questionnaire collects demographic information and opinions on government intervention, perceived efficacy, positive emotions, PTG and protective behaviours. The demographic characteristics are displayed in Table 3.

Government intervention. Four subscales adapted from a well-established questionnaire were used to measure the public's perception of government intervention (Dai et al., 2020). The subscales are rumour refutation, transparent information, positive communications, and governmental supplies (Cronbach's α = 0.95).

Table 3. Demographic characteristics of 1137 participants.

Factors	Sample Size (N = 1137)	Percent (%)
Gender		
Female	486	42.74
Male	651	57.26
Age		
18~25	397	34.92
26~35	484	42.57
36~45	229	20.14
46~59	27	2.37
Marital status		
Married	640	56.29
Other	497	43.71
Educational background		
High school or lower	173	15.22
College/Technical school	269	23.66
University bachelor's degree	552	48.55
Master's degree or higher	143	12.57
Income		
No income	106	9.32
Below 4000	183	16.10
4000~10000	528	46.44
10001~20000	253	22.26
Above 20000	67	5.88

Note: SD: 'Standard deviation'.

Perceived efficacy. In defining perceived efficacy, we consulted the protection-motivation theory of efficacy (Rippetoe & Rogers, 1987). It is recognised that perceived efficacy describes individuals' confidence in their abilities to adopt behaviours and beliefs in the effectiveness of the protective behaviours they adopt; these are termed 'self-efficacy' and 'response efficacy', respectively. The subscale of self-efficacy is adapted from a widely recognised scale of generalised self-efficacy (GSES) (Schwarzer & Born, 1997), while the subscale of response efficacy is based on previous studies (Chen & Chen, 2020; Lee & You, 2020; Seale et al., 2020) (Cronbach's α = 0.91).

Positive emotions. Being characterised as approach-related, positive emotions were measured with items assessing gratitude, hope, responsibility, confidence, acceptance and adaptation (Davidson et al., 1990). To avoid memory bias within the long term and interactive effects with negative emotions within the short term (Diener & Emmons, 1984), we compromised and set the time instruction as 10 days (Cronbach's α = 0.94).

Posttraumatic growth (PTG). PTG level was measured with a modified version of the posttraumatic growth inventory (PTGI), which includes five observed variables: New Possibilities, Relating to Others, Personal Strength, Spiritual Change, and Appreciation of Life (Cronbach's α = 0.92) (Tedeschi & Calhoun, 1996).

Protective behaviours. Based on previous studies, the questionnaire was surveyed on four subscales (avoidance behaviour, precautionary behaviour, disease management) (Dai et al., 2020; Kwok et al., 2020; Lee & You, 2020; Li, Feng, et al., 2020) (Cronbach's α = 0.90).

All the subscales were evaluated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree), with a higher score indicating more adequate government measures, stronger perceived efficacy, stronger positive emotions, more positive psychological changes and more compliance with protective behaviours. Taken together, all the items in the whole questionnaire were created based on previous measurements and theories, exhibiting excellent reliability. Therefore, the questionnaire adequately reflects the relevant variables we need in the context of the COVID-19 pandemic.

5.2. Data analysis

Data analyses were conducted by SPSS version 24.0 and Mplus version 7.4. Pearson correlation analyses were performed to verify the associations between factors to facilitate structural equation model (SEM) analysis. The SEM analysis was conducted in two steps (Anderson & Gerbing, 1988; Lin, 2015). First, we tested the measurement model to examine whether the observed variables were properly chosen to indicate each of the latent variables. Second, we tested the structural model to evaluate the proposed links between the latent variables. The SEM is evaluated by indexes including χ^2, χ^2/df, Root Mean Square Error of Approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index (TLI), and Standardised Root Mean Square Residual (SRMR). The RMSEA and SRMR values less than 0.08 are considered indicators of a good model fit. Regarding CFI and TLI, values no less than 0.90 suggest a good model fit, whereas values above 0.95 indicate an excellent fit. In addition, a χ^2/df value less than 5 implies a fair model fit. Given that χ^2/df is problematic with large samples, the adequacy of the model is more dependent on other statistics. In addition, indirect effects were also calculated using bias-corrected bootstrapping (5000 bootstrap samples) with 95% confidence intervals (CIs). When the 95% CI does not include zero, this indicates a significant effect. To control the potential influences of the key sociodemographic variables on protective behaviours, we included gender, age, marital status, educational background and income as the covariates, which have previously been reported to be associated with protective behaviours during the pandemic (Chen & Chen, 2020; Clark et al., 2020; Cvetkovic et al., 2020; Lee & You, 2020; Zhong et al., 2020).

Ethics statement and consent

No review board was involved. Informed consent was obtained from participants.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data supporting the research are available from the corresponding author upon request. The data are not publicly available due to information that could compromise the privacy of participants.

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