


# Risk Perception, Media, and Ordinary People's Intention to Engage in Self-Protective Behaviors in the Early Stage of COVID-19 Pandemic in China

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**Objective:** This study aims to examine how risk perception is associated with engagement in preventative behaviors and testing during the COVID-19 pandemic in the early stage of the COVID-19 pandemic in China.

**Methods:** A cross-sectional survey was conducted in February 2020, eventually obtaining 1613 participants, participants' risk perceptions, demographics (sex, age, education level, marital status, and employment status), as well as their engagement in self-protective behaviors and testing were assessed.

**Results:** Risk perception significantly affected intention to engage in self-protective behaviors, the more risk people feel, the more likely they intend to take self-protective actions ( $\beta = 0.0423$ ;  $P < 0.01$ ), and simultaneously, people obtaining information on COVID-19 from Official microblogs and public accounts (OMPA) ( $\beta = 0.189$ ;  $P < 0.01$ ) and Online websites (OW) ( $\beta = 0.143$ ;  $P < 0.1$ ) were more inclined to take self-protective behaviors during the COVID-19 pandemic. It also showed that the interaction of risk perception and Online websites negatively affected the intention to engage in self-protective behaviors ( $\beta = -0.0374$ ;  $P < 0.05$ ), and conversely, the interaction of risk perception and Overseas media (OM) positively affected self-protective intention ( $\beta = 0.0423$ ;  $P < 0.1$ ).

**Conclusion:** There was a close relationship between the risk perception and the intention to engage in self-protective behaviors. At the same time, the use of media not only directly affected the intention to engage in self-protective behaviors but also moderated the impact of risk perception on the self-protection intention. Specifically, official media directly strengthened the intention to engage in self-protective behaviors. Online websites not only directly affected self-protection intention but also moderated the effect of risk perception on it. Although overseas media had no direct effect on self-protection intention, they moderated the effect of risk perception on it. These conclusions have policy implications for governments' response to the COVID-19 epidemic.

**Keywords:** risk perception, media, intention to engage in self-protective behaviors, COVID-19 pandemic, self-protective behaviors

## Introduction

Since the outbreak of the COVID-19 epidemic in Wuhan, China, two years ago, it has rapidly spread to the world and has had a profound impact on the world. It not only affected people's routine work, life, and study but also affected the world's economy and society profoundly.<sup>1-5</sup> Simultaneously, it also caused psychological problems such as stress disorder, fear, anxiety, worry, sleep disturbance, etc., around the world.<sup>6-11</sup> COVID-19 was a behavior-related contagious disease, meaning that you could reduce your chances of being infected or spreading COVID-19 by taking precautions and following specific protective behaviors.<sup>12</sup> Governments worldwide took precautionary measures such as lockdown, social distancing, wearing of facemasks, etc., to curb the spread of the virus.<sup>10,13,14</sup> Although the World Health Organization strongly advocated adopting protective behaviors, many individuals did not react positively,<sup>15</sup> which might lead to the further spread of the infection and cause a wider epidemic.<sup>16</sup> Therefore, research on the factors that promote and hinder the intention to engage in protective behaviors can help us understand individual behavior and promote protective behaviors.

## Risk Perception and the Intention to Engage in Self-Protective Behaviors

During the epidemic, scholars conducted extensive research on why people reacted differently to the epidemic,<sup>17,18</sup> and what factors affected their protection intention and protective behaviors.<sup>19–25</sup> Study suggested that protective behaviors were influenced by real or perceived risk. A lower perceived risk led to lower adherence to the intention to engage in protective behaviors, and a better understanding of higher risk perception led to higher possibilities of protective behaviors.<sup>26</sup> Risk perception has been widely established as a significant predictor of engagement in preventive health behaviors.<sup>27</sup>

Medical research showed that the development trajectory of an infectious disease was often determined by the behavior of the individual, which was closely related to the individual's risk perception.<sup>28–30</sup> During the epidemic, most people adopted various protective behaviors such as maintaining social distance, washing hands frequently, and disinfecting to avoid contagion.<sup>31–33</sup> But many people did not take protective measures, endangering their lives. The reason why people had completely different behaviors, in addition to differences in gender, age, and personality, an important difference was that their risk perception was completely different.<sup>16,31,34,35</sup> Research showed that protective behavior was closely related to risk perception and external media for obtaining COVID-19 epidemic information. Risk perception was important for precautionary actions, but risk perceptions were often biased.<sup>36</sup> Unrealistic optimism often resulted in a lack of poor protective behavior, and a pessimistic bias may lead to unnecessary mass scares.

## Protection Motivation Theory(PMT)

Theoretically, the relationship between risk perception and protective behavior is mainly explained by the Protective Motivation Theory(PMT).

Rogers introduced the Protection motivation theory (PMT) to explore the mechanism of protective behavior motivation when individuals face threat stimulation.<sup>37</sup> It has been widely used as a framework for predicting protective behaviors. The PMT held that whether to take protective behavior was mainly determined by an individual's motivation, while the motivation on whether to engage in protective behavior depends on two cognitive processes - threat appraisal and coping appraisal. Threat and coping appraisals could lead to adaptive or maladaptive responses, considered threats. Threat appraisal was an individual's cognitive process based on the threat level. It was affected by three factors: threat vulnerability, threat severity, and maladaptive rewards. The coping appraisal was described as an individual's ability to carry out protective behaviors when facing threats.<sup>38</sup> It depended on the perceived response efficacy and perceived self-efficacy.<sup>39</sup> According to Kim's definition, the perceived vulnerability was defined as the individual's perceived susceptibility to the threat. Perceived severity was defined as the individual's perceived seriousness of the possible threat. Maladaptive rewards were defined as the perceived benefits of maintaining current practices considered risky. For coping appraisal, response efficacy was defined as the perceived effectiveness of the behaviors recommended to minimize the impact of the threat. In contrast, self-efficacy was described as an individual's perceived ability to perform the recommended intention.<sup>40</sup> It should be pointed out that under normal circumstances, the motivation to take protective behaviors and taking protective behaviors in the PMT theory were independent processes, and there was an obvious decision-making process before taking action. Still, in an emergency such as major epidemics, the decision to take action and behavior could be performed synchronously.

Many studies applied and tested the protective motivation to estimate the behavioral intention to engage in self-protective behaviors.<sup>17,31,41,42</sup> In the COVID-19 pandemic, researchers showed that PMT was a powerful tool in analyzing preventive behaviors.<sup>12,43,44</sup> These studies showed that evaluation of the risk of threat and the individual's coping ability was closely related to protective behaviors. Some other studies explored the relationship between threat and coping appraisal and motivation for protective behaviors more nuancedly. A study from Iran showed that PMT accounted for 61.5% of the variance in intention to COVID-19 vaccination, and perceived response efficacy was the strongest predictor of COVID-19 vaccination intention.<sup>45</sup> Another study claimed that threat and coping appraisal were predictors of protective motivation for COVID-19 prevention behaviors.<sup>46</sup>

While PMT was created to explain the individuals' motivation to take protective behaviors to cope with threats, it was unclear whether it applied to the group or the whole society. A study in the consumption field during the COVID-19 epidemic, applying PMT to the social level, showed that individuals' preventative behaviors were influenced by how they

thought the threat should be regulated by the society to which they belonged.<sup>40</sup> It indicated that assessment of the threat and risk perception of the society also significantly influenced the intention to engage in protective behaviors. It implied that when we analyzed the relationship between risk perception and motivation to take protective behaviors, we need to consider social level factors. At the same time, the influence of social level risk on individual risk perception was largely realized by the influence of media.

## Media, Risk Perception, and the Intention to Engage in Protective Behaviors

Modern society was an information society, and the processing and differentiation of information was an indispensable part of daily life. In this fast-changing era, especially with the development of modern media and the rise of new media such as global media and We-media, it became the norm that everyone was caught up in the trend of information and often could not be alone. With the rise and vigorous development of mass media, mass media gained more significant influence. They became an essential source for people to obtain various information and one of the channels for ordinary people to understand current affairs.<sup>47</sup>

The dissemination of risk information through the media made people form a risk perception and thus made decisions on protective behaviors followed by implementing protective behaviors. In the risk perception of large-scale public health events, studies focused on the social amplification effect of the media in the process of communication.<sup>48</sup> Studies revealed that media reports sometimes reduced the public's perception of risk, further weakening their daily protective behaviors.<sup>49–53</sup> Specifically, a study showed that many older people's changes in risk attitudes towards COVID-19 and their behaviors in epidemic prevention and control also stemmed from media publicity and reports.<sup>54</sup> Restrictions on social media collection of information about social development might affect attitudes toward COVID-19 vaccination through exposure to disinformation and imbalanced arguments.<sup>55</sup> Problematic social media use was significantly associated with psychological distress both directly and indirectly.<sup>23</sup>

However, there was controversy over the role of the media in disseminating risk information. A Study showed that official and unofficial media played a different comprehensive role in the information dissemination process. The official media often disclosed relevant information to make people understand the real situation, which could alleviate people's anxiety, impetuosity, and fear. In contrast, unofficial information was more likely to spread false, inaccurate, and even distorted information.<sup>11</sup> Other studies also showed that the more information released by the official media, the more stable people were in crisis. For example, under the correct guidance of state media and the government, the public was optimistic about vaccination behavior.<sup>56,57</sup> However, another research showed that social media was a double-edged sword, playing an active role in promoting effective strategies for reducing social discrimination, prejudice, and inequality during the COVID-19 pandemic on the one hand, and may also provide grounds for misinformation and discrimination on the other hand.<sup>58</sup> In this way, the use of different media by the public to obtain information is closely related to the results of information dissemination. To a certain extent, different information dissemination channels may affect people's protective behavior during the COVID-19 pandemic. Unfortunately, apart from a small number of studies that focused on various effects of different types of media on risk perception and protective behaviors,<sup>11,16,59–61</sup> there was still a lack of further exploration on what effects and how different media types would affect them.

## New Theoretical Framework

PMT revealed the close link between risk perception and the intention to engage in self-protective behaviors (motivation) to a certain extent and confirmed that high-risk perception often led to more protective behaviors during the pandemic. However, the PMT theory had a flaw. It defaulted that individuals' judgment of risk was constant, but people's perception of risk also changed with the shift of the epidemic. The process from an individual appraisal of the current situation to the formation of risk perception to making protective decisions and behaviors was not a simple linear process.

Risk perception would be constantly adjusted and changed. That was, after the individual's initial risk perception was formed, he still received a large amount of information through the media and then repeatedly adjusted the risk perception. Therefore, the individual's perception of the current epidemic risk resulted from the processing of the information obtained through the media and combining it with the previous risk comprehensive judgment. Therefore, in the whole process, the media not only played an essential role in the formation of risk perception in the first stage, but it

also adjusted and moderated existing risk perceptions in the following stage, which affected the intention and self-protective behaviors.

Based on the previous analysis, we constructed a two-stage analysis model (Figure 1). In this model, risk perception affected the intention to engage in self-protective behaviors in both stages. For media, in the first stage, it directly affected risk perception and the intention to engage in self-protective behaviors. In the second stage, the media would continue to adjust and change risk perception and then affect the intention to engage in self-protective behaviors, which meant media possibly moderated the impact of risk perception on the intention to engage in self-protective behaviors.

According to the previous analysis, we propose Hypothesis 1: There was a strong link between risk perception and the intention to engage in self-protective behaviors.

Hypothesis 2: The relationship between media and the intention to engage in self-protective behaviors varies by media type.

Hypothesis 3: The media moderated the effect of risk perception on the intention to engage in self-protective behaviors.

## Materials and Methods

### Data

The data used in this study comes from the online survey of Public Perception of COVID-19 and Its Social Consequences in 2020, which was mainly aimed at understanding people’s perception of COVID-19 and its consequences after the outbreak of the epidemic. This survey was conducted in February and lasted for one week, eventually obtaining 1613 participants, who were adults over 18 years old, regardless of gender, class, or occupation status, covering almost all regions in northeastern, northern, eastern, central, southern, southwestern, and northwestern China. In order to gain public perception and the consequences of COVID-19 in a short period, this survey adopted an online survey with the snowball method.<sup>62</sup> Specifically, a QR code of the questionnaire through WeChat was generated and released to research group members’ WeChat group and QQ friend circles and further disseminated through them. Volunteers were recruited to fill out the survey questionnaire. Before they were accepted to fill, a short consent letter was provided to inform them of the purpose of the survey and that all information provided would be strictly protected according to the law. After deleting 76 missing surveys because more than one-third of questions were not answered, 1537 responses were used.<sup>11</sup> All data were processed by Stata 12.0.

### Measures

#### Dependent Variable

The intention to engage in self-protective behaviors. There was a set of subjective evaluation items that scale the intention to engage in self-protective behaviors in the questionnaire. It included four items, eg due to the epidemic, To what extent do you plan to follow the protective behaviors? In order to disinfect daily, wear masks, wear gloves and goggles when going out, and wash hands more frequently, the choices were inconsistent, inconsistent, neutral, consistent, and totally consistent. We coded

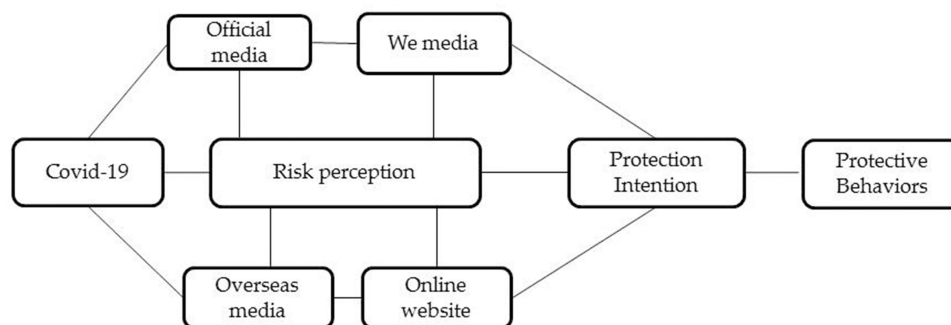


Figure 1 Media, Risk Perception and Self-Protective Behaviors Model.

them into 1 to 5. The scale's reliability was good, and the internal consistency was also high (Cronbach's alpha = 0.72, and the Kaiser–Meyer–Olkin value was 0.73), which indicated that these items were suitable for exploratory factor analysis. To aggregate the dependent variable Self-protective behaviors, we conducted exploratory factor analysis by principal component and varimax rotation. From the results (Please see the [Supplementary Files](#)), we could see that only the eigenvalue of factor 1 was larger than 1, which showed that only one factor could be extracted. Thus, we extracted this factor and referred to it as the intention to engage in self-protective behaviors according to the correlation of the indicators and their meanings. The factor score was saved as the dependent variable.

### Independent Variable

Risk perception. Based on previous researches,<sup>63–66</sup> following Dryhurst et al,<sup>29</sup> our dependent variable “Risk Perception of COVID-19” was measured by a set of subjective evaluation items that scaled the risk of COVID-19 were included. The first three items were as follows: “How do you agree that COVID-19 is highly infected/fatal/dead? How do you agree that getting sick with COVID-19 can be serious? ” They were measured on an ordinal scale with five possible answers: strongly disagree, disagree, neutral, agree, and strongly agree, coded as 1 to 5. The second 3 items were” How likely do you think it is that yourself/your friends and family/ordinary citizen will be directly affected in the future? “Alternative answers were arranged from not likely to very likely in 5 equal intervals, also coded as 1 to 5. How worried are you about the virus? Alternative answer arranged from not worried at all to very worried in 5 equal intervals, coded as 1 to 5. It showed that it was reliable to use this scale to measure the risk perception of COVID-19(Cronbach's alpha = 0.72. Then, we summed all the score and used it as the index of risk perception of COVID-19 drawing on previous researches.<sup>16,29,66</sup>

### Moderating variables

Information obtaining channels. There were four sources of information obtaining channels, namely, official microblogs and public accounts (OMPA), individual WeChat circles and microblogs(IWM), online websites(OW), and overseas media(OM). They were treated as dichotomous variables.

### Control Variable

Gender was used as a dichotomous variable (male coded as 0, female coded as 1). Education was measured as an ordinal variable (primary school or below, junior high school, high school, college, master's degree, or above). Age was measured as a ratio variable, and age squared was created as a control variable. Marital status, including single, married, divorced, and widowed, was used as a categorical variable, and single was used as the referenced group.

## Data Analysis Strategy

This study used the multiple linear regression model<sup>67,68</sup> and the OLS (ordinary least squares) method<sup>69</sup> to analyze people's intention to engage in self-protective behaviors. The specific expression is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_m M X_m \dots \dots + \beta_k X_n + \varepsilon$$

Y is the dependent variable of intention to engage in self-protective behaviors, X is the various independent variables that may affect people's intention to engage in self-protective behaviors,  $\beta$  is the relative influence coefficient,  $\beta_m M X_m$  is the moderating variable which is the interaction term between risk perception and media.

To explore the impact of risk perception on the intention to engage in self-protection behaviors, we established model 1 with only risk perception and control variables and added media variables to establish model 2 to explore the effects of various media on the intention to engage in self-protection behaviors. Model 3-Model 6 further were established to explore the moderating role of different media on the effect of risk perception on the intention to engage in self-protection behaviors.

## Results

### Descriptive results

From Table 1, we can see that there were 472 males in the sample, representing approximately 30.67%, and 1067 females, representing approximately 69.33%, and the chi2 test shows that there is no significant difference in the intention to engage in self-protective behaviors between them ( $P < 0.01$ ). Regarding education, only 3 belong to primary school, and below, 29 are a junior school, 82 are in senior high school, 970 belong to a college, and 455 are in post-graduate school. Respectively, the percentage is 0.19%, 1.88%, 5.33%, 60.03%, and 20.06%. At the same time, the chi2 test shows no significant difference in the intention to engage in self-protective behaviors between people of different education levels ( $P < 0.01$ ). Meanwhile, for marital status, 1097 are single, 420 are married, 18 are divorced, and 4 are widowed. There is a significant difference in the intention to engage in self-protective behaviors among different marital statuses ( $p < 0.05$ ). At the same time, 1239, about 80.51% of the people report that they obtain covid-19 information from official media, and 300, about 12.49% of the people report they never get information from official channels, simultaneously, 931, about 60.49% of the people report that they obtain covid-19 information from an unofficial channel, and 608, about 39.51% of the people report they never get information from an unofficial channel. Furthermore, 61, only about 3.96% of the people report they get information from overseas media, and, 1478, about 96.04% of the people report that they never obtain covid-19 information from overseas media. The Chi2 tests show that there is a significant difference between the people using official microblogs and public accounts or not ( $P < 0.01$ ), as

**Table 1** Description of the Data

	Frequency	Percentages	Mean	
Sex				$P < 0.01$
male	472	30.67	15.88	
female	1067	69.33	16.20	
Education level				$p < 0.01$
primary school and below	3	0.19	12.67	
junior school	29	1.88	17.72	
senior school	82	5.33	16.68	
college	970	60.03	16.01	
post graduate	455	20.06	16.11	
Marital status				$p < 0.05$
Single	1097	71.28	15.88	
married	420	27.29	16.69	
divorced	18	1.17	15.94	
widowed	4	0.26	16.50	
Obtaining information from Official microblogs and Public accounts(OMPA)				$p < 0.01$
Yes	1239	80.51	16.19	
No	300	19.49	15.76	
Obtaining information from Individual WeChat circles and Microblogs(IWM)				$P > 0.05$
Yes	931	60.49	16.71	
No	608	39.51	16.09	
Obtaining information from Overseas media(OM)				$P > 0.05$
Yes	61	3.96	16.01	
No	1478	96.04	16.70	
Obtaining information from Online websites(OW)				$P < 0.05$
No	1429	92.27	16.08	
Yes	119	7.73	16.37	
	Mean	Std Dev		
Risk perception	29.54	4.47		
Age	26.71	9.46		

well as a significant difference between the people using online websites or not ( $P < 0.05$ ). This result shows that people's intention to engage in self-protective behaviors may vary with the different media they use.

## Regression Results

### The Relationship Between Risk Perception, Media, and the Intention to Engage in Self-Protective Behaviors

There are two primary purposes of this study. First, we want to investigate whether risk perception affects self-protection intention. Second, we want to examine whether the channels of obtaining information moderate the impact of risk perception on self-protection intention. Therefore, we first built a model that included control variables and risk perception. Next, we built Model 2, which included obtaining information channels, that is, various media for obtaining information, to see what kind of media would directly impact self-protection intention. Then, we separately build another four models to test the moderating effects of media on the impacts of risk perception on self-protection intention.

In Table 2, from model 1, we could see that risk perception significantly affected the intention to engage in self-protective behaviors. The more risk people feel, the more likely they are to take self-protective actions. Hypothesis 1 is confirmed. In addition, compared with men, women were more inclined to take protective behaviors, and the higher the educational level, the more likely they intend to take protective behaviors. It showed that women were more cautious, and those with more education were more risk-aware and protective. At the same time, we also unexpectedly found that married people have relatively less protective behavior than single people.

The results of model 2 showed that risk perception still significantly affected self-protection intention. Simultaneously, the effects of media on self-protection intention vary by its type. Specifically, people obtaining information on COVID-19 from Official microblogs and public accounts (OMPA) and Online websites (OW) were more inclined to take self-protective behaviors during the COVID-19 pandemic. While those people using the individual

**Table 2** Regression Models of Self-Protective Behaviors

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Risk Perception	0.0355*** (0.00513)	0.0351*** (0.00517)	0.0425*** (0.00767)	0.0379*** (0.00534)	0.0332*** (0.00528)	0.0423*** (0.0103)
Official microblogs and public accounts (OMPA)(No=0)		0.189*** (0.0579)	0.186*** (0.0579)	0.192*** (0.0578)	0.192*** (0.0579)	0.466 (0.352)
Individual WeChat circles and microblogs(IWM) (No=0)		0.0322 (0.0459)	0.417 (0.301)	0.0359 (0.0459)	0.0328 (0.0459)	0.0316 (0.0459)
Online websites(OW) (No=0)		0.143* (0.0851)	0.145* (0.0851)	1.249** (0.564)	0.138 (0.0851)	0.145* (0.0852)
Overseas media(OM) (No=0)		0.134 (0.115)	0.134 (0.115)	0.139 (0.115)	-1.190 (0.761)	0.129 (0.115)
IWM×perception			-0.0131 (0.0102)			
OW×perception				-0.0374** (0.0188)		
OM×perception					0.0423* (0.0240)	
OMPA×perception						-0.00931 (0.0117)
Control variables <sup>+</sup>	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-3.587*** (0.600)	-3.734*** (0.601)	-3.939*** (0.622)	-3.804*** (0.602)	-3.674*** (0.602)	-3.941*** (0.655)
N	1537	1537	1537	1537	1537	1537
R2	0.073	0.081	0.082	0.084	0.083	0.087

**Notes:** \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$  <sup>+</sup> Control variables in these models included age, age<sup>2</sup> education level, marital status, etc. More details can be seen in the [Supplementary Files](#).

WeChat circles and microblogs(IWM) and overseas media(OM) to obtain information did not significantly affect the intention to engage in self-protective behaviors. Hypothesis 2 is confirmed.

### The Moderating Role of Media on the Effect of Risk Perception on the Intention to Engage in Self-Protective Behaviors

Model 3 to model 5 were constructed to test how media moderated the effect of risk perception on the intention to engage in self-protective behaviors. All these models consistently indicated that risk perception positively affected the intention to engage in self-protective behaviors. In model 3, the results showed that the interaction of risk perception and personal WeChat circles and microblogs(IWM) did not significantly affect the intention to engage in self-protective behaviors. The results of model 4 and model 5 showed that the interaction of risk perception and Online websites negatively affected the intention to engage in self-protective behaviors. Conversely, the interaction of risk perception and Overseas media(OM) positively affected self-protective intention. Furthermore, model 6 showed that interaction of risk perception and Official microblogs and public accounts did not significantly affect the intention to engage in self-protective behaviors. Hypothesis 3 is confirmed.

## Discussion

This study explored the relationship between the general public's perceived risk perception and the intention to engage in self-protective behaviors during the COVID-19 epidemic through the analysis of online survey data in the early stage of the epidemic.

Firstly, the study's results showed a significant positive correlation between the public's risk perception and intention to engage in self-protective behaviors. The higher level of the public's risk perception, the more inclined they were to take self-protective behaviors. This result was consistent with the previous studies.<sup>40,42,70</sup> Experience told us before the COVID-19 epidemic ultimately ended, maintaining a high-risk perception of COVID-19 and consciously taking self-protection behaviors in daily life probably was the best way to resist COVID-19 for ordinary people. The COVID-19 epidemic has lasted for two years may continue for a while before it is entirely over. However, in the past two years, people's self-protective behaviors varied by their different risk perceptions.<sup>71-73</sup> Those who thought COVID-19 was just a tiny cold with low-risk perception, had a significantly lower frequency of self-protective behaviors such as wearing masks and sanitizing hands than those with high-risk perception.<sup>15</sup> China has kept the infection rate of COVID-19 at a relatively low level for a long time.<sup>74,75</sup> In addition to the dynamic clearing policy at the national level, an important fact was that ordinary Chinese people had strong risk perceptions and were more willing to take self-protective behaviors in their daily lives. Therefore, at the theoretical and practical levels, it has been repeatedly shown that there was a strong positive relationship between risk perception and self-protective intention and behaviors.

Secondly, the study also revealed that different channels for ordinary people to obtain information about COVID-19 would have different effects on possible intention to engage in self-protective behaviors. Specifically, those who usually used Official microblogs, public accounts, and online websites to attain information had a higher likelihood of adopting self-protective behavior. In contrast, those who used personal WeChat circles, online websites, and overseas media to attain knowledge did not show a close correlation to the intention to engage in self-protective behaviors., official media directly enhanced the protection intention, while social media (including microblogs and WeChat circles) and overseas media did not. These conclusions were also consistent with the previous research.<sup>44,76,77</sup> An existing study showed that social media and other online news sources increased information overload amongst online information sources. This, in turn, negatively affected individuals' self-isolation intention by increasing perceived response costs and decreasing response efficacy, while official media never had such an effect.<sup>78</sup> At the same time, another study concluded that the use of social media platforms could positively influence the perception of public health behavioral changes and general protection against COVID-19.<sup>76</sup> Therefore, this study not only revealed that media played an important role in connecting to self-protective behaviors COVID-19 but also differentiated the effects of official media, online media, and overseas media on protection intention.



Furthermore, this study indicated the moderating effect of some media on the association between risk perception and self-protection intention. Specifically, official media positively affected self-protective intention and did not moderate the impact of risk perception on intention to engage in self-protective behaviors. Differently, the online website directly affected the self-protective intention and moderated the effect of risk perception on the intention to engage in self-protective behaviors. It was worth noting that although overseas media did not directly affect self-protection intention, they moderated the effect of risk perception on intention to engage in self-protective behaviors.

Some previous studies have paid attention to the moderating role in protective intention.<sup>40,77</sup> However, insufficient attention has been paid to the process between risk perception and self-protective intention. This study filled the space left by this previous study and contributed to revealing how media moderated the impact of risk perception on the intention to engage in self-protective behaviors.

What still needs further explanations on why some media had a moderating effect, some had a direct impact, and some had both effects simultaneously. Christian et al argued that metaphor, hyperbole, and irony contain both linguistic and cognitive content, and they could individually or “collaboratively” function as figurative framing devices in discourses.<sup>79</sup> Metaphorical framing was a subcategory of figurative framing, and its possible effect on recipients has been supported by several empirical studies.<sup>80</sup> In our opinion, the media per se may play two roles, one is the information itself, and the other is the metaphor behind the information. Research pointed out that, during the COVID-19 epidemic, to maintain social stability and people’s emotions, when releasing information related to the epidemic, the government would be very cautious, while, unofficial channels might exaggerate information related to the epidemic to catch the eyes or seek commercial interests.<sup>16</sup>

This meant that when we received official information about the epidemic, whether it was good news or bad news, its authenticity and authority were widely accepted without question. Interpretation of the message was consistent, and there is no metaphor behind the message. For Non-official information channels there was often inconsistency between the disseminated information per se and people’s interpretation of the information. Sometimes, Social media exaggerated the actual information, and the public did not believe it. Sometimes, Social media covered up the real information, and people panic excessively. This meant that the information released through Social channels might affect protective behavior. At the same time, people’s reinterpretation of relevant information would have another effect.

Therefore, we could see that the personal WeChat account and micro-blog account were not directly related to the intention to engage in self-protective behaviors. That is, they would not directly enhance or reduce people’s intention to engage in self-protective behaviors.

While the online websites as media were actually between the official media and unofficial media. Sometimes information transmitted by the website was true and credible, and sometimes it was not. It was difficult for ordinary people to distinguish. In the severe early stage of the epidemic, the vast majority of ordinary people would choose to believe possibly due to a shortage of authoritative information. Websites might exploit people’s trust for profit by covering up or exaggerating certain facts. That was why online websites not only directly affected protective behavior but also moderated the effect of risk perception on the protection intention.

Due to the strict control in China, the vast majority of ordinary residents could not have access to overseas media. Therefore, there was no significant correlation between overseas media and the intention to engage in self-protective behaviors. Those who took the initiative to go over the Great Fire Wall(GFW) to browse overseas media were biased and had suspicion and prejudice against official media. As expected, in the statistical model, overseas media moderated the impact of risk perception on the intention to engage in self-protective behaviors.

We have to admit that many factors affect people’s self-protection behaviors. In addition to people’s risk perception, differences in social systems and policies will lead to differences in people’s self-protection behaviors.<sup>15,71,77</sup> For example, in the early days of COVID-19, although people had the same perception of risk, different countries had different response policies. Some Western countries, such as the United States, only mandated that infected people wear masks, but ordinary citizens were not required to wear masks, differently in China, the state required that no matter who they were, they must wear masks equally.<sup>81</sup> Therefore, in a country that strictly implemented epidemic prevention policies, although people’s self-protection behavior was significantly affected by risk perception, it was more likely to be affected by national policies.

In addition, this study mainly focused on the relationship between people's risk perception and self-protection behavior in the early stage of COVID-19. Still, we should also see that more than two years have passed. Changes took place in varying degrees regarding the toxicity and infectivity of the virus itself, national epidemic prevention policies, and people's risk perception of covid-19.

At present, thanks to a wide range of vaccination and the emergence of specific drugs, the mortality caused by Omicron is decreasing, and most of the infected people are mild or asymptomatic infection.<sup>82</sup> People in many countries do not have special protection when they go out. Differently, the Chinese central government proposed to continue to implement the "dynamic clearing" policy strictly. Even though the influence of people in the Omicron has been greatly reduced, it was still strictly enforced to wear masks when going out. It suggested that our future research needed to take into account the impact of social policies.

This research also had some limitations. Firstly, the data in this study was completed through online surveys in a short time. Due to the overall unclearness and unclear boundaries of the online survey method, it was likely that the representativeness of this study had specific problems. For example, in the sample of this study, there was a gap in the gender ratio between men and women, and the respondent's education level was relatively high. These probably influenced the conclusions to some extent. At the same time, they were not fatal to this study, as these two indicators were not the core explained variables but just control variables and the conclusions drawn by this study were almost consistent with the previous research. Secondly, The data used in this research is cross-sectional data collected in the early stage of the epidemic. Would risk perception, media use, and self-protection behavior change over time, as well as the relationship between them? Due to the limitation of cross-sectional data, it could not be studied. However, was still worthy of future research through longitudinal data.

The conclusions of this article have some important implications for controlling the COVID-19 epidemic. Firstly, Self-protection is an important way for ordinary people to fight against the COVID-19 epidemic. Given the close relationship between risk perception and the intention to engage in self-protective behaviors, raising people's risk perception can greatly improve protective behaviors. Therefore, governments of all countries must increase people's self-risk perception. Secondly, because of the relationship between the media's risk perception and the intention to engage in self-protective behaviors, the government should be committed to building an information release and control system, especially on online and personal social media, to ensure that ordinary people can obtain accurate information about the COVID-19 epidemic.

## Conclusions

Through a study of online survey data during the early stage of the COVID-19 pandemic in China, we explored the relationship between people's risk perception, use of different media, and the intention to engage in self-protective behaviors. This study showed that there was a close relationship between them. The higher the risk perception, the more inclined people to take self-protective behaviors. At the same time, the use of media directly affected the intention to engage in self-protective behaviors and moderated the impact of risk perception on self-protection intention. Specifically, official media directly strengthened self-protection intention; online websites not only directly affect self-protection intention but also moderate the effect of risk perception on self-protection intention. Although overseas media had no direct impact on self-protection intention, they moderated the effect of risk perception on self-protection intention. The contributions of this study were not only to clarify the effect of risk perception and media on the intention to engage in self-protective behaviors but also to show how risk perception was moderated by the media, which in turn affected the intention to engage in self-protective behaviors, and this helps us to understand more about the mechanism how risk perception and media influenced the intention to engage in self-protective behaviors.

## Data Sharing Statement

The data presented in this study are available on request from the corresponding author.

## Institutional Review Board Statement

Ethical approval was obtained from the research ethics committee of Zhejiang Normal University (No. ZSRT2020055). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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## Disclosure

The authors declare no conflicts of interest.

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