



# The Relationship Between Meaning in Life and Health Behaviors in Adults Aged 55 Years and Over During the COVID-19 Pandemic: the Mediating Role of Risk Perception and the Moderating Role of Powerful Others Health Locus of Control

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## Abstract

**Background** Coronavirus disease 2019 (COVID-19) has impacted many people's meaning in life and health behaviors. This study aimed to verify the relationship among meaning in life (MIL), epidemic risk perception, health locus of control (HLC), and preventive health behaviors among older adults after the COVID-19 outbreak was declared a pandemic.

**Method** In this longitudinal study, 164 participants aged 55 years and above completed the following measures at time 1 (February 19, 2021) and one month later at time 2 (March 19, 2021): Meaning in Life in the Epidemic Questionnaire, Epidemic Risk Perception Questionnaire, Multidimensional Health Locus of Control Scale, and Health Behaviors Before and After the Epidemic Survey. Hayes' SPSS Process Macro was used to analyze the mediating effect of epidemic risk perception (model 4) and the moderating role of powerful others HLC in the mediation model (model 14).

**Results** The results showed that after controlling for gender, age, education level, and health behaviors at the baseline, risk perception had a significant mediating effect on the relationship between MIL and preventive health behaviors ( $\beta = .02$ ,  $SE = .01$ , 95% CI [.00, .04]). In addition, powerful others HLC had a moderating effect on the second half of the mediating effect ( $\beta = .02$ ,  $p = .02$ , 95% CI [.00, .03]). Specifically, compared to the older adults with low powerful others HLC, the risk perception of older adults with high powerful others HLC increased preventive health behaviors.

**Conclusion** Practitioners should adequately cultivate older adults' risk awareness and reinforce the importance of advice from doctors and professionals, thereby effectively enhancing the preventive health behaviors of older adults in China during the COVID-19 pandemic.

**Keywords** Coronavirus disease 2019 · Meaning in life · Risk perception · Health locus of control · Preventive health behaviors

## Introduction

Since late 2019, a global public health emergency (COVID-19) has resulted in significant changes in people's lives because of its infectivity and severity [1, 2]. During the pandemic, health-related behaviors have also changed [3].

To prevent the spread of the coronavirus, the World Health Organization advised the public to adopt certain health behaviors, including wearing masks, maintaining social distance, cleaning and disinfecting, and getting vaccinated [4]. These preventive health behaviors are highlighted as some of the most important strategies for reducing COVID-19 infectivity [5]. Although the overall mortality rate for COVID-19 is approximately 2–3%, it is higher among the older adult population [6, 7].

Older adults are described as a homogenous group, particularly vulnerable to coronavirus infection [8, 9]. Age-related changes result in chronic comorbidities and a reduced immune response, thereby leading to greater sensitivity to the novel coronavirus among older adults [10],

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Pandemic-related research on older adults is essential. Some cognitive factors play a crucial role in older adults' health behaviors during pandemics. Perceived risk affects their preventive health behaviors, such as wearing masks and washing hands, which may increase the risk of contracting COVID-19 [11]. Older adults tend to believe that their health primarily depends on powerful others, such as doctors [12]. It is particularly imperative to examine the cognitive mechanisms that influence health behaviors among older adults during the pandemic. However, there is a lack of existing studies. Therefore, it is important to examine the relationship and mechanism between meaning in life and health behaviors among older adults.

## Meaning in Life and Preventive Health Behaviors

Meaning in life refers to people's concerns with the core significance and purpose of their personal existence [13, 14]. Experiencing pain and overcoming it helps people discover meaning in life [15]. The COVID-19 pandemic has had a huge global impact, bringing profound changes to our lives and meaning in life [16]. People began to dissect and clarify the intricacies of their lives and re-evaluate the value and meaning in life [17].

Meaning in life may increase an individual's positive attitudes toward health, increase health-oriented behaviors (healthy eating and exercise), and reduce risk behaviors that are detrimental to health [18, 19]. Such an effect also exists in the context of the pandemic. Studies have shown that having a stronger sense of meaning in life was associated with greater intention to engage in preventive health behaviors [20, 21]. One longitudinal survey of 7,220 participants ranging in age from 18 to 65 + found that meaning in life helped individuals adopt beneficial preventive health behaviors to protect themselves from COVID-19 [22]. The COVID-19 pandemic has had a huge global impact, bringing profound changes to our lives and meaning in life [17], and people's health behaviors have also been significantly affected [3, 23, 24]. Meaning in life during the COVID-19 pandemic can indirectly affect health behaviors through one's health values [20]. However, the mechanism of how meaning in life during the pandemic has affected health behaviors has received minimal research attention, specifically, with regard to older adults.

## The Role of Risk Perception

Risk perception refers to a subjective assessment or value judgment of an individual's exposure or potential exposure to a particular risk [25, 26]. Currently, the COVID-19

pandemic is shaking the foundation of global public health governance, and the government's management of risk communication must be based on science [26]. Both epidemic risk perception and meaning in life have an impact on health behaviors, and there is an inextricable relationship between the two. However, few studies have verified both meaning in life and epidemic risk perception as they relate to health behaviors.

The health belief model has been used to explain the adoption of preventive health behaviors [27, 28]. The model proposes that preventive health behaviors that are adopted by individuals in response to threats include two cognitive stages: assessing the severity of the outcome of the threat (i.e., risk appraisal) and evaluating the effectiveness and feasibility of preventive actions (i.e., coping appraisal) [29, 30]. Health belief models can also explain health prevention behaviors during the COVID-19 pandemic. An online survey among Chinese people found correlations between people's assessment of risk and subsequent preventive behaviors. In other words, people with a higher risk perception were more likely to engage in preventive behaviors [11]. Qualitative studies of heterogeneous samples from the UK and Nigeria found that participants who considered the vaccine useful were willing to get vaccinated despite the possibility of experiencing soreness and itchiness, whereas participants who were unwilling to get vaccinated reported many barriers to vaccination [31].

## The Role of Health Locus of Control

Health Locus of Control (HLC) is the extent to which an individual believes their health is determined by themselves or external sources. It comprises three dimensions: internal HLC (personal effort and ability), powerful others HLC (doctors or physicians), and chance HLC (chance or fate) [23, 32].

Internal HLC has been shown to be positively associated with health behaviors, while chance HLC was found to be negatively associated with health behaviors [33, 34]. However, to the best of our knowledge, the relationship between powerful others HLC and health behavior needs further exploration. Some researchers have argued that higher powerful others HLC can promote healthy behaviors such as a healthy diet and exercise [35, 36], whereas others suggested that higher powerful others HLC may result in a decline in healthy behaviors [37, 38]. Therefore, this study hypothesized that powerful others HLC may not directly promote or reduce health behaviors but may regulate the relationship between other variables and health behaviors. For older adults, the impact of powerful others on health behaviors is particularly important. A cross-sectional study of 5,542

older adults found that the older the age, the higher the powerful others HLC score. One possible explanation is that diseases and physical limitations increase with age, making older individuals more dependent on the health care system and more likely to trust powerful others, such as doctors [12]. However, it remains to be examined whether powerful others HLC affects older adults' preventive health behaviors in the context of a pandemic.

## The Present Study

Based on identified gaps in the literature, this study aims to examine the influence of older adults' meaning in life on their health behaviors after the COVID-19 outbreak was declared a pandemic, and to identify the mechanism of this relationship by investigating the roles of risk perception and HLC.

This study aimed to verify the mechanisms in the relationships between meaning in life, perceived risk, powerful others HLC, and preventive health behaviors in the context of the COVID-19 pandemic. As such, the following research hypotheses were proposed:

- Hypothesis 1: In the context of the COVID-19 pandemic, older adults' risk perception mediates the relationship between meaning in life and preventive health behaviors.  
Hypothesis 2: Powerful others HLC moderates the relationship between older adults' risk perception and preventive health behaviors.

## Methods

### Participants

The participants were drawn from 14 provinces in China. We posted recruitment advertisements through social media, and interested participants were asked to fill out a screening questionnaire. The inclusion criteria were (1) older adults aged 55 years or older, (2) no cognitive impairment or major physical or mental illness, and (3) capable of using a smartphone to complete the survey questionnaire. A total of 273 participants met the criteria and completed the baseline questionnaire (at T1): 72 (26.4%) were male and 201 (73.6%) were female, with an age range of 55–86 years ( $62.47 \pm 5.29$ ). The survey was conducted between February 19 and March 19, 2021.

The study was pre-registered on the Open Science Framework ([osf.io/4cs6y](https://osf.io/4cs6y)). This study was approved by the human research ethics committee at [blinded for review].

### Data Collection

Data collection was conducted through two waves of longitudinal surveys one month apart. At T1 (February 19, 2021), 273 participants completed an informed consent form online. We then sent participants a link to the pre-test survey via “WeChat,” a social networking application, and asked them to fill it out within 24 h. The pre-test survey included demographic items, the Meaning in Life in the Epidemic Questionnaire, Health Behaviors Before and After the Epidemic Survey, and Epidemic Risk Perception Questionnaire. One month later, at T2 (March 19, 2021),<sup>1</sup> we sent participants a link to the post-test survey. Participants had 24 h to complete the post-test survey, similar to T1. One hundred sixty-four participants who completed all surveys received China Yuan (CNY) 25 as remuneration.

### Measures

**Meaning in Life in the Epidemic Questionnaire** Lü [20] adapted the Meaning in Life Questionnaire [39] to assess meaning in life during an epidemic. The questionnaire contains 10 items (e.g., “The epidemic has made me understand that I am searching for a purpose or mission in my life”) that are responded to using a 7-point Likert scale, ranging from 1 = not at all to 7 = fully. The Cronbach's alpha for the scale in this study was 0.923 and 0.940 for T1 and T2, respectively.

**Health Behaviors Before and After Epidemic Survey** This questionnaire was developed by Lü [20] based on COVID-19. It contains 12 items and is divided into two dimensions: pre-epidemic and post-epidemic health behaviors. The questionnaire assesses preventive health behaviors such as wearing masks, eating together, and washing hands before and after the outbreak. An example item is “After the COVID-19 outbreak, I developed the habit of washing my hands and disinfecting myself regularly, and I will maintain this habit after the epidemic is over.” The questionnaire uses a 5-point Likert scale to respond to the items, ranging from 1 = not at all to 5 = completely. The Cronbach's alpha for the scale in this study was 0.720 and 0.732 at T1 and T2, respectively.

**Epidemic Risk Perception Questionnaire** Zhen and Zhou [40] developed a risk perception questionnaire for the COVID-19 pandemic. The questionnaire contains 15 items that are responded to using a 5-point Likert scale, ranging from 1 = not at all to 5 = fully. An example item is “The

<sup>1</sup> According to the WHO, on March 11, 2020, the rapid increase in the number of cases outside China led the WHO Director-General to announce that the outbreak could be characterized as a pandemic.

novel coronavirus can kill those who are infected.” The scale has been shown to have good reliability, with a Cronbach’s alpha of 0.737 and 0.805 at T1 and T2, respectively.

**Multidimensional Health Locus of Control Scale Form A** This scale is one of the most widely used scales for the assessment of HLC [41]. Multidimensional Health Locus of Control Scale Form A consists of three subscales: Internal HLC, Powerful Others HLC, and Chance HLC. Only the Powerful Others HLC subscale was used in this study. An example item is “Having regular contact with my physician is the best way for me to avoid illness.” Items are responded to using a 6-point Likert scale, ranging from 1 = strongly disagree to 6 = strongly agree. The reliability of the Chinese version of the MHLC is acceptable [42]. The Cronbach’s alpha for the scale in this study was 0.842 and 0.842 at T1 and T2, respectively.

### Data Analysis

First, to test the attrition effect, chi-square tests were performed for the binary variable (gender) and the ordinal variable (education level) between the drop-out sample and the completed sample. Independent sample *t*-tests were performed for the continuous variable (age), and multivariate analysis of variance was performed for other continuous variables (meaning in life, powerful others HLC, and health behaviors).

Second, Hayes’ SPSS Process Macro 2.16.3 was used to analyze the mediating effect [43]. Meaning in life at T1 was the independent variable, epidemic risk perception at T2 was the mediating variable, and preventive health behaviors at T2 was the dependent variable (model 4). Health behaviors before the pandemic, age, gender, and education level at T1 were controlled for. Bias-corrected bootstrapping with 5,000 resamples was chosen to establish 95% confidence intervals (CIs) for direct, indirect, and total effects [44].

Third, conditional process analysis [45] was used to examine the potential moderating role of powerful others HLC in the mediation model (model 14). Mediated moderation was tested with epidemic risk perception at T2 as a mediator in the relationship between meaning in life at T1 and health behaviors during the pandemic (T2), whereas powerful others HLC at T1 was a moderator in the relationship between epidemic risk perception and health behaviors during the pandemic. To test the interaction between risk perception and powerful others HLC, the simple slope test was used.

## Results

### Attrition Analysis

Of the 273 participants who completed the pre-test, 164 (60.07%) completed the post-test questionnaire (42 men and

122 women; mean age = 62.93, *SD* = 5.37, range = 55–86 years). The demographic information is listed in Table 1. No significant differences in age, gender, education, meaning in life, COVID-19 risk perception, and health behaviors after the COVID-19 outbreak were found between the completion (164) and drop-out groups (109). Further analysis was performed on data from participants who completed all questionnaires.

### Descriptive Statistics

Table 2 provides the descriptive statistics and inter-correlations of the key variables. The mean for preventive health behaviors at T2 ( $28.01 \pm 2.71$ ) was significantly higher than the mean at T1 ( $18.51 \pm 5.94$ ). Meaning in life at T1 was significantly correlated with risk perception at T2 ( $r = 0.16$ ,  $p = 0.042$ ), risk perception at T2 was significantly correlated with health behaviors at T2 ( $r = 0.41$ ,  $p < 0.001$ ), and risk perception at T2 was significantly correlated with powerful others HLC at T1 ( $r = 0.19$ ,  $p = 0.015$ ). Age, gender, and level of education did not significantly correlate with health behaviors before or after COVID-19 and health behaviors after the COVID-19 pandemic ( $p > 0.05$ ).

### Mediation Analysis

After controlling for the effects of demographic characteristics (age, gender, and education level) and health behaviors before the COVID-19 pandemic at T1, meaning in life at T1 positively correlated with COVID-19 risk perception at T2

**Table 1** Demographic profile of the participants

Characteristic	<i>N</i>	%
Gender		
Male	42	25.6
Female	122	74.4
Age		
55–65	107	65.3
66–75	54	32.9
76+	3	1.8
Education level		
Primary and lower	7	4.3
Middle school	86	52.4
College	55	33.5
Undergraduate	14	8.5
Master degree or above	2	1.2
Living situation		
With spouse	109	66.5
With offspring	11	6.7
With spouse and offspring	33	20.1
Live alone	11	6.7

**Table 2** Descriptive statistics and inter-correlations of the key variables

Key variables	1	2	3	4	5	6	Mean	SD	Range
1. Age (T1)							62.93	5.38	55–86
2. Level of education	-.25**								Primary school–Master
3. Health behaviors before COVID-19 (T1)	.09	-.12					18.51	5.94	6–30
4. Meaning in life (T1)	-.03	-.05	.01				50.73	11.22	16–70
5. Risk perception (T2)	-.05	.11	.03	.16*			59.76	6.30	42–75
7. Powerful others HLC (T1)	.09	-.16*	-.04	.29**	.19*		22.26	4.43	8–32
7. Health behaviors after COVID-19 (T2)	.15	-.14	-.03	.19*	.41**	.19*	28.01	2.71	15–30

\**p* < .05; \*\**p* < .01

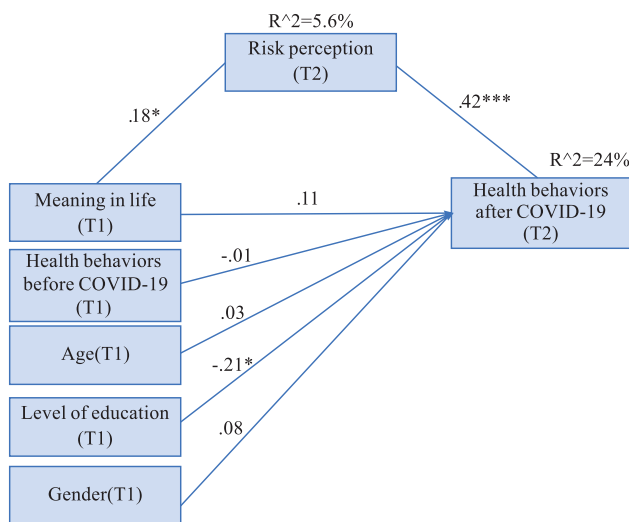
( $\beta=0.18$ ,  $SE=0.08$ ,  $t=2.34$ ,  $p=0.021$ ), and risk perception at T2 positively correlated with health behaviors during the COVID-19 pandemic at T2 ( $\beta=0.42$ ,  $SE=0.07$ ,  $t=5.89$ ,  $p<0.000$ ). The indirect effect of meaning in life at T1 on health behaviors at T2 via risk perception at T2 was significant ( $\beta=0.08$ ,  $SE=0.04$ , 95% CI [0.01, 0.17]). Furthermore, meaning in life at T1 was not significantly correlated with health behaviors after COVID-19 at T2 ( $\beta=0.11$ ,  $SE=0.07$ ,  $t=1.55$ ,  $p=0.12$ ), indicating full mediation. After controlling for gender, age, level of education [46], and health behaviors at T1, 24% of the variance in health behaviors at T2 was explained (Fig. 1).

**Conditional Process Analysis**

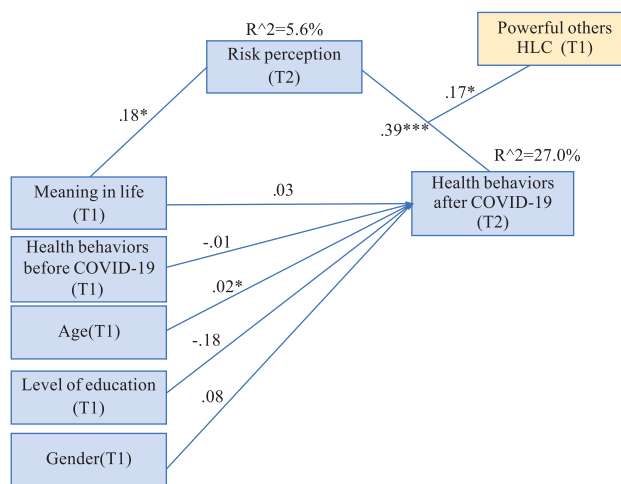
To examine the moderating effect of powerful others HLC on the mediation model, a conditional process analysis (Fig. 2) was conducted. The interaction between COVID-19

risk perception at T2 and powerful others HLC at T1 was significantly correlated with health behaviors at T2 ( $\beta=0.17$ ,  $SE=0.07$ ,  $t=2.44$ ,  $p=0.016$ ), accounting for 27% of the variance in preventive health behaviors at T2. The indirect effect of the moderated mediation was significant, and the confidence interval does not contain zero (95% CI [0.00, 0.10]).

A simple slope test (Fig. 3) was conducted to further examine the moderating effect of powerful others HLC. The results showed that compared to older adults with lower powerful others HLC ( $\beta=0.04$ ,  $SE=0.03$ , 95% CI [-0.00, 0.13]), older adults with higher powerful others HLC ( $\beta=0.10$ ,  $SE=0.06$ , 95% CI=[0.02, 0.24]) had a steeper slope between risk perception at T2 and health behaviors at T2. This indicated that older adults with higher powerful others HLC reported more preventive health behaviors as they perceived higher COVID-19 risk.

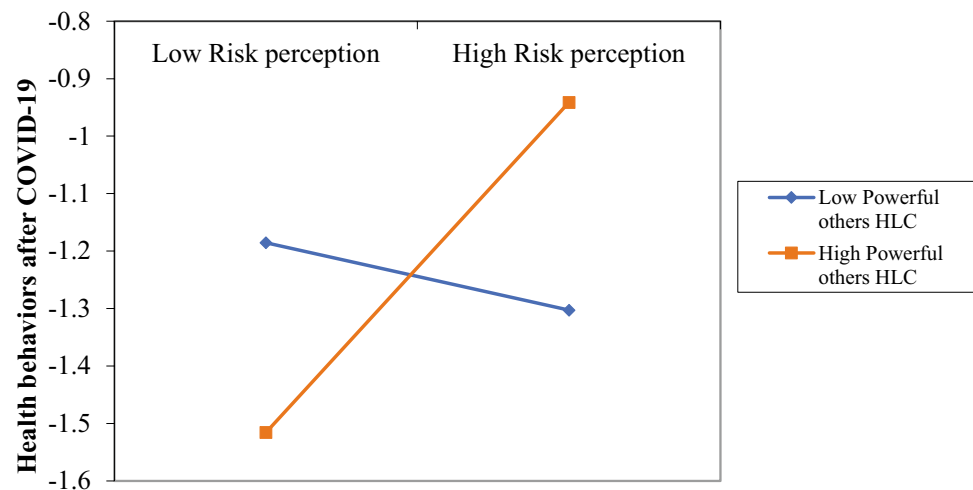


**Fig. 1** Mediation analysis of effect of meaning in life and health behaviors after COVID-19 via risk perception, controlling for baseline health behavior, age, level of education, and gender. Bootstrap 5000 resamples (*n* = 164). \**p* < .05, \*\**p* < .01, \*\*\**p* < .001



**Fig. 2** Model of the mediating role of risk perception and the moderating role of powerful others HLC between meaning in life and health behaviors after COVID-19, controlling for baseline health behavior, age, level of education, and gender. Bootstrap 5000 resamples (*n* = 164). \**p* < .05, \*\**p* < .01, \*\*\**p* < .001

**Fig. 3** Interaction of risk perception and powerful others HLC (HLC) on health behaviors after COVID-19



## Discussion

Based on the health belief model and the promoting effect of meaning in life on preventive health behavior [20, 21], this study selected older adults as the study population and constructed a moderated mediation model to verify the correlation between meaning in life and health behaviors during the COVID-19 pandemic. This study found that the preventive health behaviors of older adults increased significantly after the pandemic compared to those before the pandemic. This study also demonstrated the mediating role of risk perception and the moderating effect of powerful others HLC on the mediated relationship (the latter half path).

### Meaning in Life and Preventive Health Behaviors

In this study, it was found that older adults' meaning in life was related to preventive health behaviors during the pandemic. The higher their meaning in life, the more likely older adults will adopt preventive health behaviors, such as wearing a mask, not eating wild animals, and disinfecting. This is consistent with prior results [20, 21]. Loneliness caused by staying at home and social distancing is one of the psychological effects of the COVID-19 pandemic [47], and can particularly affect the lives of older people [48, 49]. However, meaning in life as a psychological resource can buffer loneliness and promote preventive health behaviors [21]. In addition to increasing individual health and psychological well-being [21], meaning in life may reduce the likelihood of transmission, thereby promoting public health because of the motivation to adopt preventive health behaviors, which is crucial during a pandemic.

### The Mediating Effect of Risk Perception

The results supported hypothesis 1 that in the context of the COVID-19 pandemic, older adults' risk perception fully mediated the relationship between meaning in life and preventive health behaviors. As a psychological resource, meaning in life can promote preventive health behaviors during the COVID-19 pandemic [25]. The results are consistent with the health belief model. According to the model, risk perception and coping appraisal will encourage people to adopt preventive health behaviors [29]. In this study, meaning in life was found to be an antecedent variable of risk perception related to health behaviors during the COVID-19 pandemic.

In the context of the COVID-19 pandemic, although positive biases [50, 51] and psychological defenses against loneliness [21] among older adults may lead them to adopt fewer preventive health behaviors, older adults with higher meaning in life had a higher perception of epidemic risk, and thus, they showed more preventive health behaviors. It is possible that this pandemic prompted older adults to think about and reconstruct their meaning in life [17]. Prior studies showed that, in both clinical and non-clinical groups, meaning in life had a protective function against negative mental health conditions, and it could help alleviate anxiety, depression, and hopelessness [52–54]. Therefore, older adults with higher meaning in life during the pandemic will be more receptive to limiting the risks involved with disease transmission and infection, and therefore take preventive actions by practicing the appropriate health behaviors.

## Moderation Effect of Powerful others HLC on the Mediation Process

The results of this study also supported hypothesis 2's prediction that powerful others HLC would moderate the relationship between older adults' risk perception and preventive health behaviors. In the context of a pandemic, the risk perception among older adults with high powerful others HLC can improve their preventive health behaviors compared to those with low powerful others HLC. According to research on HLC theory, the older the individual, the more he or she tends to trust powerful others [12], and a meta-analysis also found a positive correlation between powerful others HLC and healthy behaviors in older populations [55], which is consistent with the results of this study. Those with low powerful others HLC tended to attribute their health status to themselves and chance, and the latter was considered a risk factor for health behaviors [12]. Higher chance HLC has been found to be associated with lower socioeconomic status [56], and internal HLC is believed to promote health behaviors [12]. However, this study only verified powerful others HLC, and future studies can explore the influence of socioeconomic factors and internal HLC on health behaviors among older adults.

According to Helmer et al.'s (2012) study, powerful others HLC was related to good compliance, but under the direction of authority [57]. Additionally, they noted that the relationship between powerful others HLC and health behaviors is ambiguous. The present study provides empirical support for this issue. Against the background of the pandemic, many health authorities have fully explained epidemic prevention behaviors through television, smart phones, and social media. Older adults also received a significant amount of relevant information. Those who trust powerful others are more likely to adopt preventive health behaviors when perceiving a risk of being infected.

This study complements other studies [58, 59] on the impact of risk perception on health behaviors and provides an intervention perspective for improving preventive health behaviors during the pandemic. Especially in the older population, it is necessary to pay attention to changing the health attributions of older adults so that they can see the positive role of health authorities in determining behaviors that are conducive to one's health.

## Implications and Limitations

This study highlights the function of older adults' meaning in life in promoting preventive health behaviors during the COVID-19 pandemic, a major public health emergency. It

can be observed that meaning in life not only promotes the mental health of older adults (for example, it promotes life satisfaction and reduces the fear of COVID-19 [60]) but also promotes taking a more positive approach to responding to a public health emergency at the behavioral level.

The findings have practical significance for interventions that promote preventive health behaviors among older adults in the event of a major public health emergency. In addition to being more pronounced among older adults, optimism bias is stronger in collectivist cultures (e.g., China) than in individualistic cultures (e.g., Canada) [61]. Practitioners should adequately cultivate older adults' risk awareness and reinforce the importance of the advice of doctors and professionals, which would effectively enhance prevention awareness among older adults in China.

The results also suggest that prevention and intervention strategies for improving the health behaviors of older adults must cultivate and enhance meaning in life, as well as adjust the risk perception of major public health emergencies and trust in the health guidance and advice of authoritative experts. For example, "health risk information interventions" that provide information on the relationship between specific behaviors and specific health risks have been shown to significantly improve health behaviors [62]. Therefore, the development of "health risk information interventions" that target the risk of epidemics among older adults will have the potential to promote their health behaviors.

This study has some limitations. First, the data in this study are all from self-reported questionnaires, where the interpretation of the question itself and social desirability may lead to bias in response to the items. In addition, although 2-wave panel models offer some benefits in testing mediation over purely cross-sectional studies (e.g., by controlling the initial levels of variables), they are less optimal than 3-wave panel studies [63]. Future studies can further verify the causal relationship and psychological mechanism in the association between meaning in life and preventive health behaviors among older adults through longitudinal studies with multiple time points, experimental manipulation, or randomized controlled intervention studies, and by adopting objective indicators. Second, there could have been recall bias among respondents at T2; to address this systematic error, future studies should use objective indicators. Third, the screening criteria of the sample in this study were "no major physical and mental diseases" but did not exclude individuals with chronic diseases. It has been found that powerful others HLC has different roles in healthy adults and adults with chronic diseases [64, 65]. Future studies should consider this issue during sample selection and data collection. Fourth, the results of this study are based on a small sample (273

participants from 14 provinces). Therefore, there may be limitations with regard to ecological validity and generalizability. Future research could expand the sample size and distribution to replicate these results. Finally, although demographic variables were controlled for in this study, the impact of epidemic risk in the participant's area was not considered. This environmental factor can be considered in subsequent studies to further explore the pivotal role of meaning in life among older adults as well as the health behaviors and the mechanisms involved.

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**Data Availability Statement** The paper includes a link to the repository of data.

## Declarations

**Ethical Approval** 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.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

**The Welfare of Animals** This article does not contain any studies with animals performed by any of the authors.

**Conflict of Interest** The authors declare no competing interests.

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