



Article

Examining the Impact of Virtual Health Influencers on Young Adults' Willingness to Engage in Liver Cancer Prevention: Insights from Parasocial Relationship Theory

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Abstract: The emergence of virtual influencers and AI doctors has significantly increased the attention of Chinese users, especially their health awareness and cancer health literacy. In our current study, guided by parasocial relationship theory, we examined the psychological antecedents that influence Chinese young adults' willingness to engage in liver cancer prevention. Specifically, we aimed to examine the mediated mechanism of reduced unrealistic optimism within this relationship. A total of 252 respondents participated in this study, and the valid data were analyzed using hierarchical regression and mediation analysis to test our hypotheses. The results demonstrated three positive correlations between psychological factors (including perceived severity, parasocial relationship, and response efficacy) and Chinese young adults' willingness to engage in liver cancer prevention. Furthermore, we found that reduced unrealistic optimism mediated these relationships. These findings provide valuable practical insights for Chinese health departments and experts to develop effective health campaign strategies that utilize multiple media platforms for optimal promotion.

Keywords: virtual health influencer; parasocial relationship; unrealistic optimism; liver cancer prevention



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1. Introduction

Liver cancer is one of the most common tumor diseases in the world (Sung et al. 2021). Recent data showed that globally, liver cancer ranked in the top three among mortality diseases (Sung et al. 2021). China has nearly half of the world's liver cancer cases and deaths, and among all age groups, young people are at the highest risk of developing liver cancer (Sung et al. 2021; Zheng et al. 2022). In response, the Chinese government and relevant medical institutions have launched a series of policies and measures. For example, several Chinese provincial governments have effectively cooperated with local hospitals and promoted the implementation of special measures for cancer prevention and control through various facilities (e.g., community health centers and clinics) (Pengpai 2024). In addition, the Institute of Hospital Administration National Health Commission (IHANHC) has also released a new public health project to provide immediate treatment and support to patients, enhancing the well-being of cancer patients. All these implications have gradually raised the awareness of tumor prevention and control by facilitating early cancer diagnosis and immediate treatment.

In recent years, new technologies and innovations have led to remarkable improvements in communication technology (Attaran 2023). This progress has had a significant impact on health communication, particularly through emerging digital entities such as virtual influencers and AI doctors (Wolff 2022; Bunz and Braghieri 2022). In regard to AI influencers emerging with promising features, they have captured the attention of the majority of users. For example, Knox Frost, a top virtual influencer with nearly 1 million

Gen-Z followers, used his social media account to share official health guidelines during the COVID-19 pandemic. This initiative increased the health awareness and literacy among his followers (S. K. 2020). Similarly, Olympia Ohanian's doll, Qai Qai, released a playlist to educate children about engaging in COVID-19 prevention during the severe times of the pandemic (Peña 2020). However, to the best of our knowledge, there has been no study to yet conceptualize the specific terminology of virtual health influencers. Based on the current knowledge, this study defines virtual health influencers as digital images that educate and inspire audiences in various aspects of health, prevention, and wellness via Internet and media platforms. These influencers have the potential to encourage audiences to voluntarily engage in and adopt positive lifestyle behaviors.

Previous studies have primarily focused on exploring online users' perspectives on virtual influencers' authenticity (Lou et al. 2023), perceived trust (Wibawa et al. 2022), and attitude (Gerlich 2023). More recently, however, scholarly attention has shifted to investigating the impact of the exposure to virtual influencer content on various behavioral changes, such as intentions to continuously watch AI anchors (Xue et al. 2022; Huang and Yu 2023) and purchase behavior (Chiu and Ho 2023; Kim and Park 2023). While the aforementioned studies have explored the impact of viewing virtual influencer content on individual behavior change, three key limitations remain unsolved. First, most studies have explored such effects based on cognitive theories, lacking exploration from psychological and communication perspectives (e.g., parasocial relationship theory). As a result, there is a lack of explanation for how users' one-sided relationships might influence their willingness to engage in cancer screening behaviors after exposure to virtual health influencer content. Second, although many hospitals in first-tier cities (Beijing, Shanghai, Guangzhou, and Shenzhen) have been encouraged to create virtual health influencer content, there is a lack of recent studies that examine the impact of such content on people's perceptions, attitudes, and behavior change. Finally, while several case studies have explored the determinants that lead Chinese audiences to continuously watch AI news influencers and the resulting changes in perceptions, there is a lack of studies that explore the key factors that might lead audiences to engage in preventive behaviors.

As mentioned above, based on the parasocial relationship theory, this study aims to investigate the factors that influence the willingness of Chinese young adults (aged 18–34 years old) to engage in liver cancer prevention after exposure to virtual health influencer content. This age group is a particular target for several reasons. First, they tend to have unhealthy consumption habits, such as long-term exposure to aflatoxins and excessive alcohol consumption, which increase their risk of liver cancer (ZJXW 2019). Therefore, scholars and specialists have urged further study of this population. Second, Chinese young adults are known to be early adopters of metaverse technology compared to other cohorts (Ren et al. 2022). They have significant potential to be influenced by cutting-edge health content. Finally, a significant number of young adults in China watch virtual health influencer videos on platforms such as Bilibili, with many videos receiving over 1000 views from this demographic. While previous studies have provided valuable insights, there is limited knowledge about the impact of virtual health influencer content on cancer prevention engagement with this particular population.

The current study examines the mediating mechanism of cognitive bias (reduced unrealistic optimism) in the relationship between psychological factors (perceived severity, parasocial relationships, and response efficacy) and willingness to engage in liver cancer prevention.

2. Literature Review

2.1. Liver Cancer in China and Preventions

Recent reports indicate that China accounts for nearly half of the global burden of liver cancer (Liu et al. 2024). Liver cancer ranks among the top five cancers, accounting for 57.42% of cases, according to recent data. Liver cancer is also a leading cause of cancer-related deaths and is expected to be among the top five causes of all-cause cancer mortality in 2022

(Han et al. 2024). Descriptive reports suggest that smoking, drug use, alcohol consumption, and elevated body mass index are major contributors to liver cancer cases (T. Chen et al. 2023). In addition, the prevalence of liver cancer tends to increase with age (Liu et al. 2019). Recent studies have observed increasing rates of liver cancer among young Chinese (Sung et al. 2021; Zheng et al. 2022). In response to this public health challenge, Chinese health institutions and experts are strongly advocating public awareness and early screening as effective measures for liver cancer prevention (China News Network 2024).

In general, liver cancer prevention, as defined by the National Cancer Institute, includes measures designed to reduce both the risk of developing cancer and the progression of the disease. These preventive measures include maintaining a healthy lifestyle, minimizing the exposure to known carcinogens, and using drugs or vaccines to inhibit cancer development (Centers for Disease Control and Prevention 2022). Public health organizations recommend a number of preventive measures specific to liver cancer, such as maintaining a healthy weight, being vaccinated against hepatitis B, being tested for hepatitis C, and strictly avoiding tobacco and alcohol use. In this study, the willingness to engage in liver cancer prevention (WELCP) is defined as the willingness of Chinese young adults to adopt the recommended preventive measures for liver cancer to reduce both the risk of developing and the progression of the disease.

2.2. Parasocial Relationship Theory

The concept of parasocial relationships (PR) revolves around an individual's one-sided and enduring emotional connection. Specifically, audiences often cultivate unreciprocated feelings of closeness and intimacy through repeated interactions with performers in mediated reality (Dibble et al. 2016). This intimate connection typically encompasses the emotions, thoughts, and actions that audiences experience during media exposure, focusing on a particular performer or character (Walter et al. 2022). Recent psychological research has shown that this intimate connection often occurs between audiences and media celebrities in online environments, and is experienced by a wide range of people, including adults and children (Lim et al. 2020; Tolbert and Drogos 2019).

PR has been studied in many contexts, including psychology, consumer behavior, and marketing and advertising. For example, psychologists have examined how PR influences individuals' repeated viewing of live-streamed games (Lim et al. 2020). Additionally, Chung and Cho (2014) examined how audiences develop PR with media characters through the use of reality television shows and social media (Chung and Cho 2014). Consumer behavior scholars have also examined the relationship between internet celebrity characteristics and YouTube users' impulse purchase behavior as mediated by PR (T. Y. Chen et al. 2021). While previous research has provided strong evidence for PR in various contexts, relatively few studies have examined how one-sided relationships with media influencers affect individuals' willingness to engage in health behaviors, particularly in the context of exposure to health-related influencer content on social media in China. Furthermore, it remains unclear whether PR can directly or indirectly influence Chinese young adults' participation in WELCP after the exposure to virtual health influencers.

2.3. Effects of Psychological Factors on Intention

Perceived severity (PS) is recognized as a critical determinant of patients' intention to engage in health preventive behaviors (Sharma 2021). It is defined as the belief in the extent of harm that may result from the acquired disease or harmful conditions as a result of a particular behavior. In the current study, PS refers to individuals' cognitions or thoughts about the danger or harm posed by liver cancer in their environment. Response efficacy (RE) is a psychological factor that can be viewed as the belief in the effectiveness of an alternative health behavior in improving one's health status. Previous studies have defined the concept as the extent to which individuals believe that the proposed response actions will be effective in preventing the threat (Witte 1994). In this study, RE refers to an

individual's beliefs about whether the recommended action for preventing liver cancer will effectively reduce the health threat.

Previous studies have found that PS increases individuals' health preventive practices (DeDonno et al. 2022). Similarly, a previous study found a positive relationship between PS and preventive behaviors in patients with type 2 diabetes (Tan 2004). PR is recognized as a key psychological factor in an individual's intention to engage in certain types of behaviors (e.g., travel intention, online shopping behavior, and watching live streaming games) (Yuan et al. 2021; Jiaojiang 2022; Lim et al. 2020). A health behavior study found that PR with nutritionist video bloggers increased individuals' adherence to healthy weight loss diets (Sakib et al. 2020). In addition, research examining the influence of RE on health-related behaviors has found that RE is negatively associated with both alcohol and marijuana use. That is, when individuals' RE is higher, they are more engaged in maintaining healthy behaviors (Choi et al. 2013). In addition, health workers' perceived efficacy (also known as RE) significantly influenced their use of personal protective equipment to protect against COVID-19 infection (Alah et al. 2022). Therefore, the following hypotheses are proposed:

H1(a,b,c). (a) PS, (b) PR, and (c) RE have significant and positive effects on WELCP.

2.4. Unrealistic Optimism Role as a Mediator

The researchers in health psychology have found that individuals tend to unduly reduce the perceived threat when faced with negative events, a phenomenon referred to as "unrealistic optimism" (Howell et al. 2020). Previous studies have also identified this bias as the tendency for people to believe that they are less likely to experience negative events and more likely to experience positive events compared to their peers (Eshel et al. 2021). In health behavior research, individuals who strongly perceive themselves as less likely to experience serious health events relative to others exhibit this bias (Senft Everson et al. 2022). However, the majority of empirical studies suggest that unrealistic optimism is positively associated with individuals' engagement in health-promoting behaviors, such as reducing the risk of alcohol use disorder (Na et al. 2021), having less favorable attitudes toward smoking cessation treatment (Senft Everson et al. 2022), and preventing the development of diabetes mellitus (de Mello Marsola et al. 2021).

As mentioned above, there are conflicting empirical findings regarding the effect of unrealistic optimism on individuals' participation in health behaviors. The current study argues that unrealistic optimism may induce the prevention of liver cancer among Chinese young adults, as a line of evidence shows that individuals are strongly inclined to perceive themselves as being at a greater health risk compared to others (McColl et al. 2021). In this study, reduced unrealistic optimism (RUO) refers to a decrease in the tendency of individuals to hold overly optimistic beliefs about their future liver health outcomes.

Previous research on health threats has shown that increased PS increases an individual's awareness of contagiousness, also known as RUO (Safra et al. 2021). Additionally, individuals with an optimistic bias were found to have a negative association with their willingness to engage in hand hygiene practices (Kim and Hancock 2015). Similarly, Felgendreff et al. (2021) found that reduced optimistic bias (RUO) was positively influenced by the perceived infectious disease threat, which in turn increased the likelihood of individuals developing skin cancer (Felgendreff et al. 2021; Bränström et al. 2006). The existing literature has also examined the indirect effect of RUO on the relationship between parasocial relationships and individuals' engagement in health behaviors. For example, a previous study confirmed that parasocial relationships are negatively associated with individuals' optimistic bias. In other words, the stronger the parasocial relationship, the more increased RUO about infection (Walter et al. 2022). In addition, individuals' concern for their own safety from H1N1 swine flu rather than for others (RUO) led to their willingness to take protective H1N1 flu precautions (Liu and Lo 2014). To date, several studies have examined the effect of RE on RUO. A previous study showed that individuals with higher RE to viral infection had higher intentions to engage in various preventive behaviors (RUO) compared

to their cohorts (Lee et al. 2008). In addition, dispositional optimism was associated with positive engagement in smoking treatment. That is, as RUO increases, individuals are more likely to engage in healthy behaviors (Senft Everson et al. 2022). Therefore, the following hypotheses are proposed:

H2. *RUO mediates the relationship between PS and WELCP.*

H3. *RUO mediates the relationship between PR and WELCP.*

H4. *RUO mediates the relationship between RE and WELCP.*

The hypothetical model is shown in Figure 1.

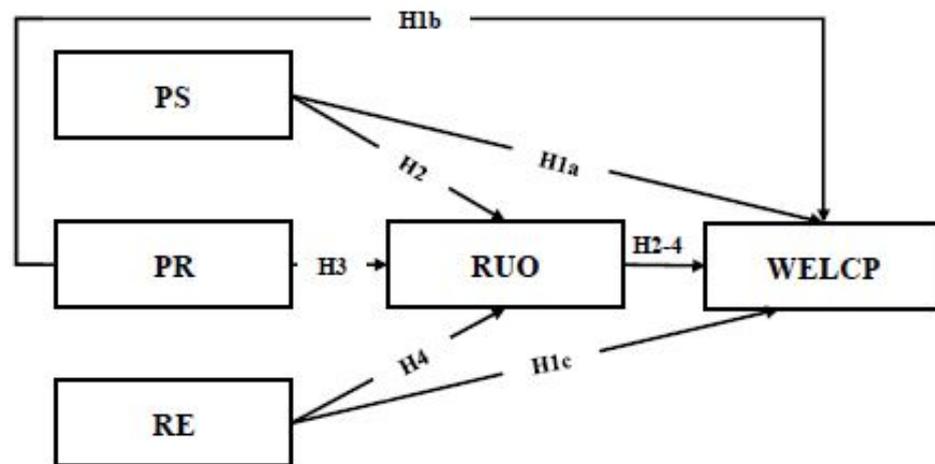


Figure 1. Model of predictors of willingness to engage in liver cancer prevention.

3. Materials and Methods

3.1. Stimuli

To ensure that the participants gained an initial understanding of virtual health influencer content, this study asked the participants to watch a 2 min video related to the preconceptions about liver cancer and virtual health influencers at the beginning of the online questionnaire. According to the methods of Nouri et al. (2011), the videos were selected based on two criteria. First, among the most recent and creative liver cancer prevention videos, the virtual health influencer content was rated in the top 100 on WeChat Channels (one of the largest short-form video platforms in China) (Nouri et al. 2011). Second, three representative creative liver cancer prevention videos were selected from this platform based on the most liked and shared metrics. Following the method of a previous study, a small survey was conducted with 50 online participants (Gong and Li 2017). Among the three types of relevant videos, “Digital Health: Dr. Bing Qiao, Liver Disease Specialist at Qingdao Sixth People’s Hospital—Methods of Preventing Liver Cancer” was ranked the highest. The virtual influencer content was developed by Dr. Bingqiao, a cancer specialist, with the support of Qingdao Sixth People’s Hospital.

Following the aforementioned process, in the current study, a 2 min stimulus video was provided at the beginning of the questionnaire. Due to the policy of the WeChat Channel, the content cannot be shared as a website link, but must be viewed on the platform (Ask 2023). Therefore, the participants were shown an image with instructions on how to search for the video and then return to the survey link (see the procedure in Appendix A). Additionally, a 2 min countdown was included on the same page of the online survey to ensure that the material was thoroughly reviewed (Huang and Yu 2023). This approach ensured that the selection provided a realistic analog and helped to develop the participants’ perceptions and feelings.

3.2. Data Collection Procedures

For sampling, this study used convenience sampling, which is highly regarded for its efficiency and cost-effectiveness in collecting nonprobability samples (Mulisa 2022). The majority of studies conducted using such sampling method are specifically designed to generate hypotheses (Vaterlaus et al. 2015; Xingting Zhang et al. 2017). The sample was collected from 22 January 2024 to 1 March 2024 through “Wenjuanxing”, a reputable platform that provides a sampling pool of nearly 260 million registered users in China. The platform is known for providing high-quality data that best meet the needs of researchers (Wang et al. 2020). Previous health behavior and AI media-related studies have used such web survey platform to study the Chinese context (Gao et al. 2024). Initially, 280 potential respondents received the survey link and 270 completed the questionnaire. To ensure a representative and accurate sample, three main methods were used to exclude biased data: (1) participants who provided nonsense responses and unrelated open-ended responses were removed ($N = 1$), (2) “straight-line” responses were excluded; respondents who intentionally provided the same response within measures were excluded ($N = 3$), and finally, “speeders” who completed the questionnaire in less than one-third of the average time were removed ($N = 14$). The final sample size was 252 participants. Previous empirical studies have used G-Power to determine an adequate and appropriate sample size using G-Power 3.1 (Guazzini et al. 2022). Specifically, power analysis has been identified as a critical step in hypothesis testing prior to hypothesis testing (Majeed et al. 2020). The current study was configured with a power of 0.95, an effect size of 0.15, and four predictors. The results indicated that the minimum required sample size was 129. Therefore, the sample was considered adequate.

3.3. Data Analysis Methods

Regarding the permission to conduct the current study, it was reviewed and approved by the Ethics Committee of the Beijing Institute of Graphic Communication (protocol code: SC20240111). Written informed consent was obtained at the beginning of the online survey, and the consent form explicitly assured all participants that their privacy and data use would be strictly protected during the study, as well as their right to refuse to participate. All the respondents were required to voluntarily sign a consent form before participating in this study.

3.4. Measurement of Variables

The survey questionnaires were derived based on existing measures, and some of the scale items were adjusted after testing with three focus groups consisting of Chinese short-form video platform users (aged 18–34). The final instrument consisted of six scales, including PS, PR, RE, RUO, and WELCP. The questionnaire was translated from English to Chinese using a rigorous back-translation process (Liu et al. 2021). In addition, the translated questionnaire was carefully reviewed by two health communication experts from Central China Normal University to ensure the content validity.

PS was operationalized with four items developed based on the research of Luo et al.’s study (Luo et al. 2021). The respondents indicated their level of agreement with statements using a 5-point Likert scale. Examples of these statements are: (1) “I believe that liver cancer is a serious disease”. (2) “I believe that cancer can have serious economic consequences”. (3) “I believe that my career would be seriously affected if I were to develop liver cancer”. (4) “I believe that my life would be negatively affected if I were to develop liver cancer”. ($M = 4.42$, $SD = 0.54$, Cronbach’s $\alpha = 0.69$).

The PR scale was derived from a previous study (Kim et al. 2024). This scale consists of five items, and the respondents indicated their level of agreement with the questions using a 5-point Likert scale. Examples of these statements include: (1) “I feel like I have a lot in common with the virtual health influencer who primarily creates the liver cancer prevention content I watch”. (2) “The virtual health influencer I watch for liver cancer prevention content seems friendly and relatable”. (3) “I believe I could have a comfortable

conversation with the virtual health influencer I follow for liver cancer prevention content". (4) "If the virtual health influencer posts a video on Douyin, I'll definitely watch it". (5) "I feel that virtual health influencers are similar to my close friends". ($M = 2.62$, $SD = 1.21$, Cronbach's $\alpha = 0.95$).

Four items were derived from a previous study to assess RE (Xiaofei Zhang et al. 2017). This scale was used to assess the respondents' beliefs about whether the recommended actions to prevent liver cancer will effectively reduce the health threat. The respondents answered questions using a 5-point Likert scale to indicate their level of agreement. These statements are: (1) "Taking precautions against liver cancer will help me stay health". (2) "Taking precautions against liver cancer will help me stay health". (3) "Taking precautions against liver cancer will improve my ability to perform daily tasks". (4) "Taking precautions against liver cancer effectively protects me from developing liver cancer". (5) "Taking precautions against liver cancer strengthens my immune system". ($M = 4.43$, $SD = 0.65$, Cronbach's $\alpha = 0.88$).

RUO assesses the tendency of individuals to hold less optimistic beliefs about their future liver health outcomes. To our knowledge, no studies have been developed to measure the reduced unrealistic optimism in the Chinese context. Therefore, the methods of Hollebeek et al. and Graffigna et al. were used in the current study (Hollebeek et al. 2014; Graffigna et al. 2015). The initial items of the measure were generated based on a literature review and systematic analysis. Subsequently, an initial face validity check was performed by all the authors. Ten potential items aimed at RUO were developed. To further enhance the validity and reliability and to minimize the error, this study was piloted with focus groups (12 Chinese volunteers). This approach is widely accepted as a means of confirming that the relevant items constitute the domains and ensuring that all the items are correct and understandable (Hyde et al. 2003). After carefully reviewing the feedback from the focus group, we retained 4 items as a result of the scale development procedures. In principle, a validation test is critical to ensure that the items are designed for the construct (Horstmann and Ziegler 2020). In this validation test, exploratory factor analysis (EFA) was applied to confirm and explain the relationships among a set of items (Shrestha 2021). Prior to performing this validity test, the Kaiser–Meyer–Olkin (KMO) test was conducted to measure the sample adequacy, and Bartlett's sphericity test was used to check the suitability of the data for factor analysis (Shrestha 2021). With a total of 252 valid samples, the KMO result was 0.71, and Bartlett's sphericity test was significant ($p < 0.001$), indicating that the sample size was adequate and appropriate for EFA (Shamsalinia et al. 2020). Finally, the EFA test demonstrated that the factor loadings ranged from 0.68 to 0.83 (RUO1 = 0.83, RUO2 = 0.81, RUO3 = 0.66, and RUO4 = 0.68). These results indicate that all the items adequately measured their respective factors. Examples of the items are: (1) "Ignoring the prevention of liver cancer has high risks and serious consequences". (2) "Vaccination against hepatitis B effectively prevents liver cancer". (3) "Liver screening is essential due to the long and demanding treatment process". (4) "Even with healthy habits, special protocols for liver cancer prevention are essential". ($M = 3.50$, $SD = 0.81$, Cronbach's $\alpha = 0.73$).

The WELCP was operationalized with four items to assess the respondents' intentions to follow the recommended preventive measures for liver cancer to reduce both the risk of developing and the progression of the disease. This was adapted from the Centers for Disease Control and Prevention (CDC) practices for the prevention of liver cancer (Centers for Disease Control and Prevention 2022). The respondents indicated their level of agreement with the following statements: (1) "I will maintain a healthy weight". (2) "I will get vaccinated against hepatitis B". (3) "I have often thought about getting tested for hepatitis C". (4) "I will stop drinking alcohol and smoking cigarettes". ($M = 4.30$, $SD = 0.71$, Cronbach's $\alpha = 0.84$).

Considering that the current study conducted a cross-sectional survey, it is highly recommended to confirm the common method bias (CMB), which can avoid the systematic error variance shared among variables measured with the same method and/or source and

introduced as a function of the same method (Richardson et al. 2009). Harman’s one-factor test was used to address the CMB. The results indicated that the single factor accounted for 29.80% (which is well below the critical value of 50%). Therefore, CMB was not considered to be a major problem in this research.

3.5. Data Analysis Methods

The data collection started from 22 January 2024 to 1 March 2024; the current study collected 252 samples. The accumulated data were rigorously examined, including hierarchical regression, mediation, and moderation analyses, all conducted using the PROCESS macro 4.0 within SPSS version 22.

4. Results

4.1. Descriptive Data

A total of 252 valid samples were collected. Table 1 shows the demographic characteristics of the participants. The respondents were mostly female (N = 132, 52.4%). The majority were either undergraduates (N = 180, 71.4%) or high school students (N = 59, 23.4%). In addition, most of the participants were between 18 and 23 years old (N = 187, 74.2%), followed by 24 to 28 years old (N = 36, 14.3%). Finally, the respondents’ monthly incomes indicated that the majority earned between RMB 4000 and RMB 8999 (N = 96, 38.0%) and RMB 9000 and RMB 13,999 (N = 58, 23.1%).

Table 1. Key demographic characteristics of the survey participants.

Variables	Item	Count	Percentage
Sex	Female	132	52.4%
	Male	120	47.6%
Education level	High school	59	23.4%
	Undergraduate	180	71.4%
	Postgraduates	13	5.2%
Age	18–23 years old	187	74.2%
	24–28 years old	36	14.3%
	29–34 years old	29	11.5%
Monthly income (RMB)	1000–3999	54	21.5%
	4000 and 8999	96	38.0%
	9000 and 13,999	58	23.1%
	<RMB 14,000	44	17.5%
	Total	252	100%

4.2. Hypothesis Testing

To test Hypothesis 1, the current study used hierarchical regression analyses with WELCP as the dependent variable. Gender, education, and income were entered as controlling confounders in the first block. PS, PR, and RE were entered separately in the second block. The effects of PS on WELCP ($\beta = 0.64$, $t = 8.63$, $p < 0.001$), PR on WELCP ($\beta = 0.16$, $t = 4.00$, $p < 0.001$), and RE on WELCP ($\beta = 0.58$, $t = 9.73$, $p < 0.001$) were significant. Therefore, H1 (a–c) was fully supported.

Hayes’ PROCESS macro (model 4) was used to test the mediation hypotheses (Rockwood and Hayes 2017). This study was set up as a bootstrap to obtain bias-corrected 95% confidence intervals for making statistical inferences about specific indirect effects. Figure 2 indicates the standardized coefficients and significance for each path in the hypothesized model. In the first mediation model, PS was a significant predictor of RUO ($\beta = 0.23$, $t = 5.90$, $p < 0.001$), RUO positively predicted WELCP ($\beta = 0.58$, $t = 8.61$, $p < 0.001$), and the indirect effect was significant ($\beta = 0.06$, $t = 9.05$, $p < 0.001$, 95% CI [0.02, 0.12]). The results of the second mediation model indicated that PR was a significant predictor of RUO ($\beta = 0.29$, $t = 7.49$, $p < 0.001$), and RUO positively predicted WELCP ($\beta = 0.28$, $t = 5.02$, $p < 0.001$). The indirect effect was significant ($\beta = 0.08$, $t = 4.62$, $p < 0.001$, 95% CI [0.04, 0.12]). The results of the third mediation model showed that RE was a significant predictor

of RUO ($\beta = 0.30, t = 3.90, p < 0.001$), RUO positively predicted WELCP ($\beta = 0.24, t = 5.18, p < 0.001$), and the indirect effect was significant ($\beta = 0.07, t = 9.76, p < 0.001, 95\% \text{ CI } [0.03, 0.12]$). Therefore, H2–4 was supported. Table 2 provides a summary of the hypotheses, proposed relationships and hypothesized relationships, and hypothesis testing results.

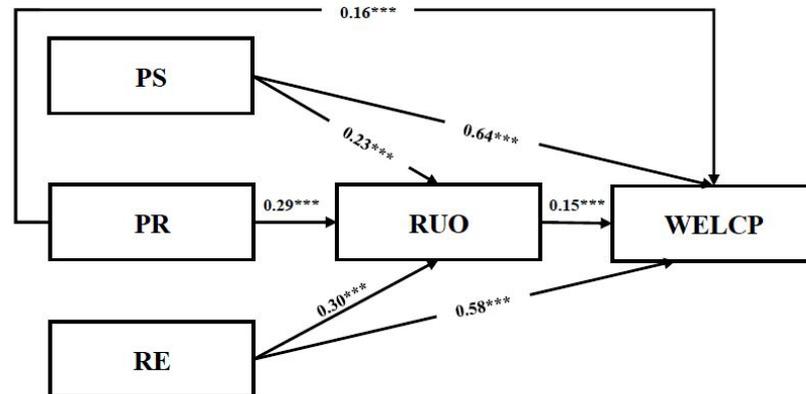


Figure 2. The effects of predictors of willingness to engage in liver cancer prevention. *** $p < 0.001$.

Table 2. Summary of direct effects.

Hypotheses	Relationship	Result
H1	(a) PS, (b) PR, and (c) RE have significant and positive effects on WELCP.	Supported
H2	RUO mediated the relationship between PS and WELCP	Supported
H3	RUO mediated the relationship between PR and WELCP	Supported
H4	RUO mediated the relationship between RE and WELCP	Supported

PS = perceived severity, PR = parasocial relationship, RE = response efficacy, RUO = reduced unrealistic optimism, WELCP = willingness to engage in liver cancer prevention.

5. Discussion

Guided by the parasocial relationship theory, the current study explored the effects of psychological factors on Chinese young adults’ willingness to engage in liver cancer prevention after the exposure to virtual health influencer content. The main purpose of this study was to thoroughly examine the direct effect and mediated effect between the relationship.

The first hypothesis of this study examined whether the perceived severity, parasocial relationships, and response efficacy have a direct effect on Chinese young adults’ willingness to engage in liver cancer prevention. The results indicate that these psychological factors significantly predict Chinese young adults’ willingness to engage in liver cancer prevention. These results are consistent with previous studies showing that the perceived severity, parasocial relationships, and response efficacy are more likely to induce individuals to engage in health prevention practices (e.g., infectious disease protection, diabetes prevention, and weight loss diets) (DeDonno et al. 2022; Tan 2004; Sakib et al. 2020).

In terms of mediated effects, Hypothesis 2 examined whether reduced unrealistic optimism indirectly leads to Chinese young adults’ willingness to engage in liver cancer prevention. The results indicate that reduced unrealistic optimism plays a significant role in mediating the relationship between the perceived severity and willingness to engage in liver cancer prevention among Chinese young adults. This finding is also consistent with previous literature. For example, the more that individuals perceive the severity of infectious diseases, the less their unrealistic optimism decreases, which in turn induces their participation in hand hygiene practices (Safra et al. 2021; Kim and Hancock 2015).

The second mediating effect of the present study revealed that Hypothesis 3 reduced unrealistic optimism acting as a mediating factor in the relationship between parasocial relationships and the willingness to engage in liver cancer prevention among Chinese young adults. In agreement with the current results, previous studies have indicated a significant positive correlation between parasocial relationships and individuals' engagement in health behaviors via reduced unrealistic optimism (Walter et al. 2022; Liu and Lo 2014).

Regarding its theoretical contributions, this study primarily addresses a significant gap in understanding how users' one-way relationships with virtual health influencers may influence their willingness to engage in liver cancer screening behaviors, an area that has been underexplored in the literature. By conducting a systematic investigation using a cross-sectional survey and rigorous hypothesis testing, the current study advances our understanding of the significance of this relationship. In addition, reduced unrealistic optimism serves as an internal reference point (S. Chen et al. 2021). Such a factor acts as a mental guide to acknowledge the potential negative consequences of future liver health outcomes. By incorporating this psychological bias into parasocial relationship theory, we have extended the theoretical framework to reveal both direct and indirect effects on the willingness to engage in liver cancer prevention among young adults. This undoubtedly contributes to the explanatory power of the original parasocial relationship theory.

This study has several limitations, which we acknowledge. First, although the final results supported both the direct and mediated hypotheses, the moderated effect on the relationship between psychological factors and Chinese young adults' willingness to engage in liver cancer prevention was not considered. It is highly recommended that future research investigates these moderated effects. Second, the perceived severity was measured via four items based on existing scales (Luo et al. 2021). However, the reliability test results indicated a relatively low Cronbach's coefficient alpha. Future studies should consider developing more concise and accurate measures. Third, the current study only focused on psychological factors as antecedents. There is a lack of research on how emotional or cognitive factors might also influence Chinese young adults' willingness to engage in liver cancer prevention. Future studies should explore these aspects through empirical research. Finally, the study included only 252 valid samples, mainly from college students (N = 180, 71.4%) and high school students (N = 59, 23.4%). As a result, therefore, the results represent only educated Chinese young adults and do not reflect the entire target population. Future studies should aim to collect a more diverse and representative sample.

The current research offers practical recommendations from two perspectives. First, previous studies have identified various barriers to cancer screening participation, including personal, social, and financial reasons (Fuzzell et al. 2021). To address these barriers, it is recommended to improve the quality of cancer screening advertisements, which may increase individuals' cancer awareness and their willingness to participate in screening (Cao et al. 2021). Given that WeChat Channels is a popular platform for health information among Chinese young adults, healthcare providers should consider launching high-quality cancer screening campaigns on this platform. In particular, the collaboration between short-form video's influencers and health experts can be highly effective. Second, a recent study showed that AI chatbots (e.g., ChatGPT) are increasingly being used for health-related purposes (Shahsavari and Choudhury 2023). A recent report also showed that Wenxinyiyan (Baidu's AI chatbot service), with nearly 800 million users, is particularly popular among Chinese young adults, who are early adopters of such platforms (DLG 2023). Therefore, the study strongly recommends that health authorities encourage young adult users to engage with cancer screening topics on Wenxinyiyan. Additionally, AI developers should ensure that the platform provides a satisfactory environment for users to freely discuss health issues.

6. Conclusions

This study examined the relationship between the psychological factors and willingness to engage in liver cancer prevention among Chinese young adults aged 18–34 years old. It is one of the few studies to examine how reduced unrealistic optimism mediates this relationship. The findings highlight the critical role of reduced unrealistic optimism in mediating the effects of psychological factors (such as perceived severity, parasocial relationship, and response efficacy) on the willingness to engage in liver cancer prevention among Chinese young adults. To address these findings, Chinese health institutions and professionals are encouraged to develop and implement comprehensive health campaign strategies that utilize multiple media platforms for effective promotion.

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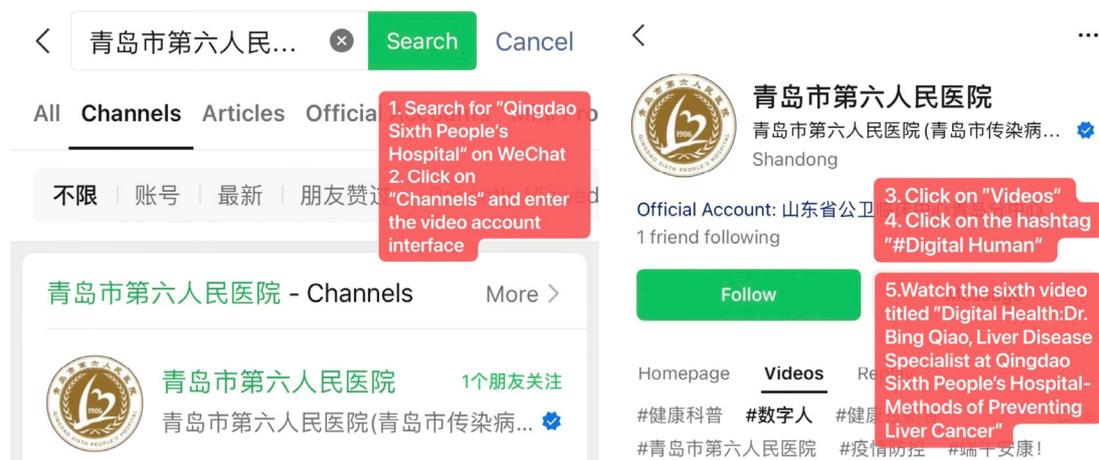
Institutional Review Board Statement: This study was approved by the Ethics Committee of Beijing Institute of Graphic Communication (protocol code: SC20240111; 11 January 2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original data are provided by all the authors. If there are relevant research needs, the data can be obtained by sending an email to the corresponding author. Please indicate the purpose of the research and the statement of data confidentiality in the email.

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Appendix A Video Search and Survey Return Instructions



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