International Journal of Communication 17(2023), 2326–2347 1932–8036/20230005

Seeking Online Health Information for Aged Parents in China: A Multigroup Comparison of the Comprehensive Model of Information Seeking Based on eHealth Literacy Levels

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People unable to use the Internet, especially most older adults in developing countries such as China, have difficulty accessing multiple benefits of seeking online health information. One possible solution is to motivate adult children to do so for their aged parents. Therefore, by incorporating variables related to aged parents and using children's eHealth literacy to conduct a multigroup analysis, the Comprehensive Model of Information Seeking (CMIS) is extended to identify what factors motivate children to seek online age-related disease information for their aged parents. Three hundred eighty-one adults participated in an online survey in March 2020. Multigroup structural equation modeling was used to analyze the baseline and multigroup models. The results show that fear and information carrier characteristics are positively associated with information seeking, mediated by the utility. Furthermore, adults with low eHealth literacy are more likely to be motivated directly by information carrier characteristics, while the rest tend to be encouraged by fear and their parents' general health status through the utility.

Keywords: online health information seeking, comprehensive model of information seeking, surrogate-seeking, eHealth literacy

The rapid expansion of the Internet has greatly enhanced the availability and accessibility of health information, making it the most commonly used source of such information (Bujnowska-Fedak, Waligóra, & Mastalerz-Migas, 2019; Volkman et al., 2014). Online health information can help people deal effectively with disease-related threats, decide on preventive treatments, and adopt healthy behaviors (Anker, Reinhart, & Feeley, 2011; Real, 2008), although some negative outcomes have also been identified, such as feeling overwhelmed and anxious (McMullan, Berle, Arnáez, & Starcevic, 2019), vaping behavior (Yang, Liu, Lochbuehler, & Hornik, 2019), and nonmedical drug use (Kam & Lee, 2013). Therefore, online health information seeking has attracted scholarly attention (e.g., Mckinley & Lauby, 2021; Vardeman-Winter, Jiang, & Tindall, 2013; Wang, Shi, & Kong, 2021).

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Date submitted: 2022-05-11

However, approximately 200 million aged Chinese adults are unable to use the Internet and, therefore, cannot seek age-related disease information or benefit from online health information. According to the China Internet Network Information Center (2019), in June 2019, the number of Chinese Internet users reached 864 million, but the number of Internet users aged 60 or older was about 59.61 million, only 6.9% of this population. Meanwhile, aging has become a global issue, particularly in China, the most populous country. According to the National Bureau of Statistics of China (2018), about 250 million Chinese citizens aged 60 or older account for 17.9% of China's population. This means that about 190 million Chinese citizens aged 60 or older are not Internet users.

Aging is highly associated with many age-related diseases, such as coronary heart disease, breast and lung cancer, hypertension, and brain infarction (Fulop et al., 2010; Morris, 2007). For example, around 80% of older adults in the United States have at least one chronic disease (Centers for Disease Control and Prevention, 2011), and 77% have at least two (Centers for Medicare & Medicaid Services, 2015). This is also true in China, where 75% of older adults suffer from more than one chronic disease (Dang, 2018). In this case, older adults must maintain their health, especially by having enough literacy to seek health information online and avoid negative outcomes.

The lack of Internet skills for the older population is a common problem in many developing countries (Sheng & Simpson, 2013). In China, local governments and nonprofit organizations such as libraries organize Internet skills training programs to help local older adults, but these small-scale programs alone are far from enough to address the issue. One possible solution is encouraging adult children to seek health information online for their aged parents (Bao, Hoque, & Wang, 2017). This is because, unlike the United States, where older adults can seek help in the community, in China, older adults are mainly supported materially and emotionally by their children, especially when it comes to health issues, thanks to the tradition of family relationships and values in China's culture of filial piety (Deutsch, 2006; Hu & Scott, 2016). With the development of information and communications technology, providing health information support to aged parents has become a responsibility for adult children: Forty-eight percent of netizens are aged 20–39, meaning that most adult children can use the Internet (China Internet Network Information Center, 2019).

While studies have examined surrogate seekers who seek health information for others, namely parents seeking health information online for their children (Kubb & Foran, 2020; Sage et al., 2018; Sebelefsky et al., 2015) and family caregivers seeking health information online for patients (Kim, Powell, & Bhuyan, 2017; Oh, 2015), only a few studies have explicitly explored children seeking online health information for parents, especially for aged parents (Bao et al., 2017).

This study contributes to the literature in two ways. Theoretically, this research applied the Comprehensive Model of Information Seeking (CMIS) model to surrogate-seeking contexts to expand its explanatory power further. Moreover, unpacking group differences based on eHealth levels proved a promising direction to further understand human behaviors and theory building. Practically, our study raises awareness of a severe social issue that deserves scholarly and practical attention and helps practitioners design effective campaigns.

Literature Review

Online Health Information Seeking for Others

The definition of information-seeking behavior in the CMIS is "the purposeful acquisition of information from selected information carriers" (Johnson & Meischke, 1993, p. 350). People have long had access to health information from interpersonal sources such as doctors, cancer-related magazines, and mass media (Johnson & Meischke, 1993). Substantial evidence supports the benefits of online health information seeking (Jiang & Street, 2017; Xiao, Lee, & Zeng, 2022).

Research on online health information-seeking behavior has recently expanded to surrogate seekers. Some individuals may be physically, cognitively, financially, or psychologically restricted or simply unable to use the Internet, so their friends or family members seek online health information on their behalf (Remillard, Mazor, Cutrona, Gurwitz, & Tjia, 2014). This behavior has a vital public health significance: It facilitates the delivery of online health information to people who have been unable to access it. This behavior was named "surrogate-seeking" by Sadasivam and colleagues (2013) or "lay information mediary behavior" by Abrahamson, Fisher, Turner, Durrance, and Turner (2008, p. 310). These mediaries were defined as "those who seek information on behalf of others in a non-professional or informal position, and they are not necessarily required to do so" (Abrahamson & Fisher, 2007, p. 1). Reifegerste, Blech, and Dechant (2017) found that 61% of online health information seekers in Europe have sought online health information for others, and whether they live together with these others or not explains the most variance in their surrogate-seeking.

Extant research on surrogate-seeking focuses mostly on parents seeking health information for their children and on family caregivers doing the same for cancer survivors (e.g., Kim et al., 2017; Oh, 2015; Sage et al., 2018). Only a few studies have explicitly explored adult children's online health information-seeking behavior for their aged parents. Using the theory of planned behavior, Bao and colleagues (2017) examined the factors motivating adult children to seek online health information for their aged parents. The authors found that subjective norms, perceived behavioral control, and risks significantly predict this behavior. However, they did not consider variables related to parents and information carriers: The characteristics of information channels and parents' general health condition and age may also have influenced this behavior (Hartoonian, Ormseth, Hanson, Bantum, & Owen, 2014; Paek, Choi, & Hove, 2017). The CMIS, which is more commonly used in the online health information-seeking context (Han et al., 2010; Hartoonian et al., 2014; van Stee & Yang, 2018), can incorporate the characteristics of information channels, thus having stronger explanatory power.

Meanwhile, Reifegerste, Blech, and Dechant (2020) have specifically employed the CMIS to investigate surrogate-seeking and subsequent social support intentions. However, different types of relationships with others will influence surrogate-seeking patterns, and Chinese people have distinct family values (Hu & Scott, 2016; Reifegerste et al., 2017). Therefore, based on previous findings, the current study dives more specifically into what factors motivate adult children to seek health information for their aged parents in China.

The Comprehensive Model of Information Seeking

The CMIS is a theoretical model based on information carrier characteristics and information seekers' perception of information that is used to predict health information-seeking behavior (Johnson & Meischke, 1993). Specifically, the CMIS states that health-related and information carrier factors influence health information-seeking behavior. Health-related factors and information carrier characteristics directly affect people's utility of the information carrier. The utility is a mediator to influence information-seeking actions, while information carrier characteristics also directly affect the actions.

At first, scholars explored this theory in the context of traditional media, such as cancer information seeking in cancer-related magazines (Johnson & Meischke, 1993). However, in the last two decades, most research using the CMIS has explored online health information-seeking behaviors, including the interactive cancer communication system (Han et al., 2010), information-seeking behavior of cancer survivors (Hartoonian et al., 2014), and health information scanning (Ruppel, 2016). The CMIS is a basic causal framework, meaning that different contexts may change the variables in the framework (Johnson, Donohue, Atkin, & Johnson, 1995). Therefore, most studies mentioned above have made some adjustments to the CMIS based on their specific contexts and obtained meaningful findings. Consequently, we propose that with adjustments, the CMIS is ideal for examining adult children's online age-related disease information-seeking behavior for their aged parents in China.

Previous studies using the CMIS included four demographic variables: age, gender, education level, and income (Hartoonian et al., 2014; Johnson & Meischke, 1993; Ruppel, 2016). Mixed results have been found regarding the effect of demographics on utility. While Hartoonian and colleagues (2014) reported no direct effects of demographics on utility, van Stee and Yang (2018) found that demographics significantly predict utility. Therefore, the effect of demographics on utility in China needs more investigation.

Direct experience refers to whether the participants or people within their social networks have experienced a certain disease. People who have experienced a certain disease themselves or whose family members and friends have been diagnosed with it may feel that the disease is close to them, making them more likely to perceive related health information as useful. This concept has been widely explored in different contexts, especially cancer information seeking (Han et al., 2010; Hartoonian et al., 2014; Johnson & Meischke, 1993; Ruppel, 2016). However, age-related diseases are much more common in older adults than cancer (Dang, 2018). Most older adults have direct experience with age-related diseases. Therefore, parents' health status and prior information seeking are more likely to be associated with this type of information seeking (Ruppel, 2016). In other words, adults who think their parents' general health is poor and who have searched for age-related disease information from any source are more likely to perceive the higher utility of the Internet for age-related information.

Salience refers to the degree of personal significance attached to a health issue. It contains two distinctive components: fear, a negative emotional state that people experience in response to a certain disease, and subjective probability, the perceived possibility of developing the disease (Johnson & Meischke, 1993). When people fear a certain disease, believing that it can significantly impact their lives and that they are susceptible to it, the urge to stay away from it reminds them of the usefulness of a given medium for

related information. Additionally, according to the health belief model, the perceived threat and possibility of developing a certain disease can facilitate an individual's behavioral changes, although the perceived threat is a cognitive appraisal different from fear (Rosenstock, 1974). The CMIS uses utility as the mediator to explain this decision-making process better. Substantial studies have proven that the subjective probability and fear of a certain disease can motivate health information-seeking behaviors (Mou, Shin, & Cohen, 2016; Nan, Underhill, Jiang, Shen, & Kuch, 2012).

In the CMIS, beliefs refer to an individual's perceived efficacy regarding a certain disease. Those who believe the disease is addressable are more motivated to seek health information than those who believe nothing can be done to prevent it (Johnson & Meischke, 1993). According to the extended parallel processing model, this may happen because people who perceive that a certain disease is addressable are motivated to adopt related healthy behaviors, while those who believe that it is inevitable are likely to avoid related information since they feel it is meaningless to seek or receive such information (Chen & Yang, 2019; Witte, 1992). Studies have indicated that people with higher efficacy are more likely to seek health information online than people with lower efficacy (Lee & Kim, 2015; Wigfall & Friedman, 2016).

Utility refers to an individual's judgment of a selected source's relevance, importance, and usefulness for seeking information (Johnson et al., 1995). According to the technology acceptance model, the perceived usefulness of a particular technology can affect users' behavioral intentions and influence their actual uses (Davis, 1989; Venkatesh & Davis, 2000). If people perceive that a selected source is useful for seeking the desired information, they will be more likely to seek information from this source; it would be unreasonable to seek online health information if people believed that the Internet was a useless source of such information. Substantial studies have found that utility positively relates to information-seeking behavior (DeLorme, Huh, & Reid, 2011; Johnson et al., 1995; Johnson & Meischke, 1993; van Stee & Yang, 2018). This study follows the definition of utility from the original theory. Based on the evidence mentioned above, we present the following research question and hypotheses:

RQ1: To what extent do adult children's (a) age, (b) gender, (c) education level, (d) income, and (e) parents' age associate with adult children's utility of online age-related disease information?

H1: Parents' general health is negatively associated with adult children's utility.

H2: Adult children's prior information seeking is positively associated with adult children's utility.

H3a: Adult children's salience (fear) is positively associated with adult children's utility.

H3b: Adult children's salience (subjective probability) is positively associated with adult children's utility.

H4: Adult children's beliefs are positively associated with adult children's utility.

In the CMIS, information carrier characteristics were initially defined as editorial tone and communication potential (Johnson & Meischke, 1993). Editorial tone refers to the individual's perception of the credibility and intent of the information from the carrier. Communication potential refers to individuals'

ability to understand the information on the channel (Johnson & Meischke, 1993). Later studies using the CMIS simplified this variable to the perceived quality of online health information and the difficulty of understanding that information (Hartoonian et al., 2014). Suppose people perceive online information as low quality and challenging to understand; in that case, they will be less likely to perceive the Internet as an appropriate means for seeking cancer information (van Stee & Yang, 2018). This study uses the later definition of information carrier characteristics. Based on the preceding propositions of the CMIS, we hypothesize the following:

H5: Information carrier characteristics are positively associated with adult children's utility.

H6: Information carrier characteristics are positively associated with adult children's age-related disease online information seeking for their aged parents.

H7: Adult children's utility is positively associated with adult children's age-related disease online information seeking for their aged parents.

eHealth Literacy

Another construct often examined in the context of health information seeking is eHealth literacy, which refers to an individual's ability to search, locate, understand, and evaluate health information on the Internet and apply it when addressing health concerns (Norman & Skinner, 2006). Studies have shown that this multidimensional concept of eHealth literacy is more applicable than the traditional concept of health literacy in the context of online health information seeking (Kim & Xie, 2017). Researchers have applied this concept to healthy behaviors in the online information context. For instance, Neter and Brainin (2012) reported that people with high eHealth literacy generally adopt more diverse search strategies, check information more carefully, and experience better outcomes than people with low eHealth literacy.

The current study seeks to expand the explanatory power of the CMIS by incorporating eHealth literacy. This eHealth literacy may play a role in children's decision-making processes and affect the relationships within the CMIS. For instance, it is plausible that adult children who perceive that their eHealth literacy is high would have stronger associations between utility and intentions to seek health information online for their aged parents. They would do this because they are confident that their surrogate-seeking online would benefit their parents. On the contrary, adult children with low eHealth literacy, even if they perceive the Internet as a useful medium for seeking age-related disease information, will be less likely to do so since they may think that they are unable to find, understand, and apply that information to help their parents.

To explore these complex processes, research question 2 is presented below, and Figure 1 shows the hypothesized CMIS outlining the relationships among the major variables:

RQ2: Are there any differences between adult children's levels of eHealth literacy in the relationships among health-related factors, information carrier factors, and actions?

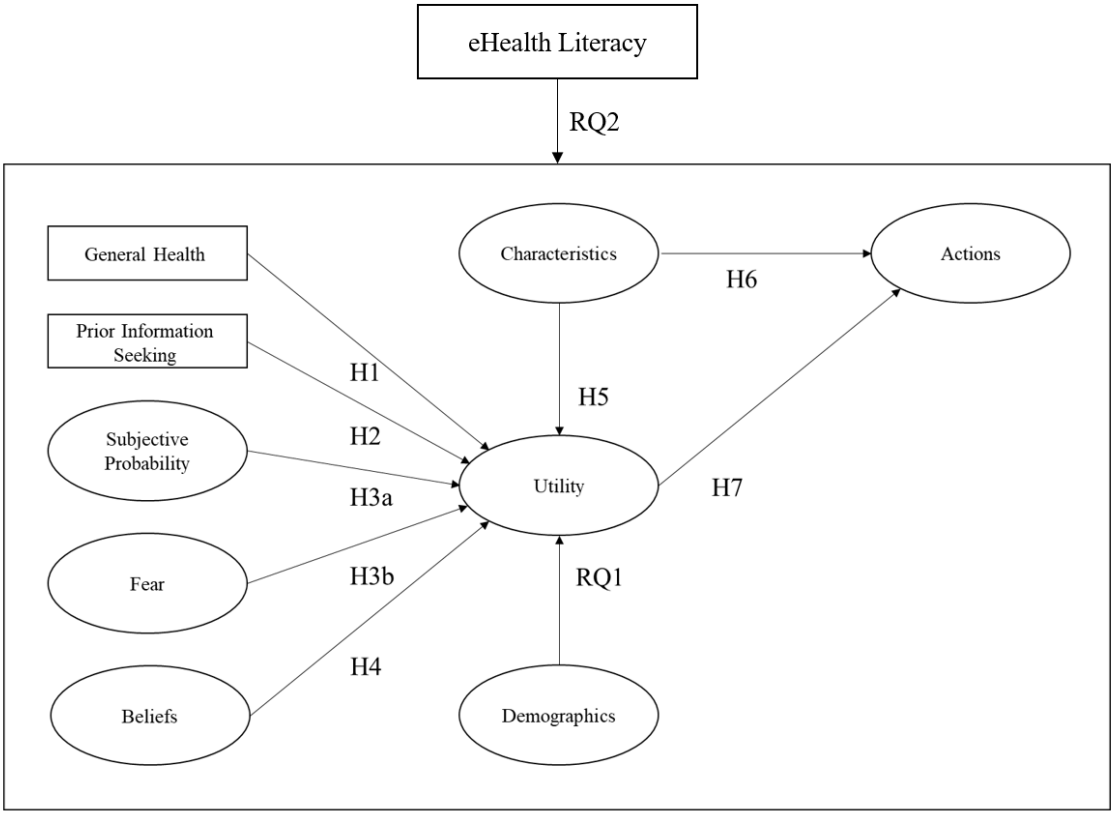

Figure 1. The hypothesized conceptual model.

Method

Participants

This study surveyed 420 online participants recruited by a research company (www.wjx.cn; Bao et al., 2017). This company has an online panel of over 2.6 million members with diverse geographical locations and demographics in China. Participants had to be Chinese citizens whose parents were alive and aged 60 or older. Only people who met the criteria and provided informed consent were presented with the questionnaire (Katz, Gur-Yaish, & Lowenstein, 2010). Due to its non-probability nature, the sample has limitations when generalizing the findings. However, as Basil, Brown, and Bocarnea (2002) illustrated, examining a non-probability sample is acceptable for studies aiming at testing and developing a theoretical model for multivariate relationships instead of building a profile for a general population's perceptions or behaviors. In other words, the estimates of univariate values may differ among different samples, but the multivariate relationships underlying variables are found to be stable.

Data collection took place in March 2020. After removing those who failed the attention checks and did not finish the survey, the final sample size was 381, which consisted of 61.7% females and 38.3% males,

ranging in age from 18 to 59 years (M = 40.23, SD = 8.32). Additionally, 83.5% of the participants (n = 318) had sought age-related disease information from a source (online or otherwise) for their aged parents.

Measures

Demographics were measured by asking for participants' age, gender, educational qualifications, and annual income in Chinese yuan. Participants were also asked about their fathers' and mothers' ages, ranging from 60 to 94 years (M = 68.78, SD = 7.55).

To measure parents' general health and salience, we followed the practice of research in gerontology, measuring the father and mother as a whole (Katz et al., 2010). General health was assessed using the item "In general, would you say your parents' health is?" measured on a 5-point Likert-type scale (1 = excellent and 5 = poor), adapted from Hartoonian and colleagues (2014) and Ruppel (2016). Responses were reverse-scored so that higher scores reflected better health status.

Next, prior information seeking was measured with the item "Have you ever looked for information about age-related disease information from any source?" adjusted from Ruppel (2016). Response options were "yes" and "no."

According to Basnyat, Nekmat, Jiang, and Lin (2018) and Johnson and Meischke (1993), salience is better treated as two latent variables: subjective probability and fear. This separation is also supported by the health belief model, which postulates that perceived susceptibility and seriousness are two distinct aspects of perceived threat, a construct equivalent to salience in the health context. Therefore, salience in this study was measured separately by subjective probability and fear. Additionally, since age-related diseases are prevalent in older adults, we measured participants' subjective probability and fear of their aged parents developing severe age-related diseases to better fit in this context. To clarify in advance, we noted in the questionnaire that severe age-related diseases could be lethal in the long term, such as hypertension, heart diseases, cerebrovascular diseases, osteoporosis, senile cataracts, senile dementia, and cancers. All five items in this section were measured on a 5-point Likert-type scale (1 = strongly disagree and 5 = strongly agree), adjusted from Johnson and Meischke (1993) and Ruppel (2016). For subjective probability, participants indicated their agreement with the two statements "I feel that my aged parents' chances of getting serious age-related diseases in the future are good" and "There is a good possibility that my parents will get serious age-related diseases" (α = 0.90). Fear was measured with three items, including "I am very afraid of my parents getting serious age-related diseases," "I worry a lot about my parents getting serious age-related diseases," and "The thought of my parents getting serious age-related diseases terrifies me" (α = 0.89).

Finally, beliefs were measured on a 5-point Likert-type scale (1 = strongly disagree and 5 = strongly agree), adapted from van Stee and Yang (2018). It comprised three items, including "It seems like everything causes age-related diseases when people are old," "There is not much you can do to lower old people's chances of getting age-related diseases," and "There are so many different recommendations about preventing age-related diseases, so it is hard to know which ones to follow" (α = 0.82).

Information carrier characteristics were measured on a 5-point Likert-type scale (1 = strongly disagree and 5 = strongly agree), adapted from Hartoonian and colleagues (2014). Participants were asked

how strongly they agreed with the following two statements: "I am concerned about the quality of online age-related disease information" and "Online age-related disease information is hard to understand" (α = 0.71). We reversed the sequences of their answers to these two items in data analysis so that higher scores would mean better quality and understandability.

The utility was measured on a 5-point Likert-type scale (1 = strongly disagree and 5 = strongly agree), adapted from Johnson and Meischke (1993). It comprised three items, including "Online age-related disease information can improve my parents' life," "Online age-related disease information is useful," and "Online age-related disease information helps my parents with their health issues" (α = 0.92).

eHealth literacy was measured by the eHealth literacy scale (Norman & Skinner, 2006). This scale has eight items measured on a 5-point Likert-type scale (1 = strongly disagree and 5 = strongly agree). In data analysis, the numbers for each of the eight questions are normally added together to get an eHealth literacy score (ranging from 8 to 40). This scale was reduced to four questions according to the dimensions they measured. The four items were as follows: "I feel confident in using information from the Internet to make health decisions," "I know how to use the Internet to answer my health questions," "I have the skills I need to evaluate the health resources I find on the Internet," and "I know where to find helpful health resources on the Internet." An average score was then computed in the multigroup analysis (α = 0.93). Based on the mean score, 46% (n = 176) of participants had low eHealth literacy, and the rest had high eHealth literacy.

The scale to measure actions came directly from previous studies on the same topic (Bao et al., 2017) but was modified as the intention to do so (α = 0.95). Participants were asked for their agreement with two items on a 5-point Likert-type scale (1 = strongly disagree and 5 = strongly agree). One example is "I plan to seek age-related disease information online for my parents."

Analytical Approach

After data cleaning, descriptive statistics and reliability examination were performed with SPSS 26. All three items measuring beliefs were reverse-coded for analysis. Structural equation modeling (SEM) was performed with Amos 24 to test the proposed model. The model was evaluated using multiple fit criteria: χ^2 goodness-of-fit statistic, the comparative fit index (CFI), the Tucker–Lewis index (TLI), the standardized root mean residual (SRMR), and the root mean square error of approximation (RMSEA). Having RMSEA ≤ .06, CFI and TLI ≥ .95, and SRMR < .08 were considered the threshold for good model fit (Hu & Bentler, 1999).

To test whether the CMIS differed among people with different levels of eHealth literacy, we divided the participants into two groups according to the mean value. The respondents' distribution across the two groups was fairly equal (i.e., high eHealth literacy: n = 205; low eHealth literacy: n = 176).

To answer RQ2, we conducted a multigroup analysis to test whether the CMIS differed across these high- and low-eHealth literacy groups. Procedurally, we first ran a multigroup model with these high- and low-eHealth literacy groups. Then a similar model was conducted but with all paths constrained to be equal. Next, the chi-square difference test was performed to compare the unconstrained and constrained multigroup models. Significant chi-square test results imply that these two groups differed statistically (Yuan & Bentler, 2004). Finally, we conducted a series of multigroup models. Using the chi-square test, each causal

path was constrained equally across the two groups at a time and compared to see whether a significant difference was located at a particular path within the model.

Results

We found excellent model fits for the measurement model, the baseline SEM model, and the multigroup model. For all participants, fear, information carrier characteristics, and gender were significant predictors of utility, while utility and information carrier characteristics significantly predicted actions. Additionally, four paths were significantly different across the multigroup models. The correlations, means, and standard deviations among the variables in the model can be requested from the authors via e-mail. All continuous variables in the model were tested for normality, and no kurtosis nor skewness exceeded 2 (Curran, West, & Finch, 1996).

Results show the model fitting the data very well, with χ^2 (148) = 263, RMSEA = .045, 90% confidence interval (CI; .036, .054), CFI = .97, TLI = .96, and SRMR = .04. The R^2 value for actions was .35. Figure 2 presents the standardized pathway coefficients and variable relationships in the model.

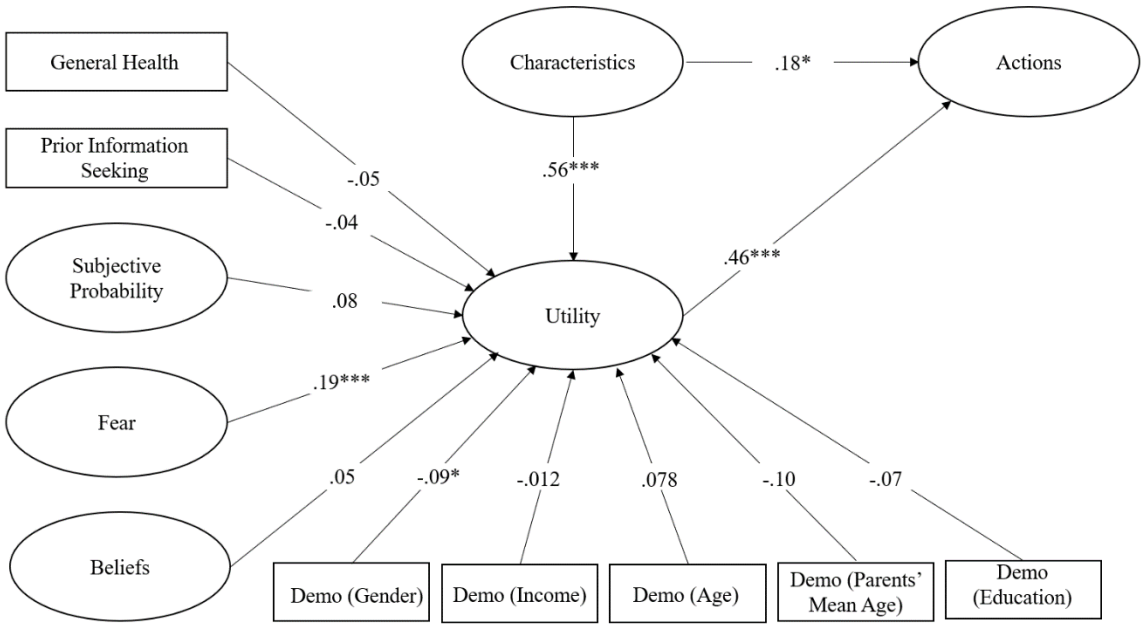

Figure 2. Structural equation model with standardized coefficients (N = 381).
Note. **p* < .05, ***p* < .01, ****p* < .001.

Direct Effects

Fear and information carrier characteristics were positively related to the utility of the Internet for health information. For gender, women were more likely to find the Internet useful for seeking age-related disease information. In addition, utility and information carrier characteristics were positively related to adult children's active information seeking online for their aged parents.

Multigroup Analysis

Table 1 shows the results of the multigroup analysis of the CMIS between the groups with high and low eHealth literacy. The R^2 values for actions were .52 in the high-eHealth literacy model and .18 in the low-eHealth literacy model. The constrained model had excellent fit (χ^2 (318) = 572, RMSEA = .046, 90% CI (.040, .052), CFI = .94, TLI = .91, SRMR = .06); the unconstrained model had better fit (χ^2 (296) = 508, RMSEA = .043, 90% CI (.037, .050), CFI = .95, TLI = .92, SRMR = .05).

The results of the chi-square difference test revealed that there was a significant group difference between the two models (χ^2 (1) = 63.62, p < .001). This implies that the CMIS differs between people with high and low eHealth literacy, hence answering RQ2.

Table 1. Multigroup Analysis Results (N = 381).

Multigroup models	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
Unconstrained	508.139	296	1.72	.95	.92	.04	.05
Constrained (all paths)	571.755	318	1.80	.94	.91	.05	.06
Chi-square difference test	$\Delta\chi^2$ (1) = 63.62, p < .00						
Constrained (fear—utility)	511.619	297	1.72	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = 3.48, p = .07						
Constrained (characteristics—utility)	525.359	297	1.77	.95	.92	.04	.06
Chi-square difference test	$\Delta\chi^2$ (1) = 17.22, p < .00						
Constrained (gender—utility)	508.289	297	1.71	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = .15, p = .70						
Constrained (general health—utility)	510.099	297	1.72	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = 1.96, p = .16						
Constrained (prior seeking—utility)	508.579	297	1.71	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = .44, p = .50						
Constrained (education—utility)	508.219	297	1.71	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = .08, p = .79						
Constrained (income—utility)	508.169	297	1.71	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = .03, p = .86						
Constrained (parents' mean age—utility)	508.79	297	1.71	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = .44, p = .51						
Constrained (age—utility)	508.139	297	1.71	.95	.92	.04	.05

Chi-square difference test	$\Delta\chi^2$ (1) = .00, p = .98						
Constrained (beliefs—utility)	509.469	297	1.72	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = 1.33, p = .25						
Constrained (subjective probability—utility)	508.319	297	1.71	.95	.92	.04	.05
Chi-square difference test	$\Delta\chi^2$ (1) = .18, p = .68						
Constrained (characteristics—actions)	515.059	297	1.73	.95	.92	.04	.06
Chi-square difference test	$\Delta\chi^2$ (1) = 6.92, p < .05						
Constrained (utility—actions)	535.769	297	1.80	.95	.92	.04	.06
Chi-square difference test	$\Delta\chi^2$ (1) = 27.63, p < .00						

The subsequent series of chi-square difference tests revealed that the group difference was located at three paths. These were the paths from characteristics to utility (χ^2 (1) = 17.22, p < .001) in the high-eHealth literacy model (β = .15, p = .09) and low-eHealth literacy model (β = .61, p < .001), the path from characteristics to actions (χ^2 (1) = 6.92, p < .01) in the high-eHealth literacy model (β = .06, p = .47) and low-eHealth literacy model (β = .37, p < .001), and the path from utility to actions (χ^2 (1) = 27.63, p < .001) in the high-eHealth literacy model (β = .69, p < .001) and low-eHealth literacy model (β = .08, p = .46). Additionally, as shown in Figures 3 and 4, the path from general health to utility was significant in the high-eHealth literacy group model (β = −.17, p < .05) and insignificant in the low-eHealth literacy model (β = −.05, p = .58), suggesting that it was also significantly different between participants with high and low eHealth literacy.

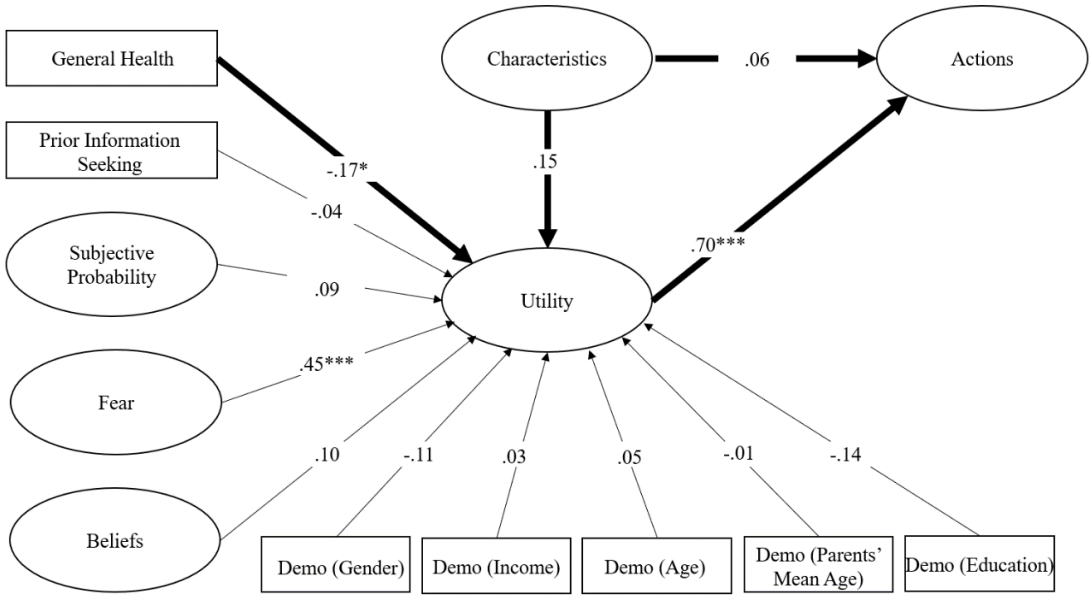

Figure 3. Multigroup analysis results for participants with high eHealth literacy (n = 205).

Note. Numbers are standardized estimates, and the highlighted paths are the significantly different paths between participants with high and low eHealth literacy; *p < .05, **p < .01, ***p < .001.

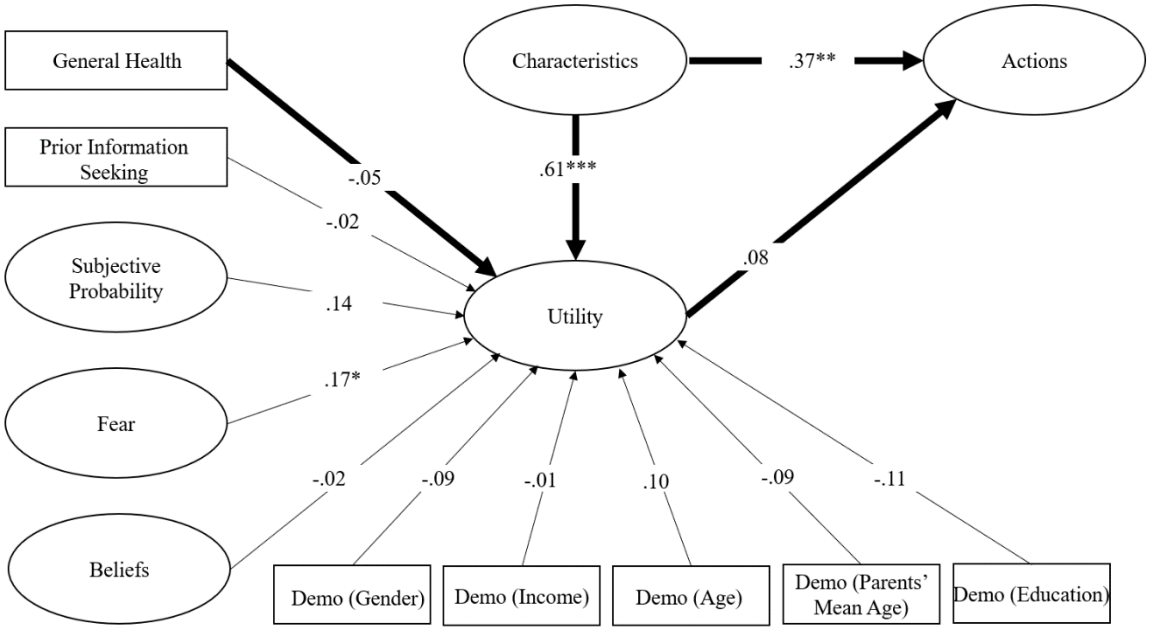

Figure 4. Multigroup analysis results for participants with low eHealth literacy (n= 176).

Note. Numbers are standardized estimates, and the highlighted paths are the significantly different paths between participants with high and low eHealth literacy; **p* < .05, ***p* < .01, ****p* < .001.

Discussion

The current study used an extended CMIS to examine the factors driving adult children's online age-related information seeking for aged parents. To achieve this, the original CMIS was adapted to incorporate parents' health conditions, and a multigroup analysis was performed based on participants' eHealth literacy.

Gender was negatively related to utility, suggesting that women are more likely than men to perceive the Internet as a useful medium for seeking age-related information for aged parents. This finding is consistent with previous research that has shown that women are more likely than men to seek health information (DeLorme et al., 2011; Nan et al., 2012; Ou & Ho, 2022; Wang et al., 2021). Our finding adds to the literature that when it comes to seeking health information for aged parents, women may also be more active than men.

For salience, fear was positively related to utility, but subjective probability did not significantly affect utility. This finding differs from previous research on online health information seeking for the individual seeker, proving that the surrogate seeking context uniquely influences their decision-making process (Basnyat et al., 2018; Wang et al., 2021). One possible explanation is that people may generally be aware of the prevalence of age-related diseases among older adults. Simply knowing their parents are likely to experience age-related diseases cannot convince them to perceive the Internet as a useful medium

for seeking age-related information. Rather, the emphasis on how severe these diseases may become can be more effective in raising the utility of the Internet.

Next, consistent with the CMIS, information carrier characteristics predicted utility, and both information carrier characteristics and utility predicted online health information seeking for aged parents. These findings are consistent with van Stee and Yang's (2018) findings in the self-seeking context. They reported that the relationships among information carrier characteristics, utility, and information-seeking behavior could be extended from magazines to the Internet context. The current study further indicates that these relationships may predict online health information seeking for aged parents in the Chinese context, consistent with a study of surrogate-seeking for aged parents in Germany (Reifegerste et al., 2020).

The multigroup analysis showed that utility was positively associated with age-related disease information seeking for participants with high eHealth literacy. In contrast, no significant association was found between utility and age-related disease information seeking for those with low eHealth literacy. This finding is consistent with previous research on online health information for the individual seeker (e.g., Gulec, Kvardova, & Smahel, 2022; Tennant et al., 2015; Wong & Cheung, 2019). One explanation for this finding in the surrogate-seeking context may be that when people have confidence in their eHealth literacy and perceive the Internet as a useful medium for seeking age-related disease information, they tend to seek this information online for their aged parents. On the contrary, when people perceive their eHealth literacy to be low, regardless of how useful they may believe the medium to be, they are unlikely to use the medium because, in their opinion, they are incapable of finding, applying, or identifying true and false age-related disease information online. Therefore, they are unlikely to perceive the Internet as a good medium for seeking age-related disease information; instead, they may consider other mediums.

One of the key findings of this study was that characteristics of the Internet significantly predicted utility and actions for participants with low eHealth literacy, while these two associations were insignificant for participants with high eHealth literacy. It is plausible that people with low eHealth literacy are more likely to rely on their perceived characteristics of the Internet to judge whether it can be used to seek age-related disease information. Specifically, only when they trust the quality and understandability of online health information will they perceive this source as useful and seek age-related disease information on the Internet. Conversely, people with high eHealth literacy may not pay much attention to the characteristics of the Internet because they are confident in finding and applying useful health information online.

While no significant association was found between parents' general health status and utility for participants with low eHealth literacy, parents' general health status was negatively associated with utility for participants with high eHealth literacy. Surprisingly, this finding is inconsistent with a previous meta-analysis of self-seeking in 20 studies across populations, where the individual seeker's health status had no significant relationship with health information seeking (Wang et al., 2021). Our finding suggests that eHealth literacy level may be an important moderator in future research on health information seeking. A possible explanation for our finding is that when they consider their parents' general health to be low, people with low eHealth literacy are highly likely to seek age-related disease information for their aged parents in other ways, such as consulting with doctors, instead of relying on the Internet. On the contrary, when people with high eHealth literacy consider their parents' general health status to be low, they may think that by

exerting their eHealth skills, seeking health information online can fulfill their parents' needs, and they, therefore, perceive the utility of the Internet as high.

Finally, although this study found that this model and multigroup approach fit well in China, future studies should also consider culture as an important factor. For instance, in Chinese culture, children are generally responsible for their parent's health status. In contrast, adults are responsible for their own health in the United States, but they still can expect help from their communities. Future research might explore community as a contextual factor in predicting surrogate-seeking behavior in American or other Western communities, where community members may seek information for others in need (Estacio, Whittle, & Protheroe, 2019; Sun, Hu, Grossman, Basnyat, & Wang, 2021).

Implications

Findings from the present study provide multiple theoretical implications related to the CMIS, surrogate-seeking for aged parents, and eHealth literacy. First, this study applied the CMIS to the context of seeking health information online for aged parents while considering the distinct family values for health issues in China. We demonstrated that future research could apply this model in other surrogate-seeking contexts, including parents' surrogate-seeking for children and caregivers' surrogate-seeking for patients in the family. Second, given that eHealth literacy effectively incorporates health literacy and Internet skills, we found that it fits well in exploring health behaviors online and warrants more exploration. Third, a multigroup analysis led to the findings that eHealth literacy systematically impacts the associations posited by the CMIS. Unpacking group differences proved a promising direction for further understanding human behaviors and theory building. Future research can examine the impact of eHealth literacy on other online behavioral outcomes and try to use other relevant variables to find other significant group differences.

There are also several implications of the findings for application in healthcare settings. To address the social issue of older adults' lack of access to online health information in China and other developing countries, practitioners can design campaigns to encourage surrogate-seeking for their aged parents. According to the findings in this study, fear should be a vital component of these campaigns. Healthcare providers should tailor messages to adult children to enhance their fear, which may improve patients' utility of the Internet for seeking health information, leading to more surrogate-seeking behaviors. The findings related to information carrier characteristics also provide implications for practice. To motivate adult children, health information online should be better supervised, verified, and simplified to ensure its quality and understandability. Finally, the findings from the multigroup analysis also offer insights into practices. Practitioners should tailor their campaigns according to audiences' eHealth literacy. Adults with high eHealth literacy should be told more about the negative consequences of their parents getting severe age-related diseases. In contrast, adults with low eHealth literacy need high-quality and accessible health information online and training on eHealth skills.

Limitations

It is also important to recognize the limitations of the current study. First, the data were collected online, making the study susceptible to sampling bias. Also, since this study applied a cross-sectional design, the causal relationships inferred from our results should be interpreted with caution. A promising direction for future research would be to employ longitudinal data or experiments to test the proposed model. In addition, more complex aspects of family life should be explored in future studies, such as social responsibilities, relationship status, and family obligations. In Chinese society, filial piety could also be an important predictor to examine. Last, this research only applied the modified CMIS in age-related disease information seeking. Applying it to information seeking for other diseases or general health may change the associations in the proposed model. Future research should further expand the explanatory power of the CMIS in other contexts.

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