Investigation of the Influential Factors in Leading People to Seek Mobile Information for the Promotion of Health-Related Behaviors

Kyung Han You (Ryu) and Jaehee Cho

1 Department of Media and Communication Studies, School of Social Sciences, Jeonbuk National University, Jeonju 54896, Korea
2 Department of Media and Entertainment, School of Communication, Sogang University, Seoul 04107, Korea

Correspondence: kuy114@jbnu.ac.kr (K.H.Y.); jcho76@sogang.ac.kr (J.C.)

Received: 13 October 2020; Accepted: 9 December 2020; Published: 15 December 2020

Abstract: This study explored the cognitive structures that influence mobile information seekers’ intentions of promoting health behaviors. Using a nationwide self-reported survey (n = 1010) conducted by a national research institute in Korea, the present study conducted multiple regression analyses and moderated mediation tests for its analysis. The results showed that two of the three social cognitive components—i.e., health information orientation (HIO) and e-health literacy (EHL)—had a positive effect on users’ mobile health information seeking behaviors (MHIS), whereas informational social support (ISS) did not. Furthermore, the effects of the social cognition factors varied based on the type of health-promoting behaviors, and the types of health-related behavior predicted by the three factors also differed. Moreover, HIO was a factor that affected only nutritional intake among all of the health promotion behaviors, while ISS was a critical factor that predicted most health-related behaviors, except for the participants’ regular exercise (REX). The findings also indicated that the respondents’ levels of health efficacy and the extent of their health-related information seeking on mobile devices partially mediated the associations between the independent variables and their health-related behavioral outcomes. Among the mediated moderation effects of the three factors in social cognition theory (SCT), only the mediated effects of EHL were found to be significant. Based on these findings, the present study highlighted that the predictors of health-promoting behaviors may vary according to the features of the information seekers. The further implications of the study are also discussed.

Keywords: social cognitive theory; health information orientation (HIO), e-health literacy (EHL); informational social support (ISS); mobile health information seeking (MHIS); health-related self-efficacy (HSE); health-promoting behavior

1. Introduction

As innovative technologies marked by mobile applications incorporated into the internet have been applied to health-related products, a plethora of research has explored the effects of these technologies on individuals’ health-related behavioral outcomes [1,2]. According to Lee et al., for example, the use of these communication technologies has helped to shape people’s health promotion behaviors, and they have suggested that, at present, the use of mobile technology is commonplace for health-related activities [3]. However, the models in the previous studies have not been able to fully explain the comprehensive cognitive structure of the information-seeking process that promotes health-related behaviors. Moreover, a number of studies have presented conflicting findings. For example, Stephens and Allen argue that mobile technology is expected to help increase...
physical activity and reduce weight [4]. On the other hand, Balatsoukas et al. point out that the misuse of new technology can lead to potentially harmful consequences of inaccurate health information [5].

In this regard, the present study argues that there are two main reasons for this. One is that most studies do not precisely reflect users’ cognitive processes in seeking information on new media platforms because they are based on simplified models that are designed to obtain more explainable outputs regarding individuals’ informational processes (e.g., Nahm et al. [6]). Another reason is that, although a few studies have attempted to conduct a systematic review, there have been few studies that have attempted a comprehensive evaluation of the diverse types of health-promoting behaviors [7,8].

With the three factors of Social Cognitive Theory (SCT)—an individual’s attitude, environmental influence, and behavioral control—being widely used in the field of health communication, SCT is considered to be one of the key theoretical bases of this study. SCT provides a well-organized conceptual framework for the prediction of the factors that influence individuals’ behavioral outcomes, by concentrating on both one’s psychological and cognitive processes, while also considering environmental factors. SCT has been applied to the very diverse fields of medicine and public health for practical purposes [9].

SCT is adequate to explain triangular interactive relationships among personal factors such as thought and motivation, behavioral factors, and environmental factors. Scholars have examined the effects of a variety of cognitive factors on motivating people to conduct health-related behaviors with the factors in SCT. For example, the Social Psychological Health Model, which investigates the ways in which various socio-cultural factors (such as social support, communication patterns, and socio-demographic variables) are related to individuals’ health-related perceptions (e.g., self-efficacy, health belief) as well as health-related behaviors, has been established in the field of health communication [10].

Despite these efforts, there is insufficient explanation as to the ways in which the information seeking process is combined with the existing factors in SCT. For this reason, there are still many unanswered questions about the ways in which health-related information seeking through new media is cognitively related to an individual’s health promotion behavior. In order to answer these questions, this present study aims to examine the relationship between individuals’ uses of new media for health-related information and their health-promoting behaviors in the cognitive dimension, mainly based on the theoretical assumptions of SCT.

Therefore, this present study has two main research purposes. First, it aims to modify the given three factors (i.e., cognitive, environmental, and behavioral factors) from SCT to be more suitable for the investigation of informational attitude, social norm, and behavioral ability. That is, we try to reconstruct the widely used components of SCT for the purpose of carefully the investigation of the health-related information-seeking process. Second, this study investigates the ways in which three modified factors, i.e., Health Information Orientation (HIO), e-health literacy (EHL), and informational social support (ISS) influence individuals’ health-related information seeking behaviors, and in turn, the ways in which these factors have a differentiated effect on their health-promoting behaviors.

For the analysis, drawing on pooled cross-sectional data, this study set up an empirical research model based on the ordinary least squares regression (OLS). Bivariate and regression analyses were performed in order to estimate the direct and indirect effects of three SCT factors on four different types of health-related behaviors [11–14].

2. Theoretical Background: Three Factors of Social Cognitive Theory

2.1. Health Information Orientation (HIO)

Among the three factors of SCT, the personal factor includes one’s beliefs and attitudes toward performance, the knowledge required for the outcomes, and the expectations of results. In other words, an individual’s cognitive decisions about their environment and experiences have a significant effect on promoting and accepting health-related behaviors. Regarding this, it is comprehensible that individuals’ health information seeking behaviors may be significantly affected by their perception
of the health information environment, as well as their beliefs and attitudes toward seeking health information. Therefore, this present research focused its attention on health information orientation (hereafter, HIO) as one of the main personal factors influencing people’s health behavior.

HIO refers to “the extent to which the individual is willing to look for health information.” [15]. According to previous research, people with higher HIO levels are more motivated to pursue health information, show more trust toward health information on the internet, and tend to use more of it in health-promoting activities. Thus, they tend to look for and learn more about health-related issues more actively than those with lower HIO [16,17]. In a similar vein, Cho et al. have shown that people with high levels of HIO are more likely to acquire health-related information through a variety of channels, and are more likely to have access to health-related devices [18]. Thus, based on these arguments, this research proposed the following hypothesis:

**Hypothesis 1 (H1).** Health information orientation will promote individuals’ health-related information seeking on mobile devices and their health-related behaviors.

### 2.2. E-Health Literacy (EHL)

SCT scholars view behavioral capability as another critical factor. Behavioral capacity refers to the level of understanding of what a specific behavior is and the ways in which to perform the particular behavior, which includes elements such as behavioral knowledge and skills. From an informational point of view, behavioral capacity means an individual’s knowledge and search abilities required in the process of seeking information. The crucial point here is that, unlike general information seeking, the pursuit of health information requires higher levels of understanding and knowledge about health-related information and the channels in which health information is distributed. Taking this into account, we need to construct variables that measure the competence and knowledge that is appropriate in pursuing health-related information. The present study considers e-health literacy as a related concept. E-Health literacy refers to “the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem” [19]. With regards to the effect of e-health literacy, many studies have reported that individuals with higher levels of e-health literacy, particularly older people, tend to accept collective learning for health care purposes [20]. Therefore, the following hypothesis could be established:

**Hypothesis 2 (H2).** E-Health literacy will enhance individuals’ health-related information seeking on mobile devices and their health-related behaviors.

### 2.3. Informational Social Support (ISS)

SCT scholars have highlighted that individuals’ behavioral intentions are influenced by various external factors. In relation to this, self-determination theory states that individuals are motivated by diverse internal and external factors. In terms of internal factors, personal factors—including health information orientation and e-health literacy—would be directly associated with people’s motivation to perform health behaviors. In addition, regarding external factors, it should be considered that social support influences one’s intentions to reduce levels of stress, to use health services, and to accept health-promoting behaviors [21–25].

In regards to social support, considering that this study is an examination of health information-seeking behaviors, focus was placed on informational social support, which includes the provision of information, consultation, and the recommendation of guidelines for patients to solve their problems [26]. It is understandable that, when people obtain useful information for their health from influential others, such as family members and friends, they are more likely to take up health behaviors. Previous studies have shown that informational social support is positively associated with individuals’ health promotion behaviors, as well as their mental health conditions [27,28]. Therefore, this research further tested the following hypothesis:
Hypothesis 3 (H3). Informational social support will be positively associated with individuals’ health-related information seeking on mobile devices and their health-related behaviors.

2.4. Consideration of Various Health Promotion Behaviors

In the health communication domain, scholars have paid close attention to the relationships between information seeking and behavioral outcomes. For example, they have explored the ways in which health information from the media affects health-promoting behaviors. Within the current mobile environment, users can easily find relevant information about health through diverse types of mobile applications. Focusing on this environment, media researchers have reported that health-related information seeking on this new media platform has a positive effect on actual health promotion behaviors and behavioral changes [29,30]. Many scholars have emphasized that, as health information increases, so does health knowledge, and the acquired knowledge is the basis for health-related decisions [26,31]. They have shown that, along with the changes in the media environment, health-related information gathering via mobile devices can provide opportunities for health-related learning, as well as providing personalized health information [32,33].

In addition, this study pays close attention to the fact that there are many dimensions to such health-promoting behaviors. There has been a recent trend focusing on the health effects of nonphysical behaviors, such as health screenings and stress management, even though such health promotion activities have not been considered much in the previous research [34,35]. However, there is a lack of comprehensive research on the ways in which various health-promoting behaviors are related to information seeking behaviors. Taking this into consideration, this study focuses on stress management and regular health screening activities in addition to existing health promotion activities, such as nutrition intake and regular exercise [36]. Therefore, we posed the following research question:

RQ1. How is an individual’s health-related information seeking on mobile devices associated with the different types of health-related behaviors?

2.5. Moderation Effect of Health Efficacy on Health Promotion Behaviors

Finally, this study examines the ways in which the effect of information seeking on health-promoting behaviors may interact with individuals’ given psychological factors. In this regard, we pay attention to another factor: health efficacy. Health efficacy is regarded as a key factor which has a significant impact on synchronizing and directing individuals’ health promotion behaviors, such as identifying one’s current health status and establishing future health plans. Self-efficacy is initially demarcated as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performance” [17]. Health communication researchers have applied this concept to studies on the relationships between health information seeking and behavioral outcomes. However, most studies on health communication have applied health-efficacy and the efficacy of seeking health information without careful consideration. For example, some studies that have examined self-efficacy in terms of internet health information used efficacy, computer self-efficacy, or mobile-use self-efficacy [13,27,37,38]. As a result, it is difficult to judge whether health-efficacy is the leading factor for, or the result of, seeking health-related information.

In this study, we assumed that health-related self-efficacy, which is distinguished from informative self-efficacy, influences individuals’ health promotion behaviors in correlation with the seeking of health information. Although there are not many studies related to this, some studies have found that health efficacy indirectly influences individuals’ health-promoting behaviors via the seeking of health information [14,39]. The mediation effect of health-related efficacy has been reported in previous studies. Particularly, a number of studies on the technology acceptance model (TAM) have demonstrated, through model testing, that health efficacy mediates the relationship between technology acceptance and health-promoting behaviors in the process of gaining technical information [40–42]. Therefore,
based on the previous studies, we propose a final hypothesized model by setting up the following second research question (see at Figure 1):

![Figure 1. Proposed research model.](image_url)

**RQ2.** Does an individual's health efficacy moderate the effect of mobile health-related information retrieval on health-promoting behaviors, and does it mediate the relationship between social cognitive factors and the four types of health-promoting behaviors via mobile information seeking?

### 3. Method

#### 3.1. Sample and Procedure

The set of data used in this study was gained from a nation-wide survey conducted by the National Information Society Agency in Korea. The data were collected between February 24 and March 5, 2016. In total, 1010 the respondents were included in the present study. Within this sample, 496 (49.9%) of the respondents were female, and 504 were male. Furthermore, 212 (21.0%) reported their age as being between 20 and 29, 237 (23.5%) between 30 and 39, 241 (23.9%) as between 40 and 49, and 320 (31.7%) were 50 or older. Education levels were recoded in five ordinal categories. In total, 217 of the participants (21.5%) had completed high school, while 695 of the participants (68.8%) had earned bachelor’s degrees or advanced degrees. The number of non-smokers was 793 (78.5%), while 196 of the respondents (19.4%) were smokers who smoked more than five times a day on average. With regard to alcohol consumption during the past month, 271 of the participants (26.8%) responded that they did not drink at all, while 289 (28.6%) responded that they drink regularly once a week.

#### 3.2. Measures

##### 3.2.1. Health Information Orientation (HIO)

This study referred to the HIO scale used in previous studies [14,43]. Seven items on a five point scale (from 1 to 5) were employed in order to measure the extent of individuals’ orientation regarding health-related information. Some examples are: “I tend to read or see health-related information”; “I like to learn about health-related issues”; “It is important to learn about health-related issues to maintain my health”; “I think as much as possible about both effects and side effects of a drug when taking it”; and “Before making health-related decisions, I look for all relevant information.” These seven items were averaged \( M = 3.67, SD = 0.78, \alpha = 0.88 \).
3.2.2. E-Health Literacy (EHL)

Health communication researchers have developed the e-health literacy scale, and have applied it in their health-related research [15]. By referring to those studies, we created new items in order to measure individuals’ abilities to use health information on mobile devices. The following seven items, on a five point scale ranging from 1 to 5, were employed: “I know how to find valuable health information resources on mobile devices”; “I can use a mobile messenger to answer questions about health”; “I know what health information resources are available on mobile devices”; “I know how to use the health information I found on mobile devices”; “I have the essential skills to assess the health information resources I found on mobile devices”; “I can distinguish health information resources from low quality resources on mobile devices”. We created a scale by averaging these items (M = 3.70, SD = 0.71, α = 0.92).

3.2.3. Informational Social Support (ISS)

As this scale has not been used much in previous research, the present study modified the social support scale based on a discussion of previous studies with a focus on informative aspects [23,24]. The respondents were asked to report their levels of social support according to the following five Likert-type scale items (from 1 to 5): “People around me seem to worry about my health problems together”; “People around me give me health-related knowledge and information”; “People around me advise me to avoid harmful health conditions”; “People around me provide me with the information I need to be able to handle difficult situations in health care”; and “People around me present solutions for my health care problems”. We used a new scale by averaging these five items (M = 3.63, SD = 0.60, α = 0.91).

3.2.4. Mobile Health-Related Information Seeking (MHIS)

In order to measure the extent of health-related information-seeking on mobile devices, the participants were asked to respond to the following statements: “I used to search mobile devices for information on health and medicine”; “I used to find articles in mobile applications about health and medical information”; “I read newspapers or news related to health and medicine on mobile devices”; “I get information about health and medicine through SNS, such as Twitter and Facebook”; “I am likely to participate in health-related cafes, clubs, and communities on mobile devices”; and “I chat with a physician or a specialist via a mobile messenger about my health or medical issues.” By averaging the items, each of which was measured on a five-point scale, ranging from 1 = not at all to 5 = almost every day, we created a new scale (M = 2.65, SD = 1.18, α = 0.87).

3.2.5. Health-Related Self-Efficacy (HSE)

Referring to the study of Cho et al. [14], this study used the following five items on a five point scale in order to estimate individuals’ self-efficacy in relation to their health, ranging from 1 = not confident at all to 5 = completely confident. The items include: “Overall, I am sure that I have a positive influence on my health”; “I am confident that I have a clear purpose to improve my health”; “I can achieve my goal to improve my health”; “I work positively to improve my health”; and “I am confident that I have control over what and how I learn about my health”. We created a scale by averaging these items (M = 3.65, SD = 0.66, α = 0.90).

3.2.6. Health-Promoting Behaviors

The three behaviors of fruit consumption, vegetable consumption, and regular exercise have been widely used in previous studies in order to estimate the respondents’ engagement in health [44–47]. However, it has been reported that these types of health behaviors do not properly reflect individuals’ health behaviors. Thus, the present study used the health-promoting lifestyle profile 2, which provides six subscales that include nutrition, regular exercise, stress management, health responsibility (regular
check-up), spiritual growth, and interpersonal support [48,49]. Among these subscales, we excluded spiritual growth and interpersonal support, as they are less relevant to our study goals. Finally, four types of health-promoting behaviors were measured in this study. We created a scale by averaging the following items, each of which was measured on a five-point scale ranging from 1 = never to 5 = routinely.

### 3.2.7. Nutrition (NUT)

First, in order to measure healthy food consumption (nutrition), the participants were asked: “I regularly eat a certain amount of meals three times a day”; “I eat foods with low cholesterol”; “I limit the intake of caffeinated foods”; “I have food considering nutritional balance”; “I regularly have vegetables high in fiber”; “I regularly consume many fruits and juices high in vitamins”; “I mainly eat natural food rather than junk food”; and “I avoid salty or spicy food”. Each item was measured on a five-point scale ranging from 1 to 5 (M = 3.03, SD = 1.04, α = 0.80).

### 3.2.8. Regular Exercise (REX)

Next, people were asked to report the ways in which they regularly engage in physical exercise: “I usually use stairs rather than elevators”; “I engage in physical exercise, such as swimming, biking, and badminton during leisure time”; “I engage in intense exercise, such as tennis, aerobics, and running about 3–4 times a week”; “I often do simple bare-hands exercises”; “I try to keep the right posture when I sit or stand”. By averaging these five items, each of which were measured on a five-point scale (ranging 1 to 5), we created a new scale (M = 2.87, SD = 1.17, α = 0.79).

### 3.2.9. Stress Management (STM)

Third, we employed the following items in order to measure extents of stress management: “I am aware of what is currently stressing me out”; “I have time for stress relief, such as meditation, travel, theater or movie-going, and shopping”; “I have my own way of controlling stress”; “I know that stress can be the cause of disease”; and “I frankly express my feelings”. All of the items were measured on a five-point scale ranging from 1 to 5, and were averaged out (M = 3.53, SD = 0.82, α = 0.71).

### 3.2.10. Health Responsibility (Regular Check-Ups, RCU)

The participants were asked to report on the individual responsibility, with items measured on five point scale, such as: “I get regular health checkups”; “I consult a health professional about health problems”; “I carry out a regular fitness test”; “I carry out self-examinations, such as for blood pressure and pulse, constantly on my own”; and “I participate in health-related programs, such as for weight control and mental discipline”. We made a scale by averaging the items (M = 2.83, SD = 1.19, α = 0.86).

### 3.2.11. Control Variables

Demographic variables (age, gender, level of education, and family income) were included as control variables, just as they have been in previous studies [50,51]. Furthermore, the participants’ unhealthy behaviors (smoking and drinking) were also included as control variables.

### 3.3. Data Analysis Processes

The statistical analysis of the collected data was performed in parallel with the SPSS and PROCESS Macro statistical packages, which are widely used in the social sciences. Specifically, in order to test the hypotheses, this study employed a hierarchical multiple regression analysis using SPSS version 22. Furthermore, in order to verify a moderated mediation effect for the two RQs by avoiding potential problems of multicollinearity, this study also employed the PROCESS Macro (model 15) 2.16 for SPSS, developed by Professor Andrew F. Hayes [52]. As is well known, the macro process can be used for path analysis based on either the ordinary least squares regression (OLS) or the maximum likelihood
estimation (ML) in order to estimate the direct and indirect effects of simple or multi-media models. The moderated mediation model adds the interaction effects between the mediator (MHIS) and the moderating variable (HSE) to the given multiple regression model. In this macro process model, the indirect effects of an independent variable on a dependent variable, through the mediator, are presented according to the level of interaction with the modulating variable. In addition, this study bootstrapped the indirect effects of four types of health-promoting behaviors by repeatedly (1000 times) sampling cases with replacements from the data in order to check the consistency of a beta coefficient generated by the moderated mediation test.

4. Results

4.1. Preliminary Analysis

A bivariate correlation analysis was performed in order to examine the relationship among all of the variables (see at Table 1). A bivariate Correlation analysis is a method that is used to test the relationship between two quantitative variables; a numerical analysis of how relevant and to what extent the correlations are related to the two variants was also used. Thus, this study conducted a Pearson correlation in order to grasp the direction and strength of the association between the continuous variables, ahead of performing a multiple regression analysis.

|        | HIO  | EHL  | ISS  | HSE  | MHIS | REX  | NUT  | STM  |
|--------|------|------|------|------|------|------|------|------|
| EHL    | -    | -    | -    | -    | -    | -    | -    | -    |
| ISS    | 0.609** | -    | -    | -    | -    | -    | -    | -    |
| HSE    | 0.603** | 0.543** | -    | -    | -    | -    | -    | -    |
| MHIS   | 0.459** | 0.439** | 0.356** | 0.333** | -    | -    | -    | -    |
| REX    | 0.344** | 0.309** | 0.295** | 0.402** | 0.488** | -    | -    | -    |
| NUT    | 0.486** | 0.406** | 0.404** | 0.434** | 0.483** | 0.660** | -    | -    |
| STM    | 0.441** | 0.482** | 0.522** | 0.414** | 0.369** | 0.449** | 0.492** | -    |
| RCU    | 0.381** | 0.347** | 0.391** | 0.394** | 0.546** | 0.626** | 0.599** | 0.446** |

Note: EHL = e-Health Literacy, ISS = Social Support, HSE = Health Efficacy, MHIS = Mobile Health Information-Seeking, REX = Regular Exercise, NUT = Nutrition, STM = Stress Management, RCU = Regular Check-Up. **p < 0.01.

We found significant correlations among all of the variables studied. Mobile health-related information-seeking (MHIS) was strongly positively related to the three factors of social cognition (HIO, r = 0.459, p < 0.01; EHL, r = 0.439, p < 0.01; SS, r = 0.356, p < 0.01) as well as the four types of health-promoting behaviors (REX, r = 0.488, p < 0.01; NUT, r = 0.483, p < 0.01; RCU, r = 0.546, p < 0.01; STM, r = 0.369, p < 0.01). Furthermore, the mediator (MHIS) and moderator (HE) were positively related (r = 0.333, p < 0.01).

4.2. Hypothesis Test

With H1 through H3, we examined whether there would be positive effects from the three social cognitive components—i.e., health information orientation, e-health literacy, and informational social support—on the participants’ health-related information seeking on mobile devices (see Table 2).
The analysis showed that two social cognitive factors—health information orientation and e-health literacy—were strongly associated with levels of individuals’ mobile health-related information seeking (HIO, B = 0.36, SE = 0.05, p < 0.01; EHL, B = 0.23), while informational social support was not shown to be a predictor (ISS, B = 0.08, HSE = 0.05, n.s.). Hence, H1 and H2 were supported, while H3 was not. Next, for RQ1, we explored the ways in which individuals’ use of mobile devices for health-related information-seeking were associated with their engagement in health-promoting behaviors.

As shown in Table 2, individuals’ use of mobile devices for health-related information-seeking was found to be a strong predictor in elevating all of the types of health-promoting behaviors (STM, B = 0.10, SE = 0.02, p < 0.01, RCU, B = 0.46, SE = 0.03, p < 0.01, REX, B = 0.38, SE = 0.03, p < 0.01, NUT, B = 0.26, SE = 0.02, p < 0.01).

However, the findings showed that the influences of three social cognitive components on the four types of health-promoting behaviors were varied in the regression model with all of the variables. Specifically, ISS was a significant factor for the prediction of all health-promoting behavior except for nutritional intakes (B = 0.08, SE = 0.03, p < 0.01, REX, B = 0.07, SE = 0.05, n.s.), while individuals’ health information orientation (HIO) was the factor influencing individuals’ nutritional intakes (B = 0.12, SE = 0.04, p < 0.01). Furthermore, the participants’ mobile health literacy (EHL) was shown to have a positive effect on individuals’ stress managing behaviors (B = 0.28, SE = 0.03, p < 0.01).

Third, for RQ2, we asked whether there would be an interaction effect of individuals’ health-related self-efficacy (HSE) and their use of mobile devices for health-related information seeking (MHIS) on the relationship between social cognition factors and health-promoting behaviors. The results showed that the interaction between MHIS and HSE had a negative effect on the respondents’ intentions of doing regular exercise (B = −0.07, SE = 0.04, p < 0.05).

The analysis indicated that the higher the HSE and the higher the MHIS, the more regularly an individual exercises on average. However, as shown in Figure 2, compared to those with higher HSE, among people with lower HSE, the greater acquisition of health-related information on mobile devices was positively associated with a higher likelihood to exercise regularly.

### Table 2. Results of the multiple regression analysis.

|                                      | Mobile Health Information Seeking | Stress Management | Regular Check-Up | Regular Exercise | Nutritional Intake |
|--------------------------------------|-----------------------------------|-------------------|------------------|------------------|--------------------|
|                                      | B  | SE  | B  | SE  | B  | SE  | B  | SE  | B  | SE  | B  | SE  | B  | SE  | B  | SE  |
| Control Variables                    |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |
| GEN                                  | 0.06 | 0.05 | −0.02 | 0.04 | 0.07 | 0.05 | 0.26 | ** 0.05 | 0.04 | 0.04 |    |    |    |    |    |    |
| AGE                                  | −0.00 | 0.00 | 0.00 | 0.00 | 0.02 | ** 0.00 | 0.01 | ** 0.01 | 0.00 | 0.01 |    |    |    |    |    |    |
| EDI                                  | 0.06 | ** 0.02 | 0.00 | 0.02 | 0.04 | 0.02 | −0.02 | 0.02 | −0.01 | 0.02 |    |    |    |    |    |    |
| INC                                  | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | ** 0.01 | 0.02 | 0.01 | 0.02 | 0.01 |    |    |    |    |    |    |
| SMF                                  | −0.04 | * 0.02 | −0.01 | 0.01 | −0.01 | 0.02 | −0.03 | 0.02 | −0.04 | ** 0.01 |    |    |    |    |    |    |
| ALC                                  | 0.02 | 0.02 | −0.01 | 0.01 | −0.03 | ** 0.02 | −0.01 | 0.01 | −0.01 | 0.01 |    |    |    |    |    |    |
| Social Cognition Variables           |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |
| HIO                                  | 0.36 | ** 0.05 | 0.02 | 0.04 | −0.09 | * 0.05 | −0.03 | 0.05 | 0.12 | ** 0.04 |    |    |    |    |    |    |
| EHL                                  | 0.23 | ** 0.05 | 0.28 | * 0.03 | −0.03 | 0.05 | −0.03 | 0.04 | 0.01 | 0.04 |    |    |    |    |    |    |
| ISS                                  | 0.08 | 0.05 | 0.29 | ** 0.03 | 0.25 | ** 0.05 | 0.07 | 0.05 | 0.12 | ** 0.04 |    |    |    |    |    |    |
| Mediator and Moderator               |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |
| MHIS                                 | −    | −   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |
| HSE                                  | −    | −   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |
| Interaction Term                     |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |    | -   |
| MHIS *HSE                            | 0.04 | ** 0.03 | 0.01 | 0.03 | −0.07 | * 0.04 | 0.02 | 0.03 |    |    |    |    |    |    |    |    |
| R2                                   | 0.25 | 0.35 | 0.42 | 0.34 | 0.40 |    |    |    |    |    |    |    |    |    |    |    |

Note: GEN = Gender, AGE = Age, EDU = Educational Level, INC = Family Income, SMF = Smoking Frequency, ALC = Drinking Frequency, HIO = Health Information Orientation, EHL = e-Health Literacy, ISS = Social Support, HSE = Health Efficacy, MHIS = Mobile Health Information-Seeking, REX = Regular Exercise, NUT = Nutrition, STM = Stress Management, RCU = Regular Check-Up. * p < 0.05, ** p < 0.01.
Meanwhile, there was no effect of the interaction term on increasing other health-promoting behaviors, i.e., stress management (STM, $B = -0.04$, SE = 0.03, $p < 0.10$), regular health check-ups (RCU $B = 0.01$, SE = 0.03, n.s), and nutritional intake (NUT $B = 0.02$, SE = 0.03, n.s.).

Finally, as shown in Table 3, the mediation test showed that the interaction variable negatively mediated only the relationship between EHL and REX among the three cognitive factors and the four health-promoting behaviors ($B = -0.0186$, SE = 0.0107, LLCI = −0.0436, ULCI= −0.0007).

**Table 3.** Indirect effect of MHIS*HSE on health-promoting behaviors.

| Moderated Mediation Effect of X on Y through M | Effect | Boot SE | Bias-Corrected CI |
|-----------------------------------------------|--------|---------|-------------------|
| Moderated Mediator                           |        |         |                   |
| EHL $\rightarrow$ MHIS $\times$ HSE $\rightarrow$ STM | 0.0141 | −0.0095 | −0.0018 0.0373    |
| EHL $\rightarrow$ MHIS $\times$ HSE $\rightarrow$ RCU | −0.0094 | −0.011 | −0.036 0.0091    |
| EHL $\rightarrow$ MHIS $\times$ HSE $\rightarrow$ REX | −0.0186 * | −0.0107 | −0.0436 −0.0007 |
| EHL $\rightarrow$ MHIS $\times$ HSE $\rightarrow$ NUT | 0.0046 | −0.0093 | −0.0115 0.0259   |

Note 1: EHL = e-Health Literacy, HSE = Health-Related Self-Efficacy, MHIS = Mobile Health Information-Seeking, REX = Regular Exercise, NUT = Nutrition, STM = Stress Management, RCU = Regular Check-Up. Note 2: the confidence intervals were calculated by employing bootstrapped resampling methods ($n = 1000$) at a 0.05 level of significance. * $p < 0.05$. 

Figure 2. Result of the moderated mediation test.
5. Discussion

This study focused on the social cognition variables that contribute to the understanding of the structural association between cognitive factors and individuals’ health-promoting behaviors. Particularly, this study explored the effect of the moderated mediation factors that influence individuals’ health efficacy regarding their health promotion behaviors. In addition, this study posited that the effect of social cognitive factors on health-promoting behaviors would differ based on the type of health-related behaviors, by taking into consideration that there are multiple dimensions to health behaviors, which include nonphysical behaviors, such as health screening behaviors and stress relief, which were less-considered in previous studies [34,35].

Our analyses showed that two of the three social cognitive components (HIO and EHL) had a positive effect on MHIS, whereas ISS did not. That is, people receiving health-related support from their interpersonal relationships may not look for health-related information on mobile devices. It can be interpreted that people receiving health-related information through people nearby them are receiving enough informed social support through their acquaintances. However, ISS was found to be a very important factor in the prediction of most health promotion behaviors, except for one’s regular exercise, from which we can infer that the extent of receiving social support means the extent of persistent exposure to health information from significant others; as such, it can have a direct impact on individuals’ health-related behaviors, rather than them seeking health-related information through other channels.

Second, the effects of social cognition factors varied based on the type of health-promoting behaviors. Particularly, the three factors did not predict individuals’ regular exercise (REX), which is somewhat different from the findings of previous studies [36]. Our analysis showed that REX is influenced by demographic factors, such as sex and age, and more importantly, it is directly influenced by other factors, such as mobile health-related information seeking and health-efficacy. This tells us that the social cognitive factors applied to the information aspect in our study revealed that it has a different attribute from health efficacy, the existing factor in SCT.

Moreover, the types of health-related behaviors predicted by the three factors also differed. For instance, HIO was found to affect only nutritional intake among all of the health promotion behaviors, while ISS was significantly important in the prediction of most health-related behaviors except for REX. It is not difficult to understand that people with higher HIO are more interested in health-related information, and thus make more effort regarding nutrition. However, it is thought-provoking that the levels of HIO have a significant effect only on nutritional intake, and not on other health-enhancing activities. The reason why HIO only affected health food consumption may be understood in several ways. One possible explanation for this may be that the health information that people aim for these days tends to be soft, practicable information, which can be used daily, rather than medical or professional information. Recently, people have become particularly interested in food, among other health-promoting behaviors, which can be seen in the recent surge in the number of food reality shows on TV and other media outlets such as YouTube, Netflix, and other over-the-top (OTT) services.

Third, e-health literacy appears to be a very important factor that influences stress management behaviors, which indicates that higher e-health literacy means higher levels of attention to mental health. Since e-health literacy refers to the ability to acquire health information online, the higher the EHL, the better the ability to organize health-related information by oneself. Therefore, those with high health literacy consider the management of stress to be the most crucial activity among all health-enhancing behaviors. Therefore, from this result, there is a need to analyze more precisely the characteristics of people with high levels of health literacy.

Fourth, our analysis showed that the level of individuals’ health efficacy mediated and moderated the relationship between mobile information seeking and intention for regular exercise. That is, while the use of health information via mobile may affect the actual promotion of regular exercise, the degree of effect varied depending on the individual’s level of health efficacy. Specifically, people with lower levels of health efficacy were more likely to have their intentions to exercise regularly be influenced by
mobile information seeking. While health-related mobile information seeking directly affects health promotion behavior, it is also necessary to ensure that the size of the actual effect is precisely identified with regard to psychological factors such as health efficacy.

Fifth, among the mediated moderation effects of the three SCT factors, only the mediated effects of EHL were found to be significant in the present study. While no direct effects of the three factors on REX were observed, indirect effects were found via the interaction variable between MHIS and HSE. This suggests that, when combined with the aforementioned MHIS and HSE, EHL can enhance the physical and direct health-promoting activities among various types of health-promoting activities.

Finally, the findings indicated that modified SCT factors have not always elevated all types of health-promoting behaviors. In order to investigate the differential influences, we identified the four health-promoting behaviors as being divided into mental (STM) and physical dimensions (REX, NUT, RCU) on a physical level, and promotive (NUT, REX) and preventive dimensions (RCU, STM) on a practical level. According to this classification, EHL is involved in health-related activities on the mental side, while HIO is associated with physical and preventive health-care activities. On the other hand, regular exercise—as a preventive and physical activity—can be regarded as a private activity rather than group act, and thus ISS can be interpreted as having no effect on REX, as opposed to influencing different types of health-related behaviors.

In sum, the present study provides meaningful implications by empirically showing that health-related behaviors can be divided into several dimensions, and that health-related behaviors may or may not be promoted by factors such as individual information-seeking orientation and attitude, or the exchange of information resources. In addition, based on those main findings, this study highlighted that the factors of the prediction of health-related behaviors may vary according to the features of the information-related behavior.

Author Contributions: K.H.Y. conceived, designed and wrote the introduction, literature review and methods sections; J.C. performed the analyses and wrote the results section. Two authors wrote the conclusions section. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2019S1A5A2A03054487).

Conflicts of Interest: The authors declare no conflict of interest.

References
1. Quanbeck, A.; Gustafson, D.; Marsch, L.A.; McTavish, F.M.; Brown, R.; Mares, M.-L.; Johnson, R.A.; Glass, J.E.; Atwood, A.K.; McDowell, H. Integrating addiction treatment into primary care using mobile health technology: Protocol for an implementation research study. *Implement. Sci.* 2014, 9, 65. [CrossRef] [PubMed]
2. Zhao, J.; Freeman, B.; Li, M. Can mobile phone apps influence people’s health behavior change? An evidence review. *J. Med. Internet Res.* 2016, 18, e287. [CrossRef] [PubMed]
3. Lee, K.; Kwon, H.; Lee, B.; Lee, G.; Lee, J.H.; Park, Y.R.; Shin, S.-Y. Effect of self-monitoring on long-term patient engagement with mobile health applications. *PLoS ONE* 2018, 13, e0201166. [CrossRef]
4. Stephens, J.; Jerilyn, A. Mobile phone interventions to increase physical activity and reduce weight: A systematic review. *J. Cardiovasc. Nurs.* 2013, 28, 320. [CrossRef] [PubMed]
5. Balatsoukas, P.; Kennedy, C.M.; Buchan, I.; Powell, J.; Ainsworth, J. The role of social network technologies in online health promotion: A narrative review of theoretical and empirical factors influencing intervention effectiveness. *J. Med. Internet Res.* 2015, 17, e141. [CrossRef]
6. Nahm, E.-S.; Resnick, B.; DeGrezia, M.; Brotemarke, R. Use of discussion boards in a theory-based health web site for older adults. *Nurs. Res.* 2009, 58, 419–426. [CrossRef]
7. Kirwan, M.; Duncan, M.; Vandelanotte, C. Smartphone apps for physical activity: A systematic review. *J. Sci. Med. Sport* 2013, 16, e47. [CrossRef]
8. McKay, F.H.; Cheng, C.; Wright, A.; Shill, J.; Stephens, H.; Uccellini, M. Evaluating mobile phone applications for health behaviour change: A systematic review. *J. Telemed. Telecare* 2018, 24, 22–30. [CrossRef]

9. McCalister, A.L.; Cheryl, P.L.; Guy, P.S. How individuals, environments, and health behaviors interact. In *Health Behavior and Health Education*, 4th ed.; Glanz, K., Barbara, K.R., Kasisomayajula, V., Eds.; Jossey-Bass: San Francisco, CA, USA, 2008; pp. 169–188.

10. Corcoran, N. *Communicating Health: Strategies for Health Promotion*; SAGE Publications: London, UK, 2013; pp. 5–28.

11. Gök, S.M.; Sezen, B. Analyzing the ambiguous relationship between efficiency, quality and patient satisfaction in healthcare services: The case of public hospitals in Turkey. *Health Policy* 2013, 111, 290–300. [CrossRef]

12. Agarwal, E.; Ferguson, M.; Banks, M.; Vivanti, A.; Batterham, M.; Bauer, J.; Capra, S.; Isenring, E. Malnutrition, poor food intake, and adverse healthcare outcomes in non-critically ill obese acute care hospital patients. *Clin. Nutr.* 2019, 38, 759–766. [CrossRef]

13. Fiorillo, D.; Sabatini, F. Quality and quantity: The role of social interactions in self-reported individual health. *Soc. Sci. Med.* 2011, 73, 1644–1652. [CrossRef] [PubMed]

14. Pan, W.; Connett, J.E. Selecting the working correlation structure in generalized estimating equations with application to the lung health study. *Stat. Sin.* 2002, 12, 475–490.

15. Dutta, M.J. Primary sources of health information: Comparisons in the domain of health attitudes, health cognitions, and health behaviors. *Health Commun.* 2004, 16, 273–288. [CrossRef] [PubMed]

16. Dutta, M.J. Trusted online sources of health information: Differences in demographics, health beliefs, and health-information orientation. *J. Med. Internet Res.* 2003, 5, e21. [CrossRef]

17. Basu, A.; Dutta, M.J. The relationship between health information seeking and community participation: The roles of health information orientation and efficacy. *Health Commun.* 2008, 23, 70–79. [CrossRef]

18. Cho, J.; Park, D.; Lee, H.E. Cognitive factors of using health apps: Systematic analysis of relationships among health consciousness, health information orientation, eHealth literacy, and health app use efficacy. *J. Med. Internet Res.* 2014, 16, e125. [CrossRef]

19. Norman, C.D.; Skinner, H.A. eHealth literacy: Essential skills for consumer health in a networked world. *J. Med. Internet Res.* 2006, 8, e9. [CrossRef]

20. Xie, B. Older adults, e-health literacy, and collaborative learning: An experimental study. *J. Am. Soc. Inf. Sci. Technol.* 2011, 62, 933–946. [CrossRef]

21. Cheung, R.; Vogel, D. Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Comput. Educ.* 2013, 63, 160–175. [CrossRef]

22. Gagnon, M.-P.; Orruño, E.; Asua, J.; Ben Abdeljelil, A.; Emparanza, J. Using a modified technology acceptance model to evaluate healthcare professionals’ adoption of a new telemonitoring system. *Telemed. e-Health* 2012, 18, 54–59. [CrossRef]

23. McCabe, M.; Ricciardelli, L.A. Sociocultural influences on body image and body changes among adolescent boys and girls. *J. Soc. Psychol.* 2003, 143, 5–26. [CrossRef] [PubMed]

24. Abdul, H.H.M.; Hisam, T.; Lin, N.; Dhiya, A.-J. e-HTAM: A technology acceptance model for electronic health. In Proceedings of the 2011 International Conference on Innovations in Information Technology, Abu Dhabi, UAE, 25–27 April 2011; pp. 134–138.

25. Pai, F.-Y.; Huang, K.-I. Applying the Technology Acceptance Model to the introduction of healthcare information systems. *Technol. Forecast. Soc. Chang.* 2011, 78, 650–660. [CrossRef]

26. Hays, J.C. Social networks and social support. In *Encyclopedia of Health & Aging*; SAGE Publications: London, UK, 2012; pp. 189–210.

27. Hoebel, J.; Starker, A.; Jordan, S.; Richter, M.; Lampert, T. Determinants of health check attendance in adults: Findings from the cross-sectional German Health Update (GEDA) study. *BMC Public Health* 2014, 14, 1–12. [CrossRef] [PubMed]

28. Schaefer, C.; Coyne, J.C.; Lazarus, R.S. The health-related functions of social support. *J. Behav. Med.* 1981, 4, 381–406. [CrossRef] [PubMed]

29. Cline, R.J.W. Consumer health information seeking on the Internet: The state of the art. *Health Educ. Res.* 2001, 16, 671–692. [CrossRef] [PubMed]
30. Yun, E.K.; Park, H.A. Consumers’ disease information-seeking behavior on the Internet in Korea. *J. Clin. Nurs.* 2010, 19, 2860–2868. [CrossRef]
31. Portnoy, D.B.; Scott-Sheldon, L.A.J.; Johnson, B.T.; Carey, M.P. Computer-delivered interventions for health promotion and behavioral risk reduction: A meta-analysis of 75 randomized controlled trials, 1988–2007. *Prev. Med.* 2008, 47, 3–16. [CrossRef]
32. Wantland, D.J.; Portillo, C.J.; Holzemer, W.L.; Slaughter, R.; McGhee, E.M. The effectiveness of web-based vs. non-web-based interventions: A meta-analysis of behavioral change outcomes. *J. Med. Internet Res.* 2004, 6, e40. [CrossRef]
33. Murray, E.; Burns, J.; Tai, S.S.; Lai, R.; Nazareth, I. Interactive health communication applications for people with chronic disease. In *Cochrane Database of Systematic Reviews*, 1st ed.; Wiley Publishers: Hoboken, NJ, USA, 2005; Volume 4, pp. 1–80.
34. Carpenter, V.; Colwell, B. Cancer knowledge, self-efficacy, and cancer screening behaviors among Mexican-American women. *J. Cancer Educ.* 1995, 10, 217–222.
35. Luszczynska, A.; Tryburcy, M.; Schwarzer, R. Improving fruit and vegetable consumption: A self-efficacy intervention compared with a combined self-efficacy and planning intervention. *Health Educ. Res.* 2006, 22, 630–636. [CrossRef]
36. Flachenecker, P.; Bures, A.K.; Gawlik, A.; Weiland, A.-C.; Kuld, S.; Gusowski, K.; Streber, R.; Pfeifer, K.; Tallner, A. Efficacy of an Internet-based program to promote physical activity and exercise after inpatient rehabilitation in persons with multiple sclerosis: A randomized, single-blind, controlled study. *Int. J. Environ. Res. Public Health* 2020, 17, 4544. [CrossRef] [PubMed]
37. Chow, M.; Herold, D.K.; Choo, T.-M.; Chan, K. Extending the technology acceptance model to explore the intention to use Second Life for enhancing healthcare education. *Comput. Educ.* 2012, 59, 1136–1144. [CrossRef]
38. Kim, J.; Park, H.-A. Development of a health information technology acceptance model using consumers’ health behavior intention. *J. Med. Internet Res.* 2012, 14, e133. [CrossRef] [PubMed]
39. Ma, Q.; Liu, L. The role of internet self-efficacy in the acceptance of web-based electronic medical records. *J. Organ. End User Comput.* 2005, 17, 38–57. [CrossRef]
40. Lim, S.; Xue, L.; Yen, C.C.; Chang, L.; Chan, H.C.; Tai, B.C.; Duh, H.B.L.; Choolani, M. A study on Singaporean women’s acceptance of using mobile phones to seek health information. *Int. J. Med. Inform.* 2011, 80, e189–e202. [CrossRef]
41. Torbjørnsen, A.; Karsh, B.-T.; Severtson, D.J.; Burke, L.J.; Brown, R.L.; Brennan, P.F. Factors affecting home care patients’ acceptance of a web-based interactive self-management technology. *J. Am. Med. Inform. Assoc.* 2011, 18, 51–59. [CrossRef]
42. Sun, Y.; Wang, N.; Guo, X.; Peng, Z. Understanding the acceptance of mobile health services: A comparison and integration of alternative models. *Electron Commer. Res.* 2013, 14,2, 183–200.
43. DuBenske, L.L.; Beckjord, E.B.; Hawkins, R.P.; Gustafson, D.H. Psychometric evaluation of the health information orientation scale. *J. Health Psychol.* 2009, 14, 721–730. [CrossRef]
44. Lewis, B.A.; Napolitano, M.A.; Buman, M.P.; Williams, D.M.; Nigg, C. Future directions in physical activity intervention research: Expanding our focus to sedentary behaviors, technology, and dissemination. *J. Behav. Med.* 2016, 40, 112–126. [CrossRef]
45. Kholifah, S.N.; Yumni, H.; Susanto, T. Minarti Structural model of factors relating to the health promotion behavior of reproductive health among Indonesian adolescents. *Int. J. Nurs. Sci.* 2017, 4, 367–373. [CrossRef]
46. Lee, E.J.; Sung, M.-H. Impacts of health perception, aging anxiety and perception of successful aging on health promotion behavior of late middle-aged women. *Korean J. Women Health Nurs.* 2017, 23, 181–190. [CrossRef]
47. Suh, H.-J. Effects of emotional labor, depression and self-efficacy on health promotion behavior of taxi driving workers. *J. Digit. Converg.* 2017, 15,8, 489–500.
48. Walker, S.N.; Sechrist, K.R.; Pender, N.J. The health-promoting lifestyle profile: Development and psychometric characteristics. *Nurs. Res.* 1987, 36, 76–81. [CrossRef]
49. Carlson, E.D. A case study in translation methodology using the health-promotion lifestyle profile II. *Public Health Nurs.* 2000, 17, 61–70. [CrossRef]
50. Jiang, Z.; Zhao, X. Brain behavioral systems, self-control and problematic mobile phone use: The moderating role of gender and history of use. *Pers. Individ. Differ.* 2017, 106, 111–116. [CrossRef]
51. Reininger, B.; Lee, M.; Jennings, R.; Evans, A.; Vidoni, M. Healthy eating patterns associated with acculturation, sex and BMI among Mexican Americans. Public Health Nutr. 2016, 20, 1267–1278. [CrossRef]

52. Bolin, J.H.; Hayes, A.F. Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach; The Guilford Press: New York, NY, USA, 2014.

Publisher’s Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).