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IMPACT OF SMART WATCH ON HEALTH PROMOTING BEHAVIORS

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Abstract. *In personal health information, as intelligent health devices are increasing rapidly and more, people are accepting it. The purpose of this study is to analyze the user's behavioral factors by the existing health promotion health model when using the smart watch. In this study, the degree of influence factors on the user behavior was statistically analyzed based on the research model presented through the data of 300 survey respondents. In other words, the validity and relativity of the observed variables in the health promotion model were verified through data analysis and the fitness level of the proposed structural model was evaluated. The analysis showed that independent variables, such as instant connectivity and real-time monitoring, are directly related to health awareness in the use of smart watches. We also analyzed the degree of health self-efficacy and technical self-efficacy. Therefore, the instant connectivity, real-time monitoring and self-efficacy (especially technical context) of smart watch have a certain influence on the health behaviors. Therefore, this provides meaningful implications for related developers through behavior analysis on smart watch.*

Keywords: Smart watches, Health awareness, Real-time monitoring, Instant connectivity, Self-efficacy

1. **Introduction.** As the population continues to increase, the average life expectancy of the future increases, and the prevalence of chronic diseases increases, and the acceleration of population leads to the burden of health insurance and medical insurance [1]. Since 2007, as Apple's iPhone has become the representative of smart terminals, it has become possible to gradually guide life into a new era according to mobile intelligence terminals. In other words, smart terminals, including smart watch/sports bracelet health monitoring bracelets, smart watches, etc. make the promotion of people's health much easier and supervise people's health behavior. So, people need physical health and disease prevention and health consciousness [2]. Smart watches (including sports wristbands) as a device to maintain personal health are thus an intelligent device that has been widely accepted in recent years. It has a smart fitness program, sleep monitoring, sleep waking, heart rate measurement, call alert and other health functions. Therefore, users can usually wear 24 hours a day, record daily exercise, store sleep, diet and other data, analyze through the data platform, and monitor the health status of users [3,4].

Therefore, the use of these tools can help promote health awareness and health awareness of the user's health status [5]. The purpose of this study is to analyze the effect of smart watch on health promoting behaviors.

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2. **Pender's Health Promotion Model (HPM) and Smart Watch.** Health promotion is achieved through changes in behavior through changes in health education, social influence, quality of life, and physical fitness. The health promotion model (HPM) used here has shown that it can manage chronic diseases effectively [6]. Therefore, the promotion of healthy lifestyle will effectively prevent adult chronic diseases. Also, in health education and health information, people acquire health care knowledge, establish health-oriented concepts, and take voluntary healthy behaviors and lifestyles [7].

The smart watch (including the sports wristband function) is a smart device that can be worn, allowing the user to record daily exercise, sleep, diet and real time data. It serves as a guideline [8].

3. **Research Model.** This study model was constructed based on HPM of Pender. The theoretical framework of Pender's HPM is derived from subjective self-efficacy and social cognitive theory. In other words, the theory suggests that individual perceptions and behaviors are influenced by external factors or instrumental interference [9]. In other words, there are three main steps. The first is external factors, which consist of possible independent variables that influence the intention of using a smart watch. This found that variable in an existing study. And as a parameter of this model, as a cognition factor of behavior, it affects final behavior intention or change.

Therefore, this research model selected influential factors that may affect health promotion using smart watches, and further classified the self-efficacy, which is an important factor in HPM theory, into health self-efficacy and technical self-efficacy. In order to use this research model, this study analyzed the potential and relevance of the variables in the research model using smartPLS 3.0. The research model for this purpose is as follows (see Figure 1).

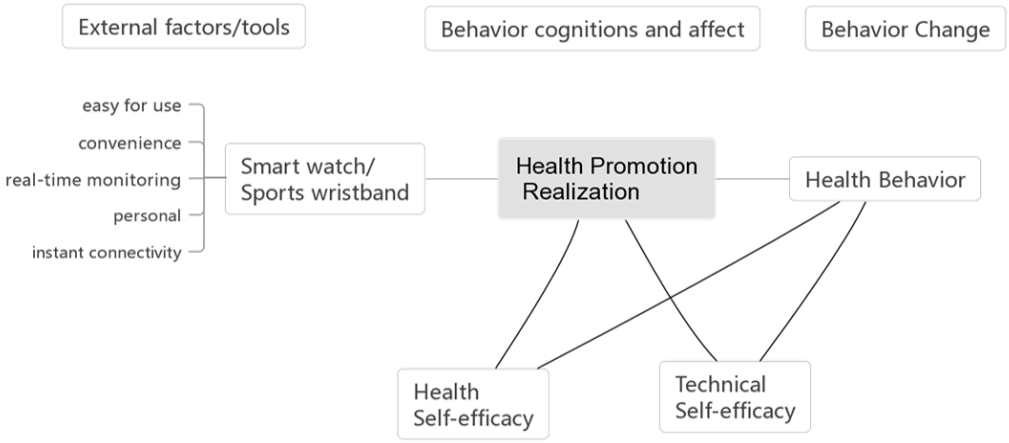

FIGURE 1. Research model

Here, the definition of each variable is as follows.

The meaning of the 'easy to use' variable means that the user can easily access all kinds of information using the device [10]. This means that you can easily access exercise, sleep and other information through a device called a smart watch. 'Connvenice' means that it is easier to focus reasonably on exercise or sport [11]. The 'real-time monitoring' function means that it is possible to continuously monitor user's movements, sleeping and diet, anytime, anywhere [4]. Various 'personal' smart watches can be set according to individual requirements [12]. Finally, the 'instant connectivity' of the independent variables means that handheld devices allow users to access information anytime, anywhere, and find health data and fitness knowledge [13]. Therefore, when accepting smart watch, it can be said that anytime, anywhere, people's personal health data and factors for health promotion have a specific impact on users of health promotion behaviors.

In this study, health self-efficacy (HSE) is another independent variable, meaning that HSE can optimize the cognitive and adaptive behaviors of the user or patient, and that the patient consciously establishes a good life style and effectively controls disease [14]. Thus, while the user is promoting health, the HSE variable implies the use of smart-watch health data to consciously maintain a healthy lifestyle [15]. In addition, technical self-efficacy (TSE) is another additional variable, indicating how much an individual thinks he or she can use a tool or device to perform a particular task [10]. Or it is expressed as confidence in the ability to perform advanced technology [16].

Also, 'health promotion realization' as a mediating variable in this study means that smart watch does not only analyze exercise data but also raise people's health awareness. These health perceptions are considered behavioral changes that can lead to healthy behaviors that maintain or promote health [17]. Lastly, these health perceptions are ultimately necessary for users to change behavior to maintain or promote health over time [17].

4. **Result of Analysis.** In this study, 50 respondents completed the pilot questionnaire and completed the final questionnaire before performing the main survey. Through the final questionnaire, data was collected between August and September 2017, along with Jeju International Airport and online surveys. Of these, the final 300 response data was selected as the sample data. 41.33% of males and 58.67% of females answered valid questionnaire. In the age distribution, 30.33% were in the 26-30 age group, 26.33% in the 31-40 age group, and 22.33% in the 18-25 age group. In addition, 41-50 years accounted for 17.33%, while over 50 years old accounted for 1.67%. In occupational distribution, 7.67% of students, 12% of housewives, 8.67% of white-collar workers, and 12% of technical workers were occupational distributors.

The variables of each item are shown in Table 1. The factor loading of all the variables is greater than 0.7. Measurement items can well explicate the variable. All variables of the alpha value are greater than 0.7, so the model has good reliability. The composite reliability (CR), as a measurement of reliability coefficient, exceeds the criteria. Table 1 shows the evaluation criteria of reliability greater than or equal to 0.7 [18,19].

According to Table 2, the degree of polymerization was tested by the average extraction variance (AVE) of each variable. The average variance extraction AVE value is above 0.7 [18,19].

Finally, as shown in Figure 2, real-time monitoring and connectivity variables directly influence health promotion realization variables, and self-efficacy is also an important influence variable, as in the final analysis model, where significant variables are left. Thus, we can confirm that health promotion realization is a mediating factor that eventually affects behavioral change. In addition, while the technical self-efficacy variable influences final health behavior through health promotion realization variables, health self-efficacy directly affects health behavior.

5. **Conclusions.** The enhanced health model used in this study attempted to show that it is very meaningful to integrate advanced science and technology into life for health promotion. Therefore, this study attempted to find the factors influencing individual's health promotion when using smart watch. In this study, the concepts of health promotion and smart watch were briefly introduced and statistical analysis was conducted through the research model. As a result of the analysis, it was found that the promotion of health consciousness formation and behavioral change was attempted to change for health promotion by using smart clock. The results of the previous analysis show that the promotion of health self-efficacy as the most significant variable has an effect on behavior. Earlier, we also identified the instant connectivity of the smart watch and the fact that the variables related to real-time monitoring indirectly affect health-changing behaviors.

TABLE 1. Construct reliability and validity

Factors	*Indicators*	*Factor Loading*	*Cronbach's Alpha*	*rho_A*	*Composite Reliability (CR)*	*AVE*
behavior change	*Behavior_1*	0.928	0.910	0.915	0.943	0.847
	Behavior_2	0.950				
	Behavior_3	0.882				
easy for use	*EU_1*	0.945	0.879	0.879	0.943	0.892
	EU_2	0.944				
health promotion realization	*HPR_1*	0.932	0.923	0.924	0.951	0.867
	HPR_2	0.950				
	HPR_3	0.912				
health self-efficacy	*HSE_1*	0.891	0.932	0.933	0.948	0.786
	HSE_2	0.896				
	HSE_3	0.872				
	HSE_4	0.912				
	HSE_5	0.861				
real-time monitoring	*RTM_1*	0.925	0.910	0.910	0.943	0.847
	RTM_2	0.928				
	RTM_3	0.908				
technical self-efficacy	*TSE_1*	0.916	0.941	0.941	0.957	0.849
	TSE_2	0.936				
	TSE_3	0.925				
	TSE_4	0.908				
connectivity	*connect_1*	0.902	0.895	0.895	0.934	0.826
	connect_2	0.932				
	connect_3	0.892				
convenience	*convenience_1*	0.814	0.888	0.898	0.917	0.689
	convenience_2	0.847				
	convenience_3	0.878				
	convenience_4	0.847				
	convenience_5	0.760				
personal	*personal_1*	0.829	0.929	0.934	0.946	0.779
	personal_2	0.906				
	personal_3	0.884				
	personal_4	0.906				
	personal_5	0.886				

TABLE 2. Correlation of the latent variables in the measurement model

	hb	*ic*	*conv*	*eu*	*pha*	*hse*	*per*	*rtm*
ic	0.699							
conv	0.734	0.806						
eu	0.677	0.716	0.764					
pha	0.886	0.693	0.694	0.662				
hse	0.789	0.632	0.706	0.647	0.805			
per	0.698	0.881	0.837	0.766	0.698	0.670		
rtm	0.731	0.809	0.822	0.735	0.735	0.707	0.837	
tse	0.755	0.591	0.642	0.609	0.782	0.799	0.632	0.655

**hb – health behaivor, ic – instant connectivity, conv – convenice, eu – easy for use, pha – promote health awareness, hse – health self-efficacy, per – personal, rtm – real-time monitoring, tse – technical self-efficacy*

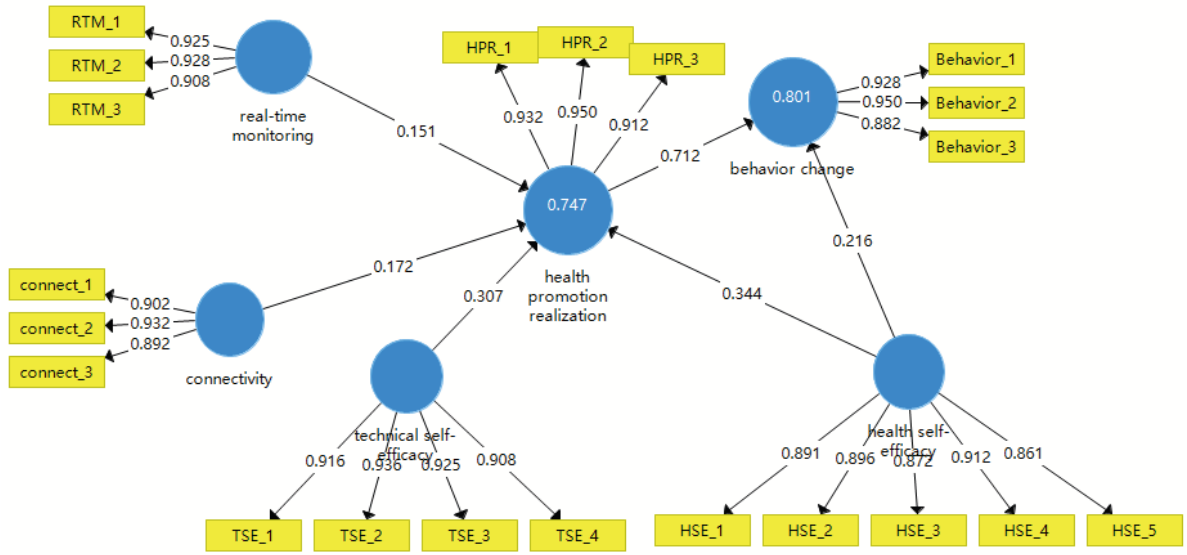

FIGURE 2. Modified smart watch/sport wristband HPM and path coefficient

Hence, this study confirms that smart portable devices for health can effectively monitor and manage health status.

In particular, this study is meaningful in that it deals with smart devices entering ubiquitous computing in the future. In the future, this model needs to be verified through other devices for smart wearable.

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