



# What drives the use of wearable healthcare devices? A cross-country comparison between the US and Korea

Digital Health  
Volume 8: 1–16  
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DOI: 10.1177/20552076221120319  
journals.sagepub.com/home/dhj  


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## Abstract

**Objective:** Given the rapid growth of the wearable healthcare device market, we examined the associations among health-related and technology-related characteristics of using wearable healthcare devices and demonstrated how the associations differ between the US and Korean users.

**Methods:** Online self-administered surveys were conducted with 4098 participants (3035 in the US and 1063 in Korea) who were recruited through two online survey service providers based on quota sampling. The primary outcome was the use of wearable healthcare devices. Seven health-related, two technology-related, and five socio-demographic factors were included as explanatory variables. Binary logistic regression analyses and a Chow test were conducted.

**Results:** The health-related characteristics that were significantly associated with using wearable healthcare devices included disease-related worries ( $\beta = 0.11^{**}$ ), health information seeking ( $\beta = 0.26^{***}$ ), physical activity ( $\beta = 0.62^{***}$ ), and health-related expenditures (\$50–\$199,  $\beta = 0.38^{***}$ ; \$200 or more,  $\beta = 0.56^{***}$ ). Hedonic ( $\beta = 0.33^{***}$ ), social ( $\beta = 0.31^{***}$ ), and cognitive innovativeness ( $\beta = 0.14^*$ ) also exhibited positive relationships. Younger, higher earner, and individuals with a child were more likely to use wearable healthcare devices. However, for Korean users, several associations disappeared including health information seeking, hedonic and social innovativeness, age, and household income.

**Conclusions:** Key drivers of using wearable healthcare devices include greater concern about a specific illness, active engagement in health-promoting behaviors, and hedonic and social motivation to adopt new technologies. However, more country-specific considerations are needed in future studies to identify the main benefits for target markets.

## Keywords

Wearable healthcare device, smartwatch, health promotion, technology innovativeness, cross-country study

Submission date: 19 February 2022; Acceptance date: 29 July 2022

## Introduction

Improvements in the standard of living and the development of medical technology have led to increased consumer interest in and desire for a healthy life. This heightened health and fitness consciousness of this generation has led to explosive growth in healthcare services<sup>1</sup> and the digital healthcare device industry. In particular, the development of sensors and communication technologies has enabled the continuous monitoring of various physiological conditions using wearable healthcare devices.<sup>2</sup> Fotiadis et al.<sup>3</sup> defined a wearable healthcare device as “a device that is

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autonomous, that is noninvasive, and that performs a specific medical function such as monitoring or support over a prolonged period of time.” The wearable healthcare device market can be segmented into various devices including diagnostic and monitoring devices, therapeutic devices, rehabilitation devices, and health and fitness devices.<sup>1</sup> The current study focuses only on health and fitness devices such as smart fitness trackers and smartwatches because they are the most popular types for consumers due to their versatility, portability, and smartphone friendliness.<sup>4</sup>

Wearable healthcare devices provide several benefits for health management. For example, they enable convenient self-monitoring of health conditions because a user can track daily health activity and vital signs in real time.<sup>5</sup> The data from wearable healthcare devices provide immediate healthcare feedback so users can make appropriate adjustments for healthier behaviors.<sup>6</sup> Wearable healthcare devices also allow for social communication and enjoyment that provide hedonic value to users.<sup>7</sup>

Numerous studies have examined the use of wearable healthcare devices such as which ones and why individuals use the devices, and what outcomes of using wearable healthcare devices may promote physical activity.<sup>8,9</sup> Previous studies have also focused on demonstrating the extent to which users’ perceptions of the usefulness,<sup>10,11</sup> ease of use,<sup>12,13</sup> and enjoyment<sup>14,15</sup> influence the use of wearable healthcare devices. In addition, previous research has identified data security and privacy concerns associated with collecting sensitive health and personal data, as a significant barrier to adopting wearable healthcare devices.<sup>16,17</sup> However, previous studies have mostly emphasized users’ perceptions of the use of healthcare devices but have largely overlooked users’ mixed motivations for using wearable healthcare devices, such as users’ specific health-related lifestyles or general attitudes toward technologies in explaining the use of wearable healthcare devices. A limited number of studies have explored the influence of users’ health-related motivation and found that healthier and more health-conscious users are more likely to use wearables for tracking their health.<sup>18,19</sup> However, one study found that having a chronic disease condition was not related to the use of a wearable device.<sup>19</sup> Although few studies have revealed the importance of technology self-efficacy to adopt wearables from a technology acceptance perspective,<sup>2,19</sup> individuals’ attitudes toward general technology were not examined. Thus, recent studies have called for research to empirically generalize findings on the use of wearable healthcare devices by considering various contexts such as consumers’ interest in health and technology.<sup>20–22</sup>

Given the multiple layers of users’ characteristics related to using wearable healthcare devices, the objective of the study examines how health-related aspects<sup>20,21</sup> and technology-related aspects<sup>2,23</sup> affect the use of wearable healthcare devices. This study also aims to investigate

differences in the associations between users in the US and Korea. Despite the global market expansion of wearable healthcare devices, few studies have attempted to compare determinants that affect wearable healthcare device usage by country.<sup>24</sup> Given the rapid growth of the global wearable healthcare device market, users around the world may have different consumption beliefs and habits. Thus, practitioners and researchers need to know what determinants and user characteristics to focus on in different countries.<sup>22</sup> In particular, the US has the largest market by value for wearable healthcare devices due to factors such as a high demand for digital healthcare, the increasing prevalence of chronic diseases, and the presence of major medical device players.<sup>4</sup> However, the wearable healthcare device market in Asia has seen the largest growth.<sup>1</sup> For example, South Korea’s market grew more than 50% last year due to rising demand<sup>25</sup> for IT products amid the pandemic-driven stay-at-home trend.<sup>26</sup>

The following research questions guided this study: (1) How are health-related and technology-related characteristics associated with using wearable healthcare devices? (2) How do the associations differ between the US and Korea?

This study contributes to the existing literature on the use of wearable healthcare devices by addressing the interplay between users’ health-related and technology-related characteristics in different country contexts. The findings can help promote global health practices with valuable insights on new products and related services to satisfy the needs of global consumers.

## Method

### *Design and sample*

Our analysis was based on two online surveys using separate national samples. One survey performed in December 2020 collected data from Korean participants through Macromill Embrain (a Korean online survey service provider). Another survey was conducted in July 2021 with US participants recruited through Qualtrics (a US online survey service provider). To ensure comparability for a cross-country comparison, an age restriction (between 20 and 69) and quota-sampling criteria with equal distribution across gender and age groups were consistently applied to both surveys. These surveys were reviewed and approved by the Institutional Review Board at Seoul National University (IRB No. 2109/004-012).

### *Measure*

*Use of wearable healthcare devices.* To measure the extent of wearable healthcare device use, the participants were asked: “How often do you use a wearable health/fitness device such as a smartwatch?” Answers were reported on a five-

point Likert scale ranging from 1 “never” to 5 “always.” This item was recoded as a dummy variable that takes the value of 1 if the participants answered “sometimes,” “Frequently,” or “Always,” and otherwise 0.

**Health-related characteristics.** Health-related characteristics in this study included health concerns, disease-related worries, health information seeking, healthy dietary intake, physical activity, smoking, and monthly health-related expenditure. Health concerns were measured based on one question asking how the participants rated their level of interest in health and wellness. Using a five-point Likert scale, higher scores indicated higher levels of interest (1 = not at all interested, 5 = extremely interested). For disease-related worries, we utilized eight items about how concerned the respondent was about conditions and illnesses such as high blood pressure, diabetes, obesity, chronic fatigue or stress, respiratory diseases, cerebrovascular diseases and stroke, myocardial infarction, and joint-related diseases. The scores of the eight items were rated on a five-point Likert scale (1 = not at all, 5 = very much) and averaged to measure disease-related worries, with a higher score representing “more concerned.” Health information seeking was averaged across eight items asking how frequently participants used information channels when seeking information about health and wellness such as TV programs, advertisements, newspaper and magazine articles, social media, peers, medical professionals, and health and exercise instructors. On a five-point Likert scale (1 = never, 5 = always), a higher score indicated more active health information-seeking behaviors using various channels. Participants were also asked to indicate how often they engaged in activities related to healthy dietary intake and physical activity. Four behaviors representing healthy dietary intake, which were adopted from multiple studies,<sup>27–29</sup> included self-monitoring of diet, self-monitoring of the quantity of foods eaten, taking prescription medication or pharmaceutical products, and taking dietary supplements. Physical activities included seven sub-items: walking or jogging, playing sports, participating in outdoor activity, swimming, doing yoga or Pilates, going to a gym or fitness center, and working out at home.<sup>30–32</sup> We averaged the four sub-items of healthy dietary intake and seven items of physical activities to form one composite variable for each set of sub-items. All items were measured on a five-point Likert scale, with 1 being “none” and 5 being “always.” The two categorical variables included smoking (1 = non-smokers, 2 = up to half a pack a day, 3 = up to one pack a day, 4 = more than one pack a day), and monthly health-related expenditure (1 = under \$50, 2 = \$50–\$199.99, 3 = \$200 or more). As shown in Appendix Table A1, the factor loading estimates of all items and Cronbach’s  $\alpha$  for each construct confirmed the validity and reliability of our measurements of health-related characteristics.<sup>33</sup>

**Technology-related characteristics.** Technology-related characteristics included self-efficacy and technology innovativeness.<sup>34</sup> In social cognitive theory, self-efficacy refers to “people’s beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives.”<sup>35</sup> Two items were also adopted from Yang and Shin<sup>34,36</sup> to measure self-efficacy focusing on one’s perceived ability to use innovative technologies. Consumers’ innovativeness has been discussed as a major driver that determines one’s willingness to adopt new technologies.<sup>37,38</sup> Reflecting the motivations of adopting innovation, Saeed et al.<sup>39</sup> suggested four dimensions of innovativeness: functional innovativeness, which represents physiological needs to solve problems; hedonic innovativeness of seeking fun; social innovativeness that pursues social meanings such as status or prestige; and cognitive innovativeness, which represents intellectual curiosity.<sup>23,40,41</sup> Eleven items were adopted from previously developed scales to measure technology innovativeness.<sup>23</sup> All constructs of self-efficacy and technology innovativeness were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), such that a higher index indicated a higher level of self-efficacy and respective innovativeness. Factor analyses and reliability analyses for all constructs suggest that they are relatively valid and consistent scales (see Appendix Table A2).

**Covariates.** We also collected demographic information on participants’ gender (0 = female, 1 = male), age group (1 = 20–29, 2 = 30–39, 3 = 40–49, 4 = 50–59, 5 = 60 years old or over), annual household income (1 = under \$35,000, 2 = \$35,000–\$74,999, 3 = \$75,000 or more), marital status (0 = unmarried, 1 = married), and the presence of a child (0 = no, 1 = yes).

## Analysis

We conducted several analyses. First, descriptive analyses including mean values for continuous variables and frequencies/proportions were used to describe sample characteristics. We also examined the statistical differences between the US and Korean samples using *t*-tests for means and chi-square tests for propositions. To address the first research question, we ran three binary logistic regressions on using wearable healthcare devices for the total, US, and Korean participants, respectively. For the explanatory variables, the mean value of variance inflation factor (VIF) was 1.98, which is far below the common cutoff threshold of 10,<sup>42</sup> indicating no multicollinearity in the regression model. A Chow test was employed to determine whether and how the associations of health-related and technology-related characteristics using wearable healthcare devices significantly differ across countries. All analyses were performed

using Statistical Package for the Social Sciences (SPSS) v24.0.

## Results

In Table 1, we first present summary statistics for our sample, and bivariate comparisons between the US and Korean participants. The mean value of using wearable healthcare devices was 2.56 out of 5. The Korean participants showed a significantly higher level of using wearable healthcare devices compared to the US participants (mean = 2.55;  $t = 188.58$ ,  $p < .001$ ). Similar to the results based on the mean values, the proportion of never using wearable health devices among the US sample was 16.5 percentage points higher than the Korean sample (Korea = 25.0%, US = 41.5%). Compared to the US participants, the averages of Korean participants were higher for health concerns (Korea = 4.04, US = 3.89;  $t = 233.41$ ,  $p < .001$ ), disease-related worries (Korea = 2.99, US = 2.18;  $t = 164.22$ ,  $p < .001$ ), and health information seeking (Korea = 3.22, US = 2.76;  $t = 244.66$ ,  $p < .001$ ). Significant differences were also noted in that participants in the Korean sample were more engaged in healthy dietary intake (Korea = 4.19, US = 4.11;  $t = 71.23$ ,  $p < .001$ ) and physical activity (Korea = 3.23, US = 3.12;  $t = 119.98$ ,  $p < .001$ ) than the US sample. In addition, 19.3% of the Korean participants were smokers while 26.2% of the US participants smoked, also indicating a significantly different composition in smoking habits ( $\chi^2 = 31.01$ ,  $p < .001$ ). In terms of health-related expenses, 43.0% of US participants spent less than \$50 per month, while 35.7% of Korean participants spent between \$50 and \$199.99 per month indicating a significant difference in proportions ( $\chi^2 = 61.67$ ,  $p < .001$ ).

With regard to technology-related characteristics, we found significant differences in all constructs between the US and Korean samples. Self-efficacy (US = 3.64, Korea = 3.49;  $t = 59.07$ ,  $p < .001$ ), hedonic innovativeness (US = 3.55, Korea = 3.41;  $t = 54.72$ ,  $p < .001$ ), and cognitive innovativeness (US = 3.44, Korea = 3.20;  $t = 31.10$ ,  $p < .001$ ) were all higher for the US participants, whereas Korean participants exhibited a higher level in functional (Korea = 3.59, US = 3.53;  $t = 64.78$ ,  $p < .001$ ) and social innovativeness (Korea = 3.16, US = 3.01;  $t = 106.03$ ,  $p < .001$ ).

The gender and age distributions of the samples were balanced as we included quota-sampling criteria. The chi-square tests of socio-demographic variables revealed significant group differences in annual household income ( $\chi^2 = 61.50$ ,  $p < .001$ ) and the presence of a child ( $\chi^2 = 8.17$ ,  $p < .01$ ). Specifically, the US sample was more likely to be in a higher income group (\$75,000 or more), and 48.3% reported having no child compared to only 43.2% of Koreans.

Table 2 shows the results from the logistic regressions for the total, US, and Korean samples. First, among the health-related characteristics, disease-related worries, health information seeking, physical activity, and health-

related expenditure were significantly associated with using wearable healthcare devices. More disease-related worries ( $\beta = 0.114$ ,  $p < .01$ ), active health information seeking ( $\beta = 0.264$ ,  $p < .001$ ), and more engaged in physical activity ( $\beta = 0.621$ ,  $p < .001$ ) were all associated with increased use of wearable healthcare devices. Higher health-related expenditure was also significantly associated with an increased use of wearable healthcare devices ( $p < .001$ ).

Second, among the technology-related characteristics, hedonic innovativeness ( $\beta = 0.327$ ,  $p < .001$ ), social innovativeness ( $\beta = 0.307$ ,  $p < .001$ ), and cognitive innovativeness ( $\beta = 0.137$ ,  $p < .05$ ) were positively associated with the use of wearable healthcare devices controlling for other variables. Lastly, among the covariates, age, income, and having a child were found to be significant factors. Increased use of wearable healthcare devices was also associated with those who were younger (40–49 years old:  $\beta = -0.375$ ,  $p < .01$ ; 50–59 years old:  $\beta = -0.775$ ,  $p < .001$ ; 60 years old or over:  $\beta = -0.942$ ,  $p < .001$ ), in a higher income group (\$75,000 or more  $\beta = 0.461$ ,  $p < .001$ ), and having a child ( $\beta = 0.218$ ,  $p < .05$ ).

To examine whether the associations remained consistent for the two countries, we ran separate regressions for each country. The result of the Chow test indicated that there were significant differences in the two coefficients for each explanatory variable ( $F = 2.833$ ,  $p < .01$ ). Positive associations between health information seeking and smoking and wearable healthcare device usage disappeared for the Korean sample. However, there was no statistical evidence that the coefficients of health-related characteristics were different between the two countries ( $\chi^2 = 0.33$ ,  $p = 0.57$ ). In the technology-related dimension, the positive association between hedonic innovativeness and using wearable healthcare devices did not hold for the Korean sample, rejecting the null hypothesis of equal coefficients ( $\chi^2 = 4.14$ ,  $p < .05$ ). Significant differences in the coefficients were found in the socio-demographic characteristics. For the US sample, males ( $\beta = -0.237$ ,  $p < .05$ ) compared to females were less likely to use wearable healthcare devices, whereas Korean males ( $\beta = 0.432$ ,  $p < .01$ ) were more likely to use wearable healthcare devices compared to females. For the Korean sample, no negative associations were found for being older and there were no positive associations with having a higher income. Significant differences between the two countries were also evident in gender ( $\chi^2 = 13.16$ ,  $p < .001$ ), age (50–59 years old:  $\chi^2 = 6.00$ ,  $p < .05$ ; 60 years old or over:  $\chi^2 = 4.78$ ,  $p < .05$ ), and income (\$75,000 or more:  $\chi^2 = 6.19$ ,  $p < .05$ ) coefficients.

## Discussion

The present study examined how health-related and technology-related characteristics are associated with the

**Table 1.** Sample characteristics: overall and by country.

|   | Total (n = 4098) |         | United States (n = 3035) |         | Korea (n = 1063) |         | t / $\chi^2$ |
|---|------------------|---------|--------------------------|---------|------------------|---------|--------------|
| <b>Use of wearable healthcare devices</b> |                  |         |                          |         |                  |         |              |
| Average (out of 5 points)                 | 2.56             | (±1.4)  | 2.55                     | (±1.54) | 2.58             | (±1.25) | 188.58***    |
| Never                                     | 1525             | (37.2%) | 1259                     | (41.5%) | 266              | (25.0%) | 259.77***    |
| Rarely                                    | 590              | (14.4%) | 314                      | (10.3%) | 276              | (26.0%) |              |
| Sometimes                                 | 708              | (17.3%) | 475                      | (15.7%) | 233              | (21.9%) |              |
| Frequently                                | 711              | (17.3%) | 499                      | (16.4%) | 212              | (19.9%) |              |
| Always                                    | 564              | (13.8%) | 488                      | (16.1%) | 76               | (7.1%)  |              |
| <b>Health-related characteristics</b>     |                  |         |                          |         |                  |         |              |
| Health concern                            | 3.93             | (±1.0)  | 3.89                     | (±1.0)  | 4.04             | (±0.7)  | 233.41***    |
| Disease-related worries                   | 2.39             | (±1.0)  | 2.18                     | (±1.0)  | 2.99             | (±0.7)  | 164.22***    |
| Health information seeking                | 2.88             | (±0.9)  | 2.76                     | (±1.0)  | 3.22             | (±0.6)  | 244.66***    |
| Health dietary intake                     | 4.13             | (±1.0)  | 4.11                     | (±1.1)  | 4.19             | (±0.9)  | 71.23***     |
| Physical activity                         | 3.15             | (±1.2)  | 3.12                     | (±1.3)  | 3.23             | (±1.0)  | 119.98***    |
| Smoking                                   |                  |         |                          |         |                  |         | 31.01***     |
| Non-smoker                                | 3108             | (75.6%) | 2250                     | (73.8%) | 858              | (80.7%) |              |
| Up to half a pack a day                   | 614              | (14.9%) | 469                      | (15.4%) | 145              | (13.6%) |              |
| Up to one pack a day                      | 279              | (6.8%)  | 230                      | (7.5%)  | 49               | (4.6%)  |              |
| More than one pack a day                  | 110              | (2.7%)  | 99                       | (3.2%)  | 11               | (1.0%)  |              |
| Health-related expenditure                |                  |         |                          |         |                  |         | 61.67***     |
| \$0-\$50                                  | 1680             | (40.9%) | 1312                     | (43.0%) | 368              | (34.6%) |              |
| \$50-\$199.99                             | 1096             | (26.7%) | 716                      | (23.5%) | 380              | (35.7%) |              |
| \$200 or more                             | 1335             | (32.5%) | 1020                     | (33.5%) | 315              | (29.6%) |              |
| <b>Technology-related characteristics</b> |                  |         |                          |         |                  |         |              |
| Self-efficacy                             | 3.60             | (±1.0)  | 3.64                     | (±1.0)  | 3.49             | (±0.8)  | 59.07***     |
| Functional innovativeness                 | 3.54             | (±1.0)  | 3.53                     | (±1.0)  | 3.59             | (±0.8)  | 64.78***     |
| Hedonic innovativeness                    | 3.51             | (±1.0)  | 3.55                     | (±1.0)  | 3.41             | (±0.8)  | 54.72***     |
| Social innovativeness                     | 3.04             | (±1.1)  | 3.01                     | (±1.2)  | 3.16             | (±0.9)  | 106.03***    |

(continued)

Table 1. Continued.

|                          | Total (n = 4098) |         | United States (n = 3035) |         | Korea (n = 1063) |         | t / $\chi^2$ |
|--------------------------|------------------|---------|--------------------------|---------|------------------|---------|--------------|
| Cognitive innovativeness | 3.38             | (±0.9)  | 3.44                     | (±1.0)  | 3.20             | (±0.8)  | 31.10***     |
| Covariates               |                  |         |                          |         |                  |         |              |
| Gender                   |                  |         |                          |         |                  |         | 0.03         |
| Female                   | 2075             | (50.6%) | 1539                     | (50.7%) | 536              | (50.4%) |              |
| Male                     | 2023             | (49.4%) | 1496                     | (49.3%) | 527              | (49.6%) |              |
| Age                      |                  |         |                          |         |                  |         | 0.49         |
| 20–29 years old          | 827              | (20.1%) | 616                      | (20.2%) | 211              | (19.8%) |              |
| 30–39 years old          | 818              | (19.9%) | 609                      | (20.0%) | 209              | (19.7%) |              |
| 40–49 years old          | 815              | (19.8%) | 608                      | (19.9%) | 207              | (19.5%) |              |
| 50–59 years old          | 826              | (20.1%) | 606                      | (19.9%) | 220              | (20.7%) |              |
| 60 years old or over     | 825              | (20.1%) | 609                      | (20.0%) | 216              | (20.3%) |              |
| Annual household income  |                  |         |                          |         |                  |         | 61.50***     |
| \$0–\$34,999             | 1257             | (30.7%) | 915                      | (30.0%) | 342              | (32.2%) |              |
| \$35,000–\$74,999        | 1487             | (36.3%) | 1021                     | (33.5%) | 466              | (43.8%) |              |
| \$75,000 or more         | 1367             | (33.4%) | 1112                     | (36.5%) | 255              | (24.0%) |              |
| Marital status           |                  |         |                          |         |                  |         | 2.00         |
| Married                  | 2718             | (66.1%) | 2034                     | (66.7%) | 684              | (64.3%) |              |
| Unmarried                | 1393             | (33.9%) | 1014                     | (33.3%) | 379              | (35.7%) |              |
| Having a child           |                  |         |                          |         |                  |         | 8.17**       |
| Yes                      | 2181             | (53.1%) | 1577                     | (51.7%) | 604              | (56.8%) |              |
| No                       | 1930             | (46.9%) | 1471                     | (48.3%) | 459              | (43.2%) |              |

Standard deviations for continuous variables and proportions for categorical variables are reported in parentheses.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$  based on t-tests for continuous variables and chi-square tests for proportion variables.

use of wearable healthcare devices comparing samples from two countries, the US and Korea. The results of the study have practical implications for the healthcare industry to develop and promote wearable healthcare devices for global consumers.

The study results verify that both health-related and technology-related characteristics significantly increase the use of wearable healthcare devices. Specifically, disease-specific worries, active health information-seeking behaviors, and physical activity are major contributing

health-related factors to the use of wearable healthcare devices. Although our results indicate that general health concerns are not associated with the use of wearable devices, the significant role of physical activity and active health information-seeking behaviors validate the findings of prior studies on the importance of individuals with a wellness-oriented lifestyle.<sup>18,19</sup> Our results also reveal that disease-specific worries were significant factors to explain the use of wearable health devices, which is not consistent with a previous study.<sup>19</sup> The results also indicate that

Table 2. Results of the logistic regressions of using wearable healthcare devices.

|   | Total   |        | United States  |         | Korea  |                |
|---|---------|--------|----------------|---------|--------|----------------|
|   | $\beta$ | (SE)   | Exp( $\beta$ ) | $\beta$ | (SE)   | Exp( $\beta$ ) |
| <b>Health-related characteristics</b>     |         |        |                |         |        |                |
| Health concerns                           | -.071   | (.049) | .932           | -.077   | (.055) | .926           |
| Disease-related worries                   | .114**  | (.042) | 1.121          | .134*   | (.052) | 1.144          |
| Health information seeking                | .264*** | (.063) | 1.302          | .321*** | (.075) | 1.378          |
| Health dietary intake                     | -.034   | (.047) | .967           | -.005   | (.055) | .995           |
| Physical activity                         | .621*** | (.116) | 1.862          | .626*** | (.056) | 1.870          |
| <b>Smoking (per day)</b>                  |         |        |                |         |        |                |
| Up to half a pack                         | -.011   | (.116) | .989           | .068    | (.142) | 1.070          |
| Up to one pack                            | -.322   | (.167) | .724           | -.394*  | (.195) | .674           |
| More than one pack                        | -.002   | (.316) | .998           | -.05    | (.357) | .952           |
| <b>Health-related expenditure</b>         |         |        |                |         |        |                |
| \$50-\$199.99                             | .377*** | (.097) | 1.459          | .36**   | (.120) | 1.434          |
| \$200 or more                             | .556*** | (.100) | 1.743          | .537*** | (.121) | 1.711          |
| <b>Technology-related characteristics</b> |         |        |                |         |        |                |
| Self-efficacy                             | -.008   | (.065) | .992           | -.025   | (.077) | .975           |
| Functional innovativeness                 | -.139   | (.076) | .870           | -.223*  | (.94)  | .800           |
| Hedonic innovativeness                    | .327*** | (.084) | 1.387          | .431*** | (.103) | 1.539          |
| Social innovativeness                     | .307*** | (.058) | 1.360          | .364*** | (.066) | 1.439          |
| Cognitive innovativeness                  | .137*   | (.069) | 1.147          | .021    | (.81)  | 1.021          |
|   |         |        |                |         |        | 1.538          |

(continued)

Table 2. Continued.

|                         | Total    |           | United States  |          | Korea     |                |         |          |                |
|-------------------------|----------|-----------|----------------|----------|-----------|----------------|---------|----------|----------------|
|                         | $\beta$  | (SE)      | Exp( $\beta$ ) | $\beta$  | (SE)      | Exp( $\beta$ ) | $\beta$ | (SE)     | Exp( $\beta$ ) |
| Covariates              |          |           |                |          |           |                |         |          |                |
| Gender                  |          |           |                |          |           |                |         |          |                |
| Male                    | -.061    | (.082)    | .941           | -.237*   | (.102)    | .789           | .432**  | (.153)   | 1.540          |
| Age                     |          |           |                |          |           |                |         |          |                |
| 30-39 years old         | -.199    | (.127)    | .820           | -.306*   | (.154)    | .737           | .129    | (.244)   | 1.137          |
| 40-49 years old         | -.375**  | (.130)    | .687           | -.501*   | (.154)    | .606           | .091    | (.268)   | 1.095          |
| 50-59 years old         | -.775*** | (.137)    | .461           | -.95***  | (.163)    | .385           | -.150   | (.285)   | .861           |
| 60 years old or ↑       | -.942*** | (.153)    | .390           | -1.06*** | (.191)    | .346           | -.287   | (.298)   | .751           |
| Annual household income |          |           |                |          |           |                |         |          |                |
| \$35,000-\$74,999       | .147     | (.098)    | 1.158          | .231     | (.122)    | 1.259          | .044    | (.171)   | 1.044          |
| \$75,000 or more        | .461***  | (.107)    | 1.586          | .643***  | (.131)    | 1.902          | .047    | (.200)   | 1.049          |
| Marital status          |          |           |                |          |           |                |         |          |                |
| Married                 | .125     | (.105)    | 1.133          | .122     | (.118)    | 1.130          | -.058   | (.301)   | .944           |
| Having a child          |          |           |                |          |           |                |         |          |                |
| Yes                     | .218*    | (.095)    | 1.244          | .223*    | (.105)    | 1.250          | .081    | (.290)   | 1.084          |
| Constant                | -4.84    | (.279)    | .008           | -.11     | (.322)    | .009           | -5.876  | (.659)   | .003           |
| Pseudo $R^2$            |          | 0.281     |                |          | 0.334     |                |         | 0.169    |                |
| Log-likelihood          |          | -2042.136 |                |          | -1400.599 |                |         | -611.894 |                |
| Observations            |          | 4098      |                |          | 3035      |                |         | 1063     |                |

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .



having a general interest in wellness and healthy dietary intake behaviors are not significantly related to wearable health devices. From a goal-driven perspective,<sup>43</sup> this result implies that setting concrete health-related goals (e.g. diabetes or heart disease management) rather than abstract goals (e.g. general interest in wellness) increases the use of wearable healthcare devices. For example, individuals who set health-related goals such as weight loss were more likely to use wearables to achieve the goals.<sup>19</sup> Regarding healthy dietary intake behaviors, a previous study found that most people use wearable healthcare devices to track simple activities (e.g. tracking heart rate and sleep)<sup>44</sup> and use fewer other features that require participants to manually input additional information, such as monitoring food intake or tracking calories burned. Thus, developing new technology making it easier and less cumbersome to use these features (e.g. automatic detection of food intake technology)<sup>45</sup> would promote the use of wearable healthcare devices.

With regard to technology-related characteristics, contrary to previous studies,<sup>2,19</sup> the current study did not support the role of one's technology self-efficacy. However, the study found that two elements of consumers' innovativeness—hedonic and social innovativeness—significantly motivated the use of wearable healthcare devices, which is consistent with a previous study.<sup>16</sup> This indicates that consumers who use technology for enjoyment and novelty (i.e. hedonic innovativeness) and for good social status and support (i.e. social innovativeness) are more likely to use wearable healthcare devices. Moreover, the use of wearable healthcare devices was not related to one's tendency to use technology to satisfy cognitive demand (i.e. cognitive innovativeness) or to solve problems (i.e. functional innovativeness). The current study identified social innovativeness, which is associated with presenting one's identity or making a unique impression,<sup>46,47</sup> as an important consumer characteristic to explain the use of wearable healthcare devices both in the US and Korean samples. These findings suggest that what drives the wearable healthcare device market goes beyond interest in improving health conditions. Individuals pursue intrinsic values by using wearable healthcare devices to reflect their social image, esthetics, and novelty attributes of wearable technology.<sup>48</sup> These features also drive the demand for wearable healthcare devices. Therefore, health-related industries and health promotion practices should consider such psychological benefits when designing their products or services in the market.

The present study further identified country-specific differences between the US and Korean samples. First, although the mean values of health-related characteristics were relatively higher in the Korean sample compared to the US, active health information seeking was not found to be a significant predictor that influences the use of wearable healthcare devices in Korea. The results further

showed that individuals in Korea were driven to use wearable healthcare devices by more symbolic or social needs (i.e. social innovativeness). One possible reason to support this difference is that Koreans perceive smartwatches as fashion products to fulfill their desire for uniqueness.<sup>49</sup> This is also explained by Hofstede's cultural values of a collective society (e.g. Korea), (i.e. a tendency to be more concerned with the group's needs and goals) than people in an individualistic society (e.g. US). Specifically, individuals in a collective society are more likely to be susceptible to social influence in their buying behavior.<sup>50</sup> In addition, hedonic innovativeness emerged as a significant driver to increase the use of wearable healthcare devices only for the US sample. It may be that US consumers focus more on the enjoyment or pleasure derived from using the devices compared to Korean consumers when purchasing wearable healthcare devices. Therefore, these factors should be given more attention when global companies design and market healthcare wearable devices.

Our results also revealed that younger people (20–29) and those with higher income levels are more likely to use wearable healthcare devices, which is in line with previous findings.<sup>12</sup> Younger people tend to believe that using a wearable health device provides health information and has functions that are more personalized to their health needs and concerns.<sup>51</sup> Many previous studies, especially studies in the US, have also reported slower levels of adoption of wearable devices among older adults.<sup>18,19</sup> In addition, using healthcare devices can boost their confidence and self-esteem to set and meet health goals,<sup>52</sup> and motivate them to be more engaged in physical activity and healthy dietary behaviors. Given that wearable healthcare technology has potential benefits for the older population, healthcare policymakers, or practitioners should employ appropriate strategies to make it easier for seniors to adopt the technology devices and motivate them to use wearable technologies to promote health. However, the patterns were found to vary across the two countries. Socio-demographic factors, such as younger age, higher income, and female were significant for increased use of wearable healthcare devices for the US sample, but not for Koreans. Only gender (male) appeared to be a significant demographic factor in Korea. The reason probably lies in the fact that Korean consumers' relatively wide adoption of innovation does not significantly vary by individuals' demographic characteristics.<sup>53,54</sup> This suggests that the demographic-based segmentation strategy for wearable healthcare devices would be effective for US consumers but not necessarily for Korean consumers.

Our study has several limitations that provide avenues for future research. First, because the data were collected during the Covid-19 pandemic (2021), responses to health-related questions, such as health information

seeking, health concerns, and the use of wearable healthcare devices may be influenced by the time-specific context. Given that the increased health awareness and concerns during the Covid-19 era accelerated the adoption of wearable healthcare devices,<sup>55</sup> it should be noted that it is likely that the measured values in the current study are overestimated. Second, while we measured the frequency of using wearable healthcare devices, we were unable to capture the various aspects of using the devices, including what types of services they use (e.g. heart rate, sleep quality, calories burned, and blood oxygen levels) and what forms of devices they use (e.g. smartwatch, fitness tracker, and smart clothing), which may impact the different levels of use. For example, although a smartwatch was used as an example of a wearable healthcare device in this study, it cannot be generalized to all types of medical wearable devices, and the devices can be used for different tasks depending on the complexity of the device. Therefore, to improve external validity, the use of wearable healthcare devices should be examined with different structures in future studies. In addition, we did not consider the possibility of interdependence between health and social characteristics. Asadi et al.<sup>20</sup> suggested that future studies address the role of social contexts (e.g. national culture) that moderate the association between health consciousness and intention to use healthcare wearables. Furthermore, we found correlations between individual health concerns and the use of wearable health devices through multiple post-hoc tests. For instance, higher concerns about cerebrovascular diseases, stroke ( $r=0.117$ ,  $p<0.01$ ), and myocardial infarction (heart attack/angina) ( $r=0.110$ ,  $p<0.01$ ) were associated with higher use of wearable health devices. Although we considered the respondents' health concerns as a composite measure by averaging the degree of concerns of multiple diseases, future studies could investigate how individual concerns about specific conditions could influence the use of wearable health devices. Lastly, although we examined country-specific differences between the US and Korean samples, other potential factors to explain the differences, such as country-specific cultural values (e.g. individualism or collectivism) or social and healthcare systems were not considered. These factors should be further examined in future research with different models.

**Author contributions:** JR, KK, JP, KE, HM, MJ, YK, JH, and HC conceived and designed the study. JK, YJ, and KK were involved in gaining ethical approval and collecting data. YN, JJ, and SA analyzed data. YN and SA contributed to the interpretation of the findings. All authors wrote the first draft of the manuscript, and reviewed and edited the manuscript.

**Declaration of Conflicting Interests:** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding:** The authors received no financial support for the research, authorship, and/or publication of this article.

**Ethical approval:** Ethical approval was given by the ethics committee of the Institutional Review Board at Seoul National University (#2109/004-012).

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## Appendix

**Table A1.** Results of the factor analyses<sup>a</sup> and reliability tests<sup>b</sup> for health-related characteristics.

|  | Total           |                     | United States  |                     | Korea          |                     |
|--|-----------------|---------------------|----------------|---------------------|----------------|---------------------|
|  | Factor loadings | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ |
| <b>Disease-related worries</b>   |                 |                     |                |                     |                |                     |
| High blood pressure  | .647            | .869                | .663           | .864                | .627           | .797                |
| Diabetes   | .711            |                     | .731           |                     | .632           |                     |
| Obesity  | .677            |                     | .703           |                     | .519           |                     |
| Chronic fatigue, stress  | .663            |                     | .640           |                     | .490           |                     |
| Respiratory diseases (asthma, chronic bronchitis, chronic obstructive pulmonary disease) | .715            |                     | .704           |                     | .568           |                     |
| Cerebrovascular diseases and stroke  | .827            |                     | .811           |                     | .811           |                     |
| Myocardial infarction (heart attack/angina)  | .830            |                     | .818           |                     | .808           |                     |
| Joint-related diseases (arthritis, etc.)   | .708            |                     | .681           |                     | .652           |                     |
| Eigenvalue   |                 | 4.20                |                | 4.15                | 3.36           |                     |
| Cumulative variance (%)  |                 | 52.58               |                | 52.07               | 42.01          |                     |
| <b>Health information seeking</b>  |                 |                     |                |                     |                |                     |
| Health/fitness/wellness-related TV programs  | .839            | .839                | .715           | .883                | .845           | .754                |
| Advertisements (TV/online)   | .834            |                     | .745           |                     | .863           |                     |
| Infomercials   | .819            |                     | .713           |                     | .845           |                     |
| Newspaper and magazine articles  | .739            |                     | .548           |                     | .740           |                     |
| Social media (blogs, Internet articles, YouTube, Instagram, etc.)                        | .750            |                     | .597           |                     | .773           |                     |
| Friends, family, coworkers, peers, etc.  | .710            |                     | .484           |                     | .696           |                     |
| Eigenvalue   |                 | 4.5                 |                | 3.80                | 3.80           |                     |
| Cumulative variance (%)  |                 | 56.25               |                | 63.38               | 63.38          |                     |
| <b>Health dietary intake</b>   |                 |                     |                |                     |                |                     |
| Watching what I eat  | .838            | .634                | .554           | .639                | .855           | .684                |

(continued)

Table A1. Continued.

|   | Total           |                     | United States  |                     | Korea          |                     |
|---|-----------------|---------------------|----------------|---------------------|----------------|---------------------|
|   | Factor loadings | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ |
| Watching how much I eat   | .825            |                     | .526           |                     | .849           |                     |
| Taking prescription medication/<br>pharmaceutical products                | .538            |                     | .492           |                     | .501           |                     |
| Taking dietary supplements  | .614            |                     | .493           |                     | .641           |                     |
| Eigenvalue  |                 | 2.049               |                | 2.06                |                | 2.11                |
| Cumulative variance (%)   |                 | 51.22               |                | 51.61               |                | 52.83               |
| Physical activity   |                 |                     |                |                     |                |                     |
| Walking, jogging, running, or biking                                      | .637            | .868                | .663           | .883                | .496           | .843                |
| Playing sports (soccer, baseball, basketball,<br>tennis, badminton, etc.) | .820            |                     | .830           |                     | .758           |                     |
| Participating in outdoor activities (hiking,<br>golf, kayaking, etc.)     | .797            |                     | .815           |                     | .732           |                     |
| Swimming  | .740            |                     | .736           |                     | .752           |                     |
| Taking yoga, Pilates, or aerobics classes                                 | .774            |                     | .781           |                     | .749           |                     |
| Going to a gym/fitness center or getting a<br>personal training           | .783            |                     | .776           |                     | .803           |                     |
| Training or working out at home   | .675            |                     | .758           |                     | .699           |                     |
| Eigenvalue  |                 | 3.93                |                | 4.12                |                | 3.61                |
| Cumulative variance (%)   |                 | 56.13               |                | 58.85               |                | 51.60               |

<sup>a</sup>The factors' loadings are all above the minimum cutoff values of 0.4 recommended by Hair et al.<sup>42</sup> and Yong and Pearce.<sup>56</sup>

<sup>b</sup>The Cronbach's  $\alpha$  coefficients are all above the minimum cutoff values of 0.7 recommended by Hair et al.<sup>42</sup>

**Table A2.** Results of the factor analyses<sup>a</sup> and reliability tests<sup>b</sup> for technology-related characteristics.

|   | Total           |                     | United States  |                     | Korea          |                     |
|---|-----------------|---------------------|----------------|---------------------|----------------|---------------------|
|   | Factor loadings | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ |
| <b>Self-efficacy</b>  |                 |                     |                |                     |                |                     |
| I am skilled in using products with new technologies                            | .824            | .899                | .824           | .901                | .832           | .889                |
| I am confident in my ability to use products with new technologies              | .802            |                     | .792           |                     | .833           |                     |
| Eigenvalue  | .489            |                     | .470           |                     | .560           |                     |
| Cumulative variance (%)   | 3.76            |                     | 3.601          |                     | 4.302          |                     |
| <b>Functional innovativeness</b>  |                 |                     |                |                     |                |                     |
| I will use a product quickly if the new technology is convenient                | .767            | .820                | .753           | .817                | .810           | .838                |
| I will always prefer a product with newer technology if it has more functions   | .584            |                     | .400           |                     | .765           |                     |
| Eigenvalue  | .378            |                     | .390           |                     | .451           |                     |
| Cumulative variance (%)   | 2.905           |                     | 2.60           |                     | 3.468          |                     |
| <b>Hedonic innovativeness</b>   |                 |                     |                |                     |                |                     |
| I am happy when using products with new technology                              | .688            | .919                | .693           | .912                | .759           | .911                |
| I am happy when I discover a product with new technology                        | .728            |                     | .736           |                     | .721           |                     |
| Owning a product with new technology makes me happy                             | .677            |                     | .702           |                     | .629           |                     |
| Eigenvalue  | .746            |                     | .732           |                     | .718           |                     |
| Cumulative variance (%)   | 5.738           |                     | 5.631          |                     | 5.523          |                     |
| <b>Social innovativeness</b>  |                 |                     |                |                     |                |                     |
| I prefer products with newer technology that distinguishes me from other people | .791            | .918                | .797           | .924                | .756           | .899                |
| I want to use products with new technology that others have not experienced     | .791            |                     | .799           |                     | .800           |                     |
| I like products with new technology that can impress other people               | .857            |                     | .861           |                     | .734           |                     |
| Eigenvalue  | 8.526           |                     | 8.645          |                     | 8.221          |                     |

(continued)

Table A2. Continued.

|  | Total           |                     | United States  |                     | Korea          |                     |
|--|-----------------|---------------------|----------------|---------------------|----------------|---------------------|
|  | Factor loadings | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ | Factor loading | Cronbach's $\alpha$ |
| Cumulative variance (%)  | 65.585          |                     | 66.495         |                     | 63.239         |                     |
| Cognitive innovativeness   |                 |                     |                |                     |                |                     |
| I often use products that require a certain level of knowledge to use them     | .737            | .889                | .730           | .887                | .670           | .893                |
| I often use products that require logical thinking                             | .832            |                     | .830           |                     | .813           |                     |
| I use most products with new technology if they satisfy my analytical thinking | .705            |                     | .701           |                     | .741           |                     |
| Eigenvalue   | 1.086           |                     | 1.094          |                     | 1.160          |                     |
| Cumulative variance (%)  | 8.357           |                     | 8.414          |                     | 8.924          |                     |

<sup>a</sup>The factors' loadings are all above the minimum cutoff values of 0.4 recommended by Hair et al.<sup>42</sup> and Yong and Pearce.<sup>56</sup>

<sup>b</sup>The Cronbach's  $\alpha$  coefficients are all above the minimum cutoff values of 0.7 recommended by Hair et al.<sup>42</sup>