International Journal of
Mental Health Promotion

Tech Science Press

http://doi.org/10.32604/ijmhp.2026.078956

ARTICLE

Health Empowerment and Intention to Use Digital Health Technologies among Korean Older Adults: Extending the Technology Acceptance Model

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Received: 11 January 2026; Accepted: 10 April 2026; Published: 28 May 2026

ABSTRACT: Backgrounds: South Korea is one of the world's fastest-aging societies, facing significant challenges in maintaining healthcare quality and accessibility for its rapidly growing elderly population. This study extends the Technology Acceptance Model (TAM) by integrating health empowerment to examine its influence on digital healthcare device adoption among Korean older adults. Specifically, this study aims to investigate how health empowerment is associated with perceived usefulness and perceived ease of use, and how these perceptions subsequently relate to attitude and intention to use digital healthcare devices. **Methods:** Data were collected from 342 Korean older adults. The analysis followed Anderson and Gerbing's two-stage approach, utilizing structural equation modeling to first evaluate the measurement model and subsequently examine the hypothetical path sequences across health empowerment, perceived usefulness, perceived ease of use, attitude, and behavioral intention. **Results:** The measurement model demonstrated satisfactory fit. Path analysis revealed that health empowerment significantly predicted both perceived usefulness (β = 0.58) and perceived ease of use (β = 0.43). Both perceived usefulness (β = 0.58) and perceived ease of use (β = 0.14) were significantly associated with attitude, which in turn was significantly associated with behavioral intention (β = 0.77). The direct path from perceived usefulness to behavioral intention was not statistically significant. Overall, the model explained 63% of the variance in intention to use, which is generally considered strong explanatory power. **Conclusions:** Integrating empowerment into the TAM framework highlights the significance of autonomy and self-efficacy in the adoption process. The findings suggest that empowerment plays an important role in shaping older adults' perceptions of digital health technologies and their intention to adopt such devices, providing a conceptual basis for developing empowerment-driven strategies to facilitate the integration of digital health technologies among ageing populations.

KEYWORDS: Health empowerment; digital health technology; extended technology acceptance model; ageing population

1 Introduction

Korea is one of the fastest-ageing societies globally. As the proportion of older adults continues to increase rapidly, the nation faces significant challenges in sustaining healthcare quality and accessibility for its ageing population. According to the Ministry of the Interior and Safety, individuals aged 65 and over are projected to constitute more than 40% of the entire population by 2050 [1]. This population shift

has, however, been accompanied by an increasing prevalence of chronic conditions, multimorbidity, and functional decline [2], all of which heighten the need for continuous, personalised, and efficient healthcare support. In this context, digital healthcare technologies, including wearable health monitors and mobile health applications, have emerged as promising solutions for enhancing self-management, early detection, and preventive care among older adults.

Digital health technologies provide older adults with opportunities to monitor their health conditions, communicate with healthcare professionals remotely, and engage more actively in managing their wellbeing. Evidence suggests that such engagement can lead to improved health literacy, enhanced autonomy, and reduced healthcare costs [3]. However, despite the growing availability of digital health innovations, their uptake among older adults remains relatively limited, compared to younger populations [4]. Several barriers have been identified, including low digital literacy, perceived complexity, privacy concerns, and limited perceived value [5]. In Korea, these challenges are compounded by cultural tendencies toward deference to professional authority and limited prior exposure to digital tools among older cohorts. Consequently, promoting digital inclusion in health management for older adults requires not only technological accessibility but also psychological readiness and empowerment to use these tools effectively.

The concept of health empowerment offers a valuable theoretical framework for understanding and addressing these barriers as it emphasises self-efficacy, autonomy, and participation in health management. In older populations, empowerment is especially vital for fostering resilience and self-care in the face of ageing-related challenges [6]. Empirical evidence shows that empowered individuals tend to adopt proactive health behaviours, follow prescribed treatments consistently, and experience enhanced well-being [7]. Therefore, integrating empowerment perspectives into behavioral technology frameworks may help explain why some older adults successfully adopt digital healthcare tools while others do not.

Despite the growing recognition of individual empowerment in health management research (e.g., [8,9]), relatively limited attention has been paid to how health empowerment influences individuals' cognitive perceptions in the context of technology adoption. Although some studies have suggested that personal empowerment may be associated with the adoption of mobile health services [10], empirical research examining the psychological 'why' behind it in the current context remains relatively underexplored.

Building on these limitations, this study integrates the psychological construct of health empowerment into the Technology Acceptance Model (TAM) framework in order to better capture the multidimensional nature of digital healthcare technology adoption. Among the theoretical models proposed to explain technology adoption, TAM is one of the most widely used and empirically validated frameworks. Accordingly, this study aims to examine digital healthcare device adoption among older adults in Korea within an extended TAM framework incorporating health empowerment.

This study proposes the following hypotheses: First, health empowerment is positively associated with perceived usefulness and perceived ease of use. Second, perceived usefulness and perceived ease of use are positively associated with attitude. Lastly, both perceived usefulness and attitude are positively associated with intention to use digital healthcare devices.

2 Conceptual Framework and Hypothesis Development

2.1 Heath Empowerment

Health empowerment refers to "a process through which people gain greater control over decisions and actions affecting their health" [11] p. 6. This psychological factor is significant in public health promotion as it fosters proactive health behaviors by enhancing an individual's mental, physical, and social capacities and by encompassing the improvement of positive self-awareness and a sense of trust [7]. As individuals

age, they often face physical decline and chronic conditions. Empowerment, therefore, fosters confidence in their ability to make health-related decisions [6]. Given its critical nature, empowerment among elderly people has been widely studied as an active alternative to reduce personal and social costs of medical services and to improve health-related quality of life (e.g., [12]). Accordingly, this study integrates the concept of health empowerment into the framework of TAM.

This extension bridges technology acceptance and health behavior theories, thereby improving TAM's relevance for older adults who often face motivational and self-efficacy barriers. The inclusion of health empowerment contributes theoretically by situating TAM within a broader psychosocial framework, and practically by identifying empowerment as a modifiable determinant that can guide intervention design, user education, and policy strategies aimed at promoting digital health adoption among ageing populations.

2.2 Extended Technology Acceptance Model

Davis [13] proposed the TAM framework to explain the process by which users adopt and utilize technology. Within this framework, perceived usefulness and perceived ease of use are critical antecedents of users' attitude toward technology, which subsequently predict their behavioral intention to engage with it (e.g., [14–16]).

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [13] p. 320. In the context of digital healthcare devices, this definition reflects a user's belief that using such devices can improve their health management, wellbeing, or quality of life by combining practical health-related benefits with personal relevance and perceived value. According to Olson et al. [17], older people, compared to young generations, tend to prefer traditional technology over more recent options such as digital healthcare devices. This preference often stems from doubts or concerns about the usefulness of these devices. Consequently, they would tend to adopt a device which they have used before and experienced its value in improving their health or daily life.

Perceived ease of use refers to the degree to which "a person believes that using a particular system would be free of effort" [13] p. 320. This construct is particularly relevant for older users who may face difficulties in accepting technology due to cognitive and physical limitations [16]. Common barriers include limited digital literacy, anxiety toward technology, or physical constraints when using digital health devices [5]. Thus, perceived ease of use plays a critical role in reducing psychological and cognitive burdens, building confidence, and promoting a feeling of autonomy over the technology. When elderly people can handle and manage devices with minimal effort, they could embrace and use them consistently over time.

Additionally, as aforementioned, health empowerment is hypothesized to operate as an underlying psychological resource that shapes these two perceptions. This addition provides a theoretically grounded extension that enhances the explanatory power of the TAM model. While TAM addresses cognitive evaluations of technology, perceived usefulness and perceived ease of use, health empowerment introduces a motivational and health-specific factor reflecting elderly people's perceived ability, autonomy, and confidence in managing their health. Drawing on health empowerment theory [6] and social cognitive theory [18], empowered individuals possess stronger self-efficacy and a proactive orientation toward health management, which shape how they perceive and interact with digital health technologies. Furthermore, from the perspective of self-determination theory [19], supporting individuals' autonomy and competence can strengthen positive evaluations and engagement with health-related technologies [20]. Specifically, empowerment is hypothesized as an antecedent influencing both perceived usefulness, by increasing recognition of technology's value in achieving health goals, and perceived ease of use, by promoting persistence and confidence when learning new systems. Therefore, the following hypotheses were established:

H1-1: *Health empowerment is positively associated with perceived usefulness of digital healthcare devices among elderly people.*

H1-2: *Health empowerment is positively associated with perceived ease of use of digital healthcare devices among elderly people.*

Furthermore, research has consistently shown strong empirical evidence on the positive impacts of perceived usefulness and perceived ease of use on intention to adopt technology directly or indirectly through attitude among elderly people, especially within the TAM framework (e.g., [21–23]). For instance, Li et al. [22] found that perceived usefulness and ease of use significantly affected the older adults' attitudes toward internet-based medical services. Harris and Rogers [24] highlighted that perceived ease of use is a critical factor influencing older adults' acceptance of healthcare technologies. Particularly, the recent meta-analysis of 41 existing articles conducted by Yang et al. [25] concluded that perceived usefulness has a significant impact on both attitude and intention to use, while perceived ease of use significantly influences attitude toward using healthcare technology among older adults. Thus, the following three paths from perceived usefulness and ease of use are proposed:

H2-1: *Perceived usefulness is positively associated with attitude toward using digital healthcare devices among elderly people.*

H2-2: *Perceived usefulness is positively associated with intention to use healthcare devices among elderly people.*

H3: *Perceived ease of use is positively associated with attitude toward using digital healthcare devices among elderly people.*

Lastly, attitude toward using a technology is defined as an individual's overall evaluative feeling about using a particular technology. A positive attitude reflects the user's belief that adopting the technology will bring desirable outcomes, while a negative attitude suggests the opposite. Intention to use refers to a person's motivational readiness or conscious plan to perform a specific behavior-in this case, to use a digital healthcare device [26]. The relationship between attitude to behavioral intention is grounded in the theory of planned behavior [26], which posits that individuals' intentions to act are directly shaped by their attitudes toward the action. Empirical studies across domains consistently confirm that a favourable attitude is associated with a greater intention to engage with technologies [27,28]. Within healthcare technology adoption, elderly users who perceive digital healthcare devices as useful, easy to use, secure, and offering good value tend to develop positive attitudes toward using them. Such positive attitudes increase their intention to adopt and integrate these devices into their daily health management routines [29,30]. Accordingly, a positive attitude toward digital healthcare devices is expected to strengthen elderly users' intention to use them.

H4: *Attitude toward using digital healthcare devices is positively associated with elderly users' intention to use them.*

The structural model and associated hypotheses are presented in Fig. 1 below.

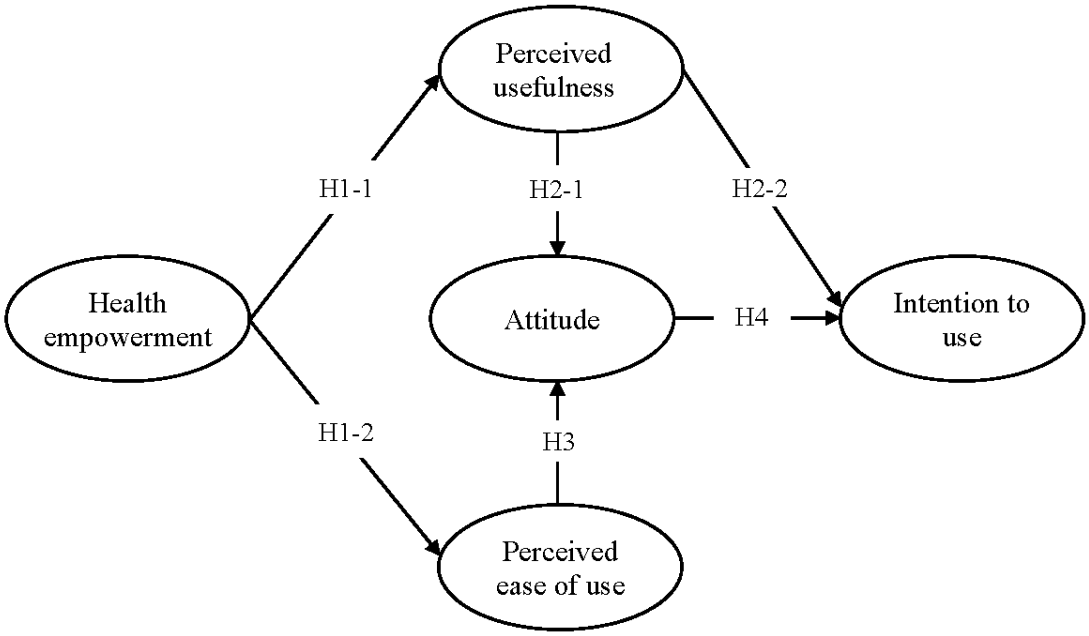

Figure 1: Hypothetical Research Model.

3 Method

3.1 Subjects and Data Collection

The study population consisted of older adults aged 65 years and above living in the Seoul metropolitan area of South Korea. Multiple research assistants visited senior community centers located in Seoul to collect data. Their primary responsibilities were to explain the concept of digital healthcare devices and to assist participants as needed during questionnaire completion. A total of 342 usable responses were collected through convenience sampling. The study protocol was approved by the Institutional Review Board (IRB) of Sangmyung University (Ethics Approval No. ex-2025-004) and the Ethics Sub-Committee of the School of Sport, Exercise and Health Sciences at Loughborough University (Project ID: 21372). All participants provided informed consent prior to participation in the study.

3.2 Measures

All measurement items were adapted from established scales in the existing literature, each showing sound psychometric properties. Six items measuring health empowerment were drawn from Park and Park [31]. The remaining items for perceived usefulness (four items), perceived ease of use (three items), attitude toward use (four items) and intention to use (three items) were adapted from Taylor and Todd [32]. Following Douglas and Craig's [33] back-translation procedures, the English questionnaire was first translated into Korean and then independently back-translated into English by two bilingual experts to increase linguistic equivalence. Participants indicated their level of agreement with each item using a 5-point Likert scale, anchored with 1 (strongly disagree) and 5 (strongly agree). The full list of the measurement items is presented in Table 1.

Table 1: Internal Structures of Observed Variables in the Measurement Model.

Construct and Measure	Mean	SD	Loading	CR	AVE
Health empowerment					
I can set up a plan to achieve health care goals.	3.91	0.65	0.73*	0.85	0.49
I can try out various ways to overcome hurdles to my health care goals.	3.89	0.67	0.68*		
I have some health problems but can find ways to be positive.	3.93	0.68	0.72*		
I know a positive method to cope with stress related to my health care.	3.75	0.83	0.73*		
I know what helps me stay motivated to take care of my health.	3.80	0.75	0.70*		
As I am well aware of myself, I can select a health care method suitable for me.	3.87	0.73	0.61*		
Perceived usefulness					
A digital healthcare device will be of benefit to me.	3.92	0.82	0.68*	0.83	0.55
Using a digital healthcare device will improve my health.	3.91	0.78	0.77*		
The advantage of a digital healthcare device will outweigh the disadvantage.	3.93	0.74	0.79*		
Overall, using a digital healthcare device will be advantages.	4.04	0.69	0.73*		
Ease of use					
Instruction for using a digital healthcare device will be easy to follow.	3.37	0.87	0.77*	0.80	0.57
It will be easy to learn how to use a digital healthcare device.	3.49	0.80	0.81*		
It will be easy to operate a digital healthcare device.	3.33	0.90	0.67*		
Attitude					
Using a digital healthcare device is a good idea.	3.98	0.63	0.88*	0.90	0.69
Using a digital healthcare device is a wise idea.	4.02	0.64	0.87*		
I like the idea of using a digital healthcare device.	3.94	0.66	0.77*		
Using a digital healthcare device would be pleasant.	3.96	0.67	0.79*		
Intention to use					
I intend to use a digital healthcare device soon.	3.82	0.80	0.83*	0.87	0.69
I intend to use a digital healthcare device to monitor my fitness and health conditions.	3.89	0.77	0.78*		
I intend to use a digital healthcare device frequently in the future.	3.94	0.75	0.88*		

*Significant at the 0.05 probability level. Note: CR = composite reliability; AVE = average variance extracted; SD = standard deviation.

3.3 Data Analysis

Descriptive analyses using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA) were conducted to examine participant characteristics through frequency analysis and to identify missing and invalid values, as well as outliers. Mean ± SD values for all observed items were also computed to summarize the data distribution. Univariate normality was assessed using skewness and kurtosis. Multivariate outliers were identified using Mahalanobis distance. Common method variance was assessed using confirmatory factor analysis (CFA) with an unobserved common latent factor (CLF). For the main analysis, Anderson and Gerbing's [34] two-stage analytical approach was utilized to test a hypothesized model incorporating the measurement and structural models. After CFA confirmed an acceptable overall model fit as well as the fit of the internal structure in the measurement model, a path analysis was performed to assess the proposed associations among the constructs in the structural model. All hypotheses testing procedures were conducted using LISREL 8.80 (Scientific software International Inc., Lincolnwood, IL, USA), and standardized path coefficients (β) were used to determine the significance of the hypothesized relationship. Lastly, in order to examine the indirect effects among the variables, a bootstrapping with 5000 resamples was conducted using IBM SPSS Amos 2.0 (IBM Corp., Armonk, NY, USA). To estimate the specific indirect effects of perceived usefulness and ease of use, phantom variables were introduced into the structural model, and unstandardized coefficients (B) were used to assess the magnitude of the indirect effects, and statistical significance was determined based on confidence intervals. A two-tailed test with the 0.05 probability level was used throughout the analyses.

4 Results

4.1 Preliminary Analysis

Firstly, the descriptive statistics showed there were no missing or invalid values in the data set. Univariate normality of the observed items was checked using skewness and kurtosis. The skewness and kurtosis values ranged from −1.06 to −0.25 and from −0.40 to 2.32, respectively, which were deemed acceptable [35]. Next, Mahalanobis distance was computed to detect multivariate outliers [36]. From the initial 342 samples, 28 cases were identified as multivariate outliers ($\chi^2(20) > 45.32$, $p < 0.001$). After their exclusion, a final sample of 314 cases was retained for the main analyses. Based on this final sample, the majority of respondents were female (78.0%), with a mean age of 75.9 years (SD = 6.0). In terms of educational background, 35.0% had completed high school, followed by 24.5% with a middle school education, 22.3% with a university degree or higher, and 18.2% with a primary school education, while 1.9% reported no formal education. This study also assessed common method variance using CFA with an unobserved CLF. The comparison between the two models, with and without CLF, revealed a ΔRMSEA of 0.013 and a ΔCFI of 0.01. Specifically, the model without the CLF yielded RMSEA = 0.059 and CFI = 0.98, while the model with the CLF yielded RMSEA = 0.046 and CFI = 0.99. Because these differences fell below the thresholds of 0.015 and 0.01, respectively [37], the model improvement was considered minimal, thus CMV was not a serious concern in this study.

4.2 Stage 1: Measurement Model Testing

A CFA was conducted to assess the psychometric properties of the measures (see Table 1). The goodness-of-fit tests showed that the measurement model fit the data well: $\chi^2(160) = 328.19$, $p < 0.01$, $\chi^2/df = 2.05$, RMSEA = 0.06, NFI = 0.96, CFI = 0.98, IFI = 0.98, SRMR = 0.05 [35]. Regarding reliability, the measurement model revealed acceptable composite reliability (CR) values ranging from 0.80 to 0.90 [38]. With respect to convergent validity, although the AVE value for health empowerment (0.49) was slightly below the cut-off of 0.50, the AVEs for the other constructs indicated that more than half of the total variance for all measures was explained by their respective constructs [39]. In addition, five items exhibited factor loadings less than 0.707, suggesting that these items had more unique variance than common variance [39]. Although five items' factor loadings ranging from 0.61 and 0.70, were slightly below 0.707, they were retained for further analysis. Prior methodological research suggests that factor loadings above 0.60 are still considered acceptable in many social science studies, particularly in exploratory or applied research contexts [38]. For discriminant validity (see Table 2), the square root of each construct's AVE (0.70 to 0.83) exceeded its correlations with respective constructs (0.70 to 0.83), confirming adequate discriminant validity [38]. Overall, while further refinement of certain items may be necessary to represent their proposed constructs better, the CFA results provided evidence supporting the adequacy of the measurement model, subsequent analysis.

Table 2: Correlation Matrix of the Latent Variables.

	Health Empowerment	Perceived Usefulness	Perceived Ease of Use	Attitude	Intention to Use
Health empowerment	**0.70**	-	-	-	-
Perceived usefulness	0.58*	**0.74**	-	-	-
Perceived ease of use	0.43*	0.25*	**0.75**	-	-
Attitude	0.39*	0.62*	0.28*	**0.83**	-
Intention to use	0.32*	0.51*	0.23*	0.79*	**0.83**

Note: The bold values on the diagonal represent the square root of the average variance extracted (AVE) of each construct. *$p < 0.05$.

4.3 Stage 2: Structural Model Testing

A path analysis was conducted to test the proposed associations (see Table 3). The results indicated that health empowerment was a significant predictor of both perceived usefulness (β = 0.58) and perceived ease of use (β = 0.43), supporting H1-1 and H1-2. As hypothesized, perceived usefulness and perceived ease of use played significant roles in shaping users' attitudes (β = 0.58 and β = 0.14, respectively) which in turn significantly influenced their intention to use (β = 0.77), thereby supporting H2-1, H3 and H4. However, the direct effect of perceived usefulness on intention to use (β = 0.04) was not significant, thus failing to support H2-2. A significant level of 0.05 was used to determine the hypothesis testing results. In addition, this study examined the indirect effects within each structural path. The results indicated that the effect of health empowerment on attitude through perceived usefulness (B = 0.40) and the effect of health empowerment on intention to use through perceive usefulness and attitude (B = 0.38) were statistically significant. In contrast, the effect of health empowerment on attitude through ease of use (B = 0.07) and the effect of health empowerment on intention to use through ease of use and attitude (B = 0.07) were not statistically significant.

Table 3: Parameters Estimates of the Structural Models.

	Exogenous Construct	Endogenous Construct	β	*t*-Value	Decision
H1-1	Health empowerment	Perceived usefulness	0.58	8.08*	Supported
H1-2	Health empowerment	Ease of use	0.43	6.12*	Supported
H2-1	Perceived usefulness	Attitude	0.58	8.31*	Supported
H2-2	Perceived usefulness	Intention to use	0.04	0.56	Not supported
H3	Ease of use	Attitude	0.14	2.31*	Supported
H4	Attitude	Intention to use	0.77	10.77*	Supported

Indirect Effects	B	95% CI	
		Lower	Upper
Health empowerment → Perceived usefulness → Attitude	0.40*	0.250	0.584
Health empowerment → Perceived usefulness → Attitude → Intention to use	0.38*	0.241	0.563
Health empowerment → Ease of use → Attitude	0.07	−0.002	0.195
Health empowerment → Ease of use → Attitude → Intention to use	0.07	−0.002	0.188

*Significant at the 0.05 probability level. Note: β = standardized coefficient; B = unstandardized coefficient; CI = confidence interval.

5 Discussion

This study aimed to investigate the attributes predicting elderly individuals' intention to use digital healthcare devices. In the context of Korea's rapidly ageing population and the rising prevalence of chronic diseases [40], understanding the cognitive and affective processes underlying technology acceptance among this population is both timely and essential. This study contributes to the literature by empirically demonstrating that health empowerment functions as a key antecedent to perceived usefulness and perceived ease of use, and by confirming the central role of attitude in shaping intention to use digital healthcare technologies.

5.1 Contribution of Health Empowerment to TAM (H1-1 and H1-2)

One of the key contributions of this study lies in integrating health empowerment into the TAM. The results indicate that health empowerment is significantly associate with higher levels of perceived usefulness (β = 0.58, t = 8.08) and perceived ease of use (β = 0.43, t = 6.12). These findings suggest that older adults who feel capable of actively managing their own health are more likely to perceive digital healthcare

devices as beneficial and user-friendly. This pattern is consistent with prior research in health psychology and digital health adoption, which demonstrates that health empowerment enhances health-promoting behaviors (e.g., [41]), readiness to engage with technology (e.g., [42,43]), and self-care practices (e.g., [44]).

By incorporating health empowerment as a psychological antecedent, this study extends the traditional TAM framework and further validates its applicability within a rapidly ageing and digitally transforming society. Existing TAM research, particularly studies focusing on older populations, has rarely accounted for health empowerment or related constructs. A systematic review on older adults' technology adoption further indicates that health-related factors have not been sufficiently considered as key facilitators or barriers in prior research [45].

The strong predictive power observed in this study indicates that autonomy and self-efficacy in health management play a critical role in shaping positive perceptions of digital healthcare technologies. This finding is also aligned with empowerment theory [46], which suggests that people with higher self-efficacy are more inclined to view health technologies as meaningful resources for enhancing wellbeing. Among elderly Koreans who often face chronic illness or increased dependency, feelings of empowerment may reframe digital healthcare devices from complex medical tools into practical aids for symptom monitoring, treatment management, and the maintenance of independence and quality of life.

5.2 The Paths from Perceived Usefulness (H2-1) and Perceived Ease of Use (H3) to Attitude

This study reaffirms the core TAM assumptions within the elderly Korean population. Perceived usefulness is strongly associates with attitude toward using digital healthcare devices (β = 0.58, t = 8.31), indicating that older adults tend to form favourable attitudes toward technologies they believe as enhancing their health, independence, or daily functioning. This finding is consistent with prior TAM-based research revealing the positive and significant influence of perceived usefulness on consumer attitudes (e.g., [47,48]). From a practical perspective, this finding suggests that device designers and healthcare providers should emphasise the tangible health benefits of digital healthcare devices, such as facilitating disease management and independent living, rather than focusing solely on technical features. Clearly demonstrating their real-world usefulness may be particularly effective for fostering positive attitudes among older adults.

Perceived ease of use is also positively associated with attitude (β = 0.14, t = 2.31). This result is in line with prior empirical research showing that perceived ease of use positively influences attitude (e.g., [49]). From a practical standpoint, this finding highlights the importance of designing digital healthcare devices with simple, intuitive interfaces. Providing age-friendly guidance, such as clear instructions and hands-on training, can reduce perceived complexity and support older adults' confidence in using these technologies. The result further suggests that while usability remains an important consideration, older users may place greater emphasis on the practical benefits of a device than on its operational simplicity. Similar patterns have been reported in previous studies, where perceived usefulness exerts a stronger influence on attitude formation than perceived ease of use across various digital contexts (e.g., [50]).

Collectively, these findings imply that older adults may be willing to tolerate certain usability challenges when digital healthcare devices deliver meaningful health-related benefits [51]. Accordingly, marketing and instructional materials should prioritise communicating how such devices support health improvement, disease management, and independent living. Clearly demonstrating real-world benefits is likely to foster positive attitudes.

5.3 Attitude as the Dominant Predictor of Intention to Use (H4)

Consistent with the TAM, attitude is strongly associated with intention to use digital healthcare devices (β = 0.77, t = 10.77). This finding highlights the central role of attitude in shaping elderly Koreans' adoption intentions and reinforces TAM's core proposition that behavioral intention is primarily driven by users' affective evaluations of a technology [13]. A substantial body of empirical research has similarly demonstrated a robust relationship between attitude and intention to use across various technology contexts (e.g., [52–54]), and the present result is consistent with these findings.

In particular, the present study found that the direct path from perceived usefulness to intention to use was not statistically significant, which is inconsistent with the core assumption of the TAM [13]. This finding also contrasts with prior studies reporting a significant positive relationship between perceived usefulness and intention to use (e.g., [15,55]). This finding suggests that, in the context of older adults' adoption of digital healthcare technologies, perceived usefulness alone may not be sufficient to directly form behavioral intention. Instead, its influence appears to operate indirectly through the formation of a positive attitude toward technology. This finding further highlights the importance of attitude in the technology acceptance process among older adults and supports the theoretical perspective that older individuals place greater emphasis on factors such as personal comfort, perceived relevance, and emotional reassurance when making technology adoption decisions [56].

In the context of the rapid expansion of digital healthcare technologies, including wearable health monitors, telemedicine platforms, and smart diagnostic devices [57], understanding this attitudinal mechanism is particularly important for explaining elderly peoples' behavioral intention. This strong association between attitude and intention highlights the need for user-centric and psychologically informed implementation strategies. For elderly populations, fostering a positive attitude represents a key pathway for enhancing acceptance, sustained use, and ultimately improved health outcomes [58]. Accordingly, interventions should focus on emotional and psychological factors, such as alleviating technology-related anxiety, providing caregiver support, and ensuring transparency regarding privacy and data security, to strengthen trust and promote long-term engagement.

5.4 Limitations and Future Research

Despite its contributions, this study has several limitations. First, the cross-sectional design limits the ability to draw causal inferences regarding the relationships among health empowerment, technology perceptions, attitude, and intention. Future research should adopt longitudinal or experimental research designs that incorporate older adults' accumulation of practical experience with digital healthcare devices or participation in health empowerment education programs. This approach would enable a clearer examination of the causal role of health empowerment in the technology acceptance process. Second, the sample primarily consisted of older adults residing in the metropolitan area of Korea, metropolitan area of Korea, with a relatively high proportion of female participants, which may limit the generalizability of the findings. Although this distribution partially reflects the demographic characteristics of the population aged 65 and older in Korea, the findings should be interpreted with caution. Variations in technology affinity and health management capabilities across genders may influence outcomes, suggesting that future research should aim for more balanced gender representation to capture these differences accurately. In addition, contexts such as rural areas or developing-country contexts, where healthcare infrastructure is relatively limited and experience with digital technologies is less prevalent, may produce divergent patterns of adoption. Therefore, future studies should conduct cross-cultural and regional comparative research to more broadly evaluate the applicability of the extended TAM framework. Finally, while this

study extends TAM by incorporating health empowerment, future research could further enrich the model by including additional constructs such as perceived risk, trust, and digital literacy. Examining these factors may provide a more concrete understanding of digital healthcare adoption and guide the design of more targeted interventions and policy strategies for ageing populations.

6 Conclusions

This study advances the understanding of digital healthcare adoption among older adults by integrating health empowerment into the TAM framework and empirically validating the proposed relationships within the Korean context. The findings suggest that health empowerment is an important psychological factor associated with technology perceptions, whereas attitude shows a relatively stronger association with intention to use digital healthcare devices. By extending TAM beyond its traditional cognitive focus, this study offers a more holistic framework for explaining technology acceptance in ageing populations. From a practical perspective, the results highlight the importance of designing and implementing digital healthcare solutions that not only deliver functional benefits but also enhance older adults' sense of control, confidence, and relevance. As Korea and other ageing societies increasingly rely on digital healthcare innovations, fostering empowered and positive orientations older users may play an important role in promoting positive attitudes and stronger intentions to adopt digital healthcare technologies.

Acknowledgement: None.

Funding Statement: This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2024S1A5C3A02043877).

Author Contributions: The authors confirm contribution to the paper as follows: Do Young Pyun (conceptualization, investigation, writing, revisions, and project administration); Bingjie Wang (writing of the original draft); Kyong Keun Choi (conceptualization, investigation, writing, revisions, and supervision); Sungjae Kim (methodology and formal analysis); and Taeyeon Koo (conceptualization, writing, revisions, and supervision). All authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials: The dataset generated and analysed during this research is available from the corresponding authors upon reasonable request.

Ethics Approval: The questionnaire and study procedures were approved by the Institutional Review Board (IRB) of Sangmyung University (Ethics Approval No. ex-2025-004) and the Ethics Sub-Committee of the School of Sport, Exercise and Health Sciences at Loughborough University (Project ID: 21372). Informed consent was obtained from all participants prior to their participation in the study.

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

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