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Article

The Paradox of Digital Health: Why Middle-Aged Adults Outperform Young-adults in Health Management Utilization via Technology

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Abstract: Globally, life expectancy has been increasing, with South Korea reaching an average of 85.6 years. Therethrough, 'being healthy' is essential for a high quality of life, and interest in health and disease prevention grew significantly after the COVID-19 pandemic. The pandemic boosted digital health technology adoption, and emphasizing the need for tailored health strategies based on age group. KIHASA conducted the study of digital confidence and health management methods involving the use of digital devices, and it examines differences in digital device use and confidence between 359 young adults (20–39Y) and 641 middle-aged adults (40–69Y). Respondents were asked about their use of digital health tools, such as wearable devices and mobile apps and confidence in using digital systems and managing health via digital tools was assessed using a five-point Likert scale. We analyzed the results, and it indicated that while young adults have lower rates of using digital devices for health care, they exhibit higher confidence in using such devices. In contrast, middle-aged adults, despite having lower confidence, report higher usage of digital devices for health care purposes. This study explored differences in digital confidence and health care usage between age group.

Keywords: digital health; health surveys; wearable electronic devices; digital divide; population health management; digital detox

1. Introduction

According to research, globally, life expectancy has been on the rise over the past few decades [1,2]. Among these countries, South Korea has made significant strides in life expectancy in recent years. As of the latest data, life expectancy at birth is approximately 85.6 years [1].

Is increasing life expectancy simply beneficial? Research involving college students and elderly adults has demonstrated that health states perceived to interfere most with Valued Life Activities (VLAs) are rated most negatively [3]. Easterlin, R.A. (2003) research also emphasized that declines in health have a sustained negative impact on happiness [4]. Since good health is the basis of a high quality of life, people can live longer and healthier lives by managing health habits and delaying the process of aging [2,5]. Nature Index (2023) highlighted that research institutions globally are increasingly focusing on health-related studies, which reflects a growing awareness and prioritization of health issues across multiple disciplines. Especially in the United States, health-science research is a major focus of federal spending [6]. The rationale behind this is that knowledge of health creates the precondition for an individual's behavioral change and significantly impacts lifestyle habit [5].

Furthermore, awareness and behaviors focused on maintaining health have increased during the COVID-19 pandemic [7], Throughout this period, individuals actively practiced or sought out relevant healthcare behaviors in their daily lives, demonstrating a global response to the pandemic [8,9]. According to the 'Healthy Living in Asia Survey', 89 percent of Koreans are aware of 'the

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importance of preventive health care', and 51 percent of Koreans have become more proactive in practicing self-care to maintain their health. After the COVID-19, 30 percent reported being more concerned about "acquiring information on health and disease prevention." This is because sufficient knowledge and information are crucial for maintaining a healthy life [10].

The COVID-19 pandemic also highlighted the limitations of analog methods in health care systems. To overcome this crisis, the digital and technological revolution in healthcare has transformed the global landscape [11]. As a result, the pandemic led to a rapid increase in the adoption of digital health technologies [12].

Several previous studies have examined the impact of digital health technologies on health outcomes [13–20]. Digital health is defined as the application of information communication technology to support health through electronic and mobile health solutions, including the use of big data, computational genomics, and artificial intelligence [21]. Digital health has the potential to improve population health by increasing access to medical services [21–25]. The scope of digital health includes interventions such as mobile applications, wearable devices, social media, telehealth, telemedicine and interactive websites [15,17,18,26–29].

"Digital Natives" and "Digital Immigrants" are terms coined by Prensky to describe the current tech-savvy generation. 'Digital Natives' refers to individuals who have been exposed to digital technology from a young age, integrating it into their daily lives from the beginning, whereas 'Digital Immigrants' refer to individuals who were not born into the digital world but have adopted technology later in life, often having to adapt and learn new digital skills as adults [30]. One instance of the digital divide is digital confidence. According to Duttweiler, P.C. (1984), younger learners exhibit a high level of digital confidence, whereas digital immigrants, who were more likely to be older boomers, demonstrate significantly lower levels of confidence [31]. In this context, the digital divide between 'Digital Natives' and 'Digital Immigrants' is of great interest to managers attempting to cope with escalating uncertainty and volatility in today's market [32]. Furthermore, this divide has significant social, political, cultural, and economic implications [33].

Existing studies have covered the overall content of the survey [34]. Inspired by the concepts of 'Digital Immigrants' and 'Digital Natives' [30], this study will classify individuals into two groups: young adults (20 to 39 years old) and middle-aged adults (40 to 69 years old). The focus of this study will be to analyze which group utilizes digital devices more extensively and to identify the confidence of that age group. Based on this analysis, health management strategies utilizing digital devices will be proposed accordingly. This study is based on a survey on 'Digital Health Accessibility and Personal Competency Factors' conducted in 2021 by KIHASA.

2. Materials and Methods

2.1. Study Subjects and Data Collection

We utilized a unique panel survey dataset from the study titled *A Study on the Personal Capacity Building Model for Improving Access to Digital Health*, conducted between December 16 and 31, 2021. The online survey received approval from the Institutional Review Board (IRB) of the principal investigator's institution, the Korea Institute for Health and Social Affairs (KIHASA), prior to data collection. Participation in the survey was voluntary.

Data collection was conducted as part of the Korea Welfare Panel Survey, managed by the research company. The sampling frame comprised 1,000 male and female individuals aged 20 to 69 from across the country. The sample was stratified by gender and age group across 17 cities and provinces, and the survey was administered through a computer-based web interview utilizing a structured questionnaire.

The gender ratio of the surveyed population was 51.1% male and 48.9% female. The age distribution was as follows: 17.9% were in their 20s (20 to 29 years old), 18.0% were in their 30s (30 to 39 years old), 21.9% were in their 40s (40 to 49 years old), 23.3% were in their 50s (50 to 59 years old), and 18.9% were in their 60s (60 to 69 years old). For analysis, the population was divided into two

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groups: young adults in their 20s and 30s, referred to as Group 1, and middle-aged adults in their 40s, 50s, and 60s, referred to as Group 2.

2.2. Survey Methods

Among the sociodemographic variables, only age (20 to 69 years old) was examined.

The survey questionnaire included the following question regarding the use of digital health management tools: **Q1** "Do you manage your health using wearable devices, mobile apps, or digital (non-face-to-face) methods? Please select all options that you are currently utilizing." The response options included nine categories: (1) wearable devices, (2) mobile apps, (3) video conferencing systems, (4) online videos, (5) telephone consultations, (6) video consultations, (7) other, (8) body composition analysis, and (9) none. For analytical purposes, responses in the "none" category were excluded.

Wearable devices used for health management included pedometers, smart bands, smartwatches, and sneaker attachment measuring instruments. Examples of mobile applications mentioned were Samsung Health, LG Health, TOSS, Cash-walk, Nike Run, NOOM, Walk-On, Apple Health, OK-cashback, CashSlide, and AIA Vitality.

Regarding the use of digital devices/systems and confidence in gathering information, the survey included the following questions:

Q 2-1	"I am well aware of how to use digital devices/systems."
Q 2-2	"I am proficient in using the menus and features of digital devices/systems.
Q 2-3	"I am confident in gathering information using digital devices/systems."

Responses were recorded using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). In social science research, Likert-type items are commonly used for response formats, and a five-point scale is recommended for unipolar items [35,36]. In this study, a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree' was employed.

Additionally, to assess confidence in using digital devices for health management, the following six questions were asked:

Q 3-1	"I do not find it difficult to manage my health using digital devices /systems."
Q 3-2	"I am confident in managing my health using digital devices/systems."
Q 3-3	"I create my own plans to manage my health using digital devices/systems."
Q 3-4	"I believe I can develop good health habits by utilizing digital devices /systems."
Q 3-5	"I can consistently and repeatedly use digital devices/systems for health management."
Q 3-6	"I can evaluate my health management results by utilizing digital devices/systems."

Responses were similarly recorded on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

2.3. Statistical Analysis

Data were analyzed using IBM SPSS Statistics software [37]. **Table 2** presents the cross-tabulation analysis of utilization rates across each group. To assess the independence between young adults and middle-aged adults in this survey, a Chi-square test was conducted, as this statistical method is commonly used for analyzing relationships between nominal variables [38]. The chi-square value (χ^2) was considered statistically significant at $p < 0.05$.

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Independent samples t-tests were applied to data in **Tables 3** and **4** to determine statistically significant differences, with results highlighted in bold for $p < 0.05$. The primary outcome measures were derived from questions 2-1 through 2-3 and 3-1 through 3-6. Responses of "disagree" and "strongly disagree" were combined to indicate respondents' hesitancy, while "agree" and "strongly agree" were combined to indicate confidence. Considering the nature of Likert-scale data, t-tests were utilized without concern for significant differences in power or error rates [39].

3. Results

3.1. Demography

There were 179 participants in the 20s age group, 180 participants in the 30s age group, 219 participants in the 40s age group, 233 participants in the 50s age group, and 189 participants in the 60s age group. Consequently, the young-adults group comprised 359 individuals, while the middle-aged adults group comprised 641 individuals.

3.2. Usage of Digital Health Management

Upon examining both groups, 78.3% of individuals were engaged in digital health management. Excluding the 21.7% who were not, the analysis was conducted on the remaining 78.3%. Of the total participants, 217 were not utilizing digital devices for health care; therefore, the analysis was conducted on the remaining 783 respondents. As this question allowed for multiple selections, the focus was placed on the percentage rather than the absolute N value. (**Table 1**)

Table 1. Case Processing Summary.

Effective Value		Missing Value		Total Value	
N	**%**	**N**	**%**	**N**	**%**
783	78.3%	217	21.7%	1000	100.0%

Upon comparing the groups, the middle-aged adults group exhibited higher frequencies across all items compared to the young-adults group. This finding suggests that the middle-aged adults engage in digital health management more frequently than the young-adults.

A cross-analysis was conducted to examine the differences between the groups. The results revealed a significant difference in the use of digital devices or systems for health management between the groups, with $\chi^2 = 21.157$ and $p = 0.007$. The analysis indicates that the likelihood of using digital devices or systems for health management increases with age. Since the survey question allowed for multiple selections, the emphasis was placed on the percentage rather than the absolute N value in **Table 2**.

Table 2. Cross Tabulation of Utilization Rates According to Group.

		Utilization of Digital Methods for Health Management and the Tools Employed										
		Wear-able devic-es	**Mobil-e apps**	**video conference-eing system**	**online video**	**telephone consultati-on**	**video consultati-on**	**etc**	**body compos-ition analysis**	**Total**	**χ^2**	***p*-Valu e**
1	N	186	216	8	44	14	5	5	1	290		**0.007**

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Group	**2**	%	23.8%	27.6%	1.0%	5.6%	1.8%	0.6%	0.6%	0.1%	37.0%	**21.157***
		N	274	342	26	105	43	16	6	2	493	
		%	35.0%	43.7%	3.3%	13.4%	5.5%	2.0%	0.8%	0.3%	63.0%	
Total		N	460	558	34	149	57	21	11	3	783	
		%	58.7%	71.3%	4.3%	19.0%	7.3%	2.7%	1.4%	0.4%	100.0%	

Obtained by complex chi-square test. Bold values denotes statistical significance at $p < 0.05$.

3.3. Confidence in Utilizing Digital Devices

An independent samples t-test was conducted to examine the difference in confidence in utilizing digital devices between the two groups. The group statistics are as follows: the young-adults group (N = 359) and the middle-aged adults group (N = 641).

According to the results presented in **Table 3**, the t-value for the first question, "I am well aware of how to use digital devices/systems," is 6.417 with a significance level (p) of 0.000. For the second question, "I am proficient in using the menus and features of digital devices/systems," the t-value is 6.748 with a significance level (p) of 0.000. The t-value for the final question, "I am confident in gathering information using digital devices/systems," is 6.107 with a significance level (p) of 0.000. Consequently, the alternative hypothesis that "there is a difference in confidence in utilizing digital devices according to group" was accepted. For all three questions, the young-adults group demonstrated relatively higher confidence.

Table 3. Statistics on Confidence in Utilizing Digital Devices for Each Group and Independent Samples Test on Questionnaires.

	Group	**N**	**Mean**	**Std. Deviation**	**Levene's test**		**t-test for Equality of Means**						
					F	**Sig.**	**t**	**df**	**Sig(2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% CI**	
												Lower	**Upper**
Q 2-1	**1**	359	3.91	.860	4.888	0.27	6.417	719.419	**.000**	.359	.056	.249	.469
	2	641	3.55	.830									
Q 2-2	**1**	359	3.86	.891	1.652	.199	6.748	998	**.000**	.389	.058	.276	.502
	2	641	3.47	.864									
Q 2-3	**1**	359	3.79	.903	.029	.865	6.107	998	**.000**	.356	.058	.242	.471
	2	641	3.43	.874									

Bold values denotes statistical significance at $p < 0.05$.

3.4. Confidence in Utilizing Digital Devices for Healthcare Management

An independent samples t-test was conducted to examine the difference in confidence in managing health using digital devices between the two groups. The group statistics are as follows: the young-adults group (N = 359) and the middle-aged adults group (N = 641).

Table 4 presents the differences in confidence between the groups in managing health using digital devices. The t-value for the first question, "I do not find it difficult to manage my health using digital devices/systems," is 7.350 with a significance level (p) of 0.000. For the second question, "I am confident in managing my health using digital devices/systems," the t-value is 6.258 with a significance level (p) of 0.000. The third question, "I create my own plans to manage my health using digital devices/systems," has a t-value of 2.570 with a significance level (p) of 0.010. The fourth question, "I believe I can develop good health habits by utilizing digital devices/systems," shows a t-value of 2.192 with a significance level (p) of 0.029. The fifth question, "I can consistently and

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repeatedly use digital devices/systems for health management," has a t-value of 3.017 with a significance level (p) of 0.003. Lastly, the sixth question, "I can evaluate my health management results by utilizing digital devices/systems," has a t-value of 4.215 with a significance level (p) of 0.000. Consequently, the alternative hypothesis that "there is a difference in confidence in health management using digital devices according to group" was accepted. The confidence levels for all six questions were significantly higher in the young-adults group compared to the middle-aged adults group, with all values being statistically significant.

Table 4. Statistics on Confidence in Utilizing Digital Devices for Healthcare Management for Each Group and Independent Samples Test on Questionnaires.

	Group	N	Mean	Std. Deviation	Levene's test		t-test for Equality of Means						
					F	Sig.	t	df	Sig(2-tailed)	Mean Difference	Std. Error Difference	95% CI	
												Lower	Upper
Q3-1	1	359	3.91	.872	7.623	.006	7.350	730.870	**.000**	.420	.057	.308	.532
	2	641	3.49	.857									
Q3-2	1	359	3.68	.918	3.490	.062	6.258	998	**.000**	.366	.058	.251	.480
	2	641	3.32	.868									
Q3-3	1	359	3.39	1.079	9.986	.002	2.570	678.615	**.010**	.177	.069	.042	.311
	2	641	3.21	.972									
Q3-4	1	359	3.69	.904	5.758	.017	2.192	655.005	**.029**	.125	.057	.013	.236
	2	641	3.57	.780									
Q3-	1	359	3.79	.887	.044	.835	3.017	998	**.003**	.167	.055	.059	.276
	2	641	3.62	.815									
Q3-6	1	359	3.68	.906	2.505	.114	4.215	998	**.000**	.235	.056	.125	.344
	2	641	3.45	.809									

Bold values denotes statistical significance at $p < 0.05$.

4. Discussion

According to Jones, C., et al (2010)., students aged 25 years and under, particularly those based in universities, were more confident in their skills related to ICT tasks. The survey also revealed that students are active users of technology and generally utilize it beyond what is required [40]. However, despite the high confidence and frequent use of digital devices among young adults, our survey results showed that the percentage of young adults actively using digital devices for health care was lower than that of middle-aged adults. This discrepancy can be interpreted in several ways. Primarily, young adults tend to use digital devices for purposes other than health care, such as social media and entertainment. Numerous studies suggest that young adults have an overwhelmingly positive view about the role of digital technologies in their daily lives, often regarding them as central resource for entertainment, information and communication [41–44]. This suggests that young adults may approach health care differently, opting not to rely on digital devices for health-related activities.

According to a study, young adults are increasingly concerned about the negative health effects associated with excessive digital device use, with 86% reporting that their inability to disconnect from digital devices outside of working hours adversely affected their well-being [45]. Prolonged use of digital devices has been associated with negative health outcomes, such as poor posture and impaired respiratory function [46,47]. Consequently, young adults have adopted practices like "digital detox" to manage their health, which may explain the lower utilization of digital devices for health care. Digital detox refers to intentionally taking breaks from digital device use to mitigate the risk of addiction [48]. Many young adults now engage in alternative activities, such as physical exercise, reading, and spending time outdoors, as part of this effort [45]. Studies have shown that digital detox

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can improve sleep quality, reduce stress, and enhance perceived health [49]. Thus, the health of the digital native (DN) generation may actually deteriorate due to overuse of digital devices.

On the other hand, the middle-aged adults group exhibited lower confidence in using digital devices compared to the young-adults group, yet they reported higher utilization of digital devices for health care. There are several possible reasons for this.

The first, the middle-aged adults tend to feel a greater need for health care as they experience more physical changes and a higher likelihood of health problems. For instance, higher cardiorespiratory fitness in middle age is closely linked to reduced medical costs over time, regardless of cardiovascular risk factors [50]. This highlights the importance of exercise for maintaining quality of life in old age. Moreover, the prevalence of multimorbidity—defined as the coexistence of multiple chronic conditions—tends to increase with age, affecting approximately half of middle-aged adults and over 80% of those aged 75 and older [51,52]. However, engaging in muscle-strengthening activities has been associated with a 26% reduction in the likelihood of developing multimorbidity [53]. Given the broad benefits of physical activity on quality of life [54], also medical costs, middle-aged adults are more inclined to actively manage their health.

The second, with the advancement of digital technologies, the middle-aged adults have gradually become more familiar with digital devices, enabling them to effectively use these tools for health care purposes. Ransdell, S,. et al. (2011) found that although older individuals reported lower confidence in using technology, they applied what they had learned more effectively than younger individuals. While older boomers did not grow up in the digital era, they are increasingly becoming proficient in online environments, particularly as students. Middle-aged adults, despite their relatively lower digital proficiency compared to young adults, may compensate through their extensive work and social experiences [55]. This allows them to use digital devices as effective health care tools.

Lastly, a report by Accenture (2019) indicated that middle-aged and older adults are highly motivated to use digital health devices and are quickly adapting to them. The survey found that older adults displayed more favorable attitudes toward digital health devices than young adults. The use of health apps among the elderly increased five times from 2014 to 2018 (from 2.9% to 15.5%), and 95% of respondents indicated that they would actively share health data from apps or wearable devices with medical professionals [56].

The findings of this study suggest that health care strategies utilizing digital devices should be tailored to different age groups. While young adults are proficient and confident in using digital devices, they are also more prone to addiction. Therefore, it is important to develop digital health care strategies that incorporate elements of digital detox. For example, "Digital Health Management Using a Digital Detox Application" could be a valuable tool to prevent digital device addiction. As mentioned, young adults may be more susceptible to digital addiction and are more likely to engage in problematic digital device use due to their higher sensitivity to immediate rewards compared to older adults [57]. Conversely, middle-aged adults are already effective in managing their health using digital devices, but their confidence in using these tools is lower. Therefore, national policies that provide guidance on how to manage health using digital devices could further improve the health outcomes of middle-aged adults. It is crucial to develop more sophisticated and tailored health care programs or mobile applications for this demographic.

This study provides important insights as the first attempt to compare the use of digital devices and health care behaviors between young and middle-aged adults. However, there are some limitations. Since this study is based on a survey, it relies on the subjective evaluations of the respondents, and the causal relationship between digital device use and specific health care activities could not be clearly established. Future studies should aim to collect more quantitative data and explore the direct relationship between digital device usage patterns and health outcomes across different age groups.

5. Conclusions

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This study investigated the differences in confidence regarding the use of digital devices and using digital devices in health care between young and middle-aged adults. The findings indicate that while young adults exhibit high confidence in using digital devices, their utilization of these devices for health care purposes is relatively low. In contrast, middle-aged adults demonstrate lower confidence in using digital devices compared to young adults, yet they are more active in employing digital devices for health care management.

These results offer significant implications for the development of health care programs and policy-making [58]. For young adults, it is recommended to emphasize the importance of utilizing digital devices into health care practices, while ensuring caution to avoid over-reliance or addiction to such technologies. Meanwhile, for middle-aged adults, it is necessary to develop customized programs that enhance the effective utilization of existing digital health care tools.

Future research should focus on identifying the underlying factors that motivate each age group to engage in health care through digital devices. Additionally, there is a need to develop more tailored and sophisticated health care programs based on these factors. Longitudinal studies are also essential to assess the long-term effectiveness of digital health care programs. This will enable the development of strategies that maximize the potential of digital devices, thereby enhancing the efficiency of health care across all age groups.

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