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Mediating Effect of Digital Health Literacy on the Relationship between Attitudes toward Artificial Intelligence and Health Empowerment among South Korean Adults

Seong M.[1] * ***PhD***
[1]Department of Nursing, Kaya University, Gimhae, South Korea

Abstract

Aims: This study examined the relationships among attitudes toward artificial intelligence, digital health literacy, and health empowerment and tested the indirect association of digital health literacy in the relationship between attitudes toward artificial intelligence and health empowerment among adults in South Korea.

Instrument & Methods: A cross-sectional descriptive correlational study was conducted with 250 adults aged 20 years or older recruited through an online survey platform in August 2026. Data were collected using structured self-report questionnaires. Descriptive statistics, t-tests, analysis of variance, Pearson correlation coefficients, and mediation analysis using PROCESS Model 4 were performed. Frequency of health information use was included as a covariate, and the indirect effect was tested with 5,000 bootstrap resamples.

Findings: Attitudes toward artificial intelligence were positively correlated with digital health literacy (r=0.45) and health empowerment (r=0.35), and digital health literacy was strongly correlated with health empowerment (r=0.70). After adjustment for health information use, attitudes toward AI were positively associated with digital health literacy (B=0.35; p<0.001), and digital health literacy was positively associated with health empowerment (B=0.67; p<0.001). The direct association between attitudes toward AI and health empowerment was not significant (B=0.02; p=0.76), whereas the bootstrapped indirect effect through digital health literacy was significant (effect=0.23; 95% CI: 0.14–0.34).

Conclusion: Digital health literacy may be an important linking factor between attitudes toward artificial intelligence and health empowerment, and these findings support further longitudinal and intervention research on the critical use of artificial intelligence-based health information and health empowerment.

Keywords

Artificial Intelligence [https://www.ncbi.nlm.nih.gov/mesh/68001185];
Health Literacy [https://www.ncbi.nlm.nih.gov/mesh/68057220];
Patient Participation [https://www.ncbi.nlm.nih.gov/mesh/68010358];
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*Corresponding Author
Tel: +82-10-2639-5127
Post Address: Department of Nursing, Kaya University, 208 Samgye-ro, Gimhae-si, Gyeongsangnam-do, Republic of Korea. Postal code: 50830
Email: mhlove0624@naver.com
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Introduction

Artificial intelligence (AI) and digital health technologies are transforming how people access, interpret, and use health information [1, 2]. Generative AI systems can provide explanations, summarize complex information, and support education and decision-making; however, their outputs may vary in accuracy, currency, and applicability [2]. In this environment, digital health literacy, the ability to search for, understand, evaluate, and apply health information in digital environments [3, 4, 5], has become increasingly important. Korean adults have reported greater difficulty evaluating the accuracy and relevance of online health information than locating it, indicating that critical appraisal remains an important component of digital health literacy [6].

Health empowerment reflects perceived control over health, the ability to solve health-related problems and make decisions, self-motivation, and active participation in health management [7]. Digital competencies may support this process because individuals who can locate and critically evaluate health information are better positioned to participate in decisions and health-promoting behaviors [8]. Consistent with this view, Korean adults with higher functional and critical digital health technology literacy have shown higher health empowerment and health-promoting behavior [9], and eHealth literacy has been associated with health-promoting behaviors in other populations [10]. Attitudes toward AI may also be relevant to health information use. General attitudes toward AI include cognitive and affective evaluations as well as behavioral tendencies toward AI and may be associated with willingness to engage with AI-based services and information resources [11]. More favorable attitudes may coincide with greater receptivity to AI-enabled information, whereas digital health literacy may determine whether such information is critically appraised and appropriately applied. Thus, digital health literacy provides a plausible statistical link between attitudes toward AI and health empowerment.

Previous studies have examined attitudes toward AI [11], digital or eHealth literacy and health behaviors [8, 10], and digital health technology literacy and health empowerment [9], but evidence integrating these constructs in a single model among general adults remains limited. The conceptual rationale of the present study is that attitudes toward AI may be related to willingness to engage with emerging AI-based information sources, whereas digital health literacy reflects the competencies needed to use digital health information safely and effectively. More favorable attitudes may be associated with greater exploration of AI tools, but empowerment is likely to depend on the ability to identify relevant information, distinguish evidence from unsupported claims, consider privacy and uncertainty, and integrate information with personal values and professional advice; high use of digital technologies should therefore not be equated with high digital health literacy.

The study also responds to a practical gap in health education. As generative AI becomes embedded in search engines, patient portals, mobile applications, and conversational interfaces, adults increasingly encounter health information produced or summarized by AI, and health professionals are likely to encounter patients who bring AI-derived information and questions to care encounters. Examining how attitudes toward AI, digital health literacy, and health empowerment are associated may help identify educational priorities for supporting safe and informed participation in health management. Therefore, this study examined attitudes toward AI, digital health literacy, and health empowerment among adults in South Korea and tested whether digital health literacy showed an indirect association in the relationship between attitudes toward AI and health empowerment.

Instrument and Methods

Study design and participants

This cross-sectional descriptive correlational study included adults aged 20 years or older residing in South Korea, who were recruited by convenience sampling through an online survey platform. Eligibility criteria were age 20 years or older, residence in South Korea, experience using a digital device such as a smartphone, tablet, or computer, ability to understand the study procedures, and voluntary consent. Individuals who did not consent, could not understand or complete the questionnaire, or did not satisfy the eligibility criteria were excluded. Sample-size requirements for indirect-effect testing vary according to the magnitudes of the component paths and the inferential method, and no single minimum sample size applies across mediation models [12, 13]. Because reliable prior estimates of the relevant path coefficients were not available for this population, an effect-size-based a priori calculation would have required assumptions that could not be well supported. Accordingly, the study targeted 250 participants for the planned single-mediator regression model with one covariate, to retain an adequate complete-case analytic sample while allowing for potentially unusable responses; this target was a pragmatic design decision rather than a formal power-based determination. All 250 eligible complete responses were included in the final analysis.

Measures

A structured self-report questionnaire assessed general, health-related, and AI-related characteristics, attitudes toward AI, digital health literacy, and health empowerment. Permission to

use the study instruments was obtained from the relevant developers or translators.

Attitudes toward AI were measured using the Korean version of the 12-item Attitudes towards Artificial Intelligence Scale (ATTARI-12), which assesses cognitive, affective, and behavioral attitudes toward AI [14, 15]. Items are rated on a 5-point Likert scale, with negatively worded items reverse-coded; higher mean scores indicate more positive attitudes. Cronbach's alpha was 0.93 in the original study [14], 0.89 in the Korean validation study [15], and 0.88 in the present study.

Digital health literacy was measured using the Korean Mobile-Based Digital Health Literacy Instrument (MHLS-SF11) [16], whose 11 items cover healthcare, disease prevention, and health promotion. Following prior use of the instrument [17], items were rated on a 5-point scale, with higher scores indicating greater digital health literacy. Cronbach's alpha was 0.93 in the instrument-development study [16], 0.91 in a previous study [17], and 0.90 in the present study.

Health empowerment was assessed using the eight-item Korean Health Empowerment Scale (K-HES), adapted from the Diabetes Empowerment Scale-Short Form and originally validated among older Korean adults [7]. Items address health goals, problem-solving, coping, stress management, support seeking, self-motivation, and selection of appropriate health-management strategies. For use with adults aged 20 years or older, wording was adjusted only where necessary to improve applicability across adult age groups while retaining the original eight-item structure, response format, scoring approach, and conceptual intent. Items were rated from 1 (strongly disagree) to 5 (strongly agree), with higher mean scores indicating greater health empowerment. Cronbach's alpha was 0.80 in the original Korean validation study [7] and 0.84 in the present study, indicating acceptable internal consistency. Because the study was designed to examine substantive associations rather than to revalidate the instrument, no separate exploratory or confirmatory factor analysis of the adapted wording was conducted; the K-HES is therefore described as an adapted measure, and its structural validity across the broader adult age range remains to be confirmed.

Data collection

Data were collected anonymously from 4 to 14 August 2026 through an online survey platform. Before accessing the questionnaire, participants reviewed information concerning the study purpose and procedures, potential risks and benefits, confidentiality, voluntary participation, and the right to withdraw, and only participants who indicated informed consent could proceed. Before analysis, the dataset was screened for eligibility and completeness. The 250 included records contained complete data for the variables used in the analyses, so no missing-data imputation was performed. Response-time or attention-check exclusion criteria were not part of the analytic plan and were therefore not applied.

Statistical analysis

Data were analyzed using IBM SPSS Statistics 29.0 and PROCESS macro 4.2. Frequencies, percentages, means, and standard deviations were used to describe participant characteristics and study variables. Independent-samples t-tests, one-way analysis of variance (ANOVA) with Scheffé post hoc tests, and Pearson correlation coefficients were used as appropriate. Regression assumptions were assessed using tolerance and variance inflation factor values, Durbin–Watson statistics, residual histograms and normal P-P plots, and scatterplots of standardized predicted values and residuals.

Mediation was tested using PROCESS Model 4 [12], with attitudes toward AI as the independent variable, digital health literacy as the mediator, and health empowerment as the dependent variable. Frequency of health information use was included as a covariate because of its theoretical relevance to health-information behavior; it was specified before interpretation of the mediation results rather than selected on the basis of bivariate statistical significance. Unstandardized coefficients, standard errors, t statistics, p-values, 95% confidence intervals (CIs), model R^2 and F statistics, and the bootstrapped indirect effect are reported. The indirect effect was evaluated using 5,000 bootstrap resamples and was considered statistically significant when the 95% bootstrap CI did not include zero. Statistical significance was set at $p<0.05$.

Group comparisons were secondary and exploratory. For comparisons involving more than two categories, ANOVA was followed by Scheffé tests only when the omnibus test was statistically significant. Because several categorical variables contained very small subgroups, pairwise contrasts involving cells with fewer than 10 participants were not emphasized and should be interpreted cautiously; these exploratory comparisons were not used to determine covariate inclusion in the mediation model. Because the design was cross-sectional, all mediation results were interpreted as indirect statistical associations and not as evidence of temporal ordering or causal mechanisms.

Findings

Participant characteristics and group differences

The 250 participants included 145 men (58.0%) and 105 women (42.0%). The largest age group was 40–49 years (26.8%), and 22.4% were aged 60 years or older. Most participants had completed college or university education (70.0%), and 58.0% were office workers. Most participants had used AI (80.4%), 68.4% had searched for information using AI, and

78.4% had searched for health information through the Internet or other digital media within the previous year. Selected exploratory group comparisons that could be interpreted without relying on very small cells are summarized in Table 1.

Table 1. Selected exploratory group comparisons with interpretable cell sizes (n=250)

Characteristic	Outcome	Overall test	Post hoc/group comparison	Interpretive note
Sex	AAI	t=2.79; p=0.01	Men (3.66±0.61) > women (3.44±0.56)	Two groups
	HE	t=1.98; p=0.05	Men (3.57±0.60) > women (3.42±0.57)	Borderline (p=0.05)
Annual income	DHL	F=2.93; p=0.02	No Scheffé pairwise comparison significant	Omnibus only
	HE	F=2.98; p=0.02	No Scheffé pairwise comparison significant	Omnibus only
Perceived health status	DHL	F=4.47; p<0.01	Moderate (3.57±0.59) < good (3.86±0.49)	Sparse extreme groups not interpreted
	HE	F=6.54; p<0.001	Poor (3.22±0.58) and moderate (3.42±0.53) < good (3.73±0.56)	Sparse extreme groups not interpreted
Prior AI use	AAI/DHL/HE	All p<0.01	Yes > no for all three outcomes	n=201 vs. 49
Searched information using AI	AAI/DHL/HE	All p<0.001	Yes > no for all three outcomes	n=171 vs. 79
AI-use frequency	AAI	F=14.31; p<0.001	Never or ≤1–2/month < weekly or more frequent use	All cells ≥33
	DHL	F=4.57; p<0.01	Never < ≥3/week and almost every day	All cells ≥33
Health-information search, past year	DHL/HE	p<0.001/p=0.02	Yes > no for both outcomes	n=196 vs. 54

AAI, attitudes toward artificial intelligence; DHL, digital health literacy; HE, health empowerment; AI, artificial intelligence. Values in parentheses are mean±standard deviation. Post hoc comparisons were performed using the Scheffé test.

Table 2. Mediation model estimates for digital health literacy in the relationship between attitudes toward artificial intelligence and health empowerment (n=250)

Path	B/Effect	SE/Boot SE	t	p	95% CI
AAI → DHL (a)	0.35	0.06	6.20	<0.001	0.24 to 0.46
HI → DHL	0.17	0.04	3.93	<0.001	0.08 to 0.25
AAI → HE (c′)	0.02	0.05	0.30	0.76	−0.08 to 0.11
DHL → HE (b)	0.67	0.05	12.62	<0.001	0.56 to 0.77
HI → HE	0.10	0.04	2.66	0.01	0.03 to 0.17
AAI → DHL → HE (ab)	0.23	0.05	–	–	0.14 to 0.34

Model statistics: mediator model R^2=0.25; F(2,247)=40.61; p<0.001; outcome model R^2=0.51; F(3,246)=85.39; p<0.001. The indirect effect was estimated with 5,000 bootstrap resamples. AAI, attitudes toward artificial intelligence; DHL, digital health literacy; HE, health empowerment; HI, frequency of health information use; B, unstandardized regression coefficient; SE, standard error; CI, confidence interval; c′, direct effect.

Some multi-category variables included cells with fewer than 10 participants, and contrasts involving those sparse categories were not used to support substantive conclusions. Among comparisons with adequate cell sizes, prior AI use and prior searching for information using AI were associated with higher scores on attitudes toward AI, digital health literacy, and health empowerment, and participants who had searched for health information during the previous year reported higher digital health literacy and health empowerment. No statistically significant differences in the three principal variables were observed by age or chronic-disease status.

Levels and correlations of the main variables

The mean attitude toward AI score was 3.57±0.60 (range: 1.15–5.00), the mean digital health literacy score was 3.67±0.57 (range: 1.00–5.00), and the mean health empowerment score was 3.51±0.59 (range: 2.00–5.00). Attitudes toward AI were positively correlated with digital health literacy (r=0.45; p<0.01) and health empowerment (r=0.35; p<0.01), and digital health literacy was positively correlated with health empowerment (r=0.70; p<0.01).

Mediating effect of digital health literacy

Regression diagnostics indicated no substantial violations of the analytic assumptions: tolerance values ranged from 0.75 to 0.88, variance inflation factors from 1.14 to 1.33, and Durbin–Watson statistics were 2.11 and 2.03 for the mediator and outcome models, respectively. Residual plots supported approximate normality, linearity, and homoscedasticity.

After adjustment for frequency of health information use, attitudes toward AI were positively associated with digital health literacy (B=0.35; SE=0.06; p<0.001), and health information use was also positively associated with digital health literacy (B=0.17; SE=0.04; p<0.001); the mediator model explained 25.0% of the variance in digital health literacy. In the outcome model, digital health literacy was positively associated with health empowerment (B=0.67; SE=0.05; p<0.001), and health information use was also positively associated with health empowerment (B=0.10; SE=0.04; p=0.01). The direct association between attitudes toward AI and health empowerment was not statistically significant after adjustment for digital health literacy and health information use (B=0.02; SE=0.05; p=0.76). The outcome model explained 51.0% of the variance in health empowerment, and the bootstrapped indirect effect through digital health literacy was 0.23 (Boot SE=0.05; 95% CI: 0.14–0.34) (Table 2).

Discussion

The principal finding was a statistically significant indirect association between attitudes toward AI

and health empowerment through digital health literacy. Although attitudes toward AI were positively correlated with health empowerment, the direct association was no longer statistically significant after digital health literacy and frequency of health information use were included in the model. Given the cross-sectional design, this pattern should not be interpreted as evidence that attitudes toward AI cause changes in digital health literacy or empowerment; rather, the findings indicate that more favorable attitudes toward AI, greater digital health literacy, and greater health empowerment co-occur in a pattern consistent with the hypothesized indirect model.

Participants reported moderately positive attitudes toward AI. Multinational patient research has similarly shown generally favorable views of healthcare AI alongside concerns about accuracy, explainability, and human oversight [18], and trust in AI-generated health information varies according to AI literacy and perceived usefulness [19]. These findings suggest that health education should not aim simply to increase positive attitudes toward AI; a more appropriate goal is calibrated engagement in which users understand both potential benefits and limitations and retain appropriate reliance on professional judgment.

Digital health literacy was positively associated with both attitudes toward AI and health empowerment. A systematic review of healthy adults identified education, socioeconomic factors, and health-information use as important correlates of eHealth literacy and linked eHealth literacy with multiple health-related outcomes [20]. Recent studies have also reported positive associations between AI attitudes and eHealth or health literacy [21, 22], and digital health literacy has been reported as an intermediary variable linking technology-related behaviors with health decision-making [23]. Together, these studies support the relevance of digital health literacy when examining how adults engage with AI-enabled health information, although the direction and temporal sequence of these relationships remain uncertain.

The strong association between digital health literacy and health empowerment is plausible because empowerment involves understanding health problems, making informed decisions, and participating actively in health management [7]. However, the observed association may also partly reflect shared determinants such as education, socioeconomic resources, prior digital experience, health-information seeking, or general self-efficacy; frequency of health information use was included as a covariate, but residual and unmeasured confounding cannot be excluded. The indirect effect likewise requires cautious interpretation. Cross-sectional mediation can produce biased estimates when the underlying process unfolds over time and does not establish temporal precedence among the variables [24], so the present model is best viewed as a statistical decomposition of associations under a prespecified conceptual model, not as proof of a causal mediation mechanism. Longitudinal studies with repeated measurement and intervention studies designed to improve digital health literacy are needed to determine whether changes in literacy precede changes in health empowerment.

The findings may nevertheless inform future health-education research. AI-generated health information can be fluent and accessible while still being incomplete, outdated, unsupported, or poorly matched to an individual's clinical context [2]. Emerging work on AI health literacy emphasizes evaluating evidence, recognizing uncertainty, protecting privacy, verifying high-stakes information, and knowing when professional consultation is necessary [25]. Educational interventions could test whether these skills improve the safe use of AI-enabled health information and patient participation, although the present cross-sectional findings alone do not establish the effectiveness of such interventions.

Exploratory subgroup findings should also be interpreted conservatively. Several multi-category variables contained very small cells, which can produce unstable means and pairwise comparisons; therefore, only comparisons that can be interpreted without relying on sparse categories are presented, cases in which an omnibus test was significant but Scheffé pairwise comparisons were not are noted explicitly, and small-cell contrasts were not used as a basis for practice recommendations.

Several sources of bias may have affected the findings. Convenience recruitment through an online platform and the requirement for prior digital-device experience may have favored participants with greater digital access or interest, limiting representation of digitally vulnerable adults. Self-report measurement of all principal variables creates potential common-method and social-desirability bias. In addition, the analytic model adjusted only for frequency of health information use; education, socioeconomic position, age, prior AI experience, and other factors may contribute residual confounding. Because the sample was drawn from adults in South Korea, cultural and health-system context should also be considered when generalizing the findings to other populations.

Measurement limitations also warrant attention. The K-HES was originally validated among older Korean adults [7], whereas the present study adapted limited wording for use across a broader adult age range while retaining the eight-item structure and scoring approach. The adapted scale demonstrated acceptable internal consistency (Cronbach's alpha=0.84); however, internal consistency alone does not establish structural or construct validity, and no factor-analytic assessment of the adapted wording was conducted. Future research should

therefore confirm the construct validity and measurement invariance of the adapted K-HES in general adult populations. In addition, the study did not use performance-based tests of digital health literacy, the inclusion of which would strengthen future research.

Despite these limitations, the study contributes an integrated analysis of attitudes toward AI, digital health literacy, and health empowerment in a community adult sample. The results support digital health literacy as an important correlate and statistical linking factor in AI-related health-information environments, while underscoring the need for longitudinal, psychometrically rigorous, and more representative research before causal or population-level conclusions are drawn. The findings identify digital health literacy as a potentially important target for future longitudinal and intervention research on the safe and informed use of AI-enabled health information. Causal direction cannot be established from the cross-sectional design, and further validation of the adapted health-empowerment measure in general adult populations is warranted.

Conclusion

Digital health literacy has an indirect statistical association in the relationship between attitudes toward AI and health empowerment among Korean adults. After adjustment for frequency of health information use, attitudes toward AI are associated with digital health literacy, and digital health literacy is strongly associated with health empowerment.

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Ethical Permissions: The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of Kaya University (approval number: KAYA IRB-456; approval date: 25 June 2026). Informed consent was obtained from all participants before access to the online questionnaire.

Conflicts of Interest: The author declared no conflicts of interest.

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