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Original Article

Analysis of Research Trends in Digital Healthcare

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ABSTRACT

Objectives: This study aimed to identify recent research trends in digital healthcare in Korea and to examine the structural relationships among major research keywords using network text analysis. **Methods:** A total of 280 articles published in journals indexed in the Korea Citation Index (KCI) from January 2021 to December 2025 were analyzed. Frequency analysis, degree centrality analysis, and community cohesion analysis were performed using NetMiner 4.5. **Results:** In the frequency analysis, Research was the most frequent keyword (79, 28.2%), followed by Core (53, 18.9%), Healthcare (48, 17.1%), Foundation (45, 16.1%), Analysis (37, 13.2%), Utilization (31, 11.1%), Telemedicine (30, 10.7%), and Artificial Intelligence (25, 8.9%). Degree centrality was highest for Research (0.944), followed by Core (0.916), Healthcare (0.833), Foundation (0.805), Utilization (0.777), and Digital (0.750). Digital, Health Management, and Digital Therapeutics showed relatively high degree centrality compared with their occurrence frequencies. The cohesion map identified three clusters: G1, digital healthcare foundations and services; G2, application, outcomes, and activation of digital healthcare technologies; and G3, awareness and utilization of digital therapeutics. **Conclusions:** These findings indicate that digital healthcare research in Korea has expanded from infrastructure and service development toward practical applications of artificial intelligence, telemedicine, data-driven health management, and digital therapeutics.

Keywords: Degree centrality, Digital healthcare, Digital therapeutics, Network text analysis, Research trends

1. Introduction

With the accelerating convergence of digital technologies, artificial intelligence (AI), big data, the Internet of Things (IoT), and mobile and wearable technologies are being widely applied to healthcare services and health management. These developments are changing not only the way healthcare is delivered but also approaches to disease prevention, diagnosis, treatment, and continuous health management. In Korea, the expansion of healthcare services based on digital transformation and the need for corresponding institutional frameworks have also been discussed continuously [1,3,5,8,12,14].

Digital healthcare has expanded beyond the provision of health information to encompass telemedicine, personalized health management, digital-device-based monitoring, AI-supported decision making, and data-driven services [3,8,12-14]. User awareness, experience, perceived usefulness, and intention to use digital healthcare have been reported as important factors in service diffusion [2,6,7]. These findings indicate that digital healthcare should be evaluated not only in terms of technological performance but also in terms of actual use and service experience.

The safe use of healthcare data and protection of personal information are also key issues in the development of digital healthcare. Korean studies have emphasized that measures to promote data use should be accompanied by de-identification, secure data transmission, and appropriate legal and institutional safeguards [4]. Internationally, data harmonisation has been highlighted as essential for addressing heterogeneity and interoperability problems in digital healthcare data [16]. Such data infrastructure underpins

the development of AI, telemedicine, and personalized health management services.

However, the benefits of digital technologies are not distributed equally among all users. Although digital technologies can improve access to healthcare, differences in digital access, digital competence, economic conditions, and the ability to use health information may create new forms of inequality [15]. In Korea, experience and perceptions of digital healthcare differ across service types [2], and the importance of designing services around actual user experience and acceptance has been emphasized [6,7]. Therefore, research on digital healthcare needs to consider accessibility, usability, acceptability, and sustained use as well as technology development.

Research on digital healthcare in Korea has rapidly diversified to include AI applications, telemedicine, data utilization, service design, intention to use, and digital transformation [1-9]. Because individual studies differ in technologies, services, target populations, and application settings, it is difficult to understand the overall research landscape from individual findings alone. As topics such as AI, telemedicine, digital health, healthcare data, user experience, and digital therapeutics increasingly intersect, a systematic examination is needed to identify the topics that have been central to Korean research and the structural relationships among them.

Frequency analysis is useful for identifying how often specific keywords appear, but it has limitations in explaining structural relationships among keywords. Network text analysis represents keywords as nodes and their relationships as links, allowing the structural relationships among research topics to be visualized and interpreted [18,19]. Degree centrality indicates how broadly a keyword is connected to other keywords and can be used to identify structurally important topics within a research field [18,19]. Community analysis groups highly connected keywords to reveal subdomains and the overall structure of a field, while modularity can be used to evaluate the extent of clustering [20].

In Korea, network text analysis has also been used to identify key topics and structures in specific research domains. Cho and Han [11] analyzed research on college education after COVID-19 using frequency analysis, degree centrality, and cohesion structure analysis and identified core topics and subdomains. Kim et al. [10] analyzed Korean research on artificial intelligence for older adults and demonstrated differences between keywords with high frequency and those with high degree centrality, as well as a community cohesion structure. These approaches are useful for identifying structural importance and relationships among research areas that cannot be captured by frequency alone.

Therefore, this study applied network text analysis to academic articles on digital healthcare published in Korea from 2021 to 2025. The study analyzed keyword frequency and interconnections and examined the cohesion structure of major research domains. The findings are intended to clarify the major trends and structural characteristics of digital healthcare research in Korea and to provide a basis for future research and digital healthcare service design.

2. Materials and Methods

2.1. Study design and data collection

This was a literature-based network text analysis study designed to identify the major topics and structural relationships among keywords in Korean academic research on digital healthcare. The units of analysis were key terms extracted and refined from article titles and abstracts. Frequency analysis, degree centrality analysis, and community cohesion analysis were conducted sequentially. The study population comprised articles published in Korean journals indexed in the Korea Citation Index (KCI) between January 2021 and December 2025. Relevant articles were retrieved by searching titles and abstracts for terms related to 'digital' and 'healthcare,' and 280 articles that met the study purpose were included in the final analysis. The dataset was constructed from the titles and abstracts of these articles. Keywords representing the research topics were extracted and then standardized. Semantically identical or similar terms were merged, Korean and English variants and spacing differences were harmonized, and expressions not relevant to the analysis were reviewed and excluded to create the final keyword list.

2.2. Data analysis

Data were analyzed using NetMiner 4.5. Frequency analysis was performed to identify keywords that appeared most frequently in digital healthcare research. Frequencies and percentages were calculated based on the 280 articles, and keywords appearing 15 or more times were reported as the principal frequency results. Degree centrality was then calculated to assess the structural importance of keywords. A higher degree centrality indicates that a keyword is connected to a greater number of other keywords and may serve as a central or bridging topic in the network [18,19]. The top 13 degree centrality ranks were reported, with keywords having identical centrality values presented at the same rank. Finally, community cohesion analysis

was performed to group highly interconnected keywords and visualize the structure of research domains. Community analysis groups keywords for which within-group connections are relatively stronger than between-group connections, and modularity is a representative index of the degree of such clustering [20]. The research domain represented by each cluster was named based on the semantic characteristics and connection patterns of the keywords contained in the cluster.

3. Results

3.1. Frequency analysis of keywords

Frequency analysis of keywords from the 280 digital healthcare articles is presented in Table 1. Among keywords appearing 15 or more times, Research was the most frequent, occurring in 79 articles (28.2%), followed by Core in 53 (18.9%), Healthcare in 48 (17.1%), Foundation in 45 (16.1%), Analysis in 37 (13.2%), Utilization in 31 (11.1%), Telemedicine in 30 (10.7%), and Artificial Intelligence in 25 (8.9%). Case and Digital Health each appeared 23 times (8.2%); Digital, Technology, Role, and Service each appeared 22 times (7.9%); Care and Medical each appeared 17 times (6.1%); Digital Transformation appeared 16 times (5.7%); and Approach appeared 15 times (5.4%). These results show that recent digital healthcare research has addressed a broad range of technology- and service-related topics, including healthcare, utilization, telemedicine, artificial intelligence, digital health, and digital transformation.

Table 1. Frequency analysis of keywords in digital healthcare research (15 or more occurrences)

No	Keyword	N (%)
1	Research	79 (28.2)
2	Core	53 (18.9)
3	Healthcare	48 (17.1)
4	Foundation	45 (16.1)
5	Analysis	37 (13.2)
6	Utilization	31 (11.1)
7	Telemedicine	30 (10.7)
8	Artificial intelligence	25 (8.9)
9	Case, Digital health	23 (8.2)
10	Digital, Technology, Role, Service	22 (7.9)
11	Care, Medical	17 (6.1)
12	Digital transformation	16 (5.7)
13	Approach	15 (5.4)

3.2. Degree centrality analysis of keywords

Results of the degree centrality analysis are shown in Table 2. Research had the highest degree centrality (0.944), followed by Core (0.916), Healthcare (0.833), Foundation (0.805), Utilization (0.777), Digital (0.750), Analysis (0.722), and Artificial Intelligence (0.694). Telemedicine and Case each had a degree centrality of 0.666, followed by Health Management (0.611); Technology, Digital Health, Medical, and Role (0.583 each); Digital Therapeutics (0.555); and Digital Transformation (0.527). When the frequency and degree centrality results were compared, Research, Core, Healthcare, and Foundation ranked highly in both analyses. In contrast, Digital appeared 22 times (7.9%) in the frequency analysis but showed a relatively high degree centrality of 0.750. Health Management and Digital Therapeutics did not appear in the frequency table, which included only keywords occurring 15 or more times, but were among the keywords with the highest degree centrality. This indicates that these topics were connected to a wide range of digital healthcare research topics despite their relatively lower absolute frequencies.

Table 2. Degree centrality analysis of keywords in digital healthcare research (top 13)

No	Keyword	Centrality of connection
1	Research	0.944
2	Core	0.916
3	Healthcare	0.833
4	Foundation	0.805
5	Utilization	0.777
6	Digital	0.750
7	Analysis	0.722
8	Artificial intelligence	0.694
9	Telemedicine, Case	0.666
10	Health management	0.611
11	Technology, Digital health, Medical, Role	0.583
12	Digital therapeutics	0.555
13	Digital transformation	0.527

3.3. Cohesion map analysis of keywords

The cohesion map analysis is presented in Fig. 1. The keywords were grouped into three clusters, G1, G2, and G3. Each cluster was named according to the semantic characteristics and connection patterns of its major keywords. G1 included Research, Foundation, Digital, Digital Transformation, Medical, Care, Health, Health Care Services, Service, Information, Data, System, Industry, Role, and Elderly. Research, Foundation, and Digital were central to the cluster and were linked with Medical, Health Care Services, Information, Data, and Digital Transformation. G1 was therefore interpreted as a research domain concern-

ing the foundations and service systems through which digital technologies are applied to healthcare and was labeled 'Digital healthcare foundations and services.' G2 included Core, Healthcare, Technology, Digital Health, Telemedicine, Artificial Intelligence, Health Management, Health Care Data, Analysis, Development, Activation, Efficiency, High Quality, User Experience, Case, Approach, Measure, and Trend. Healthcare and Core were centrally connected with Artificial Intelligence, Telemedicine, Digital Health, Health Care Data, and Health Management, while User Experience, Efficiency, High Quality, Development, and Activation were included in the same cluster. G2 was therefore labeled 'Application, outcomes, and activation of digital healthcare technologies.' G3 included Digital Therapeutics, Utilization, Use, and Awareness. These keywords formed a relatively distinct research domain, with Utilization closely connected to Digital Therapeutics, Use, and Awareness. G3 was therefore labeled 'Awareness and utilization of digital therapeutics.' This cluster suggests that research on digital therapeutics is expanding beyond technology development to include actual use, awareness, and utilization.

4. Discussion

This study used network text analysis to examine major research topics and their structural relationships in 280 digital healthcare articles published in KCI-indexed journals in Korea between 2021 and 2025. Taken together, the frequency, degree centrality, and cohesion map analyses showed that digital healthcare research in Korea is characterized by an interconnected, convergent structure involving healthcare services, artificial intelligence, telemedicine, data-driven health management, and digital therapeutics rather than by a single dominant technology.

Healthcare showed both a high frequency (48, 17.1%) and high degree centrality (0.833) and was broadly connected with Digital, Medical, Service, Care, and Health Management. This indicates that digital healthcare has developed beyond the application of information technology alone into a complex research domain that encompasses

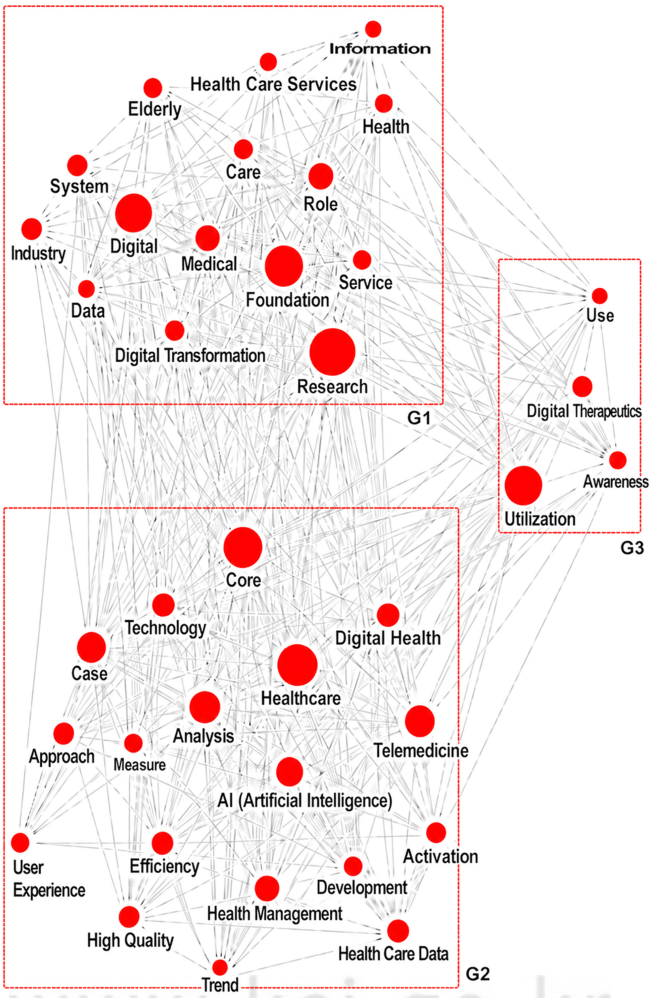

Fig. 1. Cohesion map analysis of keywords in digital healthcare research

healthcare services, health management, data, and service delivery systems. Korean studies have similarly reported that digital transformation affects competitive structures and value propositions in healthcare services [5] and that digital healthcare services are expanding through the integration of AI, IoT, mobile technologies, and other information and communication technologies [8]. International research also characterizes digital health as a broad field with the potential to improve healthcare quality and service efficiency [14].

The prominence of Artificial Intelligence and Telemedicine in both frequency and degree centrality analyses suggests that recent digital healthcare research has increasingly focused on AI-based prediction and analysis and on remote health management. Artificial Intelligence occurred 25 times (8.9%) and had a degree centrality of 0.694, whereas Telemedicine occurred 30 times (10.7%) and had a degree centrality of 0.666. Korean studies have described diverse applications and potential uses of AI in digital healthcare [3] and have linked telemedicine utilization to the activation of digital healthcare [9]. International studies likewise identify AI as an important technology for diagnosis, clinical decision support, and improvement of healthcare services [12], while telemedicine has been increasingly adopted across healthcare settings [13].

Digital had a relatively modest frequency of 22 (7.9%) but a high degree centrality of 0.750, placing it among the most structurally important keywords. High degree centrality indicates that a keyword frequently co-occurs with diverse topics and functions as an important connection point within the network [18,19]. In a network text analysis of artificial intelligence research related to older adults, Kim et al. [10] similarly found that Digital had a higher centrality than its frequency would suggest and interpreted it as a concept linking multiple research topics. In the present study, Digital appears to function as a foundational concept connecting artificial intelligence, telemedicine, healthcare, data, services, and digital transformation.

The prominent positions of Health Management and Health Care Data in the network indicate that digital healthcare research is shifting from technology development alone toward continuous, data-driven health management. Korean research has emphasized the importance of safe use of medical data, de-identification, and privacy protection as the digital healthcare industry expands [4], while digital transformation strategies have highlighted new value creation through data and technology [5]. In addition, data harmonisation and interoperability across heterogeneous data formats and sources have been identified as essential conditions for the clinical use of digital healthcare [16].

Digital Therapeutics did not appear in the frequency table based on a threshold of 15 occurrences, but it ranked among the top centrality keywords with a degree centrality of 0.555 and formed a distinct G3 cluster with Utilization, Use, and Awareness. Digital therapeutics have emerged as a new therapeutic modality that uses software-based interventions to prevent, manage, or treat disease, and recent discussions have extended beyond clinical efficacy and safety to real-world use, patient acceptance, implementation in healthcare settings, regulation, and reimbursement [17]. The clustering of Digital Therapeutics with Utilization, Use, and Awareness in this study suggests that Korean research is also moving beyond technology development toward questions of actual use and adoption.

The cohesion analysis further showed that digital healthcare research is organized around three major axes: foundations and services, application and outcomes/activation of technologies, and awareness and utilization of digital therapeutics. G1, including Digital, Medical, Information, Health Care Services, Data, and Digital Transformation, was characterized by infrastructure and service-system themes. G2, which included Artificial Intelligence, Telemedicine, Digital Health, Health Care Data, User Experience, Efficiency, High Quality, Development, and Activation, represented research on applying technologies in actual healthcare settings and evaluating service outcomes. G3, composed of Digital Therapeutics, Utilization, Use, and Awareness, formed a relatively independent domain focused on the real-world use and acceptance of digital therapeutic technologies. This structure is consistent with Korean research on trends in digital healthcare services [8] and international research on the quality of digital health [14], both of which describe digital healthcare as developing across technological, service, and user-centered dimensions.

The inclusion of User Experience, Efficiency, and High Quality within G2 indicates that research attention is moving beyond technological feasibility to whether digital healthcare is useful and sustainable for users and whether it improves service quality and efficiency. A Korean study of user experience with digital healthcare wearable devices emphasized design considerations related to wearability and actual user experience [6]. Another study of nurses reported that performance expectancy and facilitating conditions were associated with intention to use digital healthcare [7]. A national survey of perceptions of digital healthcare also found differences in experience and awareness across service types such as mobile health, telemedicine, and AI healthcare [2]. Future research should therefore evaluate user experience, intention to use, and acceptance together with clinical effectiveness and service outcomes.

When digital healthcare is applied to older adults and frontline care personnel, accessibility-oriented UI/UX design, including readable displays, simple navigation, and reduced operational complexity, should be prioritized to support practical use [6,15]. In real-world care settings, limited digital skills, time constraints, workflow disruption, device or connectivity issues, and insufficient technical support may act as barriers to adoption and sustained use [7,15].

Digital disparities and health inequalities also warrant attention as digital healthcare expands. Digital technologies can improve access to care, but disparities in infrastructure, access to devices, digital skills, health information literacy, and socioeconomic conditions may exclude some populations from services. Yao et al. [15] reported that the adoption of digital health technologies may reduce existing healthcare inequities under some conditions but may also create new forms of inequality. Because digital healthcare use and perceptions are also uneven in Korea [2], service design and educational support should explicitly address accessibility and ease of use for digitally vulnerable populations, including older adults and persons with disabilities.

This study has several limitations. Because articles published from 2021 to 2025 were analyzed as a single period, temporal changes in research topics could not be examined directly. Digital healthcare is a rapidly changing field in terms of both technology and policy; therefore, future studies should use annual or period-specific network analyses to examine changes in the centrality of Artificial Intelligence, Telemedicine, Health Care Data, and Digital Therapeutics over time. In addition, keyword network analysis is useful for identifying the overall structure and relationships within a research field but cannot fully describe the populations, study designs, interventions, or outcomes of individual studies. Combining network analysis with content analysis would therefore provide a more in-depth understanding of the development of digital healthcare research in Korea.

5. Conclusion

This study analyzed 280 digital healthcare articles published in KCI-indexed journals in Korea from 2021 to 2025 using network text analysis. In the frequency analysis, Research, Core, Healthcare, Foundation, Analysis, Utilization, Telemedicine, and Artificial Intelligence were prominent keywords, whereas the degree centrality analysis identified Research, Core, Healthcare, Foundation, Utilization, and Digital as highly connected topics. Notably, Digital, Health Management, and Digital Therapeutics showed relatively high structural importance compared with their frequencies. Based on the cohesion map analysis, the research field was divided into three clusters: 'Digital healthcare foundations and services,' 'Application, outcomes, and activation of digital healthcare technologies,' and 'Awareness and utilization of digital therapeutics.' Overall, Korean digital healthcare research has expanded from infrastructure and service development toward practical applications of artificial intelligence, telemedicine, digital health, and healthcare data, with increasing attention to user experience, service quality and efficiency, and the utilization and acceptance of digital therapeutics. Future research should evaluate the clinical effectiveness and real-world implementation of digital healthcare technologies, user acceptance and sustained use, the clinical effects and implementation of digital therapeutics, accessibility and health inequalities among digitally vulnerable populations, and temporal changes in research topics. Combining network analysis with content analysis may further clarify the evolution and future directions of digital healthcare research in Korea.

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Conflicts of Interest

The author declares no conflict of interest.

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