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Environmental and Individual Factors Associated with Clinical Practice Stress in Korean Nursing Students: A Scoping Review

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Purpose: This scoping review aimed to comprehensively examine environmental and individual factors contributing to clinical practice stress among nursing students in South Korea and to provide evidence-based recommendations for improving the clinical education environment. **Methods:** A scoping review was conducted following Arksey and O'Malley's five-stage framework and the PRISMA-ScR guidelines. Relevant studies published between January 2016 and March 2025 were identified through searches of domestic databases (KCI, RISS) and international databases (PubMed, CINAHL) using predefined keywords. A total of 18 studies met the inclusion criteria. Data were extracted using a standardized template and categorized by study characteristics, methodological features, and stress-related variables. **Results:** Most included studies were conducted after 2022 and involved students from multiple institutions. Environmental stressors identified included poor clinical setting quality, lack of instructor support, interpersonal challenges, limited educational infrastructure, and disruptions caused by new infectious diseases. At the individual-level, resilience, coping strategies, and emotional regulation were the most frequently studied variables. Among these, resilience was consistently reported as a protective factor against stress, while incivility emerged as the most prominent environmental stressor. Multiple regression models indicated that stress-related factors explained between 18.0% and 75.6% of the variance in outcomes. **Conclusion:** Clinical practice stress in nursing students results from a dynamic interaction between environmental and individual factors. Nursing education programs should incorporate resilience-enhancing interventions, strengthen collaboration with clinical sites, and adopt flexible educational methods, such as simulation-based training, particularly during periods of restricted clinical access.

Key Words: Environmental exposure; Nursing students; Psychological stress; Scoping review

INTRODUCTION

With the continuing advancement of medical technology and heightened public awareness of healthcare standards, the demand for improved healthcare services has risen markedly. These developments are closely tied to nursing education [1]. The World Health Organization has emphasized the importance of investing in nursing education and supporting the development of qualified nurses worldwide, particularly by reinforcing educational programs that build advanced nursing competencies [2]. Reflecting this trend, the Korean Accreditation Board of Nursing Education

(KABONE) revised its standards in the fourth accreditation cycle, shifting the minimum requirement for clinical practice from 1,000 hours per student to a minimum of 22 clinical credits [3].

The clinical practicum is a core element of nursing education that enables students to apply theoretical knowledge in real clinical contexts and to internalize essential competencies. Despite its importance, clinical training in Korea is often limited to observational experiences, partly due to heightened awareness of patient rights and a shortage of qualified clinical educators [4]. As of 2021, the number of university nursing departments in Korea had increased by approximately 66% compared to 2009 [5]. With the rising number of nursing students, securing high-quality clinical practice sites has become a major challenge for nursing universities. Moreover, expanding student enrollment has intensified competition for clinical placements, and the varied characteristics of clinical institutions demand that students quickly adapt each time their placement changes [6].

External influences including new and emerging infectious diseases, changes in healthcare workforce policy, and institutional variation in practicum systems have further disrupted the clinical training environment [7]. These disruptions highlight the urgent need to understand how diverse and evolving conditions contribute to nursing students' clinical practice stress.

Clinical practice stress refers to a state of tension that hinders students' performance, caused by anxiety, fear, worry, or physical discomfort resulting from practicum-related experiences [8]. Stressors are multifaceted, including discrepancies between theory and practice, non-educational environments, lack of interpersonal experience, repetitive basic tasks, insufficient professional knowledge, and low confidence [9]. Previous studies have largely emphasized psychological or personality traits as individual predictors of stress. However, several studies have also reported that clinical learning conditions and environmental characteristics exert substantial influence on practicum-related stress [10,11].

In this study, factors contributing to clinical practice stress are broadly categorized into two domains: individual and environmental. Individual factors encompass personal attributes such as self-efficacy, personality traits, coping ability, academic preparedness, and psychological resilience. Environmental factors include external elements such as the learning atmosphere of the clinical site, quality of interactions with staff, workload, patient acuity, and institutional support systems. This classification is based on the Stress Interaction Model, which conceptualizes stress as the outcome of interactions between an individual and their environment [12]. By applying this theoretical perspective, the study seeks to systematically explore how the dynamic interplay between personal characteristics and contextual conditions contributes to clinical practice stress.

The clinical practicum environment particularly the atmosphere of the clinical site and interpersonal relationships directly affects nursing students' perceptions, emotional well-being, and learning performance. A supportive environment, characterized by constructive guidance from preceptors and a positive unit culture, enhances students' sense of belonging while reducing anxiety [5]. Nevertheless, previous studies have primarily focused on psychological and academic factors, often overlooking environmental influences. For example, a domestic review covering 2015 to 2020 did not include stressors related to major public health events, and a meta-analysis categorized stress-related factors without adequately addressing environmental components [11,13]. Given these gaps, it is necessary to investigate environmental and systemic contributors such as institutional readiness, infection-related disruptions, and clinical education infrastructure that shape clinical practice stress.

This study therefore aims to synthesize existing evidence through a scoping review, examine current conditions in clinical practicum settings, and identify opportunities for educational improvement. The findings are intended to support collaborative strategies to enhance clinical training environments, strengthen instructor competencies, and refine instructional approaches in nursing education.

Accordingly, this review seeks to address a critical gap by systematically mapping and classifying stress-related variables, analyzing the representation of both internal and external influences in the literature, and identifying research patterns and deficiencies. To ensure comprehensiveness, the literature search period was set from 2016 to 2025, capturing the most recent decade of scholarship. This timeframe was selected to reflect evolving developments in nursing education, clinical training environments, and policy contexts, including significant changes before and after major infectious disease outbreaks. By encompassing this period, the review provides timely insights into individual and environmental factors affecting nursing students' clinical practice stress and offers evidence to inform current educational strategies and institutional policies. Through a scoping review of domestic literature published between 2016 and 2025, this study aims to identify and classify stress-related variables, analyze current research trends and methodologies, and provide insights that can inform the development of more effective clinical education strategies. Ultimately, the findings are expected to support improvements in clinical learning environments, guide institutional decision-making, and contribute to the design of evidence-based interventions that reduce stress and improve nursing students' practicum experiences.

METHODS

1. Study Design

This study employed a scoping review methodology to explore and synthesize research on environmental and individual factors associated with clinical practice stress among nursing students in South Korea. Unlike traditional systematic reviews, scoping reviews are particularly suited for mapping broad or complex areas of inquiry involving heterogeneous study designs and diverse interventions. Following the foundational framework proposed by Arksey and O'Malley [14], this review aimed to examine the extent, range, and nature of the existing literature, identify key concepts, and summarize findings relevant to clinical practice stress. To ensure methodological rigor and transparency, the review process was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines [15].

Based on the PCC framework (Population–Concept–Context) outlined by Levac et al. [16], this study formulated its research questions as follows: the population (P) consists of nursing students, the concept (C) relates to clinical practicum education, and the context (C) is situated within nursing colleges and hospital-based clinical settings. Accordingly, the research questions were: "What are the trends in research on environmental and individual factors related to clinical practice stress among nursing students?", "What specific environmental and personal conditions contribute to this stress?", and "What areas of the clinical practice environment require improvement, and what support is needed to better assist students in the future?"

2. Search Strategy

To comprehensively review literature related to clinical practice among Korean nursing students, this study used two representative domestic databases the Korean Citation Index (KCI) and the Research Information Sharing Service (RISS). These databases ensured the inclusion of Korean-language publications and allowed for the integration of journal articles, academic dissertations, and gray literature. In addition, two international databases were used PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) to identify English-language studies examining clinical practice stress among nursing students.

Literature searches were conducted across both domestic and international databases. Korean sources (KCI and RISS) were searched using terms such as "nursing student," "clinical practice," "stress," and "influencing factor." For international databases, PubMed and CINAHL were queried using combinations of "nursing students," "clinical practice," "stress," "related factor," and "Korean." The KCI search strategy was: (KEYALL "nursing students") AND (KEYALL "clinical practice") AND ((KEYALL "stress") OR (KEYALL "influencing factor")) AND Publish (2016Jan:2025Mar). The RISS search strategy was: (ALL: nursing students) AND (ALL: clinical practice AND ((ALL: stress) OR (ALL: influencing factor))) AND Publish (2016~2025).

3. Inclusion/Exclusion Criteria

To ensure relevance and quality, explicit inclusion and exclusion criteria were established prior to screening. The inclusion criteria were: (1) peer-reviewed journal articles published between January 2016 and March 2025; (2) studies focusing on clinical practice stress among nursing students in South Korea; (3) research examining either environmental or individual factors related to clinical practicum stress; and (4) publications written in Korean or English. These criteria were intended to capture recent and contextually relevant studies reflecting changes in clinical education environments, including those influenced by emerging infectious diseases, healthcare system instability, and institutional policy reforms.

Exclusion criteria included: (1) studies not involving nursing students as the target population; (2) research not focused on clinical practice or stress in clinical practice; (3) non-empirical works such as opinion pieces, editorials, or narrative reviews; (4) conference abstracts, posters, or book chapters; and (5) duplicate publications across databases. The screening and eligibility process was guided by these criteria to ensure that only studies with direct relevance to the research questions and conceptual framework were included in the final analysis.

4. Screening Procedure

The initial database search identified 223 articles. After duplicate removal and title/abstract screening, 26 articles were retained for full-text review. Final inclusion was determined through independent assessments by two reviewers a primary researcher and a doctoral-level research assistant—followed by consensus discussions. Disagreements were resolved through meetings and mutual agreement. Ultimately, 18 studies met the eligibility criteria and were included in the final analysis (Figure 1).

5. Quality Appraisal and Data Extraction

The quality of the selected studies was assessed using the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist [15]. This tool evaluates six domains: title/abstract, introduction, methods, results, discussion, and other reporting elements. Data were systematically extracted using a standardized template developed by the Joanna Briggs Institute (JBI). One researcher independently extracted the data, while a research assistant cross-checked all entries to ensure accuracy and consistency. Extracted fields included authors, year of publication, sample characteristics, research design, and variables examined, with particular attention to identifying and classifying factors associated with clinical practice stress.

6. Data Analysis and Synthesis

Data analysis proceeded in three phases. First, descrip-

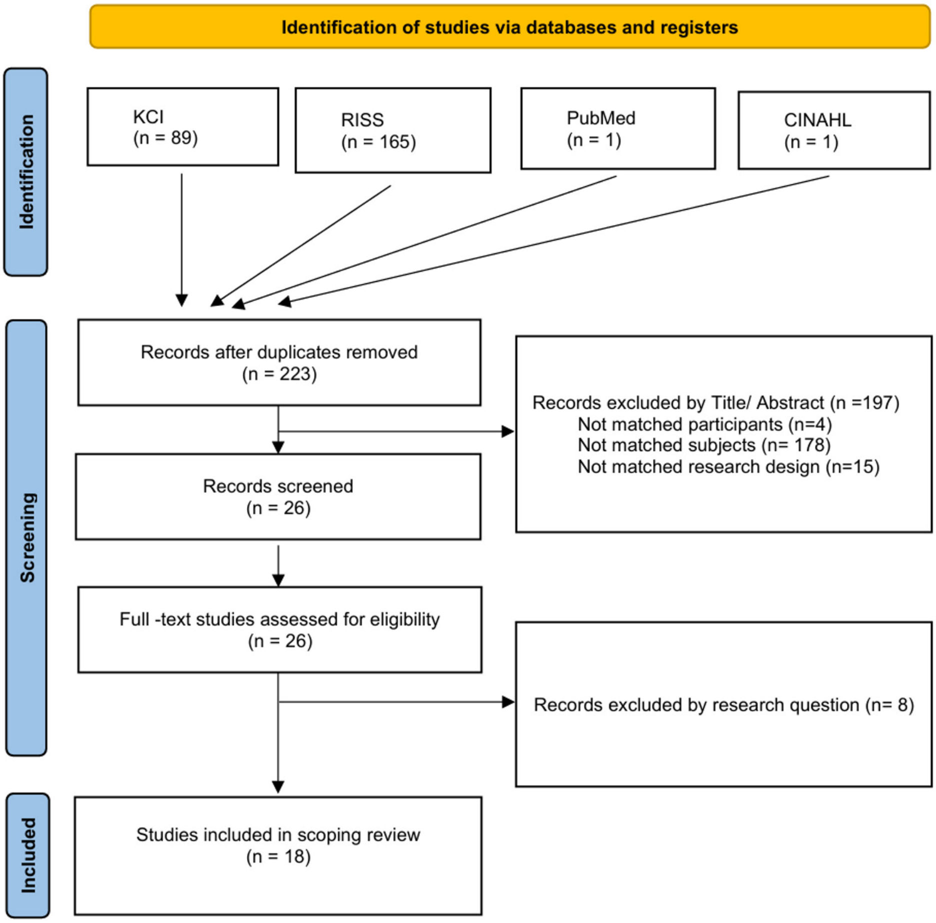

Figure 1. Flow Diagram of the Literature Selection Process. CINAHL = Cumulative Index to Nursing and Allied Health Literature; KCI = Korean Citation Index; RISS = Research Information Sharing Service.

tive characteristics such as publication year, study design, sample size, and institutional setting were summarized. Second, variables associated with clinical practice stress were identified and analyzed in terms of frequency and significance. Third, each variable was categorized as either an individual-level or environmental-level factor, enabling a structured synthesis of findings across the included studies.

To ensure validity, one researcher and a research assistant independently classified the variables according to predefined criteria. They then engaged in iterative discussions to resolve discrepancies, refining the categorization process until full consensus was reached. This collaborative approach strengthened the consistency and reliability of the classification framework. The final synthesis provided a comprehensive and contextually grounded understanding of the multidimensional factors influencing clinical practice stress in nursing students and highlighted potential areas for educational intervention.

RESULTS

1. General Characteristics of Included Studies

A total of 18 studies were included in the final analysis. The distribution of publication years was as follows: two studies were published between 2016 and 2017, one between 2018 and 2019, three between 2020 and 2021, five between 2022 and 2023, and seven between 2024 and 2025. Notably, more than half (66.7%) of the studies were published after 2021, reflecting a growing research interest in the topic in recent years (Table 1).

Regarding participants, two studies focused exclusively on third-year nursing students, four on fourth-year students, and ten included both third- and fourth-year students. One study encompassed students from all academic years, while another included both current students and recent graduates, without specifying academic level. Most studies (n = 16) employed a descriptive survey design, while one quasi-experimental study and one qualitative study were identified. Sample sizes varied considerably. One study included fewer than 50 participants, three studies had between 51 and 100, five had between 101 and 150, three had between 151 and 200, and six studies involved more than 200 participants. Comparisons between single-institution and multi-institution studies revealed important contextual differences: single-institution studies often highlighted localized factors, such as department-specific policies or unique practicum arrangements, whereas multi-institution studies captured a broader spec-

Table 1. General Characteristics of Included Studies, Participants, and Clinical Practice Environment (*N* = 18)

Variables	Categories	n (%)
Publication year	2016–2017	2 (11.1)
	2018–2019	1 (5.6)
	2020–2021	3 (16.7)
	2022–2023	5 (27.8)
	2024–2025	7 (38.9)
Participants	Third-year students	2 (11.1)
	Fourth-year students	4 (22.2)
	Third- and fourth-year students	10 (55.6)
	Others	2 (11.1)
Study design	Descriptive survey	16 (88.9)
	Quasi-experimental study	1 (5.6)
	Qualitative study	1 (5.6)
Sample size	0–50 participants	1 (5.6)
	51–100 participants	3 (16.7)
	101–150 participants	5 (27.8)
	151–200 participants	3 (16.7)
	Over 200 participants	6 (33.3)
Study setting	Single university	9 (50.0)
	Multiple universities	9 (50.0)
Clinical environment described	Yes	11 (61.1)
	No	7 (38.9)

trum of stressors arising from institutional diversity, regional healthcare resources, and inter-university differences in practicum conditions. This comparison underscores the importance of institutional context in shaping nursing students' stress experiences. Additionally, 11 studies (61.1%) explicitly described clinical practice environment characteristics such as hospital affiliation, practicum type, or setting.

2. Variables Associated with Clinical Practice Stress

Across the 18 included studies, a variety of factors were reported to influence clinical practice stress among nursing students. The most frequently investigated variable was resilience, examined in four studies. Social support and incivility were each assessed in three studies, while violence exposure, non-face-to-face clinical education, major satisfaction, and coping strategies were addressed in two studies each. Additional variables examined in individual studies included anxiety, sleep quality, teaching effectiveness, peer caring behaviors, maladaptive perfectionism, self-leadership, academic burnout, depression, pandemic-related stress, adaptation to academic departments, and confidence in core nursing skills (Table 2).

In terms of grade level, most studies (n = 14) targeted junior and senior students (3rd–4th years), who are typically exposed to more intensive clinical training. Only one study included first- and second-year students, while another included a wider range of participants, including graduate students. With respect to practicum experience, 17 of the 18 studies included participants with actual clinical experience, whereas only one focused on students without clinical exposure, investigating simulated or pre-clinical interventions instead.

Descriptions of the clinical practice environment varied. Seven studies did not explicitly specify environmental contexts, while others detailed aspects such as the number of practicum institutions, affiliated hospitals, clinical departments, or duration of clinical practice. Comparative analysis showed that multi-institutional studies tended to report greater variability in stressors due to differences in institutional culture, while single-institution studies concentrated more on localized issues, including hospital policies or departmental dynamics. Other noted contextual factors included hospital size, departmental specialization, and coronavirus disease 2019 (COVID-19)–related modifications to training. These environmental conditions func-

Table 2. Key Variables Related to Clinical Practice Stress and Their Relationships in Included Studies ($N = 18$)

No.	Author (year)	Participant year in program	Clinical practice experience	Clinical practice environment characteristics	Key variables	Relationships between variables/model explanation (%)
A1	Cho (2025)	Current & graduated students	Y	N/A	COVID-19 stress, social connectedness, resilience, coping, clinical practice stress	Clinical stress was positively associated with COVID-19 stress. Students with high COVID-19 stress were 6.65 times more likely to report clinical stress.
A2	Kim (2024)	3rd–4th	Y	N/A	Transition shock, resilience, clinical practice stress	Resilience mediated the relationship between transition shock and clinical stress (B = .655, $p < .001$; 95% CI = 0.026–0.092).
A3	Park and Yoo (2024)	3rd–4th	Y	Type, region, number of practicums	Maladaptive perfectionism, self-leadership, social support, clinical stress	Clinical stress: perfectionism (+), self-leadership and social support (–)/model explained 43% of variance.
A4	Lee and Hong (2024)	3rd–4th	Y	N/A	PMS, endocrine disruptor exposure	Clinical stress: endocrine disruptor exposure (+), social support (–), academic year (+)/model explained 18% of variance.
A5	Jeong and Park (2024)	4th	Y	N/A	Academic burnout, depression, clinical practice stress	Clinical stress: burnout (+), depression (+)/model explained 75.6% of variance.

(Continued on the next page)

Table 2. Continued

No.	Author (year)	Participant year in program	Clinical practice experience	Clinical practice environment characteristics	Key variables	Relationships between variables/model explanation (%)
A6	Yang (2024)	3rd–4th	Y	Number of institutions, educational environment	Clinical learning environment, clinical stress	Clinical stress: departmental adaptation (–).
A7	Shim (2024)	4th	Y	N/A	Online practice education, clinical stress	Clinical stress reduced by questions about substitution of in-person practice, perception of online effectiveness, and complexity of pediatric care.
A8	Kim (2023)	3rd–4th	Y	Affiliated hospital (2 universities)	Affiliated hospital, major satisfaction, housing type, clinical stress	Higher stress was observed in students without affiliated hospital due to housing and other issues.
A9	Kim et al. (2023)	3rd	Y	Type of practicum hospital	Teaching effectiveness, peer caring, clinical stress	Clinical stress: peer caring (–), teaching effectiveness (–)/model explained 21.2% of variance.
A10	Park (2023)	3rd–4th	Y	N/A	Online practicum experience, communication, clinical competence	Clinical stress not significantly associated with communication or clinical performance.
A11	Heo and Song (2023)	3rd–4th	Y	N/A	Verbal abuse, coping, major satisfaction, clinical stress	Clinical stress: major satisfaction (–), coping (+), verbal abuse (not significant).
A12	Lee (2022)	4th	Y	Practicum subject, region, institution, department	COVID-19 era, anxiety, health status, clinical stress	Clinical stress: anxiety (+), health status (–)/model explained 21.8% of variance.
A13	Kwak et al. (2021)	3rd	Y	First practicum department, region	Incivility, clinical learning environment, clinical stress	Clinical stress: incivility (+), environment (–)/ model explained 22.5% of variance.
A14	Lee et al. (2021)	3rd–4th	Y	Hospital size (tertiary, general, region)	Satisfaction, sleep duration, sleep quality, quality of life, clinical stress	Clinical stress: sleep quality, resilience (–)/model explained 50% of variance.
A15	Koong et al. (2020)	4th	Y	Difficulties in clinical practice, especially interpersonal issues	Incivility, resilience, clinical stress	Clinical stress: incivility (+), resilience (–)/model explained 41.6% of variance.
A16	Kim and Park (2018)	3rd–4th	Y	Role model: presence/ absence	Incivility, satisfaction, burnout, clinical stress	Clinical stress: incivility (+), satisfaction (–), burnout (+)/model explained 38.4% of variance.
A17	Jeong and Lee (2016)	3rd–4th	Y	Practicum duration (8–9 weeks or 10+ weeks)	Violence, resilience, emotional response, clinical stress	Clinical stress: violence (+), emotional coping (+), emotional response (+), resilience (–)/model explained 18.1% of variance.
A18	Yeom and Choi (2016)	1st, 2nd, 3rd, 4th	N	Hospital size (tertiary, general, region)	Core nursing skills training, critical thinking, self-confidence, clinical stress	Post-intervention: significant reduction in clinical stress.

(+) = positively associated with clinical stress; (–) = negatively associated with clinical stress; CI = confidence interval; COVID-19 = coronavirus disease 2019; N = clinical practice experience was absent; N/A = not available; Y = clinical practice experience was present.

tioned not only as study variables but also as important contextual factors mediating the relationship between individual characteristics and clinical stress.

Variables positively associated with clinical practice stress (i.e., risk factors) included incivility, emotion-focused coping, heightened emotional responses, transition shock, anxiety, maladaptive perfectionism, exposure to endocrine-disrupting chemicals, academic burnout, depression, and pandemic-related stress. Among these, incivility was the most consistently reported stress-inducing factor. In contrast, negatively associated variables (i.e., protective factors) included resilience, sleep quality, social support, teaching effectiveness, peer caring behavior, major satisfaction, and departmental adaptation. Resilience was the most frequently examined protective factor, identified in four studies.

Multiple regression analysis was employed in nine studies to evaluate the explanatory power of these variables. The models' explanatory power ranged from 18.0% to 75.6%, indicating substantial variability. Higher explanatory power was generally observed in multi-institution studies that incorporated both individual and environmental factors, whereas single-institution studies tended to demonstrate narrower explanatory ranges, reflecting more limited contextual variation.

3. Categorization of Environmental and Individual Factors

Across the 18 reviewed studies, a total of 41 variables were identified as influencing clinical practice stress among nursing students, comprising 22 environmental and 19 individual-level factors (Table 3). For most variables, the direction of association (positive or negative) was statistically confirmed; however, several inconsistencies were noted, as described below (Supplementary Data 1).

Among environmental factors, the most frequently reported was incivility, cited in four studies [A13,A15,A16, A17], all of which statistically confirmed its positive association with stress. Other commonly reported environmental stressors included violence [A11,A17], transition shock [A2], and difficulties related to clinical placements in non-affiliated hospitals or housing [A8]. Each of these demonstrated a statistically confirmed positive association with stress in multiple studies. New infectious diseases were identified as significant stressors in two studies

Table 3. Characteristics of Factors Related to Clinical Practice Stress (41 Factors Identified in 18 Studies) (*N*=41)

Categories	Subcategories	Main variables (study ID)
Environmental factors (n=22)	Clinical practice environment	Violence [A11,A17], incivility [A13,A15,A16], transition shock [A2]*, non-affiliated hospital and housing [A8]
	Educational environment	Core nursing skill education [A18], online practice [A7,A10], clinical learning environment [A6,A13]
	System/policy-related	Departmental adaptation [A6,A9], frequency of outside placements [A3]
	Interpersonal	Peer caring behavior [A9], senior–junior relationship improvement [A4,A6]
	Social support	Social support [A3,A4,A13], social connectedness [A1]
	Instruction/teaching quality	Academic burnout [A5], teaching effectiveness [A9]
	Emerging infection-related	COVID-19 pandemic [A1,A12]
	Other	Sleep [A14], endocrine disruptor exposure [A4]
Individual factors (n=19)	Coping and emotional regulation	Coping strategies [A1,A3,A11,A17], emotional response [A17], emotional-focused coping [A17], maladaptive perfectionism [A3]
	Self-regulation	Self-leadership [A3], self-confidence in performance [A18]
	Satisfaction and motivation	Major satisfaction [A3,A11,A16]
	Psychological state	Anxiety [A12], depression [A5], empathy [A11]
	Personality traits	Resilience [A1,A2,A4,A15,A17]
	Physical health	Health status [A12]
	Communication	Communication [A10]
	Other	Burnout [A5,A16]*

Variables marked with an asterisk (*) were identified as overlapping between environmental and individual factors across the 18 included studies.

[A1,A12], underscoring the contemporary relevance of infection-related challenges in clinical education. Additional environmental factors, such as teaching effectiveness, academic burnout, online clinical practice, and exposure to endocrine-disrupting chemicals, were mentioned less frequently but, when analyzed, generally showed a positive association with stress.

Regarding individual-level factors, resilience emerged as the most consistently identified protective factor, reported in five studies [A1,A2,A4,A15,A17], all of which statistically confirmed its negative association with stress, reinforcing its buffering effect. Coping strategies were examined in four studies [A1,A3,A11,A17]; while most confirmed a negative association with stress, suggesting an effective role in stress management, one study [A11] found that maladaptive coping styles could instead show a positive association, illustrating that the impact of coping depends on the specific strategy employed. Other individual-level factors included emotional responses [A17], self-leadership [A3], major satisfaction [A3], and psychological symptoms such as anxiety [A12] and depression [A5]. These generally aligned with theoretical expectations—for example, anxiety and depression were positively associated with stress. Less frequently mentioned variables, such as communication ability [A10] and health status [A12], were also statistically linked to stress outcomes.

Overall, the findings indicate that while environmental stressors particularly incivility and institutional characteristics are commonly documented and tend to exacerbate stress, individual traits such as resilience and adaptive coping play a critical mitigating role. Furthermore, comparisons across different periods and settings suggest that both global crises (e.g., the COVID-19 pandemic) and local institutional cultures must be considered when designing stress management interventions for nursing students. The statistical confirmation of these associations across multiple studies strengthens the empirical foundation of this review, although minor inconsistencies (such as the differential effects of coping strategies) highlight the complexity of stress-related interactions. These insights underscore the importance of multifaceted approaches that simultaneously foster individual resilience and improve the quality of the clinical learning environment.

DISCUSSION

This scoping review analyzed 18 studies conducted in South Korea over the past decade that examined clinical practice stress among nursing students. Using the scoping review methodology, the studies were reviewed in terms of general characteristics, clinical training environments, key variables, and the relationships among those variables. Furthermore, factors were categorized into environmental and individual domains to provide a more comprehensive understanding of the issue. Based on these findings, this review sought to identify key environmental contributors to clinical practice stress and propose strategies to improve the clinical training environment for nursing students.

The review showed that more than half of the selected studies (n = 12, 66.7%) were published after 2022, indicating growing scholarly attention to this topic in recent years. Nine studies were conducted within a single university, while the other nine involved multiple institutions, including some using online formats. Importantly, seven studies did not explicitly describe the characteristics of the clinical training environment. This is consistent with earlier reviews, where data were often collected across multiple institutions but without clear differentiation or analysis of environmental characteristics [13]. To address this gap, the present review systematically identified whether environmental characteristics were reported and provided in-depth analysis of their influence.

Key variables associated with clinical practice stress included resilience, social support, incivility, exposure to violence, non-face-to-face clinical education, major satisfaction, and coping strategies. Factors positively associated with stress included violence, emotion-focused coping, emotional responses, incivility, transition shock, anxiety, maladaptive perfectionism, exposure to endocrine-disrupting chemicals, academic burnout, depression, pandemic-related stress, and ineffective coping styles. Conversely, negatively associated factors included clinical learning environment quality, sleep quality, resilience, teaching effectiveness, peer caring behaviors, self-leadership, social support, departmental adaptation, and major satisfaction.

When compared with earlier reviews, notable differences emerged. Previous studies often identified major satisfaction as the most frequent protective factor [17], while stressors included empathy-related burden, burnout, and coping styles [11]. In contrast, the present review found resilience to be the most frequently reported protective factor. This shift may reflect the growing recognition of students' internal coping mechanisms and psychological resources as critical determinants of stress outcomes. The increased reporting of incivility and violence as stressors may also be linked to recent advances in student rights education and safety training initiatives promoted by the KABONE. Unlike prior reviews, which tended to classify factors as either “protective” or “risk” variables [11,13], the present review distinguished them as positively or negatively associated factors. This approach reduces interpretive ambiguity and allows for clearer analysis. Additionally, this review examined the explanatory power of multiple regression models to evaluate how well these variables predicted clinical practice stress, thereby highlighting which combinations had the strongest influence.

Environmental factors identified in this study were further categorized into seven domains: clinical practice environment, educational environment, system/policy-related factors, interpersonal relationships, social support, instructional quality, and infection-related factors. These findings are consistent with prior research indicating that clinical environmental conditions such as incivility, stress, and violence—are strongly linked to stress in nursing students [11]. While earlier studies acknowledged these stressors, their relative importance was often underemphasized. In contrast, this review placed greater emphasis on environmental components, aligning with evidence that students’ stress levels are shaped by both the quality of training conditions and the degree of institutional preparedness [10].

Prior literature has emphasized the need for structural reforms in clinical education. For example, Yang et al. [18] proposed the implementation of dedicated clinical nurse educators to improve educational quality and enhance instructor effectiveness. Similarly, other studies have reported that inadequate practicum conditions and unfamiliar clinical environments can heighten nursing students’ anxiety and stress [19]. Internationally, innovative training models such as capstone practicums and 1:1 shadowing with experienced nurses during 12-hour shifts have been implemented in the United States to promote experiential learning without traditional classroom instruction. These models suggest that collaboration with clinically competent and pedagogically trained instructors, along with alignment to learning rubrics and expected outcomes, is equally essential in the Korean context.

Environmental stressors associated with emerging infectious diseases were frequently highlighted in this review [A1,A7,A10,A12]. The recent surge in novel infectious threats has intensified both theoretical and clinical learning burdens, disrupting traditional practicum schedules and driving shifts toward online and simulation-based alternatives. For instance, pandemic-related disruptions exemplify how external public health crises can severely limit access to clinical sites while creating substantial emotional strain for students. Majrashi et al. [20] similarly observed that the disproportionate weighting of clinical practice credits in nursing curricula significantly contributes to stress. Cho [21] further argued that external factors—including new infectious threats, healthcare workforce instability, and policy changes—must be considered to ensure a safe and stable educational environment during periods of systemic disruption. Issues such as infection risk, reduced practicum availability, and excessive reliance on virtual clinical training were identified as critical challenges. These findings underscore the urgent need for flexible, infection-resilient educational models, such as simulation-based learning and scenario-driven online modules, which reflect real clinical contexts and can serve as both substitutes and complements to field training.

In March 2025, the Korean Ministry of Health and Welfare launched an initiative to support the establishment and expansion of nursing simulation centers. This initiative aims to foster simulation-based education by creating a National Nursing Simulation Consortium system [22]. Such a system has the potential to establish nationwide infrastructure for simulation-based clinical training and to build a systematic network of skilled educators. Furthermore, this project is expected to play a pivotal role in long-term educational policy and workforce development strategies, positioning simulation education not as a supplementary method but as a central clinical education strategy in response to unpredictable external factors, including emerging infectious diseases.

With regard to individual-level factors, resilience and coping strategies consistently emerged as critical variables influencing clinical practice stress [A1,A2,A15]. These findings align with prior research that has identified emotional intelligence, professional identity, and clinical competence as key attributes in stress regulation [11]. Resilience, in particular, functions as a psychological buffer that mitigates stress [23]. Therefore, educational interventions should be designed to enhance resilience and provide emotional support, including through online programs that prepare students to navigate challenging clinical environments. Some universities have already adopted non-face-to-face coaching and extracurricular support programs [24], and nursing schools are encouraged to expand such approaches. Faculty and curriculum developers should also consider embedding structured resilience training, stress management workshops, and scenario-based simulations into the core curriculum. In addition, institutional policies must address environmental stressors directly by implementing anti-incivility protocols, providing access to counseling services, and ensuring safe housing and placement arrangements for off-campus practicums. These combined strategies can address the key stress-related variables identified in this review and facilitate the translation of research findings into actionable educational and administrative reforms.

Importantly, while the RESULTS section reported that the explanatory power of multiple regression models ranged from 5.2% to 75.6%, this discussion highlights a consistent trend: models combining both individual factors (such as resilience, coping strategies, and self-leadership) and environmental factors (such as incivility, violence exposure, and inadequate practicum conditions) demonstrated higher explanatory power, often exceeding 50% [5,11,17]. In contrast, studies that examined only individual or only environmental variables yielded narrower explanatory ranges [3,8]. This pattern suggests that clinical practice stress is best explained through an integrated model that incorporates both personal psychological resources and contextual stressors [2]. Notably, resilience and coping strategies emerged as the most robust negative predictors across high-explanatory models [1,4,15], whereas incivility and transition shock were the most consistently identified positive predictors [11,16]. By articulating these statistical patterns, this review strengthens the empirical basis for designing multidimensional interventions that simultaneously address individual resilience and environmental improvements in clinical training.

During the categorization process, certain variables such as “burnout” and “transition shock” posed challenges due to conceptual overlap across domains. For instance, burnout was described in both individual and environmental contexts, reflecting its multidimensional nature, which encompasses personal psychological responses as well as systemic educational pressures. Similarly, transition shock, though largely associated with systemic placement issues, also intersects with individual-level adaptation. This ambiguity was addressed through iterative discussion and consensus-building among reviewers during the data analysis phase. By acknowledging and reflecting on these overlaps, this review enhances the conceptual rigor of its categorization process and encourages future research to develop clearer definitions and operational boundaries for commonly overlapping constructs.

In summary, the findings of this review reaffirm the importance of both environmental and individual factors in contributing to clinical practice stress among nursing students. Moving forward, research in this area is expected to expand, requiring multifaceted approaches that incorporate both internal psychological resources and external systemic influences. Future work should also investigate how these insights can be systematically integrated into nursing accreditation standards and faculty development programs to ensure sustained institutional commitment to student well-being. Given the persistent constraints in practicum environments, future studies should explore strategies to strengthen academic–clinical partnerships through structured practicum agreements, appointment of clinical instructors and preceptors, and the integration of safety and human rights training. Furthermore, logistical challenges—such as housing arrangements for off-campus practicum placements—merit further examination to ensure equitable access to high-quality clinical education.

Specifically, resilience, which consistently emerged as a factor negatively associated with clinical practice stress, could be intentionally fostered within nursing curricula by incorporating modules on stress management techniques, peer support activities, and opportunities for reflective practice. These interventions would help students strengthen psychological endurance. Coping strategies, another factor negatively associated with stress, can be further supported through scenario-based simulations and guided debriefings that enable students to explore and apply adaptive coping methods in realistic clinical situations. Conversely, to address stress-inducing factors such as incivility and exposure to violence, institutions should establish clear reporting channels, provide workshops to cultivate a respectful workplace culture, and implement systematic monitoring within practicum sites. Institutional policies could also mandate minimum standards for practicum quality, such as maintaining appropriate student-to-preceptor ratios and ensuring supportive learning environments. By aligning these curriculum enhancements and policy initiatives with the variables identified in this review, nursing programs will be better positioned to support students in managing stress and preparing for the complexities of clinical practice.

Despite the comprehensive scope of this review, several limitations should be acknowledged. First, all included studies were conducted in South Korea, which may restrict the generalizability of findings to broader international contexts. Cultural, institutional, and educational differences across countries may produce stressors or coping mechanisms not captured in this analysis. Second, although only peer-reviewed articles were included, methodological variability across studies may still have influenced the consistency of findings, despite quality appraisal using the STROBE checklist. Third, heterogeneity in study designs, measurement tools, and variable definitions posed challenges in synthesizing and comparing results, particularly when evaluating the strength of associations. Conceptual overlaps in variable categorization—such as with “burnout” and “transition shock” also highlight the need for clearer operational definitions in future research.

Considering these limitations, future studies would benefit from cross-cultural comparative analyses to examine how clinical practice stress is experienced across diverse healthcare education systems. Moreover, the development of standardized, validated instruments to measure environmental and individual stress-related variables is essential for improving consistency across studies. Longitudinal research tracking stress trajectories throughout students’ academic years would also provide a more dynamic understanding of stress development and resilience-building processes.

CONCLUSION

This scoping review synthesized evidence from 18 domestic studies conducted over the past decade to identify and categorize factors associated with clinical practice stress among nursing students. The findings demonstrate that stress is shaped not only by individual characteristics such as resilience and coping strategies but also by environmental influences, including the quality of the clinical training environment, interpersonal dynamics, perceived social support, and institutional educational conditions.

Importantly, the evolving healthcare landscape—marked by the transition to remote practicums during recent infectious disease outbreaks and compounded by systemic disruptions such as the 2024 physician strike has further complicated the clinical learning experience for nursing students. These contextual shifts underscore the need for nursing education institutions to systematically assess and adapt to barriers in the clinical training environment to reduce stress and safeguard the overall quality of nursing education.

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CONFLICTS OF INTEREST

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DATA AVAILABILITY STATEMENT

No new data were created or analyzed during this study. Data sharing is not applicable to this article.

SUPPLEMENTARY MATERIAL

Supplementary materials can be found via https://doi.org/10.7475/kjan.2025.0511.

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Theory-Based Mobile Self-Management Interventions and Behavior Change Techniques for Type 2 Diabetes Patients: A Scoping Review

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Purpose: This review aimed to analyze the use of behavior change techniques (BCTs) and the degree of theory implementation using a theory coding scheme (TCS) in mobile self-management interventions for type 2 diabetes mellitus (T2DM). **Methods:** In this scoping review, four electronic databases (PubMed, EMBASE, CINAHL, and CENTRAL) and gray literature sources were searched. Studies were independently screened according to predefined criteria. The BCT taxonomy was used to categorize techniques, and the TCS was applied to evaluate the quality of theory implementation. **Results:** Seventeen randomized controlled trials were included. Twenty-five unique BCTs were identified (mean, 8.1 per study). Commonly used BCTs included social support (unspecified) (n = 14), instructions on how to perform a behavior (n = 14), feedback on behavior (n = 11), and prompts/cues (n = 11). Techniques related to capability, such as habit formation, rewards, framing/reframing, and verbal persuasion, were rare (n = 1 study each). TCS scores ranged from 5 to 15 (mean, 10.3). All included studies cited a theory, used it to select intervention techniques, and employed randomization. However, no study used the findings to refine the theory, and only one conducted a mediational analysis of theoretical constructs. **Conclusion:** Mobile T2DM self-management interventions commonly rely on a limited range of BCTs and show restricted theoretical application beyond basic implementation. Future interventions should employ a broader array of BCTs and apply theories more rigorously, including tailoring interventions, empirically testing theoretical mechanisms, and refining theories based on results to increase their effectiveness.

Key Words: Diabetes mellitus, type 2; Health behavior; Mobile applications; Self-management

INTRODUCTION

The global prevalence and mortality of diabetes mellitus have been steadily increasing [1]. As of 2022, approximately 828 million people worldwide were living with diabetes—a nearly four-fold increase since 1990—with type 2 diabetes mellitus (T2DM) accounting for over 90% of all cases [2]. In South Korea, the prevalence of T2DM among adults aged ≥30 years increased consistently over 25 years, rising from 6.71% during 1998–2005 to 15.61% during 2020–2022 [1]. Moreover, global diabetes-related mortality among adults aged 20 to 79 years was estimated at approximately 3.4 million in 2024 [3]. In South Korea, the mortality rate for diabetes mellitus in 2023 was 21.6 per 100,000 population, ranking it as the seventh leading cause of death [4].

Elevated blood glucose levels due to diabetes substantially increase the risk of cardiovascular diseases, including peripheral vascular and coronary artery disease [5,6]. Inadequate self-management behaviors, such as poor medication adherence or inconsistent blood glucose monitoring, can result in severe complications, including blindness, myocardial infarction, stroke, and peripheral vascular disease [6]. Therefore, individuals with diabetes must engage in comprehensive self-management to effectively control their condition and prevent complications [7,8]. In this context, self-management refers to the range of daily activities that patients undertake to regulate their condition and prevent long-term complications. These activities encompass lifestyle behaviors such as maintaining a healthy diet and regular exercise, as well as essential clinical tasks like medication adherence and self-monitoring of blood glucose levels [6].

Recent advances in information and communication technology (ICT) have facilitated the development of various mobile tools—including mobile applications, text messaging, and web-based platforms—that support self-management among patients [9]. These mobile technologies assist patients by recording and visualizing data on blood glucose, medication adherence, weight, diet, and exercise, while providing real-time feedback and specific guidance based on user input [10]. Consequently, these technologies have been shown to improve glycemic control and strengthen overall self-management capabilities, yielding positive outcomes for diabetes care [10,11].

Although mobile interventions offer valuable support for diabetes self-management, their effectiveness depends on a systematic, theory-based design to promote sustained behavior change [12]. However, many existing mobile interventions only reference theoretical models superficially, demonstrating wide variation in the degree of theoretical application across studies and often lacking clear links between intervention components and theoretical constructs [13]. As the mere mention of theory does not ensure intervention effectiveness, there remains a pressing need to identify which theoretical approaches and behavior change strategies underpin effective mobile interventions [14].

To objectively assess discrepancies in theoretical application and potential limitations in behavior change strategies—and to identify effective intervention components—standardized tools are needed to evaluate theory-based interventions systematically. The behavior change technique (BCT) taxonomy is particularly useful for identifying and categorizing specific behavioral techniques applied to T2DM management in order to determine the effective elements [15]. In contrast, the theory coding scheme (TCS) evaluates the extent to which theoretical frameworks are faithfully and systematically applied during intervention design and evaluation [16]. Therefore, by using these taxonomies, it is possible to determine which BCTs are most frequently employed and how thoroughly theories are implemented in mobile interventions for patients with T2DM.

Scoping reviews can examine the available evidence within a given field, identify knowledge gaps that often precede systematic reviews, and synthesize information to provide a comprehensive overview of broad topics [17]. In particular, theory-based mobile interventions for patients with T2DM exhibit considerable heterogeneity, with wide variations in the applied theories, technologies, and intervention components. Although prior meta-analyses have investigated these interventions, their analyses of the theoretical underpinnings have been limited [10,17]. For example, some have focused on the effectiveness of BCTs while including participants with type 1 diabetes, whereas others have merely identified whether a theory was mentioned in the study without systematically assessing its quality or fidelity. In a heterogeneous field where the primary knowledge gap concerns the application of theory rather than its effectiveness, a scoping review represents the most appropriate methodological approach [18]. Therefore, while previous studies have primarily emphasized the effectiveness of mobile interventions, this review systematically evaluates the application of BCTs and the fidelity of theoretical implementation to provide guidance for more effective and practical interventions.

Accordingly, this study employed a scoping review methodology to comprehensively examine theory-based mobile self-management interventions for patients with T2DM. The primary objectives were to identify and analyze the BCTs applied within these interventions and to evaluate the degree of theoretical implementation fidelity across the included studies. This analysis aims to enhance the health outcomes of patients with T2DM by clarifying the current status of theory-based mobile interventions for diabetes self-management and by offering practical directions for future research and clinical application.

METHODS

1. Study Design

The methods used in this review were based on Arksey and O'Malley's five-step framework for scoping reviews [19]. The procedure consisted of the following stages: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the results. This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews [20]. The protocol was registered in the Open Science Framework (https://doi.org/10.17605/OSF.IO/VFD3J). Consistent with scoping review methodology, the methodological quality of the included studies was not critically appraised [19].

2. Identifying the Research Question

For scoping reviews, research questions should be broad enough to allow comprehensive exploration while remaining specific and clearly defined [17]. The research questions for this review were as follows: "What are the characteristics of theory-based mobile self-management intervention studies for patients with T2DM?", "What behavior change techniques are applied to theory-based mobile self-management interventions?", "How have these theories been implemented in studies applying theory-based mobile self-management interventions?"

3. Identifying Relevant Studies

The literature search was conducted from November 1, 2024, to November 8, 2024. To ensure a comprehensive search and capture all relevant studies regardless of publication date, no publication year restrictions were applied. Searches were performed in four electronic databases: PubMed, EMBASE, the Cumulative Index to Nursing & Allied Health Literature (CINAHL), and the Cochrane Register of Controlled Trials (CENTRAL). In PubMed, Medical Subject Headings (MeSH) were used as the controlled vocabulary, while in EMBASE, Elsevier's life science thesaurus (Emtree) was employed. The search strategy combined key terms representing "type 2 diabetes mellitus" (participants) and "mobile self-management interventions" (intervention). Keywords were adapted for each database using controlled vocabularies, Boolean operators, and truncation searches. In addition to online database searches, a manual search was conducted through Google Scholar to identify gray literature (Supplementary Data 1).

4. Study Selection

Following scoping review methodology [19] and after removing duplicate records, two authors independently screened all studies according to predefined inclusion and exclusion criteria. Any disagreements during study selection were resolved through joint review and discussion of the full texts. The inclusion criterion was a theory-based mobile self-management intervention targeting patients with T2DM. To be considered "theory-based," a study had to explicitly mention at least one theoretical framework used to guide the intervention's design or content. Studies that did not specify any theoretical foundation were excluded. Additional exclusion criteria included commentaries, case reports, and unpublished works such as conference abstracts or posters, as well as studies unrelated to the research questions. Only randomized controlled trials (RCTs) were included. RCTs were selected because, as a rigorous study design, they typically provide detailed descriptions of intervention components and their theoretical rationale—information essential for extracting high-quality data for the BCT and TCS analyses. Ultimately, 17 articles met the inclusion criteria and were analyzed (Figure 1).

5. Charting the Data

For data charting, EndNote 21 (Clarivate, Philadelphia, PA, USA) a reference management software, was used to review and organize the literature. An Excel template (ver, 2018; Microsoft, Redmond, WA, USA), developed by the researchers through discussions during research meetings, served as the standardized format for data charting. Data extraction, including the identification and classification of BCTs and TCS items, was primarily performed by one author (HM). The coding process for BCTs followed the BCT taxonomy manual, while TCS scoring adhered to the guidelines established by Michie and Prestwich [16]. To ensure consistency in the interpretation of each item and technique, detailed internal coding guidelines were developed and utilized for both BCT and TCS coding. Another author (SKH) independently reviewed and verified all extracted data and coded items, with special attention to areas requiring clarification, subjective interpretation, or potential inconsistencies. Any discrepancies or issues requiring further deliberation were resolved through iterative discussions and consensus-building during research meetings. This process involved re-examining the original

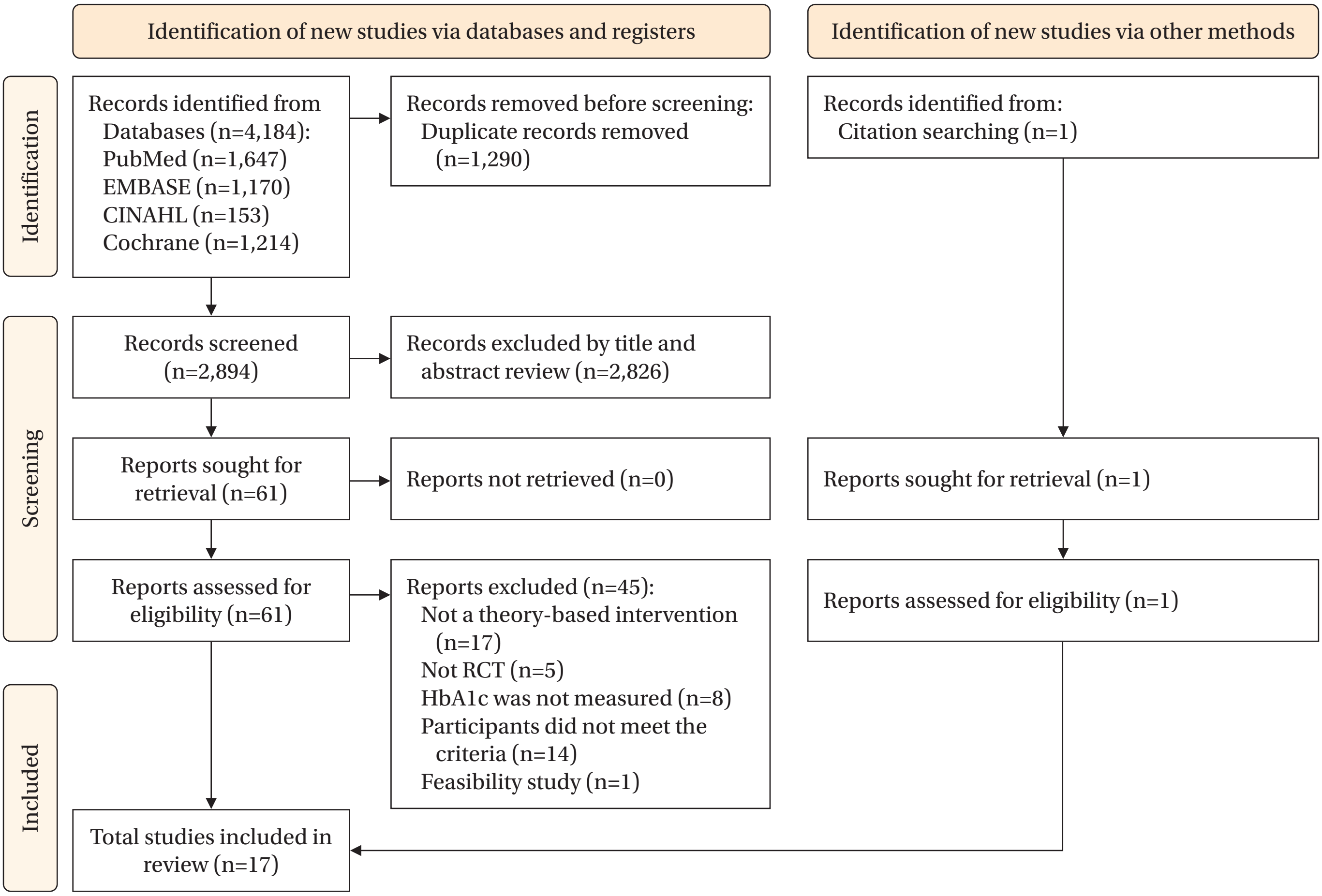

Figure 1. Flow diagram of study selection. HbA1c = hemoglobin A1c; RCT = randomized controlled trial.

study texts and re-evaluating the application of the coding guidelines until full agreement was reached between the two researchers, thereby ensuring the accuracy and reliability of the charted data.

6. Collating, Summarizing, and Reporting the Results

The extracted data were analyzed to identify the characteristics of the intervention studies, the specific BCTs employed, their frequency, and the extent of theoretical implementation.

The data extraction form for analyzing study characteristics included the following variables: authors, publication year, country, number of participants, theoretical framework, intervention characteristics (delivery methods, content, duration, and frequency), and primary study outcomes.

For the identification and coding of behavior change techniques, the BCT taxonomy [15] was applied. BCTs are specific strategies designed to facilitate behavior change and are classified into 16 categories encompassing 93 distinct techniques. Each specific BCT and its frequency of application within the selected interventions were analyzed to determine overall trends and utilization patterns.

To systematically analyze the extent of theory implementation and the characteristics of each theoretical category across the intervention studies, the TCS developed by Michie and Prestwich [16] was used. The TCS is a 19-item tool that systematically evaluates how explicitly a theory is employed, how intervention components are linked to theoretical constructs, and how the theory is integrated into the design and evaluation processes. The TCS items are grouped into six categories: (1) reference to underpinning theory (items 1, 2, 3); (2) targeting of relevant theoretical constructs (items 2, 5, 7–11); (3) using theory to select recipients or tailor interventions (items 4, 6); (4) measurement of constructs (items 12, 13); (5) testing of mediation effects (items 12–18); and (6) refining theory (item 19). Each item was rated as “yes” (1 point), “no” (0 points), or “do not know” (0 points). To ensure the reliability of TCS coding, the primary researcher (HM) conducted the initial scoring for all included studies, after which a second researcher (SKH) independently verified all coded items against the original articles. Any discrepancies identified during this verification process were resolved through consensus-based discussion between the two researchers. The final TCS scores used for analysis reflected this consensus, ensuring consistent and reliable evaluation of theory application.

RESULTS

1. Characteristics of the Included Studies

The general characteristics of the 17 theory-based mobile self-management intervention studies for patients with T2DM included in this review are summarized in Supplementary Data 2, with specific details presented in Table 1. The full list of the reviewed articles is provided in Supplementary Data 3. Regarding publication year, nine studies [A1-9] were published after 2020, six [A10-15] between 2015 and 2019, and two [A16,A17] before 2015. The studies were conducted in various countries, with South Korea contributing three [A3,A4,A10]; the United States [A11,A17], China [A2,A13], and Malaysia [A6,A14] contributing two each. The number of participants per study varied: fewer than 100 in seven studies [A2,A4,A6,A9,A10, A15,A16]; between 100 and 199 in six [A1,A3,A8,A11,A13, A14]; and 200 or more in four [A5,A7,A12,A17]. The most frequently employed theoretical frameworks were the transtheoretical model (TTM) [A1,A11,A13,A14] and the information-motivation-behavioral skills (IMB) model [A3,A9,A10,A16], each applied in four studies. These were followed by the health belief model (HBM) [A11,A15], social cognitive theory [A8,A17], theory of planned behavior (TPB) [A13,A15], and individual and family self-management theory [A2,A6], each used in two studies (11.8%). Two studies employed multiple theoretical frameworks: Benson et al. [A11] combined the HBM with the TTM, while Kleinman et al. [A15] integrated the HBM, TPB, health action process approach, and self-efficacy theory. Regarding delivery methods, mobile applications were most commonly used (10 studies) [A3-6,A8,A10,A12,A13,A15,A16], followed by telephone counseling (6 studies) [A1-3,A9-11]. The most frequent intervention components included information provision for diabetes self-management education (13 studies) [A1-9,A11-14], self-monitoring of health behaviors (10 studies) [A1,A3-6,A8,A10,A13,A15,A16], individualized feedback on behavioral changes (9 studies) [A1-4,A8-

Table 1. Descriptive Summary of Included Studies

Author (year), country	Participants	Theoretical basis	Intervention			Comparison	Outcomes		
			Platform	Content	Duration (frequency)		Clinical indicators	Self-management indicator	Psychosocial indicator
Dunker et al. (2024), Germany [A1]	I: 86, C: 65	TTM	Phone call	Self-management education Self-monitoring and recording Feedback Motivational interviewing	48 weeks (1–12 weeks: once/month, 13–48 weeks: once/3 months)	Usual care	HbA1c*	Self-care activity*	Self-efficacy* Quality of life
Hu et al. (2024), China [A2]	I: 11, C: 12	IFSMT	Video, phone call	Self-management education Feedback via phone call Sharing the goals with families/friends participants	12 weeks (video content: twice/week, phone call: biweekly)	Usual care	HbA1c BW	Self-care activity Dietary intake - Fruits - Vegetable - Refined grains - Whole wheat - Sugary drinks - Starchy PA (MET)	Self-efficacy Social support Distress

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Table 1. Continued

Author (year), country	Participants	Theoretical basis	Intervention			Comparison	Outcomes		
			Platform	Content	Duration (frequency)		Clinical indicators	Self-management indicator	Psychosocial indicator
Park et al. (2024), South Korea [A3]	I: 53, C: 52	IMB	App, phone call	Self-management education Self-monitoring and recording Reminders Feedback via phone call	12 weeks (app: daily, phone call: biweekly)	Usual care	HbA1c*	Self-care activity	Self-efficacy Quality of life
Park et al. (2024), South Korea [A4]	I: 19, C: 13	Self-regulation theory	App	Self-management education Goal setting Self-monitoring and recording Feedback Communication via automated messages Incentives	12 weeks (daily)	Usual care	HbA1c* BG LDL-cholesterol	Self-care activity - General diet - Specific diet - Exercise - Foot care - Smoking PA (MET) Dietary intake - Grains* - Protein foods - Vegetables - Fruits - Dairy BG testing*	Self-efficacy Quality of life Depression
Zhang et al. (2024), China [A5]	I: 947, C: 925	BCW	App	Self-management education Goal setting Self-monitoring and recording Reminders Incentives	96 weeks (daily)	Usual care	HbA1c* BP BG* BMI Lipid profiles Hypoglycemia Diabetic complications	Self-care activity	Quality of life
Firdaus et al. (2023), Malaysia [A6]	I: 29, C: 29	IFSMT	App	Face-to-face session: app usage and self-management Self-management and foot care education Self-monitoring and recording Reminders Communication via chat	5 weeks (daily)	Usual care	BG Diabetic complications*	Dietary behavior* Foot care behavior*	

(Continued on the next page)

Table 1. Continued

Author (year), country	Participants	Theoretical basis	Intervention			Comparison	Outcomes		
			Platform	Content	Duration (frequency)		Clinical indicators	Self-management indicator	Psychosocial indicator
Waller et al. (2023), Australia [A7]	I: 176, C: 172	COM-B	SMS	Self-management education Unidirectional, semi-personalized text messages	24 weeks (1–12 weeks: daily, 13–24 weeks: 4 times/week)	Usual care	HbA1c		Quality-adjusted life years
Jiang et al. (2022), Singapore [A8]	I: 58, C: 56	SCT	App	Self-management education Self-monitoring and recording Feedback	24 weeks (daily)	Usual care	HbA1c*	Self-care activity - BG testing* - General diet - Specific diet - Physical exercise - Foot care - Smoking	Self-efficacy Quality of life
Sayin Kasar et al. (2022), Turkey [A9]	I: 31, C: 32	IMB	SMS, phone call	Face-to-face session: app usage and self-management Self-management education Reminders Feedback via phone call	12 weeks (SMS: daily, phone call: biweekly)	Usual care	HbA1c* BP (SBP*, DBP) BW*	Self-care activity*	Self-efficacy* Self-management perceptions*
Kim et al. (2019), South Korea [A10]	I: 32, C: 36	IMB	App, phone call	Face-to-face session: app usage and self-management Goal setting Self-monitoring and recording Feedback via phone call Communication via chat	8 weeks (app: daily, phone calls: weekly)	Usual care	HbA1c* BG* BMI	Self-care activity* Dietary intake - Total calorie intake* - Carbohydrate intake* - Fat intake* - Protein intake PA (steps/day)	Self-efficacy Diabetes knowledge* Diabetes attitude Social support*

(Continued on the next page)

Table 1. Continued

Author (year), country	Participants	Theoretical basis	Intervention			Comparison	Outcomes		
			Platform	Content	Duration (frequency)		Clinical indicators	Self-management indicator	Psychosocial indicator
Benson et al. (2019), USA [A11]	I: 60, C: 58	HBM, TTM	Phone call	Goal setting Self-management education Medication management Motivational interviewing	48 weeks (once/ month)	Usual care	HbA1c BP BMI LDL-cholesterol Medication use - Statin and aspirin	PA (min/day) Tobacco use Dietary intake - Breakfast - Fruits* - Vegetables - Whole grains Medication adherence - Diabetes* - Cholesterol - Blood pressure	
Boel et al. (2019), Netherlands [A12]	I: 115, C: 115	FBM	App	Self-management education Reminders Unidirectional messages: specific goals, healthy lifestyle information and challenges, or questions	24 weeks (2–6 times/week)	Usual care	HbA1c BP BMI Lipid profile Hypoglycemia/ glycemic variability	Self-care activity Dietary intake PA (MET)	Quality of life Health status
Chao et al. (2019), Taiwan and China [A13]	I: 62, C: 59	TTM	App	Individualized self-management education Self-monitoring and recording	72 weeks (daily)	Usual care	HbA1c* BP BMI BW*	Self-care activity - Dietary* - Exercise - Medicine taking - Monitoring - Health coping	Diabetes knowledge*
Ramadas et al. (2018), Malaysia [A14]	I: 66, C: 62	TTM	Web portal	Personalized dietary education Reminders Communication via chat	48 weeks (biweekly)	Usual care	HbA1c BG	Dietary behavior*: dietary stages of change	Dietary knowledge* Dietary attitude*
Kleinman et al. (2017), India [A15]	I: 44, C: 46	HBM, TPB, self-efficacy	App	Self-monitoring and recording Reminders Algorithmic message Communication via chat	24 weeks (daily)	Usual care	HbA1c* BP BG BMI Lipids profile WC	Self-care activity* BG testing* Medication adherence*	Self-efficacy Distress

(Continued on the next page)

Table 1. Continued

Author (year), country	Participants	Theoretical basis	Intervention			Comparison	Outcomes		
			Platform	Content	Duration (frequency)		Clinical indicators	Self-management indicator	Psychosocial indicator
Orsama et al. (2013), Finland [A16]	I: 24, C: 24	IMB	App	Self-monitoring and recording Algorithm-based feedback	40 weeks (daily)	Usual care	HbA1c* BP BW*		
Trief et al. (2013), USA [A17]	I: 844, C: 821	SCT	Video call	Goal setting Feedback via phone call	240 weeks (once/4-6 weeks)	Usual care	HbA1c	Self-care activity	

App=application; BCW=behavior change wheel; BG=blood glucose; BMI=body mass index; BP=blood pressure; BW=body weight; C=control group; COM-B=capability-opportunity-motivation-behavior; DBP=diastolic blood pressure; FBM=Fogg behavior model; HbA1c=hemoglobin A1c; HBM=health belief model; I=intervention group; IFSMT=individual and family self-management theory; IMB=information-motivation-behavioral skills model; LDL=low-density-lipoprotein; MET=metabolic equivalent of task; PA=physical activity; SBP=systolic blood pressure; SCT=social cognitive theory; SMS=short messaging service; TPB=theory of planned behavior; TTM=transtheoretical model; WC=waist circumference; *Significant difference between groups ($p<.05$).

10,A16,A17], and behavioral reminders (7 studies) [A3,A5,A6,A9,A12,A14,A15]. Intervention durations ranged from 5 weeks to 5 years: two studies [A6,A10] lasted less than 3 months; four [A2-4,A9] lasted 3–6 months; five [A7,A8,A12,A15,A16] lasted 6–12 months; and six [A1,A5,A11,A13,A14,A17] lasted 12 months or longer. The main clinical indicator assessed was hemoglobin A1c (HbA1c), measured in 16 studies [A1-5,A7-17]. Key self-management indicators included self-care activities such as diet, exercise, medication adherence, and blood glucose monitoring, evaluated in 12 studies [A1-5,A8-10,A12,A13,A15,A17]. For psychosocial indicators, self-efficacy was the most frequently assessed variable, appearing in eight studies [A1-4,A8-10,A15].

2. BCTs Applied in Interventions

The frequency and types of BCTs applied in the theory-based mobile self-management interventions are summarized in Table 2. Across the 17 studies, a total of 25 distinct BCTs were identified, with each study employing between five and 13 techniques (mean=8.1 per study). The most frequently applied BCTs were social support (unspecified) (3.1) [A1-10,A13,A15-17] and instruction on how to perform the behavior (4.1) [A2-14,A17], each used in 14 studies. These were followed by feedback on behavior (2.2) [A1,A3-5,A8-10,A13-16] and prompts/cues (7.1) [A3-7,A10,A11,A13-16], both used in 11 studies, and goal setting (behavior) (1.1) [A1,A2,A4,A5,A9,A12-14,A16,A17], used in 10. Conversely, the least frequently used techniques were habit formation (8.3) [A5], material reward (behavior) (10.2) [A7], non-specific reward (10.3) [A4], framing/reframing (13.2) [A12], and verbal persuasion about capability (15.1) [A1], each applied in only one study.

3. Assessment of Theory Implementation

The results of the TCS evaluation are presented in Table 3 and Figure 2. Across the 19 TCS items, total scores ranged from 5 to 15, with a mean score of 10.3. One study achieved a score ≥15, eight studies scored between 10–14, and the remaining eight scored ≤9. Among individual items, “theory of behavior mentioned,” “theory used to select intervention techniques,” and “randomization of participants to condition” were satisfied in all 17 studies. In contrast, “targeted construct mentioned as predictor of behavior” [A1-5,A9-17], “theory-relevant constructs are measured” [A1-

Table 2. Behavior Change Techniques Taxonomy

BCT group	BCT label	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	No. of studies
1. Goals and planning	1.1. Goal setting (behavior)	√	√		√	√				√			√	√	√		√	√	10
	1.2. Problem solving									√	√			√	√			√	5
	1.4. Action planning				√	√	√			√	√			√	√			√	8
	1.5. Review behavior goals		√		√		√				√								4
2. Feedback and monitoring	2.1. Monitoring of behavior by others without feedback		√				√	√											3
	2.2. Feedback on behavior	√		√	√	√			√	√	√			√	√	√	√		11
	2.3. Self-monitoring of behavior	√		√	√	√	√		√				√	√			√		9
	2.4. Self-monitoring of outcomes of behavior	√		√	√				√				√	√		√	√	√	9
	2.7. Feedback on outcomes of behavior					√			√					√			√	√	5
3. Social support	3.1. Social support (unspecified)	√	√	√	√	√	√	√	√	√	√			√		√	√	√	14
	3.2. Social support (practical)		√			√	√							√					4
4. Shaping of knowledge	4.1. Instruction on how to perform the behavior		√	√	√	√	√	√	√	√	√	√	√	√	√			√	14
5. Natural consequences	5.1. Information about health consequences							√				√	√				√		4
7. Associations	7.1. Prompts/cues			√	√	√	√	√			√	√		√	√	√	√		11
8. Repetition & substitution	8.1. Behavioral practice/rehearsal										√			√					2
	8.3. Habit formation									√									1
	8.7. Graded tasks				√										√			√	3
9. Comparison of outcomes	9.1. Credible source									√		√	√		√				4
10. Reward and threat	10.2. Material reward (behavior)					√													1
	10.3. Non-specific reward				√														1
	10.4. Social reward									√								√	2
12. Antecedents	12.2. Restructuring the social environment		√			√													2
	12.5. Adding objects to the environment	√		√	√		√	√				√		√		√	√		9
13. Identity	13.2. Framing/reframing												√						1
15. Self-belief	15.1. Verbal persuasion about capability	√																	1
No. of BCTs used in each study		7	7	7	12	11	9	6	6	9	8	5	7	13	8	5	9	9	

BCT = behavior change technique.

Table 3. Theory Coding Scheme

Items of theory coding scheme	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	n (%)
1. Theory of behavior mentioned	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	17 (100.0)
2. Targeted construct mentioned as predictor of behavior	+	+	+	+	+	–	–	–	+	+	+	+	+	+	+	+	+	14 (82.4)
3. Intervention based on single theory	+	–	–	+	–	–	+	+	–	+	–	+	+	+	–	+	+	10 (58.8)
4. Theory used to select recipients for the intervention	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	1 (5.9)
5. Theory used to select intervention techniques	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	17 (100.0)
6. Theory used to tailor intervention techniques to recipients	+	–	–	+	+	–	–	–	+	–	+	+	–	+	+	–	+	9 (52.9)
7. All intervention techniques are explicitly linked to at least one theory-relevant construct	–	–	+	+	–	–	–	–	–	+	–	+	+	–	–	+	–	6 (35.3)
8. At least one, but not all, of the intervention techniques are explicitly linked to at least one theory-relevant construct	+	–	–	–	–	–	+	–	+	–	+	–	–	+	+	–	+	7 (41.2)
9. Group of techniques are linked to a group of constructs	+	+	+	+	–	+	–	–	–	+	–	+	+	+	–	–	–	9 (52.9)
10. All theory-relevant constructs are explicitly linked to at least one intervention technique	–	–	+	+	–	–	–	–	–	+	–	–	+	–	–	–	–	4 (23.5)
11. At least one, but not all, of the theory-relevant constructs are explicitly linked to at least one intervention technique	+	–	–	–	–	+	–	+	+	–	+	+	–	+	+	+	+	10 (58.8)
12. Theory-relevant constructs are measured	+	+	+	+	–	+	–	+	+	+	+	+	+	+	+	–	+	14 (82.4)
13. Quality of measures	+	+	+	+	–	+	–	+	+	+	+	+	+	+	+	–	+	14 (82.4)
14. Randomization of participants to condition	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	17 (100.0)
15. Changes in measured theory-relevant constructs	+	–	–	+	–	+	–	–	+	+	–	+	+	+	+	–	+	10 (58.8)
16. Mediational analysis of constructs	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	1 (5.9)
17. Results discussed in relation to theory	+	+	–	–	–	+	–	+	–	+	–	+	+	+	–	+	–	9 (52.9)
18. Appropriate support for theory	+	–	–	–	–	–	–	–	–	+	–	+	+	+	–	+	–	6 (35.3)
19. Results used to refine theory	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0 (0.0)
No. of theory coding scheme used in each study	14	8	9	12	5	9	5	8	10	14	9	13	13	15	10	9	12	

+ = yes; – = no.

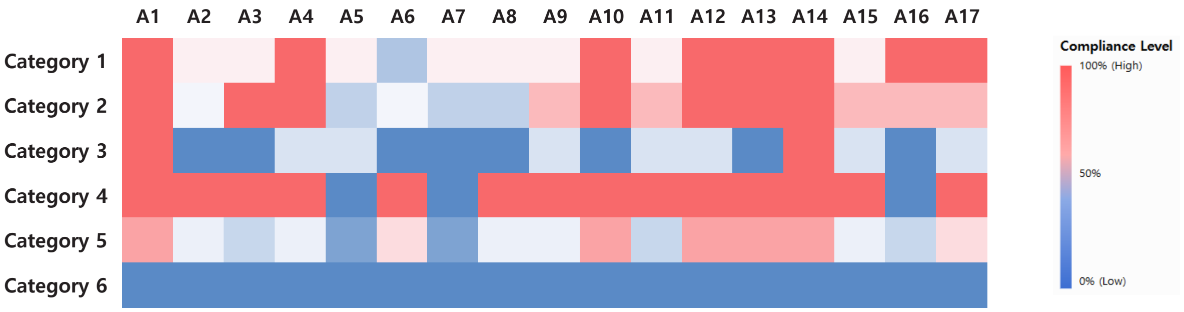

Figure 2. Heat map of theory implementation levels based on the six categories of the theory coding scheme. Category 1 = reference to underpinning theory; Category 2 = targeting of relevant theoretical constructs; Category 3 = using theory to select recipients or tailor interventions; Category 4 = measurement of constructs; Category 5 = testing of mediation effect; Category 6 = refining theory.

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4,A6,A8-15,A17], and “quality of measures” [A1-4,A6,A8-15,A17] were fulfilled in 14 studies. However, “results used to refine theory” and “mediational analysis of constructs” were satisfied in zero and one study [A17], respectively, indicating poor adherence to these advanced theoretical applications.

Analysis of the six main categories of the TCS revealed consistent patterns across the included studies. Category 1, which evaluated whether a theory was explicitly mentioned, showed generally high levels of application across all 17 studies. Studies A1, A4, A10, A12–14, A16, and A17 demonstrated particularly strong theoretical utilization, with scores exceeding 80%, whereas study A6 showed limited use with a score below 40%. Category 2, which assessed the linkage between intervention techniques and theoretical constructs, also demonstrated high connectivity in studies A1, A3, A4, and A9–17, all scoring above 80%, while studies A5–A8 scored below 40%, indicating weaker connections. Category 3, which examined the use of theory to guide participant selection and intervention tailoring, exhibited high application only in studies A1 and A14, both with 100% scores, while most other studies applied theory minimally in this respect. Category 4, which assessed the measurement of theoretical constructs and the quality of measurement tools, showed the highest overall level of theory application, with most studies achieving perfect scores; however, studies A5, A7, and A16 received 0%, reflecting inadequate construct measurement. In Category 5, which evaluated theoretical verification of intervention effects, studies A1, A10, and A12–A14 displayed strong verification with scores above 80%, whereas many others showed moderate verification at 40% to 60%, and studies A5 and A7 scored below 40%, indicating weak verification. Finally, Category 6, which assessed whether research findings were used to refine or further develop theory, revealed no evidence of theoretical advancement in any of the included studies.

DISCUSSION

This study analyzed the BCTs used in theory-based mobile self-management interventions for patients T2DM and evaluated the degree of theoretical implementation using a scoping review methodology. Based on these findings, the following discussion addresses the characteristics of the interventions, the application of BCTs, and the extent of theoretical implementation.

Among the 17 studies analyzed, 9 (52.9%) were published after 2020, reflecting the growing research interest in this field and its expansion driven by the rapid development of ICT and increasing evidence for the effectiveness of mobile interventions [9]. The most frequently applied theoretical frameworks were the TTM and the IMB model, each used in four studies (23.5%), consistent with previous findings showing that TTM is the most commonly adopted framework in mobile-based diabetes self-management interventions [21]. TTM enhances self-management effectiveness by offering stage-matched, tailored interventions and relapse-prevention strategies. When integrated with mobile technologies that enable real-time data collection and analysis, TTM facilitates interventions optimized to the participant’s stage of behavioral change [21]. Likewise, the IMB model structures and applies three core components—information, motivation, and behavioral skills—in a systematic manner. Mobile interventions based on the IMB model have demonstrated lower dropout rates compared to traditional face-to-face programs and have proven highly effective in promoting sustained self-management behaviors [22]. Both theoretical frameworks thus demonstrate strong conceptual and empirical foundations, and their high utilization in this review aligns with previous evidence of their effectiveness in enhancing mobile intervention outcomes.

Mobile applications were the predominant mode of intervention delivery, employed in 10 studies, valued for their practicality, accessibility, and sustainability, enabling self-management without temporal or spatial constraints [10]. The most frequently implemented intervention components included information provision related to diabetes self-management education (13 studies), self-monitoring (10 studies), and personalized feedback (9 studies). Systematic reviews of face-to-face self-management education programs for patients with T2DM have primarily focused on core educational elements such as exercise, nutrition, medication adherence, blood glucose monitoring, smoking cessation, cardiovascular risk reduction, and diabetes complication prevention [23]. While mobile interventions share similar educational foundations, they additionally leverage technological advantages, overcoming spatiotemporal barriers through real-time data collection and personalized feedback delivery [24]. Through these capabilities, mobile interventions have consistently been shown to improve glycemic control, self-management behaviors, and self-efficacy [25]. These findings suggest that reductions in HbA1c achieved through mobile interventions are not only clinically meaningful in preventing long-term complications but also indicate their potential as practical strategies in nursing practice to enhance patients' self-directed management and sustain healthy behaviors.

Across the 17 studies, 25 distinct BCTs were identified, with an average of 8.1 per study. The most frequently used techniques were social support (unspecified) and instruction on how to perform the behavior, mirroring patterns observed in prior analyses of interventions targeting patients with obstructive sleep apnea [26]. These findings underscore the central role of knowledge provision and social support in driving behavior change. Cognitive support through education [27] and emotional and practical reinforcement through social support [28] are both essential and complementary components of behavioral change. However, the exposure technique, which was frequently employed in Cho and Hwang's study [26], was rarely used here, likely reflecting differences in target behaviors and disease-specific challenges. Whereas exposure techniques may address procedural anxiety in treatments such as continuous positive airway pressure therapy, the interventions analyzed in this review primarily focused on long-term lifestyle modification. Additionally, habit formation, material reward (behavior), non-specific reward, framing/reframing, and verbal persuasion about capability were each identified in only one study, indicating low utilization. This limited use may reflect practical constraints such as short study durations and challenges in implementing highly personalized approaches, leading researchers to prioritize techniques with more immediate outcomes. Nevertheless, these BCTs are crucial for fostering long-term adherence through reinforcement, intrinsic motivation, and positive cognitive restructuring during early behavior change stages [15]. Future intervention research should address these practical barriers and incorporate such techniques more effectively to promote sustained behavior change.

Although this review did not directly assess the relationship between specific BCTs and intervention effectiveness, prior evidence suggests that interventions employing a greater variety of BCTs tend to achieve stronger outcomes [29]. By explicitly targeting the determinants of key health behaviors, BCTs help patients achieve and maintain desired outcomes in daily life [30]. Therefore, applying a more integrated set of BCTs is essential for developing effective theory-based mobile self-management interventions.

Analysis using the TCS revealed theory implementation scores ranging from 5 to 15 (mean = 10.3), indicating substantial variability among studies. This distribution is comparable to that reported by Timlin et al. [31] (range = 7–16, mean = 11.2), suggesting that while theoretical frameworks are often cited, their comprehensive and systematic application remains limited. Although most studies demonstrated basic theoretical integration and methodological rigor, none advanced to the critical step of using empirical results to refine theory—a notable deficiency in iterative theory development. Consistent with observations by Patton et al. [14], who highlighted unclear rationales and insufficient theoretical depth in many intervention studies, our findings indicate that while theoretical frameworks are frequently acknowledged, empirical testing and theory refinement remain underdeveloped.

Analysis by TCS category revealed high implementation fidelity for mentioning theory (Category 1) and measuring constructs (Category 4), and generally high fidelity for establishing relevance between constructs and intervention techniques (Category 2). In contrast, adherence was very low for using theory to select recipients or tailor interventions (Category 3) and for refining theory based on results (Category 6), while testing mediation effects (Category 5) showed high implementation in only a few studies [A1,A10, A12-14] and moderate to low implementation in the remaining studies. These findings—particularly the low adherence to tailoring and refinement—closely mirror those reported by Timlin et al. [31]. Thus, while the studies demonstrated reasonable fidelity in the initial application of theory (e.g., specifying theoretical frameworks, linking them to intervention elements, and measuring relevant constructs), a critical limitation was evident in the later stages of theoretical application. Based on the TCS analysis, most researchers focused primarily on the early phases of theoretical implementation but did not extend their efforts to dynamic, iterative applications involving empirical validation, participant-specific tailoring, or theory refinement based on findings. This gap underscores the disconnection between empirical outcomes and theoretical advancement. To bridge this divide, future research must move beyond mere theoretical application and actively incorporate rigorous testing and iterative model refinement based on empirical evidence. Such integration is essential for advancing nursing science and improving the practical effectiveness and clinical relevance of digital interventions, ultimately contributing to higher research quality.

This study has several limitations that indicate specific directions for future research. First, its exclusive focus on RCTs may limit generalizability to real-world settings. Although RCTs demonstrate efficacy under controlled conditions, they often fail to reflect the complexity of clinical environments, where patients with chronic conditions face multiple, interacting challenges. Therefore, future studies should adopt more diverse research designs, such as pragmatic trials or mixed-methods approaches, to better capture the practical effectiveness of mobile interventions. Second, this study did not examine which specific intervention components—such as particular BCTs or levels of theoretical implementation—are most effective. Accordingly, further quantitative research, including meta-analyses and meta-regressions, is needed to determine which elements most strongly predict successful outcomes. Despite these limitations, this study makes meaningful contributions. Academically, it provides a comprehensive overview of the current state of theory-based mobile interventions and offers empirical insights through systematic classification using BCT and TCS frameworks. Clinically, the findings deliver practical guidance for strategically applying specific BCTs and tailoring interventions according to theoretical models. Building on these results, future research should focus on standardizing design and evaluation guidelines that promote the integration of diverse BCTs and the deeper, theory-informed customization of interventions. Such efforts will enhance the quality of mobile self-management programs, improve patient engagement, and ultimately reduce diabetes-related complications.

CONCLUSION

This scoping review identified the major characteristics and emerging trends of theory-based mobile self-management interventions for patients with T2DM. The TTM and the IMB model were the most frequently used theoretical foundations. Core intervention components commonly included information provision, diabetes self-management education, self-monitoring, and feedback. HbA1c and self-management behaviors were the primary outcome measures across studies. Regarding BCT utilization, social support (unspecified), instruction on how to perform the behavior, feedback on behavior, and prompts/cues were the most frequently applied techniques, while those specifically targeting motivation and habit formation were used far less often. Considerable variation was also observed in the degree of theory implementation. Although the foundational application of theory—such as specifying frameworks and using them to guide intervention development—was relatively well executed, the deeper application involving empirical testing or theoretical advancement was notably lacking.

Based on these findings, several recommendations are proposed. Future theory-based mobile interventions should adopt a more comprehensive and integrative use of BCTs, with greater emphasis on strategies that foster long-term behavior change, such as habit formation and motivational enhancement. Research should also systematically examine the relationships between specific BCTs and intervention effectiveness, as well as between theoretical fidelity and health outcomes. Finally, rather than merely referencing theoretical frameworks, future studies should employ diverse research designs that empirically test, validate, and refine these theories.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Conceptualization and methodology - HM and SKH; validation - SKH; formal analysis - HM and SKH; investigation and data curation - HM; drafting or critical revision of the manuscript for important intellectual content - HM and SKH; visualization - HM and SKH; and supervision - SKH.

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DATA AVAILABILITY STATEMENT

The data can be obtained from the Supplementary Material.

SUPPLEMENTARY MATERIAL

Supplementary materials can be found via https://doi.org/10.7475/kjan.2025.0530.

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The Effects of Game-Based Virtual Reality in Nursing Education: A Scoping Review

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Purpose: This scoping review aimed to explore the characteristics and educational effects of game-based virtual reality (VR) programs used in nursing education, providing foundational insights for future instructional design and research. **Methods:** Following the Joanna Briggs Institute guidelines and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist, a comprehensive literature search was conducted across eight databases for studies published between April 2014 and March 2025. Studies were screened and selected using the population, concept, context framework. Twenty-four studies met the inclusion criteria and were analyzed. **Results:** Most of the 24 included studies targeted nursing students, with some involving practicing nurses. Interventions primarily employed immersive VR head-mounted displays and incorporated diverse game elements such as mission-based scenarios, challenges, feedback loops, and virtual patient interactions. Educational effects were categorized into cognitive, affective, and psychomotor domains. Improvements in knowledge acquisition, self-efficacy, learning motivation, and skill performance were consistently reported. Additionally, most studies reported enhanced learner satisfaction, engagement, and emotional immersion. However, limited evidence was found regarding teamwork and communication skills. **Conclusion:** Game-based VR programs show substantial potential as effective instructional strategies in nursing education. Their design features—including immediate feedback, repeatable immersive scenarios, and engaging game mechanics—support learner-centered and self-directed learning. Nevertheless, the current evidence base largely focuses on nursing students and short-term outcomes. Future studies should encompass diverse nursing populations and assess long-term effects and real-world applicability, particularly in team-based and clinical practice contexts.

Key Words: Education, nursing; Educational technology; Simulation training; Virtual reality

INTRODUCTION

With global changes in the healthcare environment, including population aging and the increasing prevalence of communicable and noncommunicable diseases, healthcare systems increasingly demand nursing personnel with advanced expertise [1]. The World Health Organization [2] identifies nurses as a central component in achieving universal health coverage, emphasizing the critical role of nursing education. In this context, nursing education is evolving beyond the simple transmission of knowledge to provide integrated learning experiences that foster the skills and critical thinking required in complex clinical environments [3]. This underscores the need for instructional

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designs that strengthen learners' confidence and clinical competence [4], and highlights the importance of dynamic interactions among educators, learners, and institutional support systems in determining educational effectiveness [5]. As the complexity and expectations of clinical practice continue to expand, innovative teaching and learning strategies are being actively pursued in nursing education. For instance, the widespread suspension of face-to-face classes and clinical practicums during the coronavirus disease 2019 (COVID-19) pandemic [6] accelerated the exploration of alternative approaches that can maximize learning outcomes even in remote or hybrid settings.

In particular, virtual reality (VR) technology, by offering immersion, realism, and real-time interaction with the learning environment [7], has gained recognition as a promising educational tool for enhancing the clinical competence of nursing students and practicing nurses [8]. VR-based learning allows learners to safely experience diverse clinical scenarios that closely replicate real-world conditions [9], and has been reported to positively affect knowledge, skill performance, critical thinking, self-efficacy, and learner satisfaction [10,11]. The opportunity to repeatedly practice complex and varied clinical situations helps reduce fear of failure and fosters learner confidence [12].

Recently, game-based learning (GBL) and gamification—approaches that incorporate game design elements into instructional strategies—have received increasing attention as innovative methods to improve the effectiveness of nursing education. Gamification techniques that include elements such as points, leaderboards, and rewards [13,14] can stimulate engagement and sustain learner participation, ultimately maximizing educational outcomes. These approaches have demonstrated superiority over traditional teaching methods in enhancing knowledge retention, learning motivation, critical thinking, decision-making, academic achievement, and student engagement, while also promoting teamwork and social interaction among learners [15]. Collectively, these findings indicate that gamification can serve as an effective instructional strategy in nursing education by encouraging active participation and supporting self-directed learning.

To date, a variety of game-based VR programs have been developed for nursing education across topics such as basic nursing skills [A2,A8,A12,A15,A23], infection control [A3,A7,A12], disaster nursing [A9,A10], and emotional empathy [A22,A24]. Researchers have also extensively investigated the educational effects of VR and GBL independently. For example, some studies have classified the purposes and implementation technologies of VR simulations in nursing education [11], while others have conducted meta-analyses examining the effects of VR-based interventions on knowledge acquisition, skill proficiency, and learning satisfaction [7,16]. Similarly, systematic reviews have explored the influence of GBL on immersion and self-efficacy [15,17]. In Korea, several studies have assessed the outcomes of VR-based nursing education [18] and the learning effects of gamification strategies [19]. However, existing research has limitations in that it rarely integrates analyses of hybrid interventions combining VR and GBL. Most studies focus solely on nursing students and tend to emphasize outcome evaluations rather than the structural and design features of the interventions themselves.

Therefore, this study conducted a scoping review of intervention studies on game-based VR programs for nursing education published in domestic and international journals. The aim was to comprehensively analyze their characteristics, structural components, design features, and educational outcomes. Scoping reviews are particularly valuable for systematically identifying the range and trends of existing research on a specific topic and for proposing directions for future studies [20]. Through this review, we sought to identify the educational topics and implementation methods of hybrid interventions that integrate VR and gamification, summarize their learning outcomes, and provide foundational evidence for the further development and application of game-based VR programs in nursing education.

METHODS

1. Study Design

A scoping review was conducted to identify the characteristics and educational effects of VR programs based on GBL for nursing students and nurses. The review followed the five-stage framework proposed by Arksey and O'Malley [21]: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarizing, and reporting the results. The review process was guided by the methodology of the Joanna Briggs Institute (JBI) [22], and reporting adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [23]. Both the JBI guidelines and PRISMA-ScR checklist were used throughout the review process. The protocol for this scoping review was registered on the Open Science Framework (OSF; DOI: 10.17605/OSF.IO/568BW).

2. Identifying the Research Question

To establish eligibility criteria for study selection, this scoping review applied the population, concept, and context framework recommended by the JBI [22]. The population included nursing students and practicing nurses. Studies were eligible if participants directly engaged in interventions related to nursing education. The concept referred to the application of VR technology incorporating GBL elements as an educational intervention. Only studies integrating gamification or specific game elements within VR programs were included. The context comprised nursing education settings that employed game-based VR programs to improve learning outcomes, skill acquisition, or learning motivation. Studies were eligible if they addressed educational topics such as nursing theory, clinical skills, or clinical decision-making, provided that the educational objectives were explicitly stated. Based on these criteria, the primary research question guiding this study was: “What are the educational characteristics and learning outcomes of game-based VR programs applied to nursing students and nurses?”

3. Identifying Relevant Studies

The literature search for this scoping review was conducted in April 2025. With the release of the Oculus Rift in 2013, head-mounted display (HMD)-based VR entered full-scale commercialization, making its use feasible in educational contexts [24,25]. Around 2014, research in healthcare education began to expand rapidly [26,27]. Therefore, to capture recent trends, this review searched for studies published in domestic and international journals between April 2014 and March 2025. The international databases searched were PubMed, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Cochrane Central Register of Controlled Trials (CENTRAL), and Excerpta Medica (EMBASE).

Search terms for international databases combined the following: (1) “Students,” “Nursing,” “undergraduate nursing student,” “Nurs*,” “Nursing student*,” “School Nursing,” or “Nurse”; (2) “Education” or “Learning”; (3) “Game,” “Game-based,” or “Gamification”; and (4) “Virtual Reality” or “VR.”

For Korean literature, the databases RISS, KISS, DBpia, and KMbase were searched. The search terms used internationally were adapted to suit the search functions of these databases. Korean search combinations included: (1) “nursing student,” “undergraduate nursing student,” or “nurse”; (2) “nursing,” “nursing education,” “education,” or “learning”; (3) “gamification,” “game-based,” or “game”; and (4) “virtual reality” (Supplementary Table 1).

4. Study Selection

This scoping review included studies that investigated the characteristics and educational effects of game-based VR programs in nursing education for both nursing students and practicing nurses. Eligible studies implemented educational interventions targeting these populations, applied VR technology integrated with game-based components such as scoring systems, feedback mechanisms, or challenges, and reported at least one quantitative learning outcome (e.g., knowledge, skills, attitudes, or self-efficacy). Only peer-reviewed articles published in academic journals in Korean or English were included. Acceptable study designs were experimental or quasi-experimental studies with control groups. Studies were excluded if they did not involve nursing students or nurses, did not clearly integrate game-based VR elements, or failed to report quantitative learning outcomes. In addition, gray literature such as dissertations, conference abstracts, and non–peer-reviewed reports; single-group designs; qualitative studies; descriptive surveys; meta-analyses; literature reviews; animal experiments; preliminary studies not directly related to the review objectives; and studies without accessible full texts were excluded. A total of 1,072 records were identified through database searches. All records were organized using EndNote X20 and Microsoft Excel 2020 (Microsoft, Redmond, WA, USA). After removing 183 duplicates and excluding 126 gray literature items (e.g., dissertation or conference abstracts), 763 records remained for title and abstract screening. Of these, 634 were excluded for being irrelevant to nursing education or failing to meet inclusion criteria. Subsequently, 129 full-text articles were reviewed, and 105 were excluded for the following reasons: full-text unavailable (n = 52), absence of game-based VR intervention (n = 28), or lack of quantitative outcome reporting (n = 25). Finally, 24 studies met all inclusion criteria and were included in this scoping review (Figure 1 and Supplementary Material).

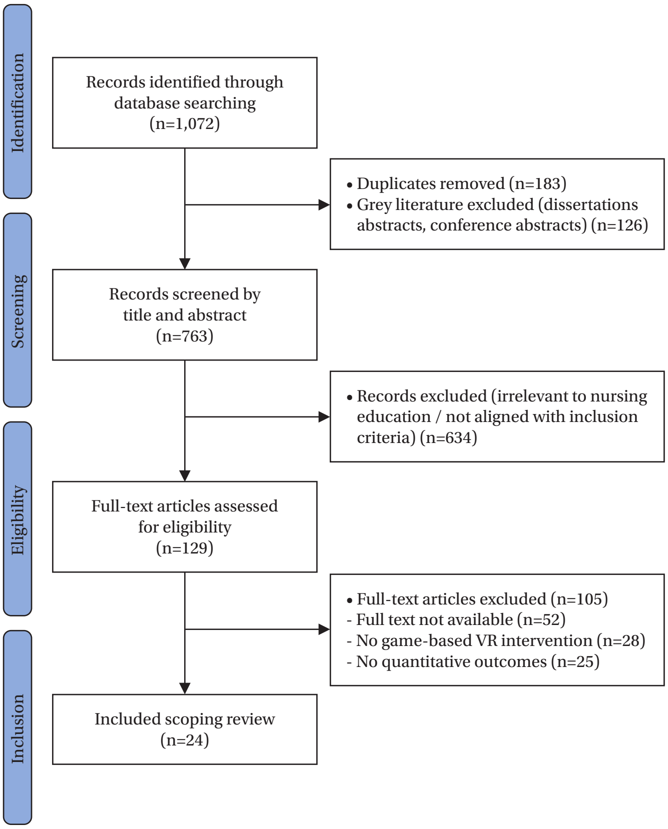

Figure 1. Flow diagram of literature selection. VR = virtual reality.

This review was conducted in accordance with the JBI Scoping Review Manual [22] to systematically map the scope and characteristics of existing research on the topic. Although scoping reviews generally allow for methodological flexibility in study design, the JBI framework permits inclusion or exclusion of specific designs depending on the review's purpose and research questions. To ensure objective comparison and analysis of learning outcomes in game-based VR educational programs, this review focused exclusively on quantitative comparative studies (experimental or quasi-experimental designs with control groups) that clearly reported intervention effects.

5. Charting the Data

The study selection process followed the procedures of a scoping review, and the flow of study selection was described in accordance with PRISMA-ScR guidelines [23]. Data extraction was independently conducted by two reviewers—a professor with a PhD in nursing and a PhD candidate in nursing—using a data extraction tool recommended by the JBI methodology [22]. Extracted data included study characteristics (author, year of publication, and country), study population, study design, details of the game-based VR intervention, and educational outcomes. Any disagreements between reviewers were resolved through discussion and consensus. In addition, a manual search was performed by examining the reference lists of included studies to identify potentially overlooked publications.

6. Collating, Summarizing, and Reporting the Results

The extracted data were categorized and descriptively summarized according to the objectives of the scoping review. Studies with related content were grouped into categories emphasizing the structural characteristics of the interventions (e.g., implementation settings, target population, program components), the design features of the educational programs (e.g., gamification techniques, feedback mechanisms, learning strategies), and the reported effects on learning outcomes (e.g., knowledge, skills, attitudes, self-efficacy). The main features and differences across studies within each category were compared and analyzed to identify overarching trends and recurring patterns in the research.

7. Ethical Considerations

Because this study was a literature review and the researchers had no access to study participants or their personal information, there were no ethical concerns. Accordingly, this study was exempt from review by the Keimyung University Ethics Committee (40525-202403-HR-001-02).

RESULTS

1. General Characteristics

The general characteristics of the 24 studies included in this review are summarized in Tables 1 and 2.

1) Year of publication

By year of publication, one study (4.2%) was published in each of 2015, 2019, and 2020 [A1-3]. Three studies (12.5%) were published in 2021 [A4-6], six studies (25.0%) in 2022 [A7-12], four studies (16.7%) in 2023 [A13-16], five studies (20.8%) in 2024 [A17-21], and three studies (12.5%) in 2025 [A22-24].

Table 1. Characteristics of Included Literature ($N=24$)

Variables	Categories	n (%)
Publication year	2015	1 (4.2)
	2019	1 (4.2)
	2020	1 (4.2)
	2021	3 (12.5)
	2022	6 (25.0)
	2023	4 (16.7)
	2024	5 (20.8)
	2025	3 (12.5)
Country	South Korea	11 (45.8)
	Taiwan	3 (12.5)
	Brazil	1 (4.2)
	China	1 (4.2)
	Cyprus	1 (4.2)
	Finland	1 (4.2)
	Germany	1 (4.2)
	Hong Kong	1 (4.2)
	Palestine	1 (4.2)
	Portugal	1 (4.2)
	Turkey	1 (4.2)
	USA	1 (4.2)
Participants	Nursing students	21 (87.5)
	Nurses	3 (12.5)
Sample size	<50	6 (25.0)
	≥50 to <100	10 (41.7)
	≥100 to <150	5 (20.8)
	≥150	3 (12.5)
Topic classification	Infection control, patient safety	6 (25.0)
	Fundamental nursing skills	6 (25.0)
	Geriatric and specialized nursing areas (e.g., pressure ulcer care, neonatal nursing, neurological assessment)	4 (16.7)
	Psychiatric nursing, empathy education	3 (12.5)
	Disaster, emergency response	3 (12.5)
	Anatomy education	2 (8.3)

2) Country of study

South Korea accounted for the largest proportion of studies (11 studies, 45.8%) [A5,A6,A8,A11-14,A16,A19,A20,A23]. This was followed by Taiwan with three studies (12.5%) [A3,A9,A21]. One study (4.2%) each was conducted in Portugal [A1], Turkey [A2], Brazil [A4], Cyprus [A7], China [A10], Germany [A15], Hong Kong [A17], Palestine [A18], the United States [A22], and Finland [A24].

3) Study population and sample size

Most studies targeted nursing students, accounting for 21 studies (87.5%) [A1-8,A10-15,A17,A18,A20-24], while three studies (12.5%) targeted practicing nurses [A9,A16,A19]. Sample sizes ranged from 14 to 202 participants. Six studies (25.0%) included fewer than 50 participants [A1,A4,A14,A16,A19,A20], while 10 studies (41.7%) involved 50 to 100 participants [A2,A5,A6,A8,A9,A11,A12,A21,A22,A24]. Five studies (20.8%) included 100 to 150 participants [A3,A7,A13,A15,A18], and three studies (12.5%) had sample sizes of 150 or more [A10,A17,A23].

4) Topics of studies

Among the 24 included studies, the most common topics were infection control and patient safety [A3,A6,A7,A12,A14,A16] and basic nursing skills [A2,A4,A8,A11,A15,A23], each addressed in six studies (25.0%). Four studies (16.7%) focused on geriatric and specialized nursing areas, such as pressure ulcer care, neonatal care, and neurological assess-

Table 2. Characteristics of the Included Studies

Author (year)	Country	Participants	Topic area	Type of program	Learning factors	Gamification elements	Primary outcomes	Secondary outcomes	Reference no.
Fonseca et al. (2015)	Portugal	14 nursing students	Preterm newborn clinical assessment/neonatal nursing	Web-based serious game (e-Baby)	Autonomy, interactivity, feedback, self-directed learning	Scenario-based simulation, virtual patient, decision-making, feedback	Increased knowledge and clinical reasoning on oxygenation assessment	High learner satisfaction, motivation, usability, engagement	A1
Biyik Bayram and Caliskan (2019)	Turkey	86 nursing students (1st year)	Tracheostomy care	Game-based VR mobile phone application	Repetition, feedback, self-directed learning, skill acquisition, theoretical-practical integration	Game scenario, character-based simulation, stage-based tasks, mobile-based access, performance feedback	Experimental group showed significantly higher skill performance in tracheostomy suction and skin care	Higher motivation, better engagement, potential for independent and repeated practice anytime/anywhere	A2
Wu et al. (2020)	Taiwan	109 (59 nurses, 50 medical interns)	Needle stick/sharp injury prevention	VR-based training using Gagne's model	Familiarity, confidence, knowledge retention, reduction of anxiety, engagement, instructional design alignment	Random scenarios, decision-based tasks, feedback loops, immersive gameplay, performance tracking	Increased familiarity and confidence with universal precautions, improved performance after VR training, and reduced needle stick injury rates	Decreased anxiety, improved speed and accuracy in decision tasks, better retention of learning effects over 2 months	A3
Girao et al. (2021)	Brazil	14 nursing students (usability test), 8 faculty evaluators	Medication preparation and administration	Serious game-based VR simulation	Motivation, immersion, satisfaction, learning, decision-making, cognitive engagement	Interactive VR environment, simulated patient, hand hygiene quiz, color-coded meds, end of task feedback	High usability ratings (100% in immersion, satisfaction, and learning); validated as "very good" by experts	Positive influence on short and long-term learning, high user engagement, practical skill reinforcement	A4

(Continued on the next page)

Table 2. Continued

Author (year)	Country	Participants	Topic area	Type of program	Learning factors	Gamification elements	Primary outcomes	Secondary outcomes	Reference no.
Lee et al. (2021)	South Korea	70 nursing students (4th year; Exp. 35, Cont. 35)	Psychiatric nursing practice	Case-based VR simulation	Knowledge, learning self-efficacy, problem-solving ability	Repetition, feedback, stage lock, animation based interaction	Improved psychiatric nursing knowledge, learning self-efficacy, and problem-solving ability	Partial improvement in therapeutic communication and communication confidence; no difference in learning immersion	A5
Yu et al. (2021)	South Korea	50 nursing students (4th year; Exp. 25, Cont. 25)	High-risk neonatal infection control	VR simulation using HMD+leap motion (HirNIC VR)	Prebriefing, debriefing, scenario-based simulation, NLN/Jeffries Framework	Immersive VR, scenario-driven simulation, hand-tracking	Performance self-efficacy, learner satisfaction	Knowledge (no significant change)	A6
Al Mugheed et al. (2022)	Cyprus	126 nursing students (3rd & 4th year)	Standard precautions education	Game-based VR phone application+online education	Self-paced learning, team-based lab practice, quizzes, recorded lessons, repeatable playback	Game scenarios, interactive VR phone application	Knowledge, attitude, compliance with standard precautions	None	A7
An (2022)	South Korea	72 nursing students (2nd year; Exp. 34, Cont. 38)	Core nursing skills: vital signs & subcutaneous injection	Metaverse-based simulation	ASSURE model-based design, repeated individual scenario learning, pre, post debriefing	Interactive scenario, 3D virtual world, object selection, embedded quiz	Knowledge, Performance confidence, clinical competency (all improved)	None	A8
Chang et al. (2022)	Taiwan	67 ER nurses (Exp. 32, Cont. 35)	Chemical disaster preparedness	360° VR-based simulation vs. tabletop drill	Role-playing (incident commander, triage, decontamination), H.A.Z.M.A.T. protocol, adaptive quiz, feedback loop (video rewatch for incorrect answers)	Immersive VR, scenario-based triage, MCQ with instant feedback, embedded learning videos, first-person experience	Self-preparedness, Self-efficacy (short-term improvement)	No sustained difference at 3-week follow-up	A9

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Table 2. Continued

Author (year)	Country	Participants	Topic area	Type of program	Learning factors	Gamification elements	Primary outcomes	Secondary outcomes	Reference no.
Hu et al. (2022)	China	158 nursing students (Exp. 78, Cont. 80)	Disaster evacuation management	VR-based mobile game application vs. traditional lecture	Scenario-based VR learning (fire, earthquake, CPR), repeated testing, feedback, mobile accessibility, self-directed	Interactive disaster scenario game, scoring system, real-time physiological response	Knowledge retention, decision-making ability, instructional satisfaction	None	A10
Yang and Oh (2022)	South Korea	83 nursing students (VR 29, Simulation 28, Cont. 26)	Neonatal resuscitation education	Immersive VR gamification program (based on Keller's ARCS model) vs. high-fidelity simulation vs. online lecture	ARCS model including perceptual arousal, goal orientation, motive matching, learning requirements	Scenario-based challenges, immediate feedback, repetition on failure, immersive VR environment, reward system	Improvement in neonatal resuscitation knowledge, problem-solving ability, self-confidence, and learning motivation	Reduction in anxiety (notably in simulation group), improvement in clinical reasoning (no significant group difference)	A11
Yu and Yang (2022)	South Korea	50 nursing students (3rd and 4th year, Exp. 25, Cont. 25)	Infection control and respiratory care for pediatric COVID-19 patients	VRICS program with prebriefing, simulation, debriefing	Based on self-efficacy theory; PPE knowledge, infection control performance, confidence, and immersion	Scenario-based VR with HMD, structured steps, real-time interaction and feedback	Improved PPE knowledge, infection control performance, and self-efficacy in the experimental group compared to control group	High levels of realism and learner satisfaction	A12
Kim et al. (2023)	South Korea	113 nursing students (1st year, Exp. 56, Cont. 57)	Anatomy education using VR	VR-based anatomy education vs. anatomage table (3D dissection table)	Learning presence, technology acceptance, learning motivation, anatomy knowledge (based on ARCS and TAM frameworks)	Interactive 3D organ modeling via Oculus (3D Organon VR Anatomy), real-time manipulation (rotate, zoom, dissect)	Increased learning presence, higher technology acceptance, and improved anatomy knowledge in the VR group	No significant difference in learning motivation between groups	A13

(Continued on the next page)

Table 2. Continued

Author (year)	Country	Participants	Topic area	Type of program	Learning factors	Gamification elements	Primary outcomes	Secondary outcomes	Reference no.
Oh and Kim (2023)	South Korea	44 nursing students (3rd year, Exp. 22, Cont. 22)	Patient safety management education	VR-based smartphone application program focusing on clinical safety (patient ID, infection control, medication)	Knowledge, attitude, and confidence in patient safety (based on self-efficacy and experiential learning principles)	VR headset (Oculus Quest 2), scenario-based learning, mobile accessibility, interactive tasks, feedback	Improvement in patient safety knowledge, attitudes, and performance confidence in the experimental group	High engagement and usefulness as preclinical orientation material	A14
Plotzky et al. (2023)	Germany	131 nursing students (2nd, 3rd year, VR high 47, VR low 41, video 43)	Endotracheal suctioning skill training	Two types of immersive VR simulations (high-tech & low-tech) vs. instructional video	Knowledge, skill performance, learning satisfaction, technology acceptance (TAM-based: usefulness, ease of use)	VR simulation with scenario-based steps, real-time feedback, hand-tracking (VR high), gamified errors (e.g., germs shown)	Knowledge significantly improved in all groups (no difference between groups); skill performance best in video group	Higher learner satisfaction in VR low group; technology acceptance higher in VR low than VR high group	A15
Ryu and Yu (2023)	South Korea	40 NICU nurses (Exp. 20, Cont. 20)	Advanced infection control in NICU	VR simulation program for preventing central line-associated bloodstream infections and ventilator-associated pneumonia (VR_AICENICU)	Infection control knowledge, performance confidence, presence, empathy, program satisfaction	Scenario-based VR with HMD, hand-tracking, immersive audio, progression-based simulation steps	Improved infection control confidence in the experimental group basic infection control knowledge significantly improved	The experimental group reported high levels of presence, empathy, and satisfaction	A16
Chan et al. (2024)	Hong Kong	202 undergraduate nursing students (preclinical, VR-Hospital exposure)	Development of nontechnical skills	Immersive VR training using VR-Hospital (multi-bed, multi-patient, multi-task single-user game)	Situation awareness, communication, teamwork, leadership, decision-making, satisfaction, self-confidence, sense of presence	Scenario-based multi-task virtual ward, voice interaction, real-time decision-making, randomized events, reflection via MCQs	Improvement in nontechnical skills (communication, teamwork, decision-making), self-confidence, and satisfaction	High sense of presence and realism (physical, psychological, affective fidelity) students experienced stress and multitasking	A17

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Table 2. Continued

Author (year)	Country	Participants	Topic area	Type of program	Learning factors	Gamification elements	Primary outcomes	Secondary outcomes	Reference no.
Jallad et al. (2024)	Palestine	138 year nursing students (1st year single group, pre-post-test)	Anatomy education (musculoskeletal system)	Immersive VR application for human anatomy course using Meta Quest 2 (before and after musculoskeletal lecture)	Technology acceptance model; ease of use, interaction, imagination, immersion, motivation, intention to use	Interactive 3D human anatomy visuals, spatial navigation, real-time engagement, high-fidelity simulation (Meta Quest 2)	Increased student satisfaction, improved anatomy knowledge, and positive perceptions toward immersive VR after the lecture	High levels of motivation, immersion, and intention to continue using VR for learning	A18
Jung and Moon (2024)	South Korea	35 novice nurses (<2 years' experience, Exp. 18, Cont. 17)	Pressure ulcer prevention and management	VR simulation program (PU-VRSim) based on Kolb's experiential learning theory and ADDIE model	Pressure ulcer knowledge, clinical judgment, self-efficacy, critical thinking	Scenario-based simulation, real-time interaction via HMD and controller, patient case progression, feedback, immersive visuals	Improved pressure ulcer knowledge in both groups; accomplished level of clinical judgment in VR group	Positive learning experience (realism, engagement, usability); some equipment-related discomfort reported	A19
Kim et al. (2024)	South Korea	49 nursing students (4th year, one-group pre-post test)	Nervous system assessment in clinical education	Virtual game-based integrated clinical practice simulation program (nervous system assessment)	Self-directed learning, academic self-efficacy, learning presence, learning flow (based on Kolb's experiential learning theory)	Scenario-based VR simulation, role-play, interactive assessments (GCS, motor, pupil), feedback, repeated practice	Significant improvement in self-directed learning and learning presence	No significant change in academic self-efficacy and learning flow students reported high engagement and realism	A20
Lin et al. (2024)	Taiwan	50 nursing students (1st-3rd year, Exp. 25, Cont. 25)	Geriatric oral health care	Virtual reality-based oral health simulation (2 sessions over 4 weeks)	Knowledge, attitude, self-efficacy, behavioral intention (based on experiential learning theory)	Scenario-based VR training, 3D interactive tasks with feedback, repeated trial, HMD use with motion sensors	Significant improvement in knowledge, attitude, self-efficacy, and behavioral intention in the experimental group	High satisfaction with VR system, supports integrating VR in nursing curriculum	A21

(Continued on the next page)

Table 2. Continued

Author (year)	Country	Participants	Topic area	Type of program	Learning factors	Gamification elements	Primary outcomes	Secondary outcomes	Reference no.
Huang et al. (2025)	United States	69 nursing students (2nd-4th year, randomly assigned to 4 groups)	Affective empathy development via VR	2 × 2 factorial design: VR vs. non-VR × clinician vs. parent perspective, using the game That Dragon, Cancer	Perceived self-location, narrative transportation, emotional engagement, affective empathy (based on empathy theory)	Immersive storytelling, first person narrative, emotional role-play, interaction with characters (Oculus Go, 360° view)	VR improved sense of presence (self-location) clinician perspective increased emotional engagement	Affective empathy increased through a mediated pathway (self-location → transportation → emotional engagement → empathy)	A22
Kim and Lee (2025)	South Korea	184 nursing students (2nd year, Exp. 92, Cont. 92)	Intravenous injection training	Web-based VR intravenous injection program (real video, speech interaction, no HMD required)	Knowledge, confidence, satisfaction (based on experiential and self-directed learning)	Real-scenario videos, branching dialogues, interactive learning via voice commands (mobile/PC accessible)	Improved knowledge and confidence in IV injection in the experimental group	Higher satisfaction with clinical training in the experimental group	A23
Koivisto et al. (2025)	Finland	52 graduating nursing students (from 3 universities of applied sciences)	Empathy development in nursing	Immersive VR simulation game using Oculus Quest HMD and hand controllers (first-person nurse role scenario)	Empathic concern, cognitive empathy, helping motivation, shared affect, distress, empathic imagination	Scenario-based patient care, clinical assessment (ABCDE), multisensory feedback, voice/hand interaction, immersive navigation	Positive experience of empathy (especially helping motivation and concern); positive user experience in all dimensions	Younger students reported more distress; older students showed greater cognitive empathy; prior work experience enhanced shared emotional understanding	A24

3D = three-dimensional; ABCDE (Clinical assessment) = clinical assessment (airway, breathing, circulation, disability, and exposure); ADDIE model = analysis, design, development, implementation, and evaluation model; ARCS model = attention, relevance, confidence, satisfaction model; ASSURE = analyze learners, state objectives, select method, media and materials, utilize media and materials, require learners participation, evaluate and revise; Cont. = control group; COVID-19 = coronavirus disease 2019; CPR = cardiopulmonary resuscitation; Exp. = experimental group; GCS = Glasgow Coma Scale; H.A.Z.M.A.T = hazardous materials; HMD = head-mounted display; IV = intravenous; MCQ = multiple-choice question(s); NICU = neonatal intensive care unit; NLN = national league for nursing; Patient ID = patient identification; PC = personal computer; PPE = personal protective equipment; PU = pressure ulcer; TAM frameworks = technology acceptance model frameworks; VR = virtual reality; VRICS program = virtual reality infection control simulation.

ment [A1,A19-21]. Three studies (12.5%) each examined mental health nursing and empathy education [A5,A22, A24] or disaster and emergency response [A9,A10,A17]. Anatomy education was the topic of two studies (8.3%) [A13,A18].

2. Types and Learning Factors of Game-Based VR Programs in Nursing Education

1) Types of programs

Based on technological structure, many of the included programs incorporated multiple technology components, such as HMDs, mobile devices, and web-based platforms, meaning that a single study could fall into more than one category. HMD-based immersive VR programs were the most common, reported in 14 studies (58.3%) [A1,A3,A6, A9-17,A21,A24]. Programs combining multiple technologies—such as HMDs with mobile or web platforms, whether integrated structurally or through content—were found in six studies (25.0%) [A4,A5,A16,A19,A20,A22]. Programs employing web-based or metaverse platforms were reported in four studies (16.7%) [A2,A8,A22,A23], and mobile-based VR programs were used in three studies (12.5%) [A2,A4,A7]. Additionally, simulations using hand-tracking or high-precision interactive technologies appeared in three studies (12.5%) [A12,A15,A24] (Table 2).

2) Learning factors of the programs

All 24 studies (100%) incorporated designs enabling learners to engage in self-directed learning by repeatedly practicing scenarios without constraints of time or location [A1-24]. Immediate feedback was provided in 22 studies (91.7%) [A1-4,A6-12,A14-24], while interaction-centered learning environments were implemented in 21 studies (87.5%) [A1-3,A5-11,A13-17,A19-24]. Among these, nine studies (37.5%) [A5-7,A12,A16,A17,A19,A23,A24] incorporated debriefing or self-assessment components beyond simple interactions, facilitating learner reflection and deeper understanding (Table 2).

3) Gamification elements

All 24 studies (100%) integrated at least one gamification element [A1-24]. The most frequent element was scenario-based, stepwise progression, reported in 21 studies (87.5%) [A1-3,A5-11,A13-17,A19-24]. Mission-based task presentation appeared in 20 studies (83.3%) [A1-3,A5-11,A13-17,A19-22,A24]. Retry and feedback structures following errors were included in 19 studies (79.2%) [A1-3,A6-11,A13-17,A19,A21-24]. Emotional immersion features, such as virtual patient responses, were implemented in 19 studies (79.2%) [A1-3,A5-11,A13,A14,A16,A17,A19-22,A24]. Sensory enhancement features, including animation and voice feedback, were found in 17 studies (70.8%) [A1,A2,A5-11,A13,A14,A16,A17,A19,A21,A24]. Finally, structures involving challenge and reward through repetition were incorporated in 17 studies (70.8%) [A1-3,A6-11,A13-17,A19,A21,A24] (Table 2).

3. Educational Effects of Game-Based VR Programs in Nursing Education

1) Primary outcomes

The primary outcomes measured in the included studies were knowledge acquisition, self-efficacy, skill performance, learning motivation, and engagement. Knowledge acquisition was reported to have improved in 21 studies (87.5%) [A1-3,A5, A7,A8,A10-24] through the application of game-based VR. Enhanced self-efficacy was observed in 20 studies (83.3%) [A1,A3,A5-17,A20-24], while increased learning motivation and engagement were reported in 18 studies (75.0%) [A1,A3,A5-11,A13,A14,A16,A17,A19-22, A24]. Significant improvements in skill performance were identified in 17 studies (75.0%) [A2,A3,A6,A7,A9-14,A16, A17,A19-22,A24], particularly in nursing procedures such as intravenous injection, anatomical understanding, and infection control (Table 2).

2) Secondary outcomes

Regarding secondary outcomes, learner satisfaction was reported to increase in 21 studies (87.5%) [A1-3,A5-14, A16,A17,A19-24], and an improved sense of immersion was noted in 20 studies (83.3%) [A1-3,A5-14,A16-21,A24]. Enhanced emotional responses, such as greater interest and empathy, were identified in 18 studies (75.0%) [A1,A3, A5-11,A13,A14,A16,A17,A19-22,A24], while improvements in teamwork and communication skills were reported in six studies (25.0%) [A6,A8,A13,A14,A19,A22] (Table 2).

DISCUSSION

This study conducted a scoping review of intervention studies on game-based VR programs for nursing education published in domestic and international journals, aiming to systematically analyze the characteristics and educational effects of these interventions and to propose future directions. Analysis of 24 intervention studies revealed that game-based VR programs had positive effects on skill performance, knowledge acquisition, self-efficacy, learning motivation, and learner satisfaction. The integration of various learning strategies and gamification elements demonstrated that such programs can be effectively utilized as meaningful instructional approaches in nursing education.

According to research trends, studies applying game-based VR in nursing education began in 2015 and increased sharply following the COVID-19 pandemic. This surge can be attributed to the suspension of clinical practicums and restrictions on face-to-face instruction during the pandemic, which significantly reduced experiential learning opportunities and compelled nursing schools to adopt new instructional modalities, thereby accelerating the demand for non-face-to-face education [28]. In this context, the need for learner-centered and immersive educational environments intensified, and game-based VR programs gained prominence as practical instructional strategies capable of compensating for limited clinical exposure while fostering higher-order competencies such as problem-solving, critical thinking, and clinical judgment [29].

The geographical distribution of studies was concentrated in Asian countries, particularly South Korea. East Asian nations have actively promoted the integration of innovative educational technologies into nursing curricula, supported by high levels of acceptance of artificial intelligence technologies and strong technology-oriented policy environments [30]. Within this framework, the adoption of VR technology as part of simulation-based and personalized learning strategies has expanded rapidly. Eleven of the included studies were conducted in South Korea, representing the largest proportion. This predominance likely reflects not only the relatively high number of VR-related publications in Korean nursing education but also the structural characteristics of nursing programs and the strong policy support for educational technology. In South Korea, nursing education has shown sustained interest in applying information and communication technologies to overcome the limitations of traditional clinical practicums, such as restricted access to clinical sites, patient safety concerns, and ethical issues [31]. Consequently, many nursing schools have established simulation centers and built VR-based training infrastructure, with digital technologies becoming increasingly embedded in clinical education. These developments have been further facilitated by government support, particularly through initiatives such as the Ministry of Education's policies, local government programs, and the University Innovation Support Project, which have collectively encouraged research and innovation in this field [32]. Therefore, the high proportion of Korean studies in this review likely reflects both publication activity and the existence of a well-developed system supporting technology-driven educational innovation in Korean nursing education. Nonetheless, because the studies were concentrated in specific regions, caution is warranted when generalizing these findings to countries or educational settings with different cultural or institutional contexts, as identical VR interventions may yield differing effects elsewhere.

Among the 24 studies reviewed, 20 studies (83.3%) [A1,A2,A4-8,A10-15,A17,A18,A20-24] targeted nursing students, whereas only four (16.7%) [A3,A9,A16,A19] involved clinical nurses. Studies focusing on nursing students primarily addressed foundational competencies such as basic nursing skills, infection control, anatomy, and mental health nursing, with outcomes emphasizing knowledge acquisition, skill performance, learning motivation, and self-efficacy. In contrast, studies involving nurses addressed patient safety-related topics in clinical practice, including neonatal intensive care unit infection control, disaster response, and pressure ulcer management. These studies predominantly reported outcomes concerning clinical applicability, such as situational response ability, clinical judgment, self-efficacy, and confidence in infection control performance. These findings suggest that for nursing students, VR serves as a means to develop essential competencies and facilitate transition to clinical practice, whereas for nurses, it functions as an advanced learning tool to enhance patient safety and professional decision-making. Accordingly, future research should differentiate between these two learner populations, comparing and analyzing their educational characteristics and learning outcomes to establish optimized VR instructional strategies tailored to each group. Moreover, the included studies generally employed small to moderate sample sizes, with most involving fewer than 100 participants, reflecting the exploratory stage of current research and resource limitations. Future investigations should broaden participant inclusion to encompass new graduates and nurses with experience in diverse clinical settings. Employing more segmented research designs that account for variables such as specialty area and technological acceptance level will be essential for validating the practical applicability and educational utility of game-based VR interventions. In terms of topic distribution, game-based VR programs were applied across a range of nursing education domains, including infection control and patient safety, basic nursing skills, mental health nursing, disaster nursing, geriatric nursing, and specialized nursing fields. Among these, infection control and basic nursing skills were the most frequently addressed topics, reflecting the current emphasis in nursing education on patient safety and the acquisition of core clinical competencies [33]. However, studies focusing on complex nursing situations requiring higher-order reasoning—such as team-based care, community health nursing, and clinical decision-making—remain limited. Future research should extend beyond narrowly defined, procedure-oriented topics to encompass integrated nursing scenarios that mirror the complexity of real-world practice and promote the development of interdisciplinary collaboration skills.

In terms of the technological characteristics of intervention designs, most studies employed immersive VR HMDs. These devices effectively supplemented limited clinical training environments by enabling learners to repeatedly engage in clinical scenarios without physical or temporal constraints. Furthermore, follow-up learning structures incorporating debriefing, reflective questioning, and self-assessment were found to enhance learners' self-directedness and reflective capacity. Feedback was included in nearly all interventions; immediate and specific feedback was effective in promoting error recognition and self-correction among learners [10,12]. This finding suggests that prompting learners to identify and correct their own mistakes during performance plays a crucial role in strengthening both skill acquisition and critical thinking abilities [34].

All intervention programs incorporated at least one gamification element to promote learner engagement and immersion. In particular, scenario-based stepwise progression [A1-3,A5-11,A13-17,A19-24], mission-style task structures [A1-3,A5-11,A13-17,A19-22,A24], immediate retry and feedback mechanisms following errors [A1-3,A6-11,A13-17,A19,A21-24], and emotional responses from virtual patients [A1-3,A5-11,A13,A14,A16,A17,A19-22,A24] were central design strategies used to encourage repeated practice and active cognitive engagement in realistic clinical contexts. According to gamification theory, challenge-and-reward-based structures enhance learners' self-efficacy and motivation for continued learning [13]. In medical education, repeated task execution combined with immediate feedback has also been shown to be an effective strategy for fostering immersion and improving technical proficiency [14]. Ultimately, gamification elements extend beyond merely stimulating interest—they create a learning environment that sustains both cognitive engagement and emotional immersion. These results indicate that gamification can serve as an effective pedagogical strategy for strengthening clinical judgment and problem-solving abilities in nursing education.

Regarding program effectiveness, the included studies consistently demonstrated positive changes across multiple learning outcomes, including knowledge acquisition, self-efficacy, learning motivation, and skill performance. Knowledge acquisition improved in nearly all studies, suggesting that VR-based learning effectively enhances understanding and retention by presenting scenarios that closely mirror real clinical environments [10]. The consistent improvement in self-efficacy across studies indicates that immersive environments, repeated practice, and immediate feedback collectively contribute to developing learners' confidence and self-directedness. Design features such as gamification components, audiovisual stimulation, and progressive challenges played a significant role in maintaining learning motivation and engagement by eliciting emotional responses and supporting sustained participation [A1-24]. In terms of skill performance, several studies reported that VR-based simulation training enhanced practical nursing skills, including intravenous injection, anatomical knowledge, and infection control [A3,A7,A12,A16,A18,A23]. These findings suggest that VR education contributes not only to theoretical knowledge but also to the development of practical competencies. However, current VR interventions may not fully capture the complexity and unpredictability of real clinical settings. Therefore, future interventions should incorporate more realistic, integrated clinical contexts to enhance practical relevance and transferability.

In addition to cognitive and technical outcomes, most studies reported high levels of learner satisfaction and engagement [A1-3,A5-11,A13,A14,A16,A17,A19-24], along with positive emotional responses such as interest and empathy [A1,A3,A5-11,A13,A14,A16,A17,A19-22,A24]. These results suggest that gamified VR environments effectively foster emotional immersion, transforming the learning process into a more enjoyable and meaningful experience [35]. However, improvements in teamwork and communication skills were reported in only a few studies [A6,A8,A13, A14,A19,A22], likely because most interventions emphasized individual learning rather than collaborative engagement. Consequently, future studies should incorporate collaborative learning frameworks that promote interactive, team-based competencies reflective of real clinical practice.

This study aimed to analyze the impact of game-based VR programs on nursing education from multiple perspectives. Whereas previous research has tended to focus on discrete outcome measures emphasizing educational effectiveness, this study is significant in that it provides a descriptive analysis of both the design components—such as technological implementation, gamification structure, feedback mechanisms, and reflective learning frameworks—and the learning outcomes. By examining not only the educational content but also the delivery modes and structural elements of learning, this study offers practical insights and strategic directions for the design and implementation of future educational programs.

However, this study had several limitations. Most of the included studies targeted nursing students; therefore, it remains uncertain whether similar effects can be expected among nurses actively working in clinical settings. In addition, many studies employed relatively small sample sizes, necessitating cautious interpretation of the results. A considerable proportion of the studies were also conducted within specific regions, particularly South Korea, which may limit the generalizability of the findings to countries or educational environments with different cultural and institutional contexts. Future research should therefore include diverse learner populations, evaluate the sustainability of intervention effects and their applicability in clinical practice, and conduct multicultural comparative studies across different national and educational settings. Nevertheless, this review excluded qualitative studies, single-group designs, and gray literature, which may restrict the comprehensiveness typically expected of scoping reviews. These exclusions could increase the potential for publication, design, or language bias. Future reviews should consider incorporating more diverse study designs and data sources to capture contextual factors, learner experiences, and implementation processes that may not be adequately reflected in quantitative evidence alone.

Building upon these findings and limitations, the implications for practice and research are that, when designing game-based VR programs, instructors should carefully structure the learning experience to align meaningfully with educational goals and avoid restricting the design to technical implementation alone. Feedback mechanisms, repeated practice, and strategies to promote immersion should be developed within a pedagogical framework that comprehensively considers learner characteristics, instructional objectives, and implementation methods. Moreover, content accessibility and ease of technology use are essential factors for establishing effective educational strategies.

CONCLUSION

This scoping review found that game-based VR programs demonstrated positive educational effects across multiple aspects of nursing education, including improvements in learners' knowledge, skill performance, self-efficacy, learning motivation, emotional engagement, and learning satisfaction. In particular, immersive and repeatable learning environments, immediate feedback, and gamified challenge-based elements were effective in promoting active participation and self-directed learning. However, most studies were limited to nursing students, and evidence regarding the applicability of these interventions in real clinical settings and their long-term effects remains insufficient. Furthermore, the effectiveness of game-based VR programs in enhancing social competencies, such as teamwork and communication skills, was verified in only a few studies, likely due to the predominance of individually structured learning formats. Future research should therefore include diverse learner groups and incorporate real-world clinical contexts to establish the broader educational and practical utility of game-based VR programs in nursing.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and design - MP and KJM; data acquisition and analysis - MP and KJM; interpretation of the findings - MP and KJM; and drafting and critical revision of the manuscript for important intellectual content - MP and KJM.

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SUPPLEMENTARY MATERIAL

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Influencing Factors of Fear of Cancer Recurrence among Adult Breast Cancer Survivors: A Cross-Sectional Study

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Purpose: This study aimed to examine the level of fear of cancer recurrence (FCR) among adult breast cancer survivors and to identify factors influencing it. **Methods:** This cross-sectional study included 104 adult breast cancer survivors who were no longer receiving active treatment. Data were collected through self-report questionnaires addressing FCR, depression, anxiety, distress, fatigue, coping with cancer, social support, subjective health status, subjective quality of life, demographic characteristics, and disease-related characteristics. Surveys were administered both face-to-face and online between March and September 2024. Data analysis was conducted using descriptive statistics, frequencies, the independent t-test, one-way analysis of variance, Pearson's correlation, and multiple regression. **Results:** The mean total FCR score was 78.83 ± 25.71 (range, 0–168), reflecting a moderate level. Among participants, 22.1% scored above the cutoff for depression, 34.6% for mild anxiety, and 27.9% for severe distress. More than 70% of participants reported fatigue. Levels of coping with cancer, social support, subjective health status, and subjective quality of life were moderate or higher. Anxiety ($\beta = .56$, $p < .001$), fatigue (≤ 34) ($\beta = .18$, $p = .019$), and subjective quality of life ($\beta = -.18$, $p = .022$) significantly influenced FCR. **Conclusion:** Ongoing assessments and tailored interventions are essential to address FCR and to promote psychological well-being in breast cancer survivors following completion of active treatment.

Key Words: Breast neoplasms; Cancer survivors; Fear; Psychological well-being; Recurrence

INTRODUCTION

Breast cancer is the most frequently diagnosed cancer among women worldwide and remains one of the leading causes of cancer-related death. In Korea, breast cancer accounted for 10.5% of all cancer cases in 2022 [1]. By age distribution, the highest proportion occurred in women in their 50s (29.8%), followed closely by those in their 40s (29.0%) [1], indicating that breast cancer is more common among middle-aged adults than older adults. In contrast to Western countries, where incidence is higher in older women, cases among younger women—particularly those in their 30s—are increasing in Korea [2]. The 5-year relative survival rate for patients diagnosed between 2018 and 2022 was 94.3%, reflecting a steady increase [3]. This rising survival rate highlights the need for long-term care and support as survivorship periods lengthen.

Fear of cancer recurrence (FCR) is defined as the fear or concern about the possibility of cancer recurrence or progression [4]. Even after completing treatment, survivors may continue to experience diverse physical and psychological symptoms. FCR is one of the most prevalent unmet needs reported by survivors [4], with prevalence estimates ranging from 49% to 82%, depending on cancer type, and with 49% to 66% experiencing moderate to severe FCR [5]. Prior research shows that FCR is influenced by demographic and disease-related factors, with women and younger survivors reporting higher levels than men and older survivors [6]. Among breast cancer survivors, younger women consistently report greater FCR than older women [7]. Compared with survivors of other cancers such as endometrial cancer, leukemia, non-Hodgkin lymphoma, and prostate cancer, breast cancer survivors tend to report higher FCR [6], suggesting that cancer type is an important determinant of severity. Younger breast cancer survivors often face heightened family and social responsibilities, which may exacerbate psychological distress and intensify FCR [8]. Thus, healthcare providers should place special emphasis on the psychological rehabilitation of younger breast cancer survivors.

Moreover, FCR has been reported to be associated with fatigue, distress, anxiety, depression, social support, coping methods, and quality of life (QOL) in cancer survivors [9-11]. The relationships between FCR and the physical and psychological symptoms experienced by survivors have been demonstrated in previous studies. Depression and anxiety in cancer survivors have been found to be positively correlated with FCR [9], and breast cancer survivors in particular have reported that higher levels of depression and anxiety are linked to increased FCR [10]. Distress and fatigue, which are among the most common symptoms experienced by breast cancer survivors, have also been positively correlated with FCR [10]. Social support and coping strategies may likewise be associated with FCR [11]. For example, one study of breast cancer survivors reported that greater social support was linked to lower FCR, and that confrontation coping could contribute to reducing FCR [11]. These findings suggest that interventions aimed at enhancing social support and strengthening coping strategies may represent effective approaches to managing FCR [11]. FCR has also been reported to have a significant negative correlation with QOL and health-related quality of life (HRQOL) [12]. As FCR increases, survivors experience greater uncertainty, heightened concern about the future, and more intense death anxiety, all of which contribute to declines in both physical and mental HRQOL [4,5]. Although many studies have identified factors associated with FCR, most investigations among breast cancer survivors have focused on only a subset of potential determinants rather than considering them comprehensively. This limitation may hinder the development of integrated interventions designed to reduce FCR in this population.

Accordingly, healthcare providers should recognize and address this concern in adult breast cancer survivors and implement appropriate interventions when needed [6]. To establish the most effective strategies for preventing and managing FCR, such as tailored psychosocial support, education, and multifactorial interventions, further research is required to examine the influencing factors of FCR and their combined effects in a comprehensive manner. Therefore, this study aimed to assess levels of FCR, depression, anxiety, distress, fatigue, coping, and social support in adult breast cancer survivors, and to identify the factors influencing FCR, with the goal of providing foundational data for psychosocial healthcare in this population.

METHODS

1. Study Design

This study employed a cross-sectional design to identify factors influencing FCR among adult breast cancer survivors. This study was conducted and reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

2. Setting and Participants

Participants were 104 female breast cancer survivors recruited through convenience sampling. All were no longer undergoing active cancer treatment and were receiving follow-up care at the outpatient clinic of a tertiary hospital in Cheonan, Korea. The inclusion criteria were (1) breast cancer survivors aged 19 to 64 years; (2) not currently undergoing active cancer treatment; and (3) ability to understand the study procedures and voluntarily provide written informed consent. The exclusion criteria were: (1) diagnosis of breast cancer at stage IV; (2) currently undergoing active treatment; (3) evidence of cancer recurrence or progression at the time of study enrollment; (4) diagnosis of cancer before the age of 19 years; and (5) diagnosis of psychological or psychiatric disorders.

The sample size was determined using multiple regression with seven predictors identified from prior literature (age, depression, anxiety, distress, fatigue, coping with cancer, and social support). Based on a medium effect size

(Cohen's $f^2=0.15$), a significance level of .05, and a power of 0.80, the required sample size was calculated as 103 using G*Power version 3.1.9.7. To account for an anticipated 5% dropout rate, 108 participants were initially recruited.

Of the 108 breast cancer survivors who consented to participate, four were excluded: one did not meet the age criterion (≥65 years), and three submitted questionnaires with substantial missing data. Thus, 104 participants were included in the final analysis.

3. Measurements

The authors obtained permission from the developers to use the following instruments: the Korean version of the Fear of Cancer Recurrence Inventory (K-FCRI), the Functional Assessment of Chronic Illness Therapy–Fatigue scale (FACIT-Fatigue), the Korean version of the Cancer Coping Questionnaire (K-CCQ), and the Multidimensional Scale of Perceived Social Support (MSPSS).

The Patient Health Questionnaire-9 (PHQ-9), the Generalized Anxiety Disorder-7 (GAD-7), and the Distress Thermometer (DT) were freely available for non-commercial use without prior permission.

1) Fear of cancer recurrence

FCR was measured using the K-FCRI, originally developed by Simard and Savard (2009) [13] and translated into Korean by Jung et al. (2024) [14]. This 42-item instrument is rated on a 5-point Likert scale (0 = not at all/never, 1 = a little, 2 = somewhat, 3 = a lot, 4 = a great deal/all the time). Scores range from 0 to 168, with higher values indicating greater FCR. The scale comprises seven subscales: triggers (8 items), severity (9 items), psychological distress (4 items), coping strategies (9 items), functioning impairments (6 items), insight (3 items), and reassurance (3 items). Cronbach's α was .95 in the original study [13], .85 in Jung et al. (2024) [14], and .94 in the present study.

2) Depression

Depression was assessed with the PHQ-9, developed by Kroenke et al. (2001) [15] and translated into Korean by Park et al. (2010) [16]. The PHQ-9 has shown good validity for detecting depression in cancer patients [17]. It consists of nine items rated on a 4-point Likert scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Total scores range from 0 to 27, with higher scores reflecting greater depressive symptoms. Cutoff scores of 5, 10, 15, and 20 correspond to mild, moderate, moderately severe, and severe depression, respectively [15]. Based on the validation studies conducted by Kroenke et al. [15] in primary care and obstetrics-gynecology settings, a cutoff score of ≥10 was used to identify major depressive disorder. Cronbach's α was reported as .86–.89 in the original article [15], .81 in Park et al. (2010) [16], and .91 in the present study.

3) Anxiety

Anxiety was assessed using the GAD-7, developed by Spitzer et al. (2006) [18] and translated into Korean by Seo and Park (2015) [19]. This tool has been validated for screening GAD in cancer patients [20]. The instrument contains seven items rated on a 4-point Likert scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day), yielding a total score ranging from 0 to 21, with higher scores indicating greater anxiety severity. Scores of 5–9 reflect mild anxiety, 10–14 indicate moderate anxiety, and ≥15 represent severe anxiety [18]. Cronbach's α values were .92 in the original study [18], .915 in Seo and Park (2015) [19], and .94 in this study.

4) Distress

Distress was assessed using the DT, developed by the National Comprehensive Cancer Network. This tool is a visual analog scale ranging from 0 (no distress) to 10 (extreme distress). A score of 4 or below indicates mild distress, whereas a score of 4 or higher reflects severe or greater levels of distress [21].

5) Fatigue

Fatigue was measured using the FACIT-Fatigue scale, developed by Yellen et al. (1997) [22] and translated into Korean by Lee and Kim (2022) [23]. This 13-item instrument was originally designed to assess fatigue associated with anemia in cancer patients. It employs a 5-point Likert scale (0 = not at all, 1 = a little bit, 2 = somewhat, 3 = quite a bit, 4 = very much), producing scores ranging from 0 to 52, with higher scores indicating less fatigue. A cutoff score of 34, identified in a study of adults with sickle cell disease [24], was used to classify clinically significant fatigue, with scores ≤34 indicating fatigue and >34 indicating its absence. Cronbach's α values were reported as .93–.95 in the original study [22], .93 in Lee and Kim (2022) [23], and .95 in this study.

6) Coping with cancer

Coping with cancer was evaluated using the K-CCQ, originally developed by Moorey et al. (2003) [25] and later translated and modified into Korean by Kim et al. (2004) [26]. This 23-item instrument is scored on a 4-point Likert scale (1 = not at all, 2 = sometimes, 3 = often, 4 = very often), with total scores ranging from 23 to 92; higher scores indicate greater coping. The scale includes two subscales: intrapersonal coping (14 items) and interpersonal coping (9 items). Intrapersonal coping reflects self-management of cancer and comprises positive reframing (6 items), coping (5 items), and planning (3 items). Interpersonal coping reflects coping through interactions with close others. Cronbach's α values were .82–.87 in the original article [25], .88–.90 in Kim et al. (2004) [26], and .93 in this study.

7) Social support

Social support was assessed using the MSPSS, developed by Zimet et al. (1988) [27] and translated into Korean by Park et al. (2012) [28]. Originally created for the general population, including adolescents [27], the MSPSS has been widely applied across populations, including Korean women with breast cancer, where it demonstrated validity and reliability [29]. This 12-item instrument is scored on a 7-point Likert scale (1 = very strongly disagree to 7 = very strongly agree), with total scores ranging from 12 to 84, where higher scores indicate greater perceived support. The scale consists of three subscales: family (4 items), friends (4 items), and significant other (4 items). Cronbach's α values were .85 in the original article [27], .90 in Park et al. (2012) [28], and .95 in this study.

8) Subjective health status and subjective quality of life

Subjective health status and QOL were each assessed with a single item rated on a numeric scale from 1 (very bad) to 7 (very good), referring to the previous week. Higher scores indicated better health status and QOL.

9) Demographic and disease-related characteristics

Participants provided data on age, educational level, marital status (spouse), number of children, employment status, monthly family income, religion, and cancer-related information. The latter included cancer stage, time since diagnosis, duration of active treatment, type of treatment received, history of cancer progression or recurrence, and family history of cancer.

4. Data Collection

Data were collected from March to September 2024 through face-to-face surveys (n = 65) and online surveys (n = 39). At the outpatient clinic of a tertiary hospital, the researcher introduced the study to potential participants during follow-up visits and distributed a recruitment notice, explaining the purpose, procedures, and confidentiality measures. Those who provided informed consent were enrolled. For face-to-face participation, written consent was obtained before administering the paper-based questionnaire. For participants preferring online participation, consent was obtained verbally, and a Google survey link was sent via text message. Participants accessed the link, provided electronic consent, and completed the online questionnaire. All participants were informed of their right to refuse or withdraw at any time without consequences for their medical care.

5. Ethical Consideration

This study was approved by the Institutional Review Board (IRB) of Konyang University (IRB No. KYU-2023-11-037-001). Written informed consent was obtained from all participants. The study was conducted in accordance with the Declaration of Helsinki, and all personal information was kept confidential.

6. Data Analysis

Data were analyzed using IBM SPSS ver. 28.0 for Windows (IBM Corp., Armonk, NY, USA). Descriptive statistics and frequencies were used to summarize demographic and disease-related characteristics, as well as FCR, depression, anxiety, distress, fatigue, coping with cancer, social support, subjective health status, and subjective QOL. The independent t-test and one-way analysis of variance were conducted to examine differences in FCR levels by participant characteristics. Also, Pearson's correlation was used to assess relationships among FCR, depression, anxiety, distress, fatigue, coping with cancer, social support, subjective health status, and subjective QOL. Finally, multiple regression analysis with a stepwise method was applied to identify factors influencing FCR.

RESULTS

1. Demographic and Disease-Related Characteristics of Participants

Table 1 summarizes participants' characteristics. The mean age was 49.70±6.52 years, and all participants were women. A total of 68 participants (65.4%) had a high school education or lower, 88 participants (84.6%) had spouses, and 91 participants (87.5%) had children. About half of the participants (51.0%) were employed, while 49 participants (47.1%) reported a monthly family income of US dollar 3,500 or more. Approximately half of the participants identified as religious.

Forty-four participants (42.3%) were in stage I, 44 (42.3%) in stage II, and the remainder were in stage III. The average time since diagnosis was 41.82±32.00 months, and the mean duration of active treatment was 10.74±19.08 months. All participants underwent surgery for breast cancer; 93 participants (89.4%) received radiotherapy, 82 (78.8%) received hormone therapy, and 75 (72.1%) underwent chemotherapy. Only five participants (4.8%) reported cancer progression or recurrence. More than half (53.8%) indicated a family history of cancer.

2. Levels of Main Variables

Table 2 presents the levels of the main variables, includ-

Table 1. Demographic and Disease-Related Characteristics (*N*=104)

Characteristics	Categories	M±SD (range) or n (%)
Demographic characteristics		
Age (year)		49.70±6.52 (33–64)
Educational level	≤High school	68 (65.4)
	≥University	36 (34.6)
Spouse	Yes	88 (84.6)
	No	16 (15.4)
Children	Yes	91 (87.5)
	No	13 (12.5)
Employment status	Employed	53 (51.0)
	Unemployed/sick leave	51 (49.0)
Monthly family income (USD)	<2,000	19 (18.3)
	≥2,000 to <3,500	36 (34.6)
	≥3,500	49 (47.1)
Religion	Yes	52 (50.0)
	No	52 (50.0)
Disease-related characteristics		
Stages	I	44 (42.3)
	II	44 (42.3)
	III	16 (15.4)
Time since diagnosis (month)		41.82±32.00 (2–152)
Duration of active treatment (month)		10.74±19.08 (1–126)
Type of treatment†	Operation	104 (100)
	Chemotherapy	75 (72.1)
	Radiotherapy	93 (89.4)
	Targeted therapy	15 (14.4)
	Immunotherapy	4 (3.8)
	Hormone therapy	82 (78.8)
Cancer progression or recurrence	Yes	5 (4.8)
	No	99 (95.2)
Family history of cancer	Yes	56 (53.8)
	No	48 (46.2)

M=mean; SD=standard deviation; USD=US dollar; †Multiple responses.

Table 2. Levels of Fear of Cancer Recurrence, Depression, Anxiety, Distress, Fatigue, Coping with Cancer, and Social Support (*N*=104)

Variables (score range)	M±SD or n (%)
Fear of cancer recurrence (0–168)	78.83±25.71
Triggers (0–32)	19.63±7.03
Severity (0–36)	17.86±7.91
Psychological distress (0–16)	6.88±4.36
Coping strategies (0–36)	21.35±6.24
Functioning impairments (0–24)	6.17±5.54
Insight (0–12)	2.86±2.93
Reassurance (0–12)	4.09±2.96
Depression (0–27)	5.52±5.70
<10	81 (77.9)
≥10	23 (22.1)
Anxiety (0–21)	4.12±4.69
≤4	68 (65.4)
5–9	23 (22.1)
10–14	9 (8.7)
≥15	4 (3.8)
Distress (0–10)	2.70±2.50
≤4	75 (72.1)
>4	29 (27.9)
Fatigue (0–52)	23.38±15.31
≤34	76 (73.1)
≥35	28 (26.9)
Coping with cancer (23–92)	54.63±12.76
Intrapersonal (4–56)	34.85±8.41
Positive reframing (6–24)	16.75±3.90
Coping (5–20)	11.13±3.31
Planning (3–12)	6.97±2.34
Interpersonal (9–36)	19.78±6.92
Social support (12–84)	60.28±19.47
Family (0–28)	21.60±7.08
Friends (0–28)	19.15±7.09
Significant other (0–28)	19.53±7.69
Subjective health status (1–7)	4.85±1.30
Subjective QOL (1–7)	5.05±1.24

M=mean; QOL=quality of life; SD=standard deviation.

ing subscales and cutoff-based distributions. The mean FCR score was 78.83±25.71, indicating a moderate level. Among the seven FCR subscales, triggers, severity, and coping strategies were at moderate or higher levels. The mean depression score was 5.52±5.70, with 23 participants (22.1%) scoring ≥10, indicating moderate to severe depression. The mean anxiety score was 4.12±4.69; while 68 participants (65.4%) scored 4 or lower, 36 participants (34.6%) were classified as having anxiety, including 13 (12.5%) with moderate to severe anxiety. The mean distress score was 2.70±2.50, and 76 participants (73.1%) reported fatigue. The mean coping with cancer score was 54.63±12.76, and the mean social support score was 60.28±19.47. Among the social support subscales, family support scored higher than support from friends or significant others. The average subjective health status (4.85±1.30) and subjective QOL (5.05±1.24) were at moderate levels.

3. Differences in Fear of Cancer Recurrence Based on Participants' Characteristics

FCR levels did not differ significantly by participants' demographic or disease-related characteristics. Because the distributions of subgroups were severely unbalanced for marital status, presence of children, and cancer progression or recurrence, these variables were not included in the analysis.

4. Correlations between Main Variables

Table 3 shows correlations among FCR, depression, anxiety, distress, fatigue, coping with cancer, social support, subjective health status, and subjective QOL. FCR was positively correlated with depression (r=.59, p<.001), anxiety (r=.63, p<.001), and distress (r=.54, p<.001). Negative correlations were found with social support (r=–.25, p=.012), subjective health status (r=–.38, p<.001), and subjective QOL (r=–.36, p<.001). No significant correlations were observed between FCR and either fatigue or coping with cancer.

5. Factors Influencing Fear of Cancer Recurrence

Stepwise multiple regression analysis was conducted to identify predictors of FCR, including depression, anxiety, distress, fatigue (≤34), social support, subjective health status, and subjective QOL. Although fatigue was not significantly correlated with FCR in Pearson's correlation analysis, a significant difference in FCR was observed between participants above and below the fatigue cutoff (t=–2.11, p=.038). Therefore, fatigue was included in the regression as a categorical variable (1=fatigue ≤34; 0=fatigue >34). Regression assumptions of normality, independence, and homogeneity of variance were verified through residual analysis. The residual scatterplot was symmetrically distributed around zero without trends, and the Q-Q plot closely approximated a straight line.

The final model explained 43.3% of the variance in FCR.

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Table 3. Correlations between Variables ($N = 104$)

Variables	r (p)								
	FCR	Depression	Anxiety	Distress	Fatigue	Coping with cancer	Social support	Subjective health status	Subjective QOL
FCR	1								
Depression	.59 (<.001)	1							
Anxiety	.63 (<.001)	.81 (<.001)	1						
Distress	.54 (<.001)	.68 (<.001)	.67 (<.001)	1					
Fatigue	.09 (.349)	.25 (.012)	.21 (.034)	.19 (.110)	1				
Coping with cancer	.14 (.147)	.05 (.658)	.08 (.397)	.07 (.499)	.08 (.436)	1			
Social support	–.25 (.012)	–.29 (.003)	–.41 (<.001)	–.33 (.001)	–.08 (.436)	.05 (.598)	1		
Subjective health status	–.38 (<.001)	–.38 (<.001)	–.39 (<.001)	–.56 (<.001)	–.01 (.957)	–.02 (.836)	.31 (.001)	1	
Subjective QOL	–.36 (<.001)	–.37 (<.001)	–.33 (.001)	–.55 (<.001)	–.161 (.103)	.01 (.902)	.35 (<.001)	.82 (<.001)	1

FCR = fear of cancer recurrence; QOL = quality of life.

Anxiety (standardized [std.] $\beta = .56$, $p < .001$), fatigue ≤34 (std. $\beta = .18$, $p = .019$), and subjective QOL (std. $\beta = -.18$, $p = .022$) were significant predictors. Specifically, participants with higher anxiety had higher FCR, those with fatigue scores ≤34 had higher FCR than those with scores >34, and participants reporting higher subjective QOL had lower FCR (Table 4).

DISCUSSION

This study investigated the level of FCR among Korean breast cancer survivors and identified factors associated with it. The findings demonstrated that anxiety, fatigue, and subjective QOL were significant predictors of FCR in this population.

Participants in this study reported moderate levels of FCR. A study of 93 Korean cancer survivors also found moderate FCR levels [30], and research with early-stage breast cancer survivors in Norway reported moderate to high FCR levels [7]. These findings align with the current results and highlight the importance of sustained attention to FCR across diverse populations. In contrast, a study conducted in a survivorship clinic at a comprehensive National Cancer Institute–designated center reported that 59.7% of participants expressed clinical needs related to FCR, but those needs were perceived as adequately met [31]. Given such inconsistent findings, further research is warranted to clarify whether FCR levels differ according to cancer type or demographic characteristics.

Although overall depression, anxiety, and distress scores were relatively low in this study, a proportion of participants exceeded clinical cutoff thresholds, underscoring the importance of ongoing monitoring and intervention by healthcare professionals. A cohort study examining long-term psychological distress among breast cancer survivors found that, compared to women in the general population, survivors experienced higher rates of depression and anxiety for at least 10 years after diagnosis [32]. Moreover, each one-point increase in distress score was associated with a 32% increase in the odds of identifying FCR as an unmet clinical need [31]. Because breast cancer has relatively high survival rates compared to other cancers, psychological symptoms in long-term survivors, especially those under extended follow-up after surgery, may be underestimated or overlooked. These findings emphasize the need for healthcare providers to conduct regular assessments of psychological well-being and to identify survivors who require professional psychological support.

Anxiety was the strongest predictor of FCR in this study, consistent with prior research [7]. A systematic review of interventions for FCR among breast cancer survivors reported that cognitive behavioral therapy (CBT), mindfulness-based interventions, acceptance and commitment therapy, and Managing Cancer and Living Meaningfully (CALM) are effective for reducing FCR [33]. As these interventions are also effective in alleviating anxiety, they may be particularly well suited for the integrated management of both anxiety and FCR. Programs such as CBT, CALM, and structured education can incorporate coping skills and emotional regulation strategies, demonstrating potential for sustainable long-term benefits [33]. These interventions should be considered as viable options for long-term FCR

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Table 4. Factors Influencing Fear of Cancer Recurrence ($N=104$)

Variables	β	SE	Std. β	t (*p*)	R^2	Adjusted R^2	F (*p*)
Constant	77.99	9.53		8.19 (< .001)	.449	.433	27.18 (< .001)
Anxiety	3.04	0.43	.56	7.05 (< .001)			
Fatigue (≤34)	10.22	4.29	.18	2.38 (.019)			
Subjective QOL	–3.79	1.63	-.18	–2.33 (.022)			

Durbin-Watson: 2.141, tolerance: 0.889–0.995, VIF: 1.005–1.125.
QOL = quality of life; SE = standard error; Std. = standardized; VIF = variance inflation factor.

management.

Although depression and distress correlated with FCR, they were not significant predictors in this study, a finding inconsistent with some prior studies [12]. This discrepancy may be explained by the relatively low levels of depression and distress reported by participants. Larger-scale and repeated studies are needed to clarify these relationships.

Subjective QOL was also identified as a significant factor influencing FCR. A study of long-term breast cancer survivors in Korea reported that higher FCR was associated with poorer HRQOL [12]. Similar associations between QOL and FCR have been reported across various cancer survivor populations [4]. Numerous interventions have been developed to improve cancer survivors' QOL, and given its close association with FCR, long-term and continuous interventions that simultaneously target QOL enhancement and FCR reduction should be prioritized.

In this study, nearly three times as many participants reported experiencing fatigue compared to those who did not, and fatigue emerged as a significant predictor of FCR. Fatigue is among the most common and persistent symptoms in breast cancer survivors following treatment. Prior studies confirm that fatigue often persists long after treatment and can significantly impair QOL [34]. Therefore, targeted fatigue management should be a priority in survivorship care. Rather than considering fatigue an inevitable post-treatment symptom, healthcare providers should evaluate its contributing factors and implement appropriate interventions to reduce its burden.

In this study, social support was not identified as a significant factor influencing FCR, although a significant correlation between the two variables was observed. Many previous studies have emphasized the importance of social support in managing FCR among cancer survivors, including breast cancer survivors [11,35]. The relatively high level of perceived social support in this study, combined with the fact that participants were exclusively adults and most had a spouse and children, may explain the inconsistent findings regarding its influence. Further research is needed to clarify the role of social support in relation to FCR.

Previous research has also reported significant associations between coping and FCR [11]. However, this study did not identify coping as a significant factor. Although the CCQ—originally developed for general cancer patients and found to be reliable among breast cancer survivors—was used, the discrepancy may stem from differences in instruments. Therefore, future studies using coping measures specifically designed for breast cancer survivors are recommended.

This study has several limitations. First, convenience sampling was conducted at a tertiary hospital, and participants were primarily adult breast cancer survivors diagnosed at Stages I and II who underwent surgical treatment. As such, the generalizability of the findings is limited. Large-scale studies that enhance external validity, along with qualitative research exploring FCR in greater depth, are needed to strengthen the evidence base. Second, the cross-sectional design precluded examination of changes in FCR over time. Longitudinal studies are recommended to assess the trajectory of FCR after completion of active treatment and to identify its determinants among Korean breast cancer survivors. Such work would provide essential evidence for developing tailored interventions to mitigate FCR. Finally, data were collected using both paper-based and online surveys. Because responses to identical questions may vary by survey mode, caution is warranted when interpreting the findings.

CONCLUSION

This study identified factors influencing FCR in adult breast cancer survivors, providing fundamental data for the development of tailored consultations and interventions. Participants reported moderate levels of FCR, and a subset exhibited clinically significant psychological symptoms that may require professional intervention. Anxiety, fatigue, and subjective QOL were significant predictors of FCR. Healthcare providers should continue to monitor psychological symptoms, including FCR, in breast cancer survivors even after the completion of active treatment. Accurate identification of survivors requiring clinical support is crucial, as is the development of targeted nursing interventions aimed at reducing FCR and promoting psychological well-being. Interventions that consider the identified influencing factors are expected to alleviate the burden on healthcare providers while addressing the growing needs of the increasing population of adult breast cancer survivors.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and/or design acquisition - KL; acquisition of data - EJP; analysis - KL; interpretation of the data - KL; and drafting or critical revision of the manuscript for important intellectual content- KL, EJP, and JOC.

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DATA AVAILABILITY STATEMENT

The data can be obtained from the corresponding authors.

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Effects of a Therapeutic Communication Program Based on King's Goal Attainment Theory for Nurses in a Hematological Oncology Ward: A Non-equivalent Control Group Pretest–Posttest Study

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Purpose: This study aimed to develop and evaluate the effectiveness of a therapeutic communication program based on King's goal attainment theory, specifically designed for nurses providing care to patients with hematological oncology in a tertiary hospital setting. **Methods:** A non-equivalent control group design was employed, involving 59 nurses (intervention group: 29, control group: 30) with experience in hematological cancer care. The therapeutic communication program, developed according to the theoretical constructs of King's theory, consisted of eight weekly sessions. Outcome variables included problem-solving ability, communication self-efficacy, and interaction satisfaction. The effects of the intervention were analyzed using the independent- and paired-samples t-test as well as a Wilcoxon signed-rank test. **Results:** In between-group comparisons of pre–post changes, communication self-efficacy increased significantly more in the intervention group than in the control group ($p = .027$). However, no significant between-group differences were found for problem-solving ability or interaction satisfaction. These findings suggest that the program effectively enhances therapeutic communication competencies among nurses in hematological oncology wards. **Conclusion:** The therapeutic communication program significantly improved problem-solving ability, communication self-efficacy, and interaction satisfaction among nurses in the intervention group within the hematological oncology ward. This theory-based intervention provides an evidence-based framework for strengthening clinical nursing practice and education.

Key Words: Health communication; Hematologic neoplasms; Patient satisfaction; Self efficacy; Therapeutics

INTRODUCTION

Therapeutic communication refers to the process of interaction between nurses and patients aimed at achieving health-related goals, encompassing both verbal and non-verbal communication [1]. This form of communication is essential for establishing trust, providing emotional support and stability, and contributing to the professional growth of nurses [2]. Effective communication skills are especially critical in high-risk, high-stress environments where nurses carry substantial responsibility [3]. However, the coronavirus disease 2019 pandemic has introduced additional obstacles to therapeutic communication, such as mask-related barriers and increased workload demands [4].

In Korea, the incidence rates of blood cancers—including lymphoma, leukemia, and multiple myeloma—rose substantially by 39.60%, 27.68%, and 43.56%, respectively, in 2020 compared to 2010 [5]. Despite this increase, research focusing on patients with blood cancer undergoing chemotherapy remains limited in the Korean context [6]. Patients diagnosed with hematological malignancies frequently experience a heavy burden of physical and psychological symptoms—such as pain, mucositis, dyspnea, fatigue, nausea, constipation, and diarrhea—that can be as severe as, or even greater than, those faced by patients with advanced solid tumors [7]. These patients require effective two-way communication regarding treatment plans and disease progression [8]. Yet, existing therapeutic communication strategies are primarily designed to help healthcare providers in planning patient management [9]. Therefore, a two-way therapeutic communication method that aligns with the needs of blood cancer patients is required. In a study by Abdellah Othman et al. [10], nurses' knowledge, skills, and service quality were significantly enhanced through a therapeutic communication program consisting of assessment, planning, implementation, and evaluation phases. Nonetheless, patients in clinical settings frequently express dissatisfaction with communication, often attributing this to a lack of empathy and caring behaviors from healthcare personnel [2]. Accordingly, therapeutic communication between patients and nurses remains a critical component of patient-centered care [4]. In this study, nursing goals were established through a therapeutic communication program applying King's goal attainment theory, with a focus on interaction with researchers to achieve those goals.

Existing therapeutic communication strategies have been developed primarily to improve patient outcomes by addressing emotional and informational needs. However, limited research has examined strategies for enhancing the therapeutic communication abilities of nurses while simultaneously fostering mutual communication between patients and nurses [9]. Studies have shown that nurses' therapeutic communication skills are closely associated with patients' trust and satisfaction. When nurses are able to accurately assess patient needs and intervene appropriately, trust within the nurse-patient relationship is strengthened [11].

Furthermore, providing high-quality, person-centered care not only enhances nurses' self-efficacy but also increases job satisfaction [12]. Although research has examined therapeutic communication skills for nurses, including general nursing communication models [1] and those specific to psychiatric nursing [13], a significant gap remains in the development and evaluation of structured communication programs specifically tailored to the emotionally complex and clinically demanding environments of hematological oncology wards. A study applying Hildegard Peplau's Interpersonal Nursing Theory to therapeutic communication emphasized key components such as empathy, trust, rapport, and the sub-factors of power-sharing [14]. Because therapeutic communication is inherently grounded in interaction, the use of King's goal attainment theory may play a pivotal role in strengthening nurses' therapeutic communication skills.

King's goal attainment theory emphasizes collaboration between nurses and patients to achieve health goals through mutual interaction, serving as the theoretical foundation for this study. The theory involves problem assessment, goal setting, and agreement on the means to achieve those goals through continuous interaction [15]. The primary nursing objective under goal attainment theory is to ensure that nurses and patients identify problems and disabilities together, establish mutual goals, and work collaboratively to reach the final outcome through ongoing interaction [16]. Prior applications of the theory have included group counseling and fall prevention programs [16,17]. However, to date, no intervention studies have applied the theory specifically to therapeutic communication programs for nurses in hematological oncology wards. Moreover, patients with hematological cancers often face prolonged, cyclical treatment regimens and unpredictable disease progression, which necessitate that nurses adopt adaptive and empathetic communication strategies grounded in both theory and clinical practice.

Accordingly, this study aims to develop a therapeutic communication program for nurses caring for patients with hematological cancer, based on King's goal attainment theory. In addition to verifying the effectiveness of the intervention, the study seeks to establish its feasibility for clinical application and to explore its potential integration into in-service training and nursing education curricula as a sustainable, evidence-based communication model.

This study aimed to develop and evaluate the effectiveness of a therapeutic communication program based on King's goal attainment theory for nurses working in hematological oncology wards.

We hypothesize that the scores for problem-solving ability (H1), communication self-efficacy (H2), and interaction satisfaction (H3) will change more in the intervention group than in the control group.

METHODS

1. Study Design

This study employed a non-equivalent control group design to develop and evaluate the effectiveness of a therapeutic communication program for nurses caring for patients with hematological cancer. The intervention was designed based on the theoretical framework of King's goal attainment theory, which emphasizes mutual goal setting and interaction between nurses and patients. This study was reported in accordance with the TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) statement.

2. Study Participants

Participants were recruited from the Catholic University of Korea, Seoul St. Mary's Hospital, a tertiary hospital in Seoul. Eligible participants were nurses with clinical experience in hematological oncology care who voluntarily agreed to participate. The inclusion criteria were: (1) registered nurses with at least six months of clinical experience, (2) experience providing care for patients with hematological malignancies, (3) no prior participation in communication training programs, and (4) understanding of the study purpose and provision of written informed consent.

Several measures were taken to minimize contamination due to non-random assignment. The control group was selected from a different floor to reduce interaction with the intervention group. Both groups were separated in terms of medical facility environment and nursing education to limit overlap. In addition, their schedules were adjusted to prevent cross-group interaction. Each group was assigned a dedicated researcher to ensure independent management. Representative nurses from the two floors were randomly selected by lottery and assigned to the intervention or control group. Data collection and analysis for each group were conducted independently to prevent potential influence between groups.

The required sample size was calculated using G*Power 3.1.9.7. Based on a prior study [18], the calculated effect size (ES) was .80, the significance level was set at .05, and the statistical power at .80. An independent two-tailed t-test indicated that at least 52 participants (26 per group) were required. To account for a 10% dropout rate, 60 participants were initially recruited (30 per group). However, one participant from the intervention group withdrew, resulting in a final sample of 59 participants (29 in the intervention group and 30 in the control group) (Figure 1).

3. Measurements

1) Problem-solving ability

Nurses' problem-solving ability was measured using a tool developed by Heppner and Petersen [19] and translat-

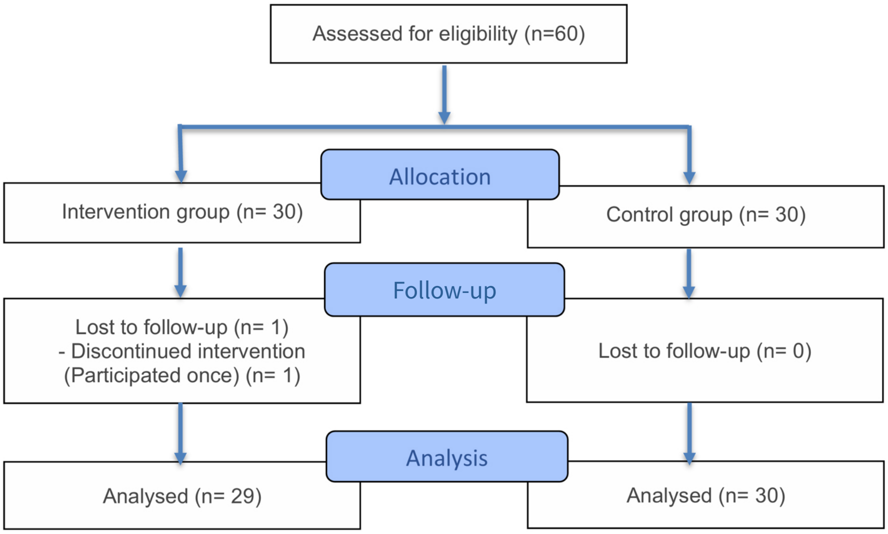

Figure 1. Flow chart of the study.

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ed by Chun [20]. The tool consisted of 21 items scored on a 5-point Likert scale, ranging from 1 (“not at all”) to 5 (“very much so”). Higher scores indicated greater problem-solving ability. The internal consistency reliability (Cronbach’s α) was .89 in the original study, .90 in Chun’s [20] study, and .82 in the present study.

2) Communication self-efficacy

Communication self-efficacy was measured using the Counseling Self-Estimate Inventory (COSE) developed by Larson et al. [21] and adapted by Hong and Choi [22]. The version used in this study was further modified and validated for nurses by Park et al. [23]. It consisted of 37 items scored on a 6-point Likert scale, ranging from 1 (“not at all”) to 6 (“very much so”). Higher scores indicated greater communication self-efficacy. Cronbach’s α was .93 in the original study, .74 in Park et al.’s study [23], and .91 in this study.

3) Interaction satisfaction

Interaction satisfaction was assessed using a tool modified and supplemented from Lim’s [24] study and later used in Kim’s [25] research. The tool contained nine items measured on a 5-point Likert scale, ranging from 1 (“not at all”) to 5 (“very much so”). Higher scores indicated greater satisfaction with interpersonal interactions. Cronbach’s α was .87 in Kim’s [25] study and .86 in this study.

4. Therapeutic Communication Program Based on King's Goal Attainment Theory

1) Contents of the therapeutic communication program

The therapeutic communication program was developed based on King’s goal attainment theory and structured according to the processes of problem assessment, goal setting, composition, and interaction (Table 1). A prior qualitative study on therapeutic communication among nurses in a hematological oncology ward [26] confirmed the need for such a program. As a result, problem-solving ability, communication self-efficacy, and interaction satisfaction were selected as outcome variables. Literature on human understanding and communication [27], along with studies on therapeutic communication [2,10,28], was reviewed to develop program content and case examples. Group activities consisted of lectures, discussions, and sharing of experiences, while individual activities included emotional support and encouragement through in-hospital group

Table 1. Therapeutic Communication Program Based on King’s Goal Attainment Theory

Procedure	Theme	Goal	Transaction	Contents	Time (min)
Problem assessment and mutual goal setting	Introduction and mutual goal setting	Check the problem and goal setting	Individual	Introduction and schedule of the TC program	20
				Identification of TC problems experienced by nurses	
			Group	Exchange of opinions among researchers and nurses about TC problems, and mutual goal setting	40
				Sharing difficulties and concerns about TC and encouragement of continued participation in the program	
Composition (researcher, nurse) and interaction	Understanding and improving TC	Understand and practice the TC	Individual	Encouragement of continued participation in TC programs and in-house messaging	20
				Peer support for therapeutic communication	
			Group	Education through TC pamphlet 1) The concept of TC, obstacles, and precautions 2) Communication in nursing settings: patients, older adults, and families 3) Types of therapeutic communication: accepting, inducing, clarifying, encouraging, encouraging explanation, encouraging expression of feelings, exploring, focusing, planning actions, leading, informing, building awareness, observe, silence, offer cooperation, summarize, restate, check information	40

(Continued on the next page)

Table 1. Continued

Procedure	Theme	Goal	Transaction	Contents	Time (min)
				4) Examples of therapeutic communication contexts: ① TC with uncooperative patients before starting chemotherapy ② TC with patients hospitalized after the first diagnosis of hematological cancer ③ TC for patients with high anxiety after first diagnosis ④ TC with an end-of-life blood cancer patient ⑤ Communication with black consumers ⑥ Communication with the patient after surgery 5) Problem-solving skills: problem identification and definition, problem analysis, solution development, best solution analysis and selection, implementation, and evaluation 6) Communication self-efficacy: definition, checklist for improving self-efficacy, role play by situation Sharing the experience of therapeutic communication Discussing therapeutic communication response strategies for each situation	
Composition (researcher, nurse) and interaction	Understanding and improving TC	Understand and practice the TC	Individual	Encouragement for continued participation in TC Programs and in-house messaging Experiences of peer support for TC in the past week	20
			Group	Sharing difficulties with TC experienced in the past week Delivery of feedback on TC experience by situation	40
Composition (researcher, nurse) and interaction	Improving interaction satisfaction	Check the TC problem	Individual	Encouragement for continued participation in the TC program and sending in-house messaging The field of peer support experienced last week. Checking for disadvantages	10
			Group	Identification of individual problems in TC experienced Delivery of feedback for TC by situation	50
Composition (researcher, nurse) and interaction	Improving interaction satisfaction	Improvement of therapeutic communication ability through interaction	Individual	Mutual satisfaction education in TC 1) Checking items for emotional exchange, interaction process, and mutual satisfaction Education and internal messaging on the importance of interaction for TC	10
			Group	Sharing experiences of interaction in TC Training TC using the 5A level 1) Ask: the researcher proceeds with questions about TC to the nurse 2) Advise: brief information about the TC skills of nurses and individualized advice 3) Assess: identification of personal characteristics for TC 4) Assist: provides assurance and support for action for TC 5) Arrange: support and encouragement to maintain TC	50

(Continued on the next page)

Table 1. Continued

Procedure	Theme	Goal	Transaction	Contents	Time (min)
Composition (researcher, nurse) and interaction	Improving interaction satisfaction	Improvement of therapeutic communication ability through interaction	Individual	Encouragement for continued participation in the TC program and sending in-house messaging Counseling and encouragement about the interaction difficulties experienced in the past week	20
			Group	Delivering feedback on interactive experiences in TC Sharing experience of TC ability and delivering feedback using 5A level	40
Composition (researcher, nurse) and interaction	Improving TC skills	Improvement of skill practice TC through individual	Group	Comparison of TC behaviors that are well implemented and those that are not Sharing opinions to improve TC skills and mutual satisfaction Expression of opinions where peer support is needed to improve TC	60
	Continuing TC skills	Improvement of skill practice TC through individual	Group	Checking the goals set through the TC program Identification of problems and obstacles Reminder of the importance of nurse-patient interaction even after the study is over Encouragement to continue TC	60

TC = therapeutic communication.

messages. A therapeutic communication pamphlet was developed by one professor from the Department of Nursing, two head nurses, and four nurses with more than 10 years of experience. Content validity was assessed and confirmed.

The first session focused on "problem assessment and goal setting." The researcher introduced the therapeutic communication program and schedule and identified communication problems experienced by nurses. From the second to seventh sessions, nurses and researchers engaged in interactive activities. Specifically, the second and third sessions focused on "understanding and improving therapeutic communication." These sessions included education, experience sharing using pamphlets, and discussions on response strategies for various situations. They also incorporated peer support, encouragement, and internal messages to promote continued participation. The fourth and fifth sessions addressed "Improving interaction satisfaction," consisting of lectures and educational sessions on mutual satisfaction and shared interaction experiences. In the fifth session, the 5A clinical counseling framework (Ask–Advise–Assess–Assist–Arrange) [29] was applied. The sixth session provided feedback on interaction experiences and included discussion of applying the 5A steps. The seventh session focused on "improvement of therapeutic communication ability." Nurses practiced therapeutic communication behaviors, compared outcomes, and shared opinions to enhance mutual satisfaction. Peer support needs were also discussed. The eighth session centered on "continuation of actions to improve therapeutic communication ability." Goals were reviewed, and obstacles were identified (Table 1).

2) Program implementation and progress

The study was conducted over eight weeks, from October 2022 to December 2022. Surveys were administered before and after the eight-week program.

A conceptual framework based on King's goal attainment theory was established to evaluate the effectiveness of the therapeutic communication program among nurses caring for patients with hematological cancer (Figure 2).

The program emphasized mutual decision-making between the researcher and participants, reflecting the interactive nature of King's theory. Its objectives were to enhance problem-solving ability, communication self-efficacy, and interaction satisfaction.

The therapeutic communication program was conduct-

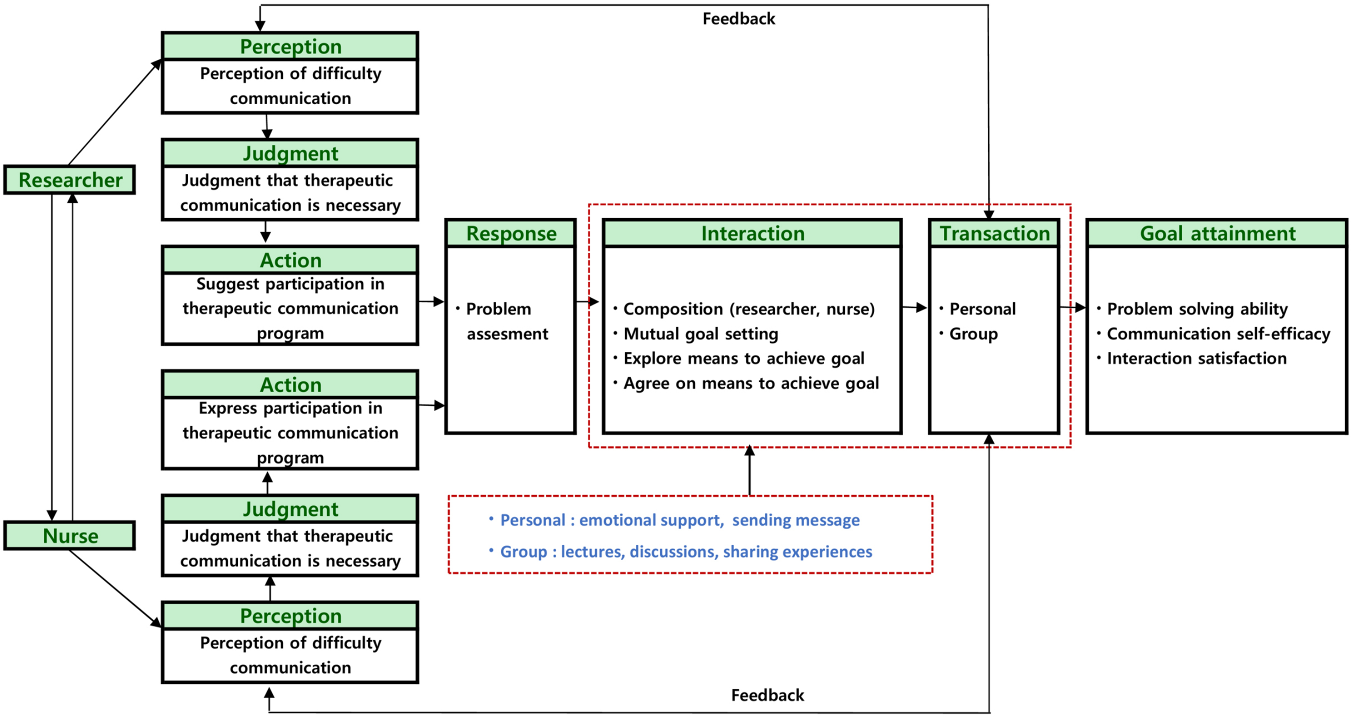

Figure 2. Conceptual framework of a therapeutic communication program based on King's goal attainment theory.

ed over an eight-week period, with each session lasting one hour, following the structure of previous studies [30]. During the introductory phase (week 1), participants were introduced to the program's structure and objectives. The development phase (weeks 2–7) included educational pamphlets, lectures, group discussions, experience sharing sessions, peer feedback, and motivational messages delivered via in-hospital communication platforms. In the final phase (week 8), participants reviewed program content, reaffirmed goals, and received reinforcement and encouragement through weekly intra-hospital messages. Both individual activities (e.g., colleague support, experience sharing, self-reflection) and group activities (e.g., role play, discussion, collective experience sharing) were incorporated throughout the intervention (Table 1). During the program, nurses discussed with the researcher the communication difficulties they had experienced in the previous week. The researcher worked continuously with each nurse to improve therapeutic communication skills by providing counseling and feedback. Particularly during weeks 2 to 7, feedback was provided to participants at each session, and based on this feedback, interactions and transactions were repeated over the following week to reapply strategies in therapeutic communication.

5. Data Collection Method

Before the start of the study, an announcement was made to the nursing department of the Catholic University of Korea, Seoul St. Mary's Hospital, and nurses who volunteered were recruited. For the pre-survey, research assistants explained the study's purpose, procedures, and data collection methods, and written consent was obtained. Surveys were conducted in a private setting to ensure participant convenience. Participants were informed that confidentiality and anonymity were guaranteed, that data would be used solely for research purposes, and that participation was voluntary, with the option to withdraw at any time without penalty. Both the intervention and control groups completed the same questionnaire, which required approximately 20 minutes. To ensure blinding, research assistants—rather than the researchers—administered the surveys after being trained on the study's objectives, content, and procedures. The control group received no intervention during the study period. After the intervention was completed, the control group was provided with the same educational materials on therapeutic communication as those given to the intervention group.

6. Ethical Considerations

This study was approved by the Institutional Review Board (IRB) of the Catholic University of Korea, Seoul St. Mary's Hospital (approval No. KC22EASI0575). Participants were informed of the study's purpose, procedures, and voluntary nature. They were assured that they could withdraw at any time without penalty and that refusal to participate carried no disadvantages. Confidentiality and anonymity of all collected data were guaranteed, and the data were used solely for research purposes. Written informed consent was obtained from all participants. A small token of appreciation was provided after completion of data collection.

7. Data Analysis

Data were analyzed using IBM SPSS version 26.0 (IBM Corp., Armonk, NY, USA). The chi-square test (χ^2 test) and the independent-samples t-test were performed to confirm the baseline homogeneity of general characteristics, and the independent-samples t-test was used to check the homogeneity of primary variables. The independent-samples t-test was performed to evaluate the significance of differences between the post-scores of the intervention group and those of the control group. The paired-sample t-test was conducted to assess whether the differences between the pre- and post-tests were significant in the intervention group and the control group. Changes in interaction satisfaction were further analyzed using Wilcoxon's signed-rank test. The significance level of $p<.05$ was used for all statistical tests.

RESULTS

1. Participant Characteristics and Homogeneity Testing

A pretest of homogeneity was conducted with 29 participants in the intervention group and 30 participants in the control group to examine general characteristics and baseline values of the dependent variables. The results showed no significant differences, confirming that both groups were homogeneous at baseline (Table 2).

2. Hypothesis Verification

1) Problem-solving ability

The pre–post change did not differ significantly between the intervention and control groups (between-group mean difference = 0.08, standard deviation [SD] = 0.09; t = 0.86; $p=.195$). Therefore, the hypothesis that the intervention group would show a greater improvement in problem-solving ability was not supported.

2) Communication self-efficacy

The pre–post change was significantly greater in the intervention group than in the control group (between-group mean difference = 0.21, SD = 0.11; t = 1.96; $p=.027$). This result supports the hypothesis that the intervention group would demonstrate a greater increase in communication self-efficacy.

3) Interaction satisfaction (changes in score)

The pre–post change in interaction satisfaction did not differ significantly between the intervention and control groups (between-group mean difference = 0.11, SD = 0.14;

Table 2. Homogeneity Test of General Characteristics between Groups ($N=59$)

Variables	Categories	n (%) or M ± SD			χ^2 or t	p
		IG (n = 29)	CG (n = 30)	Total		
Age (year)		27.79 ± 4.03	29.63 ± 4.78	28.73 ± 4.45	–1.60	.116
Married	No	22 (75.9)	23 (76.7)	45 (76.3)	0.01	.942
	Yes	7 (24.1)	7 (23.3)	14 (23.7)		
Education level	Bachelor	27 (93.1)	26 (86.7)	53 (89.8)	1.73	.422
	≥ Master's degree	2 (6.9)	4 (13.3)	6 (10.2)		
Hematological oncology ward work experience	< 5 years	25 (86.2)	20 (66.7)	45 (76.3)	6.13	.106
	≥ 5 years	4 (13.8)	10 (33.3)	14 (23.7)		
Problem-solving ability		3.36 ± 0.36	3.43 ± 0.36	-	–0.75	.456
Communication self-efficacy		4.07 ± 0.49	3.94 ± 0.38	-	1.16	.251
Interaction satisfaction		3.77 ± 0.48	3.67 ± 0.60	-	0.73	.471

CG = control group; IG = intervention group; M = mean; SD = standard deviation.

$t=0.81$; $p=.210$). Therefore, the hypothesis that the intervention group would show a greater improvement was not supported (Table 3).

DISCUSSION

Various educational models, such as Communication Skills Training, have been implemented to improve communication competencies. However, these models are primarily designed for medical counseling and have limitations when applied to nursing practice [31]. Moreover, most clinical education is delivered in a didactic manner, lacking interactive or experiential elements necessary to motivate learners and develop the practical skills required for managing complex patient situations [32].

The program developed in this study, based on King's goal attainment theory, emphasizes interaction between nurses and patients to identify problems, set goals, and work collaboratively toward achieving those goals [17]. By tailoring the approach to the individual goals of each patient, the program enhances communication and promotes patient participation in treatment. Interaction between patient and nurse improves the quality of communication throughout the goal attainment process, strengthening self-efficacy and treatment adherence. Furthermore, the program encourages patients to record their goals and exchange feedback, making communication richer and more effective through multiple methods.

Systematic reviews and meta-analyses of interventions based on goal attainment theory have demonstrated applicability across diverse domains, including health promotion (ES=0.76), goal setting and health contracts (ES=0.35), fall prevention (ES=1.25), counseling and education (ES=0.72), and parent participation (ES=1.35). These findings suggest that the theory can be flexibly applied depending on the patient's situation [33].

This study found that the program exerted significant positive effects on nurses' problem-solving abilities, communication self-efficacy, and interaction satisfaction. Following the intervention, nurses in the experimental group demonstrated marked improvements in communication skills. These findings are consistent with Kim and Sim [12], who reported that clinical nurses' communication skills have a direct impact on problem-solving ability.

In this program, problem-solving strategies were taught in stages, and case scenarios reflecting real therapeutic communication situations were integrated into the curriculum. Participants developed empathy and perspective-taking skills through role-plays, acting as patients, nurses, and observers. This approach proved particularly valuable in scenarios such as communicating with non-cooperative patients before cancer treatment. The training also addressed providing feedback in challenging clinical situations and using open- and closed-ended questions appropriately. This teaching method aligns with prior simulation-based education research that sought to enhance

Table 3. Effects of the Therapeutic Communication Program between Groups ($N=59$)

Variation	Time	M±SD			t	*p*
		IG (n=29)	CG (n=30)	Δ(IG–CG)		
Problem-solving ability	Pre	3.36±0.36	3.43±0.36	–0.07±0.36	–0.75	.456
	Post	3.96±0.20	3.96±0.16	0.00±0.18	0.15	.885
	Pre–post difference	0.60±0.29	0.52±0.39	0.08±0.09	0.86	.195
	t	11.05	7.43			
	p	<.001	<.001			
Communication self-efficacy	Pre	4.07±0.49	3.94±0.38	0.13±0.44	1.16	.251
	Post	4.29±0.56	3.95±0.51	0.34±0.54	2.45	.017
	Pre–post difference	0.22±0.49	0.01±0.31	0.21±0.11	1.96	.027
	t	2.42	0.17			
	p	.022	.865			
Interaction satisfaction	Pre	3.77±0.48	3.67±0.60	0.10±0.54	0.73	.471
	Post	4.08±0.52	3.87±0.61	0.21± 0.57	1.47	.146
	Pre–post difference	0.31±0.45	0.20±0.61	0.11±0.14	0.81	.210
	Z	3.72	1.80			
	p	<.001	.083			

CG=control group; IG=intervention group; M=mean; SD=standard deviation.

the clinical competencies of new nurses [22]. It is also notable that less experienced nurses may find it difficult to express their opinions confidently or may lack clinical expertise due to heavy workloads [12].

In a randomized controlled study of problem-solving and decision-making skills [34], significant improvements in problem-solving ability were observed only in the experimental group. By contrast, improvements were noted in both the intervention and control groups in this study, with no statistically significant between-group differences. Despite efforts to minimize environmental contamination—such as separating nursing units and reducing shared educational influences—problem-solving ability also improved in the control group. This finding suggests that controlling external factors in non-equivalent control group designs is challenging and may influence results. Furthermore, 10 more participants in the control group had over five years of hospital experience compared to the intervention group, where 86% had fewer than five years of experience. The greater experience among control participants may have contributed to improvements in problem-solving ability over time. Additionally, motivational effects of research participation and informal information sharing within the ward may also have played a role.

Communication self-efficacy significantly improved among nurses in the intervention group, consistent with previous research [35]. Effective nurse-patient communication is critical for ensuring the efficiency and quality of care and has been shown to positively influence patients' perceptions of health, treatment satisfaction, and clinical outcomes [4]. However, current communication practices are often shaped by individual nurse characteristics and educational background, with few standardized competencies established for basic nurse-patient communication [4]. Structured communication education, as implemented in this study, can enhance nurses' self-confidence, self-efficacy, and capacity for patient-centered care [2]. By integrating scenario-based role-plays, structured reflection, and video observation, the program facilitated measurable gains in self-efficacy.

In this study, interaction satisfaction improved significantly within the intervention group; however, no statistically significant differences were found between groups. This contrasts with prior research [17], which reported improvements exclusively among intervention participants. The intervention was grounded in evidence that patient-centered communication—which emphasizes respect for individual preferences, shared decision-making, and patient engagement—enhances quality of care [28]. Accordingly, it incorporated opportunities to share therapeutic communication experiences, structured feedback to strengthen interpersonal interactions, and counseling and encouragement to address challenges encountered in clinical practice. These elements may have contributed to the observed within-group improvements. Meanwhile, environmental factors such as natural improvement over time in the control group and institution-level training in interpersonal interaction may have operated in parallel, potentially explaining the lack of significant between-group differences.

This program described in this study enhances the professional expertise of nurses in the hematological oncology ward and promotes communication and treatment engagement through patient interactions. The program is expected to increase patient satisfaction and treatment outcomes, particularly for those undergoing long-term therapy. Moreover, digital systems can facilitate continuous monitoring of patient conditions, optimizing treatment effectiveness even without direct contact. The provision of emotional support is also critical, as it helps reduce anxiety and stress, strengthens psychological stability, and promotes a more positive attitude toward treatment.

This study holds significance both theoretically and practically. First, it empirically validates King's goal attainment theory as a robust and applicable framework for clinical nursing practice, demonstrating that theoretical models can be effectively translated into practice to strengthen essential communication competencies.

Second, the therapeutic communication program developed here represents a structured, evidence-based intervention suitable for application in both clinical practice and nursing education, including continuing professional development. Its modular and stepwise design supports scalability across various institutional contexts.

Third, improving nurses' communication skills may indirectly benefit patient-reported outcomes, such as satisfaction, adherence to treatment, and overall health status. This program therefore has potential as a strategic intervention to advance patient-centered care and improve clinical outcomes. Future research should empirically examine these patient-related effects.

Fourth, cultural characteristics of Korean nursing practice—such as time constraints and norms surrounding emotional expression—can pose challenges to therapeutic communication. This program accounted for such cultural particularities, underscoring the need for cross-cultural research to evaluate its adaptability and effectiveness in diverse healthcare systems.

This study has several limitations. First, it was conducted in a single tertiary general hospital, which restricts the generalizability of findings. Future research should include multiple institutions and employ randomized designs to improve external validity. Second, the non-randomized control group design raises the possibility that external factors contributed to improvements in the control group despite efforts to minimize contamination. Future studies should adopt randomized controlled designs or use additional strategies to reduce contamination for more accurate evaluation. Third, the study measured only short-term effects over an eight-week intervention. Longitudinal follow-up and systematic re-education are necessary to determine long-term benefits. Finally, interaction satisfaction was assessed solely from the nurses' perspective. Future studies should incorporate patient-centered interventions and evaluate satisfaction from both nurses and patients to provide a more comprehensive understanding of program effectiveness.

CONCLUSION

This study developed and empirically validated a therapeutic communication program for nurses in hematological oncology wards, grounded in King's goal attainment theory. Within the intervention group, problem-solving ability, communication self-efficacy, and interaction satisfaction improved significantly. However, in between-group comparisons, only communication self-efficacy was significantly higher in the intervention group than in the control group. These findings indicate that strengthening interactional processes, such as mutual perception, shared goal setting, and structured feedback, may be particularly effective in enhancing nurses' communication self-efficacy, a core competency in oncology nursing. The program also provides a practical model for in-service training and continuing professional development in the emotionally demanding context of hematological oncology. By embedding patient-centered, goal-oriented communication into routine care, it narrows the gap between theory and practice. Ultimately, this program may help strengthen nurses' capacity for holistic care in increasingly complex healthcare environments.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and/or design acquisition - HL and BMP; analysis - HL and BMP; interpretation of the data - HL, BMP, HK (Heeju Kim), JK and HK (HyunJung Kim); drafting or critical revision of the manuscript for important intellectual content - HL and BMP; and literature search - HL and BMP.

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DATA AVAILABILITY STATEMENT

The data can be obtained from the corresponding author.

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Stigma and Self-Management in Patients Undergoing Hemodialysis: A Cross-Sectional Study

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Purpose: This study aimed to examine the relationship between stigma and self-management among patients undergoing hemodialysis and to identify the key factors influencing their self-management practices. **Methods:** A convenience sample of 139 hemodialysis patients, aged 18 years or older with an arteriovenous fistula, was recruited from online websites designed for patients undergoing hemodialysis in South Korea. Data were collected using a self-reported questionnaire that assessed demographic and clinical characteristics, self-management behavior, and stigma. Data analysis included descriptive statistics, the independent t-test, one-way analysis of variance, Pearson r correlations, and hierarchical regression analysis to evaluate the influence of stigma on self-management. **Results:** Hierarchical regression analysis showed that demographic and clinical characteristics accounted for 25.1% of the variance in self-management, and the inclusion of stigma increased the explained variance to 31.4%. Significant predictors included the number of hemodialysis sessions per week (≥3) ($\beta = -.38$, $p < .001$), stigma ($\beta = -.27$, $p < .001$), monthly household income (≥4 million won) ($\beta = .24$, $p = .014$), and marital status (single) ($\beta = -.18$, $p = .028$). **Conclusion:** The findings highlight the substantial impact of stigma and treatment burden on self-management, while socioeconomic status and marital support serve as protective factors. Targeted interventions that reduce stigma and strengthen support systems are warranted.

Key Words: Chronic disease; Renal dialysis; Self-management; Social stigma

INTRODUCTION

The prevalence of chronic kidney disease continues to rise, making it the seventh leading cause of death worldwide [1]. By 2040, kidney disease is projected to become the fifth most common cause of mortality [1]. In line with this trend, the number of patients undergoing hemodialysis has steadily increased, with a six-fold rise in the Korean population between 2002 and 2017 [2]. Hemodialysis patients must engage in multiple aspects of self-management to preserve their health [3]. These include adhering to dietary and fluid restrictions, taking medications as prescribed, maintaining dialysis schedules, managing comorbid conditions, and caring for the arteriovenous (AV) fistula [3].

Stigma is defined as a stereotypical attribute that distinguishes individuals from others and fosters discrimination [4]. Patients with chronic illness often experience diminished social standing as a result of their conditions, leading to social exclusion and internalized stigma [4]. Previous research has demonstrated that stigma undermines treatment adherence and health outcomes by discouraging medical utilization, reducing motivation, and worsening disease progression [5]. Stigma has been identified as a major barrier to self-management in chronic illnesses such as epilepsy [6], diabetes [7], and hypertension [8]. These findings suggest that stigma is not only a social problem but also an important behavioral determinant in chronic disease management.

Among patients undergoing hemodialysis, stigma may be particularly evident due to the visible aspects of treatment, such as the AV fistula, changes in skin tone, and altered physical appearance, as well as the restrictions imposed by strict treatment schedules [9]. Prior studies have shown that some patients conceal their condition to avoid discomforting others, which can lead to non-adherence to dietary restrictions and even alcohol use [10]. Stigma has also been associated with poor adherence to potassium, phosphorus, and salt restrictions [11]. However, self-management in hemodialysis extends beyond dietary and fluid control, encompassing medication adherence, fistula care, and consistent communication with healthcare providers [3]. Although stigma has been studied in relation to dietary and fluid adherence, limited research has addressed its relationship with overall self-management among hemodialysis patients.

This study was guided by social cognitive theory [12], which emphasizes the continuous interaction of personal factors (such as demographic and clinical characteristics) and environmental factors (such as stigma) in shaping self-management behaviors. The objectives were to (1) assess the levels of stigma and self-management among hemodialysis patients; (2) examine differences in stigma and self-management according to general and clinical characteristics; (3) investigate correlations between stigma and self-management; and (4) identify factors influencing self-management among patients undergoing hemodialysis.

METHODS

1. Study Design

This study employed a cross-sectional correlational design.

2. Setting and Samples

We collected data through an online survey. Participants were patients undergoing hemodialysis with an AV fistula, aged ≥18 years. Inclusion criteria required patients to have an AV fistula, be aged ≥18 years, and possess the ability to read and complete online surveys. AV fistula patients were selected because this type of vascular access is the most common among hemodialysis patients and is regarded as the gold standard for long-term treatment [13]. In addition, prior qualitative research reported that hemodialysis patients felt stigmatized when exposing their AV fistula [14]. Exclusion criteria included cognitive impairment or severe psychiatric disorders that could interfere with comprehension of the questionnaire. The required sample size was estimated at 118 using G*Power 3.1.9.7, with an effect size of 0.15, an alpha level of .05, a power of .80, and 10 predictors. To account for potential dropout, 20% was added, yielding a target sample size of 142. After excluding three participants with incomplete survey responses, 139 participants were included in the final analysis.

3. Measurements

1) Demographic and clinical characteristics

Demographic data included age, sex, marital status, and monthly household income. Clinical data included hemodialysis duration (years), number of hemodialysis sessions per week, number and types of comorbidities, number and types of medications, perceived difficulty with hemodialysis, support from medical staff (doctors and nurses), and support from family.

2) Self-care behavior measurement scale

Self-care behavior was assessed using the scale originally developed by Song [15] and revised by Cho [16]. The revised version contains 35 items covering eight domains: diet and hydration control, AV fistula care, exercise and rest, medication adherence, blood pressure and weight control, post-hemodialysis care, physical and mental management, and social activity. Each item is rated on a 5-point Likert scale (1 = complete inability, 5 = exceptional proficiency), with total scores ranging from 35 to 175. Higher scores indicate greater engagement in self-care behaviors. The Cronbach's α of the revised version was .88 [16]; in this study, Cronbach's α was .91.

3) Stigma scale for chronic illness

Stigma was measured using the 8-item stigma scale for chronic illness (SSCI-8), originally developed for patients with neurological disorders [17] and applied here in its Korean version [18]. Although initially designed for neurological disorders [17], the scale has demonstrated reliability and validity across various chronic conditions, including chronic pain [19] and breast cancer [20], supporting its applicability to hemodialysis patients. The SSCI-8 comprises two domains—internalized and experienced stigma—scored on a 5-point Likert scale (1 = never, 5 = always). Total scores range from 8 to 40, with higher scores reflecting greater stigma. The Cronbach's α of the original version was .89 [17], and the translated version was .90 [18]; in this study, Cronbach's α was .93.

4. Data Collection

Participants were recruited through online hemodialysis support groups identified via Naver Band (NAVER, Seongnam, Korea) and KakaoTalk (Kakao, Seongnam, Korea), private social networking platforms for group communication. Study flyers were also posted on online communities for individuals with end-stage renal disease. Interested participants accessed the survey via a URL link, which provided study information and a consent form. Only those who provided informed consent were able to proceed. Each participant could respond only once. Recruitment was conducted from November 7, 2022, to December 20, 2022.

5. Ethical Considerations

Participants were provided with study information and a consent form before beginning the survey. Only those who provided consent were allowed to complete the questionnaire. They were informed that participation was voluntary, withdrawal was permitted at any time without penalty, and incomplete responses would not be included in the analysis. The consent form described the study's purpose, methods, duration, potential risks and benefits, and measures for data privacy. Research data and consent forms were securely stored for the legally required period and scheduled for safe disposal afterward. The institutional review board of Seoul National University approved the data collection process before the start of the study (Date of approval: 2022/10/25, IRB No. 2211/001-001).

6. Data Analysis

Statistical analyses were performed using IBM SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, mean, and standard deviation [SD]) were used to summarize demographic and clinical characteristics, as well as self-management and stigma scores. Independent t-tests, one-way analysis of variance, and post-hoc analyses were conducted to examine differences in self-management and stigma by demographic and clinical factors. Pearson's correlations were calculated to explore associations among continuous variables. Hierarchical regression analysis was performed with self-management as the dependent variable. Demographic and clinical characteristics were entered in the first step, and stigma was entered in the second step to assess its additional contribution.

RESULTS

1. Demographic and Clinical Characteristics of the Participants

The mean age of the participants was 48.17 years (SD = 10.20). Of the 139 participants, 63 (45.3%) were male and 76 (54.7%) were female, with the majority (61.2%) being married (Table 1). Clinical characteristics are summarized in Table 1. On average, participants had been receiving hemodialysis for 4.60 years (SD = 5.10), with a mean of 2.19 sessions per week (SD = 0.91), and reported 1.31 comorbidities (SD = 0.99). Hypertension and diabetes mellitus were the most prevalent comorbid conditions. Participants took an average of three medications (SD = 1.53), with anti-hypertensive agents being the most common (51.1%). In terms of perceived challenges, participants identified maintaining a healthy lifestyle as the most difficult aspect of managing hemodialysis, followed by psychological stress, managing physical symptoms, financial difficulties, forming social relationships, and other issues related to AV fistula care. Regarding support, participants reported most often receiving assistance from medical staff (50.4%) and family (42.4%).

2. Stigma and Self-Management of the Participants

Table 2 presents differences in self-management and stigma according to demographic and clinical characteristics. Married participants reported significantly higher levels of self-management compared to single participants ($p < .001$). Regarding income, participants with monthly household earnings ≥4 million Korean won demonstrated

Table 1. Demographic and Clinical characteristics of the Participants (*N* = 139)

Variables	Categories	M ± SD or n (%)
Demographic characteristics		
Age (year)		48.17 ± 10.20
	22–39	28 (20.1)
	40–49	49 (35.3)
	50–59	42 (30.2)
	60–67	20 (14.4)
Sex	Male	63 (45.3)
	Female	76 (54.7)
Marital status	Married	85 (61.2)
	Single	45 (32.4)
	Other	9 (6.4)
Monthly household income (million Korean won)	≥ 4	54 (38.9)
	≥ 2.5 to < 4	47 (33.8)
	< 2.5	38 (27.3)
Clinical characteristics		
Hemodialysis period (year)		4.60 ± 5.10
	< 1	11 (7.9)
	≥ 1 to < 3	63 (45.3)
	≥ 3 to < 5	27 (19.4)
	≥ 5 to < 10	24 (17.3)
	≥ 10	14 (10.1)
No. of hemodialysis sessions per week		2.19 ± 0.91
	< 3	73 (52.5)
	≥ 3	66 (47.5)
No. of comorbidities		1.31 ± 0.99
	0	22 (15.8)
	1	76 (54.7)
	2	41 (29.5)
Comorbidities†	HTN (yes)	77 (55.4)
	DM (yes)	54 (38.8)
	Cardiovascular disease (yes)	15 (10.8)
	Others (yes)	39 (28.1)
No. of medications		3.00 ± 1.53
	1	19 (13.7)
	2	42 (30.2)
	3	34 (24.5)
	4	26 (18.7)
	≥ 5	18 (12.9)
Medications†	Anti-hypertensive agent	71 (51.1)
	Vitamin supplement	63 (45.3)
	Phosphate binder	57 (41.0)
	Iron supplement	56 (40.3)
	Hypoglycemic agent	52 (37.4)
	Antiplatelet agent	31 (22.3)
	Potassium lowering agent	28 (20.1)
	Calcium supplement	27 (19.4)
	Sodium bicarbonate	6 (4.3)
	Others	10 (7.2)

(Continued on the next page)

Table 1. Continued

Variables	Categories	M ± SD or n (%)
Difficulties regarding hemodialysis†	Maintain healthy lifestyle (yes)	93 (66.9)
	Psychological stress (yes)	81 (58.3)
	Manage physical symptoms (yes)	75 (54.0)
	Financial difficulty (yes)	55 (39.6)
	Social relationship formation (yes)	41 (29.5)
	Others (related to arteriovenous fistula care) (yes)	6 (4.3)
Support from medical staff (doctors, nurses)	Always	30 (21.6)
	Often	70 (50.4)
	Sometimes	30 (21.6)
	Rarely	3 (2.1)
	Never	6 (4.3)
Support from family	Always	53 (38.1)
	Often	59 (42.5)
	Sometimes	16 (11.5)
	Rarely	9 (6.5)
	Never	2 (1.4)

DM = diabetes mellitus; HTN = hypertension; M = mean; SD = standard deviation; †Multiple response.

higher self-management compared to those earning < 2.5 million Korean won (p = .003). Patients undergoing fewer than three hemodialysis sessions per week reported better self-management (p < .001) and higher stigma (p = .045) compared with those undergoing three or more sessions weekly. Participants without hypertension exhibited significantly higher stigma compared to those with hypertension (p = .002). In addition, patients with diabetes mellitus reported significantly higher self-management compared to those without diabetes (p = .031).

Table 3 summarizes stigma and self-management scores. The mean self-management score was 132 (SD = 17.98), with a mean item score of 3.77 (SD = 0.51), indicating generally good self-management. Subscale mean item scores, from highest to lowest, were: medication (4.20, SD = 0.62), AV fistula care (4.08, SD = 0.49), social activity (4.04, SD = 0.70), care after hemodialysis (3.78, SD = 0.76), physical and mental management (3.69, SD = 0.59), blood pressure and weight control (3.65, SD = 0.80), exercise and rest (3.57, SD = 0.82), and diet and hydration control (3.49, SD = 0.74). The mean stigma score was 16.67 (SD = 6.22), with a mean item score of 2.08 (SD = 0.78), indicating that participants generally reported low levels of stigma. Among the stigma domains, internalized stigma was higher than enacted stigma.

3. Correlations among Variables

Pearson's correlations are presented in Table 4. Self-management was positively associated with age (r = .20, p = .017) and number of comorbidities (r = .21, p = .013). Conversely, self-management was negatively correlated with the number of medications (r = –.20, p = .020) and stigma (r = –.22, p = .008).

4. Factors Influencing Self-Management

Multiple linear regression was conducted to examine the association between stigma and self-management, controlling for demographic and clinical characteristics. A two-step hierarchical regression model was used, with self-management as the dependent variable. In Model 1, demographic and clinical characteristics—including marital status, monthly household income, diabetes mellitus, difficulty in managing physical symptoms, and number of hemodialysis sessions per week—explained 25.1% of the variance in self-management (F = 7.62, adjusted R^2 = .251) (Table 5). When stigma was added in Model 2, the variance explained increased to 31.4% (F = 8.88, adjusted R^2 = .314). In the final model, four of eight predictors were statistically significant: number of hemodialysis sessions per week (≥ 3) (β = –.38, p < .001), stigma (β = –.27, p < .001), monthly household income (≥ 4 million won) (β = .24, p = .014), and marital status (single) (β = –.18, p = .028).

Table 2. Difference in Stigma and Self-Management by Demographic and Clinical Characteristics of the Participants (*N* = 139)

Variable	n (%)	Stigma				Self-management			
		Mean	SD	t or F	*p*	Mean	SD	t or F	*p* (Scheffe)
Age (year)				0.95	.346			−1.76	.081
< 50	77 (55.4)	17.12	6.51			129.61	18.67		
≥ 50	62 (44.6)	16.11	5.86			134.97	16.76		
Sex				−0.41	.680			−1.21	.230
Female	76 (54.7)	16.87	6.50			133.68	17.30		
Male	63 (45.3)	16.43	5.92			129.97	18.70		
Marital status				1.93	.149			8.86	< .001
Married[a]	85 (61.2)	15.86	5.81			136.66	16.31		(a > b)
Single[b]	45 (32.4)	18.07	6.83			123.47	17.01		
Others[c]	9 (6.5)	17.33	6.25			130.67	23.43		
Monthly household income (million Korean won)				0.22	.802			6.21	.003
≥ 4[a]	54 (38.8)	17.07	6.92			137.52	15.88		(a > c)
≥ 2.5 to < 4[b]	47 (33.8)	16.57	5.84			131.64	18.06		
< 2.5[c]	38 (27.3)	16.22	5.75			124.61	18.37		
Number of hemodialysis sessions per week				2.02	.045			5.14	< .001
< 3	73 (52.5)	17.67	5.57			138.85	15.83		
≥ 3	66 (47.5)	15.56	6.74			124.42	17.24		
Hemodialysis period				1.96	.052			1.77	.079
< 5	100 (71.9)	17.31	6.12			133.67	17.51		
≥ 5	39 (28.1)	15.03	6.26			127.72	18.67		
HTN				3.19	.002			−1.75	.082
Yes	77 (55.3)	15.21	5.43			134.38	18.40		
No	62 (44.7)	18.48	6.69			129.05	17.12		
DM				0.73	.467			−2.18	.031
Yes	54 (38.8)	16.19	6.01			136.11	17.82		
No	85 (61.2)	16.98	6.37			129.39	17.68		
Difficulty in maintaining healthy lifestyle				−2.26	.026			1.73	.086
Yes	93 (66.9)	17.49	6.49			130.16	18.38		
No	46 (33.1)	15.00	5.34			135.72	16.70		
Psychological stress				0.06	.952			−1.40	.163
Yes	81 (58.3)	16.64	6.50			133.80	17.83		
No	58 (41.7)	16.71	5.87			129.48	18.03		
Difficulty in managing physical symptoms				0.63	.528			−2.84	.005
Yes	75 (53.9)	16.36	6.59			135.91	16.98		
No	64 (46.1)	17.03	5.80			127.42	18.16		
Financial difficulty				−0.76	.450			−0.50	.615
Yes	55 (39.6)	17.16	6.19			132.98	19.59		
No	84 (60.4)	16.35	6.26			131.36	16.93		
Difficulty in forming social relationship				−1.67	.097			0.84	.404
Yes	41 (29.5)	18.02	6.83			130.02	17.95		
No	98 (70.5)	16.10	5.90			132.83	18.05		

Korean won is the currency of South Korea, with 1 million won being equivalent to about 0.71 USD.
DM = diabetes mellitus; HTN = hypertension; SD = standard deviation.

Table 3. Stigma and Self-Management of the Participants (*N* = 139)

Variables	Possible range	Min	Max	Mean ± SD	Items
					Mean ± SD
Self-management	35–175	86	164	132 ± 17.98	3.77 ± 0.51
Medication	2–10	5	10	8.40 ± 1.24	4.20 ± 0.62
Arteriovenous fistula care	6–30	16	30	24.50 ± 2.95	4.08 ± 0.49
Social activity	3–15	5	15	12.12 ± 2.11	4.04 ± 0.70
Care after hemodialysis	2–10	4	10	7.56 ± 1.51	3.78 ± 0.76
Physical and mental management	9–45	19	45	33.23 ± 5.30	3.69 ± 0.59
Blood pressure and weight control	3–15	3	15	10.95 ± 2.41	3.65 ± 0.80
Exercise and rest	4–20	6	20	14.28 ± 3.29	3.57 ± 0.82
Diet and hydration control	6–30	7	30	20.96 ± 4.47	3.49 ± 0.74
Stigma	8–40	8	31	16.67 ± 6.22	2.08 ± 0.78
Internalized	3–15	3	14	6.71 ± 2.82	2.24 ± 0.94
Enacted (experienced)	5–25	5	19	9.96 ± 3.79	1.99 ± 0.76

SD = standard deviation.

Table 4. Correlations between Demographic and Clinical Characteristics, Stigma, and Self-Management (*N* = 139)

Variables	r (*p*)					
	1	2	3	4	5	6
1. Age	1					
2. Hemodialysis period	.03 (.704)	1				
3. Number of medications	.03 (.748)	.49 (< .001)	1			
4. Number of comorbidities	.45 (< .001)	.01 (.951)	.18 (.033)	1		
5. Stigma	–.26 (.002)	–.14 (.111)	–.24 (.005)	–.36 (< .001)	1	
6. Self-management	.20 (.017)	–.13 (.122)	–.20 (.020)	.21 (.013)	–.22 (.008)	1

Table 5. Summary of Hierarchical Regression Analysis for Variables Associated with Self-Management

Independent variables	Model 1					Model 2				
	B	SE	β	t	*p*	B	SE	β	t	*p*
Marital status (single)	–9.27	3.08	–.24	–3.00	.003	–6.76	3.03	–.18	–2.23	.028
Marital status (others)	–0.44	5.70	–.01	–0.08	.939	1.67	5.49	.02	0.31	.761
Monthly household income (≥ 2.5 to < 4 million Korean won)	2.00	3.59	.05	0.56	.579	2.78	3.45	.07	0.81	.422
Monthly household income (≥ 4 million Korean won)	6.98	3.64	.19	1.92	.057	8.77	3.52	.24	2.49	.014
DM (no)	–1.76	2.87	–.05	–0.62	.540	–0.41	2.77	–.01	–0.15	.883
Difficulty in managing physical symptoms (no)	–4.49	2.77	–.13	–1.62	.108	–3.56	2.66	–.10	–1.34	.184
Number of hemodialysis sessions per week (≥ 3)	–11.18	2.86	–.31	–3.91	< .001	–13.61	2.82	–.38	–4.83	< .001
Stigma						-0.77	0.22	–.27	–3.59	< .001
R^2	.289					.353				
Adjusted R^2	.251					.314				
F	7.62					8.88				
p	< .001					< .001				

Reference group: Marital status (married), Monthly household income (< 2.5 million Korean won), Number of hemodialysis sessions per week (< 3), Difficulty in managing physical symptoms (yes), DM (yes).
DM = diabetes mellitus; SE = standard error.

DISCUSSION

This study examined the relationship between stigma and self-management among patients undergoing hemodialysis and identified factors influencing self-management. Overall, patients demonstrated a relatively high level of self-management, with an average score of 3.77 ± 0.51 on a 5-point scale, and reported experiencing stigma only rarely, with an average score of 2.08 ± 0.78. Several factors may account for these findings. Many participants reported receiving strong support from family members and healthcare providers, which likely served as a protective buffer against stigma [21,22]. A qualitative study of patients undergoing hemodialysis found that trust in doctors and nurses helped patients better manage dialysis sessions and physical symptoms [23]. Similarly, family support has been shown to enhance treatment adherence and strengthen emotional resilience [24]. Recruitment through online platforms and patient support groups may also have fostered a sense of community, enabling participants to share experiences and provide mutual support [25]. The online nature of this study may have further influenced the findings. The mean age of participants was 48.17 years, which is younger than the national average of 62 years among Korean hemodialysis patients [2]. Younger patients are more likely to have higher levels of digital health literacy [26], which can facilitate engagement in online communication and peer networks, ultimately reducing stigma and promoting self-management. Digital proficiency may thus have contributed to the development of peer support systems that enhanced social connectedness, reduced stigma, and strengthened self-management [26]. In this study, stigma was assessed using a scale that measured internalized and enacted stigma [17]. However, anticipated stigma is also an important factor that may hinder self-management in chronic illness [27]. Anticipated stigma may mediate the effects of internalized and experienced stigma on access to care [27]. Future research should therefore examine its impact on self-management among patients undergoing hemodialysis.

Interestingly, patients receiving fewer than three hemodialysis sessions per week reported higher stigma but better self-management compared with those undergoing three or more sessions. The frequency of dialysis can vary depending on residual kidney function or clinical recommendations [28], and may also be influenced by patients' dietary control and fluid management [28]. Compared with thrice-weekly dialysis, twice-weekly sessions may help preserve residual kidney function, reduce infection risk, and lessen complications of the AV fistula, while potentially improving quality of life [29]. In this study, 52.5% of participants had been receiving hemodialysis for less than three years, suggesting that many were in the early stages of treatment. Patients in this phase often experience psychosocial burdens, uncertainty, and reduced acceptance of their condition [25]. Prior research similarly indicates that individuals within the first three years of dialysis frequently report hopelessness, uncertainty, and emotional instability [25]. At the same time, these patients may adhere more rigorously to dietary and fluid restrictions, reducing the need for more frequent dialysis [28]. Longitudinal studies are needed to clarify whether stigma decreases as patients progress through the adaptation process and undergo longer-term treatment.

Another noteworthy finding was that patients without hypertension reported higher stigma compared to those with hypertension, despite hypertension being the most common comorbidity (63.1%). This may reflect the complexity of comorbidity profiles: 29.5% of participants had two or more comorbidities, with 44.3% having diabetes mellitus and 32.0% affected by conditions such as liver disease, lung disease, eye disease, cerebrovascular disease, or osteoarthritis. These overlapping conditions may have shaped participants' perceptions of stigma in nuanced ways [20].

Although this study found only a weak negative correlation between stigma and self-management, stigma nonetheless emerged as an important influencing factor, alongside the number of hemodialysis sessions per week, marital status, and household income. These findings highlight stigma as a significant barrier to effective self-management. Accordingly, strategies to address stigma are critical. Interventions should aim to strengthen patient motivation and empower individuals to take an active role in their care [30]. Because patients undergoing hemodialysis require lifelong therapy until transplantation, programs that cultivate a positive mindset, enhance personal empowerment, and reduce stigma are essential [31]. Healthcare providers should be trained to identify and minimize stigma-related barriers [31], and peer support groups should be promoted as a means of fostering patient-centered care [32]. Finally, public campaigns are needed to reduce stigma more broadly. Educational initiatives, such as posters in hospitals and informational content on social media, can raise awareness that successful self-management in hemodialysis is achievable and encourage positive health behaviors [33].

This study has several limitations. First, this study recruited hemodialysis patients from online, which may have led to the underrepresentation of the target population-patients undergoing hemodialysis. Specifically, potential participants with limited access to online resources or low digital literacy may not have had the opportunity to participate, thereby limiting the generalizability of the findings. Second, collecting self-reported data through online surveys may have resulted in misinterpretations of the survey questions, as participants did not have access to real-time assistance from researchers. Therefore, future research should consider combining online surveys with onsite, community-based recruitment to minimize underrepresentation and enhance the generalizability of the results. Third, the mean age of the study sample was approximately 48 years, which is considerably lower than the national average age of hemodialysis patients in South Korea [2]. This discrepancy may also limit the generalizability of the findings, as younger patients may differ from older patients in terms of stigma perception and self-management behaviors.

CONCLUSION

Self-management is a dynamic and ongoing process that requires continuous attention and practice in daily life. The findings of this study indicate that stigma is an important influencing factor in the self-management of patients undergoing hemodialysis, with a negative correlation between stigma and self-management. Marital status, monthly household income, and number of weekly hemodialysis sessions, along with stigma, were identified as the strongest predictors of self-management. These results verify the necessity of developing and implementing programs aimed at reducing stigma and enhancing self-management among patients undergoing hemodialysis.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and design acquisition - SR and YHP; data collection - SR; analysis - SR and YHP; interpretation of the data - SR and YHP; and drafting or critical revision of the manuscript for important intellectual content - SR and YHP.

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DATA AVAILABILITY STATEMENT

The data can be obtained from the corresponding author.

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Associations between Health Literacy, Autonomy Support, and Health Behavior Adherence in Premature Coronary Artery Disease Patients: A Cross-Sectional Survey

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Purpose: This study aimed to examine the influence of health literacy and autonomy support on health behavior adherence among patients with premature coronary artery disease (PCAD), defined as onset before age 55 years in males and 65 years in females. **Methods:** A descriptive, cross-sectional design was employed. Data from 153 patients were collected at a hospital in Seoul, South Korea, between January and March 2023. Statistical analyses included the independent t-test, one-way analysis of variance, Pearson correlation coefficients, and hierarchical multiple regression, conducted using IBM SPSS WIN ver. 27.0. **Results:** Health literacy ($\beta = .36$, $p < .001$) was the strongest determinant of health behavior adherence. A disease duration of more than one year ($\beta = .17$, $p = .016$) was positively associated with adherence, while male sex ($\beta = -.16$, $p = .039$) and the absence of comorbidities ($\beta = -.17$, $p = .011$) showed significant negative associations. Autonomy support from healthcare providers was not significantly associated with health behavior adherence. **Conclusion:** Healthcare professionals should prioritize improving patient health literacy through tailored communication and educational strategies. Male patients and those newly diagnosed should be recognized as vulnerable groups for low adherence. Targeted interventions should be designed to meet their specific needs. Furthermore, patients with PCAD should be guided to increase their awareness and understanding of their condition.

Key Words: Coronary artery disease; Health behavior; Literacy; Personal autonomy

INTRODUCTION

Coronary artery disease (CAD) is the leading cause of death worldwide [1]. In South Korea, heart disease ranks as the second leading cause of death after malignant neoplasms, with CAD accounting for 45% of all heart disease cases in 2024 [2]. CAD is a chronic degenerative condition that predominantly affects older adults. However, interest in CAD among younger populations has grown since a U.S. autopsy study revealed that 20% of males and 8% of females in their 30s had progressive coronary lesions, based on 2,876 autopsies of individuals who died from non-cardiac causes such as accidents and suicide [3].

In South Korea, chronic diseases that are major risk factors for CAD—such as hypertension, hyperlipidemia, and diabetes—have increased by 10.7%, 12.8%, and 63%, respectively, among people in their 30s over the past five years. During the same period, the incidence of myocardial infarction rose by 21% in those in their 20s, 6% in their 30s, and 9% in their 40s [2]. These findings suggest that CAD is

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occurring at increasingly younger ages.

According to the guidelines of the American College of Cardiology (ACC) and the American Heart Association (AHA), CAD presenting as atherosclerotic stenosis or occlusion of the coronary arteries in males younger than 55 years and females younger than 65 years is defined as premature coronary artery disease (PCAD) [4]. Globally, annual PCAD mortality increased by 25% between 1990 and 2019 [5]. Despite the preventable nature of CAD and widespread awareness of its risk factors, PCAD incidence continues to rise among young and middle-aged adults. To counter this trend, it is necessary to identify factors and barriers contributing to inadequate disease management and prevention in these age groups.

Lifestyle modifications can substantially reduce cardiovascular risk. Individuals who improved their diet and exercise had a 50% lower risk compared to those who did not, while smokers who made no lifestyle changes had more than four times the cardiovascular risk of nonsmokers [6]. Research on adherence to health behaviors that address CAD risk factors [7], as well as government initiatives such as the “Primary Care Chronic Disease Management Pilot Program” [8], has been ongoing. Nevertheless, CAD patients still demonstrate low engagement in aerobic activity, and 44% continue smoking even after coronary interventions [9]. Early risk factor management is essential to prevent severe cardiovascular disease [4]. Thus, patients diagnosed with PCAD at a younger age must recognize their risk factors and consistently adhere to health-promoting behaviors.

Among the factors influencing health behavior adherence in CAD patients, health literacy [10] and autonomy support from healthcare providers [7] are particularly important for those with PCAD. Health literacy refers to the ability to access, understand, and use health information to improve one’s health [11]. Its importance is underscored by its inclusion in the National Health Promotion Plan [12]. High health literacy in cardiovascular patients is associated with greater resilience, better quality of life [13], and stronger adherence to health behaviors [14]. In contrast, low health literacy is linked to poor disease management, including underutilization of preventive services, low medication adherence, and higher risks of chronic disease [15]. For CAD patients, health literacy is especially critical, as lifelong management of risk factors directly affects survival [14]. Although health literacy typically decreases with age, a recent national survey showed that 70% of adults had suboptimal levels, with a mean age of 44.4 years, indicating that many younger adults are affected [15]. PCAD is generally diagnosed in people in their 40s and 50s, who may not prioritize health management. Younger adults often neglect their health due to overconfidence and may receive inadequate education about managing chronic conditions [16]. Consequently, low health literacy can hinder PCAD patients from recognizing disease severity, interpreting complex medical information, and implementing lifestyle changes. Assessing health literacy in PCAD patients and evaluating its impact on health behavior adherence is therefore essential to promote behavioral change and prevent major cardiovascular events.

Autonomy support from healthcare providers also influences health behavior adherence. Grounded in self-determination theory, autonomy support refers to patients’ perception that providers encourage intrinsic motivation by offering opportunities for choice and self-decision [17]. From this perspective, motivating PCAD patients to modify risk factors and adopt healthier behaviors requires fostering intrinsic motivation. Evidence shows that CAD patients demonstrate stronger adherence to health behaviors when supported by providers [7], with similar findings in patients with other chronic illnesses [18]. Increasing patient motivation to engage in health-promoting behaviors is a central role of nurses and other healthcare providers. Thus, it is necessary to assess autonomy support in PCAD patients and determine its influence on their adherence.

This study therefore aimed to investigate the associations between health literacy, autonomy support from healthcare providers, and adherence to health behaviors intended for risk factor modification in individuals with PCAD.

METHODS

1. Study Design

This study employed a descriptive, cross-sectional design.

2. Setting and Samples

Participants were male patients under 55 years of age and female patients under 65 years who were diagnosed with CAD (mild CAD, angina, or myocardial infarction) at a tertiary hospital in Seoul. The inclusion criteria were: (1) male patients aged 19 to 55 years and female patients aged 19 to 65 years according to the guidelines of the ACC and AHA [4], and (2) a confirmed diagnosis of CAD, including stable angina, unstable angina, variant angina, myocardial infarction, or mild CAD. The exclusion criterion was (1) a diagnosis of psychiatric or cognitive disorders.

Sample size estimation was performed using G*Power 3.1.9.2 software. With 14 predictors (12 characteristics: sex, age, marital status, education, job, income, type of cardiovascular disease, treatment method, duration of illness, presence of comorbidities, family history of CAD, and subjective physical health status; two independent variables: health literacy and autonomy), a medium effect size (f^2) of 0.15, a significance level of .05, and power of 0.80, the minimum required sample size was 139. To account for a 20% dropout rate, the target sample size was set at 174. A total of 174 questionnaires were distributed, and 153 were finalized for analysis after excluding 21 with incomplete or inaccurate responses.

3. Instruments

1) Demographic and clinical characteristics

Six demographic characteristics (sex, age, marital status, education, job, and income) and six clinical characteristics (type of cardiovascular disease, treatment method, duration of illness, presence of comorbidities, family history of CAD, and subjective physical health status) were collected through a self-report survey.

2) Health literacy

Health literacy, defined as the ability of cardiovascular patients to understand health information and make informed decisions, was measured using a tool developed by Sim [19], with permission obtained via email. The instrument consists of 22 items across four subdomains: understanding and seeking health information (4 items), interaction with healthcare providers (4 items), utilization of health information resources (6 items), and active evaluation of health information (8 items). Each item is rated on a 4-point Likert scale ranging from 1 (never) to 4 (always). Four negatively worded items were reverse-coded. Higher scores indicate greater health literacy. The original tool demonstrated a Cronbach's α of .89 [19], while reliability in this study was quantified by a Cronbach's α value of .73.

3) Autonomy support of health providers

Autonomy support of health providers was assessed using the Health Care Climate Questionnaire (HCCQ), developed by Williams et al. [20] based on self-determination theory. The HCCQ was designed to measure patients' perceptions of the autonomy-supportive behavior of healthcare professionals. The Korean version was translated and back-translated by Won and Kim [7] to ensure content validity, and permission for academic use was obtained as stated on the provider's website. The tool includes 15 items on a unidimensional scale, with responses rated on a 7-point Likert scale from 1 (not at all true) to 7 (very true). One negatively worded item was reverse-coded. Higher scores reflect greater perceived autonomy support from healthcare providers. Reliability was shown by Cronbach's α values of .89 in the original study [20] and .91 in this study.

4) Health behavior adherence

Health behavior adherence in patients with PCAD was measured using a tool modified for cardiac patients by Song et al. [21], based on the Health Promoting Lifestyle Profile developed by Walker et al. [22], with permission from the author. The tool consists of 21 items across five subdomains: health responsibility (5 items), exercise (4 items), dietary behavior (6 items), stress management (3 items), and smoking cessation (3 items). Each item is rated on a 4-point Likert scale ranging from 1 (never) to 4 (always). Higher scores indicate better adherence to health behaviors. The reliability was shown by Cronbach's α values of .82 in the original study [21] and .79 in this study.

4. Data Collection

Data collection was conducted from January 17 to March 10, 2023, in the cardiology outpatient clinic and wards of a tertiary hospital in the metropolitan area. Convenience sampling and self-administered questionnaires were used. Written informed consent was obtained from all participants who voluntarily agreed to participate. Completing the questionnaire required approximately 15 to 20 minutes. After data collection, the researcher held a question-and-answer session to address misconceptions about health information and provide guidance as needed.

5. Ethical Considerations

This study was approved by the Institutional Review Board of Hanyang University Hospital (IRB No. HYUH 2022-12-014-001). Participants were informed of the study's purpose and procedures and assured that participation would not affect their usual care or provide additional benefits. Only consented information was used. Participants were informed of their right to voluntary participation and autonomy in decision-making. The researcher also assured anonymity and confidentiality of the collected data.

6. Data Analysis

Data were analyzed using IBM SPSS for Windows version 27.0 (IBM Corp., Armonk, NY, USA). Patients' demographic and clinical characteristics were analyzed using frequencies and percentages. Differences in autonomy support of health providers, health literacy, and health behavior adherence according to participant characteristics were analyzed using the independent t-test and one-way analysis of variance, with post-hoc testing performed using the Scheffe method. Pearson's correlation coefficients were calculated to examine the relationships among health literacy, autonomy support of health providers, and health behavior adherence. Hierarchical multiple regression analysis was used to identify predictors of health behavior adherence. In step one, control variables that showed significant differences in adherence were entered. In step two, health literacy and autonomy support were added as independent variables. Nominal control variables were converted into dummy variables. To assess multicollinearity among independent variables, tolerance and variance inflation factors (VIFs) were checked.

RESULTS

1. Patients' Characteristics and Differences in Health Behavior Adherence

Among the 153 participants, 100 were male (65.4%) and 53 were female (34.6%). The mean age of male participants was 46.7±5.6 years, with the largest proportion in the 50–54 age group (50.0%). The mean age of female participants was 56.1±6.6 years, with the 50–59 age group being the most common (47.2%). Diagnoses included mild CAD (9.8%), angina (47.1%), and myocardial infarction (43.1%). The duration of illness exceeded one year for 87 participants (56.9%). Regarding lifestyle behaviors, 81 participants (52.9%) reported not consuming alcohol, and 105 participants (68.6%) were nonsmokers (Table 1).

Health behavior adherence showed significant differences by sex (male) ($t=-3.62$, $p<.001$), employment status (yes) ($t=-2.29$, $p=.023$), duration of illness (less than 1 year) ($t=-4.37$, $p<.001$), comorbidity status (no) ($t=3.36$, $p<.001$), smoking (yes) ($t=-4.78$, $p<.001$), and alcohol consumption (yes) ($t=-2.58$, $p=.011$), with lower adherence in these groups compared to their counterparts. According to the post-hoc test, health behavior adherence was significantly lower in the 40–49 age group compared to those aged 50 years and above ($F=6.89$, $p=.001$). Notably, male participants aged 30–39 demonstrated significantly lower adherence compared to those aged 50–54 ($F=4.43$, $p=.014$) (Table 1).

2. Level of Health Literacy, Autonomy Support of Health Providers, and Health Behavior Adherence

The overall mean score for health literacy was 3.18±0.31, the mean score for autonomy support of healthcare providers was 5.64±0.83, and the mean score for health behavior adherence was 2.66±0.41 (Table 2).

Table 1. Differences in Health Behavior Adherence According to Participants' Characteristics (*N*=153)

Variables	Categories	n (%) or M±SD	Health behavior adherence		
			M±SD	t or F	*p* (Scheffe)
Sex	Male	100 (65.4)	2.58±0.38	–3.62	<.001
	Female	53 (34.6)	2.82±.042		
Age	30–39^{a}	16 (10.5)	2.60±0.50	6.89	.001
	40–49^{b}	53 (34.6)	2.52±0.38		(b<c)
	≥50^{c}	84 (54.9)	2.77±0.38		
Age of males (n=100)	30–39^{a}	14 (14.0)	2.43±0.47	4.43	.014
	40–49^{b}	46 (46.0)	2.51±0.34		(a<c)
	50–54^{c}	50 (50.0)	2.71±0.35		
		46.7±5.6			

(Continued on the next page)

Table 1. Continued

Variables	Categories	n (%) or M±SD	Health behavior adherence		
			M±SD	t or F	*p* (Scheffe)
Age of females (n=53)	30-49	9 (17.0)	2.82±0.55	0.00	.999
	50-59	25 (47.2)	2.82±0.40		
	60-64	19 (35.8)	2.83±0.39		
		56.1±6.6			
Marital status	Unmarried	31 (20.3)	2.60±0.41	−1.02	.308
	Married	117 (76.5)	2.68±0.40		
	Other	5 (3.3)	-		
Education	Under middle school	14 (9.2)	2.72±0.46	0.35	.702
	High school	60 (39.2)	2.63±0.41		
	Above college	79 (51.6)	2.68±0.39		
Job	Yes	131 (85.6)	2.63±0.40	−2.29	.023
	No	22 (14.4)	2.85±0.37		
Income (10,000 won)	Less than 100	24 (15.7)	2.84±0.38	1.75	.140
	100–200	18 (11.8)	2.72±0.31		
	201–300	25 (16.3)	2.63±0.41		
	301–400	31 (20.3)	2.56±0.42		
	More than 400	55 (35.9)	2.64±0.42		
Type of cardiovascular disease	Mild coronary artery disease	15 (9.8)	2.67±0.44	0.29	.747
	Angina pectoris	72 (47.1)	2.68±0.37		
	Myocardial infarction	66 (43.1)	2.59±0.37		
Treatment method	Only medication	67 (43.8)	2.63±0.41	−0.80	.423
	Intervention and medication	86 (56.2)	2.69±0.40		
Duration of illness	<1 year	66 (43.1)	2.51±0.37	−4.37	<.001
	≥1 year	87 (56.9)	2.78±0.39		
Comorbidities	Yes[†]	104 (68.0)	2.74±0.39	3.36	<.001
	Diabetes mellitus	41 (39.4)			
	Hypertension	73 (70.1)			
	Dyslipidemia	65 (62.5)			
	Cerebrovascular disease	7 (6.7)			
	Kidney disease	7 (6.7)			
	Peripheral vascular disease	3 (2.8)			
	Congestive heart failure	3 (2.8)			
	No	49 (32.0)			
		2.51±0.40			
Family history of cardiovascular disease	Yes	58 (37.9)	2.61±0.36	−1.32	.186
	No	95 (62.1)	2.70±0.43		
Body mass index (kg/m^2)	<25	71 (46.4)	2.71±0.42	1.36	.176
	≥25	82 (53.6)	2.62±0.39		
Alcohol consumption	Yes	72 (47.1)	2.58±0.40	−2.58	.011
	No	81 (52.9)	2.74±0.39		
Smoking	Yes	48 (31.4)	2.44±0.39	−4.78	<.001
	No	105 (68.6)	2.76±0.37		
Subjective physical health status	Good or better	24 (15.7)	2.76±0.39	1.18	.309
	Moderate	96 (62.7)	2.67±0.40		
	Bad or worse	33 (21.6)	2.59±0.43		

M = mean; SD = standard deviation; [†]Multiple responses.

3. Correlations among the Study Variables

Health behavior adherence was positively correlated with health literacy (r = .48, $p < .001$) and autonomy support of healthcare providers (r = .26, $p < .001$). In addition, health literacy and autonomy support of healthcare providers were positively correlated with each other (r = .34, $p < .001$) (Table 3).

4. Factors Influencing Health Behavior Adherence among Patients with PCAD

Hierarchical multiple regression analysis was conducted to identify factors influencing health behavior adherence. Four control variables—sex, employment status, duration of illness, and presence of comorbidities—were included. Although age showed significant differences in adherence, these differences may have been influenced by sex-related age limits (males under 55 years, females under 65 years); therefore, age was not included as a control variable. Alcohol consumption and smoking, which also showed differences in adherence, were excluded due to overlap with components of the dependent variable and thus were not considered independent variables. Health literacy and autonomy support of healthcare providers, which were significantly correlated with adherence, were then added as independent variables. Dummy variables were coded as follows: female for sex, unemployed for job, less than one year for duration of illness, and presence of comorbidities. The tolerance values ranged from .71 to .98, exceeding the threshold of .10, and VIFs ranged from 1.01 to 1.39, well below the threshold of 10, indicating no multicollinearity. The Durbin–Watson statistic was 2.038, close to 2, suggesting no autocorrelation of residuals and confirming the assumption of normally distributed errors.

The regression model in Model 1 was statistically significant (F = 10.69, $p < .001$), with the control variables explaining 20.3% of the variance in health behavior adherence. Among the control variables, duration of illness ≥1 year was a significant positive factor, while male sex and absence of comorbidities were significant negative factors. Model 2, which added health literacy and autonomy support, was also statistically significant (F = 14.31, $p < .001$). The inclusion of these variables increased the explanatory power by 14.6%, yielding a total explained variance of 34.5%.

The final regression model identified health literacy (β = .36; 95% confidence interval [CI] = 0.29–0.67), duration of illness ≥1 year (β = .17; 95% CI = 0.03–0.25), absence of comorbidities (β = –.17; 95% CI = –0.27 to –0.04), and male sex (β = –.16; 95% CI = –0.27 to –0.01) as significant predictors of health behavior adherence. Among these, health literacy was the most influential factor. In summary, higher health literacy and longer disease duration were associated with better adherence, whereas the absence of comorbidities and male sex were associated with lower adherence. Autonomy support of healthcare providers did not have a significant effect (Table 4).

Table 2. Level of Health Literacy, Autonomy Support of Health Providers, and Health Behavior Adherence (*N* = 153)

Variables	Possible range	M±SD
Health literacy	1–4	3.18±0.31
Autonomy support of health providers	1–7	5.64±0.83
Health behavior adherence	1–4	2.66±0.41

M = mean; SD = standard deviation.

Table 3. Correlations among the Study Variables (*N* = 153)

Variables	Health behavior adherence	Health literacy
	r (*p*)	
Health literacy	.48 (<.001)	-
Autonomy support of health providers	.26 (<.001)	.34 (<.001)

DISCUSSION

This study aimed to assess the level of health behavior adherence among patients with PCAD and to analyze the impact of health literacy and autonomy support from healthcare providers on adherence. By providing foundational data, the study sought to identify the current status of health behavior adherence in this patient population.

In this study, health behavior adherence among patients with PCAD differed significantly by sex, employment status, disease duration, and presence of comorbidities. Among these, sex, disease duration, and comorbidities were identified as significant influencing factors. Male participants (mean age 46.7 years) had significantly lower adherence scores (mean 2.58) compared to female participants (mean age 56.1 years; mean 2.82). This result contrasts with previous research, which reported that adherence scores of female CAD patients (mean 2.95) were similar to those of male patients (mean 2.98) [23]. The av-

Table 4. Factors Influencing Health Behavior Adherence among Patients with Premature Coronary Artery Disease ($N=153$)

Variables	Model 1					Model 2				
	B	β	t	*p*	95% CI	B	β	t	*p*	95% CI
(Constant)	2.73		32.06	<.001		0.97		3.14	.002	
Sex (male)	−0.17	−.19	−2.34	.021	−0.32 to 0.02	−0.14	−.16	−2.08	.039	−0.27 to −0.01
Job (yes)	−0.05	−.04	−0.50	.614	−0.24 to 0.14	−0.07	−.06	−0.87	.383	−0.23 to 0.09
Duration of illness (≥1 year)	0.26	.31	4.32	<.001	0.14 to 0.38	0.14	.17	2.42	.016	0.03 to 0.25
Comorbidities (no)	−0.17	−.19	−2.60	.010	−0.30 to −0.04	−0.15	−.17	−2.57	.011	−0.27 to −0.04
Health literacy						0.48	.36	4.93	<.001	0.29 to 0.67
Autonomy support of health provider						0.04	.09	1.38	.168	−0.02 to 0.10
R^2	.224					.370				
Adjusted R^2	.203					.345				
⊿ R^2						.146				
F (*p*)	10.69 (<.001)					14.31 (<.001)				

Reference of dummy variables: sex (female = 0), job (no = 0), duration of illness (< 1 year = 0), comorbidities (yes = 0).
CI = confidence interval.

erage age in that study [23] was 65.1 years, and the overall adherence score was 2.97. Another study [24] on older rural male CAD patients (≥ 65 years) reported higher adherence scores of 2.92 (raw data 72.99) compared with the current findings. However, a study of middle-aged males with CAD (mean age 57.3 years, range 40–64) reported an adherence score of 2.65 (raw data 72.99) [25], which is comparable to the results for males in the present study. All of these studies employed the same instrument, which included five subdomains, developed by the same author. In particular, adherence among males in their 30s was significantly lower than that of males aged 50 years and above in this study. These findings suggest that adherence among male patients shows age-related differences. Mortality among male PCAD patients has also been reported to be higher than that of females [5]. This study further identified male sex as a negative predictor of adherence. Prior research has shown that, among adult males, obesity, lack of physical activity, and alcohol consumption are major predictors of cardiovascular risk in the 30–44 age group [26]. Thus, younger male patients with PCAD in their 30s should be considered a relatively vulnerable group for health behavior adherence. However, as the number of male participants in the 30–39 age group was small in this study, further research with a larger sample size is warranted.

Employed patients with PCAD had significantly lower adherence scores (mean 2.63) compared with unemployed patients (mean 2.85). This finding is consistent with previous research, which suggested that patients with CAD in their 40s and 50s often neglect adherence to health behaviors due to work responsibilities [27]. In that study [27], employed patients scored lower (mean 2.82; raw data 70.43) than unemployed patients (mean 2.93; raw data 73.29). Although job status was not identified as a direct predictor in the regression analysis, the lower adherence among employed patients highlights the need for tailored nursing interventions that consider occupational challenges. Examples include workplace-based health programs, flexible scheduling for cardiac rehabilitation, and mobile health tools for self-monitoring.

This study also found that patients with a disease duration of more than one year demonstrated significantly higher adherence compared to those diagnosed within the past year. Disease duration of one year or more was a positive predictor of adherence. These findings are consistent with Ha and Seo [28], who reported that CAD patients who had undergone coronary interventions more than a year earlier scored higher in adherence. Longer disease duration likely improves self-management capabilities through continuous education, counseling, and increased disease awareness [28]. Previous studies have also demonstrated that adherence to lifestyle recommendations regarding smoking cessation, diet, and exercise within 30 days of an acute coronary syndrome significantly reduces mortality [6]. Early identification and modification of risk factors are therefore crucial for CAD management [4]. Assessing health behavior patterns immediately after diagnosis and providing targeted education to improve awareness are essential. In particular, regular follow-up during outpatient visits within the first year of diagnosis may help patients adopt and maintain healthier behaviors.

In addition, this study found that patients with PCAD who had comorbidities exhibited significantly higher adherence scores, while the absence of comorbidities emerged as a negative predictor. This result aligns with the findings of Han and Kim [29], who reported that myocardial infarction patients with comorbid conditions such as hypertension and diabetes demonstrated higher adherence. In this study, 32% of participants reported no comorbidities. Although the absence of additional diseases may seem beneficial, it may lead patients to underestimate the seriousness of their CAD and overestimate their health status, which could reduce adherence to health behaviors [16]. Therefore, educating PCAD patients without comorbidities about the importance of adherence is critical to slowing disease progression and preventing adverse cardiac events. Targeted education that emphasizes both the risks of neglecting health behaviors and the benefits of consistent adherence may help these patients manage their condition more effectively.

Health literacy emerged as the most significant factor influencing health behavior adherence in this study. Previous research supports this finding, demonstrating that health literacy affects adherence in elderly CAD patients [14] and also impacts health behaviors in middle-aged CAD patients [30]. This study reinforces the importance of health literacy not only for older adults, who may struggle to assimilate new health information, but also for younger patients with PCAD. To improve the health literacy of PCAD patients, efforts are required from both healthcare providers and patients. First, healthcare professionals must recognize the importance of clear, effective communication in enhancing patient health literacy [31]. Nurses, in particular, should understand the positive influence of health literacy on adherence and, when necessary, undergo training to strengthen their communication skills. Second, patient education must be tailored to individual literacy levels. Effective approaches include preemptively identifying patients with low health literacy, applying guidelines that emphasize plain and simple language in healthcare settings, and incorporating these into routine clinical practice. Such strategies have been shown to improve both health behaviors and health outcomes [15]. For PCAD patients, structured education systems should highlight the benefits of adherence and the risks of neglect, using accessible language and beginning early in the disease trajectory. This approach can better equip patients to manage their condition effectively.

However, autonomy support from healthcare providers did not significantly influence health behavior adherence in this study. This finding contrasts with Park [32], who identified autonomy support as a determinant of adherence in CAD patients. Several explanations are possible. First, the mean level of autonomy support in this study was higher and less variable compared to previous studies [32], while adherence scores were notably lower than those reported in earlier research [23,24]. Although autonomy support and adherence were positively correlated, the relationship was weak, which may explain why autonomy support did not emerge as a significant predictor in regression analysis. Second, the relatively low adherence among PCAD patients may reflect a diminished perception of disease severity or intentional noncompliance with health behaviors [33]. To strengthen adherence among PCAD patients, healthcare professionals should prioritize raising disease awareness. For example, connecting patients with specialized professionals, such as those in smoking cessation programs, may help address specific risk factors. Moreover, as prior studies suggest that autonomy support influences health behavior adherence [7] and represents a key psychological component of self-determination theory [17], further research—particularly longitudinal studies or intervention trials—is needed to clarify the long-term effects of autonomy support in this population.

This study has several limitations. First, it was conducted as a descriptive survey using a convenience sample from a single tertiary hospital, which limits the generalizability of the findings to all patients with PCAD. Additional research across diverse clinical settings is warranted. Second, the reliance on self-reported questionnaires may have introduced response bias, as participants could have exaggerated or minimized their answers, particularly for sensitive questions. Third, the cross-sectional design prevents causal inferences between predictors (e.g., health literacy) and health behavior adherence. Although the results suggest potential influencing factors, longitudinal or experimental studies are necessary to establish causal relationships.

CONCLUSION

The level of health behavior adherence among PCAD patients in this study was lower than that of general CAD patients. Specifically, male patients, those diagnosed within the past year, and patients without comorbidities demonstrated lower adherence, indicating that they should be classified as vulnerable groups requiring targeted interventions. Health literacy was the most significant factor influencing adherence. Therefore, healthcare professionals, particularly nurses, should provide CAD-related education tailored to the literacy levels of PCAD patients, beginning during the initial hospitalization and continuing through outpatient follow-up. Although autonomy support from healthcare providers was not significantly associated with adherence in this study, strategies to enhance patients' disease awareness and emphasize the importance of managing modifiable risk factors are essential. By focusing on improving health literacy and addressing the needs of vulnerable subgroups, healthcare interventions can better promote adherence to health-promoting behaviors in patients with PCAD.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and design - SRC and YY; data collection - SRC; analysis and interpretation of the data - SRC and YY; drafting and critical revision of the manuscript - SRC and YY.

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DATA AVAILABILITY STATEMENT

The data can be obtained from the first author.

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Factors Influencing Health-Related Quality of Life in Patients with Rotator Cuff Tears: A Cross-Sectional Study

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Purpose: This study investigated health-related quality of life (HRQoL) and aimed to identify factors influencing HRQoL for patients with rotator cuff tears (RCTs). **Methods:** We conducted a descriptive correlational survey with 118 outpatients diagnosed with RCTs at a tertiary general hospital in Seoul. Data were collected between February and June 2021 using structured self-report questionnaires, including the numeric rating scale, Korean version of the Shoulder Pain and Disability Index, Verran and Snyder-Halpern Sleep Scale, and the World Health Organization Quality of Life Instrument, Short Form. **Results:** HRQoL showed significant positive correlations with sleep quality ($r = .64$, $p < .001$) and the frequency of shoulder-intensive sports activities ($r = .24$, $p = .008$). It was negatively correlated with symptom days per week ($r = -.32$, $p < .001$), symptom hours per day ($r = -.51$, $p < .001$), pain ($r = -.21$, $p = .025$), functional disability ($r = -.49$, $p < .001$), and depression ($r = -.60$, $p < .001$). Stepwise regression analysis indicated that sleep quality ($\beta = .36$, $p < .001$) was the strongest predictor of HRQoL, followed by occupation ($\beta = .26$, $p < .001$), depression ($\beta = -.24$, $p = .010$), and symptom hours per day ($\beta = -.19$, $p = .013$). **Conclusion:** Sleep quality was the most influential factor affecting HRQoL in patients with RCTs. These findings underscore the need for comprehensive nursing interventions that address sleep disturbances, provide psychological support for depressive symptoms, consider occupational demands, and promote early management of prolonged symptoms to enhance HRQoL in this population.

Key Words: Quality of life; Rotator cuff injuries; Sleep quality

INTRODUCTION

With increased life expectancy and greater participation in sports activities, the incidence of rotator cuff tears (RCTs) is rising sharply. RCTs account for more than 70% of shoulder pain cases [1] and represent one of the most common musculoskeletal disorders in adults [2]. In the United States, approximately 4.5 million patient visits are related to shoulder pain each year, with about 250,000 rotator cuff repairs performed annually. These numbers are expected to increase further due to the aging U.S. population [2]. A similar trend has been observed in South Korea. According to data from the Health Insurance Review and Assessment Service (HIRA), shoulder disorders (M75) ranked 12th among inpatient diagnoses in 2024. The number of patients diagnosed with rotator cuff syndrome (M751), including RCTs, has steadily grown over the past decade, from 589,759 in 2015 to 899,322 in 2024 [3].

RCTs are primarily caused by degenerative changes. As blood supply to shoulder tendons decreases and muscle elasticity declines, the likelihood of tears increases [4]. Accordingly, the prevalence of RCTs has significantly increased in adults over the age of 50 years. However, cases in younger individuals are also on the rise, often associated with muscle injury or inflammation from vigorous sports activity [4].

Patients with RCTs frequently report severe pain that worsens at night and disrupts sleep [5]. These disturbances include shorter sleep duration, delayed sleep onset, fragmented sleep, and reduced sleep efficiency, all of which are strongly linked to nocturnal pain and limited sleeping positions [6]. Shoulder pain is also significantly associated with depression [7], and higher levels of depression correspond to lower quality of life [8]. Furthermore, both pain and functional impairment from RCTs have been shown to adversely affect quality of life [9]. Taken together, these findings suggest that patients with RCTs experience a combination of physical and psychological challenges that substantially affect their well-being [10]. Nonetheless, few comprehensive studies have examined these factors collectively in this population.

Health-related quality of life (HRQoL) is a multidimensional construct that encompasses perceived physical, psychological, and social functioning, role performance, and general health perception, thereby reflecting subjective well-being and overall life satisfaction [11]. HRQoL is widely used as a comprehensive indicator for assessing the impact of disease across multiple life domains. It is also a critical parameter in disease evaluation, treatment planning, and the measurement of patient satisfaction with care [12]. In this regard, an increasing number of studies argue that care for patients with RCTs should extend beyond physical impairment to include psychological factors [13]. Previous research has demonstrated strong associations between RCTs and diverse symptoms. Pain and physical disability are consistently linked to RCTs [10], as are depressive symptoms [14]. Sleep disorders, in particular, are frequently reported as comorbid conditions [15]. However, most prior studies have investigated individual symptoms in isolation rather than exploring their combined effects on HRQoL. Moreover, earlier research often relied on generalized measures of psychological or functional status, which may not capture the lived experiences of RCT patients. This study aimed to address these gaps by incorporating shoulder-specific measures of functional disability and multidimensional assessments of sleep disturbances, given their high prevalence and clinical significance in this patient population. Specifically, we sought to evaluate HRQoL levels and identify the major factors influencing HRQoL in patients with RCTs through a multivariate approach.

METHODS

1. Study Design

This study used a cross-sectional correlational design. This study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2. Setting and Samples

Participants were patients with RCTs. Inclusion criteria were: (1) outpatients aged 18 years or older diagnosed with RCTs and undergoing regular follow-up at a tertiary hospital in South Korea; and (2) individuals who understood the study purpose and voluntarily agreed to participate. Exclusion criteria were: (1) patients who had undergone rotator cuff surgery and were experiencing infection or other complications; (2) those with additional musculoskeletal disorders beyond RCT; and (3) those with mental illnesses or other complex conditions affecting pain.

The required sample size was estimated using G*Power 3.1.7 [16]. For multiple regression analysis with a significance level of .05, a power of .8, a medium effect size of .20, and 12 predictors (eight disease-related characteristics and four primary variables: pain, functional disability, depression, and sleep quality), a minimum of 98 participants was indicated. Although a previous study involving patients with rheumatoid arthritis applied a 10% dropout rate [17], we adopted a more conservative 15% rate to account for pain and limited shoulder mobility in RCT patients. This yielded an adjusted target sample size of 116. A total of 118 participants were recruited, and all were included in the final analysis.

Initially, 12 predictors were selected based on clinical relevance and prior studies. Four additional general characteristics were incorporated into the final regression model after demonstrating statistical significance in bivariate analysis. To confirm adequacy for the final model with 13 predictors, a second sample size calculation using the same parameters indicated a requirement of 101 participants. Therefore, the 118 participants recruited were sufficient to support the regression analysis.

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3. Instruments

1) Socio-demographic and disease-related characteristics

Socio-demographic variables included age, sex, body mass index (BMI), education level, occupation, marital status, and smoking status. Disease-related variables were identified through literature review and comprised eight items: duration of RCT symptoms, symptom days per week, symptom hours per day, usual shoulder use, frequency of shoulder-intensive sports activities, history of rotator cuff repair surgery, medication use for RCT-related pain, and presence of diabetes mellitus [15,18,19].

2) Pain

Pain intensity was measured using the numeric rating scale (NRS), which is derived from the visual analog scale [20]. The NRS ranges from 0 (no pain) to 10 (worst imaginable pain), reflecting pain experienced in daily life. It is widely used as a subjective pain assessment tool. Test-retest reliability of the NRS has been reported as strong ($r=.73$–$.88$) [21].

3) Functional disability

The Shoulder Pain and Disability Index (SPADI) includes 13 items divided into two subscales: a 5-item pain subscale assessing pain severity and an 8-item function/disability subscale evaluating difficulty with daily upper-limb activities. Scores are calculated as the mean of all items, with higher scores indicating greater disability. The Korean version of SPADI has established validity and reliability [22]. Cronbach's α was .94 in the original study [22] and .92 in this study.

4) Depression

Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D) [23], for which the Korean version has well-established reliability and validity [24]. The tool comprises 20 items rated on a 4-point Likert scale, capturing the frequency of depressive symptoms over the past week. Higher scores indicate greater depression. Cronbach's α was .91 in the original study [24] and .76 in this study.

5) Sleep quality

Sleep quality was measured with the Verran and Snyder-Halpern (VSH) sleep scale, consisting of eight items that assess waking during sleep, tossing and turning, total sleep time, depth of sleep, sleep latency, mood upon awakening, method of awakening, and sleep satisfaction [25]. Higher total scores reflect better sleep quality. The Korean version of the VSH has validated psychometric properties [26]. Cronbach's α was .83 in the original study [26] and .94 in this study.

6) Health-related quality of life

The Korean version of the World Health Organization Quality of Life Instrument, Short Form (WHOQOL-BREF) was used to measure HRQoL [27]. This tool includes 26 items: 24 items across four domains (physical health, psychological health, social relationships, and environment) and two items measuring overall quality of life. Items are rated on a 5-point scale and converted to a 100-point scale, with higher scores indicating better HRQoL [28]. Cronbach's α was .96 in the original study [27] and .95 in this study.

4. Data Collection

Data collection was conducted from February 25, 2021, to June 29, 2021, at one tertiary general hospital in Seoul, South Korea. With permission from the orthopedic and nursing departments, participants were recruited from outpatients diagnosed with RCTs. While waiting for consultations, the principal investigator explained the study purpose and procedures. Those who agreed provided written informed consent before completing the survey. Each survey required 10 to 20 minutes to complete, and participants received a small gift as a token of appreciation.

5. Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of Seoul National University Hospital (IRB No. H-2101-124-1190). The principal investigator explained the purpose and methods of the research. Participants were also assured that they could withdraw from the study at any point without any disadvantage.

6. Data Analysis

Data analysis was conducted using IBM SPSS ver. 25.0 (IBM Corp., Armonk, NY, USA), with a significance level of

.05. Descriptive statistics were used to summarize socio-demographic and disease-related characteristics, as well as pain, functional disability, depression, sleep quality, and HRQoL. Group differences were examined using the independent t-test for normally distributed variables and the Mann–Whitney U test for non-normal distributions. One-way analysis of variance with the Scheffe post-hoc test was also conducted. Associations among variables were analyzed using Pearson correlation coefficients, and the factors influencing HRQoL were identified through stepwise multiple regression.

RESULTS

1. Participant Characteristics

The mean age of participants was 62.05±8.86 years, with most in their 50s or 60s (76.2%). A majority were female (56.8%), and 47.5% were classified as obese (BMI≥25 kg/m^2). Overall, 44.1% had a college-level education or higher, and 91.5% were married. Regarding occupation, 25.4% were office workers or professionals. Additionally, 28.0% reported current or past smoking history.

In terms of disease-related characteristics, the average duration of rotator cuff-related symptoms was 32.71 months, with 55.1% reporting a duration of 1–3 years. Participants experienced symptoms on average 5.34 days per week and 10.00 hours per day. The mean level of usual shoulder use was 3.22 out of 5, and the mean frequency of shoulder-intensive sports activities was 2.28 out of 5. Furthermore, 26.3% had undergone rotator cuff surgery, 19.5% used medication for rotator cuff pain, and 20.3% had diabetes (Table 1).

2. Pain, Functional Disability, Depression, Sleep Quality, and Health-Related Quality of Life of Participants

Participants' scores for pain, functional disability, depression, sleep quality, and HRQoL are summarized in Table 2. The mean pain score was 5.40±2.37. The overall functional disability score was 55.86±17.24, with pain and function/disability subscale scores of 67.73±19.83 and 48.64±18.19, respectively. The mean depression score was 33.84±6.33, and the mean sleep quality score was 43.79±18.32. The total HRQoL score was 53.50±11.73, with subdomain scores of 11.85±2.48 for physical health, 12.31±2.27 for psychological health, 13.47±2.09 for social relationships, and 12.62±1.87 for environmental health.

3. Differences in Health-Related Quality of Life According to Participant Characteristics

HRQoL scores by socio-demographic and disease-related characteristics are presented in Table 3. In terms of socio-demographic characteristics, individuals younger than 65 years had significantly higher HRQoL scores than those aged 65 or older ($t=3.76$, $p<.001$). Participants with a college education or higher reported greater HRQoL than those with a high school diploma or lower ($F=11.24$, $p<.001$). Post-hoc analysis indicated that both the middle school or lower and high school groups had significantly lower scores compared to the college or above group. Married participants reported higher HRQoL than unmarried individuals ($z=1.97$, $p=.049$). In terms of occupation, office workers or professionals had significantly higher HRQoL than those in other occupations ($t=4.59$, $p<.001$).

Regarding disease-related characteristics, participants not taking medication for RCT-related pain had significantly higher HRQoL scores than those who were ($z=-4.13$, $p<.001$). Likewise, participants without diabetes mellitus reported higher HRQoL scores than those with diabetes ($z=-3.23$, $p<.001$).

4. Correlations among Key Variables

Correlations among major variables are presented in Table 4. Sleep quality ($r=.64$, $p<.001$) and frequency of shoulder-intensive sports activities ($r=.24$, $p=.008$) showed a positive correlation with HRQoL. Meanwhile, symptom days per week ($r=-.32$, $p<.001$), symptom hours per day ($r=-.51$, $p<.001$), pain ($r=-.21$, $p=.025$), functional disability ($r=-.49$, $p<.001$), and depression ($r=-.60$, $p<.001$) were negatively correlated with HRQoL.

5. Factors Influencing Health-Related Quality of Life in Patients with Rotator Cuff Tears

Stepwise regression analysis was conducted to identify predictors of HRQoL in patients with RCTs. Independent variables included age, education level, marital status, occupation, medication use for RCT-related pain, diabetes mellitus, symptom days per week, symptom hours per day, frequency of shoulder-intensive sports activities, pain, functional disability, depression, and sleep quality. Cate-

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Table 1. Socio-demographic and Disease-Related Characteristics ($N = 118$)

Variables	Categories	n (%)	M ± SD	Min–Max
Age (year)	30–39	3 (2.5)	62.05 ± 8.86	36–83
	40–49	8 (6.8)		
	50–59	28 (23.7)		
	60–69	62 (52.5)		
	70–79	14 (11.9)		
	80–89	3 (2.5)		
Sex	Male	51 (43.2)		
	Female	67 (56.8)		
BMI (kg/m^2)	Underweight and normal weight (≤ 22.9)	26 (22.0)	24.77 ± 2.63	18.4–32.5
	Overweight (23.0–24.9)	36 (30.5)		
	Obesity (≥ 25.0)	56 (47.5)		
Education level	Middle or lower	24 (20.3)		
	High	42 (35.6)		
	College or above	52 (44.1)		
Marital status	Married	108 (91.5)		
	Others	10 (8.5)		
Occupation	Office worker, professional	30 (25.4)		
	Non-office worker	36 (30.5)		
	Housewife	42 (35.6)		
	Unemployed or retired	10 (8.5)		
Smoking	Ever smoker	33 (28.0)		
	Non-smoker	85 (72.0)		
Symptom duration (month)	< 6	12 (10.2)	32.71 ± 42.80	1.5–240.0
	6–11	18 (15.3)		
	12–36	65 (55.1)		
	> 36	23 (19.5)		
Symptom days per week	1–2	7 (5.9)	5.34 ± 1.67	2–7
	3–5	59 (50.0)		
	6–7	52 (44.1)		
Symptom hours per day	Within an hour	10 (8.5)	10.00 ± 8.01	0.1–24.0
	1–5	32 (27.1)		
	6–11	30 (25.4)		
	12–23	26 (22.0)		
	24	20 (16.9)		
Usual level of shoulder use			3.22 ± 1.12	1–5
Frequency of shoulder-intensive sports activities			2.28 ± 1.28	1–5
History of rotator cuff repair surgery	Yes	31 (26.3)		
	No	87 (73.7)		
Medication use for rotator cuff-related pain	Yes	23 (19.5)		
	No	95 (80.5)		
Diabetes mellitus	Yes	24 (20.3)		
	No	94 (79.7)		

BMI = body mass index; M = mean; Max = maximum; Min = minimum; SD = standard deviation.

gorical variables were dummy-coded as follows: education (high school or lower = 0, college or higher = 1), marital status (others = 0, married = 1), occupation (others = 0, office worker/professional = 1), medication use for RCT-related pain (no = 0, yes = 1), and diabetes mellitus (no = 0, yes = 1).

The assumptions of regression analysis were tested and met. Tolerance values ranged from .48 to .97, and the variance inflation factor ranged from 1.03 to 2.10, both indicat-

Table 2. Pain, Functional Disability, Depression, Sleep Quality and HRQoL (N = 118)

Variables	Subscale	M ± SD	Range	Min	Max
Pain		5.40 ± 2.37	0–10	0	10
Functional disability	Total	55.86 ± 17.24	0–100	5.38	100
	Pain	67.73 ± 19.83		8.00	100
	Function disability	48.64 ± 18.19		3.75	100
Depression		33.84 ± 6.33	0–60	24.00	53.00
Sleep quality		43.79 ± 18.32	0–80	8.60	71.20
HRQoL	Total	53.50 ± 11.73	0–100	28.16	75.30
	Physical health	11.85 ± 2.48	4–20	6.29	17.14
	Psychological health	12.31 ± 2.27	4–20	7.33	17.33
	Social relationship	13.47 ± 2.09	4–20	6.66	18.66
	Environment	12.62 ± 1.87	4–20	7.50	17.00

HRQoL = health-related quality of life; M = mean; Max = maximum; Min = minimum; SD = standard deviation.

Table 3. Differences in HRQoL According to Participant Characteristics (N = 118)

Variables	Categories	n (%)	HRQoL	
			M ± SD	t/z or F (p) Scheffe
Age (year)	< 65	66 (55.9)	56.92 ± 9.43	3.76 (< .001)
	≥ 65	52 (44.1)	49.17 ± 12.97	
Sex	Male	51 (43.2)	54.91 ± 11.91	1.13 (.259)
	Female	67 (56.8)	52.44 ± 11.57	
BMI (kg/m^2)	Underweight & normal weight (≤ 22.9)	26 (22.0)	52.26 ± 12.24	0.66 (.517)
	Overweight (23.0–24.9)	36 (30.5)	52.36 ± 11.78	
	Obesity (≥ 25)	56 (47.5)	54.82 ± 11.54	
Education level	Middle or lower^{a}	24 (20.3)	47.27 ± 12.23	11.24 (< .001)
	High^{b}	42 (35.6)	50.71 ± 10.56	a, b < c
	College or above^{c}	52 (44.1)	56.64 ± 10.35	
Marital status[†]	Married	108 (91.5)	54.19 ± 11.53	1.97 (.049)
	Others	10 (8.5)	46.09 ± 12.00	
Occupation	Office worker & professional	30 (25.4)	60.35 ± 8.50	4.59 (< .001)
	Others	88 (74.6)	51.17 ± 11.81	
Smoking	Ever smoker	33 (28.0)	53.84 ± 12.52	0.18 (.854)
	Non-smoker	85 (72.0)	53.37 ± 11.49	
History of rotator cuff repair surgery	Yes	31 (26.3)	57.04 ± 10.71	1.98 (.050)
	No	87 (73.7)	52.24 ± 11.88	
Medication use for rotator cuff-related pain[†]	Yes	23 (19.5)	44.28 ± 11.40	–4.13 (< .001)
	No	95 (80.5)	55.74 ± 10.73	
Diabetes mellitus[†]	Yes	24 (20.3)	46.18 ± 12.18	–3.23 (< .001)
	No	94 (79.7)	55.38 ± 10.91	

BMI = body mass index; HRQoL = health-related quality of life; M = mean; SD = standard deviation; [†]Mann–Whitney U test.

ing no concerns with multicollinearity. The Durbin–Watson statistic was 1.85, suggesting no autocorrelation of residuals. Additionally, the residuals met the assumption of normality.

Stepwise regression results showed that Model 1, which included only sleep quality, explained 40.2% of the variance in HRQoL (F = 79.71, p < .001), establishing sleep quality as the strongest predictor. In Model 2, the addition of occupation increased explanatory power to .48 (F = 17.16, p < .001), highlighting the independent contribution of social factors. Model 3 included depression, further increasing the adjusted R^2 to .52 (F = 10.47, p = .002), supporting the importance of psychological factors. In Model 4, symptom hours per day was added, resulting in an adjusted R^2

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Table 4. Correlations among Variables Related to HRQoL ($N=118$)

Variables	r (*p*)									
	A	B	C	D	E	F	G	H	I	J
A. Symptom duration	1									
B. Symptom days per week	.14 (.119)	1								
C. Symptom hours per day	.16 (.086)	.56 (<.001)	1							
D. Usual level of shoulder use	.28 (.002)	.21 (.021)	.16 (.087)	1						
E. Frequency of shoulder-intensive sports activities	.02 (.855)	–.07 (.458)	–.15 (.111)	.02 (.861)	1					
F. Pain	.05 (.592)	.21 (.024)	.31 (<.001)	.08 (.374)	–.05 (.625)	1				
G. Functional Disability	.13 (.170)	.27 (.003)	.49 (<.001)	.01 (.881)	–.20 (.030)	.58 (<.001)	1			
H. Depression	.02 (.827)	.30 (.001)	.48 (<.001)	.04 (.676)	–.14 (.143)	.32 (<.001)	.43 (<.001)	1		
I. Sleep quality	–.11 (.259)	–.33 (<.001)	–.47 (<.001)	–.06 (.506)	.03 (.734)	–.34 (<.001)	.49 (<.001)	–.71 (<.001)	1	
J. HRQoL	–.08 (.418)	–.32 (<.001)	–.51 (<.001)	–.14 (.123)	.24 (.008)	–.21 (.025)	–.49 (<.001)	–.60 (<.001)	.64 (<.001)	1

HRQoL=health-related quality of life.

of .54 (F=6.38, $p=.013$), producing a model that integrates physical, psychological, and social domains.

In the final model (Model 4), the significant predictors of HRQoL were sleep quality ($\beta=.36$, $p<.001$), occupation ($\beta=.26$, $p<.001$), depression ($\beta=-.24$, $p=.010$), and symptom hours per day ($\beta=-.19$, $p=.013$), with sleep quality emerging as the strongest predictor of HRQoL (Table 5).

DISCUSSION

This study aimed to identify the factors influencing HRQoL in adults with RCTs. Analysis revealed that sleep quality, occupation, depression, and symptom hours per day were significant predictors. These findings suggest that functional, emotional, and physiological dimensions are interrelated in shaping overall quality of life. By examining multidimensional variables such as socio-demographic characteristics, physical function, and psychological factors, this study provides a more comprehensive understanding of the determinants of HRQoL in this population. The results highlight the interrelationships among these factors and emphasize the importance of a comprehensive, multidisciplinary approach when planning treatment and care for patients with RCTs.

In this study, the overall HRQoL score of participants was 53.50, which is comparable to the preoperative HRQoL score of 58.8 reported in a previous study of RCT patients [29]. This finding indicates that the HRQoL of individuals with RCTs remains low. Therefore, interventions to improve HRQoL in this patient group should focus on identifying and actively addressing the contributing factors.

Sleep quality was identified as the most influential predictor in the regression model. This demonstrates that sleep is not simply a measure of rest or daily functioning but a multifaceted indicator encompassing pain perception, emotional well-being, and the ability to engage in everyday activities [30]. Sleep disturbances are prevalent in RCT patients and are frequently worsened by nocturnal pain, which hinders physical recovery and heightens emotional distress [31]. These results underscore that sleep quality is a central determinant of overall well-being, rather than a secondary health indicator.

Among socio-demographic characteristics, occupation also showed a significant association with HRQoL. In this study, occupations were classified into office-based and other categories according to functional demands related to shoulder use. Office workers generally engaged in less physically demanding tasks, whereas self-employed individuals, manual laborers, and housewives were more likely to experience repetitive or prolonged shoulder use, which increased physical strain and exacerbated pain [32]. These occupational characteristics may contribute to activity lim-

Table 5. Factors Influencing the Health-Related Quality of Life (N=118)

Variables	Model 1					Model 2					Model 3					Model 4				
	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p
(Constant)	35.60	2.17		16.39	<.001	34.51	2.05		16.82	<.001	58.73	7.74		7.59	<.001	59.54	7.57		7.87	<.001
Sleep quality	0.41	0.05	.64	8.93	<.001	0.39	0.04	.61	9.05	<.001	0.26	0.06	.40	4.42	<.001	0.23	0.06	.36	3.91	<.001
Occupation (office, professional=ref.)						7.49	1.81	.28	4.14	<.001	7.50	1.74	.28	4.32	<.001	6.92	1.71	.26	4.04	<.001
Depression											−0.54	0.17	−.29	−3.24	.002	−0.44	0.17	−.24	−2.62	.010
Symptom hours per day																−0.27	0.11	−.19	−2.53	.013
R^2			.41					.48					.53					.55		
Adjusted R^2			.40					.48					.52					.54		
$\triangle R^2$			.41					.08					.04					.03		
F change (p)			79.71 (<.001)					17.16 (<.001)					10.47 (.002)					6.38 (.013)		

S.E.=standard error.

itations and higher physical burden, underscoring the need for tailored intervention strategies that account for job-related demands.

Depression emerged as another significant predictor, negatively associated with HRQoL. Although strongly correlated with sleep quality, its independent retention in the regression model suggests a distinct contribution. Chronic physical restrictions caused by pain can lead to emotional withdrawal and negative self-perceptions [14]. These findings indicate that psychological distress in RCT patients is not merely a secondary response to physical symptoms but may represent a primary factor reducing HRQoL [13]. Therefore, routine assessment of psychological status and provision of emotional support should be integral components of nursing care.

Among disease-related characteristics, symptom hours per day also significantly influenced HRQoL. This finding suggests that symptom chronicity adversely affects patients' subjective health perceptions, functional performance, and recovery expectations [33]. Thus, early intervention at the onset of symptoms may be essential for preserving HRQoL in patients with RCTs.

Although variables such as pain, functional disability, and certain disease-related characteristics showed significant correlations with HRQoL in the bivariate analyses, they were excluded from the final regression model. This may be due to overlapping explanatory contributions from other variables in the model. It is possible that these factors influence quality of life indirectly through more immediate variables such as sleep quality or depressive symptoms. This interpretation is supported by previous studies demonstrating that psychological factors—including depression, anxiety, and sleep disorders—mediate the relationship between physical symptoms and quality of life [34]. These findings indicate that interventions focusing solely on alleviating pain or improving physical function may have a limited impact on overall quality of life, underscoring the need for comprehensive approaches that address emotional regulation and sleep recovery simultaneously. Furthermore, traditional clinical indicators such as surgical history, medication use, smoking, and diabetes mellitus did not significantly affect HRQoL in this population. These results suggest that subjective experiences, including emotional well-being and the chronicity of symptoms, may be more directly associated with quality of life than medical history or comorbidities [13].

In conclusion, this study is meaningful in that it identified key factors influencing HRQoL in patients with RCTs. The findings suggest a shift in clinical priorities from conventional pain- and function-based interventions toward more targeted strategies addressing sleep quality as a core determinant of HRQoL. Sleep status, which strongly affects physical recovery, emotional stability, and daily functioning, should be routinely assessed and managed in nursing practice. Additionally, categorizing occupations according to functional demands rather than descriptive titles offers new insight into evaluating patients' physical requirements and recovery potential [32]. This functional approach may help guide the development of customized nursing strategies that consider patients' daily environments and lived experiences. The simplified presentation of key predictors in this study also provides practical evidence for designing nursing interventions and educational programs. In particular, sleep and emotional health represent domains in which nurses can play an active role through education, counseling, and supportive care. Since the final regression model explained approximately 53% of the variance in HRQoL, future research should incorporate additional variables such as overall health status, comorbidities, coping strategies, and social support to yield a more comprehensive understanding. Differentiating general pain from night pain, which may have an immediate impact on sleep quality, could improve the precision of symptom assessment. Moreover, future studies may benefit from incorporating objective measures such as wearable sleep trackers to complement self-reported data and enhance the accuracy of sleep assessment.

This study has several limitations. First, generalizability is restricted, as the sample consisted of 118 RCT patients recruited from the orthopedic outpatient clinic of a single tertiary hospital in Seoul. Caution is warranted in interpretation because the study population included post-surgical acute-phase patients, and the purpose of outpatient visits was not distinguished. Second, although the sample size was initially calculated based on disease-related characteristics and primary variables, several general characteristics reached statistical significance during bivariate analysis and were subsequently included in the final regression model. While the sample of 118 participants satisfied the power requirements for the expanded model with 13 predictors, larger and more diverse samples are needed to enhance generalizability. Third, night pain is a characteristic symptom of RCTs, yet the survey items did not explicitly distinguish it. Consequently, respondents may have incorporated night pain into their general pain responses, which likely contributed to sleep quality emerging as the most significant factor. Future studies should specifically assess the correlation between night pain and sleep quality. Fourth, the WHOQOL-BREF, as a generic HRQoL instrument, may not fully capture the unique quality of life issues faced by RCT patients due to its broad scope. Finally, this study considered only diabetes mellitus as a chronic disease variable, although other comorbidities such as osteoarthritis and previous shoulder injuries may also influence the progression and lived experience of RCTs. The exclusion of these conditions may have limited the assessment of comorbidities on HRQoL.

CONCLUSION

This study found significant correlations between HRQoL and factors including age, education level, marital status, occupation, medication use for RCT-related pain, presence of diabetes mellitus, symptom days per week, symptom hours per day, frequency of shoulder-intensive sports activities, pain, functional disability, depression, and sleep quality. Stepwise regression analysis identified sleep quality, occupation, depression, and symptom hours per day as the most influential predictors of HRQoL.

Based on these findings, comprehensive quality of life improvement programs should be developed and implemented for patients with RCTs. Such programs should include targeted interventions to improve sleep, psychological support for depressive symptoms, consideration of occupational demands, and early management of prolonged symptoms.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and design acquisition - HJH and YHP; analysis - HJH; interpretation of the data - HJH; and drafting or critical revision of the manuscript for important intellectual content - HJH and YHP.

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The data can be obtained from the corresponding author.

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Utilization of Life-Sustaining Treatments before Death by Health Insurance Type in Older Adults in South Korea: A Nationwide Cohort Study

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Purpose: This study investigated differences in the use of life-sustaining treatments during the last six months of life between older adults covered by the National Health Insurance (NHI) and those enrolled in the Medical Aid (MA) program. **Methods:** A retrospective cohort design was applied using national claims data from the National Health Insurance Service. The study population included individuals aged ≥65 years who died in 2023, with 286,319 decedents (247,935 with NHI and 38,384 with MA) analyzed. We compared hospitalization frequency and duration, intensive care unit (ICU) stays, and the use of life-sustaining treatments, including cardiopulmonary resuscitation, mechanical ventilation, hemodialysis, chemotherapy, transfusions, and vasopressors, between NHI and MA groups. Logistic regression analyses were conducted with adjustments for age, sex, comorbidities, place of death, and advance care planning status. **Results:** Completion rates of advance directives and physician orders for life-sustaining treatment were lower in MA than in NHI decedents. MA decedents had fewer admissions but significantly longer hospital and ICU stays than NHI decedents. They were less likely to receive mechanical ventilation, chemotherapy, transfusion, and vasopressors but more likely to undergo hemodialysis. **Conclusion:** Substantial disparities exist in end-of-life care by insurance type, suggesting that socioeconomic inequalities and reimbursement structures influence patterns of intensive care near the end of life. Targeted interventions are needed to ensure equitable, patient-centered end-of-life care for socioeconomically vulnerable older adults.

Key Words: Health insurance; Insurance claim review; Medicaid; Terminal care

INTRODUCTION

Socioeconomic status (SES) is a critical determinant of disparities in access to and utilization of healthcare services, including life-sustaining treatments at the end of life (EOL), even in countries with universal healthcare or robust public health systems [1-3]. Health insurance type—an indicator of SES—can substantially affect both access to care and treatment decisions [4]. Differences in the use of life-sustaining treatments and EOL care across insurance types reflect not only service availability but also broader issues of healthcare equity and patient-centered care [5].

In Korea, 91% of the population is enrolled in the National Health Insurance (NHI) scheme, which provides universal health coverage [6]. The government supports individuals unable to afford insurance through the Medical Aid (MA) program. Most MA beneficiaries are older adults with multiple chronic conditions whose financial hardship frequently hinders appropriate and timely treatment, leading to health deterioration [7]. These clinical and economic constraints may result either in underutilization of necessary active treatments or in the delivery of unnecessary life-sustaining interventions. International studies have reported that low SES and Medicaid coverage are associated with lower utilization of hospice services and greater reliance on intensive care at the EOL [8-10].

Although quantitative research increasingly documents disparities in palliative care access and life-sustaining treatment use across socioeconomic groups [8-10], little is known about the experiences of people with low SES in EOL care. Compared with individuals at the highest SES level, those at the lowest level are more likely to die in hospitals rather than at home or in hospices and to receive acute hospital-based care during the last three months of life [11]. This trend indicates a higher likelihood of receiving life-sustaining treatments among those with low SES. Aggressive EOL care is associated with reduced quality of life for patients and families and contributes to high medical expenditures during the last months of life, further straining the healthcare system [12,13].

Despite substantial research on EOL care in terminally ill populations, particularly among those with cancer or dementia [14,15], few studies have specifically examined EOL care in individuals with low SES, such as MA beneficiaries. Understanding patterns of healthcare utilization and life-sustaining treatment in this group, characterized by multiple chronic conditions and often lacking familial support, is essential to improving the quality of EOL care. Therefore, this study aimed to investigate differences in healthcare utilization, focusing on hospitalizations, intensive care unit (ICU) stays, and life-sustaining treatments, during the last six months of life between older adults with NHI and those with MA, using national claims data.

METHODS

1. Study Design

This study used a retrospective cohort design based on claims data from the National Health Insurance Service (NHIS) of South Korea. Study procedures and findings were reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist [16].

2. Data Source and Study Population

Claims data were obtained from the NHIS database, a comprehensive national resource that integrates information from both the NHIS and the MA program. The database contains extensive records, including qualification data (e.g., age, sex, income, region, and qualification type), claims data (e.g., procedure, diagnostic, and medication codes), health checkup results, death-related information, and details about medical institutions.

The study cohort consisted of 286,319 individuals aged ≥65 years who died between January 1 and December 31, 2023, and who had used healthcare services within six months before death (Figure 1). To assess healthcare utilization—including life-sustaining treatment—during this period, each individual's medical observation window was defined as the six months preceding their date of death. Hospitalization and life-sustaining treatment utilization were evaluated within 0–30, 0–90, and 0–180 days before death.

3. Measurements

1) Hospital and ICU admissions and length of stay

Hospitalizations and ICU admissions were defined as the average frequency per person during each observation window. Hospitalization days and ICU stays were defined as the average duration per person within the same periods.

2) Life-sustaining treatment use

Life-sustaining treatments were identified using specific procedure codes, including cardiopulmonary resuscitation (CPR), mechanical ventilation, extracorporeal membrane oxygenation (ECMO), hemodialysis, chemotherapy, transfusion, and vasopressors. These interventions are recognized as life-sustaining treatments under the Act on Hospice and Palliative Care and Decisions on Life-Sustaining Treatment for Patients at the End of Life (Life-Sustaining Treatment Decision Act) in South Korea (Act No. 19466, April 1, 2025) [17]. ECMO was excluded from the analysis

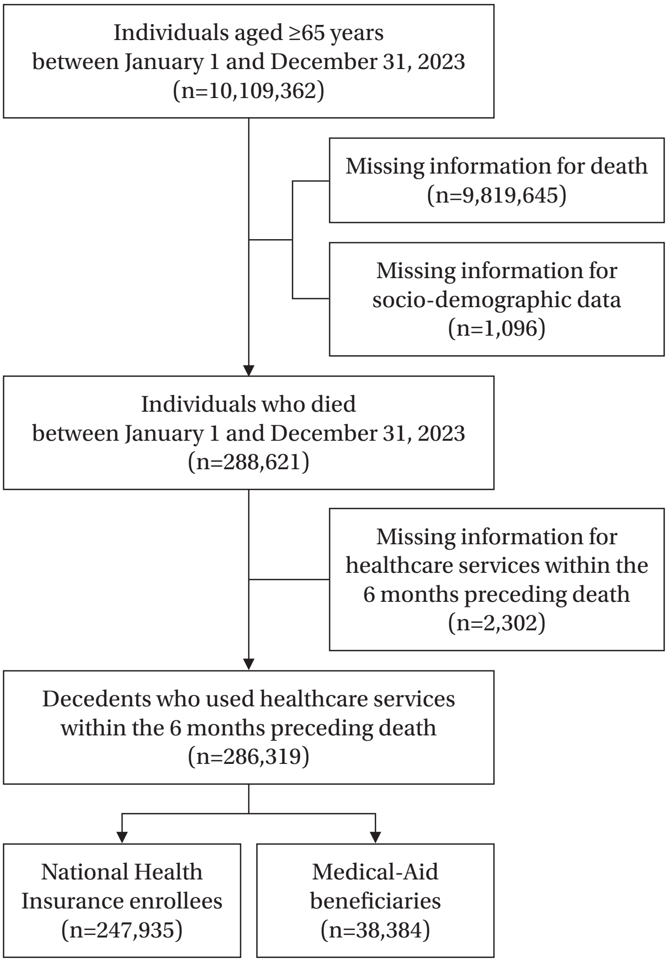

Figure 1. Flow chart of cohort selection.

due to its extremely low use, accounting for <0.01% of all cases. Life-sustaining treatment use was defined as receiving at least one relevant treatment during a given observation window. Individuals who received the specified treatment at least once within 0–30, 0–90, or 0–180 days before death were coded as "1," and those who did not receive the treatment were coded as "0."

3) Covariates

Age was grouped into 65–74, 75–84, and ≥85 years. Geographic regions were classified into three tiers: large (metropolitan cities), medium (cities with or without administrative districts), and small (eup/myeon [town/township] areas within cities). The number of chronic diseases was categorized as 0, 1, 2, or ≥3. Chronic conditions included hypertension, diabetes, mental and behavioral disorders (including epilepsy), respiratory tuberculosis, heart disease, cerebrovascular disease, nervous system disease, malignant neoplasms, thyroid disease, liver disease (including chronic viral hepatitis), and chronic kidney disease. Disease severity was assessed using the Charlson comorbidity index (CCI) score [18], categorized as 0, 1, 2, or ≥3. Place of death was grouped into tertiary hospitals, general hospitals, long-term care hospitals, and others. The presence of advance directives and physician orders for life-sustaining treatment was determined by whether participants had completed the documentation.

4. Ethical Considerations

This study involved secondary analysis of existing data. It was exempted from ethics review by the Institutional Review Board of the first author's university in South Korea (No. 2022-10-021).

5. Data Analysis

All analyses were conducted using the Statistical Analysis System (SAS) version 9.4 (SAS Institute, Inc., Cary, NC, USA). Descriptive statistics, the chi-square test, and the independent t-test were applied to compare characteristics of NHI and MA decedents. Differences in the number of hospitalizations, ICU admissions, and length of stay during the 180 days before death were examined using independent t-tests. Use of life-sustaining treatments across NHI and MA groups was compared with descriptive statistics and chi-square tests for three timeframes (0–30, 0–90, and 0–180 days before death). Logistic regression analysis was performed to estimate the relative risk of life-sustaining treatment use within 180 days before death by insurance type, with results reported as odds ratios (ORs) and 95% confidence intervals (CIs). Multiple logistic regression models were adjusted for age, sex, CCI score, place of death, and completion of advance directives or physician orders for life-sustaining treatment.

RESULTS

1. Participants' General Characteristics by Health Insurance Type

The final sample included 286,319 older adults who had died, with 247,935 covered by NHI and 38,384 enrolled in MA (Table 1). The two groups showed statistically significant differences in demographic and clinical characteristics. More than half of the NHI decedents were males

(50.8%), whereas most MA decedents were females (55.4%). The mean age was higher among NHI decedents (82.86±8.24) than among MA decedents (81.66±9.20). A substantial proportion of both groups were aged ≥85 years (45.8% in NHI and 41.6% in MA). The mean CCI score was also higher in MA decedents (0.33±0.88) than in NHI decedents (0.32±0.87). In both groups, the most frequent place of death was long-term care hospitals. Deaths in tertiary hospitals were more common among NHI decedents (16.9%) than among MA decedents (11.7%). Completion rates of advance directives (2.8% vs. 1.1%) and physician orders for life-sustaining treatment (1.0% vs. 0.9%) were both higher in the NHI group compared with the MA group.

2. Hospitalizations and ICU Admissions for 180 Days before Death by Health Insurance Type

Hospitalization and ICU admission patterns differed significantly between NHI and MA decedents (Table 2). During the last 180 days of life, MA decedents had fewer hospital admissions than NHI decedents (5.25±4.57 vs. 6.08±5.44). However, despite fewer admissions, MA decedents had significantly longer cumulative hospital stays (45.86±88.77 days) compared with NHI decedents (30.85±68.45 days). Similarly, the mean number of ICU admissions was slightly higher among MA decedents (1.47±0.93) than NHI decedents (1.42±0.87). The average ICU stay was also longer in the MA group (10.41±17.69 days) than in the NHI group (8.99±16.34 days).

Table 1. General Characteristics of the Participants (*N*=286,319)

Characteristics	Categories	n (%) or mean±SD		χ^2/t	*p*
		NHI (n=247,935)	MA (n=38,384)		
Sex	Male	125,972 (50.8)	17,113 (44.6)	515.17	<.001
	Female	121,963 (49.2)	21,271 (55.4)		
Age (year)		82.86±8.24	81.66±9.20	–24.09	<.001
	65–74	44,273 (17.9)	9,852 (25.7)	1,323.11	<.001
	75–84	90,098 (36.3)	12,554 (32.7)		
	85 or older	113,564 (45.8)	15,978 (41.6)		
Size of residential area	Large	92,423 (37.3)	16,159 (42.1)	408.48	<.001
	Medium	115,654 (46.6)	17,168 (44.7)		
	Small	39,858 (16.1)	5,057 (13.2)		
No. of chronic diseases		2.12±1.17	2.12±1.21	–0.82	.411
	0	10,309 (4.2)	1,558 (4.1)	69.15	<.001
	1	72,900 (29.4)	11,994 (31.2)		
	2	81,758 (33.0)	11,995 (31.3)		
	3 or more	82,968 (33.5)	12,837 (33.4)		
CCI score		0.32±0.87	0.33±0.88	2.15	.032
	0	214,655 (86.6)	33,073 (86.2)	5.18	.159
	1	6,844 (2.8)	1,094 (2.9)		
	2	6,257 (2.5)	982 (2.6)		
	3 or more	20,179 (8.1)	3,235 (8.4)		
Place of death	Tertiary hospital	41,969 (16.9)	4,503 (11.7)	1,798.69	<.001
	General hospital	75,357 (30.4)	10,977(28.6)		
	Long-term care hospital	81,711 (33.0)	16,597 (43.2)		
	Others	48,898 (19.7)	6,307 (16.4)		
Advance directive	Yes	7,011 (2.8)	421 (1.1)	393.89	<.001
	No	240,924 (97.2)	37,963 (98.9)		
POLST	Yes	2,425 (1.0)	335 (0.9)	3.86	.049
	No	245,510 (99.0)	38,049 (99.1)		

CCI=Charlson comorbidity index; MA=Medical Aid; NHI=National Health Insurance; POLST=physician orders for life-sustaining treatment; SD=standard deviation.

Table 2. Number of Admissions and Lengths of Stays in Hospital and ICU for 180 Days before Death by Health Insurance Type (*N*=286,319)

Variables	Mean±SD		t	*p*
	NHI (n=247,935)	MA (n=38,384)		
Number of hospital admissions	6.08±5.44	5.25±4.57	–51.91	<.001
Length of hospitalization (day)	30.85±68.45	45.86±88.77	51.09	<.001
Number of ICU admissions	1.42±0.87	1.47±0.93	4.86	<.001
Length of ICU stay (day)	8.99±16.34	10.41±17.69	8.02	<.001

ICU=intensive care unit; MA=Medical Aid; NHI=National Health Insurance; SD=standard deviation.

3. Use of Life-Sustaining Treatment during the 180 Days before Death by Health Insurance Type

Table 3 compares life-sustaining treatment use between NHI and MA decedents across the 0–30, 0–90, and 0–180 day periods before death. Overall, the utilization rates of most life-sustaining treatments—except for hemodialysis and vasopressors—were consistently higher among NHI decedents than among MA decedents. Specifically, NHI decedents had higher rates of CPR (13.0%, 13.6%, and 13.8% vs. 11.6%, 12.3%, and 12.5%), mechanical ventilation (14.2%, 16.3%, and 17.2% vs. 12.4%, 14.3%, and 15.1%), chemotherapy (8.2%, 15.6%, and 18.8% vs. 5.3%, 10.5%, and 12.9%), and transfusion (3.7%, 5.9%, and 6.7% vs. 2.0%, 3.3%, and 3.9%) across all observation windows (all $p<.001$). In contrast, hemodialysis rates were higher in the MA group (4.3%, 5.0%, and 5.2% vs. 4.8%, 5.4%, and 5.6%), and vasopressor use was also higher among MA decedents (33.2%, 38.2%, and 40.3% vs. 34.0%, 38.8%, and 40.7%), except at 0–180 days, where the difference was not statistically significant.

4. Impact of Healthcare Insurance Type on the Utilization of Life-Sustaining Treatments during the 180 Days before Death

Table 4 shows the results of logistic regression analyses examining the association between health insurance type and use of life-sustaining treatments in the 180 days before death. The models were adjusted for age, sex, CCI score, place of death, and completion of advance directives or physician orders for life-sustaining treatment. Compared with NHI decedents, MA decedents were significantly less likely to receive mechanical ventilation (OR=0.93, 95% CI=0.90–0.96), chemotherapy (OR=0.62, 95% CI=0.60–0.64), transfusion (OR=0.58, 95% CI=0.55–0.61), and vasopressors (OR=0.97, 95% CI=0.95–0.99). Conversely, MA decedents were more likely to undergo hemodialysis (OR=1.06, 95% CI=1.01–1.11, $p=.017$).

DISCUSSION

This study examined the impact of health insurance type on healthcare utilization, including life-sustaining treatments, during the last 180 days of life in older adults. The findings show that MA decedents experienced longer hospital and ICU stays but were significantly less likely than NHI decedents to receive most life-sustaining treatments, with the exceptions of CPR and hemodialysis. These results highlight the importance of targeted interventions to address socioeconomic disparities in EOL care by clarifying the underlying mechanisms and assessing the quality of care delivered.

In this study, the overall completion rate of advance directives and physician orders for life-sustaining treatment among all decedents was notably low. This may reflect the relatively short time since the implementation of the Life-Sustaining Treatment Decisions Act and the advanced age of the study population. Although national and professional initiatives have gradually increased completion rates [19], the lower rates among MA decedents compared with NHI decedents remain concerning. This finding is consistent with previous studies showing that individuals from low-income households are less likely to participate in advance care planning and have limited access to or awareness of related resources [20,21]. Contributing factors include information asymmetry, limited health literacy, distrust of the healthcare system, and social barriers. In particular, MA beneficiaries often have lower education levels [7,22], less access to healthcare information, and more constrained healthcare-seeking behaviors [22], which may hinder meaningful discussions with healthcare providers about future care preferences [23]. Tailored educational and counseling programs, along with structured

Table 3. Use of Life-Sustaining Treatment for 180 Days before Death by Health Insurance Scheme

Categories		0–30 days			0–90 days			0–180 days		
		n (%)	χ^2	*p*	n (%)	χ^2	*p*	n (%)	χ^2	*p*
Cardiopulmonary resuscitation	NHI	32,118 (13.0)	55.04	< .001	33,796 (13.6)	49.63	< .001	34,233 (13.8)	45.76	< .001
	MA	4,451 (11.6)			4,726 (12.3)			4,811 (12.5)		
Mechanical ventilation	NHI	35,262 (14.2)	92.49	< .001	40,445 (16.3)	98.91	< .001	42,574 (17.2)	99.53	< .001
	MA	4,757 (12.4)			5,493 (14.3)			5,804 (15.1)		
Hemodialysis	NHI	10,669 (4.3)	18.54	< .001	12,376 (5.0)	14.24	< .001	12,791 (5.2)	14.09	< .001
	MA	1,837 (4.8)			2,090 (5.4)			2,156 (5.6)		
Chemotherapy	NHI	20,215 (8.2)	371.51	< .001	38,584 (15.6)	677.51	< .001	46,504 (18.8)	766.04	< .001
	MA	2,043 (5.3)			4,023 (10.5)			4,962 (12.9)		
Transfusion	NHI	9,144 (3.7)	299.22	< .001	14,517 (5.9)	405.06	< .001	16,703 (6.7)	437.56	< .001
	MA	758 (2.0)			1,280 (3.3)			1,511 (3.9)		
Vasopressors	NHI	82,372 (33.2)	9.36	.002	94,702 (38.2)	4.91	.027	99,848 (40.3)	2.52	.112
	MA	13,056 (34.0)			14,888 (38.8)			15,622 (40.7)		

MA = Medical Aid; NHI = National Health Insurance.

Table 4. Impact of Healthcare Insurance Type on the Use of Life-Sustaining Treatments for 180 Days before Death

Dependent variables	Odds ratios	95% CI	*p*
Cardiopulmonary resuscitation	0.97	0.94–1.01	.130
Mechanical ventilation	0.93	0.90–0.96	< .001
Hemodialysis	1.06	1.01–1.11	.017
Chemotherapy	0.62	0.60–0.64	< .001
Transfusion	0.58	0.55–0.61	< .001
Vasopressors	0.97	0.95–0.99	.006

Reference group: National Health Insurance group. Confounders: age, sex, Charlson comorbidity index, place of death, and completion of advance directive or life-sustaining treatment plans.
CI = confidence interval.

clinical guidance, are needed to promote advance care planning in vulnerable groups such as MA or Medicaid beneficiaries. These efforts are essential, as advance directives and physician orders for life-sustaining treatment form the foundation of care that reflects individual preferences and values.

Although MA decedents had fewer hospital admissions within 180 days before death, their hospitalizations and ICU stays were substantially longer than those of NHI decedents. This may be attributable to group characteristics, as MA decedents appeared to have greater disease severity, which could lead to more prolonged hospital and ICU stays. Similarly, Huang et al. [24] reported that older decedents with cancer and lower SES experienced longer hospitalizations. These findings suggest that once admitted, MA beneficiaries may remain hospitalized longer due to delayed discharge planning [25] or limited access to post-acute care resources, including home-based or long-term care services [7,26,27]. Such limitations, often tied to socioeconomic disadvantage, may contribute to reliance on hospital-based care. However, some evidence contradicts this trend; for example, a Swedish study found that ICU patients with lower income, less education, and single-household status were more likely to forgo ICU treatment [28]. Further investigation, including analysis of medical records, is needed to clarify these disparities.

When adjusting for age, sex, CCI score, place of death, and advance care planning, logistic regression showed that MA decedents were significantly less likely than NHI decedents to receive most life-sustaining treatments—except for CPR and hemodialysis—during the 180 days before death. This aligns with findings from a recent South Korean study [29] showing that older adults with poor self-perceived financial and health status were less likely to prefer life-sustaining treatment at EOL. In particular, lower chemotherapy use among MA decedents may reflect financial barriers that limit access to oncology care and hinder timely initiation or continuation of treatment [9]. Moreover, because MA beneficiaries often represent medically and socially vulnerable populations [7], they may present with advanced disease, poor functional status, or delayed diagnoses, making them less suitable candidates for cancer-directed therapies [30]. Providers may also hesitate to recommend chemotherapy to MA beneficiaries due to concerns about treatment adherence, follow-up capacity, or social support [31]. However, these findings contrast with prior evidence suggesting that individuals with lower SES are more likely to receive aggressive EOL care, including life-sustaining treatments [32], and are less likely to use hospice care [9]. These inconsistencies underscore the need for further investigation into the mechanisms that reduce treatment utilization among MA beneficiaries. Importantly, our findings highlight the urgent need for targeted policies and clinical interventions to promote equitable, person-centered EOL care for socioeconomically disadvantaged populations, particularly those covered by MA.

Our logistic regression results also showed higher use of hemodialysis among MA decedents compared with NHI decedents. This pattern may be explained by the case payment system (flat-fee reimbursement scheme) for outpatient hemodialysis applied to MA beneficiaries since 2002 [33]. Under this scheme, a fixed payment of approximately USD 100 per hemodialysis covers physician fees, dialysis materials and medications, and diagnostic tests [33]. This substantially reduces the financial burden for MA beneficiaries and may encourage greater use of dialysis services [34]. Further research is required to determine whether, and why, hemodialysis may be overutilized among MA beneficiaries at the EOL.

This study had several limitations. Because it relied on claims data, it lacked detailed clinical information such as patient preferences, functional status, the context of medical decision-making, and cause of death. In addition, because claims data exclude non-reimbursed services, it was not possible to account for out-of-pocket expenditures that may influence life-sustaining treatment use. This limitation restricts the ability to fully assess variations in utilization linked to patients' financial burdens. Moreover, the analysis was confined to a single year, preventing evaluation of temporal trends. Future research should examine multi-year data to identify changes over time. Data on advance care planning were also limited, and the retrospective design precludes causal inference. Despite these limitations, this study provides valuable insights into disparities in EOL care by insurance type.

CONCLUSION

This study reveals significant disparities in EOL care by insurance type, showing that MA beneficiaries were less likely to receive aggressive treatments (except hemodialysis) and less likely to engage in advance care planning. These findings emphasize the need for multifaceted strategies to reduce inequities, strengthen decision-making support, and improve the quality of EOL care for medically and socially vulnerable populations. Future research should further investigate the drivers of these disparities and evaluate the effectiveness of interventions designed to improve EOL outcomes across socioeconomic groups.

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CONFLICTS OF INTEREST

Jeonghyun Cho has been the Editor-in-Chief of the *Korean Journal of Adult Nursing* since 2024. She was not involved the review process of this manuscript. Otherwise, there was no conflict of interest.

AUTHORSHIP

Study conception and design acquisition - JC, HK, and SSK; data collection - NYK; analysis and interpretation of the data - JC, HK, NYK, JHB, and SSK; drafting and critical revision of the manuscript - JC, HK, SSK, JHB, and NYK.

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DATA AVAILABILITY STATEMENT

The data are not publicly available due to institutional regulations and please contact the corresponding author for data availability.

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A Predictive Model for Person-Centered Care in Intensive Care Units in South Korea: A Structural Equation Model

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Purpose: Person-centered care emphasizes the therapeutic relationship between medical staff and patients, founded on mutual trust and understanding. In intensive care settings, there is growing recognition of the need to improve the care environment and promote patient-focused nursing. This study aimed to construct and validate a predictive model explaining person-centered care in intensive care units. **Methods:** This study employed a cross-sectional design involving 230 intensive care unit nurses working in a tertiary hospital, each with more than one year of direct patient care experience. Data were collected online between March 2 and March 30, 2023. Data analysis was conducted using IBM SPSS ver. 26.0 and AMOS ver. 25.0. **Results:** Statistically significant pathways were identified from nursing competency to the nursing work environment and person-centered care; from communication competence to teamwork and person-centered care; from nursing professionalism to teamwork and the nursing work environment; and from the nursing work environment to person-centered care. Nursing professionalism indirectly influenced person-centered care through teamwork and the nursing work environment. **Conclusion:** Enhancing person-centered care in intensive care units requires recognizing the critical roles of communication competence, nursing competency, and the nursing work environment. Developing and implementing educational programs that strengthen communication and nursing competencies, alongside initiatives that improve the nursing work environment, are essential.

Key Words: Intensive care units; Person-centered care; Structural equation modeling

INTRODUCTION

Intensive care units (ICUs) provide specialized treatment using life-support devices and continuous monitoring to care for critically ill patients [1]. Because of the high severity of illness and the complexity of tasks, ICUs primarily deliver disease-centered treatment, requiring exceptional focus and professional expertise [2]. Intensive care nurses possess specialized knowledge for managing critically ill patients and must demonstrate advanced critical care nursing skills [3]. These nurses experience substantial physical and psychological stress while caring for severely ill patients due to their heavy workload, uncertain patient prognoses, operation of complex medical equipment, and the responsibility of communicating with families [4]. Excessive workload and stress can compromise patient safety [5].

Recently, awareness has increased regarding the importance of patient participation in treatment decision-making [6]. The medical paradigm has shifted from staff-centered to patient-centered and from disease-oriented to symptom-focused care [7]. Person-centered care (PCC) involves building therapeutic relationships between healthcare professionals and patients based on mutual trust and understanding [8]. Nurses who respect patients' values and autonomy deliver professional care by focusing on individuals and communicating effectively [9].

PCC and patient-centered care share core elements, including empathy, respect, engagement, relationship communication, shared decision-making, holistic focus, individualized attention, and coordinated care. However, they differ in their ultimate goals. Patient-centered care primarily aims for symptom relief and functional recovery, whereas PCC emphasizes holistic well-being and meaningful living by reflecting the individual's values and life context. PCC thus represents a broader concept, extending beyond the patient to encompass the person as a whole [10]. Currently, PCC serves as an overarching concept, reflecting the principle that individualized nursing should be provided to all individuals, regardless of setting or clinical context [11]. In ICUs, PCC requires that professional nurses with specialized expertise respect and empathize with patients while delivering individualized interventions [12]. PCC has been shown to reduce hospitalization length and outpatient visits, generate economic benefits through decreased medical costs [13], and improve patient satisfaction by enhancing nursing service quality [14]. However, ICU nurses often face challenges implementing PCC due to the urgent nature of tasks, time constraints, and the presence of complex medical equipment that limits interaction [3,15]. Therefore, improving the ICU care environment and emphasizing PCC are essential [16]. Nursing care that respects, empathizes with, and acknowledges patient individuality should be prioritized, and ICU nursing should focus on person-centered holistic care that incorporates patients' values and preferences [14].

Numerous studies have examined PCC. The theory of PCC was developed through research identifying four core elements using the person-centered nursing conceptual framework, which has been widely applied to practice and comprehensively articulates the essential components of PCC [8,17]. Previous studies have analyzed the defining attributes of PCC in ICUs [12], examined its practical application [18], and developed measurement tools [19]. More recently, research has explored changes in the medical environment and factors influencing PCC during the coronavirus disease 2019 (COVID-19) pandemic [20,21]. Structural equation modeling (SEM) has also been used to comprehensively examine PCC among nurses [22,23]. However, most previous studies have focused on diverse clinical settings such as general wards, limiting their applicability to the unique environment and structural demands of ICUs. Although some studies included ICU nurses as participants, few have conducted an in-depth investigation of how PCC is implemented in ICUs, where continuous monitoring, specialized treatment, and rapid responses to critical events are prioritized. Accordingly, the present study aims to elucidate the factors influencing PCC in the specialized ICU context, providing an empirical foundation for improving the quality of ICU nursing practice.

An integrated causal model was developed based on McCormack and McCance's [8] Person-Centered Nursing Theory and the four attributes of person-centered critical care nursing proposed by Jakimowicz and Perry [12]. McCormack and McCance [8] argue that person-centered outcomes arise from care processes shaped by nurses' prerequisites and the care environment. In this study, prerequisites include nursing competency, communication competence, and nursing professionalism, while the care environment encompasses teamwork and the nursing work environment. Jakimowicz and Perry [12] conceptualized ICU PCC as the application of advanced knowledge and technical expertise to preserve patient dignity and identity. Their four key attributes—patient identity, biomedical nursing practice, compassionate presence, and professional presence—are considered here as the care processes through which PCC is achieved. By integrating these frameworks, this study proposes a hypothetical model linking nurse characteristics, environmental factors, and PCC processes in ICUs (Figure 1). The model's pathways were subsequently tested for statistical significance and overall fit. This study thus aims to empirically validate an integrated causal model of PCC in ICUs, establishing a theoretical and empirical foundation for improving the quality of critical care nursing.

METHODS

1. Study Design

This cross-sectional study constructed a theoretical model of PCC for ICUs through a literature review and tested the model's suitability by hypothesizing pathways using survey-based SEM. The study is reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

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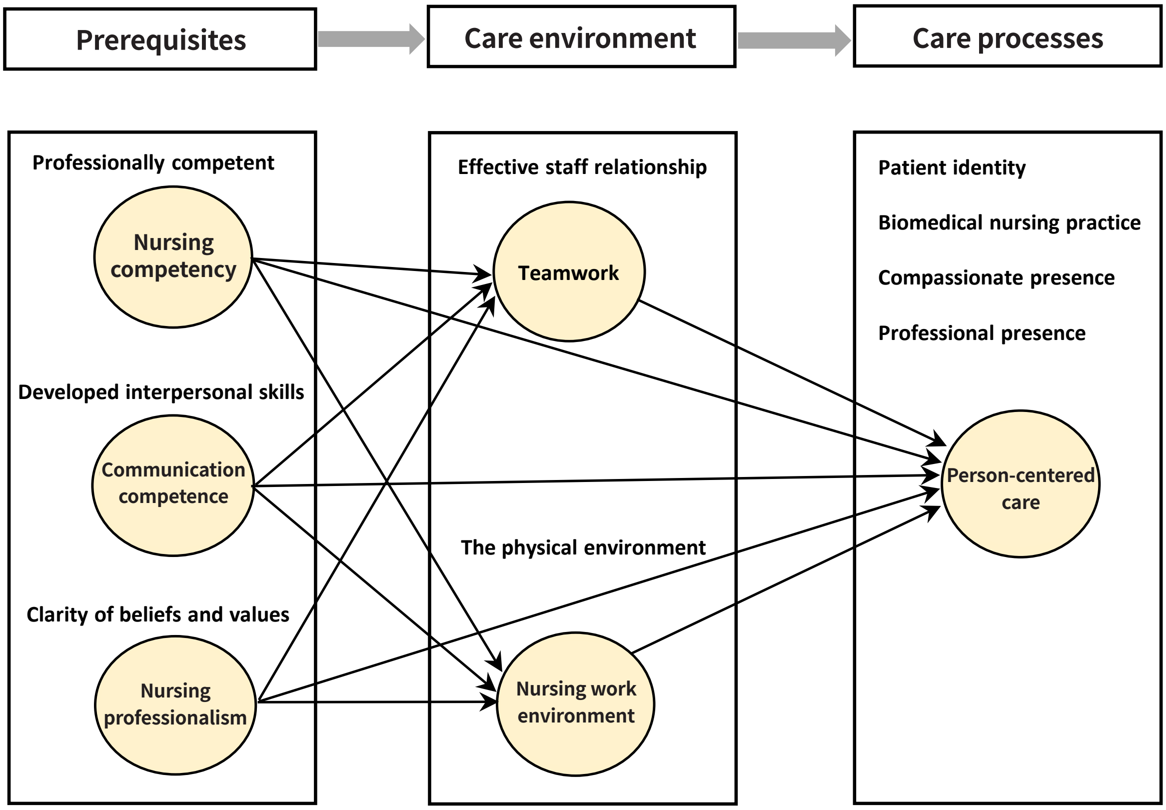

Figure 1. Theoretical framework of person-centered care in intensive care unit settings.

2. Setting and Samples

The sample consisted of 230 ICU nurses employed in the ICUs of a tertiary general hospital in South Korea, each with at least one year of direct patient care experience. According to Benner [24], nurses' skill levels are classified as novice, advanced beginner, competent, proficient, and expert. Nurses with at least one year of clinical experience are generally categorized as advanced beginners or are transitioning into the competent stage, during which they can provide nursing care with greater stability and autonomy in clinical settings. In addition, previous studies have demonstrated that clinical experience in ICUs positively influences the practice of PCC [15,20]. Based on these findings, a minimum of one year of ICU experience was established as an inclusion criterion.

Although there is no universal standard for determining sample size in SEM, the minimum number of participants recommended for the maximum likelihood estimation method, which is the most commonly used approach in structural modeling, is between 100 and 150. In general, a sample size of 200 is considered adequate for most structural models [25]. Therefore, this study included 230 participants to account for potential dropout.

3. Measurements

1) Person-centered care

The Person-Centered Critical Care Nursing scale, originally developed for ICU nurses by Kang et al. [7], was used to measure the PCC process. The instrument consists of 15 items across four domains: compassion (4 items), individuality (4 items), respect (4 items), and comfort (3 items). Each item is rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores indicating greater levels of PCC practice. Cronbach's α for this study was .83.

2) Nursing competency

Nursing competency was assessed using an instrument adapted by Kim [26], based on Jang's [27] four-stage clinical career development model encompassing 13 nursing competencies. The tool includes 13 items across four domains: scientific nursing competency (3 items), ethical nursing competency (2 items), personal nursing competency (3 items), and esthetical nursing competency (5 items). Each item is rated on a 4-point Likert scale (1 = disagree to 4 = strongly agree), with higher scores reflecting higher nursing competency. Cronbach's α for this study was .90.

3) Communication competence

Communication competence was measured using the Global Interpersonal Communication Competence Scale developed by Hur [28]. The scale comprises 15 items rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores indicating greater communication competence. Cronbach's α in this study was .85.

4) Nursing professionalism

Nursing professionalism was measured using the Nursing Professional Values Scale developed by Yeun et al. [29]. The instrument includes 29 items across five domains: originality of nursing (3 items), roles of nursing service (4 items), professionalism of nursing (5 items), social awareness (8 items), and self-concept of the profession (9 items). The nursing originality domain contains reverse-scored items. Each item is rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores indicating more firmly established professional nursing intuition. Cronbach's α in this study was .94.

5) Teamwork

Teamwork was assessed using the Teamwork Perceptions Questionnaire developed by the Agency for Healthcare Research and Quality and the U.S. Department of Defense [30], using the Korean version translated and validated by Hwang and Ahn [31]. This tool includes 35 items across five domains: team structure (7 items), leadership (7 items), situation monitoring (7 items), mutual support (7 items), and communication (7 items). Each item is rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores representing more positive perceptions of teamwork. The Cronbach's α value obtained in this study was .96.

6) Nursing work environment

The Practice Environment Scale of the Nursing Work Index developed by Lake [32] and translated and validated in Korean by Cho et al. [33] was used to assess the nursing work environment. The scale consists of 29 items across five domains: nurse participation in hospital affairs (9 items), nursing foundations for quality of care (9 items), nurse manager ability, leadership, and support for nurses (4 items), staffing and resource adequacy (4 items), and collegial nurse-physician relationships (3 items). Each item is rated on a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree), with higher scores reflecting more positive perceptions of the nursing work environment. Cronbach's α in this study was .96.

4. Data Collection

Data were collected from March 2 to March 30, 2023. An actively operating online nursing community with over 500,000 members was selected. The purpose and procedures of the study were explained to the community administrator, and permission was obtained. A recruitment notice was then posted to invite participants, and the online survey was distributed to those who voluntarily expressed their intent to participate. Participants provided informed consent via the online link before completing the survey.

5. Ethical Considerations

This study was approved by the Institutional Review Board (IRB) of Chung-Ang University (IRB No.: 1041078-20221231-HR-033). The study was conducted online, and participants were allowed to proceed with the survey only after reading an explanatory statement containing information on the study purpose, content, procedures, confidentiality, voluntary participation, withdrawal rights, and consent.

6. Data Analysis

Data were analyzed using SEM with IBM SPSS ver. 26.0 and AMOS ver. 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participants' characteristics and study variables, and instrument reliability was evaluated using Cronbach's α. Univariate normality was assessed through means, standard deviations, skewness, and kurtosis in IBM SPSS, while multivariate normality was examined in AMOS. Convergent and discriminant validity were tested using confirmatory factor analysis. Model fit was assessed using the root mean square residual (RMR), standardized root mean square residual (SRMR), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), Tucker–Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). The significance of direct, indirect, and total effects was examined through bootstrapping procedures.

RESULTS

1. Participant Characteristics and Degree of Person-Centered Care Based on General Characteristics

The general characteristics of the participants and the degree of PCC according to these characteristics are presented in Table 1. The total number of participants was 230, including 203 women (88.3%) and 27 men (11.7%). The mean age was 29.84 years, with 126 participants (54.8%) aged 20–29 years and 92 participants (40.0%) aged 30–39 years.

PCC significantly differed by age ($F=28.91$, $p=.014$), highest level of education ($F=12.21$, $p=.001$), position ($t=2.72$, $p=.011$), shift type ($t=3.56$, $p=.002$), total clinical work experience ($F=7.56$, $p<.001$), and average monthly income ($F=2.98$, $p=.020$). Participants aged 40 years or older demonstrated higher PCC levels than those in their 20s or 30s. Those with a master's degree reported higher PCC levels than participants with an associate or bachelor's degree. Additionally, participants with more than 10 years of clinical experience exhibited higher PCC levels than those with 1–4 years of experience.

2. Confirmatory Factor Analysis of Measured Variables

A latent variable was considered to demonstrate convergent validity when its construct reliability exceeded 0.7 and the average variance extracted (AVE) was greater than 0.5 [25]. In this study, the reliability coefficients of all subdomains met the threshold of 0.7, confirming adequate internal consistency. For the sub-variables of PCC—compassion, individuality, respect, and comfort—the AVE was 0.439, while the construct reliability was 0.751, thus satisfying the standard criterion for composite reliability and supporting convergent validity. An examination of the confidence intervals of the correlation coefficients revealed that none included 1.0, thereby confirming discriminant validity and demonstrating that each construct represented a distinct concept. As Malhotra [34] noted, convergent validity may still be acceptable when AVE is below 0.5 if the composite reliability is 0.7 or higher, further supporting the adequacy of this measurement model.

3. Model Fit Indices of Theoretical Models

The criteria for determining an acceptable model fit were as follows: $\chi^2/df\leq3$, $RMR\leq.05$, $SRMR\leq.08$, $GFI\geq.90$, $AGFI\geq.80$, CFI and $TLI\geq.90$, and $RMSEA\leq.05$, with values below .08 also considered acceptable [25]. The theoretical model in this study demonstrated an adequate level of fit: $\chi^2/df=2.25$, $RMR=.02$, $SRMR=.06$, $GFI=.85$, $AGFI=.81$, $TLI=.91$, $CFI=.92$, and $RMSEA=.07$. Overall, the model fit indices met or closely approximated the recommended criteria, indicating a satisfactory goodness of fit.

4. Process of Deriving the Final Model

The final model was derived through a three-step process. In theoretical model 2, the relationship between nursing competency and teamwork, which was present in hypothetical model 1, was found to be non-significant and was therefore removed. In theoretical model 3, the relationship between communication competence and the nursing work environment was also excluded due to a lack of statistical significance. After excluding these non-significant paths, the model's goodness of fit (χ^2/df) changed minimally from 2.25 to 2.24, with no change in the other fit indices. Across all three theoretical models, seven paths remained statistically significant, and excluding the non-significant paths did not meaningfully alter the overall model fit. Therefore, theoretical model 1 was retained as the final model to fully consider the effects of each factor (Table 2). Of the 11 hypothesized paths, seven were statistically significant (Figure 2).

5. Direct, Indirect, and Total Effects

The direct, indirect, and total effects of the final model are shown in Table 3. The PCC process was directly influenced by nursing competency, communication competence, and the nursing work environment. Nursing professionalism indirectly affected PCC through its influence on teamwork and the nursing work environment. Teamwork itself did not have a direct effect on PCC. The model's explanatory power, with PCC as the endogenous variable, was 65.1% ($SMC=.651$).

DISCUSSION

This study developed a hypothetical model based on Mc-

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Table 1. Participant Characteristics and Degree of Person-Centered Care Based on General Characteristics ($N = 230$)

Variables	Categories	n (%)	M ± SD	t/F (p) Scheffé
Gender	Men	27 (11.74)	3.64 ± 0.37	0.59 (.557)
	Women	203 (88.26)	3.58 ± 0.48	
Age (year)	20–29^{a}	126 (54.78)	3.53 ± 0.41	28.91 (.014) c > a, c > b
	30–39^{b}	92 (40.00)	3.60 ± 0.49	
	≥ 40^{c}	12 (5.22)	4.11 ± 0.63	
Marital status	Unmarried	184 (80.00)	3.59 ± 0.48	0.02 (.981)
	Married	46 (20.00)	3.59 ± 0.42	
Children	0	205 (89.13)	3.59 ± 0.47	0.23 (.792)
	1	8 (3.48)	3.57 ± 0.49	
	≥ 2	17 (7.39)	3.51 ± 0.44	
Religion	Christian	27 (11.74)	3.62 ± 0.44	0.89 (.448)
	Catholic	16 (6.96)	3.74 ± 0.39	
	Buddhist	18 (7.83)	3.49 ± 0.43	
	None	169 (73.47)	3.58 ± 0.49	
Educational background	College^{a}	7 (3.04)	3.28 ± 0.34	12.21 (.001) c > a, c > b
	University^{b}	190 (82.61)	3.53 ± 0.41	
	≥ Master's degree^{c}	33 (14.35)	3.99 ± 0.58	
Position	Staff nurse	205 (89.13)	3.54 ± 0.41	2.72 (.011)
	Charge nurse	25 (10.87)	3.95 ± 0.73	
Shift type	3 shifts	212 (92.17)	3.54 ± 0.42	3.56 (.002)
	2 shifts	18 (7.83)	4.13 ± 0.70	
Average number of patients per shift (person)	≤ 2	136 (59.13)	3.63 ± 0.50	1.54 (.216)
	3	67 (29.13)	3.55 ± 0.40	
	≥ 4	27 (11.74)	3.47 ± 0.45	
Total clinical experience (year)	1–4^{a}	115 (50.00)	3.52 ± 0.39	7.56 (< .001) c > a, c > b
	5–9^{b}	75 (32.61)	3.56 ± 0.45	
	≥ 10^{c}	40 (17.39)	3.84 ± 0.63	
Current department work experience (year)	1–4	159 (69.13)	3.54 ± 0.40	2.94 (.068)
	5–9	58 (25.22)	3.74 ± 0.62	
	≥ 10	13 (5.65)	3.48 ± 0.41	
Average monthly income (10,000 KRW)	200–299	13 (5.65)	3.47 ± 0.34	2.98 (.020)
	300–349	106 (46.09)	3.53 ± 0.44	
	350–399	76 (33.04)	3.72 ± 0.47	
	400–449	22 (9.57)	3.61 ± 0.50	
	≥ 450	13 (5.65)	3.36 ± 0.59	
Department (intensive care unit)	Medial	129 (56.09)	3.60 ± 0.51	0.35 (.844)
	Surgical	59 (25.65)	3.56 ± 0.36	
	Neonatal	21 (9.13)	3.54 ± 0.32	
	Pediatric	10 (4.35)	3.71 ± 0.62	
	Integrated	11 (4.78)	3.52 ± 0.64	

M = mean; SD = standard deviation.

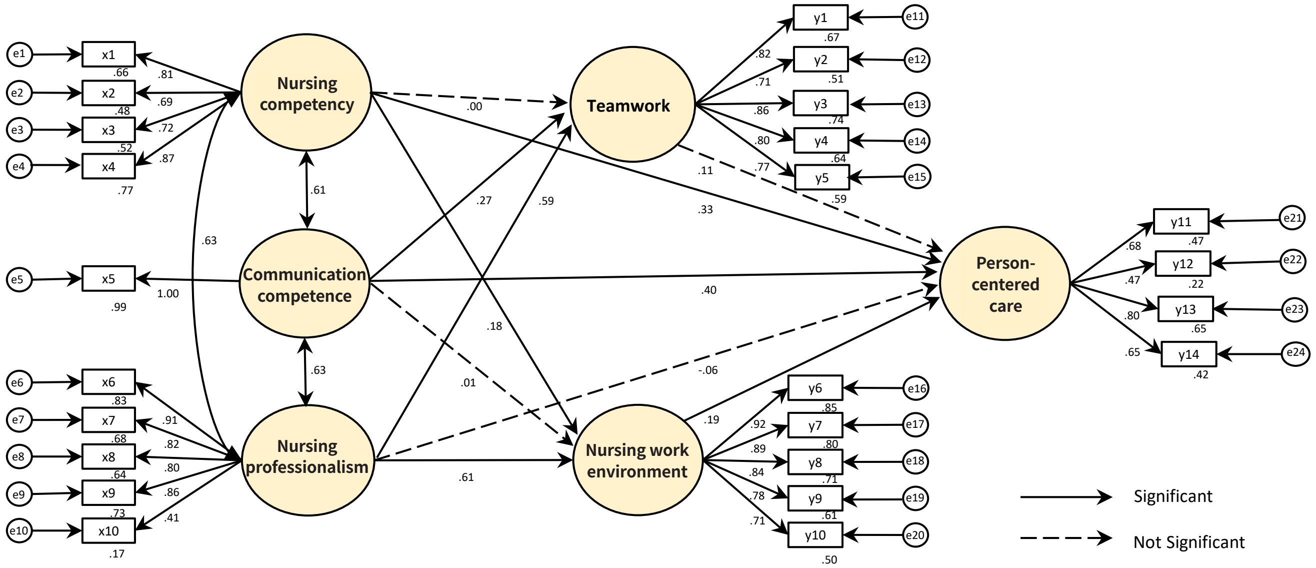
Cormack and McCance's [8] person-centered nursing theory and the attributes identified by Jakimowicz and Perry [12] to examine factors influencing PCC in ICUs. Model testing was conducted in three steps, resulting in a final model in which seven of the 11 hypothesized paths were statistically significant. These findings provide a foundation for discussing the interrelationships among factors influencing PCC in ICUs.

This study found statistically significant pathways from nursing competency to both the nursing work environment and PCC, confirming that nursing competency plays a pivotal role in facilitating the delivery of PCC. Previous re-

Table 2. Final Model (N=230)

Exogenous variables		Endogenous variables	Unstandardized coefficient	Standardized coefficient	SE	CR	p
Nursing competency	→	Teamwork	0.00	0.00	0.07	–0.00	.999
	→	Nursing work environment	0.24	0.18	0.10	2.29	.022
	→	PCC	0.32	0.33	0.09	3.69	<.001
Communication competence	→	Teamwork	0.27	0.27	0.07	3.91	<.001
	→	Nursing work environment	0.01	0.01	0.10	0.11	.916
	→	PCC	0.41	0.40	0.09	4.78	<.001
Nursing professionalism	→	Teamwork	0.44	0.59	0.06	7.36	<.001
	→	Nursing work environment	0.65	0.61	0.08	7.72	<.001
	→	PCC	–0.05	–0.06	0.09	–0.53	.597
Teamwork	→	PCC	0.11	0.11	0.10	1.05	.292
Nursing work environment	→	PCC	0.14	0.19	0.06	2.16	.031

CR=critical ratio; PCC=person-centered care; SE=standard error.



x1: scientific nursing competency
x2: ethical nursing competency
x3: personal nursing competency
x4: esthetical nursing competency

x5: communication competency

x6: self-concept of the profession
x7: social awareness
x8: professionalism of nursing
x9: the roles of nursing service
x10: originality of nursing

y1: team structure
y2: leadership
y3: situation monitoring
y4: mutual support
y5: communication

y6: nurse participation in hospital affairs
y7: nursing foundations for quality of care
y8: nurse manager ability, leadership, and support of nurses
y9: staffing and resource adequacy
y10: collegial nurse-physician relations

y11: compassion
y12: individuality
y13: respect
y14: comfort

Figure 2. Path diagram of the final model.

search similarly indicates that PCC is directly influenced by nursing competency [23]. For example, nursing competency has been shown to have a significant positive correlation with the delivery of PCC and has been identified as a key influencing factor [35]. These findings affirm that nursing competency is not merely an individual trait but a core foundation through which nurses translate clinical expertise into patient-centered interactions and outcomes. Inter-

Table 3. Standardized Direct, Indirect, and Total Effects of the Model (N=230)

Endogenous variables	Exogenous variables	Effect size (p)			SMC
		Direct effect	Indirect effect	Total effect	
PCC	Nursing competency	0.33 (<.001)	0.03 (.254)	0.36 (<.001)	.651
	Nursing professionalism	–0.06 (.650)	0.18 (.034)	0.11 (.255)	
	Communication competence	0.40 (<.001)	0.03 (.434)	0.43 (<.001)	
	Teamwork	0.11 (.408)		0.11 (.408)	
	Nursing work environment	0.19 (.046)		0.19 (.046)	
Teamwork	Nursing competency	0.00 (.991)		0.00 (.991)	.617
	Nursing professionalism	0.59 (<.001)		0.59 (<.001)	
	Communication competence	0.27 (.001)		0.27 (.001)	
Nursing work environment	Nursing competency	0.18 (.051)		0.18 (.051)	.548
	Nursing professionalism	0.61 (<.001)		0.61 (<.001)	
	Communication competence	0.01 (.915)		0.01 (.915)	

PCC=person-centered care; SMC=squared multiple correlation.

estingly, nursing competency did not have a direct effect on teamwork. Effective teamwork arises from interdependent collaboration, open communication, and shared decision-making, which contribute to positive outcomes for patients, organizations, and staff alike [36]. Therefore, enhancing individual competence alone does not automatically lead to improved teamwork. To foster effective teamwork, efforts to strengthen nurses' competencies must be accompanied by organizational support, including the establishment of collaborative systems and a culture that promotes mutual respect and cooperation.

Communication competence also emerged as a key determinant of PCC, underscoring the crucial role of interpersonal skills in high-acuity care settings. Previous studies have reported a significant positive correlation between communication competence and PCC [6]. Whether viewed through an ecological lens [15] or in adult ICU contexts [2], communication consistently mediates the quality and depth of nurse-patient relationships. These findings reaffirm the importance of communication competence in intensive care nursing. To enhance the quality of nursing care in ICUs, specific strategies are required to strengthen nurses' communication competencies.

Although nursing professionalism did not directly affect PCC in the model, it showed a significant indirect effect through the nursing work environment. This finding suggests that nursing professionalism enhances PCC by fostering a supportive and ethically grounded organizational culture. Nursing professionalism exhibited statistically significant pathways to both teamwork and the work environment, aligning with previous research showing that professional values influence organizational dynamics and job performance. Establishing nursing professionalism positively contributes to the delivery of high-quality nursing care and the effective performance of nursing duties [29].

The study also found that teamwork did not have a direct effect on PCC, which contrasts with earlier findings that reported a significant positive relationship between teamwork and PCC [15,21,37]. One possible explanation is that the participants' teamwork levels were already uniformly high, reducing variability and diminishing its predictive power for PCC outcomes. As Rosen et al. [38] emphasized, the effects of teamwork cannot be explained solely by team competencies but are also shaped by complex organizational structures and cultures. Similarly, the current findings suggest that institutional culture and organizational characteristics may mediate the relationship between teamwork and PCC. The results therefore highlight the structural dimensions of organizational culture and work systems. Effective implementation of teamwork requires a multidimensional approach encompassing both cultural and structural supports. Future studies should thus explore organizational culture and structural variables to provide a more comprehensive understanding of how teamwork influences PCC.

Furthermore, this study found that the nursing work environment had a statistically significant direct effect on PCC, indicating that the pathway from the nursing work environment to the delivery of PCC is meaningful. This finding aligns with prior research involving nurses in COVID-19–dedicated hospitals, which also demonstrated a significant influence of the nursing work environment on PCC [20]. These results highlight the crucial role of organizational culture and environmental factors in shaping nurses' PCC and underscore that fostering a high-quality nursing work environment is essential for promoting PCC [39].

Overall, this study confirmed that communication competence, nursing competency, and the nursing work environment are influential determinants of ICU nurses' PCC delivery. The implications for practice are threefold. First, structured communication training programs are necessary to enhance ICU nurses' communication competence [2,15]. In Denmark, a communication education program for healthcare professionals significantly improved self-efficacy, demonstrating the effectiveness of structured training in enhancing communication competence [40]. Simulation-based training and interprofessional communication programs should therefore be implemented. Second, continuous professional development and the establishment of practical support systems are vital to strengthening nursing competency. Because ICU nursing requires advanced clinical judgment and specialized expertise, professional education in this setting is of paramount importance. Studies have shown that adequate training for ICU nurses improves both patient outcomes and operational efficiency [41]. Practical competency should be systematically reinforced through advanced training, case-based learning, simulation education, and mentoring. Third, organizational investment in improving the nursing work environment is essential. High workload intensity and emotional strain directly affect the quality of nursing care. Therefore, building a stable and sustainable work environment requires adequate staffing, emotional support, and reinforcement of teamwork and leadership [39].

This study holds practical value and clinical applicability as it presents concrete strategies and actionable measures relevant to intensive care nursing practice. By identifying key factors that enhance the delivery of PCC, these findings provide foundational data for future ICU nursing education and program development. Because there is currently no validated instrument to directly assess PCC among hospitalized ICU patients, the theoretical framework of McCormack and McCance's [8] person-centered nursing theory and the four attributes of critical care nursing proposed by Jakimowicz and Perry [12] were adopted. Accordingly, ICU nurses' delivery of PCC was used as an evaluative indicator. Nevertheless, the study's reliance on voluntary online recruitment may have introduced limitations, such as potential selection bias and reduced representativeness of the broader ICU nursing population.

CONCLUSION

This study analyzed the causal relationships among factors influencing PCC using SEM and proposed an integrated model explaining the mechanisms underlying PCC. The results identified nurses' communication competence, nursing competency, and nursing work environment as the most influential factors significantly affecting the delivery of PCC. Accordingly, three practical measures are recommended to enhance the implementation of PCC: (1) the development of practice-oriented educational programs designed to strengthen ICU nurses' communication competence; (2) the continuous and systematic integration of educational curricula with practice-based learning to advance nurses' competencies and professional development; and (3) the implementation of organizational support measures to improve the nursing work environment, including optimal staffing levels, physical environment enhancement, and the cultivation of a positive workplace culture. Future research should aim to develop reliable measurement tools for systematically evaluating the effectiveness of PCC in critically ill patients. Additionally, educational and experimental intervention studies are needed to assess the efficacy of the proposed strategies for improving PCC.

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CONFLICTS OF INTEREST

Kisook Kim, a contributing editor of the *Korean Journal of Adult Nursing*, was not involved in the editorial evaluation or decision to publish this article. The remaining author has declared no conflicts of interest.

AUTHORSHIP

Study conception and design acquisition - KK and SK; data collection - KK and SK; analysis and interpretation of the data - KK and SK; drafting and critical revision of the manuscript - KK and SK.

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Data sharing is not applicable to this article.

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Impact of Social Frailty on Changes in Quality of Life and Health-Related Quality of Life among Middle-Aged and Older Adults: Findings from the Korean Longitudinal Study of Aging (2006–2022)

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Purpose: This study examined the 16-year longitudinal impact of social frailty on quality of life (QoL) and health-related quality of life (HRQoL) among middle-aged and older adults. **Methods:** Data were obtained from the Korean Longitudinal Study of Aging (2006–2022), comprising 9,905 participants (6,003, aged 45–64 years; and 3,902, aged ≥65 years). Social frailty was assessed using five components: social support, social activity, social network, loneliness, and living alone. QoL and HRQoL were measured using self-reported satisfaction scales. Generalized estimating equations were applied to adjust for covariates. **Results:** Social frailty was prevalent among both middle-aged (44.6%) and older adults (60.1%) and was significantly associated with lower QoL and HRQoL. In longitudinal analyses, declines in QoL and HRQoL persisted throughout the follow-up period in older adults, whereas in middle-aged adults, the declines were significant only during the earlier years. In middle-aged adults, current smoking exerted a stronger negative impact on QoL and HRQoL (QoL: $\beta = -4.33$, $p < .001$; HRQoL: $\beta = -2.89$, $p < .001$), while in older adults, lack of regular exercise had a greater effect on HRQoL ($\beta = -3.84$, $p < .001$). **Conclusion:** Social frailty was associated with lower QoL and HRQoL across both age groups, with stronger and more persistent effects among older adults. Early interventions are needed during midlife, while sustained strategies are essential in later life. Age-specific approaches are crucial to promoting healthy aging.

Key Words: Frailty; Longitudinal studies; Quality of life; Social isolation

INTRODUCTION

Frailty is characterized by a state of vulnerability to stressors arising from diminished intrinsic capacity reserves [1]. Building on this definition, the integrated conceptual frailty model proposed by Gobbens et al. [2] further elucidates how physical, psychological, and social factors of frailty interact with aging, leading to adverse health outcomes. With the growing importance of early frailty detection and the provision of appropriate services, interest in this issue has increased within community and primary healthcare settings [3]. Frailty results from a complex interplay of factors such as inadequate nutrition, mobility impairment, unintentional weight loss, cognitive decline, and social isolation [2]. However, while the physical and psychosocial aspects of frailty have been widely emphasized, relatively less attention has been directed toward its social dimensions [4].

Social frailty refers to a state of vulnerability that compromises health and well-being, stemming from insufficient social support, connectedness, resources, and fulfillment of basic social needs [5]. It interacts with both physical and psychological frailty, influencing disease onset, progression, and prevention. Thus, assessing and understanding social frailty is vital [4]. Social frailty reflects an accumulation of risks or a depletion of essential resources needed to satisfy fundamental social needs throughout life [5]. A prior review of frailty assessment instruments, emphasizing their social components, identified social activities, social support, social networks, loneliness, and living alone as the most commonly represented constructs within the social domain [6].

Social frailty can lead to various adverse health outcomes, including cognitive impairment [7], depression [8], and increased risks of mortality and functional disability [9]. Consequently, social frailty negatively affects health-related quality of life (HRQoL) by disrupting both physical and mental health domains—key components of HRQoL [10,11]. Moreover, its influence extends beyond health to broader life domains, adversely affecting overall QoL [12]. While HRQoL primarily reflects health status, quality of life (QoL) encompasses a broader spectrum, including economic conditions, social relationships, job satisfaction, cultural values, and personal goals and expectations [13]. Therefore, examining both QoL and HRQoL provides a more comprehensive understanding of how social frailty influences well-being and health-related outcomes.

Previous studies on social frailty have largely focused on older adults, limiting understanding of its effects across the life course [10-12]. However, evidence indicates that social vulnerability negatively affects both middle-aged and older adults [9], with differing social characteristics and risk profiles between these groups. Accordingly, it is essential to analyze the effects of social frailty on QoL and HRQoL separately by age group. Furthermore, most prior studies employed cross-sectional designs, offering limited insight into the long-term impacts of social frailty [10,11]. To address these gaps, the present study used a longitudinal approach encompassing middle-aged adults (45–64 years) to assess the cumulative effects of social frailty over time. The findings aim to support the development of targeted interventions to mitigate its adverse effects and provide evidence-based guidance for preventive strategies and policies tailored to both middle-aged and older adults, ultimately enhancing QoL and HRQoL.

METHODS

1. Study Design

This longitudinal, descriptive, secondary analysis utilized data from the Korean Longitudinal Study of Aging (KLoSA), which collected data biennially from 2006 to 2022. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2. Setting and Samples

A total of 10,254 individuals participated in the 2006 KLoSA. Participants with missing data on key independent variables (e.g., socioeconomic status, social frailty-related variables, and health-related variables) or dependent variables (QoL and HRQoL) were excluded. Consequently, 9,905 individuals remained in the baseline year (2006), including 6,003 individuals aged 45–64 years and 3,902 individuals aged ≥65 years. However, not all participants completed every subsequent survey wave. After excluding those who did not participate consecutively, the final study population consisted of 8,406 individuals in 2008, 7,527 in 2010, 6,898 in 2012, 6,404 in 2014, 5,959 in 2016, 5,457 in 2018, 4,995 in 2020, and 4,567 in 2022 (Figure 1).

3. Measurements/Instruments

1) Quality of life and health-related quality of life

QoL was assessed using the question, “How satisfied are you with your overall quality of life compared to your peers of the same age group?” Similarly, HRQoL was measured using the question, “How satisfied are you with your overall health status?” Responses were rated on a 0–100 scale in 10-point increments, with higher scores indicating better QoL and HRQoL. Although baseline QoL and HRQoL data were collected in 2006, they were measured concurrently with independent variables, making it difficult to evaluate the longitudinal impact of social frailty on these outcomes. To establish a clear temporal sequence, only QoL and HRQoL data collected from 2008 onward were included in the analysis.

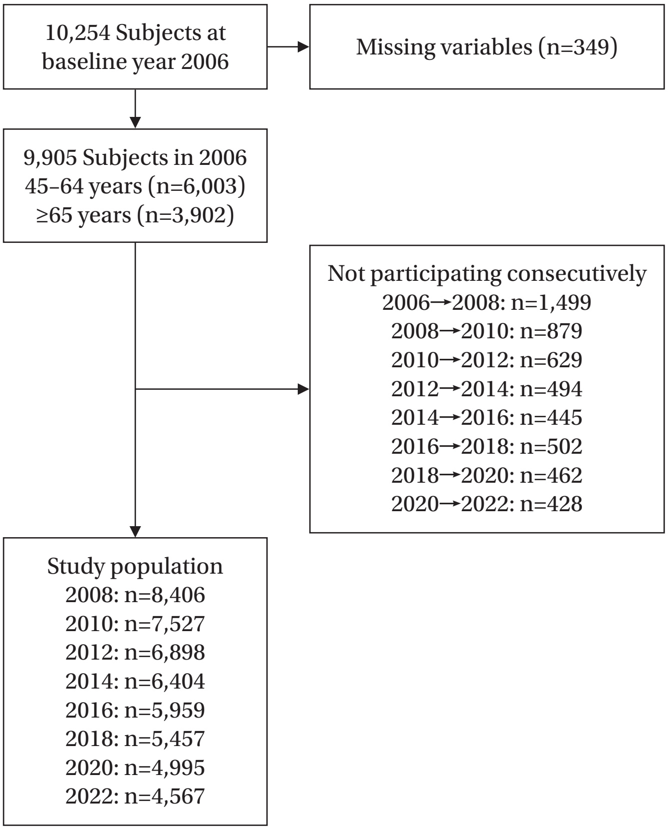

Figure 1. Study population.

2) Social frailty

In this study, social frailty was assessed using five key components—social isolation, loneliness, social networks, social support, and social participation—identified in a systematic review by Bessa et al. [6]. These components were operationalized using corresponding items from the KLoSA, ensuring that the measurement of social frailty was grounded in established literature while appropriately adapted to the KLoSA dataset. Social support was evaluated with the question: "In the future, if you were unable to perform daily activities such as eating, dressing, or using the toilet and required long-term assistance, do you have any relatives or friends—excluding your spouse and those you currently live with—who could help you?" (0 = yes, 1 = no). Social activity was measured with the question: "Do you participate in any activities (e.g., religious group, social club such as an alumni group or senior center, leisure/cultural/sport group, volunteering, political/civic/interest group)?" (0 = yes, 1 = no). Social networks were assessed with the question: "Do you have any close friends or relatives?" (0 = yes, 1 = no). Loneliness was determined by the question: "Did you feel lonely during the past week?" Participants could answer never or seldom (< 1 day/week), sometimes (1–2 days/week), often (3–4 days/week), or always (5–7 days/week). Responses of never or seldom (< 1 day/week) were coded as 0, and all other responses were coded as 1. Living alone was determined by the question: "Do you live alone?" (0 = no, 1 = yes). The total social frailty score ranged from 0 to 5. Participants scoring 2 or higher were classified as socially frail, those scoring 1 as socially prefrail, and those scoring 0 as socially nonfrail [7].

3) Covariates

Sociodemographic and health-related characteristics at baseline were included as covariates, following previous studies [10,14,15]. Sociodemographic variables comprised gender, educational level, region, and job status. Health-related characteristics included depression, chronic diseases, smoking, alcohol consumption, and regular exercise. Regular exercise was assessed using the question, "Do you usually exercise at least once a week?" (0 = yes, 1 = no). Depression was measured using the 10-item version of the Center for Epidemiologic Studies Depression (CES-D) scale. Participants who endorsed four or more items were classified as having depression [16].

4. Data Collection/Procedure

The KLoSA is a nationally representative panel survey conducted biennially by the Korea Employment Information Service since 2006, targeting individuals aged 45 years or older residing in Korea. The Korea Labor Institute oversaw participant selection, ensuring inclusion of individuals from both urban and rural regions.

Data were collected through face-to-face interviews using a structured questionnaire designed to assess various aspects of the lives of middle-aged and older adults. The survey encompassed a broad range of topics, including demographic characteristics, family structure, health status, medical care, employment history, financial assets, subjective expectations, QoL, and pension-related information [17].

5. Ethical Considerations

Data from the KLoSA were collected after obtaining informed consent from all participants by the Korea Employment Information Service. For this study, before initiation, a data use agreement was submitted and approved by the

Institutional Review Board of Pukyong National University (Date of approval: 2024/03/12, No. PKNU 2025-02-010).

6. Data Analysis

Analysis of variance was used for continuous variables, and chi-square tests were performed for categorical variables to identify differences in general characteristics according to social frailty. Generalized estimating equations (GEEs) were applied to analyze changes in QoL and HRQoL from 2006 to 2022 based on social frailty status in both age groups. Sociodemographic and health-related characteristics at baseline (2006) were adjusted for in the analysis. The results yielded β coefficients along with their standard errors and p-values. Because QoL and HRQoL, as outcome variables, can fluctuate over time, GEE was selected instead of survival analysis. All QoL and HRQoL measurements obtained during the follow-up period were included in the analysis. The GEE approach was also used to identify factors influencing changes in QoL and HRQoL and to determine the longitudinal association between baseline social frailty (2006) and repeatedly measured QoL and HRQoL across the second to ninth KLoSA waves (2008–2022), after adjusting for covariates. All statistical analyses were performed using IBM SPSS ver. 29.0 (IBM Corp., Armonk, NY, USA), with statistical significance set at $p<.05$.

RESULTS

1. General Characteristics of Participants by Social Frailty and Age Group at Baseline (2006)

Table 1 presents the general characteristics of the 9,905 participants stratified by social frailty status and age group in 2006. Among them, 6,003 were aged 45–64 years and 3,902 were aged ≥65 years. In the 45–64 age group, 14.0% were nonfrail, 41.4% were prefrail, and 44.6% were frail, whereas in the ≥65 age group, 11.0% were nonfrail, 28.9% were prefrail, and 60.1% were frail. There were no significant gender differences in social frailty among participants aged 45–64 years ($p=.090$); however, among those aged ≥65 years, a higher proportion of women were frail compared to men ($p<.001$). Educational level, region, and job status showed significant variations in social frailty across both age groups.

Regarding health-related characteristics, the prevalence of depression differed significantly by social frailty status, with a higher proportion observed among frail individuals ($p<.001$). The number of chronic diseases also varied significantly across frailty groups ($p=.022$ for ages 45–64; $p=.008$ for ages ≥65). For health behaviors, current smoking was most prevalent among frail individuals in the 45–64 age group ($p=.001$), while in the ≥65 age group, the lowest proportion of current smokers was observed among the frail ($p<.001$). Furthermore, alcohol consumption and engagement in regular physical activity were significantly lower among frail individuals ($p<.001$ for both).

2. GEE Analysis of Quality of Life and Health-Related Quality of Life by Social Frailty (2006–2022)

The GEE analysis evaluated longitudinal changes in QoL and HRQoL from 2006 to 2022 according to social frailty status (Table 2, Figure 2). For QoL, the 45–64 age group showed significant reductions in 2008 (β=–1.50, $p<.001$), 2010 (β=–1.13, $p<.001$), 2012 (β=–1.91, $p<.001$), and 2014 (β=–2.05, $p<.001$). In the ≥65 age group, greater declines were observed, particularly in 2010 (β=–2.14, $p<.001$), 2012 (β=–3.66, $p<.001$), and 2014 (β=–3.25, $p<.001$). Among older adults, the decline persisted until 2018 ($p<.001$), whereas in the 45–64 age group, no significant changes were found after 2016 ($p=.651$). Similarly, HRQoL declined significantly over time. In the 45–64 age group, HRQoL scores were significantly lower in 2008 (β=–1.17, $p<.001$), 2010 (β=–0.96, $p=.004$), 2012 (β=–1.01, $p=.002$), and 2018 (β=–1.20, $p=.001$), showing a progressive deterioration. In the ≥65 age group, a more pronounced decline was noted, especially in 2008 (β=–1.06, $p=.011$), 2010 (β=–1.94, $p<.001$), 2012 (β=–2.08, $p<.001$), and 2018 (β=–2.09, $p<.001$).

Table 3 presents the GEE results examining the longitudinal relationship between social frailty and changes in QoL and HRQoL among participants aged 45–64 and ≥65 years. After controlling for all covariates, social frailty remained significantly associated with lower QoL and HRQoL in both age groups. Compared with the nonfrail group, the frail group had substantially lower QoL and HRQoL scores, with a greater decline observed among adults aged ≥65 years. In the 45–64 age group, the frail group demonstrated a significant reduction in QoL, which was even more pronounced in the older group. A similar pattern emerged for HRQoL, with the frail group showing the greatest decrease. Among adults aged 45–64 years,

Table 1. General Characteristics of Participants by Social Frailty and Age Group at Baseline (2006) (N=9,905)

Characteristics	Age 45–64 years (n=6,003)				Age ≥65 years (n=3,902)			
	Socially nonfrail	Socially prefrail	Socially frail	p	Socially nonfrail	Socially prefrail	Socially frail	p
No. of participants (%)	842 (14.0)	2,484 (41.4)	2,677 (44.6)		431 (11.0)	1,127 (28.9)	2,344 (60.1)	
Gender				.090				<.001
Men	352 (41.8)	1,145 (46.1)	1,192 (44.5)		239 (55.5)	528 (46.9)	911 (38.9)	
Women	490 (58.2)	1,339 (53.9)	1,485 (55.5)		192 (44.5)	599 (53.1)	1,433 (61.1)	
Educational level				<.001				<.001
Middle school or above	622 (73.9)	1,891(76.1)	1,740 (65.0)		186 (43.2)	394 (35.0)	543 (23.2)	
Elementary school or below	220 (26.1)	593 (23.9)	937 (35.0)		24 (56.8)	733 (65.0)	1,801 (76.8)	
Region				<.001				.034
Urban	635 (75.4)	2,081 (83.8)	2,191 (81.8)		289 (67.1)	827 (73.4)	1,650 (70.4)	
Rural	207 (24.6)	403 (16.2)	486 (18.2)		142 (32.9)	300 (26.6)	694 (29.6)	
Job status				<.001				<.001
No	363 (43.1)	1,091 (43.9)	1,358 (50.7)		322 (74.7)	905 (80.3)	2,008 (85.7)	
Yes	479 (56.9)	1,393 (56.1)	1,319 (49.3)		108 (25.3)	222 (19.7)	336 (14.3)	
Depression				<.001				<.001
No	479 (56.9)	1,269 (51.1)	1,166 (43.6)		228 (52.9)	470 (41.7)	749 (32.0)	
Yes	363 (43.1)	1,215 (48.9)	1,511 (56.4)		203 (47.1)	657 (58.3)	1,595 (68.0)	
No. of chronic diseases	0.44±0.70	0.44±0.74	0.61±0.91	<.001	1.02±0.98	1.04±1.03	1.13±1.05	.022
Smoking				.001				<.001
Nonsmoking	610 (72.4)	1,760 (70.9)	1,820 (68.0)		289 (67.1)	796 (70.6)	1,760 (75.1)	
Ex-smoking	80 (9.5)	203 (8.2)	208 (7.8)		77 (17.9)	140 (12.4)	244 (10.4)	
Current smoking	152 (18.1)	521 (21.0)	649 (24.2)		65 (15.1)	191 (16.9)	340 (14.5)	
Drinking alcohol				.010				<.001
Nondrinking	397 (47.1)	1,258 (50.6)	1,377 (51.4)		229 (53.1)	669 (59.4)	1,531 (65.3)	
Ex-drinking	37 (4.4)	99 (4.0)	147 (5.5)		39 (9.0)	97 (8.6)	235 (10.0)	
Current drinking	408 (48.5)	1,127 (45.4)	1,153 (43.1)		163 (37.8)	361 (32.0)	578 (24.7)	
Regular exercise				<.001				<.001
No	431 (51.2)	1,280 (51.5)	1,696 (63.4)		237 (55.0)	683 (60.6)	1,725 (73.6)	
Yes	411 (48.8)	1,204 (48.5)	981 (36.6)		194 (45.0)	444 (39.4)	619 (26.4)	

Values are presented as number (%) or mean±standard deviation.

women had significantly lower QoL and HRQoL scores than men, whereas in the ≥65 age group, gender differences were not significant for either outcome. Participants with lower educational attainment had significantly lower QoL and HRQoL in both age groups, although the effect on HRQoL was slightly stronger among those aged 45–64 years. In both age groups, urban residents reported significantly lower QoL than rural residents; however, urban residence was not significantly associated with HRQoL decline in either group. Unemployment was significantly linked to lower QoL and HRQoL in both age categories.

Among health-related variables, depression was strongly associated with reduced QoL and HRQoL in both age groups, with a greater impact among adults aged ≥65 years. A higher number of chronic diseases was significantly associated with lower QoL and HRQoL across both age groups, with a stronger influence on HRQoL. Current smoking was also significantly associated with reduced QoL and HRQoL in both groups, with a slightly stronger effect among those aged 45–64 years. Ex-drinking was similarly linked to lower QoL and HRQoL in both age groups. Lack of regular exercise was significantly associated with poorer QoL and HRQoL across both age groups, with a more pronounced effect on HRQoL among older adults compared to the middle-aged group.

DISCUSSION

This study investigated the longitudinal impact of social frailty on QoL and HRQoL over a 16-year follow-up period among middle-aged and older Korean adults. The findings indicate that individuals with social frailty are more vulner-

Table 2. Longitudinal Generalized Estimating Equations Analysis of Quality of Life and Health-Related Quality of Life by Social Frailty (2006–2022) (*N*=9,905)

Year	Adjusted†					
	Age 45–64 years			Age ≥65 years		
	β	SE	*p*	β	SE	*p*
Longitudinal changes in quality of life						
Socially frail group (Ref. nonfrail group)	–4.01	0.38	<.001	–7.22	0.61	<.001
2008 (2006)	–1.50	0.28	<.001	–1.50	0.37	<.001
2010 (2006)	–1.13	0.29	<.001	–2.14	0.39	<.001
2012 (2006)	–1.91	0.29	<.001	–3.66	0.41	<.001
2014 (2006)	–2.05	0.30	<.001	–3.25	0.44	<.001
2016 (2006)	–0.14	0.30	.651	–1.21	0.46	.008
2018 (2006)	–0.41	0.32	.200	–2.10	0.51	<.001
2020 (2006)	–0.24	0.33	.460	0.59	0.55	.280
2022 (2006)	0.17	0.33	.603	0.94	0.56	.095
Longitudinal changes in health-related quality of life						
Socially frail group (Ref. nonfrail group)	–2.97	0.43	<.001	–5.84	0.71	<.001
2008 (2006)	–1.17	0.31	<.001	–1.06	0.42	.011
2010 (2006)	–0.96	0.33	.004	–1.94	0.46	<.001
2012 (2006)	–1.01	0.33	.002	–2.08	0.47	<.001
2014 (2006)	0.02	0.34	.952	–1.91	0.52	<.001
2016 (2006)	0.39	0.35	.267	–1.17	0.55	.034
2018 (2006)	–1.20	0.37	.001	–2.09	0.59	<.001
2020 (2006)	–0.46	0.38	.222	–0.74	0.64	.251
2022 (2006)	–0.49	0.38	.192	0.14	0.70	.836

SE=standard error; Ref.=reference; †Gender, educational level, region, job status, depression, no. of chronic diseases, smoking, drinking alcohol, regular exercise in 2006. Socially frail group comprises both frail and prefrail.

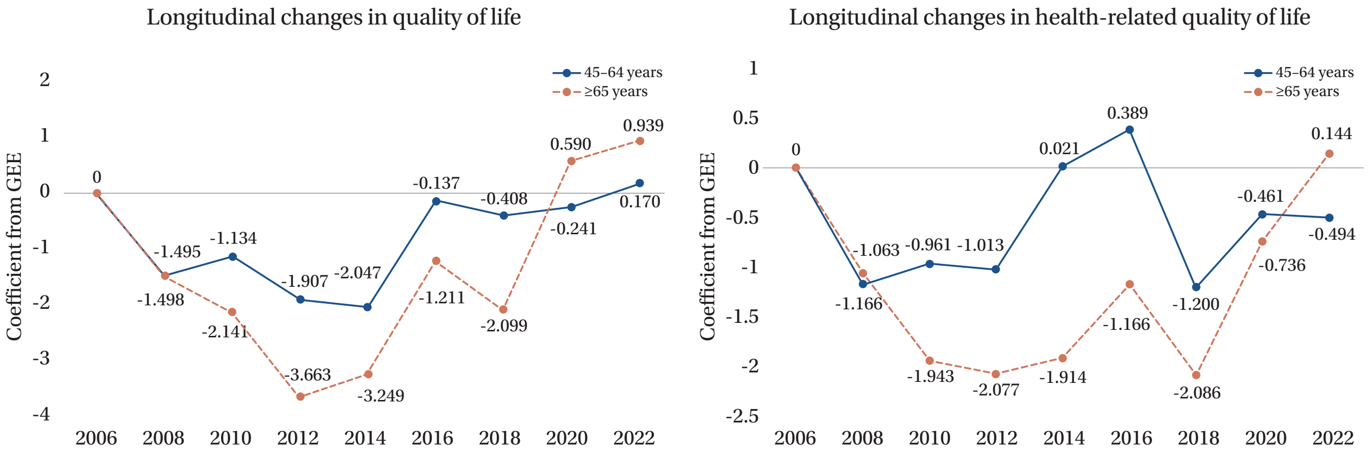

Figure 2. Longitudinal changes in quality of life and health-related quality of life over the period 2006–2022. GEE=generalized estimating equation.

able to declines in both QoL and HRQoL than their socially nonfrail counterparts. This study strengthens existing evidence by demonstrating the long-term effects of social frailty on QoL and HRQoL using a robust longitudinal design. While previous research has primarily focused on older adults (≥65 years), examining either QoL or HRQoL in isolation and relying mostly on cross-sectional data, our study addressed these limitations by including middle-aged adults, analyzing both QoL and HRQoL concurrently, and employing a longitudinal approach. These re-

Table 3. Factors Influencing Longitudinal Changes in Quality of Life and Health-Related Quality of Life by Age Group: A Generalized Estimating Equations Analysis (N = 9,905)

Variables	Quality of life						Health-related quality of life					
	Age 45–64 years			Age ≥ 65 years			Age 45–64 years			Age ≥ 65 years		
	β	SE	*p*	β	SE	*p*	β	SE	*p*	β	SE	*p*
Social frailty												
Nonfrail	Ref			Ref			Ref			Ref		
Prefrail	–1.50	0.42	< .001	–3.53	0.70	< .001	–0.74	0.48	.122	–2.11	0.87	.015
Frail	–5.85	0.44	< .001	–8.42	0.69	< .001	–4.97	0.49	< .001	–8.10	0.83	< .001
Gender												
Men	Ref			Ref			Ref			Ref		
Women	–1.72	0.47	< .001	–0.69	0.67	.305	–1.25	0.53	.018	–1.46	0.77	.059
Educational level												
Middle school or above	Ref			Ref			Ref			Ref		
Elementary school or below	–4.71	0.37	< .001	–3.48	0.59	< .001	–5.86	0.42	< .001	–4.36	0.66	< .001
Region												
Urban	–1.90	0.37	< .001	–2.70	0.52	< .001	–0.13	0.42	.750	–0.46	0.59	.443
Rural	Ref			Ref			Ref			Ref		
Job status												
No	–2.34	0.35	< .001	–2.10	0.61	.001	–3.79	0.39	< .001	–3.78	0.69	< .001
Yes	Ref			Ref			Ref			Ref		
Depression												
No	Ref			Ref			Ref			Ref		
Yes	–1.32	0.30	< .001	–3.41	0.48	< .001	–1.17	0.34	.001	–2.95	0.54	< .001
No. of chronic diseases	–1.89	0.21	< .001	–1.47	0.23	< .001	–4.45	0.23	< .001	–3.23	0.26	< .001
Smoking												
Nonsmoking	Ref			Ref			Ref			Ref		
Ex-smoking	–0.64	0.62	.305	–1.38	0.84	.098	–0.51	0.70	.464	–1.47	0.93	.116
Current smoking	–4.33	0.51	< .001	–2.68	0.77	< .001	–2.89	0.56	< .001	–2.18	0.86	.012
Drinking alcohol												
Nondrinking	Ref			Ref			Ref			Ref		
Ex-drinking	–3.53	0.89	< .001	–2.80	0.98	.004	–3.93	1.01	< .001	–3.69	1.08	.001
Current drinking	–0.07	0.37	.843	–0.44	0.62	.474	0.961	0.42	.021	–0.21	0.70	.765
Regular exercise												
No	–3.09	0.32	< .001	–2.86	0.54	< .001	–2.96	0.35	< .001	–3.84	0.60	< .001
Yes	Ref			Ref			Ref			Ref		

Independent variables were measured at baseline (2006), and quality of life and health-related quality of life were assessed during the follow-up (2008–2022).

SE = standard error; Ref = reference.

sults underscore the importance of incorporating social factors when understanding the decline in QoL and HRQoL among middle-aged and older adults.

Previous studies have mainly examined social frailty among older adults (≥ 65 years), emphasizing its influence on health outcomes in later life [10-12]. However, our findings reveal that although social frailty is more pronounced among older adults, it is also prevalent in middle-aged adults (45–64 years), suggesting that social vulnerability may begin earlier than previously recognized. These results align with prior research involving adults aged 37–73 years, in which 72.06% of socially frail individuals were between 45 and 64 years of age [18]. Middle adulthood is a life stage characterized by progressive physical aging, increasing social and economic burdens, and psychological transitions such as the empty-nest syndrome [19,20]. The convergence of physical strain, economic pressure, and diminished social roles may collectively contribute to the onset of social frailty in midlife. The early emergence of social frailty may have long-term implications for both QoL and HRQoL, fur-

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ther emphasizing the need for early intervention to mitigate its adverse effects. Additionally, this study found no significant gender differences in social frailty among middle-aged adults, whereas women exhibited a higher prevalence of social frailty among older adults. This disparity may be attributed to structural and socioeconomic factors, including women's higher life expectancy, increased likelihood of widowhood, and reduced financial security in later life [21,22]. In Korea, the Ministry of Health and Welfare's Customized Care Service for the Elderly offers programs that strengthen social connections among isolated older adults [23]; however, few of these are specifically tailored for older women. Because social isolation, low social support, and loneliness are distinct yet interrelated factors that negatively affect HRQoL among older women, targeted programs that address these aspects are needed [24]. From a nursing perspective, social participation interventions tailored to women can help reduce loneliness, enhance social support, and ultimately improve both QoL and HRQoL.

The study findings further demonstrate that declines in QoL and HRQoL were more pronounced among socially frail individuals across both middle-aged (45–64 years) and older (≥65 years) adults. However, the deterioration in QoL was greater than that in HRQoL in both age groups, suggesting that social frailty affects broader life domains beyond physical health, including psychological well-being, independence, and social relationships [25]. This finding is consistent with prior studies indicating that social isolation, loneliness, and living alone exert broad negative effects—not only on direct health outcomes but also on overall life satisfaction and psychological well-being [26,27]. Notably, while declines in QoL and HRQoL persisted until 2018 among older adults (≥65 years), reflecting the cumulative effects of social frailty, they were significant only in the earlier years among middle-aged adults (45–64 years) and did not continue in later years. Previous studies have reported that frailty progresses more rapidly in older adults, with an increasing number transitioning into more severe frailty categories as they age [28]. This underscores the need for age-specific intervention strategies. For middle-aged adults, preventive approaches may help delay the onset of frailty, while for older adults, sustained support is crucial to mitigate its long-term consequences. These findings align with the present study, suggesting that middle-aged adults benefit more from early interventions focused on social engagement and risk reduction, whereas older adults require continuous, supportive measures to manage cumulative frailty and prevent further decline. In Korea, current programs such as the Ministry of Health and Welfare's Customized Care Service for the Elderly and community-based health promotion initiatives primarily target older adults who are already vulnerable, with limited preventive strategies for those in midlife. Therefore, preventive measures such as smoking cessation programs, alcohol abstinence education, and initiatives promoting social participation are needed for middle-aged adults. Conversely, sustained interventions, including group exercise and community engagement programs, are vital for older adults. From a nursing perspective, implementing these age-specific strategies can significantly contribute to improving both QoL and HRQoL across the lifespan.

This study highlights the influence of sociodemographic and health-related factors on QoL and HRQoL among middle-aged (45–64 years) and older (≥65 years) adults. First, gender differences were evident among middle-aged adults but not among older adults. Women in midlife had significantly lower QoL and HRQoL than men, likely due to biological transitions such as menopause, shifting self-perceptions with aging, and situational stressors, including caregiving responsibilities, work-related challenges, and financial concerns [29,30]. In contrast, gender disparities diminished among older adults, possibly because retirement alleviates the dual burden of work and family responsibilities, provides clearer social roles, and reduces stress from multiple obligations—thereby leading to greater life satisfaction [31]. Second, lower educational attainment was associated with poorer QoL and HRQoL, with a more pronounced effect among middle-aged adults. This may reflect the double burden faced by middle-aged individuals with lower socioeconomic status: first, they are more likely to experience greater health impairment, and second, once their health deteriorates, they tend to report lower HRQoL compared with higher-status groups [32]. Finally, health behaviors such as smoking, alcohol consumption, and physical activity significantly influenced both QoL and HRQoL. Current smoking and past alcohol consumption had more pronounced negative effects on QoL and HRQoL among middle-aged adults, whereas physical inactivity had a stronger adverse impact on HRQoL among older adults. These findings are consistent with previous studies indicating that smoking is associated with decreased HRQoL among young and middle-aged populations compared with older adults [33]. In addition, regular physical activity has been shown to reduce the risk of noncommunicable diseases, including cardiovascular disease, stroke, diabetes, and certain cancers [34], while also improving mental health outcomes [35]. Collectively, these results underscore the need for age-specific interventions, such as smoking cessation and alcohol abstinence education for middle-aged adults, and expanded physical activity programs for older adults, to promote well-being in aging populations.

Overall, this study contributes to the literature by providing longitudinal evidence of the impact of social frailty on QoL and HRQoL, highlighting both distinct effects across middle-aged and older adults and common trajectories over time.

Despite its strengths, this study has several limitations that should be considered when interpreting the findings. First, although a longitudinal design was employed, establishing a definitive causal relationship between social frailty and declines in QoL and HRQoL remains challenging. While the results suggest that social frailty precedes a decline in QoL, it is also possible that poor QoL and HRQoL contribute to the progression of social frailty. Future research should incorporate experimental or intervention-based designs to better elucidate these causal mechanisms. Second, this study focused on middle-aged and older Korean adults, which may limit the generalizability of the findings to other cultural or social contexts. The manifestations and effects of social frailty on QoL may vary across societies due to differences in social support systems, cultural norms, and healthcare accessibility. Cross-cultural research is warranted to determine whether these patterns hold in diverse populations. Third, although analyses were adjusted for sociodemographic and health-related variables, potential unmeasured confounders—such as undiagnosed chronic diseases or psychological distress—may still have influenced the results. Future studies should employ mediation and moderation models to better capture the complex interactions between social frailty and QoL. Fourth, QoL and HRQoL were measured using single-item self-reported questions from the KLoSA, which may not fully reflect their multidimensional constructs and could limit measurement reliability and validity. Future research should utilize standardized, multi-item instruments to provide more comprehensive assessments. Despite these limitations, this study offers valuable insights by demonstrating the long-term impact of social frailty on QoL and HRQoL. Addressing these limitations in future research will enhance understanding of the mechanisms underlying social frailty and guide the development of more effective interventions to mitigate its negative consequences.

CONCLUSION

This study extends existing research on social frailty by demonstrating its significant impact on both middle-aged (45–64 years) and older (≥65 years) adults, emphasizing the necessity of interventions across the life course. The findings reveal that social frailty affects not only HRQoL but also overall well-being, with its effects persisting longer among older adults. For middle-aged adults, strategies such as strengthening workplace social support and promoting early lifestyle interventions—particularly smoking cessation and alcohol moderation—may enhance resilience and recovery potential. In contrast, older adults require sustained approaches, including expanded physical activity programs and community engagement initiatives, to prevent the rapid progression of social frailty. Furthermore, community-based social health promotion programs should incorporate age- and gender-specific screening for social frailty, followed by tailored interventions that provide individualized management. By highlighting both the early onset and cumulative effects of social frailty, this study underscores the critical importance of developing targeted policies and evidence-based interventions to improve QoL and promote healthy aging.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and design acquisition, drafting or critical revision of the manuscript for important intellectual content - YK and YL; analysis, interpretation of the data - YL.

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DATA AVAILABILITY STATEMENT

This study used publicly available data from the Korea Employment Information Service. The dataset can be accessed at: https://survey.keis.or.kr/eng/klosa/klosa01.jsp.

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Factors Influencing Adherence to Physical Exercise Rehabilitation during the First Three Months Post-Stroke among Adults with First-Onset Stroke

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Purpose: This study aimed to identify key predictive factors influencing adherence to physical exercise rehabilitation among adults during the first three months following a first-onset ischemic stroke in China. **Methods:** A cross-sectional descriptive study was conducted among 137 adults who attended clinical follow-up appointments within the first three months after experiencing a first-onset ischemic stroke. Predictors included family support, coping with role transition, depression, self-efficacy, and body image. Hierarchical multiple regression analysis was performed. **Results:** The mean adherence score for physical exercise rehabilitation was 39.58 (standard deviation = 6.71), indicating a moderate adherence level (70.6%). In model 1, male sex ($\beta = .20$, $p = .017$) and post-stroke duration of 2 months ($\beta = .31$, $p = .015$) and 3 months ($\beta = .39$, $p = .002$) were significant predictors of adherence to physical exercise rehabilitation. Adding main predictors in model 2 resulted in a significant increase in explained variance ($\Delta R^2 = .418$, $p < .001$), accounting for 51.5% of the total variance ($R^2 = .515$, adjusted $R^2 = .484$). Male sex ($\beta = .15$, $p = .017$), family support ($\beta = .43$, $p < .001$), self-efficacy ($\beta = .26$, $p < .001$), depression ($\beta = -.24$, $p = .001$), and coping with role transition ($\beta = .16$, $p = .033$) were significant predictors. Body image and post-stroke duration were not significant after adjustment. **Conclusion:** Efforts to promote adherence to physical exercise rehabilitation should prioritize family support, depressive symptoms, self-efficacy, and coping with role transition. Furthermore, body image may warrant attention when developing sex-specific intervention strategies.

Key Words: Exercise therapy; Patient compliance; Self concept; Social support; Stroke

INTRODUCTION

Stroke remains a major global public health concern, contributing substantially to mortality and long-term disability [1]. In China, stroke is both a leading cause of death and the primary contributor to adult disability [2]. Epidemiological data from 2020 highlight the substantial burden of stroke, with 17.8 million survivors, including 3.4 million first-onset cases, and 2.3 million deaths [2]. Among survivors, 12.5% experience stroke-related disabilities (modified Rankin Scale >1), representing approximately 2.2 million individuals [2]. Additionally, there is an increasing trend of stroke incidence among younger adults [3]. Data from the national Stroke Risk Population Screening and Intervention Program (2012–2016) showed that individuals aged 18 to 64 years accounted for more than 66.6% of first-ever stroke cases [4]. Therefore, stroke prevention and management are critical priorities in adult populations.

The impact of stroke extends beyond the acute phase, imposing significant burdens on individuals across physiological, psychological, and social dimensions [3]. Approximately 60% to 80% of adult stroke survivors experience residual disabilities that substantially limit daily functioning and impede social reintegration, while also facing heightened psychological distress and elevated recovery expectations [5]. Therefore, optimizing rehabilitation outcomes for adult stroke survivors is essential to improve quality of life and support successful societal reintegration. Adherence to physical exercise rehabilitation is widely recognized as a cornerstone of ischemic stroke recovery [6]. It is defined as the consistent and systematic engagement of post-stroke individuals in prescribed exercise regimens aimed at restoring motor function and resuming daily activities [7]. Importantly, the first three months following a stroke represent a period of heightened neuroplasticity, characterized by rapid spontaneous neurological recovery facilitated by synaptic reorganization and axonal sprouting in peri-infarct regions [8]. This critical window offers a unique opportunity in which early and sustained participation in structured exercise programs can significantly enhance recovery processes and prevent functional decline [9].

Despite its well-documented benefits, adherence to physical exercise rehabilitation remains low among stroke survivors. Previous studies using the Exercise Adherence Questionnaire (EAQ) have revealed concerningly low adherence rates. For example, Zhao and Bai [10] reported that only 7.4% of stroke patients demonstrated high adherence, while most exhibited moderate (41.1%) or low (51.5%) adherence. Similarly, Cao et al. [11] found that 82.2% of participants had low adherence. These findings highlight a substantial gap between recommended rehabilitation practices and actual patient behavior.

Given the critical role of physical exercise rehabilitation in functional recovery, it is essential to investigate the determinants influencing adherence during the early post-stroke period. A clearer understanding of these factors can inform the development of targeted, evidence-based interventions to enhance rehabilitation outcomes and improve long-term quality of life for this population.

The Roy adaptation model (RAM) provided the conceptual foundation for this study [12], supported by an extensive review of the literature to deepen understanding of adaptive processes in adults with first-onset ischemic stroke, particularly in relation to adherence to physical exercise rehabilitation. Stroke often results in lasting disabilities and functional limitations [3], requiring survivors to adapt rapidly to maintain independence and well-being. Stroke survivors are expected to engage in a multidimensional adjustment process in response to new physical, psychological, and social realities. According to RAM, adherence to physical exercise rehabilitation can be explained through four adaptive modes: physiological, self-concept, role function, and interdependence [12]. In this study, the relationships between these adaptive modes and the selected variables were examined to establish a theoretical foundation for understanding rehabilitation adherence. Following a first-onset stroke—particularly during the critical first three months—survivors may face challenges in adjusting to altered physical abilities, evolving self-perceptions, changing roles, and shifts in social support networks [5]. Therefore, the RAM offers a comprehensive framework for interpreting adherence behaviors, encompassing not only physical recovery but also psychological and social adaptation.

Prior research has identified multiple psychosocial and behavioral factors that influence treatment adherence in both stroke and other chronic illnesses [13]. Among these, in the context of community-dwelling stroke survivors, self-efficacy has consistently shown a positive correlation with rehabilitation adherence [13]. A stronger belief in one's ability to perform specific actions predicts greater engagement in prescribed exercise regimens and improved long-term functional outcomes [13]. Similarly, depression—a common post-stroke condition—impairs cognitive function, reduces motivation, and diminishes engagement in rehabilitation. Several studies have linked depressive symptoms to lower adherence to physical exercise rehabilitation among stroke survivors [5,14]. Furthermore, family support has emerged as a critical determinant of rehabilitation engagement. Supportive family environments have been shown to enhance patient confidence and encourage adherence, whereas the absence of such support is often associated with poor treatment compliance [5]. Another salient factor, particularly within the context of chronic illness, is coping with role transition, which encompasses cognitive and behavioral strategies such as confronting, avoiding, or yielding to challenges. Evidence suggests that individuals who employ a proactive, "facing" approach to adaptation are more likely to maintain higher adherence levels [15]. In addition, body image—defined as one's perceptions and attitudes toward physical appearance—has been associated with adherence behaviors among individuals with chronic illness. Studies indicate that patients with negative body image perceptions tend to exhibit poorer adherence to treatment [16]. Collectively, these factors highlight the multidimensional nature of adherence behaviors and provide a foundation for examining their influence on post-stroke rehabilitation.

Previous studies have demonstrated that self-efficacy, family support, depression, coping with role transition, and body image influence treatment adherence in stroke and other chronic illnesses [5,13-16]. However, their specific roles during the first one to three months after a first-onset stroke—a period critical for adaptation and recovery—remain underexplored, particularly among adult survivors aged 18 to 60 years, who represent more than two-thirds of stroke cases in China (66.6%) and possess distinct rehabilitation needs compared with older adults [4]. This study addresses this gap by examining these factors in relation to adherence to physical exercise rehabilitation during early recovery, guided by the RAM. Within this framework, the variables correspond to the four adaptive modes: self-efficacy and body image align with the self-concept mode; coping with role transition corresponds to the role function mode; depression represents an emotional manifestation within the physiological mode; and family support reflects the interdependence mode. The findings from this study will provide evidence-based insights to inform the development of targeted, patient-centered rehabilitation strategies and promote sustained functional recovery among stroke survivors.

METHODS

1. Study Design

This cross-sectional descriptive study was conducted at the Neurology Outpatient Clinic of the First Affiliated Hospital of Wenzhou Medical University (FAH of WMU) in China from July to October 2024.

2. Setting and Samples

The target population consisted of adult patients diagnosed with a first-onset ischemic stroke who received treatment at the Department of Neurology, FAH of WMU. Participants were recruited based on the following inclusion criteria: (1) attendance at a clinical follow-up between 1–3 months after discharge; (2) age between 18 and 60 years; (3) ability to read and communicate in Chinese; (4) full consciousness and good cooperation; and (5) an Activities of Daily Living (ADL) score between 21 and 90. The exclusion criteria were: (1) disability due to other causes; (2) severe cardiopulmonary dysfunction or a history of craniocerebral trauma; and (3) serious auditory or visual impairment that prevented cooperation with the study. Participants did not receive any monetary or non-monetary compensation for their participation.

In the absence of a directly comparable prior study, the sample size was determined a priori using G*Power software (version 3.1). The calculation was based on a planned multiple regression analysis with nine predictors, an alpha level of .05, statistical power of .85, and a medium effect size (0.15), as recommended for nursing research [17]. This resulted in a required sample size of 126 participants. To account for a potential 10% attrition rate, the target was increased to 138 participants. The final analytic sample included 137 participants (one case was excluded due to excessive Cook's distance), yielding an achieved post hoc power of approximately .92, indicating adequate statistical power for the final model.

3. Instruments

1) General demographic questionnaire

The general demographic questionnaire consisted of eight items covering sex, age, date of first onset, length of hospital stay, post-stroke duration, date of follow-up visit, ADL score, and site of limb function loss.

The ADL scale is a commonly used instrument for evaluating patients' self-care ability in daily life. It assesses multiple dimensions of functional capacity on a scale ranging from 0 to 100. The scoring criteria are as follows: a score of 0–20 indicates complete dependence on others for daily living; 21–40 suggests a significant need for assistance; 41–60 indicates a moderate need for help; 61–90 signifies that the patient has basic self-care abilities; and a score of 91–100 indicates that the patient is largely independent in performing daily living activities.

2) Physical exercise rehabilitation adherence

Physical exercise rehabilitation adherence was defined as the extent to which stroke patients performed prescribed exercises systematically and scientifically to restore limb function and daily activities according to professional guidance. Adherence was measured using the EAQ developed by Lin et al. [7]. The EAQ includes 14 items across three dimensions: adherence to rehabilitation exercises, exercise monitoring, and advice seeking. Each item is rated on a 4-point Likert scale ranging from 1 (“not do it at all”) to 4 (“do it completely”), yielding a total score range of 14–56. Higher scores indicate stronger adherence. Adherence levels were categorized as high (≥75%), moderate (50.0%–74.9%), and low (≤50%), using the formula: adherence level = actual adherence score/possibility total adherence score (56 points) × 100%. Cronbach’s α was .92 in Lin’s study [7]; in this study, it was .90.

3) Self-efficacy

Self-efficacy—defined as an individual’s confidence in executing specific behaviors to achieve desired outcomes—was assessed using the General Self-Efficacy Scale (GSES) developed by Schwarzer and Jerusalem and translated into Chinese by Zhang and Schwarzer [18]. The GSES consists of 10 items rated on a 4-point Likert scale from 1 (“not at all true”) to 4 (“exactly true”), with a total score range of 10–40. Higher scores indicate greater self-efficacy. Cronbach’s α in this study was .72.

4) Coping with role transition

Coping with role transition was assessed using the Post-Discharge Coping Difficulty Scale (PDCDS) developed by Fitzgerald, Piacentine and translated into Chinese by Zhao et al. [19]. The Chinese version of the scale consists of two primary dimensions: the life management dimension, which includes emotional self-regulation, self-care capacity, self-medication management ability, and challenges faced by family caregivers; and the emotional needs dimension, which comprises life stress and rehabilitation-related difficulties [19]. The PDCDS contains seven items rated on a 10-point Likert scale from 0 (“no difficulty”) to 10 (“very difficult”), with total scores ranging from 0 to 70. Lower scores indicate more effective coping with post-discharge difficulties [19]. Cronbach’s α was .89 in Zhao et al.’s study [19] and .91 in this study.

5) Body image

Body image is defined as an individual’s beliefs and attitudes toward their physical appearance, encompassing perceptions of physical form, body size and shape, weight, and attractiveness. Body image was assessed using the Body Image States Scale (BISS), developed by Cash et al. and translated into Chinese by Wang [20]. The scale consists of six items rated on a nine-point Likert scale. Three items—body shape, weight, and degree of self-perception—are positively scored from 1 (extremely dissatisfied) to 9 (extremely satisfied), while the remaining three items—body size, self-attractiveness, and comparison with others—are negatively scored from 9 (extremely satisfied) to 1 (extremely dissatisfied) [20]. The total score ranges from 6 to 54, with lower scores indicating a more positive perception of body image. The Cronbach’s α for the Chinese version was .71 in Wang’s research [20] and .76 in this study.

6) Depression

Depression is a class of mood disorders characterized by significant and persistent disturbances in mood, cognition, and behavior, manifesting as depressed mood, slowed thinking, impaired cognitive functioning, diminished volitional activity, and somatic symptoms. Depression was assessed using the Patient Health Questionnaire (PHQ-9), developed by Spitzer et al. and translated into Chinese by Bian et al. [21]. The PHQ-9 consists of nine symptom items and one overall functional assessment. The symptom items measure reduced interest, depressed mood, sleep disturbance, fatigue, changes in appetite, low self-esteem, concentration difficulties, psychomotor retardation, and suicidal ideation. Each item is rated on a four-point scale ranging from 0 (“not at all”) to 3 (“nearly every day”), with higher scores indicating greater depressive severity. The total score ranges from 0 to 27. Depression severity is classified as follows: 0–4, no depressive symptoms; 5–9, mild; 10–14, moderate; and ≥15, severe [21]. Cronbach’s α for the Chinese version was .84, and it was .86 in the present study.

7) Family support

Family support refers to the degree to which family members provide emotional, informational, and instrumental assistance to meet patients’ needs during recovery. Family support was measured using the Perceived Social Support from Family Scale (PSS-Fa), developed by Procidano and Heller and translated into Chinese by Chen [22]. The PSS-Fa consists of 20 items rated on a 5-point Likert scale ranging from 1 (“totally disagree”) to 5 (“totally agree”), with higher scores indicating greater perceived family support. The Cronbach's α in Procidano’s study was .90 [23] and for this study was .87.

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4. Data Collection

Rigorous standardized procedures were employed for participant selection and data collection. Using a simple random sampling method, eligible patients were identified through a multi-step process. After obtaining approval from the Institutional Review Boards (IRBs) of Burapha University and the First Affiliated Hospital of Wenzhou Medical University, researchers accessed daily outpatient lists (Monday to Sunday) to identify first-onset stroke patients within one to three months post-discharge. Each eligible patient was assigned a unique identification number written on uniformly sized pieces of paper, which were placed in an opaque box, thoroughly mixed, and randomly drawn at a 50% selection rate by an independent staff member.

During the data collection process, all selected patients were informed both orally and in writing about the study's purpose, procedures, confidentiality assurances, and voluntary nature. They were clearly informed that participation was voluntary and that refusal or withdrawal at any stage would not affect their access to medical care. Written informed consent was obtained from all participants prior to data collection.

Questionnaires were administered under standardized conditions. After obtaining permission to meet the patient, the researcher met participants in a designated visitor area adjacent to the neurology office. Each participant was provided with a paper-based questionnaire packet, including the General Demographic Questionnaire, EAQ, PSS-Fa, PDCDS, PHQ-9, BISS, and GSES, which took approximately 30 minutes to complete. For participants with motor impairments, researchers assisted by scribing responses under direct supervision, ensuring accuracy and confidentiality. All questionnaires were reviewed for completeness while respecting the participants' right to skip questions. Upon confirmation of completion, all data were securely uploaded to the study's software system and stored in a password-protected database.

5. Ethical Considerations

This study was reviewed and approved by the Institution Review Board (IRB) of Burapha University, Thailand (2024/July/16th, G-HS052/2567) and the First Affiliated Hospital of Wenzhou Medical University, China (2024/July/14th, KY2024-151).

All participants were provided with a comprehensive explanation of the study objectives, procedures, data handling, and participant rights. The researchers ensured that all participants fully understood the information provided and voluntarily signed informed consent forms prior to participation.

6. Data Analysis

All data analyses were performed using IBM SPSS ver. 27.0 (IBM Corp., Armonk, NY, USA), with the level of statistical significance set at $p < .05$. Descriptive statistics, including frequencies, percentages, means, and standard deviations (SDs), were used to describe participant characteristics and study variables. The independent t-test and one-way analysis of variance (ANOVA) were applied to examine differences in adherence to physical exercise rehabilitation across participant characteristics. For any significant effects found in the ANOVA, post hoc comparisons were performed using Tukey's honestly significant difference test. Hierarchical multiple regression analysis was conducted to identify predictors of adherence to physical exercise rehabilitation.

The assumptions of multiple regression were verified before analysis. Scatterplots of the dependent variable against each independent variable demonstrated approximately linear relationships. The Durbin–Watson statistic was 1.631 for Model 1 and 1.83 for Model 2, indicating no autocorrelation. Normality was confirmed using histograms and Q–Q plots, and homoscedasticity was supported by the residuals plotted against predicted values. Variance inflation factor values ranged from 1.11 to 1.34, confirming the absence of multicollinearity. Cook's distance values were below 1, and standardized residuals indicated no influential outliers. No missing data were observed.

RESULTS

1. Characteristics of Participants

Data from 137 adults with first-onset ischemic stroke were analyzed. The majority of participants were male (68.6%), and most were aged between 51 and 60 years (66.4%), with a mean age of 52.20 years (SD = 6.76). Most participants demonstrated moderate dependency, as indicated by ADL scores ranging from 61 to 90 (92.7%, mean = 83.69, SD = 11.70). Regarding post-stroke duration, 11.7% were assessed at one month, 24.1% at two months, and 64.2% at three months post-stroke (mean = 2.53, SD = 0.70). Detailed demographic and clinical characteristics are presented in Table 1.

2. Descriptive Information of Study Variables

Table 2 summarizes the overall adherence to physical exercise rehabilitation, with a mean score of 39.58 (SD = 6.71), representing a moderate level of adherence (70.6%). Among the three dimensions, adherence to rehabilitation exercise demonstrated a high level (mean = 24.49, SD = 4.17; 76.5%), while exercise monitoring (mean = 7.80, SD = 1.56; 64.9%) and advice seeking (mean = 7.30, SD = 2.07; 60.8%) showed moderate levels. The mean scores were 28.72 (SD = 4.69) for self-efficacy, 25.74 (SD = 12.13) for coping with role transition, 32.55 (SD = 5.28) for body image, 0.66 (SD = 1.54) for depression, and 66.97 (SD = 10.65) for family support, as shown in Table 3.

3. Differences in Adherence to Physical Exercise Rehabilitation across Demographic and Clinical Characteristics

Significant differences in adherence to physical exercise rehabilitation were observed according to sex and post-stroke duration. Male participants exhibited significantly greater adherence than female participants (t = 2.06, p = .041). With respect to clinical factors, adherence also differed significantly among the three post-stroke duration groups (F = 4.08, p = .019). Post-hoc comparisons revealed that participants at three months post-stroke demonstrated significantly higher adherence than those at one month. Conversely, no significant differences were identified in adherence across age groups (t = 0.43, p = .666) or ADL levels (t = –0.21, p = .403), as presented in Table 1.

4. Correlations among Key Study Variables

Pearson correlation analyses revealed significant positive correlations between rehabilitation adherence and both self-efficacy (r = .50, p < .001) and family support (r = .56, p < .001). In contrast, depression (r = –.36, p < .001) and body image (r = –.17, p = .022) were significantly negatively correlated with adherence. No significant associations were identified for coping with role transition (r = –.06, p = .257). Detailed correlation coefficients are presented in Table 4.

Table 1. Characteristics of Participants (*N* = 137)

Variables	Adherence to physical exercise rehabilitation				
	Categories	n (%)	M ± SD	t or F	*p* (Tukey's HSD)
Sex	Male	94 (68.6)	40.37 ± 6.29	2.06	.041
	Female	43 (31.4)	37.86 ± 7.32		
Age (year)	18–45	18 (13.1)	40.22 ± 5.70	0.43	.666
	46–60	119 (86.9)	39.49 ± 6.86		
Post-stroke duration (month)	1^a	16 (11.7)	35.35 ± 8.37	4.08	.019
	2^b	33 (24.1)	39.67 ± 6.28		(c > a)
	3^c	88 (64.2)	40.34 ± 6.30		
ADL score	21–60	10 (7.3)	39.80 ± 3.58	–0.21	.403
	61–90	127 (92.7)	39.57 ± 6.90		

ADL = activities of daily living; HSD = honestly significant difference; M = mean; SD = standard deviation.

Table 2. Descriptive Statistics for Adherence to Physical Exercise Rehabilitation (*N* = 137)

Variables	Possible score (range)	Actual score (range)	M ± SD	Adherence level (%)
Total adherence to physical exercise rehabilitation	14–56	17–55	39.58 ± 6.71	Moderate (70.6)
Adherence to rehabilitation exercise	8–32	9–32	24.49 ± 4.17	High (76.5)
Exercise monitoring	4–12	4–12	7.80 ± 1.56	Moderate (64.9)
Advice seeking	3–12	3–12	7.30 ± 2.07	Moderate (60.8)

M = mean; SD = standard deviation.

Table 3. Description of Factors Related to Rehabilitation Exercise (N = 137)

Variables	Possible score (range)	Actual score (range)	M ± SD
Family support	20–100	19–93	66.97 ± 10.65
Coping with role transition	0–70	3–58	25.74 ± 12.13
Depression	0–27	0–13	0.66 ± 1.54
Self-efficacy	10–40	15–40	28.72 ± 4.69
Body image	6–54	16–48	32.55 ± 5.28

M = mean; SD = standard deviation.

Table 4. Correlation between Predictors and Adherence to Physical Exercise Rehabilitation (N = 137)

Variables	Adherence for physical exercise rehabilitation	Family support	Coping with role transition	Depression	Self-efficacy	Body image
	r or t (p)					
Adherence to physical exercise rehabilitation	1					
Sex	.17 (.021)					
Post-stroke duration of 2 months	.01 (.468)					
Post-stroke duration of 3 months	.15 (.038)					
Family support	.56 (< .001)	1				
Coping with role transition	–.06 (.257)	–.07 (.216)	1			
Depression	–.36 (< .001)	–.12 (.078)	.36 (< .001)	1		
Self-efficacy	.50 (< .001)	.32 (< .001)	–.16 (.030)	–.38 (< .001)	1	
Body image	–.17 (.022)	–.06 (.252)	.35 (< .001)	.04 (.329)	–.18 (.017)	1

5. Predictive Factors of Adherence to Physical Exercise Rehabilitation

Preliminary analyses indicated that adherence to physical exercise rehabilitation differed significantly by sex (t = 2.06, p = .041) and post-stroke duration (F = 4.08, p = .019), while no significant differences were observed for age or ADL (Table 1). Therefore, sex and post-stroke duration were retained as covariates in subsequent regression analyses.

In the covariate-only model (Model 1), male sex (β = .20, p = .017) and post-stroke duration of two months (β = .31, p = .015) and three months (β = .39, p = .002) were significant predictors of physical exercise rehabilitation adherence. Model 1 accounted for 9.7% of the variance in adherence (R^2 = .097, adjusted R^2 = .076, F(3, 133) = 4.76, p = .004). When the main predictors (family support, coping with role transition, depression, self-efficacy, and body image) were added in model 2, the explained variance significantly increased by 41.8% (ΔR^2 = .418, F(5, 128) = 22.03, p < .001), resulting in a total explained variance of 51.5% (R^2 = .515, adjusted R^2 = .484). In this adjusted model, male sex remained significant but decreased in magnitude (β = .15, p = .017), while post-stroke duration at two and three months was no longer significant. Among the main predictors, family support (β = .43, p < .001), self-efficacy (β = .26, p < .001), depression (β = –.24, p = .001), and coping with role transition (β = .16, p = .033) emerged as significant predictors of adherence. Body image was not a significant predictor (β = –.13, p = .050), suggesting that its apparent effects in unadjusted models may be partly attributable to sex differences. Full regression results are summarized in Table 5.

DISCUSSION

This cross-sectional descriptive study examined adherence to physical exercise rehabilitation and identified its key predictive factors among adults during the first three months following a first-onset ischemic stroke in China. The findings revealed that family support and self-efficacy were the strongest predictors of adherence, while depression, sex, and coping with role transition showed secondary predictive effects after controlling for sex and post-stroke duration. Body image and post-stroke duration were not statistically significant.

Initial bivariate analyses found no significant association

Table 5. Hierarchical Multiple Regression Analysis of Factors Influencing Adherence to Physical Exercise Rehabilitation (*N* = 137)

Variables	Categories	Model 1					Model 2				
		B	SE	β	t	*p*	B	SE	β	t	*p*
Constant		32.92	1.88		17.51	< .001	11.83	4.74		2.49	.014
Sex	Female (ref.)										
	Male	2.87	1.20	.20	2.41	.017	2.18	0.90	.15	2.42	.017
Post-stroke duration (month)	1 (ref.)										
	2	4.84	1.97	.31	2.45	.015	1.71	1.53	.11	1.12	.27
	3	5.50	1.76	.39	3.13	.002	1.45	1.42	.11	1.03	.31
Family support							0.27	0.04	.43	6.56	< .001
Coping with role transition							0.08	0.04	.16	2.15	.033
Depression							–1.06	0.31	–.24	–3.30	.001
Self-efficacy							0.38	0.10	.26	3.70	< .001
Body image							–0.17	0.09	–.13	–1.98	.050
Adjusted R^2		.076					.484				
R^2		.097					.515				
Change of R^2		.097					.418				
df		3					5				
F (*p*)		4.76 (.004)					22.03 (< .001)				
Durbin–Watson		1.631					1.83				

df = degrees of freedom; SE = standard error.

between rehabilitation adherence and coping with role transition. However, this variable was retained in the hierarchical regression model based on two key considerations. First, previous research has established its theoretical importance as a determinant of long-term rehabilitation engagement [15]. Second, according to the RAM, effective adaptation to role transitions represents a critical psychosocial process in post-stroke recovery, influencing health behaviors such as rehabilitation adherence [12]. The selective inclusion of this variable ensured that the final model maintained an appropriate balance between statistical rigor and clinical relevance.

The hierarchical regression analysis emphasized that modifiable psychosocial factors—particularly strong family support and high self-efficacy—were the most robust predictors of greater adherence to physical exercise rehabilitation. Lower depression levels and more positive perceptions of coping with role transitions also contributed significantly, though to a lesser extent. Conversely, the effects of non-modifiable factors, such as stroke duration, diminished once psychosocial variables were accounted for. Although male sex was associated with higher adherence, this finding highlights the importance of developing sex-tailored intervention strategies rather than suggesting an inherently causal relationship. The regression model explained 51.5% of the variance in adherence, indicating a substantial influence of psychosocial and demographic factors. Nevertheless, 48.5% of the variance remained unexplained, suggesting that additional variables, such as environmental, cognitive, or healthcare system-related factors, should be examined in future research to further clarify adherence mechanisms.

Adherence to rehabilitation exercises in the early post-stroke period is critical for optimizing functional recovery and preventing secondary complications. Consistent engagement in exercise rehabilitation during this period significantly enhances motor outcomes and reduces the risk of long-term disability. In this study, the mean adherence score was 39.58 (SD = 6.71), corresponding to a moderate level of adherence (70.6%). Dimensional analysis showed relatively high adherence to rehabilitation exercise itself (76.5%), while adherence to exercise monitoring (64.9%) and advice-seeking behaviors (60.8%) remained at moderate levels. This result was slightly lower than that reported by Zhang et al. [24], who found an adherence rate of 77.1%. Although this moderate level of engagement suggests a reasonable degree of participation, it remains suboptimal for maximizing rehabilitation benefits. These findings emphasize the necessity of identifying key determinants of adherence and implementing targeted nursing interventions to improve adherence and support recovery.

The moderate adherence levels observed in this study may partly reflect the influence of sex composition and post-stroke duration. Regression analyses identified male sex as a significant predictor of greater rehabilitation adherence, consistent with the findings of Zhang et al. [24], who reported superior adherence among male stroke patients. Several factors may explain this pattern. Physiologically, males generally exhibit higher baseline physical fitness and more favorable hormonal profiles, both of which may enhance recovery potential [25]. Additionally, male often carry greater social and familial responsibilities, leading to stronger motivation and expectations to maintain functional independence through rehabilitation [26]. According to the RAM, individuals with greater physiological and psychological adaptive capacity are better equipped to adjust to post-stroke changes and engage actively in rehabilitation exercises [12,25]. This highlights the need to explore and develop sex-specific intervention strategies.

In the initial regression model (model 1), post-stroke duration at two and three months, compared with one month, was a significant predictor of adherence. However, this effect was no longer significant once behavioral variables were introduced in model 2. This finding suggests that time since stroke does not exert a direct influence on adherence; rather, its apparent effect becomes non-significant once psychosocial factors such as family support and self-efficacy are considered. According to the RAM, individuals gradually make adaptive adjustments to environmental and physiological changes over time. A longer post-stroke duration allows patients more opportunities for both physical and psychological adaptation, facilitating progressive engagement in rehabilitation activities and enhancing willingness and confidence to participate in exercise programs [27].

Among all predictors, family support emerged as the most significant determinant of rehabilitation exercise adherence, consistent with previous evidence [5,10]. Within the framework of the RAM, interdependence is identified as one of the four primary adaptive modes, highlighting the central role of social support systems in health recovery [12]. For stroke survivors, family support serves as a critical adaptive resource that strengthens the ability to cope with physical and psychosocial stressors associated with stroke, thereby promoting greater adaptive capacity and sustained rehabilitation engagement [28]. These findings underscore the need for healthcare professionals to provide targeted health education to families, emphasizing the essential role of family involvement, particularly during the first three months post-stroke, to optimize recovery outcomes.

Self-efficacy was identified as the second most influential predictor of adherence to physical exercise rehabilitation, even after controlling for sex and post-stroke duration. This finding reinforces the importance of psychological resources in facilitating adherence during the early recovery phase. Consistent with prior empirical studies, self-efficacy has been recognized as a pivotal determinant of exercise adherence among stroke survivors [13]. Self-efficacy represents an individual's belief in their capacity to manage challenges and execute specific behaviors effectively. In the context of RAM, health maintenance is achieved through adaptive responses to environmental stimuli [12]. Stroke survivors with higher levels of self-efficacy often demonstrate stronger self-identity and greater self-esteem [29], enabling them to approach rehabilitation with confidence and perseverance. During the critical window of neuroplasticity, enhanced self-efficacy enables patients to take full advantage of recovery opportunities, establish sustainable exercise routines, and improve adherence to rehabilitation regimens [30]. Clinically, healthcare providers should promote self-efficacy by setting achievable short-term goals, offering structured guidance to reframe challenges as opportunities for mastery, and providing timely positive feedback to reinforce patients' confidence in their rehabilitation progress.

Depression was also found to be a significant predictor of adherence to physical exercise rehabilitation. This finding aligns with previous research demonstrating that post-stroke depression significantly impairs exercise adherence [31]. In this study, only 2.9% of participants exhibited mild depressive symptoms, a prevalence notably lower than that reported in prior studies [32]. Within the RAM, depression reflects a maladaptive response within the self-concept mode [12], representing difficulties in psychological adjustment following stroke. Depressive symptoms can compromise post-stroke rehabilitation adherence by impairing physiological regulation, role adaptation, and stimulus processing capacity. Among adult stroke patients, psychosocial stressors may reduce both energy and motivation for rehabilitation participation [33]. Moreover, fatigue associated with depression often further limits participation in therapy, hindering neurofunctional recovery [14]. These findings emphasize the importance of standardized early depression screening and timely psychological interventions—such as counseling or behavioral therapy—to optimize rehabilitation adherence and improve long-term functional outcomes.

Coping with role transition also emerged as a significant predictor of adherence to physical exercise rehabilitation. Notably, while the bivariate analysis did not identify a significant correlation between coping with role transition and adherence, its significance became apparent in the multiple regression model after controlling for sex and post-stroke duration. This suggests that the relationship between coping with role transition and adherence may be mediated or moderated by other psychosocial factors. Within RAM, coping reflects a patient's ability to adjust to changes in role function following stroke. For individuals experiencing their first stroke, the abrupt shift in identity can lead to challenges in role adaptation and maladaptive coping responses, which in turn affect health behaviors such as treatment adherence [34]. Maladaptive coping often diminishes motivation for rehabilitation, resulting in poor adherence to prescribed exercise regimens. Working-age stroke survivors, in particular, frequently face significant psychosocial adjustments as they transition from "breadwinner" to "care recipient" or from "professional" to "patient." Successful adaptation to these role changes can reduce frustration and depressive symptoms while increasing engagement in rehabilitation. The first three months after stroke represent a critical window for both neurological recovery and psychological adaptation; poor adjustment during this period may establish negative behavioral patterns that compromise long-term adherence. Prior evidence in chronic illness populations also supports the positive relationship between effective coping and treatment adherence [15]. These findings reinforce the importance of enhancing role transition coping to improve rehabilitation engagement. Nurses can play a pivotal role in implementing role-restructuring interventions that help patients identify pre-morbid social roles, recognize roles that remain sustainable, and modify those requiring functional adaptation.

Contrary to the initial hypothesis, although correlation analysis revealed a weak negative association between body image and adherence to physical exercise rehabilitation, this relationship was not significant in the hierarchical multiple regression model after adjustment. Similarly, Schwieger et al. [35] reported that body image did not significantly influence brace-wearing adherence among females with adolescent idiopathic scoliosis. One possible explanation is that body image primarily reflects satisfaction with physical appearance and does not directly translate to health behavior. Furthermore, patients with similar levels of body image satisfaction may adopt markedly different coping mechanisms. For example, individuals with low body image but high self-efficacy may channel dissatisfaction into motivation to exercise, thereby enhancing adherence [16]. In contrast, patients who experience both low body image and poor self-identity are more likely to disengage from rehabilitation activities [33]. Such individual variability limits the predictive utility of body image as a uniform indicator of rehabilitation adherence. Therefore, healthcare providers should emphasize personalized strategies that integrate self-efficacy enhancement and adaptive coping support to optimize rehabilitation outcomes.

The findings from this study provide meaningful contributions to both clinical nursing practice and nursing research, offering theoretical innovation by addressing key gaps in the existing literature. First, with respect to the study population, this research specifically targeted adult stroke patients aged 18 to 60 years, a demographic that has been underrepresented in prior studies. Second, in terms of the temporal dimension, this study uniquely focused on the first three months following the initial onset of ischemic stroke—a critical window for neurorehabilitation and behavioral adaptation. By systematically investigating adherence to physical exercise rehabilitation during this period and identifying key predictive factors among adult stroke survivors, this study provides empirical evidence to guide early, individualized intervention strategies. The findings also advocate the implementation of evidence-based approaches to enhance adherence, with the broader goal of helping patients attain optimal physical, cognitive, emotional, and social recovery. Moreover, these results can assist healthcare professionals in delivering personalized, patient-centered guidance that facilitates a smoother transition from hospital-based rehabilitation to community or home-based continuing care. However, several limitations should be acknowledged. First, as a single-center study, the generalizability of findings to broader populations may be limited. Second, the reliance on self-reported measures of adherence introduces potential recall and social desirability biases. Future studies could strengthen methodological rigor by incorporating objective assessment tools, such as direct observation or digital monitoring systems. Finally, the cross-sectional design limits the ability to infer causal relationships or track behavioral changes over time. Future longitudinal or mixed-method designs are recommended to capture the dynamic nature of post-stroke adaptation and explore the motivational mechanisms that underlie adherence behaviors.

Despite significant advances in medical technology that have improved survival rates among stroke patients, maintaining adherence to physical exercise rehabilitation remains a persistent challenge. Within this context, nurses play a pivotal role in fostering and sustaining engagement in rehabilitation activities. To address this challenge effectively, a multifaceted and patient-centered approach is essential. During the early post-stroke phase, strengthening family support through structured education for both patients and caregivers can foster a collaborative and empowering environment. Enhancing patients' confidence by employing motivational interviewing, structured goal-setting, and positive reinforcement can further improve adherence. Routine screening for depressive symptoms and the timely provision of psychological support are critical for reducing emotional barriers that impede participation. Additionally, assisting patients in adapting to new roles through counseling and coping strategy training can promote emotional adjustment and resilience. Addressing body image concerns through validated assessment tools and reframing focus from appearance toward functional improvement may further support engagement. Collectively, these targeted, nurse-led interventions can significantly improve rehabilitation adherence, thereby enhancing long-term recovery and quality of life among stroke survivors.

CONCLUSION

This study identified the factors associated with adherence to physical exercise rehabilitation among adults experiencing a first-onset ischemic stroke. Stronger family support and higher self-efficacy emerged as the most powerful and consistent predictors of adherence, while lower levels of depression also contributed substantially. Positive perceptions of coping with role transition demonstrated additional, though smaller, predictive value. The observed association between male sex and higher adherence underscores the importance of developing sex-tailored interventions rather than implying inherent behavioral differences. These findings provide actionable insights for clinical practice. Healthcare professionals should emphasize family education, motivational goal-setting, regular depression screening, and role adaptation counseling to strengthen adherence during the early post-stroke period. Future research should expand sample sizes and incorporate multicenter designs to enhance representativeness, while longitudinal methods are recommended to track adherence trajectories over time. The inclusion of objective adherence measures, such as digital monitoring or direct observation, would also improve the accuracy of outcome evaluation. Through these methodological and clinical advancements, future work can more effectively address post-stroke adaptation challenges, promote consistent rehabilitation adherence, and ultimately improve the overall quality of life of stroke survivors.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and/or design acquisition - YW, PH, and PP; acquisition of data - YW; analysis - YW, PH, and PP; interpretation of the data - YW, PH, and PP; and drafting or critical revision of the manuscript for important intellectual content - YW, PH, and PP.

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DATA AVAILABILITY STATEMENT

The data can be obtained from the corresponding authors.

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Influences of Online Health Information Seeking Behavior and E-health Literacy on Self-Management in Hemodialysis Patients: A Cross-Sectional Study

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Purpose: This study aimed to examine the influences of online health information-seeking behavior and e-health literacy on self-management among patients undergoing hemodialysis. **Methods:** A correlational survey was conducted with 150 adult hemodialysis patients who had been receiving dialysis for at least three months. Data were collected from July to November 2023 using structured questionnaires. The variables measured included online health information-seeking behavior, e-health literacy, and self-management. Data were analyzed using descriptive statistics, the independent t-test, one-way analysis of variance, Pearson correlation coefficients, and hierarchical multiple regression with IBM SPSS/WIN 28.0. **Results:** Participants demonstrated moderate to high levels of online health information-seeking behavior, e-health literacy, and self-management. Self-management was positively correlated with online health information-seeking behavior ($r = .34$, $p < .001$) and e-health literacy ($r = .45$, $p < .001$). Hierarchical multiple regression analysis identified e-health literacy ($\beta = .30$, $p < .001$), regular exercise during the past year ($\beta = .27$, $p < .001$), and alcohol consumption during the past year ($\beta = -.22$, $p = .002$) as significant predictors of self-management, explaining 32% of the variance. **Conclusion:** E-health literacy, regular exercise, and alcohol consumption significantly affect self-management among hemodialysis patients. Therefore, nursing interventions should focus on enhancing e-health literacy and promoting healthy lifestyle habits to strengthen self-management capabilities in this population.

Key Words: Health literacy; Information seeking behavior; Internet use; Renal dialysis; Self-management

INTRODUCTION

According to the 2022 report of the Korean Renal Data System, the number of patients diagnosed with chronic kidney disease (CKD) exceeded 127,000 in 2021 and continues to rise [1]. Among those receiving renal replacement therapy (RRT), hemodialysis remains the dominant modality, accounting for 83.6% in 2019 (n = 15,587), 82.2% in 2020 (n = 15,201), and 83.6% in 2021 (n = 16,115) [1]. This trend underscores the clinical importance of hemodialysis as a major treatment option for patients with CKD.

Despite advances in medical technology and improvements in dialysis techniques, patients undergoing hemodialysis continue to depend on dialysis machines throughout their lives and experience various physical and psychological challenges [2]. Because hemodialysis cannot fully replace kidney function, patients must engage in extensive self-management activities such as adhering to dietary restrictions, controlling fluid intake, taking medications as prescribed, and preventing infections [3]. Self-management among hemodialysis patients refers to proactive behaviors aimed at optimizing health outcomes, preventing complications, and minimizing disease burden through symptom control and appropriate use of healthcare resources [4]. Specifically, it includes adherence to dietary and fluid restrictions, appropriate medication use, vascular access and infection management, regular exercise, and effective utilization of healthcare services [4]. Effective self-management is essential for delaying the progression of complications and reducing healthcare costs [4].

With advances in information and communication technology, patients now have easier access to a wide range of health information through the internet [5]. At the same time, public interest in healthcare applications based on artificial intelligence and the internet of things has expanded rapidly [6]. These developments have increased patient engagement in online health information-seeking behavior, creating a new model of health management that differs from traditional provider-centered approaches [7]. Online health information seeking allows patients to access large amounts of information in real time without spatial or temporal limitations, which can be particularly valuable for individuals with restricted mobility or limited healthcare access, such as those undergoing hemodialysis [8]. Hemodialysis patients, who visit hospitals multiple times per week and face financial and time constraints due to prolonged treatment [9], may especially benefit from leveraging online health resources.

However, the reliability of online health information is inconsistent, and uncritical acceptance of inaccurate information can lead to adverse health outcomes [10]. Therefore, the ability to effectively locate, evaluate, understand, and apply health information—known as e-health literacy—has emerged as a critical competency in modern healthcare [11]. High e-health literacy improves health awareness and encourages the adoption of positive health behaviors [12]. In contrast, low e-health literacy can hinder effective information use, making it difficult for patients to engage in appropriate health behaviors and potentially worsening health disparities [13]. Given the complex and long-term nature of hemodialysis treatment, patients must play an active role in their own care. Thus, online health information-seeking behavior and e-health literacy are expected to exert significant influences on self-management.

Previous studies have shown that higher e-health literacy is associated with healthier lifestyle behaviors and better quality of life [12,13]. In Korea, the eHealth Literacy Scale has been validated for patient use [14]. For hemodialysis patients, effective self-management—including dietary control, fluid restriction, and medication adherence—is vital for preventing complications and improving outcomes [15,16]. Although valid instruments for measuring self-management have been developed [17,18], few studies have explored how online health information-seeking behavior and e-health literacy affect self-management in this population. This study seeks to fill that gap by examining these relationships and providing evidence for the development of targeted nursing interventions and educational programs.

Accordingly, the present study aims to examine the effects of online health information-seeking behavior and e-health literacy on self-management among patients undergoing hemodialysis. The findings are expected to provide foundational data for developing tailored nursing interventions and educational programs that enhance access to and utilization of health information, ultimately improving quality of life and promoting health equity among this patient population.

METHODS

1. Study Design

This study employed a cross-sectional observational design to examine the influences of online health information-seeking behavior and e-health literacy on self-management among patients undergoing hemodialysis. The study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2. Setting and Samples

Participants were recruited through convenience sampling among adult patients receiving hemodialysis. Inclusion criteria were as follows: (1) age ≥19 years; (2) undergoing hemodialysis for ≥3 months due to CKD; (3) receiving hemodialysis at least twice per week; and (4) ability to communicate verbally or in writing and to provide informed consent. Exclusion criteria included receiving other forms of RRT, such as peritoneal dialysis. The three-month threshold was used to exclude patients in the initial adaptation phase, which may involve heightened physical or psychological sensitivity that could confound study variables [19].

The sample size was calculated using G*Power 3.1.9.7 for multiple regression analysis with a significance level of .05, power of .80, a medium effect size of 0.15 [13], and 13 predictors (7 general characteristics, four health-related characteristics, and two independent variables). The required sample size was 131. To account for an anticipated 15% attrition rate, 154 participants were recruited. A total of 150 participants completed the survey and were included in the final analysis, comprising 35 recruited offline and 115 recruited online.

3. Instruments

The survey consisted of 52 items, including general characteristics (7 items), health-related characteristics (4 items), online health information-seeking behavior (13 items), e-health literacy (8 items), and self-management (20 items). Permission to use each instrument was obtained via email from the original authors.

1) General and health-related characteristics

General characteristics included sex, age, education level, marital status, occupation, perceived socioeconomic status, and daily internet use time (7 items). Health-related characteristics included alcohol consumption during the past year, smoking status, regular exercise during the past year, and self-rated health status (4 items).

2) Online health information seeking behavior

This construct was measured using the instrument originally developed by Laflamme [20] and later revised by Park and Lee [21]. It consists of 13 items across three subdomains: production activities (7 items), use of health information communities (3 items), and search for health information (3 items). Each item is rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), with higher scores indicating greater engagement in online health information-seeking behavior. The reliability of the instrument was confirmed by Cronbach's α values of .89 in Park and Lee [21] and .91 in this study.

3) E-health literacy

E-health literacy was assessed using the Korean version of the eHealth Literacy Scale (KeHEALS), adapted by Chang et al. [14] from the original instrument developed by Norman and Skinner [11]. This self-report scale includes eight items measuring the ability to locate, evaluate, and apply health information obtained from the internet. Each item is rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), with higher scores indicating higher e-health literacy. The instrument demonstrated strong internal consistency, with Cronbach's α values of .89 in both the original study [14] and in this study.

4) Self-management

Self-management was assessed using the Hemodialysis Self-Management Instrument–Korea (HDSMI-K), developed by Cha and Kang [17] based on the original HDSMI by Song and Lin [18]. The instrument consists of 20 items across four subdomains: problem-solving and communication (7 items), hydration and weight control (3 items), diet and dialysis (5 items), and self-defense and emotional control (5 items). Each item is rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree), with higher scores indicating better self-management. The instrument demonstrated good reliability, with Cronbach's α values of .87 in the original study [17] and .91 in this study.

4. Data Collection/Procedure

Data were collected from June 1 to November 30, 2023, after obtaining Institutional Review Board (IRB) approval. Both offline and online recruitment methods were used, but all surveys were ultimately completed online using Google Forms (Google LLC, Mountain View, CA, USA). For offline recruitment, study announcements were posted on bulletin boards within dialysis units following hospital approval. Eligible patients who expressed interest completed the survey during dialysis sessions or before/after treatment using tablet devices provided by the researcher. Research assistants were available to assist participants as needed. For online recruitment, notices were posted in a large kidney disease-related internet community with over 170,000 members and a medical open chat community on a social media platform with approximately 570 members. After obtaining permission from community administrators, recruitment notices were shared. Interested individuals contacted the researcher directly to receive the survey link. These communities used verification processes to ensure that members were actual hemodialysis patients, enhancing participant credibility. All participants—whether recruited offline or online—completed the same Google Forms survey. The first page of the survey provided detailed information about the study, including confidentiality, voluntary participation, and withdrawal rights. Informed consent was obtained electronically by selecting "I agree" before proceeding. No paper-based consent forms were used, and responses were restricted to one per participant.

5. Ethical Considerations

The study protocol and instruments were reviewed and approved by the IRB of Gangneung-Wonju National University (IRB No.: GWNUIRB-2022-14, GWNUIRB-2022-14-5). Permission to use the instruments was obtained from their original developers. Participants provided informed consent after reading a detailed explanation of the study's purpose, procedures, and ethical safeguards. They were informed that participation was voluntary and could be withdrawn at any time without penalty. All data were anonymized and used solely for research purposes. After data analysis, all digital records were stored securely on the researcher's password-protected computer and will be retained for three years in accordance with institutional guidelines, after which they will be permanently deleted. Participants who consented to provide contact information received a convenience store gift voucher, after which their contact data were permanently deleted.

6. Data Analysis

Data were analyzed using IBM SPSS ver. 28.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, mean, and standard deviation [SD]) were used to summarize participants' general and health-related characteristics, as well as levels of online health information-seeking behavior, e-health literacy, and self-management. Data normality was examined using skewness, kurtosis, and normality test statistics. Skewness ranged from –0.48 to 0.72, and kurtosis ranged from –0.91 to 0.65, indicating that the data were approximately normally distributed. The Kolmogorov–Smirnov and Shapiro–Wilk tests were nonsignificant (K–S $p=.200$; S–W $p=.083$), confirming that the normality assumption was met. Accordingly, parametric tests were used. Group differences were examined using the independent t-test and one-way analysis of variance, followed by the Scheffe post hoc test. Pearson correlation coefficients were used to assess relationships among the main variables. Hierarchical multiple regression analysis was conducted to identify factors influencing self-management. In the first step, general demographic and health-related characteristics were entered to control for their effects. In the second step, online health information-seeking behavior and e-health literacy were added to determine their additional explanatory power for self-management. This approach enabled assessment of the independent contributions of the main variables beyond general characteristics.

RESULTS

1. General and Health-Related Characteristics of Participants

Table 1 presents the general and health-related characteristics of the participants. Among the 150 participants, 62.7% were male (n = 94) and 37.3% were female (n = 56), with a mean age of 49.5 years (SD = 11.43; range = 25–80 years). The largest age group was 40–49 years (27.3%, n = 41). Regarding education level, 80.7% (n = 121) held a university degree or higher. Most participants were married (74.7%, n = 112). In terms of occupation, office workers comprised the largest group (51.4%, n = 77). Regarding perceived socioeconomic status, 71.3% (n = 107) reported a middle or higher level. For daily internet use, 44.0% (n = 66) used the internet for 2 to <4 hours, followed by 23.3% (n = 35) for 4 to <6 hours, 20.0% (n = 30) for <2 hours, and 12.7% (n = 19) for ≥6 hours. Among health-related characteristics, 44.7% (n = 67) reported alcohol consumption during the past year. For smoking status, 42.7% (n = 64) were non-smokers, 38.0% (n = 57) were former smokers, and 19.3% (n = 29) were current smokers. The proportion reporting regular exercise in the past year was similar between those exercising 1–2 times per week (41.3%, n = 62) and those exercising three or more times per week (43.4%, n = 65). Regarding self-perceived health status, 44.7% (n = 67) rated their health as poor, 44.0% (n = 66) as fair, and 11.3% (n = 17) as good.

2. Levels of Online Health Information Seeking Behavior, E-health Literacy, and Self-Management

The mean score for online health information-seeking behavior was 3.43 (SD = 0.79) on a 5-point scale. Subdomain

Table 1. General and Health-Related Characteristics of the Participants (*N* = 150)

Characteristics	Categories	n (%)	M ± SD
General			
Sex	Male	94 (62.7)	
	Female	56 (37.3)	
Age (year)	19 to < 40	38 (25.3)	49.5 ± 11.43
	40 to < 50	41 (27.3)	
	50 to < 60	34 (22.7)	
	≥ 60	37 (24.7)	
Education level	≤ High school graduate	29 (19.3)	
	≥ University degree	121 (80.7)	
Marital status	Yes	112 (74.7)	
	No	38 (25.3)	
Occupation	Office workers	77 (51.4)	
	Service workers	29 (19.3)	
	Professionals and technicians	15 (10.0)	
	Unemployed	29 (19.3)	
Perceived socioeconomic status	Lower class	43 (28.7)	
	≥ Middle class	107 (71.3)	
Internet use time (hour/day)	< 2	30 (20.0)	3.3 ± 2.13
	2 to < 4	66 (44.0)	
	4 to < 6	35 (23.3)	
	≥ 6	19 (12.7)	
Health-related			
Alcohol consumption during the past year	Yes	67 (44.7)	
	No	83 (55.3)	
Smoking status	Non-smokers	64 (42.7)	
	Former smokers	57 (38.0)	
	Current smokers	29 (19.3)	
Regular exercise in the past year (frequency)	None	23 (15.3)	
	1–2/week	62 (41.3)	
	≥ 3/week	65 (43.4)	
Self-recognized health status	Poor	67 (44.7)	
	Fair	66 (44.0)	
	Good	17 (11.3)	

M = mean; SD = standard deviation.

scores were as follows: production activities, 3.28 (SD = 0.90); use of health information communities, 3.48 (SD = 0.97); and search for health information, 3.71 (SD = 0.81).

The mean e-health literacy score was 3.67 (SD = 0.63) on a 5-point scale. The highest-rated item was “I know how to use the internet to answer my questions about health” (3.88, SD = 0.82), while the lowest-rated item was “I have the skills I need to evaluate the health resources I find on the internet” (3.49, SD = 0.90).

The mean self-management score was 3.24 (SD = 0.42) on a 4-point scale. Subdomain scores were: hydration and weight control, 3.33 (SD = 0.60); diet and dialysis, 3.29 (SD = 0.44); problem-solving and communication, 3.23 (SD = 0.46); and self-defense and emotional control, 3.14 (SD = 0.45) (Table 2).

3. Differences in Variables by Participant Characteristics

Significant differences in online health information-seeking behavior were observed by education level (t = –3.13, $p = .002$), occupation (F = 5.86, $p < .001$), and daily internet use time (F = 7.75, $p < .001$). Post hoc analyses revealed higher scores among professionals and technicians compared with unemployed or service workers, and among those who used the internet for ≥ 4 hours per day compared with those using it for < 2 hours. Significant differ-

Table 2. Descriptive Statistics for Online Health Information Seeking Behavior, E-health Literacy, and Self-Management (*N*=150)

Variables	Categories	Items	M±SD
Online health information seeking behavior (1–5)	Total	13	3.43±0.79
	Production activities	7	3.28±0.90
	Use of health information communities	3	3.48±0.97
	Search for health information	3	3.71±0.81
E-health literacy (1–5)	Total	8	3.67±0.63
	1. I know what health resources are available on the internet		3.68±0.81
	2. I know where to find helpful health resources on the internet		3.69±0.86
	3. I know how to find helpful health resources on the internet		3.74±0.82
	4. I know how to use the internet to answer my questions about health		3.88±0.82
	5. I know how to use the health information I find on the internet to help me		3.69±0.81
	6. I have the skills I need to evaluate the health resources I find on the internet		3.49±0.90
	7. I can tell high quality health resources from low quality health resources on the internet		3.55±0.93
	8. I feel confident in using information from the internet to make health decisions		3.62±0.83
Self-management (1–4)	Total	20	3.24±0.42
	Problem-solving and communication	7	3.23±0.46
	Hydration and weight control	3	3.33±0.60
	Diet and dialysis	5	3.29±0.44
	Self-defense and emotional control	5	3.14±0.45

M=mean; SD=standard deviation.

ences by health-related characteristics were also found for regular exercise in the past year (F=3.72, p=.026), with higher scores among participants exercising three or more times per week. No significant differences were observed for sex, age, marital status, perceived socioeconomic status, alcohol consumption, smoking status, or self-perceived health status.

E-health literacy differed significantly by education level (t=–3.43, p=.002), occupation (F=5.31, p=.002), perceived socioeconomic status (t=–2.83, p=.005), and daily internet use time (F=11.60, p<.001). Post hoc results were similar to those for online health information seeking. Regular exercise in the past year also showed significant differences (F=10.73, p<.001), with higher e-health literacy among participants who exercised at least once per week. No significant differences were found for sex, age, marital status, alcohol consumption, smoking status, or self-perceived health status.

Self-management scores differed significantly by sex (t=–2.22, p=.028) and perceived socioeconomic status (t=–2.08, p=.041). Significant differences were also found for alcohol consumption during the past year (t=2.56, p=.011) and regular exercise during the past year (F=14.49, p<.001), with higher self-management scores among those exercising weekly or more. However, no significant differences were observed for age, marital status, occupation, daily internet use time, smoking status, or self-perceived health status (Table 3).

4. Correlations among Key Variables

Self-management was positively correlated with both online health information-seeking behavior (r=.34, p<.001) and e-health literacy (r=.45, p<.001). Online health information-seeking behavior was also positively correlated with e-health literacy (r=.58, p<.001) (Table 4).

5. Factors Influencing Self-Management

Hierarchical multiple regression analysis was conducted to identify predictors of self-management. Model 1 included sex, perceived socioeconomic status, alcohol consumption during the past year, and regular exercise during the past year as control variables. Based on post hoc results,

Table 3. Differences in Online Health Information-Seeking Behavior, E-health Literacy, and Self-Management According to Participants' General and Health-Related Characteristics ($N=150$)

Characteristics	Categories	Online health information seeking behavior		E-health literacy		Self-management	
		M ± SD	t or F (*p*) Scheffé	M ± SD	t or F (*p*) Scheffé	M ± SD	t or F (*p*) Scheffé
General							
Sex	Male	3.38 ± 0.83	−0.84 (.403)	3.66 ± 0.69	−0.18 (.859)	3.18 ± 0.43	−2.22 (.028)
	Female	3.50 ± 0.72		3.68 ± 0.53		3.33 ± 0.37	
Age (years)	19 to < 40^{a}	3.68 ± 0.70	2.14 (.097)	3.87 ± 0.53	1.83 (.144)	3.28 ± 0.39	0.90 (.441)
	40 to < 50^{b}	3.43 ± 0.66		3.57 ± 0.59		3.26 ± 0.44	
	50 to < 60^{c}	3.34 ± 0.79		3.59 ± 0.52		3.14 ± 0.37	
	≥ 60^{d}	3.24 ± 0.96		3.64 ± 0.82		3.26 ± 0.45	
Education level	≤ High school graduate	3.02 ± 0.89	−3.13 (.002)	3.24 ± 0.78	−3.43 (.002)	3.09 ± 0.51	−1.86 (.071)
	≥ University degree	3.52 ± 0.74		3.77 ± 0.55		3.27 ± 0.38	
Marital status	Yes	3.45 ± 0.82	−0.68 (.498)	3.70 ± 0.67	−1.03 (.305)	3.27 ± 0.39	−1.86 (.065)
	No	3.35 ± 0.72		3.58 ± 0.50		3.13 ± 0.48	
Occupation	Office workers^{a}	3.49 ± 0.71	5.86 (< .001) b, d < c	3.78 ± 0.56	5.31 (.002) b, d < c	3.27 ± 0.38	2.42 (.069)
	Service workers^{b}	3.24 ± 0.87		3.49 ± 0.61		3.24 ± 0.36	
	Professionals and technicians^{c}	4.06 ± 0.48		4.00 ± 0.63		3.39 ± 0.29	
	Unemployed^{d}	3.12 ± 0.86		3.38 ± 0.70		3.07 ± 0.57	
Perceived socioeconomic status	Lower class	3.30 ± 0.89	−1.19 (.234)	3.44 ± 0.73	−2.83 (.005)	3.12 ± 0.48	−2.08 (.041)
	≥ Middle class	3.47 ± 0.75		3.76 ± 0.56		3.29 ± 0.38	
Internet use time (hours/day)	< 2^{a}	2.92 ± 0.82	7.75 (< .001) a < c, d	3.23 ± 0.72	11.60 (< .001) a, b < d a < c	3.15 ± 0.46	1.99 (.119)
	2 to < 4^{b}	3.42 ± 0.60		3.61 ± 0.51		3.19 ± 0.37	
	4 to < 6^{c}	3.63 ± 0.91		3.90 ± 0.60		3.33 ± 0.40	
	≥ 6^{d}	3.87 ± 0.72		4.11 ± 0.47		3.37 ± 0.49	
Health-related							
Alcohol consumption during the past year	Yes	3.71 ± 0.65	−0.67 (.503)	3.49 ± 0.76	−0.92 (.354)	3.14 ± 0.42	2.56 (.011)
	No	3.64 ± 0.62		3.37 ± 0.82		3.31 ± 0.40	
Smoking status	Non-smokers^{a}	3.44 ± 0.79	0.55 (.579)	3.65 ± 0.08	0.48 (.622)	3.33 ± 0.38	2.72 (.070)
	Former smokers^{b}	3.35 ± 0.85		3.63 ± 0.60		3.17 ± 0.43	
	Current smokers^{c}	3.54 ± 0.67		3.77 ± 0.69		3.17 ± 0.45	
Regular exercise in the past year (frequency)	None^{a}	3.06 ± 0.86	3.72 (.026) a < c	3.14 ± 0.72	10.73 (< .001) a < b, c	2.85 ± 0.49	14.49 (< .001) a < b, c
	1–2/week^{b}	3.40 ± 0.78		3.74 ± 0.57		3.27 ± 0.36	
	≥ 3/week^{c}	3.58 ± 0.74		3.78 ± 0.57		3.34 ± 0.36	
Self-recognized health status	Poor	3.28 ± 0.89	2.12 (.124)	3.55 ± 0.73	2.12 (.124)	3.20 ± 0.46	0.45 (.638)
	Fair	3.55 ± 0.67		3.44 ± 0.51		3.27 ± 0.35	
	Good	3.52 ± 0.75		3.70 ± 0.63		3.24 ± 0.47	

M = mean; SD = standard deviation.

the exercise variable was simplified into a binary category (exercise vs. no exercise).

Multicollinearity was assessed, with tolerance values ranging from .91 to .96 in Model 1 and .58 to .92 in Model 2. Variance inflation factor values were within acceptable limits (Model 1, 1.04–1.10; Model 2, 1.09–1.71). Durbin–Watson statistics were 1.98 and 1.96, respectively, indicating no autocorrelation. Cook's distance values were below .10 for both models, confirming the absence of influential outliers.

Model 1 was significant (F = 10.44, $p < .001$) and explained 20.0% of the variance in self-management. Significant predictors included regular exercise during the past year (β = .39, $p < .001$) and alcohol consumption during the past year (β = –.19, $p = .013$). In Model 2, online health information-seeking behavior and e-health literacy were added. The model explained 32.0% of the variance, representing a significant 12% increase in explanatory power (Δadjusted $R^2 = .12$, F = 12.73, $p < .001$) compared with Model 1. Significant predictors in Model 2 were e-health literacy (β = .30, $p < .001$), regular exercise during the past year (β = .27, $p < .001$), and alcohol consumption during the past year (β = –.22, $p = .002$) (Table 5).

Table 4. Correlations between Online Health Information-Seeking Behavior, E-health Literacy, and Self-Management ($N = 150$)

Variables	OHISB	eHL	SM
		r (p)	
OHISB	1		
eHL	.58 (< .001)	1	
SM	.34 (< .001)	.45 (< .001)	1

eHL = E-health literacy; OHISB = online health information seeking behavior; SM = self-management.

DISCUSSION

This study examined the levels of online health information-seeking behavior, e-health literacy, and self-management among patients undergoing hemodialysis, and identified factors influencing self-management. Hierarchical regression analysis revealed that e-health literacy, regular exercise, and alcohol consumption were significant predictors, with e-health literacy emerging as the strongest explanatory variable. This finding suggests that the ability to understand, evaluate, and apply information—rather than the mere frequency of searching—plays a decisive role in determining self-management levels.

The mean self-management score in this study was 3.24, consistent with the findings of Kang et al. [15]. Among the subdomains, "hydration and weight control" had the highest score, while "self-defense and emotional control" had the lowest. High scores in hydration and weight management may be attributed to patients' awareness of their direct relationship with blood pressure control and the pre-

Table 5. Factors Influencing the Self-Management ($N = 150$)

Variables	Model 1					Model 2					Collinearity statistics	
	B	SE	β	t	p	B	SE	β	t	p	Tolerance	VIF
(Constant)	2.86	.09		30.90	< .001	2.01	.17		12.21	< .001		
Female sex†	0.09	.07	.10	1.31	.194	0.09	.06	.10	1.43	.156	.91	1.10
Perceived socioeconomic status (≥ Middle class)‡	0.06	.07	.06	0.80	.426	–0.00	.07	–.00	–0.04	.970	.87	1.15
Alcohol consumption (during the past year) (yes)§	–0.16	.06	–.19	–2.52	.013	–0.19	.06	–.22	–3.16	.002	.92	1.09
Regular exercise in the past year (yes)‖	0.45	.09	.39	5.22	< .001	0.31	.08	.27	3.74	< .001	.86	1.16
Online health information-seeking behavior						0.06	.04	.12	1.44	.153	.66	1.52
E-health literacy						0.20	.06	.30	3.39	< .001	.58	1.71
R^2 (ΔR^2)				.22					.35 (.13)			
Adjusted R^2 (ΔAdjusted R^2)				.20					.32 (.12)			
F (p)				10.44 (< .001)					12.73 (< .001)			
Durbin–Watson				1.98					1.96			

B = regression coefficient; SE = standard error; VIF = variance inflation factor; Dummy variables: †Male sex; ‡Perceived socioeconomic status (lower class); §Alcohol consumption (no); ‖Exercise in the past year (none).

vention of cardiovascular complications [3]. Conversely, the low score in self-defense and emotional regulation indicates that patients may experience difficulty asserting their rights or coping with emotional challenges during treatment [22], underscoring the need for psychosocial support and interventions. In this study, general characteristics such as sex and perceived socioeconomic status were significantly associated with self-management. Specifically, higher perceived socioeconomic status was associated with higher self-management scores. This finding aligns with previous research [16], which reported that patients with higher socioeconomic status, greater health literacy, and better access to self-management resources exhibited higher levels of self-management. Therefore, targeted educational interventions are necessary to support socioeconomically disadvantaged groups who may lack such resources.

E-health literacy was identified as the most influential explanatory variable for self-management among hemodialysis patients, consistent with findings from a previous study of cardiovascular patients [23]. In that study, the mean e-health literacy score was 1.82, and higher literacy levels were significantly associated with healthier behaviors and better health-related quality of life. Similarly, a study of patients with hypertension [24] reported a mean score of 3.00, showing significant correlations with health beliefs. In the present study, the mean score was 3.67, which is relatively higher than in these prior populations. This difference may be partially explained by age. The mean age of participants in this study was 49.5 years (range 25–80), substantially younger than the average ages in the hypertension (64.7 years) [24] and cardiovascular (71.3 years) [23] studies. Younger patients are generally more familiar with digital devices and online information seeking, and many participants in this study had prior experience with online health communities, likely contributing to higher e-health literacy levels.

Beyond mean differences, this study revealed notable variations across subdomains. Specifically, the item “I know how to use the internet to answer my questions about health” received the highest rating, suggesting that participants were relatively skilled in accessing and searching for health information online. In contrast, the item “I have the skills I need to evaluate the health resources I find on the internet” received the lowest rating, indicating difficulty in assessing the credibility of online information. This suggests that although hemodialysis patients can easily locate health information, they may lack the critical judgment needed to translate it into reliable self-management strategies.

These results highlight differences between this study and previous research. For instance, Kim and Kim [25] reported that e-health literacy did not significantly influence health-promoting behaviors among cancer patients, possibly because the complexity of cancer treatment limits patient autonomy in decision-making. In contrast, hemodialysis patients must engage in daily self-management activities such as dietary regulation, fluid and weight control, and medication adherence [4]. Thus, the ability to critically evaluate and apply health information becomes a key determinant of effective self-management in this population. Taken together, the findings have important clinical and educational implications. Patient education and nursing interventions for hemodialysis patients should not only focus on the provision of health information but also emphasize strengthening vulnerable subdomains—particularly “information evaluation skills.” Moreover, because e-health literacy was associated with occupation and socioeconomic status, digital health education should be tailored for older adults and socioeconomically disadvantaged groups who may have lower digital competence [25]. In the context of rapid digital transformation in healthcare, such targeted approaches are essential to enhance patients’ autonomy and self-management capacity.

The second factor influencing self-management among patients undergoing hemodialysis was regular exercise, consistent with previous research. A systematic review [26] reported that aerobic or combined exercise programs performed three times per week for 8 weeks to 12 months improved aerobic capacity, walking ability, and overall health-related quality of life. Similarly, another systematic review [27] found that regular, long-term exercise significantly enhanced physical function and quality of life in hemodialysis patients. Regular exercise increases self-efficacy and serves as a motivational factor, thereby promoting self-management [27]. However, while previous studies primarily evaluated the effects of structured exercise interventions under experimental conditions [26,27], the present study identified a relationship between patients’ actual exercise levels in daily life and their self-management performance using observational data. Some studies have reported that patients on hemodialysis experience fatigue and musculoskeletal pain, which limit their ability to engage in regular exercise [28]. Such barriers have been recognized as major obstacles to sustaining and maximizing the benefits of exercise. Nevertheless, because this study recruited many participants from online communities, the sample may have included individuals with greater interest in health management and stronger self-motivation, potentially contributing to higher reported levels of regular exercise compared with previous research. Therefore, the findings suggest that regular exercise among patients undergoing hemodialysis should not be understood solely in terms of intervention outcomes but also within the context of environmental and psychological strategies that facilitate exercise maintenance in daily life [26,27]. For example, nurses could enhance self-management by helping patients set individualized exercise goals during dialysis sessions or by connecting them to online communities for motivational and peer support.

The third factor influencing self-management was alcohol consumption. In this study, alcohol use remained an independent negative predictor even after controlling for e-health literacy, regular exercise, and other variables, underscoring its clinical significance. Alcohol use represents not only a lifestyle behavior but also a behavior that heightens physical and clinical risk. A recent case report [29] described a 70-year-old woman who experienced severe symptoms—including loss of consciousness, respiratory depression, and hypotension—after ingesting disinfectant alcohol. Notably, these complications occurred at relatively low blood alcohol levels (82 mg/dL) and resolved only after hemodialysis. This case illustrates how alcohol consumption can precipitate acute deterioration in renal function among dialysis patients [29]. Moreover, prior studies have shown that individuals with CKD experience elevated stress and depression, with some resorting to alcohol as a coping mechanism [9]. Other research [30] has also reported that patients with a history of drinking exhibit lower self-management scores, suggesting that alcohol use is a persistent and structural barrier to effective self-management. Consequently, patient education for individuals on hemodialysis should extend beyond simple advice to limit alcohol intake and instead emphasize that alcohol use can trigger severe, potentially life-threatening complications [29]. In clinical practice, a comprehensive approach integrating alcohol prevention education with alternative stress management strategies, such as regular exercise or social support programs, is warranted.

Meanwhile, although online health information-seeking behavior was positively correlated with self-management, it did not emerge as a significant predictor in the regression analysis. This suggests that online health information seeking may not directly influence self-management but could exert indirect effects through other variables such as e-health literacy. The mean score for online health information-seeking behavior in this study was 3.43, comparable to that reported by Son and Kang [31] (3.40) but notably higher than the score reported by Son and Lee [32] (1.68), despite the use of the same measurement instrument. These discrepancies may be attributable to differences in study populations. In Son and Kang [31], participants were middle-aged women, whereas this study included patients undergoing hemodialysis—a group with a greater need for health information due to the demands of chronic disease management. By contrast, in Son and Lee [32], most participants were middle-aged men in their 40s, who may have perceived a lower need for health information seeking. Additionally, the absence of significant age-related differences in online health information-seeking behavior suggests that older patients are also actively utilizing digital health resources. This reflects improved access to digital technologies among older adults and indicates that educational programs for hemodialysis patients should not assume limited digital accessibility based solely on age [33]. Nevertheless, when older adults engage with online health information, evaluating its reliability and applying it appropriately may remain particularly challenging [8]. In this regard, Lim [34] found that while e-health literacy was associated with online health information-seeking behavior among adults aged 20 years and older, it was not a significant predictor of self-management—a finding consistent with the present study. This underscores that the frequency of information searching does not directly translate into effective self-management. Rather, the qualitative aspects of information use, including critical evaluation and practical application, as well as educational interventions that facilitate behavioral translation, are crucial. Therefore, improving self-management among hemodialysis patients requires tailored digital health education programs that strengthen information appraisal and selection skills, with a specific focus on enhancing e-health literacy.

Ultimately, improving self-management in patients undergoing hemodialysis requires not merely an increase in the quantity of online health information available but rather a qualitative enhancement of education and intervention strategies based on strengthened e-health literacy. This study demonstrated that e-health literacy is the most influential factor for self-management among hemodialysis patients, while also identifying regular exercise promotion and alcohol use reduction as essential components of comprehensive self-management strategies.

This study has several limitations. First, because some participants were recruited through online communities, there is a potential overrepresentation of individuals with relatively high e-health literacy. Therefore, the generalizability of the findings may be limited due to the use of convenience sampling. Second, as data collection relied on self-reported questionnaires, response bias may have occurred. Third, the self-management instrument used in this study did not comprehensively capture lifestyle behaviors such as smoking, alcohol consumption, and regular exercise, which may limit the thorough assessment of associations between self-management and lifestyle factors. Nonetheless, methodological consistency was maintained by ensuring that both online and offline participants completed the same online survey platform.

Despite these limitations, this study provides several important implications. First, it empirically validated that e-health literacy is the primary determinant of self-management among hemodialysis patients, addressing a research gap that has been insufficiently explored in previous studies. Second, the findings offer practical guidance for nursing practice by underscoring that patient education and intervention programs should move beyond simple information delivery and instead focus on systematically strengthening patients' abilities to understand, critically evaluate, and effectively utilize health information. Such strategies can enhance patients' self-management capabilities and serve as foundational evidence for developing targeted nursing interventions and educational programs.

CONCLUSION

This study identified e-health literacy, regular exercise, and alcohol consumption as key determinants of self-management among patients undergoing hemodialysis, with e-health literacy emerging as the most influential factor. Although patients demonstrated proficiency in searching for health information online, their limited ability to critically evaluate information highlights the need for targeted educational strategies. Regular exercise functioned as a facilitator of self-management, whereas alcohol consumption acted as a persistent barrier, underscoring the importance of comprehensive lifestyle modification. Future research should utilize more representative samples and develop validated assessment tools that include lifestyle behaviors. Moreover, tailored interventions for patients with low e-health literacy are particularly warranted to strengthen self-management and enhance the effectiveness of nursing education and clinical practice.

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CONFLICTS OF INTEREST

Jaehee Jeon has been editorial board member of the *Korean Journal of Adult Nursing* since 2018. She was not involved in the review process of this manuscript. Otherwise, there was no conflict of interest.

AUTHORSHIP

Study conception and/or design acquisition - MYK and JJ; analysis - MYK and JJ; interpretation of the data - MYK and JJ; and drafting or critical revision of the manuscript for important intellectual content - MYK and JJ.

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DATA AVAILABILITY STATEMENT

The data can be obtained from the corresponding authors.

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Impact of Disability Acceptance on Life Satisfaction among Older Adults with Disabilities: A Longitudinal Comparative Study of the Pre-pandemic (2018–2019) and Pandemic Periods (2020–2022)

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Purpose: This study aimed to analyze the multiple mediating effects of self-esteem, depression, and crisis coping on the relationship between disability acceptance and life satisfaction among older adults with disabilities, comparing periods before and during the coronavirus disease 2019 pandemic. **Methods:** This study employed a longitudinal comparative design, using data from waves 1–5 of the Disability and Life Dynamics Panel. The sample was divided into pre-pandemic (2018–2019) and pandemic (2020–2022) periods. Roy's adaptation model served as the theoretical framework. Multiple mediation effects were examined using the PROCESS macro (Model 6). **Results:** Both the direct and indirect effects of disability acceptance on life satisfaction were significant, indicating partial mediation. In the pre-pandemic period, approximately 60% of the total effect was attributable to the direct effect and 40% to the indirect effect. During the pandemic, the proportion shifted, with the direct effect decreasing to 49% and the total indirect effect increasing to 51%. **Conclusion:** In crisis situations such as a pandemic, self-esteem, depression, and crisis coping play crucial roles in improving life satisfaction among older adults with disabilities. These findings highlight the need for policy approaches that consider diverse socio-psychological factors to increase life satisfaction among older adults during pandemics.

Key Words: Attitude of disability; Coping skills; Depression; Personal satisfaction; Self concept

INTRODUCTION

South Korea is undergoing rapid population aging, bringing profound social and demographic changes. According to recent statistics, the country had already entered a super-aged society by 2024, and by 2050, older adults are projected to comprise more than 40% of the total population [1]. The 2023 National Survey of Older Adults further revealed that functional limitations and disability-related challenges are becoming increasingly serious, with more than half of all registered persons with disabilities being older adults in that year [2]. This indicates that aging among persons with disabilities progresses relatively faster than in the general older population and is accompanied by higher risks of physical and functional decline as well as secondary health conditions.

From an academic standpoint, the concepts of “aging with disability” and “disability with aging” cannot be regarded as identical or fixed; thus, a comprehensive research approach that captures their heterogeneity is necessary [3]. Moreover, both domestic and international studies and policy frameworks generally follow the World Health Organization's definition of the aging population as individuals aged 60 years and older [4]. Previous research has also defined older adults with disabilities as individuals experiencing limitations in activities of daily living or restrictions in full participation in social roles [5].

Older adults with disabilities face numerous challenges, including social, financial, physical, and psychological difficulties [2,6]. Thus, their average life satisfaction tends to be lower than that of individuals without disabilities and the general older population [7]. Life satisfaction among older adults with disabilities encompasses their acceptance of their disability, maintenance of self-esteem and positive psychological states, and subjective evaluation of their lives based on their health status and available social and economic resources [8].

Previous studies have identified disability acceptance as a crucial determinant directly influencing life satisfaction in older adults with disabilities [9,10]. Negative disability acceptance, which is defined as the inability to accept physical, mental, and social limitations resulting from disability, can lower self-esteem and heighten depression, thereby diminishing life satisfaction [11]. Conversely, greater acceptance of one's disability, regardless of its type, is associated with higher life satisfaction and enhanced self-esteem, reflecting a stronger sense of self-worth and personal value [12]. Self-esteem and depression interact dynamically, jointly influencing life satisfaction [12,13].

In disaster and crisis situations, persons with disabilities are exposed to greater risks and stress due to the physical, informational, and environmental constraints associated with disability [14]. Previous research has demonstrated that individuals with disabilities are disproportionately affected by disasters compared to the general population [15,16]. Crisis coping has been recognized as a mediating mechanism through which positive psychological resources contribute to life satisfaction [17]. However, studies examining the impact of crisis coping on life satisfaction among older adults with disabilities remain scarce.

Disability acceptance [12,18], self-esteem [12,19], and depression [18] have been reported as major factors that significantly influence life satisfaction among older adults with disabilities.

Older adults with disabilities are particularly vulnerable during health crises because they are often excluded from policy support. Inequality tends to worsen under such circumstances, leading to increased depression, social stigma, and discrimination, all of which further lower life satisfaction and self-esteem [20,21]. The recent health crisis triggered by the coronavirus disease 2019 (COVID-19) pandemic resulted in widespread social isolation, mental health challenges, and economic instability, adversely affecting both the right to life and overall quality of life [20]. Consequently, it has become a major cause of reduced life satisfaction [22]. Historically, infectious disease crises such as the 2009 swine flu pandemic and the 2012 Middle East respiratory syndrome coronavirus outbreak have also had consistent negative impacts on general life satisfaction [19,23].

Life satisfaction is influenced by multiple interrelated factors, and these effects may vary depending on whether a health crisis is present. However, most previous studies on life satisfaction among older adults with disabilities have primarily focused on direct effects among variables such as social support, depression, self-esteem, quality of life, living environment, and economic status [9], or on simple mediation effects. Yet, cross-sectional designs and simple mediation analyses are insufficient to capture the complex, multidimensional interactions among these factors or to explain how mediating effects differ under conditions of a health crisis [24].

Therefore, longitudinal comparative studies are needed to identify and assess the various factors influencing life satisfaction among older adults with disabilities and to analyze the multidimensional interactions among these factors as they respond to evolving health crisis situations.

Roy's adaptation model [25] views human beings as living, open systems that interact with their environment and continuously adapt to changing stimuli. According to this theory, individuals employ a range of coping mechanisms to effectively adapt to environmental challenges.

Previous studies applying Roy's adaptation model to infectious disease crises have conceptualized pandemics as external stimuli. Within this framework, individuals strive to achieve adaptive outcomes through coping mechanisms, which enhance their overall adaptability and capacity to respond to environmental stressors. These studies underscore the importance of adaptive processes in understanding the psychosocial and health-related responses of older adults with disabilities during a pandemic [26,27].

Through the lens of Roy's adaptation model, shifting health crisis situations can be interpreted as environmental stimuli. Specifically, older adults with disabilities who previously existed in relatively stable coping environments before the pandemic may have relied on the adaptive mechanism of “disability acceptance” when confronted with the new environmental stressor of the pandemic. In this process, self-esteem, depression, and crisis coping may function as adaptive behaviors that ultimately lead to life satisfaction as an adaptive response. Furthermore, as Roy’s adaptation model aims to identify and regulate factors influencing adaptation to enhance life satisfaction, it provides an appropriate theoretical framework for exploring strategies to improve life satisfaction among older adults with disabilities (Figure 1).

Accordingly, this study seeks to analyze the direct and indirect—or multiple mediating—effects of self-esteem, depression, and crisis coping in the relationship between disability acceptance and life satisfaction among older adults with disabilities, comparing the pre-pandemic and pandemic periods within the framework of Roy’s adaptation model. The findings are expected to provide foundational data for developing policies that help older adults with disabilities effectively cope with future infectious disease crises.

The Disability and Life Dynamics Panel has continuously collected data on life satisfaction and related social and psychological factors among registered persons with disabilities from before the COVID-19 pandemic to the present. Therefore, conducting a retrospective secondary analysis using these data is expected to enhance both the efficiency and validity of the study.

METHODS

1. Research Design

A longitudinal comparative study was conducted using data from the Disability and Life Dynamics Panel collected between 2018 and 2022. The study compared and analyzed differences in the factors influencing life satisfaction among older adults with disabilities before and during the COVID-19 pandemic. The study is reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

2. Research Data and Participants

1) Research data

Raw data from the Disability and Life Dynamics Panel were obtained from the Korea Disabled People’s Development Institute (KODDI) in accordance with its official data disclosure procedures. The panel was designed to establish foundational data for developing and supporting policies related to people with disabilities. Specifically, this study utilized data from the first survey (2018) through the fifth survey (2022).

2) Research participants

Participants were individuals with registered disabilities aged 60 years or older, based on an age classification re-

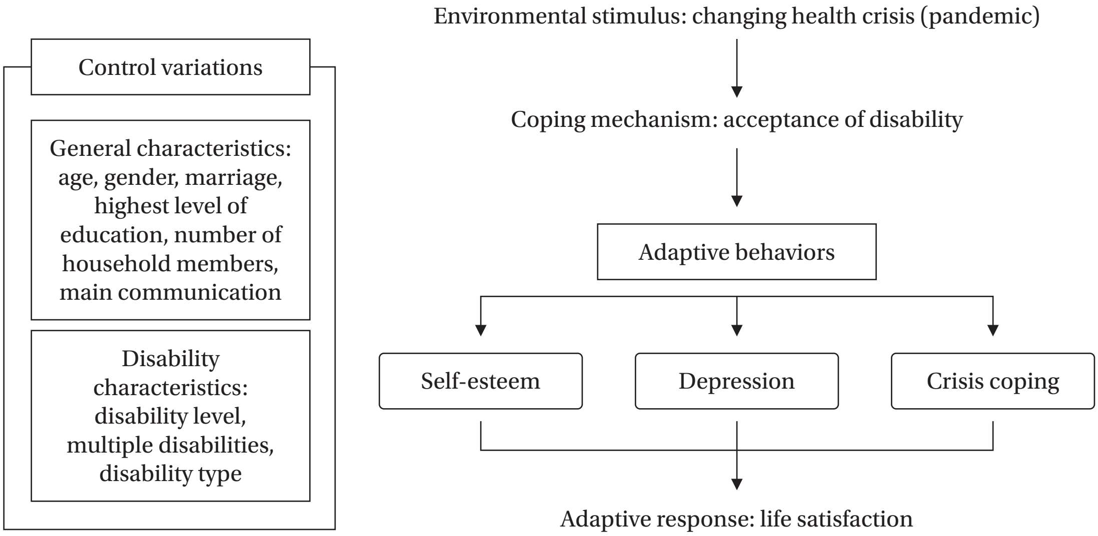

Figure 1. Conceptual framework: Roy’s adaptation model.

flecting the early aging characteristics commonly observed among people with disabilities. For analytical purposes, the data were divided into two temporal groups: the pre-pandemic period (2018–2019) and the pandemic period (2020–2022). The pre-pandemic dataset included 4,115 cases, and the pandemic dataset included 6,661 cases.

3. Measurements

The participants' general characteristics included age, gender, marital status, highest level of education, number of household members, and primary mode of communication. The disability-related characteristics included the severity of disability, the presence of multiple disabilities, and type of disability. These variables were incorporated as control variables in the analysis.

To identify key influencing factors, variables were selected from the Disability and Life Dynamics Panel based on a literature review confirming their associations with life satisfaction. These included disability acceptance [12,18,28,29], self-esteem [12,18,28], and depression [12,19]. Additionally, crisis coping was included as a variable that emerged as significant in this study. All variables were scored according to the User Guide of the 2024 Disability and Life Dynamics Panel [29].

1) Life satisfaction

Life satisfaction was measured using eight subdomains developed by the Korea Welfare Panel Study team: health, income, housing environment, school life, occupation, marital life, social relationships, and overall life satisfaction [29]. Each item was rated on a 10-point scale ranging from "had a very negative impact" (1) to "had a very positive impact" (10), with higher scores indicating a more positive perception of life. The reliability coefficient (Cronbach's α) in this study was .96.

2) Disability acceptance

Disability acceptance was defined as recognizing and respecting one's disability while maintaining a positive view of life. Kaiser's (1987) Disability Acceptance Scale (DAS) [30] was modified by adding three items addressing resilience and overcoming disability, resulting in a 12-item instrument used in this study. Each item was rated on a 4-point scale from "not at all" (1) to "very much" (4), with higher scores indicating greater acceptance of disability. The Cronbach's α coefficient was .81.

3) Self-esteem

Self-esteem, defined by Rosenberg (1965) as a positive or negative attitude toward oneself, was measured using the Korean translation of Rosenberg's Self-Esteem Scale [31]. The instrument consists of 10 items, each rated on a 4-point scale ranging from "not at all true" (1) to "always true" (4). Higher scores indicate higher self-esteem. The Cronbach's α coefficient was .76.

4) Depression

Depression was defined as the subjective level of depressive feelings experienced in daily life over the previous week. In this study, it was measured using the 11-item short form of the Center for Epidemiologic Studies Depression Scale (CES-D-11) developed by the National Institute of Mental Health [32]. Each item was rated on a 4-point scale ranging from "very rarely" (1) to "most of the time" (4), with higher scores indicating greater depressive symptoms. The Cronbach's α coefficient in this study was .90.

5) Crisis coping

Crisis coping was measured using a tool developed by KODDI researchers to assess individuals' awareness of appropriate response measures in crisis situations [29]. The instrument consists of six items covering knowledge and abilities related to reporting emergencies, alerting others, locating emergency tools, using fire extinguishers, moving to evacuation shelters, and recognizing crisis situations. Each item was rated on a 4-point scale ranging from "extremely unable" (1) to "fully capable" (4), with higher scores indicating higher crisis response ability. The Cronbach's α coefficient in this study was .94.

4. Data Collection Methods and Content

The Disability and Life Dynamics Panel utilized the Ministry of Health and Welfare's national database of registered persons with disabilities as its sampling frame, ensuring a 95% confidence interval (CI) for national representativeness. Data collection was conducted through one-on-one, in-person interviews performed by trained professional interviewers with individuals with disabilities living in the community (not residing in facilities) and their household members. Sensitive information was collected through self-report questionnaires to maintain anonymity. The survey content covered five major areas—general status, disability acceptance and changes, health and medical care, independence, and social participation—comprising more than 280 items [29].

The panel employed a double sampling method, in which towns and rural districts were first selected to ensure proportional representation in the final sample. Data collection occurred annually in the second half of each year, tracking the same participants longitudinally. Although data were anonymized annually, the sample retention rate exceeded 85%, supporting the panel's validity for longitudinal analysis [29].

5. Ethical Considerations

This study is a retrospective secondary analysis using existing panel data, making it impractical to obtain individual informed consent. Accordingly, the dataset was requested and obtained through KODDI's official anonymous data request procedure. All data were anonymized prior to analysis, and stringent measures were taken to protect participants' privacy and personal information. This study was reviewed and approved by the Institutional Review Board of the Sahmyook Medical Center with which the primary researcher is affiliated study (date of approval: 2025/03/31; No. 116286-202503-HR-02).

6. Data Analysis

All analyses were conducted using IBM SPSS/WIN Statistics ver. 24.0 (IBM Corp., Armonk, NY, USA). The general and disability-related characteristics of participants were analyzed using frequency analysis, and group homogeneity was verified using the chi-square test. Differences between the pre-pandemic and pandemic periods in disability acceptance, self-esteem, depression, crisis coping, and life satisfaction were assessed using the independent samples t-test. Correlations among variables were examined using Pearson's correlation analysis. Hierarchical regression analysis was employed to sequentially introduce independent and mediating variables while controlling for confounding effects. Finally, path analysis was performed using Hayes's (2022) PROCESS Macro for SPSS (ver. 4.2, model 6) to test multiple mediation effects of self-esteem, depression, and crisis coping on the relationship between disability acceptance and life satisfaction.

RESULTS

1. Participants' General and Disability-Related Characteristics

In the analysis of participants' general and disability-related characteristics, significant differences between the pre-pandemic and pandemic periods were found in age ($p=.028$), highest level of education ($p<.001$), main mode of communication ($p<.001$), and disability level ($p=.021$). However, gender, marital status, number of household members, multiple disabilities, and disability type did not show statistically significant differences between the two periods ($p>.05$) (Table 1).

2. Descriptive Statistics and Correlations of Variables

The differences in variables by period are presented in Table 2. Disability acceptance was lower during the pandemic than before it ($t=0.67$, $p<.001$). Self-esteem was higher during the pandemic than pre-pandemic ($t=-13.32$, $p<.001$). Depression was lower during the pandemic than before the pandemic ($t=20.13$, $p<.001$). Crisis coping was higher during the pandemic than pre-pandemic ($t=-7.08$, $p<.001$). Life satisfaction was also higher during the pandemic period compared with pre-pandemic ($t=-15.34$, $p<.001$).

In addition, the perceived impact of disability on life decreased during the pandemic compared to the pre-pandemic period; however, this difference was not statistically significant ($p=.27$). Evaluations of family relationships ($p<.001$), family health ($p<.001$), emotional support and assistance ($p<.001$), perceptions of social networking services (SNS) ($p=.015$), the extent of daily living assistance required due to disability ($p<.001$), and economic hardship ($p<.001$) all increased during the pandemic compared with pre-pandemic. Nonetheless, these variables showed low correlations with the independent variable of this study—acceptance of disability—in the correlation analysis ($r\leq|0.30|$). The variables showing moderate or stronger correlations are summarized in Table 2.

Life satisfaction was significantly correlated with all variables during both the pre-pandemic and pandemic periods ($p<.001$). It was moderately positively correlated with disability acceptance ($r=.36$, $p<.001$; $r=.40$, $p<.001$) and self-esteem ($r=.31$, $p<.001$; $r=.38$, $p<.001$), with stronger correlations during the pandemic than pre-pandemic. De-

Table 1. General and Disability Characteristics

Variables	Categories	Pre-pandemic (n=4,115)	Pandemic period (n=6,661)	Total (n=10,776)	χ^2 (p)
		n (%)			
Age	60–69	3,241 (78.8)	5,363 (80.5)	8,604 (79.8)	4.86 (.028)
	≥70	874 (21.2)	1,298 (19.5)	2,172 (20.2)	
Gender	Men	2,211 (53.7)	3,608 (54.2)	5,819 (54.0)	0.19 (.659)
	Women	1,904 (46.3)	3,053 (45.8)	4,957 (46.0)	
Marriage	No	139 (3.4)	252 (3.8)	391 (3.6)	1.52 (.469)
	Yes	2,671 (64.9)	4,271 (64.1)	6,942 (64.4)	
	Others	1,305 (31.7)	2,138 (32.1)	3,443 (32.0)	
Highest level of education	Primary	1,138 (27.7)	1,684 (25.3)	2,822 (26.2)	28.20 (<.001)
	Middle	979 (23.8)	1,570 (23.6)	2,549 (23.7)	
	High	1,239 (30.1)	2,237 (33.6)	3,476 (32.3)	
	College	79 (1.9)	158 (2.4)	237 (2.2)	
	University	293 (7.1)	492 (7.4)	785 (7.3)	
	Master’s	37 (0.9)	60 (0.9)	97 (0.9)	
	Doctorate	9 (0.2)	20 (0.3)	29 (0.3)	
	No education	341 (8.3)	440 (6.6)	781 (7.2)	
Number of household members	1	1,007 (24.5)	1,595 (23.9)	2,602 (24.1)	0.66 (.884)
	2	2,020 (49.1)	3,276 (49.2)	5,296 (49.1)	
	3	677 (16.5)	1,128 (16.9)	1,805 (16.8)	
	≥4	411 (10.0)	662 (9.9)	1,073 (10.0)	
Main communication	Sign language	63 (1.5)	61 (0.9)	124 (1.2)	93.51 (<.001)
	Writing	87 (2.1)	35 (0.5)	122 (1.1)	
	Gesture	114 (2.8)	124 (1.9)	238 (2.2)	
	Incomplete speech	642 (15.7)	970 (14.7)	1,612 (15.1)	
	Complete speech	3,145 (77.0)	5,378 (81.6)	8,523 (79.8)	
	Augmentative and alternative	36 (0.9)	25 (0.4)	61 (0.6)	
Disability level	Severe	1,845 (44.8)	2,835 (42.6)	4,680 (43.4)	5.36 (.021)
	Mild	2,270 (55.2)	3,826 (57.4)	6,096 (56.6)	
Multiple disabilities	Yes	235 (5.7)	430 (6.5)	665 (6.2)	2.44 (.119)
	No	3,880 (94.3)	6,231 (93.5)	10,111 (93.8)	
Disability type	Physical and sensory	298 (20.9)	4,840 (72.7)	7,828 (72.6)	13.82 (.387)
	Internal organ	906 (63.6)	1,445 (21.7)	2,351 (21.8)	
	Develop/mental	221 (15.5)	376 (5.6)	597 (5.5)	

pression showed a moderate negative correlation with life satisfaction ($r=-.41$, $p<.001$; $r=-.51$, $p<.001$), and the magnitude of this negative correlation was greater during the pandemic. In contrast, the correlation between life satisfaction and crisis coping ($r=.33$, $p<.001$; $r=.33$, $p<.001$) remained stable across the two periods.

3. Differences in the Factors Influencing Life Satisfaction Before and during the Pandemic

For the hierarchical regression analysis, general and disability-related characteristics were first controlled, followed by the inclusion of disability acceptance as the independent variable in the second step. In the third step, the mediating variables (self-esteem, depression, and crisis coping) were introduced.

Multicollinearity was tested prior to regression analysis. The tolerance values ranged from 0.43 to 0.99, exceeding 0.1, and the variance inflation factors ranged from 1.01 to 2.33, not exceeding 10, in both periods. Additionally, the Durbin–Watson statistic was close to 2, confirming no autocorrelation among residuals.

The influence of general and disability-related characteristics on life satisfaction in the pre-pandemic and pandemic periods was significant ($F=22.83$, $F=32.03$) in Model 1. After controlling for these characteristics, the influence of

Table 2. Descriptive, Correlations, and Regression Models for Factors Influencing Life Satisfaction

Variables	M ± SD	r (*p*)				
		Disability acceptance	Self-esteem	Depression	Crisis coping	Life satisfaction
Pre-pandemic (n = 4,115)						
Disability acceptance	2.34 ± 0.38	1				
Self-esteem	25.73 ± 3.48	.41 (< .001)	1			
Depression	21.97 ± 6.41	–.23 (< .001)	–.26 (< .001)	1		
Crisis coping	2.98 ± 0.90	.23 (< .001)	.23 (< .001)	–.32 (< .001)	1	
Life satisfaction	4.73 ± 1.65	.36 (< .001)	.31 (< .001)	–.41 (< .001)	.33 (< .001)	1
Pandemic period (n = 6,661)						
Disability acceptance	2.28 ± 0.43	1				
Self-esteem	26.70 ± 3.94	.55 (< .001)				
Depression	19.44 ± 6.28	–.33 (< .001)	–.37 (< .001)	1		
Crisis coping	3.10 ± 0.80	.31 (< .001)	.37 (< .001)	–.32 (< .001)	1	
Life satisfaction	5.23 ± 1.62	.40 (< .001)	.38 (< .001)	–.51 (< .001)	.33 (< .001)	1
Model	R^2	Adjusted R^2	B	F	*p*	Durbin–Watson
Pre-pandemic (n = 4,115)						
Model 1	.16	.15	5.01	22.83	< .001	1.89
Model 2	.23	.22	1.43	35.35	< .001	
Model 3	.32	.32	2.37	52.39	< .001	
Pandemic period (n = 6,661)						
Model 1	.14	.13	5.58	32.03	< .001	1.95
Model 2	.23	.22	2.84	56.44	< .001	
Model 3	.37	.37	4.06	104.22	< .001	

B = Unstandardized coefficient: the amount of change in the dependent variable for a one-unit change in the independent variable; M = mean; Model 1 = general factor, disability; Model 2 = : general factor, disability, disability acceptance (independent); Model 3 = general factor, disability, disability acceptance (independent), self-esteem, depression, crisis coping (parameters); SD = standard deviation.

disability acceptance on life satisfaction was also significant (F = 35.35, F = 56.44) in Model 2. When self-esteem, depression, and crisis coping were added (Model 3), the model remained significant (F = 52.39, F = 104.22) (all $p < .001$).

The explanatory power for life satisfaction in Model 1 was higher before the pandemic (adjusted $R^2 = 15.0\%$) than during it (adjusted $R^2 = 13.4\%$). In Model 2, explanatory power was equal for both periods (adjusted $R^2 = 22.2\%$). In Model 3, the explanatory power during the pandemic (adjusted $R^2 = 36.7\%$) exceeded that of the pre-pandemic period (adjusted $R^2 = 31.8\%$) (Table 2).

The independent variable (disability acceptance) and mediating variables (self-esteem, depression, and crisis coping) collectively explained 31.8% of the variance in life satisfaction pre-pandemic and 36.7% during the pandemic—an increase of 4.9 percentage points. These findings indicate that self-esteem, depression, and crisis coping are important variables in explaining life satisfaction.

4. Multiple Mediating Effects of Self-Esteem, Depression, and Crisis Coping

Because multiple regression analysis identifies only direct effects, it may yield inaccurate results when mediation effects are present. Examining the paths of mediating variables allows for the identification of direct, indirect, and total effects, thereby offering a more comprehensive understanding of causal mechanisms. Based on the premise that disability acceptance influences life satisfaction through self-esteem, depression, and crisis coping, mediating paths were analyzed before and during the pandemic using Hayes's (2022) PROCESS Procedure for SPSS version 4.2 (model 6).

A multiple mediation model was constructed to evaluate the effect of disability acceptance on life satisfaction. To rigorously assess indirect effects, bootstrapping was applied with a 95% CI. The results are presented in Table 3.

In both the pre-pandemic and pandemic periods, dis-

Table 3. Verification of Significance of Mediation Effect

Path	Effect (B)	BootSE	95% CI	*p*
Pre-pandemic (n = 4,115)				
Total effect	1.55	0.06	1.43–1.68	< .001
Direct effect	0.93	0.06	0.81–1.06	< .001
Total indirect effect	0.62	0.04	0.55–0.70	
DA > SE > LS	0.18	0.03	0.12–0.23	
DA > D > LS	0.18	0.02	0.14–0.23	
DA > CC > LS	0.07	0.01	0.05–0.10	
DA > SE > D > LS	0.10	0.01	0.08–0.12	
DA > SE > CC > LS	0.05	0.01	0.04–0.06	
DA > D > CC > LS	0.03	0.00	0.02–0.04	
DA > SE > D > CC > LS	0.02	0.00	0.01–0.02	
Pandemic period (n = 6,661)				
Total effect	1.50	0.04	1.42–1.58	< .001
Direct effect	0.73	0.05	0.64–0.82	< .001
Total indirect effect	0.77	0.03	0.71–0.83	
DA > SE > LS	0.18	0.03	0.13–0.24	
DA > D > LS	0.25	0.02	0.21–0.29	
DA > CC > LS	0.05	0.01	0.04–0.07	
DA > SE > D > LS	0.23	0.01	0.18–0.23	
DA > SE > CC > LS	0.06	0.01	0.04–0.07	
DA > D > CC > LS	0.02	0.00	0.01–0.02	
DA > SE > D > CC > LS	0.01	0.00	0.01–0.02	

BootSE = bootstrapped standard error; CC = crisis coping; CI = confidence interval; D = depression; DA = disability acceptance; LS = life satisfaction; SE = self-esteem.

ability acceptance had a significant direct effect on life satisfaction ($p < .001$). Its indirect effects through the mediating variables (self-esteem, depression, and crisis coping) were also significant ($p < .001$). Thus, disability acceptance exerted a partial mediating effect on life satisfaction via self-esteem, depression, and crisis coping.

During the pre-pandemic period, the total effect (t = 24.60, $p < .001$), direct effect (t = 14.62, $p < .001$), and total indirect effect (B = 0.62, 95% CI = 0.55–0.70) were all positive and significant. The path-specific indirect effects (95% CI = 0.01–0.23) were likewise significant, as the CIs did not include zero.

During the pandemic period, the total effect (t = 35.84, $p < .001$), direct effect (t = 16.10, $p < .001$), and total indirect effect (B = 0.77, 95% CI = 0.71–0.83) were also positive and significant. The path-specific indirect effects (95% CI = 0.01–0.02) remained significant, as the CIs excluded zero.

Before the pandemic, approximately 60% of the total effect of disability acceptance on life satisfaction was direct (B = 0.93), and 40% was indirect through mediating pathways (B = 0.62). During the pandemic, this ratio shifted, with the direct effect (B = 0.73) decreasing to 49% and the total indirect effect (B = 0.77) increasing to 51%. Therefore, during the pandemic, disability acceptance exerted a stronger indirect influence on life satisfaction through complex psychological mediating processes than it did before the pandemic (Figure 2).

DISCUSSION

This study aimed to analyze differences in the multiple mediating variables influencing life satisfaction among older adults with disabilities before and during the pandemic, using data from the Disability and Life Dynamics Panel. According to Roy's adaptation model, individuals employ various coping mechanisms to effectively adapt to environmental stimuli. In this study, we examined the extent to which disability acceptance—conceptualized as a coping mechanism—affected life satisfaction (response) among older adults with disabilities before and during the pandemic, which functioned as a health crisis and environmental stressor. The mediating roles of self-esteem, depression, and crisis coping were considered as adaptive

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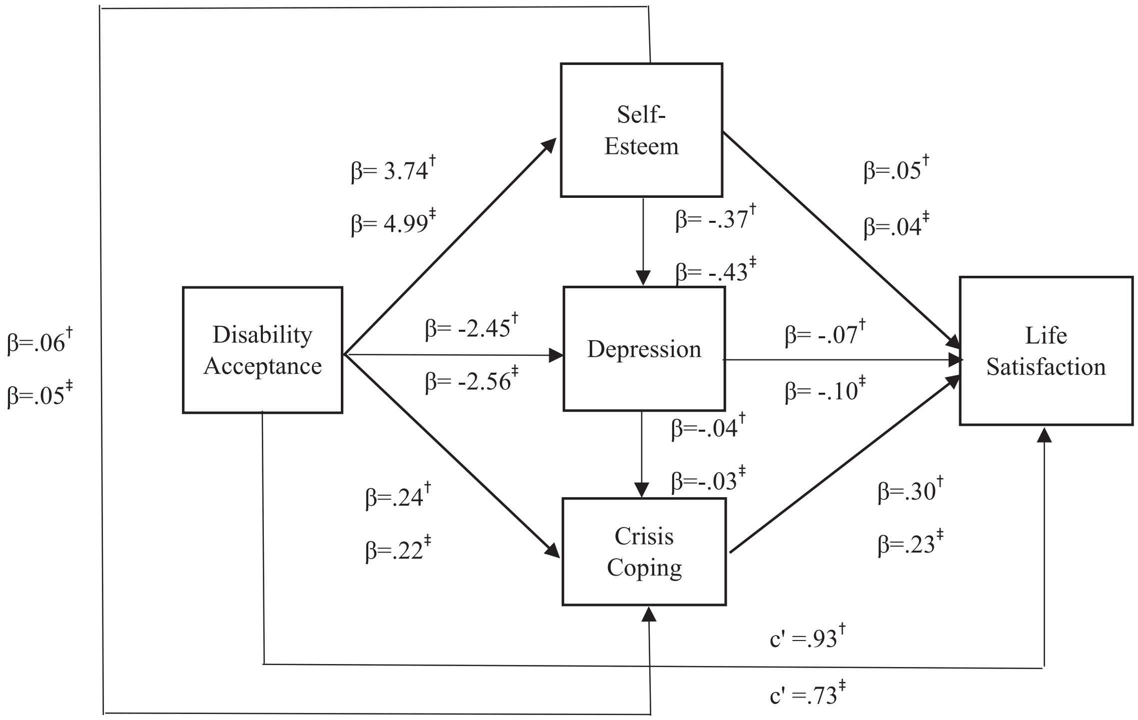

Figure 2. Paths of the mediating effects of major variables on life satisfaction. β = indirect effect; c' = direct effect; †Pre-pandemic; ‡Pandemic period.

modes within this framework.

Older adults with disabilities encountered the pandemic as an environmental stimulus and, through positive disability acceptance, enhanced their life satisfaction by fostering higher self-esteem, reducing depression, and improving crisis coping. These findings provide foundational data for developing policies to help older adults with disabilities effectively adapt to environmental stressors such as future pandemics. Based on the major findings, the following section discusses the factors influencing life satisfaction during the pandemic and the mediating variables identified, while comparing them with previous research where applicable.

First, the dependent variable—life satisfaction among older adults with disabilities—was higher during the pandemic than in the pre-pandemic period. This finding contrasts with previous studies [33] reporting that pandemic-related challenges, including social isolation, economic hardship, limited access to medical services, and increased psychological stress, tend to reduce life satisfaction. Guan et al. [34], however, found that despite social restrictions, strengthened bonds with family, community, and neighbors contributed to improved life satisfaction among older adults, supporting the current results. Therefore, in the context of a pandemic, it is essential to consider the varying patterns of life satisfaction changes based on the characteristics of the target population when developing policy approaches. A few strategies include providing individualized care services, encouraging social interaction, and enhancing crisis coping abilities.

Second, self-esteem among older adults with disabilities was higher during the pandemic than pre-pandemic, and the mediating effect of self-esteem was statistically significant. These results differ from studies suggesting that self-esteem decreased due to heightened discrimination and inadequate support systems during the pandemic, such as insufficient policy measures, poor information accessibility, and limited physical access to testing sites [21]. In a study of individuals with mental disorders, the direct effect of disability acceptance on life satisfaction was insignificant, but a complete mediating effect through self-esteem was identified [12]. Similarly, research on individuals with hearing impairments found that incorporating self-esteem into explanatory models significantly increased its predictive power for life satisfaction [28]. Collectively, these findings support the conclusion that self-esteem plays an essential mediating role in the relationship between disability acceptance and life satisfaction. Therefore, the need for proactive policy interventions to enhance self-esteem among older adults with disabilities is highlighted in health crises such as the COVID-19 pandemic.

Third, depression among older adults with disabilities decreased during the pandemic compared with pre-pandemic, and this reduction had a significant mediating effect on increased life satisfaction. This result contrasts with prior studies suggesting that the pandemic negatively impacted mental health and increased depression [34]. Notably, while the prevalence of depression in South Korea rose during the pandemic, especially among adults under 50 years [35], the present findings indicate a different pattern among older adults with disabilities. This aligns with studies reporting lower depression levels among individuals with disabilities compared with those without [20]. Therefore, it is reasonable to conclude that tailored depression reduction policies reflecting the characteristics of older adults with disabilities would be effective during health crises such as the COVID-19 pandemic.

Fourth, crisis coping ability was significantly higher during the pandemic than before, and it also exhibited a mediating effect on life satisfaction. However, the strength of the relationship between crisis coping and life satisfaction weakened somewhat during the pandemic compared with the pre-pandemic period. Research on crisis coping among both people with and without disabilities remains limited. One study found that older adults with considerable limitations in instrumental activities of daily living faced difficulties in coping with crises. Nonetheless, optimism, a sense of mastery, and social support from family and friends were identified as key resources that enhanced coping capacity and improved life satisfaction during the pandemic [17]. Overall, these findings correspond with the present results, which suggest that crisis coping functions as a mediating factor influencing life satisfaction. Therefore, there is a need to develop programs aimed at improving crisis coping to enhance life satisfaction in older adults with disabilities. The crisis coping tools used in this study did not include items specific to health-related crises such as infectious diseases. Therefore, developing new instruments that can assess coping mechanisms in health-related crisis contexts—including pandemics—is necessary.

Finally, the multiple mediation model indicated that the direct effect of disability acceptance on life satisfaction decreased during the pandemic, while the indirect effects through mediating variables such as self-esteem and depression became more pronounced. This supports previous findings by Shin et al. [9], who argued that higher disability acceptance alone may not guarantee greater life satisfaction without concurrent social and environmental mediating factors. Accordingly, this study, grounded in Roy's adaptation model, verified the adaptive process of older adults with disabilities confronting a pandemic as an environmental stressor through the identification of multiple mediating effects. Interventions designed to improve life satisfaction among older adults with disabilities in future infectious disease crises should therefore focus not only on enhancing disability acceptance but also on strengthening psychological support, including promoting self-esteem and alleviating depression. The findings underscore the adaptive nature of psychological processes and the complex interactions among disability acceptance, psychological resources, and life satisfaction under crisis conditions.

Based on the study results, several recommendations are proposed. First, while this study focused on psychological variables—namely disability acceptance, self-esteem, depression, and crisis coping—previous research has highlighted that social support, family relationships, economic status, health condition, social participation, and access to community resources are also important determinants of life satisfaction. Although sociodemographic and disability-related characteristics were included as control variables in the regression analysis, this approach may not have fully captured the complex interrelationships among these factors. Future studies should consider using structural equation modeling to more comprehensively examine the relationships between disability acceptance and life satisfaction in older adults with disabilities.

Second, quantitative research alone is insufficient to fully explain the real-life changes, challenges, and psychological adaptation processes of older adults with disabilities during pandemics. Future research should adopt a mixed-methods approach that integrates quantitative data with qualitative insights, such as in-depth interviews and focus groups, to enhance interpretive depth and inform evidence-based policy recommendations.

Third, while this study compared pre-pandemic and pandemic periods, the pandemic itself consisted of multiple response stages, including social distancing measures, mandatory mask-wearing, and vaccination campaigns. These social interventions likely influenced variations in life satisfaction. Accordingly, further research should examine the factors influencing life satisfaction at each stage

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and explore how changes in resilience contribute to its improvement.

However, this study has certain limitations. As data were collected during a single infectious disease crisis, the generalizability of findings to other crisis contexts may be limited. Additionally, the retrospective secondary analysis design introduces potential constraints related to data collection procedures. Moreover, due to the scarcity of previous comparative studies on life satisfaction among older adults with disabilities during health crises, it remains challenging to fully interpret the observed differences.

CONCLUSION

This longitudinal study compared the effects of disability acceptance on life satisfaction among older adults with disabilities before and during an infectious disease pandemic. It identified variations in self-esteem, depression, and crisis coping; clarified the mediating roles of these variables; and provided evidence to inform practical interventions aimed at improving life satisfaction in preparation for future public health crises. The main findings can be summarized as follows:

First, disability acceptance and depression significantly decreased during the pandemic compared with pre-pandemic levels, whereas self-esteem, crisis coping, and life satisfaction significantly increased. Second, in the pathway linking disability acceptance and life satisfaction, self-esteem, depression, and crisis coping demonstrated partial mediating effects, which were stronger during the pandemic than before. This finding highlights the heightened importance of socio-psychological factors in influencing life satisfaction during times of crisis.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and/or design acquisition - HK and SRS; analysis - HK; interpretation of the data - HK; and drafting or critical revision of the manuscript for important intellectual content - HK and SRS.

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DATA AVAILABILITY STATEMENT

The data used in this study can be obtained from the Disability Statistics Data Portal (https://koddi.or.kr/stat/html/user/main/main).

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Instructions for Authors

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Table of Contents

I. AIMS AND SCOPE

The *Korean Journal of Adult Nursing* (KJAN) is the official peer-reviewed research journal of the Korean Society of Adult Nursing (KSAN). KJAN is devoted to the dissemination of groundbreaking research on theory, practice, and education in the field of adult nursing. Research on other subject areas or issues that contribute to adult nursing is published at the discretion of the Editorial Board. The goal of KJAN is to contribute to health maintenance, health promotion, and disease prevention and management in adults by publishing research. KJAN is published four times per year at the end of February, May, August, and November.

II. RESEARCH & PUBLICATION ETHICS

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If manuscripts have been submitted or are currently under consideration for publication in KJAN, the Editorial Board will determine the nature and degree of duplicate publication or duplicate submission for the manuscript. If a manuscript has been published in KJAN, the KSAN ethics committee will determine the nature and degree of duplication.

2. Authorship

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If a manuscript is based on a master's thesis or doctoral dissertation, the author must disclose that the manuscript is the product of his/her thesis or a dissertation for an academic degree. The first author must be the recipient of the academic degree from the work presented in the manuscript.

Any changes in authorship (addition, deletion or change in order of authorship) must be approved by the Editorial Board prior to the manuscript's acceptance for publication. To request such a change, the Editor must receive the following from the corresponding author: (a) the reason(s) for the change in the author list; and (b) written confirmation (e-mail, letter) from all authors that they agree with any addition, removal, or rearrangement.

3. Conflicts of Interest

The corresponding author will be responsible for informing the editor regarding potential conflicts of interest for all listed authors that might influence their interpretation of data. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. If there is no conflict of interest, this should also be explicitly stated as "The author(s) declared no conflict of interest."

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This journal encourages and enables authors to share data that supports the research publication, where appropriate, and to interlink the data with other published articles. Research data refers to the results of observations or experiments that validate the research findings. To facilitate reproducibility and data reuse, this journal encourages authors to share their software, codes, models, algorithms, protocols, methods, and other useful materials related to the project. Data generated through the participation of subjects and the public should be put to maximum use by the research community and, whenever possible, translated to deliver patient benefits. Data sharing benefits numerous research-related activities: reproducing analyses, testing secondary hypotheses, developing and evaluating novel statistical methods, teaching, aiding the design of future trials and meta-analyses, and helping to prevent error, fraud, and selective reporting. To promote more transparent and reproducible research, we ask authors to submit a Data Availability Statement in the manuscript to help readers understand how they can access the data, code, and other resources that support the research findings.

The following are examples of data-sharing statements:

- Example 1: The data can be obtained from the corresponding authors.
- Example 2: The data can be obtained from the Supplementary Material.
- Example 3: (In the case of healthcare big data) The data can be obtained from __ (the name of the)_repository source.
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6. Artificial Intelligence (AI)–Assisted Technologies

At submission, authors are required to disclose whether they used AI-assisted technologies (such as Large Language Models [LLMs], chatbots, or image creators) in their work. Authors should describe how they used AI-assisted technologies in both the cover letter and the appropriate section of the manuscript. For example, if AI was used for writing assistance, this should be described in the Acknowledgments section. If AI was used for data collection, analysis, or figure generation, the authors should describe this use in the Methods section. Chatbots (such as ChatGPT) should not be listed as authors because they cannot be held responsible for the accuracy, integrity, and originality of the work, and these responsibilities are required for authorship. Therefore, authors are responsible for any submitted material that included the use of AI-assisted technologies. Authors should carefully review and edit AI-generated results because AI can generate authoritative-sounding output that can be incorrect, incomplete, or biased. Authors must ensure there is appropriate attribution of all quoted material, including full citations, and should not list AI and AI-assisted technologies as an author or co-author, nor cite AI as an author.

7. Process for Managing Publication Malpractice

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If a published manuscript is suspected of an ethics violation, the KSAN ethics committee, which includes the Editor-in-Chief of KJAN, will be convened. The procedure will be conducted in the following order: a preliminary investigation, a second investigation, and decision, in accordance with the prescribed regulations. If a published manuscript is determined to involve an ethics violation, members found to have violated this regulation and the general ethical principles of research will be subject to the following consequences, and other relevant matters shall be determined by the KSAN ethics committee.

1) The published manuscript will be retracted, and a public statement will be made regarding the reason for retraction.
2) Submission privileges to KJAN will be suspended for three years.
3) The retraction of the manuscript will be announced on KJAN's official website and in the printed journal.

III. GUIDELINES FOR MANUSCRIPT PREPARATION

1. Types of Manuscripts

KJAN publishes original articles, review articles, invited articles, and editorials.

1) *Original Articles* include full papers reporting original research. These are reports of empirical findings from high-quality basic and clinical research studies within the scope and focus of KJAN.
2) *Review Articles* include critical presentations of topics relevant to nursing theory, practice, and education regarding adult nursing. Unsolicited reviews will be considered for publication if topical, of high quality, and subject to peer review. The body of a review article should be a comprehensive, scholarly evidence-based review of the literature, accompanied by a critical analysis and reasonable conclusions.
3) *Invited Articles* provide concise reviews of a subject of importance to nursing researchers written by an invited expert in nursing science.
4) *Editorials* are commissioned by editors, and may include comments on manuscripts included, recent research trends in the field of adult nursing, and opinions on relevant topics.

2. General Guidelines

1) **Language and style:** Manuscripts should be written in English. The paper size setting should be A4, and the file should be compatible with Microsoft Word. The formatting requirements are as follows: the texts should be double-spaced and in Times New Roman 12-point font size with margins of top 30 mm, bottom 25 mm, left 25 mm, and right 25 mm. Page numbers are placed at the bottom of each page.

2) **Manuscript length:** The manuscript has different limits depending on the type of article submitted. (1) An original article should be no more than 6,000 words; (2) A review article should not exceed 8,000 words; and (3) An editorial should be no longer than 2,500 words. This word count includes only the main body of the text (i.e., not abstract, references, tables, or figures).

3) **Abbreviations:** Do not use abbreviations in the title or abstract and limit their use in the text. Expand all abbreviations at first mention in the text. Avoid using abbreviations in the article title. For standard abbreviated words and units, refer to the NLM (National Library of Medicine) Style Guide for Authors, Editors, and Publishers, 2nd Edition (2007) (http://www.nlm.nih.gov/citingmedicine).

4) **Description of participants:** Authors should ensure correct use of the terms sex (when reporting biological factors) and gender (identity, psychosocial or cultural factors), and, unless inappropriate, report the sex or gender of study participants, the sex of animals or cells, and describe the methods used to determine sex or gender. If the study was done involving an exclusive population, for example in only one sex, authors should justify why, except in obvious cases (e.g., prostate cancer). Authors should define how they determined race or ethnicity and justify their relevance.

5) **Permissions:** Authors should obtain permission from the copyright owners to use measurements or instruments for their studies. Permission to reproduce previously published material must also be obtained in writing from the copyright holder (usually the publisher) and acknowledged in the manuscript.

6) **Describing machinery or technical equipment:** Generic names should be used. When proprietary brands are used in research, include the name of the brand and the manufacturer, city (state), and nation in parentheses after the first mention of the generic name in the Methods section. Brand names are identified by symbols such as TM and ®, and should only be used when necessary.

7) **References and citation style:** References and citations follow the National Library of Medicine (NLM) Style. The submitting authors are responsible for ensuring adherence to NLM guidelines.

3. Research Reporting Guidelines

Authors are encouraged to adhere to relevant reporting guidelines when describing their study. Reporting guidelines endorsed by the journal are listed below, from the EQUATOR network (https://www.equator-network.org/).

Observational cohort, case-control, and cross-sectional studies
Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)
Meta-analysis of Observational Studies in Epidemiology (MOOSE)
Qualitative studies
Consolidated Criteria for Reporting Qualitative Research (COREQ)
Standards for Reporting Qualitative Research (SRQR)
Quasi-experimental/ non-randomized trials
Transparent Reporting of Evaluations with Non-randomized Designs (TREND)
Randomized (and quasi randomized) controlled trials
Consolidated Standards of Reporting Trials (CONSORT)
Study of Diagnostic accuracy/assessment scale
Standards for the Reporting of Diagnostic Accuracy Studies (STARD)
Systematic Review and meta-analysis
Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA)
Meta-analysis of Observational Studies in Epidemiology (MOOSE)
Quality improvement studies
Standards for Quality Improvement Reporting Excellence (SQUIRE)

4. Manuscript Components

The composition of manuscripts shall be in the following order: title page, abstract and keywords, main text, references, tables and figures, and appendices. Each section begins on a new page. The main body of the manuscript (including the references, figures, tables, acknowledgements, and any funding information) should not include any identifying information, such as the authors' names or affiliations, to ensure a blind review.

1) Title page

The following should be included on the title page: (1) the title of the article; (2) the running title; (3) author information (ORCID number is required for all authors); (4) permission for measurements/instruments used in the study; (5) IRB approval institution and number; (6) disclosure; and (7) reporting guidelines checklist relevant to the research design used.

2) Abstract and Keywords

An abstract of up to 250 words for articles (including reviews) should be typed double-spaced on a separate page. It should cover the main factual points, including statements of the Purpose, Methods, Results, and Conclusion. The abstract should be accompanied by a list of three to five keywords for indexing purposes. Medical Subject Headings (MeSH) keywords (http://www.nlm.nih.gov/ mesh/meshhome.html) should be used, with careful selection of keywords that precisely reflect the focus of the study.

3) Main text

The text should be composed in the following order: Introduction, Methods, Results, Discussion, Conclusion, and References.

Introduction: Clearly state the need for this study and the main question or hypothesis of the study. Summarize the literature review or background in the area of the study.

Methods: Describe the study design, setting and samples, measurements/instruments, data collection/procedure, ethical considerations, and data analysis. If a study presents qualitative research, the instrument can be omitted. When discussing research methods, it is important to provide specific and detailed information to enable reproducibility. In the section on ethical considerations, the author should state that the study protocol was approved by the institutional review board (IRB No. ##-##-###). Please provide the initials of institutional names at the time of submission for peer review.

Results: Describe the main results in a concise paragraph. This section should be the most descriptive.

Discussion: The discussion should be based only on the reported results. It is strongly recommended that authors discuss how the study findings relate to advances in nursing practice, nursing knowledge development, and nursing implications.

Conclusion: State the conclusions and recommendations for further study. Do not summarize the study results.

4) References

In-text Citation: Citations of references in the text should follow Citing Medicine: The NLM Style Guide for Authors Editors, and Publishers 2nd edition (http://www.nlm.nih.gov/citingmedicine). References should be numbered serially in the order of appearance in the text, with numbers in brackets [ ] (e.g., social support [1], fatigue [2,3], depression [4-6]). If a reference is cited more than once, use the original reference number (e.g., social support [1,2], fatigue [2-5], depression [1,4-6]).

Reference list: References should be listed on a separate page at the end of the paper in the order of citation. The number of references should be 35 or less for an original article except for a manuscript on model construction, which is allowed to include up to 50 references. Citations of master's and doctoral dissertations should be minimized, with a maximum of three citations.

5) Tables and Figures

There should be no more than five tables and figures in total. Tables and figures should be self-contained and complement, but not duplicate, information contained in the text. Each table and figure should be placed on a separate page. All lines are to be single. Vertical lines are not acceptable. The title of a table should be placed on top. Within the title, the first letters of important words should be capitalized (e.g., Table 1. Clinical Characteristics of the Sample). The title of the figure should be placed below the figure with the first letter capitalized (e.g., Figure 1. Path diagram of the model.). Tables and Figures should be numbered consecutively in Arabic numerals. All abbreviations used in tables should be explained in footnotes. List abbreviations in alphabetical order; do not include the word “and” before the last abbreviation (e.g., BP = blood pressure; ED = emergency department). Footnote symbols including asterisks and other symbols should be placed after abbreviations in the table. Table footnotes should be indicated with superscript symbols in sequence: †, ‡, §, ‖, ¶, #, *, ††

If the point value of a number can exceed 1, write “0” before the decimal point (e.g., $t=0.26$, $F=0.98$, $R^2=.61$), otherwise do not write “0” before the decimal point (e.g., $p<.001$). The p value (as an indicator of statistical significance) should be written without a footnote and should be rounded to three decimal places (e.g., $p=.003$). If “*p*” is .000, then indicate that *p* is less than 0.001 (e.g., $p<.001$). Percentages (%) should be rounded off to one decimal place (e.g., 24.7%); test statistics, such as t, F, x^2, and r, should be rounded off to two decimal places (e.g., $t=0.26$, $F=0.98$, $R^2=.61$).

6) Appendices

Authors should submit an appendix containing the final developed instrument in instrument development studies and a list of reviewed articles in a systematic review or meta-analysis.

5. Reference Format

1) Journals

(1) For six or fewer authors, list all authors:

1. Han S, Min J, Kim DK, Kong ID, Kim N. The understanding and application of telomere length as an emerging biomarker in adult nursing research: a review. Korean J Adult Nurs. 2023;35(1):1-12. https://doi.org/10.7475/kjan.2023.35.1.1

(2) For more than six authors, list the first six followed by et al.

1. Lee S, Kim MK, Hong EY, Lee JJ, Kim HJ, Kim HS, et al. Structural equation modeling on spiritual nursing care of clinical nurses based on the theory of planned behavior. Korean J Adult Nurs. 2022;34(1):27-38. https://doi.org/10.7475/kjan.2022.34.1.27

(3) Forthcoming journal articles

1. van Corven CT, Bielderman A, Wijnen M, Leontjevas R, Lucassen PL, Graff MJ, et al. Defining empowerment for older people living with dementia from multiple perspectives: a qualitative study. Int J Nurs Stud. Forthcoming 2020 Nov 10. https://doi.org/10.1016/j.ijnurstu.2020.103823

2) Periodicals or magazines

1. Rutan C. Creating healthy habits in children. Parish Nurse Newsletter. 2012 May 15:5-6.

3) Newspaper articles

1. Cho CU. Stem cell windpipe gives Korean toddler new life. The Korea Herald. 2013 May 1; Sect. 01.

4) Books

(1) Reference to an entire book

1. Hughes JH. Military veteran psychological health and social care: contemporary issues. 1st ed. London: Taylor & Francis; 2017.
2. Kim SJ. Nursing theory. Seoul: Soomoonsa; 1985.

(2) Chapter in an edited book

1. Miller CW. Applied cardiovascular physiology. In: Wingfield WE, Raffe MR, editors. The veterinary ICU book. Jackson, WY: Teton NewMedia; 2002. p. 1-14.

(3) An edited book

1. Munslow A, Rosenstone RA, editors. Experiments in rethinking history. New York, NY: Routledge; 2004.

(4) Unknown authors or editors

1. Merriam-Webster’s collegiate dictionary. 10th ed. Springfield, MA: Merriam-Webster; 1995.

(5) Book with translator(s)

1. McEwen M, Wills EM. Theoretical basis for nursing. 4th ed. Koh CK, translator. Philadelphia, PA: Wolters Kluwer; 2019. p. 20-5.

(6) An encyclopedia or dictionary

1. Sadie S, editor. The New Grove dictionary of music and musicians. 6th ed. London: Macmillan; 1980.
2. Fitzpatrick JJ, Wallace M, editors. Encyclopedia of nursing research. 3rd ed. New York, NY: Springer Publishing Company; 2012.

5) Scientific and technical reports

1. Hong S, Sung M, Choi J, Kim J, Kim S. Family policies implications in the context of an increase in one-person households. Korean Women’s Devel-

opment Institute Report. Seoul: Korean Women's Development Institute; 2017 July. Report No.: 1105012716.

6) Unpublished dissertations and theses: Not recommended. Maximally three dissertations and theses in total are al- lowed if necessary.
  (1) Dissertations
    1. Zhao JJ. Design of a 3D virtual learning environment for acquisition of cultural competence in nursing education: experience of nursing and other health care students, instructors, and instructional designers [dissertation]. Vancouver: University of British Columbia; 2019. p. 100-5.
  (2) Theses
    1. Huh MS. Effect of Danjeon breathing on stress urinary incontinence and quality of life in middle aged wom- en [master's thesis]. Busan: Dongeui University; 2005.

7) Conference proceedings
  (1) Unpublished proceedings
    1. Lankntree C, Briere J. Early data on the trauma symp- tom checklist for children (TSCC). Paper presented at: The meeting of the American Professional Society on the Abuse of Children; 1991 January 25; San Diego, CA.
  (2) Posters
    1. Cho YJ, Han YR. The relationship between the professional self concept, work stresses and their triage competency in emergency nurses. Poster session pre- sented at: Korean Society of Nursing Science; 2020 October 23; Seoul.

8) Web
    1. Ministry of the Interior and Safety. Safety experience center [Internet]. Sejong: Ministry of the Interior and Safety; 2022 [cited 2023 January 12]. Available from: https://www.mois.go.kr/frt/sub/a06/b10/safe- tyExperience/screen.do

IV. SUBMISSION AND PEER REVIEW

1. Submission

Manuscripts should be submitted electronically via this journal's submission system (https://submit.kjan.or.kr/). The first and corresponding authors should be members of KSAN, with the exception of non-Korean authors. Under certain circumstances, non-members can submit manuscripts following approval by the Editorial Board. All correspondence, including notification of the editor's decision and requests for revisions, will be processed via this system. Authors should complete the Submission Checklist and sign the Copyright Transfer Agreement form and submit via the submission system. For any questions regarding the use of the online system, please contact the KJAN publication director via phone, fax, or e-mail.

2. Peer Review

This journal follows a double-blind peer review process. Each submission will initially be assessed by the editors to determine suitability for publication in this journal. If a submission is deemed suitable, it will typically be sent to a minimum of three reviewers for an independent expert assessment of the scientific quality. The decision as to whether an article is accepted or rejected will be taken by our editors.

1) **Preview:** The editorial committee initially assesses each submission. The primary goal is to quickly determine which papers should not be sent for peer review and which ones should. To prevent delays for authors who may wish to submit their work elsewhere, papers that do not meet basic standards or are unlikely to be published, even with a favorable peer review—such as those with insufficient novel contributions or unclear relevance to the field—may be rejected at this stage.

2) **Peer-review process:** There is a two-week peer review period, and the first decision is made after the evaluation is finished. Following the review, the Editorial Board will decide between the options: acceptable options include minor revision, major revision, or rejection. The Editorial Board may request authors to make changes to the manuscript in response to reviewers' comments. If the author deems a reviewer's opinion to be unacceptable or thinks that a reviewer has misinterpreted the data, a reasonable explanation should be provided. Authors should try their best to comply with any requests made by the reviewers to modify the manuscript.
   After making changes to the manuscript, the author should upload the updated files along with a response to

each reviewer's comment. Revisions from the author must be finished within 14 days of the request. The Editorial Board will inform the author if it is not received by the deadline. The author should discuss an extension with the Editorial Board if they want to prolong the revision window past 14 days. The Editorial Board may consider further review upon the author's request. The Editorial Board will ultimately decide whether to approve the submitted manuscript for publication and may, if necessary, ask for additional alterations, edits, and deletions to the article text. Statistical editing is also done if a statistician needs to review the data professionally.

The Editor-in-Chief of KJAN will make the final decision regarding the manuscript's publication based on the reviewers' comments and the scientific merits of the manuscript. Any potential or existing conflict and issues in the manuscript must be discussed in detail with the Editorial Board.

3) **Appeals of decisions:** Any appeals against the editorial decision must be made within 2 weeks of the date of the decision letter. Authors who wish to appeal against a decision should contact the Editor-in-Chief, explaining in detail the reasons for the appeal. All appeals will be discussed with at least one other associate editor. If consensus cannot be reached thereby, an appeal will be discussed at a full editorial meeting. The process of handling complaints and appeals follows the COPE guidance (https://publicationethics.org/guidance). KJAN does not consider second appeals.

V. FINAL PREPARATION FOR PUBLICATION

1. Final Version

After the paper has been accepted for publication, the author(s) should submit the final version of the manuscript. The names and affiliations of the authors should be double-checked, and if the originally submitted image files were of poor resolution, higher-resolution image files should be submitted at this time. Symbols (e.g., circles, triangles, squares), letters (e.g., words, abbreviations), and numbers should be large enough to be legible on reduction to the journal's column widths. All symbols must be defined in the figure caption. If references, tables, or figures are moved, added, or deleted during the revision process, renumber them to reflect such changes so that all tables, references, and figures are cited in numeric order.

2. Manuscript Corrections

Before publication, the manuscript editor will correct the manuscript so that it meets the standard publication format. The author(s) must respond within 48 hours when the manuscript editor contacts the corresponding author for revisions. If the response is delayed, the manuscript's publication may be postponed to the next issue.

3. Proofs and Reprints

The author(s) will receive the final version of the manuscript as a PDF file. Upon receipt, the author(s) must notify the editorial office of any errors found in the file within 48 hours. Any errors found after this time are the responsibility of the author(s) and will have to be corrected as an erratum.

4. Correction

To correct errors in published articles, the corresponding author should contact the journal's editorial office with a detailed description of the proposed correction. Corrections that seriously affect the interpretation or conclusions of the article will be reviewed by the editors. Corrections will be published as an author correction or a publisher correction in a later issue of the journal.

Minor errors will be corrected directly in the online version of the article. An indication of the correction, along with the date it was made, will be added to the article information in both the HTML and PDF versions. A separate correction note will not be published.

VI. ARTICLE PROCESSING CHARGE

When a manuscript is accepted for publication, an article processing charge (APC) of 600 USD (KRW 600,000) per article is charged to the corresponding author.

VII. COPYRIGHT, OPEN ACCESS POLICY

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All manuscripts published in KJAN are protected by copyright. The copyright and transfer rights of the digital content of the published paper and journal are owned by the

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VIII. OTHER EDITORIAL POLICY

1. Archiving Policy

All manuscripts published in KJAN are freely available through open access to read and download from any electronic link, including those found on the KJAN website (http://www.kjan.or.kr/) immediately and permanently after publication.

History:

Enacted Jun, 1994
Revised Dec, 1999
Revised Dec, 2002
Revised Dec, 2003
Revised Dec, 2006
Revised Dec, 2007
Revised Jun, 2008
Revised Dec, 2008
Revised Feb, 2009
Revised Jun, 2009
Revised Apr, 2010
Revised Aug, 2010
Revised Jun, 2012
Revised Jul, 2014
Revised Aug, 2016
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Revised Aug, 2018
Revised Dec, 2018
Revised Jun, 2020
Revised Mar, 2023
Revised Aug, 2023
Revised May, 2025

Submission Checklist

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Adult Nursing

Before submitting the manuscript, please review the following items and mark the applicable content with a "✓" (checkmark).

1. General Considerations

☐ The manuscript should be written according to the research and publication ethics of KJAN.
☐ The first and corresponding authors should be members of the KSAN (*Foreign researchers may submit to KJAN, even though they are not KSAN members).
☐ Copyright transfer agreement signed by all authors and relevant EQUATOR reporting guidelines checklist should be submitted by submission system.
☐ Institutional review board (IRB) approval institution and number:

2. Title page

☐ Please follow the title page template available online.

3. Manuscript preparation

3.1. General guidelines

☐ A4 paper size, 12-point font Times New Roman in MS Word file.
☐ Line space: double spacing / Margins of 30 mm on the top and 25 mm on the bottom, left, and right.
☐ Page numbers at the bottom of each page.
☐ Subheadings of abstract, text, references, and tables and figures.
☐ Original article should be no more than 6,000 words; a review article should not exceed 8,000 words; and an editorial should be no longer than 2,500 words.

3.2. Abstract and Keywords

☐ 250 words or fewer in the abstract.
☐ Subheadings of Purpose, Methods, Results, and Conclusion.
☐ Three to five keywords from MeSH terms.

3.3. Main Text

☐ The main text consists of introduction, methods, results, discussion, conclusion, and references.

3.4. References

☐ The number of references should be 35 or fewer (50 or fewer for model construction).
☐ References follow NLM style.
☐ All references are written with DOIs.
☐ All citations in the paper should have a complete and accurate corresponding reference in the reference list.
☐ Present recent (within 5 years) articles to the extent possible.

3.5. Tables and Figures

☐ The total number of tables and figures should be 5 or fewer.
☐ All abbreviations should be described below the tables or figures.
☐ When numbers are used, the units of the numbers should also be given.
☐ All table and figure numbers should be mentioned in the text.
☐ Tables and figures are presented on separate pages after the references, with one table and figure per page.

Manuscripts submitted to KJAN will be returned if they do not conform to the submission guidelines of KJAN. The authors of this article understand and confirm the above instructions.

Name of corresponding author: ___________ Date: ______/______/______ (Signature)

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The author(s) of this manuscript clearly state all the interests related to this manuscript including financial interests (benefit of research fund, employment, possession of stocks, lecturer's fees or consultancy fees, material support, etc.) and personal interests (concurrent position, conflict of interest, conflict in intellectual property rights, etc.).

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