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인공지능과의 공존을 위한 연구윤리적 쟁점과 당면과제

최희승[1], 황윤선[2], 박영례[3]

[1]서울대학교 간호대학, 간호과학연구소, [2]동서대학교 간호학과, [3]국립군산대학교 간호학부

EDITORIAL

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Corresponding author:
Youn Sun Hwang
Department of Nursing, Division of Health Science, Dongseo University, 47 Jurye-ro, Sasang-gu, Busan 47011, Korea
E-mail: yshwang@gdsu.dongseo.ac.kr

Research ethics and emerging challenges in the era of coexistence with artificial intelligence

Heeseung Choi[1], Youn Sun Hwang[2], Youngrye Park[3]

[1]College of Nursing, The Research Institute of Nursing Science, Seoul National University, Seoul, Korea
[2]Department of Nursing, Dongseo University, Busan, Korea
[3]Department of Nursing, Kunsan National University, Gunsan, Korea

과학과 컴퓨팅 기술의 빠른 발전은 인공지능(artificial intelligence [AI])의 일상적 보편화를 촉진하고 있으며, 여러 학문 분야의 교육과 연구에서 그 활용이 급격히 확대되고 있다. 데이터를 학습하고 스스로 판단함으로써 예측, 추천, 생성할 수 있는 지능형 프로그램 또는 시스템을 일컫는 AI 기반 도구(AI-powered tools)는 아이디어 개발 및 연구설계, 문헌 검토 및 통합, 데이터 관리 및 분석, 번역 및 글쓰기 전반에 이르기까지 다양한 측면에서 활용되고 있다[1]. AI 기반 도구는 교육과 학술연구의 효율성을 높이는 데 유용한 조력자가 될 수 있지만, AI의 불완전성에 기인한 데이터의 편향이나 왜곡, 그리고 연구자의 비윤리적인 AI 활용이나 무분별한 의존으로 인한 잠재적인 위험도 공존하고 있다[2]. AI를 학문적 글쓰기에 활용하는 학생들 사이에서도 창의적 · 비판적 사고의 저하, 잘못된 정보 활용, 표절 등에 관한 우려가 제기되고 있다[2].

AI 기반 도구는 학술 출판물의 정확성, 무결성, 신뢰성을 보장하는 데 필요한 고차원적 추론능력과 맥락적 이해를 충분히 갖추지 못하고 있다. 이에 따라 답변 생성과정에서 실제로 존재하지 않거나 관련성이 낮은 출처를 제시하거나, 허위 정보를 근거 자료처럼 제시하는 'AI 기반 인용 해킹(AI citation hacking)'이 발생할 수 있다[3]. 또한 AI 기반 도구의 활용과정에서는 데이터나 이미지 조작, 가짜 논문 생성, 표절 및 저작권 침해 등 연구윤리와 학문적 진실성을 훼손하는 문제가 나타나고 있다[3]. 따라서 AI의 내재적 한계를 인식하고, 비판적 검토 없이 이를 연구에 적용함으로써 초래될 수 있는 잠재적 위험에 대해 윤리적 성찰과 책임 있는 대응이 요구된다.

연구윤리는 학술연구의 전 과정에서 요구되는 진실성, 투명성, 객관성, 책임성 등의 행동규범을 포함하며, 학문적 성실성을 강조한다. AI 기술의 발달과 연구환경의 변화에 따라 연구자가 준수해야 할 연구윤리의 범위와 내용은 달라질 수 있으나, 연구윤리의 기본 원칙과 책임 있는 연구수행의 핵심 가치에는 변함이 없다. 즉 연구자는 연구의 전 과정과 결과를 투명하게 공개하고, 연구 결과물인 데이터에 대한 접근성을 보장함으로써 연구의 확산을 촉진하는 개방 과학 패러다임, FAIR (findability, accessibility, interoperability, and reusability) 데이터 원칙, 투명성과 진실성의 원칙을 준수해야 한다[4].

AI 활용과 관련된 윤리적 문제를 해결하기 위해서는 연구자 개인의 윤리의식과 책임 있는 연구수행이 필수적이지만, 동시에 연구윤리 교육의 질을 제고하기 위한 교육 및 연구기관의 주도적이고 실질적인 노력이 요구된다. AI가 과학 생산과 콘텐츠 제작 전반에 활용되는 현황에 대한 인식조사

결과[5], AI 활용과 관련된 실질적 훈련과 교육의 부족, 그리고 윤리적 활용방안에 대한 이해 부족이 드러났다. Kim과 Hwang [6]의 국내 AI 윤리 관련 학술연구 동향분석에서도 연구의 양적 증가는 이루어지고 있으나, 실용적 · 실천적 관점의 연구는 여전히 부족한 것으로 나타났다. 따라서 조직적 수준에서의 체계적인 연구윤리 교육체계 구축과 함께, 교육내용 및 방법에 대한 심층적 논의가 필요하다. 한편, 간호대학생 115명을 대상으로 3일간 AI 윤리교육 프로그램을 실시한 결과, 대조군에 비해 교육을 받은 학생들의 AI 윤리 인식, 도덕적 민감성, AI 활용 의도 및 AI에 대한 긍정적 태도가 유의하게 향상되었다[7]. 본 프로그램은 AI 활용에 대한 기초 지식 교육을 시작으로, 도덕적 민감성과 윤리적 딜레마 탐구, 실제 AI 윤리 사례 분석과 집단 토의 기반 의사결정 활동으로 구성되어 있으며, 구체적이고 실천적인 교육 접근법의 효과를 입증한다. 이러한 결과는 연구자의 기초 역량을 형성하는 학부 및 대학원 단계에서 윤리적 성찰과 책임 있는 AI 활용 태도를 배양할 수 있는 연구윤리 교육을 정규 교육과정에 포함할 필요성을 시사한다. 이는 미래 연구자의 연구윤리 역량을 체계적으로 강화하기 위한 핵심 과제라 할 수 있다.

윤리적인 연구환경 자체를 뒷받침하는 제도적 · 정책적 지원도 동시에 이루어져야 한다. 교육, 연구 및 관련 기관은 AI 사용 시 지켜야 할 연구윤리 가이드라인을 시대적 상황과 현실성을 고려하여 체계적으로 마련해야 하며, 정부는 이와 관련된 법적 문제를 신속하게 재정비해야 한다. 국내에서는 대학들이 자체적인 AI 관련 가이드라인을 제시하고 있지만 강제력과 적용 범위가 상이하며, 교육 및 관련 기관들의 지침은 선제적인 예방이 아닌 사후 규제에 머무르고 있다[8]. Elsevier, Taylor & Francis, Sage와 같은 일부 저명한 출판 매체는 AI 사용을 위한 연구 및 출판윤리와 저자 가이드라인을 제시하고 AI 기반 도구의 사용을 허용하는 반면, Science 저널은 AI가 생성한 이미지나 멀티미디어 자료 게재와 관련하여 더 엄격한 기준을 제시하고 있다. AI 기반 도구 활용에 대한 견해에는 차이가 있지만, 본 학술지인 한국간호과학회지를 비롯하여 일반적으로 통용되는 논문 출판 가이드라인은 다음과 같다.

논문의 원고 작성, 이미지 또는 그래픽 요소 제작, 데이터 수집 및 분석 등에서 AI 기반 도구, 언어모델, 기계학습 또는 이들과 유사한 기술들을 사용한 경우, 저자는 자료의 출처와 AI 활용범위를 명확하게 밝혀야 한다. 모든 내용이 저자의 데이터와 아이디어를 반영하고 표절과 위 · 변조가 없다는 것을 보증하는 것은 저자의 책임이며, AI 활용은 감사의 글(Acknowledgment)이나 연구방법 부분에 명시할 것을 권고한다. 즉 연구결과에 대한 공식적 책임은 모두 저자에게 있으며, AI에게 저자 자격을 부여하기보다는 연구과정에서 AI의 기여도를 명확히 밝히는 것이 중요함을 의미한다. 또한 저자는 AI를 활용하여 작성한 논문의 내용이 법적 보호를 받기 어렵다는 점, 원본 저작자의 권리를 침해할 가능성이 있다는 점을 충분히 인지해야 한다.

데이터 보호의 측면에서도 생성형 AI 활용 학술연구에는 중요한 법적 고려사항이 존재한다. 특히 간호학 분야 연구에서는 건강정보와 같은 민감한 개인정보를 AI 학습데이터로 활용할 때 개인정보 보호법 및 의료법에 따라 더욱 엄격한 관리체계를 구축해야 하며, 연구자에게 최종 확인 및 관리 책임이 있다[8]. 또한 논문 심사자와 편집인 역시 논문 원고에 대한 평가와 리뷰 의견 작성 및 교신과정에서 AI를 사용하였다면 이를 명시해야 한다. 또한 입력된 프롬프트(논문 원고 포함)는 폐기하지 않고 일정 기간 보관해야 하며, 저자의 논문 원고를 AI에 제공하는 행위는 제출된 원고에 대한 비밀유지의무 위반에 해당함을 인식해야 한다. 결론적으로, 학술연구의 핵심 원칙을 보존할 수 있는 범위 내에서 AI를 활용하는 것은 일반적으로 수용 가능한 방향으로 받아들여지고 있다.

AI 개발 · 활용에 관한 광범위한 윤리원칙이 국제적으로 논의되고 있는데, Organization for Economic Cooperation and Development (OECD)가 2019년에 최초로 발표한 'OECD AI Principles (OECD AI Policy Observatory)'과 United Nations Educational, Scientific and Cultural Organization (UNESCO)가 2021년에 최초로 발표한 'AI 윤리에 관한 권고(Recommendation on the Ethics of AI)'[9]가 대표적인 예시이다. 국내에서도 2023년에 한국지능정보사회진흥원이 '생성형 AI윤리 가이드북'[10]을, 2024년에 한국연구재단이 '생성형 AI 도구의 책임 있는 사용을 위한 권고사항'을 발표하였다. 국내외 권고안들은 AI 사용 시 출처 명시나 범위 공개를 권장하고, 인권 존중과 책임 있는 AI 사용 등 핵심 가치를 강조하였으나, 모두 권고 수준이며 강제성이 없다는 한계가 있다. AI 기술이 급변하는 상황에서 사후 규제는 효율성과 현실성이 매우 부족하므로 연구자들이 AI를 윤리적으로 활용하도록 사전에 유도하고, 문제 발생 가능성을 예측하여 선제적으로 대응할 수 있도록 전환해야 할 것이다. 즉 글로벌 원칙과 협력을 통해 교육과 연구 전문가, 윤리학자, 정책 입안자, 편집자, 연구자들은 AI 활용과 관련된 윤리적, 기술적 복잡성을 관리하고, 책임감 있고 명확한 윤리적 · 법적 지침을 수립하여 연구자들이 AI를 책임감 있게 활용하도록 돕는 것이 우리에게 당면한 시급한 과제이다.

연구환경의 변화는 연구자에게 요구되는 역량의 변화를 의미한다. 개인용 컴퓨터와 통계프로그램의 보급, 인터넷 상용화, PubMed, Web of Science와 같은 글로벌 데이터베이스의 출현이 본격화되었고, 그 결과, 글로벌 연구역량, 컴퓨터 활용능력이 연구자에게 요구되는 필수 역량으로 부상하였다. 더불어 AI 기술 발전으로 인한 AI 활용역량(AI proficiency) 또한 새로운 핵심 연구역량으로 요구되고 있고, 이는 숙련도의 의미를 넘어 윤리적인 함의까지 포함하고 있다. AI 활용역량 증진을 위해 노력하되, 창의성, 비판적 사고, 윤리적 판단과 책임은 인간의 고유한 영역으로 남겨두어야 할 것이다.

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Conflicts of Interest

All authors are members of the editorial board of the *Journal*

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Lessons from the US Advanced Practice Registered Nurse system

Eun-Ok Im, Dongmi Kim

School of Nursing, The University of Texas at Austin, Austin, TX, USA

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Corresponding author:
Eun-Ok Im
School of Nursing, The University of Texas at Austin, 1710 Red River Street, Austin, TX 78712, USA
E-mail: eunok.im@austin.utexas.edu

Purpose: This review compares the development of South Korea's Advanced Practice Registered Nurse (APRN) system the well-established APRN system in the United States and provides recommendations for future improvements to the APRN system in South Korea.
Methods: To compare the APRN systems between the two countries, an integrative literature review was conducted using multiple databases and professional nursing organization documents and reports from both the United States and South Korea.
Results: Issues were identified in five major domains: (1) research evidence, (2) education and training, (3) the scope of practice, (4) financial mechanisms, and (5) public awareness and acceptance.
Conclusion: Recommendations are made in four areas: (1) building evidence to support APRN programs; (2) strengthening APRN education; (3) establishing legal support and reimbursement mechanisms; and (4) improving public awareness and acceptance of APRNs.

Keywords: Advanced practice nursing; Health policy; Health workforce; Nurse practitioners; Scope of practice

Introduction

In the United States, Nurse Practitioner (NP) programs have evolved over nearly 60 years since their inception in 1965 [1]. The United States introduced the NP roles in response to the nationwide primary care provider shortage created by expanding Medicaid/Medicare coverage [1]. Since then, the primary care demand has continued to rise in the United States due to its own aging population and physician shortage. Indeed, national nursing professional organizations noted that "demand for health care continues to rise, fueled by the growth of its aging population and the continued shortage of primary health care providers," and argued that NPs could help meet this need. As of 2023, Advanced Practice Registered Nurse (APRN) in the United States workforce exceeds 385,000 licensed NPs nationwide that contributes to over 1 billion patient visits each year, which is projected to grow further [2].

Today's healthcare environment in South Korea is having similar challenges such as its aging populations, rising chronic illnesses, and persistent shortages of healthcare professionals [3,4]. These pressures have led to increasing demands for effective and high-quality care and intensified interest in APRNs [5]. Patients and families are no longer satisfied with one-size-fits-all services—they seek more specialized, individualized nursing care that fits their specific health conditions and healthcare needs [6]. Concurrently, South Korea faces persistent provider shortages. South Korea has one of the lowest doctor-to-population ratios among the Organization for Economic Co-operation and Development (OECD) countries, with approximately 2.6 physicians per 1,000 people [7]. Critical specialties—such as pediatrics, emergency medicine, and geriatrics—are especially understaffed, and many physicians prefer highly paid elective fields (e.g., dermatology, cosmetic surgery) over essential health services [8]. These shortages are felt acutely in rural and under-served areas: rural provinces have less than half the physician density of Seoul, leading to double the risk of delayed critical care [8,9]. The combination of these high

demand and limited supply has further stressed a hospital-centric, fee-for-service system. South Korea's system allows free patient choice of providers, which has led to extremely high consultation rates (highest per capita in the OECD) but very short visits [10]. This model incentivizes volume over coordination, and leaves primary care underdeveloped [11].

In recent years, South Korea's healthcare system has been exploring the implementation of APRN programs to address these challenges. South Korea's healthcare reformers have likewise recognized APRNs as part of the solution [12]. Advanced practice nursing in South Korea dates back to the 1970s, with formal Advanced Practice Nurse (APN) certification introduced in the early 2000s [13]. By 2023, 17,103 certified APNs are practicing in South Korea [14]. However, these APNs have reportedly been underutilized because of restrictive laws and unclear scope of practice; APNs are supposed to function under the supervision of physicians without independent prescriptive authority or a billing mechanism for their practice [15,16]. In 2024, a landmark Nursing Act in South Korea was passed, which established a legal basis for advanced nursing practice [17]. However, actual APRN practice in South Korea still remains limited with a lack of supporting structures in many aspects.

The purpose of this paper is to compare South Korea's APRN development with the well-established APRN system in the United States and to provide recommendations for future development of the APRN system in South Korea. In this paper, APRN means "a registered nurse (RN) who has completed advanced education and training, typically at the master's or doctoral level, and is qualified to provide a wide range of advanced healthcare services" [18]. The comparison between South Korea and the United States is made in five domains including: (1) research evidence, (2) education and training, (3) the scope of practice, (4) financial mechanisms, and (5) public awareness and acceptance.

Methods

For the comparison between the two countries, an integrative literature review was conducted. Following the methodological guidance of Whittemore and Knafl [19], this integrative review emphasizes conceptual synthesis and thematic integration rather than exhaustive cataloging of studies, as the included evidence spans diverse methodologies and document types [19]. Literature on APRNs was searched in multiple databases, including PubMed, CINAHL, KCI, and RISS, using the keyword "APRN" and its Korean equivalent, "전문간호사." For PubMed and CINAHL, revised search terms were applied, as these databases yielded a greater number of irrelevant studies. Only the articles published within the last 10 years were included. For RISS, due to limitations in the search functions, only the term "APRN" was used, and manual screening of titles and abstracts was conducted.

Studies were excluded if they (1) did not specifically address APRN or their policy, education, or practice frameworks; (2) focused solely on other nursing roles (e.g., staff nurses, clinical nurse specialists [CNSs], or nurse aides) without reference to APRNs; (3) were duplicates or conference abstracts without full text; (4) were unrelated to the health systems of the United States or South Korea; (5) were published in non-English or non-Korean languages; or (6) were not peer-reviewed articles.

Detailed search terms are presented in Table 1, and Figure 1 provides the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram with detailed information on the selection process for the database search. The database search initially retrieved 760 articles, of which 121 met the inclusion criteria. These comprised research papers, opinion articles, and editorials related to APRNs in the United States or South Korea. In addition, current documents and reports from nursing professional organizations in the United States—including the American Association of Nurse Practitioners (AANP), American Association of Colleges of Nursing (AACN), American Academy of Nursing (AAN), and American Nurses Association (ANA)—as well as from the Korean Ministry of Health and Welfare and the Korean Nurses Association were reviewed. These materials were searched using Google and Naver, limited to publications within the past 10 years, and available as PDF files, yielding 221 results from the United States and 907 results from South Korea. From these, 16 relevant documents and reports were included in the review. The literature search and analysis were conducted between July and August 2025. Documents and reports were excluded if they (1) did not explicitly address APRN-related policy, education, or workforce issues; (2) were press releases, event announcements, or brief news items without substantive policy or practice content; (3) were duplicates or overlapping versions of the same report; (4) lacked accessible full-text or official publication status; or (5) were focused on non-APRN nursing or healthcare workforce topics.

To minimize author bias, multiple strategies were employed throughout the review process. Multiple databases were searched to ensure comprehensive coverage of both United States and South Korean sources, and additional official reports from professional organizations were included to balance peer-reviewed and policy-based perspectives. All potentially relevant articles were screened independently by the author twice to verify consistency in selection and interpretation. Findings were synthesized using a

Table 1. Search strategies

Database	Search terms
PubMed	("Advanced Practice Registered Nurse"[Title] OR "Advanced Practice Nurse"[Title] OR APRN[Title] OR "Nurse Practitioner"[Title] OR NP[Title] OR "advanced practice nursing"[MeSH Terms] OR "nurse practitioners"[MeSH Terms]) AND ("United States"[Title] OR "U.S."[Title] OR USA[Title] OR America[Title] OR "South Korea"[Title] OR Korea[Title] OR "Republic of Korea"[Title] OR "United States"[MeSH Terms] OR "Republic of Korea"[MeSH Terms]) AND ("scope of practice"[Title] OR "practice authority"[Title] OR autonomy[Title] OR "prescriptive authority"[Title] OR regulation[Title] OR licensure[Title] OR credentialing[Title] OR billing[Title] OR reimbursement[Title] OR "health policy"[Title] OR legislation[Title] OR "scope of practice"[MeSH Terms] OR "professional autonomy"[MeSH Terms] OR "prescriptions"[MeSH Terms] OR "legislation, nursing"[MeSH Terms] OR "licensure, nursing"[MeSH Terms] OR "health policy"[MeSH Terms])
CINAHL	(TI "Advanced Practice Registered Nurse" OR TI "Advanced Practice Nurse" OR TI APRN OR TI "Nurse Practitioner" OR TI NP OR MH "Advanced Practice Nursing" OR MH "Nurse Practitioners")
	AND
	(TI "United States" OR TI "U.S." OR TI USA OR TI America OR TI "South Korea" OR TI Korea OR TI "Republic of Korea" OR MH "United States" OR MH "Republic of Korea")
	AND
	(TI "scope of practice" OR TI "practice authority" OR TI autonomy OR TI "prescriptive authority" OR TI regulation OR TI licensure OR TI credentialing OR TI billing OR TI reimbursement OR TI "health policy" OR TI legislation OR MH "Scope of Practice" OR MH "Professional Autonomy" OR MH "Prescriptions" OR MH "Legislation, Nursing" OR MH "Licensure, Nursing" OR MH "Health Policy")
KCI	("전문간호사" OR "전문간호사 제도" OR "전문간호사 역할") AND ("업무범위" OR "권한" OR "처방권" OR "규제" OR "면허" OR "자격" OR "수가" OR "보상" OR "법률")
RISS	전문간호사

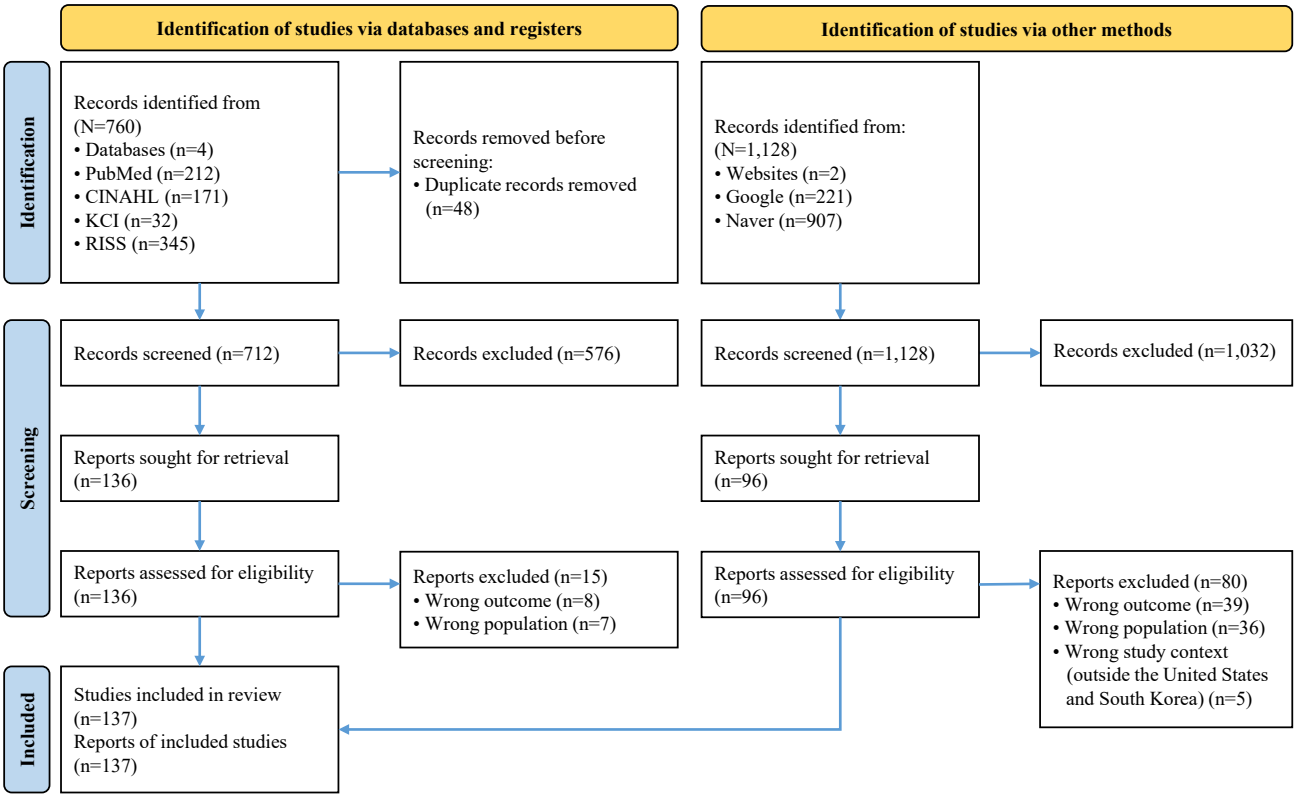

Figure 1. Flow diagram included searches. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

structured comparison framework rather than subjective interpretation, thereby reducing the influence of individual perspectives.

The comparison between the United States and South Korea was chosen for its conceptual and policy relevance. The United States represents one of the most mature and well-defined APRN systems globally, offering a robust model for scope of practice, regulation, and reimbursement. In contrast, South Korea is in the early stages of APRN policy development, having only recently enacted the Nursing Act and continuing to address challenges related to licensure, reimbursement, and role standardization [17]. By contrasting a well-established system (the United States) with an emerging one (South Korea), this study identifies transferable lessons, policy gaps, and context-specific challenges, providing practical insights to guide South Korea's nursing policy advancement and workforce reform.

Differences between the United States and South Korea

The literature review identified five major areas of comparison between the United States and South Korea, including the research evidence supporting APRN practice and policy; education curriculum and training standards for APRN preparation; scope of practice and related regulatory frameworks; reimbursement mechanisms for APRN-provided services; and public awareness and acceptance of APRNs. These five domains collectively formed the analytical foundation for developing four key areas of policy recommendation: establishing legal and reimbursement support, standardizing education and training systems, clarifying and expanding the scope of practice, and promoting public and interprofessional awareness of APRN roles. The following sections summarize the findings in each comparative area, synthesizing evidence from both United States and South Korean sources.

1. Research evidence

In the United States, a robust body of health services research has documented APRN outcomes, helping to legitimize and guide the related policies. Numerous trials and analyses have compared APRN (often NP-led) care with physician care in primary and acute settings [20]. A landmark randomized trial conducted in the United States found no significant differences in health outcomes, utilization, or patient satisfaction between patients managed by NPs versus physicians, when NPs had comparable authorities and caseloads [21]. Mundinger et al. [21] reported that 6-month health status and 1-year utilization outcomes were statistically equivalent for patients randomized to receive primary care from either a NP or a Doctor of Medicine; neither group showed worse chronic disease control or higher hospital utilization [21]. Other studies conducted in the United States similarly found APRN care to be clinically equivalent (or even superior) to physician care. For instance, a large Veterans Affairs system study showed that patients reassigned to NP primary care had similar clinical outcomes and incurred no higher costs, despite using slightly less specialty and inpatient care. In fact, patients under NP-led care had fewer hospitalizations and maintained equivalent chronic disease control, suggesting that NPs deliver care of comparable quality [22].

A Cochrane systematic review by Laurant et al. [23] further reinforces the evidence base, revealing higher patient satisfaction with NP care and no significant differences in clinical outcomes when compared to physician care. Likewise, an AANP literature review noted that "the majority of cost-focused studies" found NP care cost-effective relative to physicians,' with similar or better patient outcomes [24]. Studies also documented cost savings from NP management of chronic conditions like diabetes, asthma, and heart diseases [25], as well as reduced hospital readmissions and shorter stays when NPs were involved [26]. For example, hospitals with higher NP staffing spent about 5% less per Medicare patient and saw lower readmission rates [27]. These findings suggest that expanding APRNs can help control costs while maintaining the quality of care.

In contrast, research on APRN outcomes is sparse in South Korea. APRN research must generate evidence to inform policy and reimbursement. Pilot initiatives already undertaken during 2024 provided the data for analysis. For instance, the Ministry of Health and Welfare's "pilot project on nursing-related tasks"—launched amid the doctor shortage crisis—allowed nurses to legally perform certain procedures under supervision [28]. Evaluating the outcomes of this pilot (e.g., clinical errors, patient throughput, staff feedback) could yield valuable insights on safe task delegation. Additionally, there existed very few studies on if the creation of APRN-led care teams (such as new hospitalist-APN models) could improve access and safety. Such hospitalist–APRN collaborative models may represent a practical mechanism for integrating APRNs into existing hospital systems, fostering interprofessional collaboration and improving continuity of inpatient care [29]. With the limited number of studies, the methods used in the few studies were also limited although a wide range of research methods could be used (e.g., prospective trials, comparative case studies, longitudinal studies, cost-effectiveness studies). One Korean education review also noted that properly trained APNs could

"improve patient safety and cost-effectiveness of healthcare" [30], but more peer-reviewed Korean data would be essential.

2. Education and training

In the United States, APRNs (especially NPs) must complete advanced academic programs that build on their RN foundation. Currently, APRN candidates must first obtain a RN license (typically via a Bachelor of Science in Nursing), then pursue a graduate degree. Master's programs for NPs usually take about 2 years of full-time study, while many institutions now offer Doctor of Nursing Practice (DNP) programs lasting roughly 4 years [31]. The ANA and accreditation bodies emphasize that many employers and state boards are beginning to require the DNP for new APRNs [32]. Graduates must also pass national certification exams (the American Nurses Credentialing Center [ANCC] or AANP Certification Board) in their specialty, and programs themselves must be accredited by recognized agencies (e.g., the Commission on Collegiate Nursing Education or the Accreditation Commission for Education in Nursing) [33].

In addition, APRN programs in the United States mandate hundreds of supervised clinical practice hours. In fact, a joint NP certification statement confirms that a minimum of 500 hours of direct patient care must be completed [34]. Many DNP tracks far exceed this (often targeting 1,000 clinical hours) [35]. These practica occur in varied settings under experienced preceptors, exposing trainees to acute and chronic care management, diagnosis, and prescribing in real-world practice [36]. Also, in the United States, continuing nursing education (CNE) is a mandated component of professional maintenance for APRNs, with many states requiring a specified number of CNE hours for licensure renewal. For example, the ANCC accredits CNE providers and requires NPs to complete continuing education in pharmacology, ethics, and clinical updates as part of national recertification standards [37]. These requirements aim to ensure ongoing clinical competence, align practice with emerging evidence, and promote quality and safety in advanced nursing care.

In contrast, in South Korea, clinical nursing assistants and physician assistants (PAs) typically acquire skills informally rather than through standardized education programs. Most PAs in South Korea enter practice as experienced nurses and learn their advanced tasks by apprenticeship, without a formal PA or APRN curriculum [38]. CNE is not well integrated. Notable, a greater proportion of clinical support nurses reported not receiving pre-service education, with 60.2% (n=100) indicating no prior training, compared to 39.8% (n=66) who did receive such education [39]. This makes outcomes variable and hampers professional development.

3. The scope of practice

The scope of practice refers to the activities that healthcare professionals are legally authorized to perform [40]. In the United States, the current scope of NPs' practice (legally permitted) is prescribed by state laws, and varies across the United States. The scope of practice can generally be categorized into three: (1) full, (2) reduced, or (3) restricted [40,41]. As of 2025, about 30 states and territories belong to the full category; NPs can independently perform the full range of their training, diagnosing patients, prescribing medications (including controlled substances), managing treatments, and operate their own independent practices without physician supervision. However, NPs are required to have a certain level of experience working under the supervision of a physician or additional training before allowing full practice authority. In the states with the reduced practice scope, NPs have most authority with some limits in certain areas that may need a formal collaborative agreement with a physician (e.g., prescription of certain medications, operation of an independent clinic) [40]. In the states with restricted practice scope (currently 11 states), NPs should practice under the direct supervision of physicians for all of their scope of practice, and they cannot practice independently [40]. However, in some states, these restrictions are loosened as NPs gain experience [40]. Over the past few decades, NPs' autonomy has been expanded in the United States, driven by: (1) research evidence supporting NPs' safe and effective care and (2) the increasing nationwide need for more primary care providers [40,41]. By 2024, in the United States, about 30 states and DC had updated their laws to grant full practice authority so that NPs can practice independently without physician oversight [42]. Other states still have some limitations, mainly due to political and professional debates with physician groups [40,43].

In the United States, all 50 states currently license APRNs (NP, CNS, Certified Nurse-Midwife [CNM], and Certified Registered Nurse Anesthetist [CRNA]) with well-defined scopes of practice. To achieve clarity, the United States has moved toward a consensus regulatory model. The National Council of State Boards of Nursing's model recommends four distinct APRN titles with masters-level education and national certification, plus independent prescriptive authority [44]. Studies showed that these legal regimes affected care; full practice authority states had more NPs practicing in rural/underserved areas and improved recruitment, whereas restrictive states correlated with primary-care shortages, higher

chronic disease burden, and geographic disparities [45].

Legislation in South Korea has struggled to keep pace with APRN practice. Historically, South Korean law classified nurses as PAs under the Medical Service Act, which granted no autonomous scope [46]. Only in late 2024. South Korea enacted a dedicated Nursing Act. Under the new law, the Minister of Health and Welfare may grant a nurse an APN qualification in addition to the standard nursing license outlined in Article 4 [17,47]. However, many details remain unsettled. The Act itself did not spell out specific role scopes or define all APRN categories, and hospital policies still vary widely. As a result, unlicensed PAs continue to work in "legal limbo" without clear authority [38]. For example, medical technicians who step in for resigning residents have no legal protections if complications occur. Reports noted that many patients in South Korea could not even distinguish whether their caretaker was a doctor, nurse, or PA, because titles and duties were inconsistent and undocumented [48].

Indeed, "PA Nurses" or similar hybrid labels (introduced during recent reform debates) have only created confusion. Currently, PAs' activities are often unrecorded and unregulated [38]. PAs in Korean hospitals currently operate with no consistent documentation, oversight, or institutional accountability [49]. Moreover, because each hospital sets its own rules regarding the roles of PA nurses, individual nurses often report uncertainty when transitioning to new institutions [50]. International Council of Nurses (ICN) has warned that conflating these roles is "counterproductive" and poses safety risks [51]. The system in South Korea needs to either formally incorporate qualified PAs under the nurse license with proper education or recognize them as separate medical practitioners.

4. Financial mechanisms

In the United States, APRNs are recognized as reimbursable providers under Medicare, Medicaid, and private insurance, but payment policies vary. Medicare Part B allows APRNs (NPs, CNMs, CRNAs, CNSs) to bill directly using their own National Provider Identifier (NPI). Under current rules, Medicare pays APRNs 85% of the physician fee schedule for the same service [52]. In Medicaid and commercial plans, all 50 states allow APRNs to enroll and bill, often at parity with physicians or slightly lower rates [25,52]. Some states explicitly require Medicaid to reimburse APRNs at the full physician rate. For example, one study in Medicaid-fee-for-service states with payment parity found NP-led pediatric asthma care costed almost $300 less per patient than physician care [25].

In contrast, in South Korea, the lack of reimbursement mechanisms for APN services in the Korean National Health Insurance system has been pointed out. As noted by Choi et al. [5], there is an "absence of a medical fee schedule" for APN-provided services, which means there is no way for healthcare facilities to bill or be reimbursed for care delivered by an APN [5]. In a healthcare system where virtually all payments are tied to physician services or facility fees, this omission makes hospitals financially reluctant to formally employ APNs as clinical providers [53]. Even if a hospital wanted to utilize APNs (for example, to manage a diabetes clinic), they might not receive insurance reimbursement for those patient visits unless a physician's name is attached to the service. This financial disincentive significantly hinders APN integration. Korean experts have called for the government to create a reimbursement system and staffing standards for APNs to facilitate their employment and appropriate compensation [54].

5. Public awareness and acceptance

Decades of advocacy have made APRNs a familiar concept in the United States. For instance, a recent survey in the United States found 82% of patients support NPs practicing to the full extent of their training [55]. Similarly, nearly 80% of healthcare professionals (including physicians, nurses, and PAs) in the poll endorsed this view [56]. In practice, many patients report high satisfaction with APRN care; as noted above, several studies even found higher patient satisfaction scores for NP care [57]. Factors contributing to this trust include the longer and more thorough consultations that APRNs tend to provide and the emphasis APRNs place on patient education and preventive counseling [58]. In the United States, the APRN role consistently ranks highly in public esteem: for example, the US News & World Report placed the NP at the top of its 2022 "Best health care jobs" list, reflecting strong public and institutional regard [59]. Americans take pride in having over 385,000 licensed NPs delivering a billion patient visits per year [60]. Such visibility comes from organizing conferences (e.g., annual NP week), public service campaigns, and highlighting APNs' contributions [61]. For instance, the American College of Nurse-Midwives launched "Our moment of truth: a new understanding of midwifery care," a public relations initiative to reintroduce midwives as a standard option in women's health [62]. Nurse anesthetists and specialists use analogous outreach: for example, public-friendly fact sheets and community talks to explain CRNA care and CNS roles [63,64].

In South Korea, patients have traditionally met physicians for diagnosis and treatment, and the concept of a nurse as a primary

provider is very new to the public. Subsequently, there may be initial resistance or confusion among patients about the roles of APRNs. Traditional Korean culture accords high respect for physicians, and the ideal physician is an older man with gray hair [65]. Also, traditional Korean culture views nurses as the one who carries out physicians' orders [65]. With the contemporary nursing education system in South Korea, nurses are gaining stature and respect in Korean culture. Yet, still, the level of public awareness on APRNs would be very low, and intensive efforts will be needed to have people understand NPs as highly qualified professionals, not "second-tier" healthcare providers.

Discussion

Based on the identified differences in APRN systems between the United States and South Korea, the following recommendations are made for the future APRN programs in South Korea. The recommendations are presented in four areas: (1) building evidence to support APRN programs; (2) strengthening APRN education; (3) establishing legal support and reimbursement mechanisms; and (4) improvements public awareness and acceptance of APRNs. The recommendations derived from this review are intended to inform key nursing and health policy stakeholders in both South Korea and the United States, supporting ongoing policy discussions on APRN regulation, reimbursement, workforce integration, and public awareness.

1. Building the evidence to support APRN programs

First of all, data tracking on the APRN workforce needs to be done in South Korea. Implementing routine data tracking to understand the APRN workforce and its deployment would be essential. Currently, official figures suggest around 16,888 Korean APRNs were certified by late 2022 [53], but the actual on-the-job impact is unclear. A recent survey found that of 1,347 certified APRNs, only 29.1% were actually working in advanced practice roles [12]. Many certified APNs continue to work as general RNs, administrators, or even as "clinical nurse practitioner (differently named by hospitals)" with delegated tasks. Complicating the landscape further, there are so-called PAs performing similar functions without formal regulation or role clarity [66]. Therefore, establishing a national APRN registry (possibly under the Nursing Act framework) would allow tracking of how many APRNs are active and what are their specialties and practice settings. Regular workforce studies could then identify geographic or specialty gaps. As Choi [12] observed, the lack of a reporting system "obscures APRNs' actual activities within healthcare institutions" [12]. Tracking could inform workforce planning and reveal whether policy changes (e.g., new role authorization) actually lead to expanded APRN utilization.

More importantly, evidence generation should extend to public health outcomes. Given the chronic disease epidemic, APRN-led interventions for prevention and chronic disease management—especially in rural areas with severe physician shortages—merit particular attention [67]. In the United States, the states with full practice authority of APRNs witnessed notable improvements in primary care access, especially in rural areas [68]. These policy shifts often led to measurable increases in the supply of primary care providers, enhanced patient access, and reductions in avoidable hospitalizations [69]. South Korea could benefit from similar models. For example, community health programs staffed by APRNs could be piloted to manage hypertension, diabetes, or eldercare, and document outcomes (e.g., improved disease control, reduced hospitalizations). These data would underscore the value of APRNs in primary care—an area the Korean system has struggled with. Building this national evidence base will help persuade stakeholders (physicians, insurers, and the public) to understand the merits of APRNs and guide continuous improvement of APRN education and practice.

2. Strengthening APRN education

To strengthen the APRN workforce in South Korea, the APRN education programs need to be strengthened with collaborative inputs from frontline stakeholders including physicians, experienced PAs, nursing leaders, and nursing educators in revising the APRN curricula. For example, rather than 13 rigidly defined APN specialties, training pathways need to reflect patient and population needs. In the United States, APRN education programs follow a four-role paradigm (NP, CNS, CNM, and CRNA) with specialties embedded in graduate programs. The individual role paradigms of APRNs correspond to a setting or patient group: NPs often focus on primary care (e.g., rural health clinics), clinical nurse specialists work in hospitals (e.g., intensive care unit [ICU] or oncology units), certified nurse-midwives serve maternity care, and nurse anesthetists staff surgical suites [70]. By contrast, South Korea's current "13-specialty" model (spanning fields from home care to emergency nursing) has outpaced practical deployment [53]. Korea's 13 APRN fields may not align neatly with service demands; for instance, critical care and emergency fields cover physicians' shortages there, but those in the fields like infection control or public health may be less visible. Many APNs in

South Korea end up working outside their certified field or sharing duties with nurses. Thus, education programs need to be restructured by actual needs.

The curriculum also needs to be strengthened with ample clinical training hours, which will make the trainees enter the workforce with greater confidence and competence, provide better patient care, and smoothen their role integration in clinical teams [71]. Increasing practicum hours and strengthening training standards will produce APRNs who can more independently perform complex tasks (such as comprehensive patient assessments, clinical decision-making, and certain medical procedures) from the start of their careers [72]. Over time, this competence builds trust among physicians and healthcare administrators, who will be more likely to fully utilize APRNs' skills [73]. Surely, well-prepared APRNs will be better able to demonstrate their values in practice, creating a positive feedback loop: as outcomes improve and become evident, it bolsters the case for continued support and investment in APRN education and roles.

Faculty development is vital in strengthening APRN education in South Korea as well. At present, only 39 institutions in South Korea offer APRN programs, concentrated in metropolitan areas [74]. There is a shortage of qualified faculty with advanced practice experience, and the existing master's-level programs are already straining academic resources [75]. To expand capacity, South Korea needs to invest in faculty training. Experienced APRNs (both domestic and from abroad) could be recruited as instructors. Existing doctoral or post-master faculty could be sent on fellowships to APRN programs in other countries to learn their curriculum designs. Collaborative faculty appointments with hospitals would allow clinicians to teach APRN students. Additionally, developing an online or blended learning component—as practiced in some countries—could partially alleviate faculty shortages and widen access [76]. The Ministry of Health and Welfare or universities could offer teaching awards or grants to those who develop APRN curricula, creating incentives for faculty engagement.

3. Establishing legal support and reimbursement mechanisms

It would be essential to establish the necessary legal support and reimbursement support for APRNs in South Korea. First, nursing laws need to clearly define the APRN scopes of practice, licensure requirements, and regulatory standards for all APRN roles. As the ICN advises, legislation should "confer and protect" APN titles and outline regulatory mechanisms [77]. Also, South Korea could likewise adopt a unified statutory approach—defining APRN roles, ensuring title protection, and enacting legislation analogous to the Nurse Practice Acts in the United States. Such regulatory clarity would not only safeguard APRN professional status but also promote public trust and interprofessional collaboration by making role boundaries transparent and enforceable.

The South Korean Nursing Act also provides an opportunity to formally absorb current clinical practice nurses into the APRN pathway. South Korea lacks a separate PA system, so it is logical to bring all advanced practice clinicians under one legal framework. Specifically, current clinical nurses performing advanced tasks need to be allowed to obtain APRN certification, perhaps through an accelerated pathway, rather than remain in an ill-defined limbo. This integration would also simplify regulation: rather than multiple nurse/PA titles, South Korea could focus on regulating and compensating a single cadre of APRNs. In practice, achieving these reforms will require addressing vested interests. Debates between the Korean Medical Association and the Korean Nurses Association over the 2021 revision of the 'Regulations on the Recognition of Advanced Practice Nurse Qualifications' have intensified, primarily due to unresolved legal ambiguities and the continued absence of clarity on previously identified issues [78]. However, evidence—including ICN position statements—indicates that well-implemented APRN legislation complements physician care, enhancing system capacity without compromising quality [51]. For example, in hospitals in the rural areas of the United States, CRNAs often provide the sole anesthesia coverage under state opt-out laws, freeing physicians to focus on complex cases [79]. Clear, standardized laws in Korea will prevent the current patchwork (where APRN job duties vary by hospital) and protect both providers and patients. As ICN notes, a robust nursing law aligning with international standards will unlock Korea's "huge untapped potential" by enabling nurses to work to their full scope [51].

Additionally, establishing a reimbursement structure for APRN services is critical to ensure sustainable workforce integration. In the United States, APRNs are recognized as reimbursable providers under Medicare, Medicaid, and private insurance, and are able to bill directly using their own NPI at standardized rates [52]. This payment structure has incentivized healthcare systems to fully utilize APRNs in primary and specialty care, contributing to cost-effective and accessible service delivery [80]. By contrast, the Korean National Health Insurance system currently lacks a medical fee schedule for APRN-provided services, creating significant financial disincentives for hospitals to employ APRNs as independent clinicians [54]. Without an official billing and reimbursement

mechanism, APRNs remain underutilized, and their contributions to improving access and efficiency go unrecognized. Therefore, a clearly defined reimbursement framework should be introduced alongside legal reforms to promote the formal employment and fair compensation of APRNs.

Such reforms need to be actively championed by Korean nursing associations, whose advocacy will be critical in engaging policymakers, negotiating payment standards, and framing APRN integration as a solution to persistent healthcare access and workforce shortages. The experience in the United States demonstrates that when APRNs are legally recognized and financially supported, they contribute substantially to system efficiency, cost containment, and equitable care delivery. By aligning legislative, regulatory, and reimbursement structures, South Korea can unlock the full potential of its APRN workforce and advance its commitment to high-quality, accessible healthcare.

4. Enhancing public awareness and acceptance

Nursing professional organizations in the United States have invested in public campaigns to raise awareness of APRN roles throughout the past decades. The AANP has launched several national multimedia initiatives. For instance, the "We choose NPs" campaign (beginning 2018) used TV ads, social media, and a patient-focused website to highlight real stories of NP care and advocate for patient access [81]. During the COVID-19 (coronavirus disease 2019) pandemic, AANP's "NPs combat COVID" ads showcased NPs on the front lines and linked to an informational site for patients [82]. More recently, AANP ran "Lifesaving NP-delivered care" spots telling individual patient narratives of how NPs identified or treated critical conditions [81].

Campaigns need to highlight APRNs' qualifications and roles (as organizations in the United States run "NP week" events and public service announcements). Sharing research findings (even pilot data) supporting the high quality of APRN care can reassure patients. Media stories featuring patient and community support for APRNs can also build demands. For example, nursing professional associations in the United States often publicize patient testimonials about NP care, and co-brand alongside local health fairs. Continuing such advocacy will help the public understand the new APN roles under the Nursing Act.

Fostering interprofessional dialogue is also important. Hospital systems and clinics can model collaborative practice by integrating APRNs into physician-led teams from the start. Within the healthcare community, changing perceptions is equally important. Previously, some physician groups in South Korea resisted expanding APRNs (viewing them as competitors or assistants). However, targeting opinion leaders—especially doctors in high-need specialties (e.g., emergency and ICU physicians who see staffing crises firsthand)—can help build consensus. Training APRNs in advocacy and health policy is also recommended so that APRNs themselves become ambassadors of their roles [83]. Educational programs could include policy workshops or joint forums with physicians to demonstrate collaborative models. Success stories—such as APRNs improving care in understaffed wards—should be highlighted in medical meetings and joint conferences. Importantly, leaders (e.g., the Korean Medical Association and nursing professional associations) need to be invited to co-develop the necessary guidelines.

Conclusion

South Korea's recent medical crisis strongly supported the limits of physician-centered care in meeting 21st-century health demands. The nation stands at a pivotal moment for APRN practice. Recent legislative changes opened the door for APRNs to help mitigate healthcare provider shortages, but made it clear that this potential requires intentional actions. Strengthening the APRN workforce offers a proven path to increasing capacity and resilience. In this paper, APRN systems between the United States and South Korea were compared. The recommendations outlined in this paper are grounded in the best practices drawn from the experience in the United States. Yet, the concepts from the APRN system in the United States need to be carefully translated into Korean policy, education, and practice languages because of prominent differences in healthcare systems and cultures between the two countries. By learning from the APRN system in the United States and tailoring it to local needs, South Korea's nursing and healthcare leaders can ensure that its APRN program initiative is a successful and sustainable endeavor, ultimately making significant positive impacts on the nation's health.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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산욕기 산모를 위한 통합형 건강관리 프로그램의 효과: 비무작위 대조군 실험연구

황은숙[1], 노주희[2]

[1]전북대학교 간호대학, [2]전북대학교 간호대학 · 간호과학연구소

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Corresponding author:
Ju-Hee Nho
College of Nursing, Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, Jeonju 54896, Korea
E-mail: jhnho@jbnu.ac.kr

Effects of an integrated healthcare program for postpartum women: a quasi-experimental study

Eun Suk Hwang[1], Ju-Hee Nho[2]

[1]College of Nursing, Jeonbuk National University, Jeonju, Korea
[2]College of Nursing, Research Institute of Nursing Science, Jeonbuk National University, Jeonju, Korea

Purpose: This study aimed to develop and evaluate an integrated healthcare program for postpartum mothers based on Cox's interaction model of client health behavior.
Methods: A non-equivalent control group pretest-posttest design was used. The integrated healthcare program was administered 6 times over 2 weeks to postpartum mothers in the experimental group (n=21), while the control group (n=23) received standard care. Data were collected from June 3 to July 15, 2024, through structured questionnaires measuring postpartum fatigue, depression, marital intimacy, and mother-infant attachment. Analyses were conducted using IBM SPSS ver. 23.0.
Results: The experimental group showed significantly lower postpartum fatigue (Z=–2.00, p=.023), a significantly proportion of improvement in postpartum depression (χ^2=10.32, p=.012), and a significant increase in mother-infant attachment (t=1.70, p=.048) compared to the control group. However, there was no significant difference in marital intimacy between groups (Z=–0.46, p=.326).
Conclusion: These results suggest that an integrated health management program including physical health, psychological stability, and relational support can be used as an effective nursing intervention to promote health in postpartum mothers. Therefore, additional research is warranted that expands and applies integrated programs for postpartum mothers in various environments in postpartum care centers and communities.

Keywords: Depression; Fatigue; Life style; Postpartum period; Program

서론

1. 연구의 필요성

산욕기는 분만 후 약 6–8주 동안 산모의 신체가 임신 전 상태로 회복되는 시기로, 이 시기의 산모는 신체적 손상 회복뿐만 아니라 심리적 변화, 환경 적응, 어머니 역할에 대한 적응이라는 복합적인 과제에 직면하게 된다[1,2]. 산후관리는 이러한 변화 속에서 산모의 신체적, 정신적 건강 회복을 도모하고, 신생아의 건강을 함께 돌보는 통합적 간호활동을 의미한다[3].

산모가 출산 후 가장 흔히 경험하는 문제 중 하나는 산후피로로, 이는 극심한 에너지 고갈감과 신체 · 정신기능 저하로 나타나며 주관적으로 인식되는 피로의 정도와 양상에 따라 다양하게 나타난다[4]. 급격한 호르몬 변화, 유즙 분비, 통증, 수면 부족 등으로 인해 피로는 더욱 악화되며, 특히 산

후 초기의 피로 수준이 높게 나타나는 것을 볼 수 있다[5,6]. 산후피로는 산후우울과도 유의한 관련성을 보여 조기 중재가 적극적으로 필요하다[7].

산후우울은 약 50%–80%의 산모가 일시적인 산후우울감(postpartum blues)을 경험하는 것에서 시작되며, 이 중 일부는 산후우울증(postpartum depression)으로 진행되기도 한다[8,9]. 산후우울증은 주로 출산 후 4주 전후에 발병하며, DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition)에 따라 주요 우울장애로 진단한다[10]. 절반 이상의 산모들이 산후우울감을 경험한바 있으며, 이 중 34.7%가 도움을 적절하게 받지 못한 것으로 보고되었다[11]. 이 결과를 통해 산후 정신건강 관리의 중재가 체계적으로 필요함을 알 수 있다.

모아애착(mother-infant attachment)은 임신 중 형성되어 출산 직후 강화되는 정서적 유대로, 어머니가 영아의 신호에 민감하게 반응하고 필요를 충족시키는 양육행동을 통해 발달한다[12,13]. 안정적인 모아애착은 아동의 정서, 인지, 사회성 발달에 긍정적 영향을 미치며, 인간발달의 핵심 요소로 간주된다[14]. 그러나 산후조리원에서는 산모와 신생아가 분리된 생활을 하는 경우가 많아 상호작용 기회가 제한되며, 이로 인해 모아애착 형성에 부정적 영향을 미칠 수 있어, 이에 대한 관심과 중재가 필요하다[15,16]. 지금까지 산욕기 산모를 대상으로 다양한 중재프로그램이 시도되었으며, 모유수유 및 신생아 돌보기 자기효능감 향상, 산후운동, 모아애착 증진 등의 접근은 긍정적인 효과를 보여왔다[17-20].

배우자와의 관계는 산모의 심리적 안정에 중요한 영향을 미치는 요인 중 하나이다. 배우자는 산모에게 있어서 가장 가까운 지지자라고 할 수 있으며, 배우자와의 높은 부부친밀도는 산후우울과 불안을 완화시키고 나아가 삶의 질을 향상시키는 중요 요인으로 작용한다[21]. 또한 배우자가 보내주는 정서적 지지와 공감은 산모의 심리적 적응을 도와주며, 부부가 함께 부모 역할에 적응하는 데에도 긍정적인 영향을 미친다[7]. 따라서 산욕기 초기부터 부부친밀도를 높일 수 있는 적극적인 중재가 필요하다고 할 수 있다.

신체활동과 영양교육을 통합한 접근은 건강위험 요인을 감소시키는 기본적인 중재로, 이를 통합하여 제공하는 것이 효과적임을 제시하고 있다[22]. 그러나 영양교육에 대한 중재연구는 주로 임산부를 대상으로 진행되었고[23], 산욕기 산모를 대상으로 한 영양교육 연구는 부족한 실정이다. 또한 대부분의 연구는 단편적이거나 한두 가지 요소에 초점을 맞춰 진행되었다. Cox [24]의 대상자 건강행위 상호작용모델(interaction model of client health behavior)은 대상자와 전문가 간의 상호작용을 통하여 전문가가 대상자의 건강행위를 확인하며 건강정보 제공 시 교육자, 상담자, 정보제공자로서의 중재를 제공하여 긍정적인 건강행위를 유도하는 배경적 이론이다. 국내에서는 과체중 및 비만 임부에게 Cox의 대상자 건강행위 상호작용모델을 적용한 프로그램이 임부의 적정체중 증가, 피로 및 임신스트레스 증가를 억제하는 데 효과가 있는 것으로 보고되었다[23]. 국외에서는 Wagner 등[25]이 Cox 모델을 기반으로 자가관리 기술과 영아 돌봄 기술을 산모의 요구에 맞추어 제공한 결과, 관리 만족도와 교육효과에서 유의한 차이를 확인한 바 있다. 산욕기 산모는 신체적 회복뿐만 아니라 정서적 안정, 부부 및 모아 관계의 재조정이 필요한 시기로, 포괄적이고 통합적인 접근이 필요한 시기이다. 특히 Cox의 대상자 건강행위 상호작용모델은 단순한 건강정보 전달을 넘어서, 정서적 지지와 의사결정 참여, 관계적 상호작용을 통한 내적 동기화 과정을 중요시함으로, 산욕기 산모처럼 신체적, 심리적, 관계적 조절을 돕는 데 적용할 수 있는 적합한 모델이다. 그러나 기존에 진행된 연구는 주로 임부의 신체적 자기관리 또는 산모의 신체적 자가관리 측면과 신생아 관리에만 초점을 맞추고 있다[23,25]. 이에 본 연구에서는 Cox 모델의 대상자와 전문가 간의 상호작용을 통한 정서적 지지, 건강정보 제공, 의사결정 통제 및 전문가적/기술역량 제공을 구성요소로 하여, 신체적 건강(영양교육, 신체활동, 산후관리), 심리적 안정(스트레스 관리)뿐 아니라, 관계적 지지(모아관계 및 배우자 지지)를 포괄하는 통합형 건강관리 프로그램을 통해 산모의 건강에 직접적 효과를 미치는 산후피로, 산후우울 및 모아애착과 간접적 효과를 미치는 부부친밀도에 대한 효과를 확인하여 산욕기 산모의 건강증진과 간호중재 개발에 기여하고자 한다.

2. 연구목적

본 연구의 목적은 산욕기 산모의 건강증진을 위하여 통합형 건강관리 프로그램을 개발 · 적용하고, 그 효과를 주효과 변수인 산후피로, 산후우울, 모아애착과 부효과 변수인 부부친밀도를 통해 평가하는 것이다.

3. 연구가설

1) 주효과 가설

가설 1. 통합형 건강관리 프로그램에 참여한 실험군은 대조군보다 산후피로가 더 감소될 것이다

가설 2. 통합형 건강관리 프로그램에 참여한 실험군은 대조군보다 산후우울 정도가 더 낮아질 것이다.

부가설 2-1) 통합형 건강관리 프로그램에 참여한 실험군은 대조군보다 산후우울 점수가 더 낮아질 것이다.

부가설 2-2) 통합형 건강관리 프로그램에 참여한 실험군은 대조군보다 산후우울군의 호전 비율이 더 높을 것이다.

가설 3. 통합형 건강관리 프로그램에 참여한 실험군은 대조군보다 모아애착이 더 향상될 것이다.

2) 부효과 가설

가설 4. 통합형 건강관리 프로그램에 참여한 실험군은 대조군보다 부부친밀도가 더 향상될 것이다

방법

1. 연구설계

본 연구는 산욕기 산모를 대상으로 Cox [24]의 대상자 건강행위 상호작용 모델을 기반으로 한 통합형 건강관리 프로그램을 개발하고, 그 효과를 검증하기 위한 비동등성 대조군 전 · 후 유사 실험설계(non-equivalent control group pretest-posttest design)이다.

2. 연구대상

본 연구의 대상자는 출산 후 6주까지의 산욕기 산모로 산후조리원에 입소한 산모 중 연구목적을 이해하고 서면 동의한 자를 편의표집 방법을 통해 모집하였다. 자연분만 산모는 출산 후 3일째, 제왕절개 산모는 출산 후 5일째 입소한 자로, 산후조리원에 2주 이상 머무를 예정인 산모를 포함하였다. 실험군과 대조군 간 중재의 확산 및 오염 방지를 위해, 총 2개의 산후조리원을 선정하였다. 두 기관은 시설규모, 서비스 내용, 지역적 특성이 유사하도록 고려하였으며, 한 기관은 실험군, 다른 한 기관은 대조군으로 배정하였다. 이후 각 조리원에 입소하는 산모 중 선정기준에 부합하고 참여에 동의한 자를 입소 순서에 따라 대상자 연령, 분만방법(자연분만/제왕절개) 등을 고려한 층화 배정을 하여 군 간 주요 변수의 균형을 확보하고자 하였다. 구체적인 대상자 선정기준은 (1) 재태기간이 37주 이상 42주 미만이고 정상 신생아를 분만한 여성, (2) 임신 중 합병증이 없는 경우, (3) 배우자가 있는 여성, (4) 신체활동과 의사소통이 가능한 여성을 선정하였다. 제외기준은 (1) 산후우울과 관련이 있는 갑상선질환이나 우울증 병력이 있는 경우, (2) 정신과 질환을 진단받고 치료 중인 경우, (3) 신생아 집중치료실에 입원, 치료 중인 경우이다.

본 연구의 표본크기는 G*Power ver. 3.1.9.2 프로그램(Heinrich-Heine-Universität Düsseldorf)을 이용하여 산출하였다[26]. 산욕기 산모를 대상으로 산후피로와 산후우울[27], 모아애착[28], 부부친밀도[29]를 주요 결과변수로 설정한 선행 중재연구들에서 효과크기(d)는 산후피로 0.92–1.84, 산후우울 3.21, 모아애착 1.20, 부부친밀도 0.87로 보고되었으며, 이를 근거로 본 연구에서는 효과크기(d) .80, 유의수준(α) .05, 검정력(1-β)은 .80을 기준으로 계산하였을 때, 최소 표본 수는 그룹당 21명으로 총 42명이 산출되었다. 본 연구에서는 프로그램의 탈락률 약 10%를 고려하여 실험군 대조군 각 23명씩 총 46명을 모집하였다. 1회기 프로그램 진행 중 개인적 사유로 연구참여를 중단한 실험군 2명을 제외하고, 최종적으로 실험군 21명과 대조군 23명이 참여하여 총 44명이 분석에 포함되었다(Figure 1).

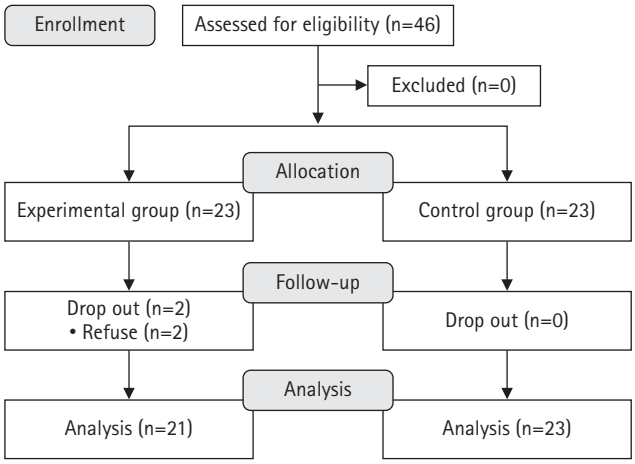

Figure 1. Flow chart of the participants' enrollment.

3. 연구도구

1) 일반적 및 산과적 특성

일반적 및 산과적 특성은 나이, 학력, 직업, 종교, 수입 정도, 임신 횟수, 분만횟수, 분만형태, 자녀성별, 양육 도우미의 유무의 총 10개 항목으로 구성하였다.

2) 산후피로

산후피로는 Yoshitake [30]가 개발하고 Pugh와 Milligan [31]이 수정 · 보완한 Fatigue Continuum Form을 Song [32]이 번역한 한국어판 도구를 사용 승인을 받은 후 사용하였다. 이 도구는 총 30문항으로서 '전혀 그렇지 않다' 1점에서부터 '항상 그렇다' 4점까지의 4점 Likert 척도로, 최저 30점에서 최고 120점으로 점수가 높을수록 피로도가 높음을 의미한다. Pugh와 Milligan [31]의 연구에서는 Cronbach's α는 .83, Song 등[32]의 연구에서는 Cronbach's α는 .92이며, 본 연구에서 Cronbach's α는 .92였다.

3) 산후우울

산후우울은 Cox 등[33]이 개발한 Edinburgh Postnatal Depression Scale (EPDS)을 Kim [34] 이 번안한 EPDS-K를 사용 승인을 받은 후 사용하였다. 이 도구는 총 10문항으로 된 4점 Likert 척도로, 최저 0점에서부터 최고 30점까지로 점수가 높을수록 우울 정도가 높음을 의미한다. EPDS-K의 문항 중 3, 5, 6, 7, 8, 9, 10번은 역산 처리하였다. EPDS의 절단점(cut off score)은 10점 미만은 비우울군, 10–12점은 경도우울군, 13점 이상은 중증우울군을 의미한다[33,34]. 개발 당시 Cox 등[33]의 연구에서는 Cronbach's α는 .89, Kim [34]의 연구에서는 Cronbach's α는 .84이며, 본 연구에서 Cronbach's α는 .82였다.

4) 모아애착

모아애착은 Condon과 Corkindale [35]이 개발한 Maternal Postpartum Attachment Scale (MPAS)을 Kim과 Tak [36]이 번안한 MPAS-K를 사용 승인을 받은 후 사용하였다. 총 14문항으로 구성되어 있고, 문항별로 2–5점으로 평가하는 Likert 척도로 되어있다. 2점 척도의 경우 1, 5점, 3점 척도는 1, 3, 5점, 4점 척도는 1, 2.3, 3.6, 5점으로 재코딩하여 모든 문항에 동일한 가중치를 부과하여 측정하도록 권고되어[35,36], 본 연구에서도 해당 방법으로 측정하였다. 총 점수범위는 14–70점이며, 총점이 낮을수록 애착 혹은 유대 장애가 있고, 총점이 높을수록 산후 모아애착 발달이 긍정적인 것을 의미한다. 개발 당시 Condon과 Corkindale [35]의 연구에서 Cronbach's α는 .78, Kim과 Tak [36]의 연구에서 Cronbach's α는 .80이며, 본 연구에서 Cronbach's α는 .85였다.

5) 부부친밀도

부부친밀도는 Lee [37]가 개발한 15문항의 척도를 사용하였다. 본 도구는 인지, 정서, 성 영역 각 5문항으로 구성되며, '전혀 그렇지 않다' 1점에서부터 '매우 그렇다' 5점까지의 5점 Likert 척도를 사용하였다. 최저 15점에서부터 최고 75점까지로 점수가 높을수록 부부친밀도가 높음을 의미한다. 문항 중 2, 9, 14번은 역산 처리하였다. 도구의 개발 당시 Cronbach's α는 .90이며[37], 본 연구에서 Cronbach's α는 .82였다. 도구 사용 전 도구 사용에 대한 승인을 받았다.

4. 연구 진행절차

1) 통합형 건강관리 프로그램 개발

본 프로그램은 ADDIE (analysis, design, development, implementation, evaluation) 교수설계모형에 따라 개발되었다. 분석단계에서는 문헌고찰과 함께 분만 경험이 있는 여성 10명과 전문가 6인을 대상으로 프로그램 제공 시 정보에 대한 요구도조사를 실시하였다. 그 결과, 산욕기 산모들은 체중관리, 규칙적인 운동, 식이조절의 중요성을 인식하고 있었으나, 산후피로, 우울감, 스트레스 등으로 인해 실제적인 건강관리에 어려움 겪고 있음을 나타냈다. 또한 산후 신체활동, 영양관리와 정서적 지지 및 산욕기 간호로 신생아 측면과 산모 측면에서 관리방법에 대한 정보 제공의 필요성을 제시하였다.

설계단계에서는 문헌고찰과 요구도 분석결과를 기반으로 회차별 주제를 설정하고, 프로그램의 틀을 구성하여 소요시간과 방법을 결정하였다. 전체 프로그램은 총 6회기로, 1회 40분, 개별교육 4회기와 집단교육 2회기로 구성하였다. 회기별 주제는 영양관리, 신체활동, 스트레스관리, 산욕기관리로 설정하였으며, 각 주제에 내에는 산모의 간호요구를 반영하여 전체적으로 구조화한 프로그램 초안을 작성하였다.

개발단계에서는 산욕기 산모를 위한 통합형 건강관리 프로그램은 Cox의 대상자 건강행위 상호작용 모델기반으로 선행연구와 산모와 전문가 요구도를 근거로 구성하였다[23–25]. 대상자 고유요소로는 인구학적 특성(나이, 출산력), 사회적 영향(교육수준, 직업), 건강관리 경험(임신 중 합병증), 환경적 자원(수입), 내적 동기화, 인지적 각성, 정서적 반응 등이 포함된다. 대상자–전문가 상호작용 요소는 정서적 지지, 건강정보 제공, 의사결정 통제와 전문가적/기술역량으로 구성된다. 정서적 지지에는 대상자의 의견 경청, 칭찬, 격려를 하는 내용이 포함되고, 건강정보 제공에는 영양, 신체활동, 스트레스관리, 산욕기 간호(산모 측면, 신생아 측면), 배우자 참여지지에 대한 정보가 포함된다. 의사결정 통제에는 전화, 문자, social network service (SNS)를 통해 대상자의 의사결정을 지지하였고, 전문가적/기술역량에는 전문가인 연구자가 대상자에게 영양, 신체활동, 스트레스관리 및 산욕기 간호에 대한 상담을 하는 내용이 포함된다. 건강산출 요소는 산후피로, 산후우울, 부부친밀도, 모아애착으로 설정하였다(Supplementary Figure 1). 산욕기 산모와 임부를 대상으로 한 선행연구의 중재기간은 2주에서 4주[38–40], 회기는 4회기에서 8회기[29,38]로 다양했다. 본 연구의 중재는 산후조리원에 입소해 있는 기간을 고려하여 1회 40분씩 2주간 개별교육 4회와 집단교육 2회로 총 6회기 전문가와 상호작용하는 프로그램으로 개발하였다. 프로그램의 구성, 형식 및 내용에 대해 근무경력 10년 이상이 된 산부인과 간호사 2인, 산후조리원 간호사 1인, 보건소 모자보건팀 간호사 1인, 간호학 교수 2인의 전문가 자문을 거쳐 확정하였다(Table 1).

2) 실험군과 대조군 배정 및 사전조사

본 연구는 2024년 6월 3일부터 2024년 7월 15일까지 전주시 소재 H 산후조리원과 S 산후조리원, 총 2개 기관의 관리자에게 연구 허락을 받은 후, 연구방법, 진행과정과 연구자 연락처 등이 포함된 연구 공고문을 게시하고 연구에 참여하기를 동의한 자로 대상자를 모집하였다. 연구참여에 동의한 산모는 연구자가 선정기준과 특성을 고려하여 기관별로 실험군과 대조군으로 배정하였다. 사전조사는 양 군 모두 병원에서 퇴원하여 조리원에 입소한 당일에 실시하였으며, 연구자가 연구목적과 절차를 설명하고 서면 동의를 받은 후, 일반적 및 산과적 특성, 산후피로, 산후우울, 모아애착, 부부친밀도를 포함한 설문지를 자기기입식으로 작성하도록 하였고, 응답시간은 약 20분 정도 소요되었다.

3) 통합형 건강관리 프로그램 적용

실행 및 평가단계에서는 실험군을 대상으로 2주간 총 6회기의 통합형 건강관리 프로그램을 적용하였다. 프로그램은 연구자와 산후요가 전문강사가 진행하였으며, 개별교육 4회와 집단교육 2회로 구성되었다. 교육주제는 영양, 신체활동, 스트레스 관리, 산욕기 및 신생아 관리였다. 중재기간 동안 연구자는 문자와 SNS를 활용하여 매일 아침 격려 메시지를 제공하고, 필요 시 전화상담을 실시하였다. 1회기 중재에서 산욕기 산모의 통합적 건강관리의 중요성을 강조하여 적극적인 참여를 격려하였다.

Table 1. Integrated healthcare program for postpartum women: contents of each session

Session	Client-Professional Interaction	Activities	Time (min)
1	Affective support	Researcher introduction, rapport building	40
		- Listening, affective support, encouragement, praise	
	Health information (individual education)	Physical activity	
		- Education on the necessity of physical activity and its advantages and disadvantages	
		- Education and demonstration of physical activity methods	
		Nutritional management	
		- Education on the need for proper diet and nutrient intake	
		- Provides diet plan and necessary nutrient intake information	
		- Training on how to write a food diary	
	Decision control	Consultation on physical activity and discomfort by phone or text	
		Consultation by phone or text regarding nutritional intake and inquiries	
	Professional/technical competencies	Check and feedback on physical discomfort	
		Check and provide feedback on nutritional intake status	
2	Affective support	Sharing experiences and feelings about participating in the program	40
		- Listening, affective support, encouragement, praise	
	Health information (group education/individual education)	Physical activity (group)	
		- Postnatal yoga and pelvic floor exercises with experts	
		Stress management	
		- Causes, symptoms, and treatment of postpartum depression	
		- Send a supportive and encouraging text message to your spouse at least once a day	
	Decision control	Consultation on physical activity and discomfort by phone or text	
		Consultation by phone or text to check stress and depression	
	Professional/technical competencies	Check and feedback on physical discomfort	
		Identify and provide feedback on stress and depressive feelings	
3	Affective support	Sharing your physical condition and feelings and providing empathy	40
		- Listening, affective support, encouragement, praise	
	Health information (individual education)	Physical activity	
		- Postpartum yoga and pelvic floor muscle exercises	
		Postpartum care (maternal aspect)	
		- Education on physical changes in postpartum mothers and postpartum abnormalities	
		- Education on how to care for the breasts, perineum, and lochia of postpartum mothers	
	Decision control	Consultation on physical activity and discomfort by phone or text	
		Consultation by phone or text regarding discomfort due to physical changes	
	Professional/technical competencies	Check and consult on physical discomfort	
		Check and provide feedback on discomfort due to physical changes	
4	Affective support	Sharing physical condition and feelings to provide empathy	40
		- Listening, affective support, encouragement, praise	
	Health information (individual education)	Physical activity	
		- Postpartum yoga and pelvic floor muscle exercises	
		Nutritional management	
		- Check the eating habits and meal diary of postpartum mothers	
		- Check the intake and provide education	
	Decision control	Consultation on physical activity and discomfort by phone or text	
		Consultation on nutritional intake and inquiries by phone or text	
	Professional/technical competencies	Check and feedback on physical discomfort	
		Check and provide feedback on nutritional intake status	

(Continued on the next page)

Table 1. Continued

Session	Client-Professional Interaction	Activities	Time (min)
5	Affective support	Share your physical condition and feelings and providing empathetic	40
		- Listening, affective support, encouragement, praise	
	Health information (group education/individual education)	Physical activity	
		- Postnatal yoga and pelvic floor exercises	
		Stress management (group)	
		- Send a text message of praise and encouragement to your spouse at least once a day	
		- Participate in making a topiary mini pot	
	Decision control	Consultation on physical activity and discomfort by phone or text	
		Consultation on nutritional intake and inquiries by phone or text	
	Professional/technical competencies	Check and feedback on physical discomfort	
		Identify and provide feedback on stress and depressive feelings	
6	Affective support	Share your physical condition and feelings and providing empathetic	40
		- Listening, affective support, encouragement, praise	
	Health information (individual education)	Physical activity	
		- Postnatal yoga and pelvic floor exercise	
		Postpartum care (newborn aspect)	
		- Education on how to deal with newborn health problems (including bathing and umbilical cord care)	
		- Education to promote mother-infant attachment	
	Decision control	Consultation on physical activity and discomfort by phone or text	
		Consultation by phone or text on how to manage the health of your newborn	
	Professional/technical competencies	Check and feedback on physical discomfort	
		Check and consult on newborn health management methods	

영양교육은 1, 4회기 총 2회에 걸쳐 1회당 20분 동안 개별교육을 진행하였다. 교육내용은 산욕기 산모의 적절한 식이와 영양소 섭취의 필요성, 식단표와 식생활 지침, 모유수유 시 식사방법을 포함하였다. 주의사항으로는 알레르기 음식과 질기거나 딱딱한 음식 섭취 금지 등의 정보를 제공하였다. 특히 2주차 4회기에는 산모의 식습관 및 식사일기를 확인하여 영양 관련 피드백을 제공하여 개인에게 맞는 맞춤형 식생활을 할 수 있도록 하였다. 교육 후에도 산모의 궁금한 것을 질문받고, 적절한 영양분 섭취 및 올바른 식습관을 실천할 수 있도록 동기부여하고 상담을 통해 상호작용을 하였다.

신체활동은 산후요가 전문가가 산욕기 산모의 적정 신체활동의 필요성과 효과 그리고 골반저근 운동과 산후운동 방법을 포함한 산후요가 교육을 산후조리원에 입소해 있는 기간을 고려하여 2주 동안 주 3회, 20분으로 총 6회기로 실시하였다. 신종 코로나바이러스 감염증(코로나19) 이후 아직도 감염위험의 이유로 외부인의 출입을 제한하고 있으므로 산후요가는 전문 강사가 주 1회 수요일 10시 5층 산후운동실에서 집단교육으로 진행하였고, 연구자는 주 2회 산후요가 전문가에게 자문 받은 내용과 영상을 통해 개별 진행하고, 산후운동으로 인한 불편함 및 신체적 변화가 있는지를 확인하고 상담하였다. 또한 산욕기 산모가 혼자서도 시행할 수 있도록 회기에 진행한 산후요가를 동영상으로 촬영하여 대상자들과 공유 및 격려하였다.

스트레스 관리는 2, 5회기 총 2회에 걸쳐 진행하였다. 교육내용으로 산후우울의 원인과 증상 및 대처방법, 배우자 지지 및 토피어리 화분 만들기 프로그램을 20분씩 실시하였다. 2회기에는 개별교육으로 산모의 산후우울을 파악하고 경험 및 느낌을 나누며, 출산 직후 호르몬의 변화로 인한 산후우울의 원인과 증상에 대해서 알아보았다. 또한 배우자와 함께 하루에 1번 이상 칭찬 및 격려 문자를 보내게 함으로써 배우자로 지지를 제공받고 느낄 수 있도록 하였다. 5회기 교육은 목요일 오후 2시에 6층 세미나실에서 집단교육 형식으로 진행되었으며, 토피어리 미니화분 만들기를 주제로 구성하였다. 본 활동은 산모의 우울감을 긍정적으로 전환하고 스트레스를 완화하는 데 효과가 있는 것으로 알려져 있으며[41], 산욕기 산모들이 서로의 감정과 상태를 나누며 상호 소통할 수 있는 기회를 제공하였다. 이후에도 문자 및 SNS를 활용하여 산모들의 스트레스 요인과 감정 변화에 대해 지속적인 상담과 지지가 이루어지도록 상호작용을 유지하였다.

산욕기 관리는 총 2회에 걸쳐 20분씩 개별교육을 진행하였다. 산모 관리 측면에서 3회기 교육은 산욕기 산모의 신체 변화 및 이상 반응에 대한 이해를 증진하고, 유방, 회음부, 오로 관리 방법 등을 포함한 자가관리 방법을 중심으로 구성하였다. 또한 산모의 신체적 변화에 따른 불편감을 듣거나 관찰을 통해 파악하고, 이에 대해 적절한 상담을 제공하였다. 문자와 SNS를 활용하여 산모의 신체 불편감과 통증상태를 지속적으로 확인하고, 자가관리 할 수 있도록 상담과 동기부여를 지속하였다. 신생아 관리 측면에서 6회기 교육은 교육요구도가 높았던 신생아 목욕, 모유수유 방법, 제대관리 방법 등을 중심으로 이루어졌다. 이외에도 딸꾹질, 위식도 역류, 발열, 배변문제, 신

생아 황달, 청색증, 이상행동 등 신생아의 일반적인 건강문제에 대한 대처방법을 안내하였으며, 모아애착 증진에 초점을 두고 교육을 구성하였다. 모아애착 형성은 도입–사귐–상호조절의 3단계로 구성되었다. 도입 단계에서는 손가락–손바닥–팔을 통해 아기를 만지고, 얼굴을 마주하며 눈을 맞추고 말하는 자세 및 감각적 접촉(시각, 촉각, 청각)을 통해 상호작용을 시작하였다. 사귐 단계에서는 아기의 외모나 행동에서 닮은 점을 인식하고 이를 자신과 연결시키며, 아기의 행동을 주변 사람과 연결하여 사회적 관계망을 형성하고 고유한 행동에 의미를 부여하였다. 마지막 상호조절 단계에서는 모유수유, 목욕, 기저귀 갈이 등을 통해 아기의 요구에 민감하게 반응하며 정서적 돌봄을 실천하고, 아기를 독립된 존재로 인식하고 수용한다. 이 과정은 아기와의 상호유희를 격려하고, 고유성에 대한 존중을 통해 모아애착을 증진하는 데 목적을 두었다. 신생아 건강관리와 관련된 문의사항이나 어려움에 대해서는 문자 및 SNS를 통해 상담과 피드백이 이루어졌다.

프로그램이 진행되는 연구의 특성상 대상자와 연구자 모두에게 눈가림을 적용할 수 없었다. 그러나 프로그램 제공 시 개입의 객관성과 중재효과의 신뢰성을 유지하고자 중립적인 태도를 유지하며, 모든 참여자에게 동일한 방식과 언어로 교육 및 피드백을 제공하는 표준화된 절차를 준수하여 연구의 타당도를 높이기 위해 노력하였다.

4) 대조군 관리

대조군은 산후조리원에서 제공되는 일반적인 산욕기 간호인 신생아 목욕, 모유수유, 신생아 응급처치에 관한 정보 등을 제공받았다.

5) 실험군과 대조군 사후조사

실험군은 프로그램 종료된 후 마지막 회차 효과를 고려하여 중재 종료 2일 후에 시행하였으며, 대조군은 사전조사를 시행한 날로부터 2주 후에 진행하였다.

5. 연구의 윤리적 고려

본 연구는 전북대학교 연구윤리위원회(Institutional Review Board [IRB])의 승인(IRB no., JBNU 2024-04-033-001)을 받고 진행하였으며, 임상연구정보서비스(Clinical Research Information Service, CRIS No. KCT0009901)에 등록되었다. 대상자 모집 시 본 연구에 대한 목적, 내용, 사생활보장, 중도포기 가능성 및 연구자료 분석 시 익명성에 대해 설명한 후 자발적인 서면 동의를 받았다. 연구참여 도중 언제든지 참여를 철회할 수 있음을 알려주었고, 연구과정 동안 어떠한 불이익도 받지 않음을 설명하였다. 수집된 자료는 부호화와 익명 처리하였고 연구목적으로만 사용함을 제시하였다. 대조군에게는 설문지 회수 후 중재를 원하는 대상자에게 실험군에게 제공된 프로그램의 내용을 축약하여 1회의 중재로 제공하였다.

6. 자료 분석방법

본 연구의 자료 분석은 IBM SPSS WIN ver. 23.0 프로그램(IBM Corp.)을 이용하여 분석하였다. 실험군과 대조군의 동질성 검증을 위해 χ^2 test, independent t-test를 통해 사전 동질성 검증을 하였다. 자료의 정규성 검정은 Shapiro-Wilk test로 하였으며, 연구대상자의 일반적 특성 및 산과적 특성은 서술적 통계를 하였다. 종속변수 측정도구들은 신뢰도 검정을 위해 Cronbach's α 계수를 각각 산출하였고, 종속변수의 등분산 가정은 Levene의 등분산 검정으로 하였다. 실험군과 대조군의 중재효과를 비교하기 위해 사전-사후 조사 차이값에 대해 정규성과 사전 동질성을 모두 만족한 변수(모아애착)는 independent t-test를 시행하였고, 정규성 분포를 하지 않은 변수(산후피로, 부부친밀도)에 대해서는 Mann-Whitney U test를, 정규성과 사전 동질성을 모두 만족하지 않은 변수(산후우울)에 대해서는 공변량 처리하여 ranked analysis of covariance (ANCOVA)를 시행하였다. 집단별 차이에 따른 변수(산후우울 점수의 절단점에 따른 분류)는 기대빈도가 5 미만인 셀이 전체 셀의 20%를 초과하여 Fisher's exact test를 실시하였다. 유의수준은 .05 이하로 하였다.

결과

1. 대상자의 일반적 특성 및 산과적 특성과 사전 종속변수의 동질성 검정

본 연구대상자의 일반적 및 산과적 특성에 대한 동질성 검정한 결과, 실험군과 대조군 간 평균연령은 32.4±2.08세, 31.9±2.60세였다. 총 임신 횟수에서 첫 임신인 산모는 실험군 16명(76.2%), 대조군 15명(65.2%)이었으며, 분만형태는 제왕절개가 실험군 11명(52.4%), 대조군 15명(65.2%)으로 나타났다. 각 변수에 대해 통계적으로 유의한 차이가 없어 두 집단은 일반적 및 산과적 특성에서 동질하였다. 사전 종속변수에 대한 동질성 검정결과, 산후피로, 부부친밀도, 모아애착에서 두 집단 간 유의한 차이가 없어 동질하였다. 그러나 산후우울 점수에서는 두 집단 간 통계적으로 유의한 차이가 나타나 동질하지 않은 것으로 확인되어, 공변량 처리하였다. 한편, 산후우울의 절단점 기준(10점 미만, 10–12점, 13점 이상)에 따른 군 간 분포는 유의한 차이를 보이지 않아 동질하였다(Table 2).

2. 가설검정

1) 가설 1

산후피로 점수의 중재 전후 차이 값에 대해 Mann-Whitney U test를 이용하여 분석한 결과, 실험군의 중위수와 사분위 범위(interquartile range, IQR)는 −5.00점(IQR, 7.00), 대조군은 −1.00점(IQR, 17.00)으로 두 집단 간 유의한 차이가 있어(Z=−2.00 p=.023),

Table 2. Homogeneity of baseline characteristics (N=44)

Characteristic	Exp. (n=21)	Cont. (n=23)	χ^2 or t or Z	*p*
Age range (yr)			1.15	.587[a]
≤30	7 (33.3)	7 (30.4)		
31–34	8 (38.1)	12 (52.2)		
≥35	6 (28.6)	4 (17.4)		
Mean age (yr)	32.4±2.08	31.9±2.60	−0.63	.533
Educational level			0.24	.622
≤College graduate	5 (23.8)	7 (30.4)		
≥University graduate	16 (76.2)	16 (69.6)		
Religion			0.16	.761
Yes	7 (33.3)	9 (39.1)		
No	14 (66.7)	14 (60.9)		
Occupation			0.05	>.999
Yes	13 (61.9)	15 (65.2)		
No	8 (38.1)	8 (34.8)		
Family income (10,000 won/mo)			2.17	.394[a]
<300	7 (33.3)	5 (21.7)		
300–<500	12 (57.1)	12 (52.2)		
≥500	2 (9.5)	6 (26.1)		
No. of pregnancy			0.64	.426
First	16 (76.2)	15 (65.2)		
≥Second	5 (23.8)[b]	8 (34.7)[b]		
No. of delivery			0.76	.384
First	17 (81.0)	16 (69.6)		
≥Second	4 (19.0)	7 (30.4)		
Type of birth			0.74	.541
Virginal birth	10 (47.6)	8 (34.8)		
Cesarean section	11 (52.4)	15 (65.2)		
Sex of newborn			0.13	.767
Boy	13 (61.9)	13 (56.5)		
Girl	8 (38.1)	10 (43.5)		
Planning childcare assistance			0.78	.545
Yes	10 (47.6)	14 (60.9)		
No	11 (52.4)	9 (39.1)		
Postpartum fatigue: 30–120	62.00±12.74	54.52±11.91	−2.01	.051
Postpartum depression: 0–30	9.95±4.87	7.13±4.81	150	.031[c]
Postpartum depression			4.03	.156[a]
Normal: <10	11 (52.4)	17 (73.9)		
Mild depression: 10–12	3 (14.3)	4 (17.4)		
Severe depression: ≥13	7 (33.3)	2 (8.7)		
Marital intimacy: 15–75	59.81±6.87	62.65±5.87	1.48	.147
Mother-infant attachment: 14–70	53.73±9.65	57.82±6.27	170.5	.095[c]

Values are presented as number (%) or mean±standard deviation.
Cont., control group; Exp., Experimental group; No., number.
[a]By Fisher's exact probability test. [b]Each group included one mother with a history of one spontaneous abortion. [c]By Mann-Whitney U test.

가설 1은 지지되었다(Table 3).

2) 가설 2

(1) 부가설 2-1

산후우울 점수의 중재 전후 차이 값에 대해 ranked ANCOVA를 이용하여 분석한 결과, 실험군 −2.43±4.49점, 대조군 −0.17±2.81점으로 두 집단 간 유의한 차이가 없어(F=0.79, *p*=.380), 부가설 2-1은 기각되었다(Table 3).

(2) 부가설 2-2

중재 전후 산후우울 점수의 절단점에 따라 세 군(비우울, 경도우울, 중증우울)으로 분류하였을 때, 호전된 산모는 실험군 9명(42.9%), 대조군 2명(8.7%)으로 나타났다. 두 집단 간 비율 차이는 통계적으로 유의한 차이가 있어(Fisher exact test, *p*=.012), 부가설 2-2는 지지되었다(Table 4).

Table 3. Effectiveness of the integrated healthcare program intervention (N=44)

Variable	Pre		Post		Difference		t or F or Z	p
	Median (IQR)	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)	Mean±SD		
Postpartum fatigue							−2.00	.023[a]
Exp.	62.00 (12.50)	62.00±12.74	56.00 (12.00)	55.38±9.01	−5.00 (7.00)	−6.62±11.03		
Cont.	51.00 (17.00)	54.52±11.91	50.00 (17.00)	53.48±12.34	−1.00 (17.00)	−1.04±11.81		
Postpartum depression							0.79	.380[b]
Exp.	9.00 (6.50)	9.95±4.87	7.00 (5.00)	7.52±3.49	−2.00 (5.50)	−2.43±4.49		
Cont.	6.00 (6.00)	7.13±4.80	6.00 (5.00)	6.96±3.84	0.00 (2.00)	−0.17±2.81		
Marital intimacy							−0.46	.326[a]
Exp.	59.00 (10.50)	59.81±6.87	59.00 (12.00)	59.71±7.42	0.00 (4.50)	−0.10±3.32		
Cont.	51.00 (17.00)	62.65±5.87	62.00 (9.00)	61.65±6.25	1.00 (5.00)	−1.00±3.63		
Mother-infant attachment							1.70	.048[c]
Exp.		53.73±9.65		57.04±6.72		3.31±4.99		
Cont.		57.82±6.27		58.44±5.38		0.62±5.49		

Cont., control group (n=23); Exp., experimental group (n=21); IQR, interquartile range; SD, standard deviation.
[a]By Mann-Whitney U test. [b]By ranked analysis of covariance. [c]By independent t-test.

Table 4. Comparison of changes in postpartum depression status between groups (N=44)

Variable	Difference					p
	−2	−1	0	1	2	
Postpartum depression						.012[a]
Exp.	4 (19.0)	5 (23.8)	9 (42.9)	2 (9.5)	1 (4.8)	
Cont.	0 (0.0)	2 (8.7)	20 (87.0)	1 (4.3)	0 (0.0)	

Values are presented as number (%). −2: from severe depression to normal; −1: from severe depression to mild depression or from mild depression to normal; 0: no change; 1: from normal to mild depression or from mild depression to severe depression; 2: from normal to severe depression.
Cont., control group (n=23); Exp., experimental group (n=21).
[a]By Fisher's exact probability test.

3) 가설 3

모아애착 점수의 중재 전후 차이 값에 대해 independent t-test를 이용하여 분석한 결과, 실험군 3.31±4.99점, 대조군 0.62±5.49점으로 유의한 차이가 있어(t=1.70, p=.048), 가설 3은 지지되었다(Table 3).

4) 가설 4

부부친밀도 점수의 중재 전후 차이 값에 대해 Mann-Whitney U test를 이용하여 분석한 결과, 실험군의 중위수와 사분위 범위는 0.00점(IQR, 4.50), 대조군은 1.00점(IQR, 5.00)으로 두 집단 간 유의한 차이가 없어(Z=−0.46, p=.326), 가설 4는 기각되었다(Table 3).

고찰

본 연구는 Cox [24]의 대상자 건강행위 상호작용 모델을 기틀로 산욕기 산모를 위한 통합적 건강관리 프로그램을 개발하고 적용하여 그 효과를 검증하였다. 프로그램 적용결과, 실험군의 산후피로가 유의하게 감소하였으며, 산후우울 호전 비율과 모아애착 수준이 증가하여 산모의 건강증진에 효과가 있음을 확인하였다. 현재까지 산욕기 산모를 대상으로 한 통합형 건강관리 프로그램 중재는 제한적이었으나, 본 연구는 산욕기 산모의 신체적, 심리적, 관계적 측면에서의 다양한 문제를 해결하는 데 도움을 주고 산모의 건강을 증진시키기 위해 적용할 수 있는 중재 중의 하나임을 확인할 수 있었다.

본 연구의 통합형 건강관리 프로그램을 적용한 결과, 실험군의 산후피로의 점수는 프로그램 중재 전 중위수와 사분위 범위는 62.00점(12.50)에서 중재 후 56.00점(12.00)으로 감소하여 통계적으로 유의한 차이를 보였다. 이 결과는 통합형 건강관리 프로그램이 신체적 회복을 촉진하였으며, 피로 유발의 다양한 요인을 통합적으로 중재한 결과로 해석된다. 산후피로는 단순한 육체적 피로로 생각하지 않고 수면의 질과 정서적 스트레스, 영양상태, 육아부담 등 여러 가지 다양한 요인이 복합적으로 작용하는 다차원적 개념으로 이해하여야 한다[4,42]. 그렇다면 신체활동과 영양관리 그리고 정서적 지지 등이 포함된 통합적 중재가 효과적인 관리전략이 될 수 있다. 본 연구결과를 신체활동 측면에서 살펴보면, 산후요가는 순환 개선과 산욕기 시기의 근골격계 통증을 완화하고 이완, 촉진을 통해 산모의 신체 회복을 도왔으며, 이 결과는 임산부 요가가 산후 불편감과 통증을 완화한 기존의 연구결과와 일치한다[43]. 최근 체계적 문헌고찰 연구에서도 요가와 유산소 운동이 산모의 피로, 우울, 불안을 유의하게 감소시켰다고 보고하여[44], 본 연구결과를 지지하였다. 영양관리 측면에서, 출산 이후 에너지 대사 및 면역력 유지를 위해 단백질, 유제품, 철분,

과일, 채소 등의 균형 잡힌 섭취를 하도록 교육하였으며, 이는 출산 후 여성의 영양결핍 상태가 피로의 주요 원인으로 작용할 수 있다는 연구와 그 맥락을 같이한다[45]. 정서적 지지 측면에서 살펴본다면 SNS와 문자메시지를 활용한 상담을 통해서 산모의 고립감 및 불안감을 완화하고 자가관리 동기를 강화하도록 하였다. 이는 산욕기 산모들이 육아부담과 사회적인 고립으로 인한 피로를 겪는다는 측면에서 살펴본 의미 있는 접근으로, Hahn-Holbrook 등[46]이 보고한 바와 같이 정서적 지지가 산후 스트레스 호르몬을 조절하고 나아가 피로 감소에도 기여한다는 연구결과와 같은 맥락이라고 할 수 있다. 본 연구에서 적용한 통합형 건강관리 프로그램은 산욕기 산모의 신체적 회복뿐 아니라 정서적 안정과 건강행위 강화를 유도하여서 산후피로를 완화시키는 데 효과적으로 기여하였다. 단편적 개입에 그친 것이 아닌, 산모가 실제로 경험하는 여러 가지 문제를 통합적으로 고려하고 접근하였다는 점에서 본 프로그램이 향후 산욕기의 건강문제 관리를 위한 효과적인 중재로 활용될 가능성이 있을 것으로 생각된다.

본 연구에서 통합형 건강관리 프로그램을 적용한 결과, 실험군의 산후우울 점수는 중재 전 평균 9.95점에서 중재 후 7.52점으로 감소하였으나, 통계적으로 유의한 차이는 나타나지 않았다. 그러나 산후우울 점수의 절단점을 기준으로 비우울, 경도우울, 중증우울 세 군으로 분류했을 때, 산후우울 상태가 호전된 산모의 수는 실험군이 9명, 대조군이 2명으로 집단 간 유의한 차이를 보여, 통합형 건강관리 프로그램이 산후우울 감소에 긍정적인 영향을 미쳤음을 확인하였다.

산후우울은 출산 이후 급격한 호르몬 변화, 수면 부족, 양육 부담, 사회적 고립 등 다양한 요인에 의해 유발되는 정서적 건강문제로 알려져 있다[5-7]. 산모의 절반 이상이 산후우울감을 경험하였고, 이 중 34.7%가 적절한 도움을 받지 못한 것으로 보고되었으며[11], Gao 등[47]은 초산모에게 대인관계 중심의 심리치료를 적용하여 산후우울 감소효과를 확인하였다. 본 연구는 효과적인 지지체계를 제공할 수 있도록 선행연구를 근거로 하여 집단교육, 개별상담, 토피어리 만들기 등의 다양한 중재활동을 진행하였다. 이러한 방법들은 산후조리원에서 다른 산모들과의 신체적 · 심리적 상태 및 양육에 관한 정보 공유를 통해 정서적 안정을 경험하였다고 생각한다. 또한 연구자는 불안을 호소하는 산모들과의 개별면담을 통해 호르몬 변화에 대한 이해를 돕고 정서적 지지와 격려를 제공하였으며, 이러한 과정은 산후우울 감소에 긍정적인 영향을 준 것으로 해석된다. 본 연구에서 산후우울 점수는 사전 검사에서 실험군과 대조군 간에 통계적으로 유의한 차이를 보였다. 이는 자연분만 산모는 출산 후 3일째, 제왕절개 산모는 출산 후 5일째에 조리원에 입소하여 사전설문을 실시한 시점의 차이에 따른 영향일 가능성이 있다. 향후 연구에서는 조사시점과 분만형태를 사전에 통제하거나 분만형태에 따른 하위분석을 포함하여 산후우울에 대한 정확한 효과를 검증할 필요가 있다.

본 연구에서 통합형 건강관리 프로그램을 적용한 결과, 실험군에서 모아애착 점수는 중재 전 평균 53.78점에서 중재 후 57.04점으로 유의하게 증가하였다. 이는 산모와 신생아 간의 정서적 유대감을 강화하는 다양한 중재요소들이 효과적으로 작용했음을 시사한다고 할 수 있다. 본 연구에서는 신생아에 대한 양육기술을 산모의 실제상황에 맞추어 실질적으로 교육하고, 건강문제에 대한 대처방법을 산모들에게 개별적으로 제공하였다. 이러한 접근은 신생아 양육기술의 향상이 모아애착에 긍정적인 영향을 미친다고 보고한 연구결과와 일치한다[29]. 특히 본 프로그램은 모아애착 형성을 도입-사귐-상호조절의 3단계로 구조화하였으며, 이러한 구성은 피부 접촉이 모아애착 증진에 효과적이라고 한 연구와 그 맥락을 같이 한다[48]. Keskin과 Yagmur [49]는 배우자의 육아에 대한 참여가 산모의 모아애착 수준을 유의하게 향상시킨다고 보고한바 있으며, 본 연구에서도 배우자 지지를 유도하는 중재전략을 포함하였고, 이는 모아애착 형성에 효과적으로 기여하였다. 따라서 본 연구에서 적용한 통합형 건강관리 프로그램은 산욕기 초기 산모의 모아애착 형성에 효과적인 간호중재임을 확인하였다.

본 연구에서 통합형 건강관리 프로그램을 적용한 결과, 실험군의 부부친밀도 점수는 중재 전 중위수와 사분위 범위는 59.00점(10.50)에서 중재 후 59.00점(12.00)으로 변화가 거의 없어 통계적으로 유의한 차이가 없었다. 이와 같은 결과는 산욕기라는 시기적 특성과 외부환경 요인이 원인이라고 생각해볼 수 있다. 본 중재가 진행되었던 기간이 코로나19 이후 산후조리원 내 감염예방조치로 가족의 출입이 제한되고 배우자는 면회만 허용되는 상황이었다. 따라서 남편과의 물리적 접촉이나 상호작용 기회가 감소함으로 부부친밀도를 형성하기 어려운 환경적 상황이, 부부친밀도를 높이는 데 방해가 된 원인의 하나라고 생각해볼 수 있다. 또한 연구참여자는 출산 후 2-3주에 해당하는 산욕기 초기 산모로, 신체 회복과 심리적 안정이 충분히 확보되지 않은 상태였다. 본 연구에서도 산모들이 육아 적응과 신체 회복에 집중하는 시기였던 점이 친밀도 향상에 한계를 보인 것으로 생각된다. 남편이 함께 참여하는 산후관리 프로그램에서 부부친밀도가 유의하게 향상되었고 남편의 지지가 산모의 정서 안정에 유의한 영향을 미친다고 하여[7,29], 본 연구에서는 배우자와 하루에 1번 이상 칭찬과 격려메시지 교환으로 정서적 지지 및 교류를 유도하였으나, 산욕기라는 시기적 특성과 코로나19 이후 산후조리원의 환경적 상황이 방해요소로 작용했다고 생각한다. 향후 연구에서는 부부친밀도 향상을 위한 전략으로 부부가 함께 참여할 수 있는 비대면 소통 강화 등의 구성요소로 온 · 오프라인 혼합형 중재프로그램 개발이 필요하다고 생각된다.

본 연구의 제한점은 첫째, 연구대상자를 산후조리원에 입소한 산모를 대상으로 소규모로 편의표집 하였기에, 연구결과를 전체 산욕기 산모에게 일반화하는 데에는 제한이 있다. 둘째, 총 2주간 중재프로그램 종료 후에 그 효과를 측정하여, 이후 그 효과가 지속될 것인지에 대한 장기간의 효과를 평가하기에는 한계가 있다. 특히 산후우울은 일반적으로 출산 직후 수일 이내 시작되어 1-2주 내에 자연적으로 감소하는 경향이 있으므로[33], 단일 시점에서 평가만으로는 중재의 효과를 충분히 설명하기에 부족할 수 있다. 향후 연구에서는 1

주 간격의 반복 측정 또는 4주, 8주 등의 장기적인 추적관찰을 통한 종단적 연구를 진행하여 효과를 확인할 필요가 있다. 셋째, 실험군과 대조군은 서로 다른 산후조리원에 입소한 산모들로 구성되었으며, 두 기관은 시설규모, 서비스 내용, 지역적 특성이 유사하도록 선정되었으나, 산후조리원 간 환경 차이가 중재효과에 영향을 미쳤을 가능성을 완전히 배제할 수는 없다. 대조군의 산후조리원에서는 일반적인 산욕기 간호인 신생아 목욕, 모유수유, 신생아 응급처치에 관한 교육만 제공되었고, 본 연구에서 제공된 신체적 건강, 심리적 안정, 관계적 지지에 관한 중재는 시행되지 않았으나, 비공식적인 상호작용이나 간호사의 개인적 지지가 일부 존재했을 가능성은 있다. 따라서 향후 연구에서는 무작위 대조군 연구를 설계하고, 동일 기관 내에서 대상자를 배정할 필요가 있다.

결론

본 연구는 산욕기 산모의 산후피로와 산후우울 감소, 모아애착 및 부부친밀도 증진을 목적으로 Cox의 대상자 건강행위 상호작용모델에 기반한 통합형 건강관리 프로그램을 개발하고 그 효과를 검증하였다. 프로그램 적용한 결과, 산후피로는 감소하였고, 산후우울군이 호전되었으며, 모아애착이 향상되었다. 이러한 결과는 신체적 건강, 심리적 안정, 관계적 지지를 포함한 통합형 건강관리 프로그램이 산욕기 산모의 건강증진을 위한 효과적인 간호중재로 활용될 수 있음을 시사한다. 다만 본 연구는 산후조리원에 입소한 산모를 대상으로 소규모로 실시되었고, 분만형태에 따른 조사시점의 차이 및 기관 간 환경 차이 등 제한점이 있어 연구결과 해석에 주의가 필요하다. 그럼에도 불구하고 본 프로그램은 산후조리원뿐만 아니라 지역사회로, 특히 산후관리 사각지대에 놓이기 쉬운 결혼이주여성 또는 취약계층 산모를 위한 보건소 및 건강가정지원센터 등의 지역기관을 통한 적용 가능성이 있다. 지역사회에서는 대면교육과 온라인교육을 혼합한 방식으로 모바일 기반 온라인 교육자료 및 상담과 다국어 자료 배포 등으로 접근성을 높일 수 있다. 시간과 장소의 제약을 비대면 전략으로 병행함으로써 참여율을 향상시킬 수 있을 것이다. 향후 연구에서는 다양한 환경의 산후조리원과 지역사회에서 다양한 문화적 · 사회적 배경을 가진 산모를 포함하고, 지역사회와 연계한 프로그램으로 확대, 적용한 추가 연구를 제언한다.

Article Information

Conflicts of Interest

Ju-Hee Nho has been the Editor of *Journal of Korean Academy of Nursing* since 2022 but had no role in the review process. Except for that, no potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

Please contact the corresponding author for data availability.

Supplementary Data

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Development of a predictive model for exclusive breastfeeding at 3 months using machine learning : a secondary analysis of a cross-sectional survey

Hyun Kyoung Kim

Department of Nursing, Kongju National University, Gongju, Korea

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Corresponding author:
Hyun Kyoung Kim
Department of Nursing, Kongju National University, 56 Gongjudaehak-ro, Gongju 32588, Korea
E-mail: hkk@kongju.ac.kr

Purpose: This study aimed to develop a machine learning model to predict exclusive breastfeeding during the first 3 months after birth and to explore factors affecting breastfeeding outcomes.
Methods: Data from 2,579 participants in the Korean Early Childhood Education & Care Panel between March 1 and June 3, 2025 were analyzed using Python version 3.12.8 and Colab. The dataset was split into training and testing sets at an 80:20 ratio, and five classifiers (random forest, logistic regression, decision tree, AdaBoost, and XGBoost) were trained and evaluated using multiple performance metrics and feature importance analysis.
Results: The confusion matrix of the random forest classifier model demonstrated strong performance, with a precision of 86.6%, accuracy of 84.8%, recall of 96.8%, F1-score of 91.9%, and an area under the curve of 86.0%. Twenty-one features were analyzed, from which feeding plan, breastfeeding at 1 month, marriage period, maternal prenatal weight, self-respect, alcohol consumption, grit, value placed on children, maternal age, and depression emerged as important predictors of exclusive breastfeeding in the first 3 months.
Discussion: A robust model was developed to predict exclusive breastfeeding that identified feeding planning and breastfeeding at 1 month as the most influential predictors. The model could be implemented in clinical and community settings to guide tailored breastfeeding support strategies, coupled with the integration of maternal self-respect, grit, and the value placed on children in counseling programs to promote exclusive breastfeeding.

Keywords: Birth; Breast feeding; Machine learning; Pregnancy; Women

Introduction

Exclusive breastfeeding (EBF) is defined as receiving only breast milk—no other liquids or solids—except for oral rehydration solutions, or drops or syrups containing vitamins, minerals, or medicines, meaning that breast milk serves as the sole source of nutrition for the infant during the early postpartum period [1,2]. The Healthy People 2030 Initiative set a goal to increase the 6-month EBF rate from 27.2% (based on 2021 data) to 42.4% [2]. However, South Korea has shown persistently low and declining breastfeeding rates in recent years. The EBF rate at 3 months fell from 30.5% in 2018 to 19.3% in 2024, reflecting a significant downward trend [1].

Breastfeeding offers substantial health benefits for both infants and mothers. It provides optimal nutrition for infants, supporting healthy growth and development. Additionally, breastfeeding reduces the risk of several short- and long-term illnesses. Breastfed children have a lower risk of developing asthma, obesity, type 1 diabetes mellitus, and sudden infant death syndrome. Breastfeeding is also associated with reduced maternal risk of type 2 diabetes mellitus, hypertension, breast cancer, and ovarian cancer. Accordingly, the American Academy of Pediatrics recommends EBF for the first 3 months of an infant's life [3]. Research has underscored the im-

portance of 3 months of EBF, linking it to a reduced risk of infantile eczema up to 2 years of age, a 60% reduction in sudden infant death syndrome, and a 62% decrease in postnatal mortality. Continuing breastfeeding until 3 months also lowered the risk of ulcerative colitis and childhood obesity [3].

Key predictors of exclusive breastfeeding at 3 months include feeding intention, initial feeding practices, high breastfeeding self-efficacy, positive attitudes toward breastfeeding, low confidence in formula feeding, and fewer concerns about insufficient milk supply [4]. EBF at 3 months has also shown positive associations with breastfeeding support following hospital discharge, perceptions that formula has limited nutritional value, experiences of mastitis, return to work, and vaginal delivery [5]. Additional influential factors include prenatal intention to breastfeed, early skin-to-skin contact, EBF at hospital discharge, maternal self-efficacy, postpartum professional support, delayed introduction of formula, and supportive partner involvement [6]. Moreover, childbirth method, prenatal decisions regarding breastfeeding, breastfeeding at 1 month, and participation in prenatal parenting education programs have been identified as significant predictors [7]. This study examined features differentiating EBF status by incorporating variables identified in previous research, using Bronfenbrenner's ecological systems theory—a framework that conceptualizes the individual's environment as an interconnected ecosystem. The analysis included a range of micro- to macro-level influences, including individual, social, and institutional factors [8].

The persistently low EBF rate in Korea has not been fully explained by existing research. While this study does not seek to explain causality behind low EBF rates, it focuses on distinguishing breastfeeding status through data-driven classification. In this context, machine learning techniques offer a promising approach by enabling the identification of features that contribute to accurate differentiation of EBF versus non-EBF cases. Only a few studies have applied machine learning methods: for instance, studies in China [9] and Turkey [10] reported EBF rates at 6 months of 83% and 41%, respectively, compared to only 21% in Korea, underscoring the need for a context-specific approach. Machine learning provides a robust computational tool to manage high-dimensional, nonlinear data and reveal complex patterns that traditional methods may miss [11]. Accordingly, this study aimed to develop a model to classify EBF status at 3 months postpartum using machine learning, and to identify key features that contribute to this model's classification performance.

Methods

1. Study design

This study employed a secondary analysis using machine learning techniques to examine factors influencing EBF at the first 3 months. This study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.

2. Datasets

Publicly available data from the Korean Early Childhood Education & Care Panel (K-ECEC-P) 2022, collected by the Korea Institute of Child Care and Education (KICCE) [12], were used. The target population comprised mothers of children born in 2022. When their infants were 3 months old, mothers completed an online survey. Cross-sectional data on 3,380 mothers were obtained from the 2022 K-ECEC-P dataset. Of these, 2,579 mothers reported their breastfeeding status at 3 months and were included in the analysis. Data were accessed for analysis on March 1, 2025. KICCE provided the survey codebook, instrument profile, user guide, and the dataset for public use. Survey items covered maternal demographic, obstetric, psychological, social, emotional, and behavioral data. Twenty-one features were selected for analysis: maternal age, marriage period, maternal prenatal weight, employment status, number of children, twin pregnancy, type of birth, smoking, alcohol consumption, use of rooming-in, time of first breastfeeding, skin contact with baby, use of nursery, use of babysitter, breastfeeding at 0 months, breastfeeding at 1 month, feeding plan, self-respect, grit, value placed on children, and depression.

3. Sampling

This study conducted a secondary analysis of the 2022 K-ECEC-P dataset, an anonymized public dataset provided by the KICCE and accessed without modification from its official website. KICCE identified the target population based on the most recent national census data available at the time of the sampling design, utilizing the 2019 birth and death statistics from Statistics Korea, and employed quota sampling using a list of medical institutions with delivery records as the sampling frame. The sampling approach included both appropriate sampling units and frames to ensure representative selection. The sample included 143 obstetric clinics and hospitals nationwide, covering both regional and local institutions. Pregnant women were recruited through in-person interviews during visits to these facilities. Baseline survey I was

administered using tablet-assisted personal interviews at initial contact.

Participants were mothers of children born between January and August 2022 who had completed Baseline Survey I of the K-ECEC-P. Exclusion criteria included childbirth prior to 2022 (i.e., preterm births), cases of miscarriage or infant death, and situations where the mother's health was severely compromised. Additional exclusions applied to participants who refused to participate, demonstrated repeated non-cooperation, or were unable to complete the survey due to missing or invalid contact information. Of the 3,380 eligible participants, 594 were excluded due to non-response to the postpartum survey, 11 were excluded for not responding to the main survey, and 196 were removed because of excessive missing data. The final analytic sample comprised 2,579 participants, representing 76.3% of the initial eligible population. Within the final sample, 495 mothers reported EBF, while 2,084 mothers did not exclusively breastfeed, including 1,611 who used formula feeding only and 473 who practiced mixed feeding (Figure 1). For the purposes of the machine learning analysis, the final dataset was dichotomized into two groups: EBF (n=495) and non-EBF (n=2,084).

4. Measurements

1) Label: exclusive breastfeeding

EBF was measured using a single question: "Please indicate the feeding method according to your baby's age in months," with response options "1=exclusive breastfeeding," "2=mixed (breast and formula)," and "3=formula only." Responses of 2 and 3 were recoded to 0 for dichotomization.

2) Features

(1) Self-respect

Self-respect was assessed using the Korean version of the Self-Respect Scale [13], adapted from the original Rosenberg Self-Esteem Scale [14]. This 10-item scale uses a 4-point Likert response format ranging from "not at all" (1) to "very true" (4). Cronbach's alpha was .77 in the original and .83 in this study.

(2) Grit

Grit was measured using the Short Grit Scale (GRIT–S), developed by Duckworth and Quinn [15] and validated in Korean [16]. This 8-item scale uses a 5-point Likert format ("not at all"=1 to "very true"=5). Cronbach's alpha was .77 in the original and .83 in this study.

(3) Value placed on children

The Value Placed on Children Scale assesses the importance parents place on children, with eight items covering two subdomains: emotional value (four items) and instrumental value (four items) [17]. The scale uses a 5-point Likert response from "not at all true" (1) to "very true" (5). Cronbach's alpha was .88 in the original and .95 in this study.

(4) Depression

Depression was measured using the Korean version of the Edinburgh Postpartum Depression Scale (K-EPDS) [18], based on the 10-item EPDS [19]. Each item is scored on a 4-point Likert scale (0–3). Cronbach's alpha was .85 in the original and .79 in this study.

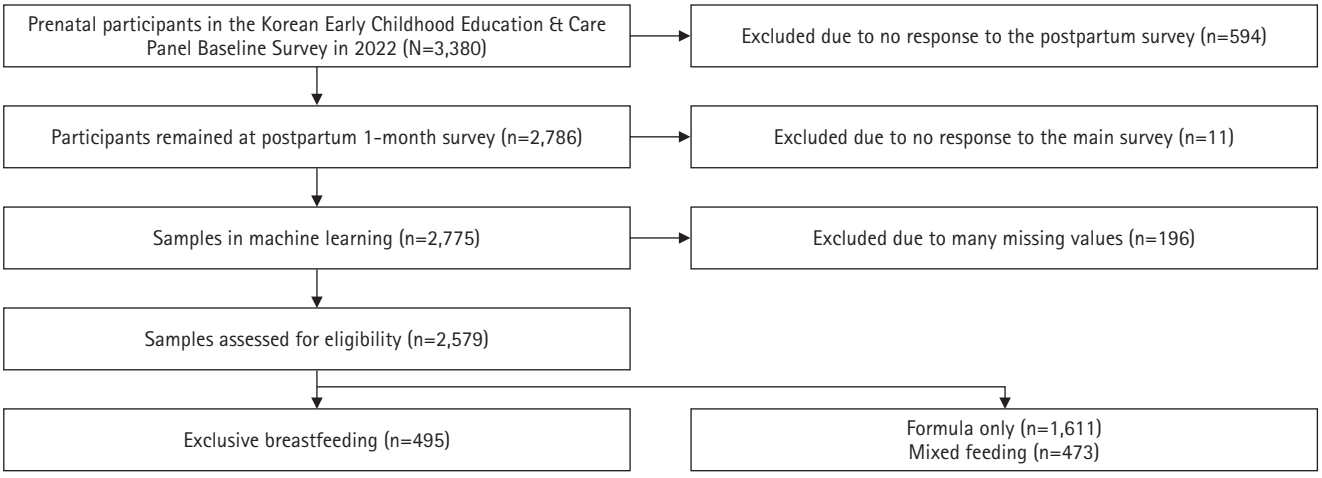

Figure 1. Flow of study participants.

(5) General and obstetric characteristics

Personal characteristics included maternal age (years), marriage period (months), maternal prenatal weight (kg), employment status (employed/unemployed), smoking (yes/no), and alcohol consumption (yes/no), all self-reported. Obstetric characteristics included number of children, twin pregnancy (yes/no), skin contact with baby (yes/no), type of birth (normal spontaneous vaginal delivery / cesarean section, combining elective and emergency cases), time of first breastfeeding (hours after birth), use of rooming-in (yes/no), use of nursery (yes/no), use of babysitter (yes/no), breastfeeding at 0 months, breastfeeding at 1 month, and feeding plan (yes/no), all self-reported.

5. Analysis

Supervised machine learning models were used to predict EBF, employing Python ver. 3.12.8 (https://www.python.org/) and the Google Colab environment ver. 1.2.0 (Colaboratory Chrome Extension; Google LLC). Python libraries used included Pandas, NumPy, Matplotlib, and Scikit-Learn, with specific imports such as matplotlib.pyplot as plt, seaborn as sns, plotly.express as px, sklearn, pandas as pd, and numpy as np for exploratory data analysis (EDA) and data processing. EDA included examining variable data types, assessing the distribution and normality of continuous variables, and applying standardization using the StandardScaler preprocessing method—specifically for the variable "marriage period." The process also involved identifying missing values, detecting outliers coded as "9999" for maternal prenatal weight, and computing frequency counts for categorical variables. The K-ECEC-P provided a pre-cleaned dataset, and missing values were handled according to variable type: numerical values were imputed with the mean, and categorical values with the mode where applicable [20]. After preprocessing, the final analytic sample comprised 2,579 participants. Missing and outlier values were managed according to variable type: means were used to impute missing numerical data, and the mode was used for categorical data where applicable [20]. However, no categorical variables in this dataset contained missing values. Specifically, 18 missing values for marriage period were imputed with the mean. One missing value for the 3-month EBF variable was excluded from the analysis. As a result, the final analytic sample remained at 2,579 cases. The dataset was split into training and test sets in an 80:20 ratio.

After preprocessing, the cleaned dataset was used to train and evaluate random forest, logistic regression, decision tree, AdaBoost, and XGBoost classifier models. The performance of the five models was evaluated using accuracy, precision, recall, F1-score, and area under the receiver operating characteristic curve (AUC-ROC), as well as confusion matrices. Accuracy was defined as the proportion of correct predictions (both positive and negative) out of all predictions. Precision was calculated as the proportion of true positives among all positive predictions. Recall was calculated as the proportion of true positives among all actual positives. The F1-score balances precision and recall, representing their harmonic mean. AUC-ROC assesses the model's ability to discriminate between classes [21,22]. In addition, 95% confidence intervals (CIs) for model performance metrics were estimated using the bootstrapping method. GridSearchCV was employed during model development to perform hyperparameter tuning by systematically searching for the optimal combination of parameter values to improve model performance. After model selection, important factors influencing EBF were assessed using absolute feature importance, derived differently across models: for the decision tree (Supplementary Figure 1) and random forest, importance was calculated based on the reduction in Gini impurity; for logistic regression, it was determined using the absolute values of standardized coefficients; for AdaBoost, it was obtained from the weighted impurity decrease across weak learners; and for XGBoost, it was evaluated using the 'gain' metric, representing each variable's contribution to improving model performance [11,22].

6. Ethical statements

This study received approval from the Institutional Review Board (IRB) of KICCE (approval no., KICCEIRB-2022-01), which permitted the use of the dataset without additional IRB review. All study procedures conformed to the Declaration of Helsinki, and informed consent was obtained from all participants.

Results

1. Data characteristics

The study population had a mean maternal age of 33.5±4.16 years, with an average marriage period of 24.33±13.91 months, a mean maternal prenatal weight of 68.05±12.17 kg, and an average number of children of 1.45±0.65. Employed mothers accounted for 50.7%, twin births for 5.1%, cesarean sections for 61.3%, alcohol consumption for 48.0%, smoking for 2.9%, and use of rooming-in for 70.6%. The timing of first breastfeeding was categorized as follows: ≤1 hour (4.6%), >1–24 hours (24.3%), >24–48 hours (20.8%), >48 hours–7 days (35.9%), and none (14.4%). Skin con-

tact with the baby was reported by 47.3%. Use of nursery was reported by 86.2% of mothers and 52.2% reported use of a babysitter. Breastfeeding only at 0 months accounted for 24.6%, breastfeeding only at 1 month for 23.3%, and feeding plan for 24.2%. The mean score was 30.18±5.01 for self-respect, 22.26±4.25 for grit, 25.84±4.86 for value placed on children, and 7.78±5.65 for depression. Breastfeeding at 3 months included EBF (19.2%) and non-EBF (80.8%) (Table 1).

2. Model performance comparison

A confusion matrix was generated to compare five machine learning models—decision tree, random forest, logistic regression, AdaBoost, and XGBoost—using a confusion matrix. Model performance metrics included accuracy, precision, recall, F1-score, and AUC-ROC. The highest accuracy was observed with the random forest model (84.8%; 95% CI, 83.4–86.2), while the lowest was with the decision tree classifier (73.5%; 95% CI, 72.2–75.6). AdaBoost demonstrated the highest precision (88.3%; 95% CI, 87.1–89.6), with random forest showing the lowest (86.6%; 95% CI, 85.3–87.9). The random forest achieved the highest recall (96.8%; 95% CI, 96.1–97.5), while the decision tree had the lowest recall (78.7%; 95% CI, 77.1–80.3). The highest F1-score was also seen in the random forest (91.9%; 95% CI, 89.0–95.7), with the lowest in the decision tree (82.5%; 95% CI, 80.8–86.2). The highest AUC-ROC was recorded by both XGBoost and random forest (86.0%; 95% CI, 84.7–87.3). Thus, except for precision, overall model performance was superior in the random forest (Table 2).

3. Feature importance

The top 10 features important for predicting EBF were identified using the random forest. The most influential predictors at 3 months were feeding plan (.12; 95% CI, 0.09–0.14), breastfeeding at 1 month (.11; 95% CI, 0.09–0.13), marriage period (.06; 95% CI, 0.05–0.07), maternal prenatal weight (.06; 95% CI, 0.05–0.07), self-respect (.05; 95% CI, 0.05–0.06), alcohol consumption (.05; 95% CI, 0.04–0.07), grit (.05; 95% CI, 0.04–0.05), value placed on children (.05; 95% CI, 0.05–0.06), maternal age (.05; 95% CI, 0.04–0.05), and depression (.04; 95% CI, 0.04–0.05) (Table 3).

Table 1. Characteristics of datasets (N=2,579)

Characteristic	Category	Value
Maternal age (yr)		33.5±4.16 (17–49)
Marriage period (mo)		24.33±13.91 (6–62)
Maternal prenatal weight (kg)		68.05±12.17 (45–125)
Employment status	Employed	1,308 (50.7)
	Unemployed	1,271 (49.3)
No. of children		1.45±0.65 (1–4)
Twin pregnancy	Yes	131 (5.1)
	No	2,448 (94.9)
Type of birth	Normal delivery	997 (38.7)
	Cesarean section	1,582 (61.3)
Alcohol consumption	Yes	1,237 (48.0)
	No	1,342 (52.0)
Smoking	Yes	75 (2.9)
	No	2,504 (97.1)
Use of rooming-in	Yes	1,820 (70.6)
	No	759 (29.4)
Time of first breastfeeding	≤1 hr	119 (4.6)
	>1–24 hr	627 (24.3)
	>24–48 hr	537 (20.8)
	>48 hr–7 day	925 (35.9)
	None	371 (14.4)
Skin contact with baby	Yes	1,221 (47.3)
	No	1,358 (52.7)
Use of nursery	Yes	2,222 (86.2)
	No	357 (13.8)
Use of babysitter	Yes	1,346 (52.2)
	No	1,233 (47.8)
Breastfeeding at 0 mo	Breastfeeding only	635 (24.6)
	Mixed	1,602 (62.1)
	Formula only	342 (13.3)
Breastfeeding at 1 mo	Breastfeeding only	600 (23.3)
	Mixed	1,171 (45.4)
	Formula only	808 (31.3)
Feeding plan	Yes	625 (24.2)
	No	1,954 (75.8)
Self-respect		30.18±5.01(12–40)
Grit		22.26±4.25 (11–40)
Value placed on children		25.84±4.86 (9–40)
Depression		7.78±5.65 (0–29)
Breastfeeding at 3 mo	EBF	495 (19.2)
	Non-EBF	2,084 (80.8)

Values are presented as mean±standard deviation (minimum–maximum) or number (%).
EBF, exclusive breastfeeding.

Discussion

This study developed a predictive model to classify mothers practicing EBF at 3 months postpartum and identified key determinants of EBF. Grounded in Bronfenbrenner's ecological systems theory, this study framework identified key contributors to distinguishing between EBF and non-EBF groups. The most influential predictors were feeding plan and breastfeeding at 1 month. Microsystem-level factors included marriage period, maternal age,

Table 2. Comparison of the performance of machine learning models (N=2,579)

Model	Precision	Accuracy	Recall	F1-score	AUC-ROC
AdaBoost	88.3 (87.1–89.6)	82.4 (89.5–91.7)	90.6 (89.5–91.7)	89.6 (86.9–90.3)	84.0 (82.6–85.4)
XGBoost	87.5 (86.2–88.8)	84.6 (83.2–86.0)	93.6 (92.7–94.6)	90.7 (88.5–92.9)	86.0 (84.7–87.3)
Decision tree	87.0 (85.7–88.3)	73.5 (72.2–75.6)	78.7 (77.1–80.3)	82.5 (80.8–86.2)	85.0 (83.6–86.4)
Random forest	86.6 (85.3–87.9)	84.8 (83.4–86.2)	96.8 (96.1–97.5)	91.9 (89.0–95.7)	86.0 (84.7–87.3)
Logistic regression	87.4 (86.1–88.7)	83.6 (82.2–85.1)	93.5 (92.6–94.5)	86.7 (83.4–88.4)	85.0 (83.6–86.4)

Values are presented as % (95% confidence interval).
F1-score, harmonic mean of precision and recall; AUC-ROC, area under the receiver operating characteristic curve.

Table 3. Top 10 feature importance values from the random forest (N=2,579)

Feature	Absolute importance (95% CI)	Real value
Feeding plan	.12 (0.09–0.14)	0.12
Breastfeeding at 1 mo	.11 (0.09–0.13)	0.11
Marriage period	.06 (0.05–0.07)	−0.06
Maternal prenatal weight	.06 (0.05–0.07)	−0.06
Self-respect	.05 (0.05–0.06)	0.05
Alcohol consumption	.05 (0.04–0.07)	−0.05
Grit	.05 (0.04–0.05)	0.05
Value placed on child	.05 (0.05–0.06)	0.05
Maternal age	.05 (0.04–0.05)	−0.05
Depression	.04 (0.04–0.05)	−0.05

CI, confidence interval.

and employment status, while health-related variables such as maternal prenatal weight and alcohol consumption also contributed substantially. Macro-system attributes—including grit, self-respect, the value placed on children, and depression—further improved the model's classification performance.

In this study, the random forest demonstrated superior performance among the five machine learning models. Feature importance differed between models; in the random forest, importance was calculated by measuring how much each feature reduces impurity at each node. The random forest is widely recognized for its superior predictive accuracy and robustness, particularly in handling complex, high-dimensional data. It reduces overfitting by aggregating multiple decision trees through bootstrap sampling and random feature selection, thereby enhancing generalizability across datasets [23].

Existing studies have primarily addressed breastfeeding outcomes at 6 months or during the immediate postpartum period. Previous machine learning studies for breastfeeding prediction have reported accuracies ranging from 0.70 to 0.90 [9,10,24-26]. For instance, Açikgöz et al. [9] and Choi et al. [24] developed models to predict EBF at 6 months using the random forest algorithm, with reported accuracies of 0.72 and 0.76, respectively. Liu et al. [10] also focused on 6-month outcomes using the random forest algorithm, reporting accuracies ranging from 0.77 to 0.90, and further examined predictors including breastfeeding self-efficacy, intention, social support, and postpartum depression. Oliver-Roig et al. [25] and Walle et al. [26] analyzed breastfeeding initiation and early cessation during the in-hospital postpartum stay, reporting accuracies of 0.84 and 0.83, using XGBoost and random forest, respectively. Therefore, this study addresses a gap in the literature by developing a machine learning model specifically aimed at predicting EBF at 3 months postpartum. It further contributes by developing a predictive model tailored to the context of South Korea, where the 3-month EBF rate remains relatively low [1].

The top predictors spanned both micro-system factors, such as personal and demographic characteristics, and macro-system factors, such as values [8]. Unlike a previous study during the in-hospital postpartum period, which found older maternal age and normal body mass index increased EBF [25], this study identified longer marriage duration—often accompanying delayed marriage and advanced maternal age in South Korea—as associated with lower EBF rates. Although no prior studies have directly examined marriage duration, an analysis of Korean data showed that women aged 40–49 years had significantly lower odds of breastfeeding than those aged 19–29 years (odds ratio, 0.47) [27]. Similarly, research in the United Kingdom has linked maternal obesity to reduced breastfeeding outcomes, potentially due to physiological and psychological factors such as delayed lactogenesis and low body confidence [28]. Feeding plan and breastfeeding at 1 month were the strongest predictors, suggesting that early plans and experiences critically influence sustained EBF. This underscores the importance of prenatal counseling and immediate postpartum support.

This study also identified unique predictors not emphasized in prior machine learning research [9,10,24-26], including alcohol consumption, maternal grit, value placed on children, self-respect, and depression. Compared to non-drinkers, those who quit, reduced, or resumed drinking had lower odds of breastfeeding [29]. Depression negatively affects breastfeeding self-efficacy, while social support and positive attitudes enhance it [30]. Although

self-respect and value placed on children have been less studied, alignment with family-centered norms has been linked to stronger breastfeeding beliefs and empowerment [31]. Grit, marked by persistence despite adversity, has emerged as a distinguishing trait among breastfeeding mothers [32]. Drawing on emotional availability theory, maternal psychological well-being—including self-respect and depression—may influence breastfeeding through emotional attunement and sensitivity toward the infant [33]. Macro-system characteristics such as self-respect, grit, and value placed on children were also critical predictors, highlighting the need for emotionally attuned, resilience-focused breastfeeding interventions. Previous machine learning studies have analyzed various predictors of breastfeeding, including maternal health problems and drinking water access [9], self-efficacy [10], maternal diabetes mellitus [24], neonatal weight, skin contact with baby, and prior maternal breastfeeding experience [25], as well as maternal age, cesarean section, and access to healthcare facilities [26]. While sociodemographic variables were commonly included across studies, the present study additionally incorporated behavioral factors (feeding plan, breastfeeding at 1 month) and psychological factors (self-respect, grit, value placed on children), which demonstrated strong predictive power for EBF at 3 months postpartum. These findings suggest the model's effectiveness in early identification of mothers at risk of early breastfeeding cessation. The inclusion of such multidimensional factors highlights the strengths of machine learning in capturing complex interactions beyond traditional biomedical predictors, supporting the appropriateness of the variable selection in this study.

This study has several limitations. First, although the K-ECEC-P dataset is large and nationally representative, its cross-sectional design limits causal inference between predictors and EBF outcomes. Longitudinal data would allow for more robust predictive modeling and temporal interpretation. Second, EBF was measured using a single self-reported item at 3 months postpartum, which may introduce recall and social desirability bias, potentially affecting classification accuracy. Third, although this study incorporated a range of psychosocial, demographic, and obstetric variables, key predictors identified in previous research—such as breastfeeding self-efficacy, skin contact with baby, workplace breastfeeding support, and history of lactation consultation—were not available in the secondary dataset, potentially limiting the model's scope and comprehensiveness. Fourth, the imputation of missing values using means or modes, although necessary, may have introduced bias. Finally, these findings are contextually based on Korean mothers and healthcare settings, so caution should be exercised when generalizing to other populations. Further external validation using diverse and longitudinal cohorts is needed to confirm the robustness and applicability of the model.

Conclusion

This study developed and evaluated machine learning models to predict EBF at 3 months postpartum using data from the K-ECEC-P. Among the five models tested, the random forest demonstrated the best overall performance, with high accuracy, precision, and AUC-ROC, making it a suitable tool for identifying key predictors of EBF. The analysis showed that early breastfeeding behaviors—particularly feeding plan and breastfeeding at 1 month—were the strongest predictors of EBF. Additionally, maternal psychological factors such as self-respect, grit, and value placed on children had significant effects on sustained breastfeeding. These findings underscore the importance of early intervention during the prenatal and early postpartum periods to support and encourage exclusive breastfeeding. Healthcare providers should prioritize enhancing maternal psychological readiness and reinforcing positive breastfeeding intentions and behaviors immediately after birth. By applying machine learning to maternal and infant health data, this study provides a data-driven framework for targeted interventions aimed at improving breastfeeding outcomes. Future research should employ longitudinal models and diverse populations to enhance generalizability and support the development of personalized breastfeeding support programs.

Article Information

Conflicts of Interest

Hyun Kyoung Kim is member of the editorial board of the *Journal of Korean Academy of Nursing*. However, she was not involved in the editorial handling, peer review, or decision-making process for this manuscript.

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Data Sharing Statement

Please contact the corresponding author for data availability.

Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.4040/jkan.25086.

Author Contributions

HKK participated in the conception, design of the study, the acquisition of data, drafted the first and final manuscript and funding acquisition.

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Development of a machine learning-based prediction model for early hospital readmission after kidney transplantation: a retrospective study

Hye Jin Chong[1], Ji-hyun Yeom[2]

[1]Department of Nursing, Sunchon National University, Suncheon, Korea
[2]Division of Nephrology, Jeonbuk National University Hospital, Jeonju, Korea

RESEARCH PAPER

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Corresponding author:
Hye Jin Chong
Department of Nursing, Sunchon National University, 255 Jungang-ro, Suncheon 57922, Korea
E-mail: hyejin@scnu.ac.kr

Purpose: This study aimed to develop and validate a machine learning-based prediction model for early hospital readmission (EHR) post-kidney transplantation.

Methods: The study was conducted at the organ transplantation center of a university hospital, utilizing data from 470 kidney transplant recipients. We built and trained four machine learning models and tested them to identify the strongest EHR predictors. Predictive performance was evaluated using confusion matrices and the area under the receiver operating characteristic curve (ROC AUC).

Results: Among the 470 kidney transplant recipients with a mean age of 46.1±15.30 years, 322 (68.5%) were males, and 74 (15.7%) were readmitted within 30 days after kidney transplantation. In total, 241 (51.2%) recipients were found to have experienced EHR after applying the random over-sampling examples method. The random forest model achieved the best performance, with an ROC AUC of .87 (validation set) and .82 (test set). The 15 most important features were steroid pulse therapy (recipient), cerebrovascular accident (recipient), heart failure (recipient), male sex (donor), cardiovascular disease (recipient), weekend discharge (recipient), peritoneal dialysis (recipient) cerebrovascular accident as the cause of brain death (donor), current smoker (recipient), cardiac arrest (donor), previous kidney transplantation (recipient), age (donor), hypertension (donor), male sex (recipient), and dialysis duration (recipient).

Conclusion: Our framework demonstrated strong predictive interpretability. It can support appropriate and effective clinical decision-making by assisting transplant professionals in stratifying recipients based on their risk of EHR. prioritizing post-discharge care and follow-up for high-risk individuals, and allocating targeted interventions such as closer monitoring or education.

Keywords: Clinical decision-making; Decision support; Kidney transplantation; Machine learning; Patient readmission

Introduction

Kidney transplantation (KT) is the optimal renal replacement therapy option for patients with end-stage renal disease (ESRD) compared with dialysis [1]. Successful KT reduces morbidity and mortality in these patients, improves quality of life, and is a cost-effective alternative to dialysis [2].

Early hospital readmission (EHR), defined as an unplanned hospitalization within 30 days post-KT discharge [3], is a prevalent and significant issue. Approximately 30% of KT recipients in the United States and Korea are readmitted within this period, with several European cohorts reporting rates of 20%–35% [4,5]. This is considerably higher than the 4%–15% observed for other surgical procedures. EHR in KT recipients is associated with markedly worse outcomes, including increased healthcare costs, a two-fold higher risk of graft failure, a three-fold rise in

subsequent readmissions, and up to a 75% increase in mortality [6-11]. Consequently, reducing EHR remains a critical priority for transplant healthcare providers and systems.

Several factors contribute to the elevated readmission risk. KT is frequently performed on patients with compromised baseline health due to ESRD, and many recipients have pre-existing comorbidities, including diabetes, hypertension, and cardiovascular disease (CVD) [12,13]. The long-term burden of chronic illness and associated frailty heightens postoperative vulnerability. Post-discharge, KT recipients must follow complex immunosuppressive regimens, which increase the risks of infection, metabolic disturbances, and drug-related toxicities [12]. Additionally, donor-related and procedural factors contribute to post-transplant complications and elevated EHR risk. Donor-specific factors include age, cause of death, and cerebrovascular history, while transplant process characteristics include cold ischemic time, induction therapy, and duration of intensive care unit (ICU) stay [7]. Policymakers and health insurance services generally use the 30-day EHR rate as an important proxy for evaluating hospital quality due to its strong correlation with mortality [14]. Common causes of EHR within this period include infections, acute rejection episodes, surgical complications, fluid imbalances, and adverse effects from immunosuppressive therapy, all typically occurring in the early postoperative phase post-KT [6,15].

Previous studies indicate that many EHRs are preventable through timely and coordinated interventions, including early outpatient recipient follow-up, medication reconciliation, and targeted recipient education [16]. They emphasize the importance of identifying high-risk recipients who could benefit from these interventions. However, specific risk factors contributing to EHR remain inconsistently reported, with many studies based on the US healthcare systems, limiting their applicability to Korea due to differences in clinical practice, healthcare access, and recipient management protocols [17]. Population-specific evidence on Korean KT recipients also remains limited. Therefore, identifying risk features within the Korean clinical setting is critical for guiding risk-based surveillance and improving recipient outcomes.

Prediction models have been employed for risk assessment in healthcare settings in the past [6]. These multivariable logistic regression models facilitate early identification of individuals at risk of illness or adverse events, enabling effective interventions for those who could benefit the most from identifying specific risk factors. However, only a few studies attempt to predict EHR post-KT, reporting a low accuracy of .61–.69 [18]. These data are frequently restricted to surveillance datasets of varying quality and limited granularity. Prior studies also focus exclusively on isolated features associated with EHR post-KT, thereby limiting their impact [19,20].

Notably, machine learning (ML) methods have gained traction in healthcare for outcome prediction and clinical decision support due to their ability to model complex, non-linear relationships in structured clinical data [21]. Compared with traditional linear models, including logistic regression, ML approaches provide enhanced predictive accuracy for hospital readmission by utilizing flexible algorithms that capture intricate interactions among features [22]. ML methods are particularly advantageous because: (1) They automatically detect non-linear relationships and higher-order interactions without requiring a predefined model structure [23], which is vital for predicting EHR post-KT, where multiple recipient, donor, and perioperative factors interact. (2) ML facilitates the incorporation of numerous features. In our study, these features were selected based on prior literature and clinical relevance. Although feature selection was not entirely automated, the ML models effectively evaluated each feature's significance and optimized prediction performance by their relative contributions. ML models are typically scalable to large datasets. However, our dataset includes 470 transplant cases, which is smaller than national registry cohorts but remains statistically adequate. It includes comprehensive, multi-dimensional clinical features across recipient, donor, and transplant process domains. This sample size is comparable to prior ML-based transplantation studies [24] and supports predictive modeling with meaningful interpretation and internal validation.

Therefore, the study aimed to address previous research limitations [18,25] that primarily utilize linear models to identify EHR risk factors in KT recipients. We applied ML techniques to Korean kidney transplant data to predict EHR risk. Besides recipient-related features, this study incorporated donor-specific factors and the transplant process characteristics. Here, complex factors refer to the combined influence of donor, recipient, and procedural features on EHR. While ML methods can model interactions, our analysis focused on identifying key predictors using feature importance from algorithms including decision tree (DT), random forest (RF), extreme gradient boosting (XGBoost), and support vector machine (SVM). The developed models may support risk stratification and early intervention for preventing EHR in KT recipients [26].

Methods

1. Data extraction and content

This retrospective observational cohort was derived from the

electronic medical record (EMR) system of a single university transplant center in South Korea and reported following the Strengthening the Reporting of Observational Studies in Epidemiology guidelines. The inclusion criteria were (1) KT recipients aged ≥18 years; (2) those who underwent KT between January 1, 2000, and December 31, 2022; and (3) those who received follow-up care at the study institution. Recipients were excluded if they were lost to follow-up within 30 days.

Data were extracted from the EMR system between April 1 and August 31, 2024. A researcher with prior experience in transplant data abstraction and serving as a KT coordinator retrieved the data from the hospital's transplant center. A board-certified transplant nephrologist reviewed all data to ensure clinical validity.

The primary outcome was unplanned rehospitalization within 30 days of discharge from the index hospitalization during which KT was performed. Only unplanned hospital readmissions were included, defined as the first unexpected inpatient admission, including those occurring through the emergency room. Planned readmissions—including protocol biopsies, scheduled follow-up procedures, or elective admissions—were excluded from the outcome's definition to focus on clinically relevant, unanticipated events.

Features were selected based on our clinical experience and prior research [3,6,27-29]. The features included in the model were initially selected for their clinical relevance and further refined through consultation with a multidisciplinary team comprising a transplant physician, nurse, and transplant coordinator. They were organized as follows: (1) donor-related characteristics (e.g., age, sex, and cause of brain death), (2) recipient-related characteristics (e.g., body mass index, number of the human leukocyte antigen mismatch, and dialysis modality and duration), and (3) transplant process factors (e.g., cold ischemic time, induction immunosuppression, and delayed graft function) (Table 1).

2. Statistical analyses

Clinically relevant features were selected and statistically assessed for associations with EHR using appropriate parametric and non-parametric tests. All statistical analyses were performed using STATA ver. 18.0 (Stata Corp., 2023) and R software ver. 4.3.2 (R Core Team, 2023; https://www.R-project.org/). Descriptive statistics were generated using means and standard deviations for continuous features, and frequencies and percentages for categorical features. To compare the predictive features between recipients readmitted within 30 days post-KT and those not readmitted within 30 days, the t-test and chi-square or Fisher's exact test were used for continuous and categorical features, respectively. A two-sided p-value <.05 was considered statistically significant for all tests.

3. Preprocessing

1) Handling missing data

A notable proportion of cases were labeled as "unknown" for some categorical variables, such as diabetes mellitus, cardiac arrest, and panel reactive antibody (PRA). Rather than removing these observations or applying imputation, we retained "unknown" as a distinct categorical variable since it may represent clinically relevant uncertainty or an unrecorded status in real-world settings. This approach preserves sample integrity and

Table 1. Comparison of baseline characteristics between KT recipients with and without early hospital readmission (N=470)

Characteristic	Total (N=470)	Readmission within 30 days (n=74)	No readmission within 30 days (n=396)	p
Donor-related characteristics				
Body mass index (kg/m^2)	24.23±3.14	23.76±2.95	24.31±3.17	.144
Age (yr)	46.1±15.30	48.5±15.80	45.7±15.20	.170
Sex				.482
Male	246 (52.3)	42 (56.8)	204 (51.5)	
Female	224 (47.7)	32 (43.2)	192 (48.5)	
Cardiac arrest				.343
No	142 (30.2)	28 (37.8)	114 (28.8)	
Yes	72 (15.3)	11 (14.9)	61 (15.4)	
Unknown	256 (54.5)	35 (47.3)	221 (55.8)	
Cause of brain death				.061
Accident	121 (25.7)	18 (24.3)	103 (26.0)	
Cerebrovascular accident	104 (22.1)	25 (33.8)	79 (19.9)	
Others	245 (52.1)	31 (41.9)	214 (53.0)	

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Table 1. Continued

Characteristic	Total (N=470)	Readmission within 30 days (n=74)	No readmission within 30 days (n=396)	*p*
Diabetes mellitus				.103
No	422 (89.8)	66 (89.1)	356 (89.9)	
Yes	22 (14.7)	1 (1.4)	21 (5.3)	
Unknown	26 (5.5)	7 (9.5)	19 (4.8)	
Hypertension				.232
No	375 (79.8)	55 (74.3)	320 (80.8)	
Yes	69 (14.7)	12 (16.2)	57 (14.4)	
Unknown	26 (5.5)	7 (9.5)	19 (4.8)	
Creatinine (mg/dL)	1.07±0.70	1.13±0.70	1.06±0.70	.453
Recipient-related characteristics				
Duration of dialysis (yr)	3.60±4.30	3.85±3.90	3.56±4.40	.562
Human leukocyte antigen mismatch	3.56±1.40	3.63±1.40	3.55±1.40	.639
Body mass index (kg/m^2)	22.55±4.40	22.84±3.60	22.50±4.60	.471
Post-KT admission day	19.00±7.80	19.35±10.60	18.93±7.20	.747
Discharge				.005
Weekday	434 (92.3)	62 (83.8)	372 (93.9)	
Weekend	36 (7.7)	12 (16.2)	24 (6.1)	
Age (yr)	47.1±12.00	49.5±12.70	46.6±11.80	.074
Sex				.549
Male	322 (68.5)	48 (64.9)	274 (69.2)	
Female	148 (31.5)	26 (35.1)	122 (30.8)	
KT type				.867
Deceased donor KT	312 (66.4)	48 (64.9)	264 (66.7)	
Living donor KT	158 (33.6)	26 (35.1)	132 (3.3)	
ABO-incompatible transplantation				.291
No	426 (90.6)	70 (94.6)	356 (89.9)	
Yes	44 (9.4)	4 (5.4)	40 (10.1)	
Heart failure				.194
No	412 (87.7)	61 (82.4)	351 (88.6)	
Yes	58 (12.3)	13 (17.6)	45 (11.4)	
Lung disease				.805
No	445 (94.7)	71 (95.9)	374 (94.4)	
Yes	25 (5.3)	3 (4.1)	22 (5.6)	
Cardiovascular disease				.052[a]
No	445 (94.7)	74 (100)	371 (93.7)	
Yes	25 (5.3)	0 (0)	25 (6.3)	
Cerebrovascular accident				.260[a]
No	421 (89.6)	69 (93.2)	352 (88.9)	
Yes	49 (10.4)	5 (6.8)	44 (11.1)	
Peripheral vascular disease				.682[a]
No	443 (94.3)	71 (95.9)	372 (93.9)	
Yes	27 (5.7)	3 (4.1)	24 (6.1)	
History of orthopedic surgery				>.999[a]
No	450 (95.7)	71 (95.9)	379 (95.7)	
Yes	20 (4.3)	3 (4.1)	17 (4.3)	
No. of any other comorbid condition				.661
0	340 (72.4)	49 (66.2)	291 (73.5)	
1	120 (25.5)	23 (31.1)	97 (24.4)	
2	8 (1.7)	2 (2.7)	6 (1.5)	
3	1 (0.2)	0 (0)	1 (0.3)	
>4	1 (0.2)	0 (0)	1 (0.3)	

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Table 1. Continued

Characteristic	Total (N=470)	Readmission within 30 days (n=74)	No readmission within 30 days (n=396)	*p*
Hypertension				.117
No	65 (13.8)	15 (20.3)	50 (12.6)	
Yes	405 (86.2)	59 (79.7)	346 (87.4)	
Smoking habit				.629
Nonsmoker	343 (73.0)	51 (68.9)	292 (73.7)	
Ex-smoker	78 (16.6)	15 (20.3)	63 (15.9)	
Current smoker	49 (10.4)	8 (10.8)	41 (10.4)	
Drinking habit				.902
Does not drink alcohol	371 (78.9)	57 (77.0)	314 (79.3)	
History of drinking	71 (15.1)	12 (16.2)	59 (14.9)	
Current drinking	28 (6.0)	5 (6.8)	23 (5.8)	
Diabetes mellitus				.350
No	305 (64.9)	44 (59.5)	261 (65.9)	
Yes	165 (35.1)	30 (40.5)	135 (34.1)	
Hepatitis B				.652
No	437 (93.0)	70 (94.6)	367 (92.7)	
Yes	29 (6.1)	4 (5.4)	25 (6.3)	
Unknown	4 (0.9)	0 (0)	4 (1.0)	
Cancer				.972
No	441 (93.8)	70 (94.6)	371 (93.7)	
Yes	29 (6.2)	4 (5.4)	25 (6.3)	
Dialysis type				.358
Hemodialysis	429 (91.3)	65 (87.8)	364 (91.9)	
Peritoneal dialysis	41 (8.7)	9 (12.2)	32 (8.1)	
Panel reactive antibody ≥50%				.173
No	311 (66.2)	42 (56.8)	269 (67.9)	
Yes	53 (11.3)	11 (14.8)	42 (10.6)	
Unknown	106 (22.5)	21 (28.4)	85 (21.5)	
Previous KT				.748
No	427 (90.9)	66 (89.2)	361 (91.2)	
Yes	43 (9.1)	8 (10.8)	35 (8.8)	
Transplant process factors				
Cold ischemic time (min)	113.73±111.70	122.39±122.20	112.12±111.70	
Delayed graft function				
No	438 (93.2)	65 (87.8)	373 (94.2)	
Yes	32 (6.8)	9 (12.2)	23 (5.8)	
Induction immunosuppression				>.999[a]
Bacilimab	411 (87.4)	65 (87.8)	346 (87.4)	
Anti-thyroglobulin	59 (12.6)	9 (12.2)	50 (12.6)	
Intensive care unit stay (day)	4.65±2.30	4.06±2.40	4.76±2.20	.021
Creatinine at discharge	1.51±1.30	1.54±1.10	1.51±1.30	.808
Steroid pulse therapy				.001
No	436 (92.8)	57 (77.0)	379 (95.7)	
Yes	34 (7.2)	17 (23.0)	17 (4.3)	

Values are presented as mean±standard deviation or number (%) unless otherwise stated.
KT, kidney transplantation.
[a]By Fishier exact test.

reflects potential underlying patterns in clinical data. Tree-based models, including RF and XGBoost, are known to handle such categories robustly without requiring explicit imputation.

We excluded participants with >10% missing data. Among the 650 KT recipients, 470 were included in the primary analysis. Continuous features were imputed using cohort means, and cate-

gorical features using cohort modes, based on the following rationale: (1) residual missingness was low, (2) single-value imputation preserves sample size, and (3) subsequent tree-based algorithms are inherently robust to minor variance distortion introduced by mean/mode substitution.

2) Data encoding and scaling

Categorical features were handled differently depending on each ML algorithm's requirements. They were specified as factors in R for DT, RF, and SVM, enabling each model to process them without explicit encoding. Additionally, categorical features were one-hot encoded since XGBoost does not directly support them. For continuous features, neither standardization nor normalization was applied since tree-based models (e.g., RF, DT, and XGBoost) do not require feature scaling. ML algorithms were employed to predict EHR post-KT since they are robust against issues including overfitting and collinearity [30]. Random over-sampling examples (ROSE) resampling was applied only within the training folds during cross-validation (CV). Stratified sampling based on EHR status was used to preserve the original distribution of the target feature.

3) Class balance

To address class imbalance—where only 15.7% (74/470) of recipients experienced EHR—we applied the ROSE method to the training set alone. ROSE synthetically increased the minority class prevalence to approximately 51%, while preserving the overall feature distribution [31,32]. This technique generates synthetic data points for the minority class using a smoothed resampling approach, which is more robust than simple duplication and helps prevent overfitting [30].

4. Model construction

We developed four ML models to predict EHR after KT—DT, RF, XGBoost, and SVM with a radial basis function kernel (SVM-RBF)—chosen for their ability to model non-linear relations in structured clinical data. Because SVM is distance-based, continuous variables were min–max scaled as described in preprocessing. To balance complexity and generalization, we searched the following hyperparameter ranges: DT cp 0.001–0.05, RF mtry 3–10, SVM-RBF C $\in$ {0.1, 1, 10} with sigma fixed at 0.01, and for XGBoost $\eta \in$ {0.3, 0.4}, max_depth 1–3, subsample {0.50, 0.75, 1.00}, up to 140 boosting rounds. Hyperparameters were tuned via grid search, with the cross-validation (CV) protocol, model-selection criteria, and performance results detailed in Model Evaluation. XGBoost grid outcomes are summarized in Supplementary Figure 1, and CV summaries in Supplementary Table 1.

5. Model evaluation

We adopted a leakage-free evaluation protocol following model construction. The dataset was split once into training/validation/test sets (80%/10%/10%) using stratified sampling by EHR status. All hyperparameter tuning and model selection were performed only on the training data via stratified 10-fold CV with grid search; all preprocessing and any class-imbalance handling were fit within the training folds and applied to the hold-out sets without refitting.

The primary metric was the receiver operating characteristic curve (ROC AUC), and secondary metrics were the precision–recall curve (PRC AUC), F1-score, accuracy, sensitivity, and specificity. For thresholded metrics, a single probability threshold was fixed by maximizing the mean F1 across training–CV folds and then held constant for validation and test. Uncertainty for ROC/PRC AUCs was quantified with nonparametric bootstrap (1,000 resamples) on the validation and test sets. CV summaries are reported in Supplementary Table 1.

For XGBoost, grid search evaluated learning rate ($\eta \in$ {0.3, 0.4}), max_depth (1–3), subsample (0.50, 0.75, 1.00), and the number of boosting iterations (≥100). The highest cross-validated ROC AUC (approximately .78) was obtained at η=0.3, max_depth=2, and subsample=1.00 (see Supplementary Figure 1), which guided the final hyperparameters used in subsequent analyses. Across models, RF and XGBoost were retained as the top performers; on the validation/test sets they achieved accuracy around .70–.79, F1-score of .79, and ROC AUC between .79 and .87, as summarized in Table 2.

6. Feature importance analysis

Permutation feature importance was computed from RF and XGBoost to identify major predictors of EHR. Additionally, a shallow DT was fitted as an illustrative surrogate model for visualization (Figure 1). Each node within the model processes data based on specific features, while the leaf nodes present the final prediction outcomes, indicating EHR status with "yes."

7. Ethical considerations

The Institutional Review Board of the National Hospital approved this study and granted a waiver of informed consent (No.

Table 2. Model evaluation via cross-validation (N=470)

	Accuracy (95% CI)	F1-score	Sensitivity	Specificity	ROC AUC	PRC AUC (95% CI)[a]
Decision tree						0.74 (0.53–0.90)
Validation set	0.72 (0.57–0.84)	0.51	0.63	0.83	0.73	
Test set	0.60 (0.45–0.74)	0.51	0.40	0.83	0.61	
Random forest						0.90 (0.78–0.97)
Validation set	0.79 (0.63–0.89)	0.79	0.83	0.74	0.87	
Test set	0.79 (0.65–0.90)	0.79	0.76	0.83	0.82	
XGBoost						0.82 (0.66–0.92)
Validation set	0.70 (0.55–0.83)	0.79	0.79	0.61	0.79	
Test set	0.79 (0.65–0.90)	0.79	0.76	0.83	0.81	
Support vector machine						0.76 (0.56–0.90)
Validation set	0.66 (0.51–0.79)	0.68	0.71	0.61	0.74	
Test set	0.67 (0.52–0.80)	0.68	0.68	0.65	0.72	

AUC, area under the curve; CI, confidence interval; PRC, precision-recall curve; ROC, receiver operating characteristic curve; XGBoost, extreme gradient boost.
[a]PRC 95% CI results obtained from bootstrapping (1,000 repetitions).

2024-01-057-002) since it involved the use of existing, de-identified retrospective data without direct interaction with or additional risk to the participants.

Results

1. Demographic and clinical characteristics

Among the 470 identified KT recipients, 74 (15.7%) were readmitted within 30 days post-KT. The original imbalanced samples were upsampled using the ROSE method, resulting in 241 readmitted (51.2%) and 229 non-readmitted (48.8%) recipients.

The mean post-KT hospital stay was 19 days, with 92.3% of recipients discharged on weekdays (Table 1). Baseline characteristics were compared between the two groups based on the EHR status (Table 1). Differences were observed between the groups in terms of recipient discharge days (weekdays or weekends), duration of ICU stay post-KT surgery, and administration of steroid pulse therapy (all $p<.05$).

2. Model evaluation

Table 2 summarizes each ML model's performance metrics based on validation and test datasets. Overall, the RF and XGBoost models demonstrated the highest predictive performance, while the SVM and DT models showed relatively lower but interpretable outcomes.

The RF model achieved the highest accuracy on validation (.79; 95% CI, 0.63–0.89) and test (.79; 95% CI, 0.65–0.90) sets. It exhibited balanced sensitivity (.83) and specificity (.74) in the validation set, along with an ROC AUC of .87 and a high PRC AUC of .90 (95% CI, 0.78–0.97), indicating strong discrimination and precision–recall balance. The XGBoost model showed slightly lower performance in the validation set (accuracy, .70; 95% CI, .55–.83; ROC AUC=.79), but matched the RF model in test set accuracy (.79; 95% CI, .65–.90). Its test set ROC AUC was .81, and PRC was .82 (95% CI, .66–.92), suggesting that despite potential sensitivity to overfitting during training, it demonstrated strong generalizability in external evaluation. The SVM model demonstrated moderate classification performance [33], as evidenced by its validation and test accuracies of .66 (95% CI, .51–.79) and .67 (95% CI, .52–.80), respectively, which were lower than those of the RF and XGBoost models (both .79) but higher than those of the DT model (.60) in the test set. Its ROC AUC scores were .74 (validation) and .72 (test), and the PRC AUC was .76 (95% CI, .56–.90), indicating fair but suboptimal discriminative ability. According to prior benchmarks [34], ROC AUC values between .70 and .80 are typically interpreted as acceptable or moderate in classification tasks involving imbalanced datasets. The SVM provided stable but less discriminative performance than the tree-based models, supporting its classification as a moderately effective model for EHR prediction in this context. While the DT model showed moderate performance in the validation set (accuracy, .72; 95% CI, .57–.84; ROC AUC=.73) [33], it experienced a notable performance drop on the test set (accuracy, .60; 95% CI, .45–.74; ROC AUC=.61). Sensitivity declined markedly to .40, although specificity remained relatively high (.83). The PRC AUC of .74 (95% CI, .53–.90) confirmed its limited generalizability compared to other models.

As shown in Table 2 and Supplementary Figure 1, model performance was compared across four classifiers. Among them, the

RF model achieved the most stable and superior performance across validation and test datasets, recording the highest ROC AUC (validation=.87, test=.82) and F1-score (.79). These results formed the basis for selecting RF as the primary model for further interpretation and feature importance analysis.

3. Feature importance

Figure 1 depicts the DT model's structure used to predict EHR post-KT. The root node begins with steroid pulse therapy, and each subsequent split is determined by key clinical features, including the brain-dead donor due to cerebrovascular accident (CVA), donor sex, discharge day (weekend vs. weekday), heart failure, and dialysis modality. Each node presents the predicted outcome (EHR=1 or 0), associated probability of readmission, and population proportion represented. Blue and red nodes indicate predicted (EHR=1) and no (EHR=0) readmission, respectively. This tree structure visually illustrates how combinations of clinical conditions step-wisely stratify risk.

The first criterion was whether the recipient had received pulse steroid therapy. If a recipient did not receive this therapy (value=0), the probability of not being readmitted was 44%, representing 85% of the sample. However, readmission probability increased to 90% if a recipient received steroid pulse therapy (value=1), representing 15% of the sample. The second criterion was whether the brain-dead donor was due to CVA. Among recipients who did not receive steroid pulse therapy, those whose recipients did not become brain-dead donor due to CVA (value=0) showed a 38% probability of avoiding readmission, representing 63% of the sample. Conversely, readmission probability increased to 64% if the brain-dead donor was due to CVA (value=1). The third criterion was donor sex. Among recipients with a brain-dead donor due to CVA, the readmission probability was 83% if the donor was female (value=0), representing 13% of the sample. If the donor was male (value=1), the probability of not being readmitted was 34%. The fourth criterion was discharge day (weekend vs. weekday). Readmission probability was 34% if the recipient was discharged on a weekend (value=1) but increased to 69% if discharged on a weekday (value=0). For cases involving weekend discharge (value=1), the DT advanced to the next split based on heart failure status. Readmission probability was 61% if the recipient had heart failure (value=1). If the recipient did not have heart

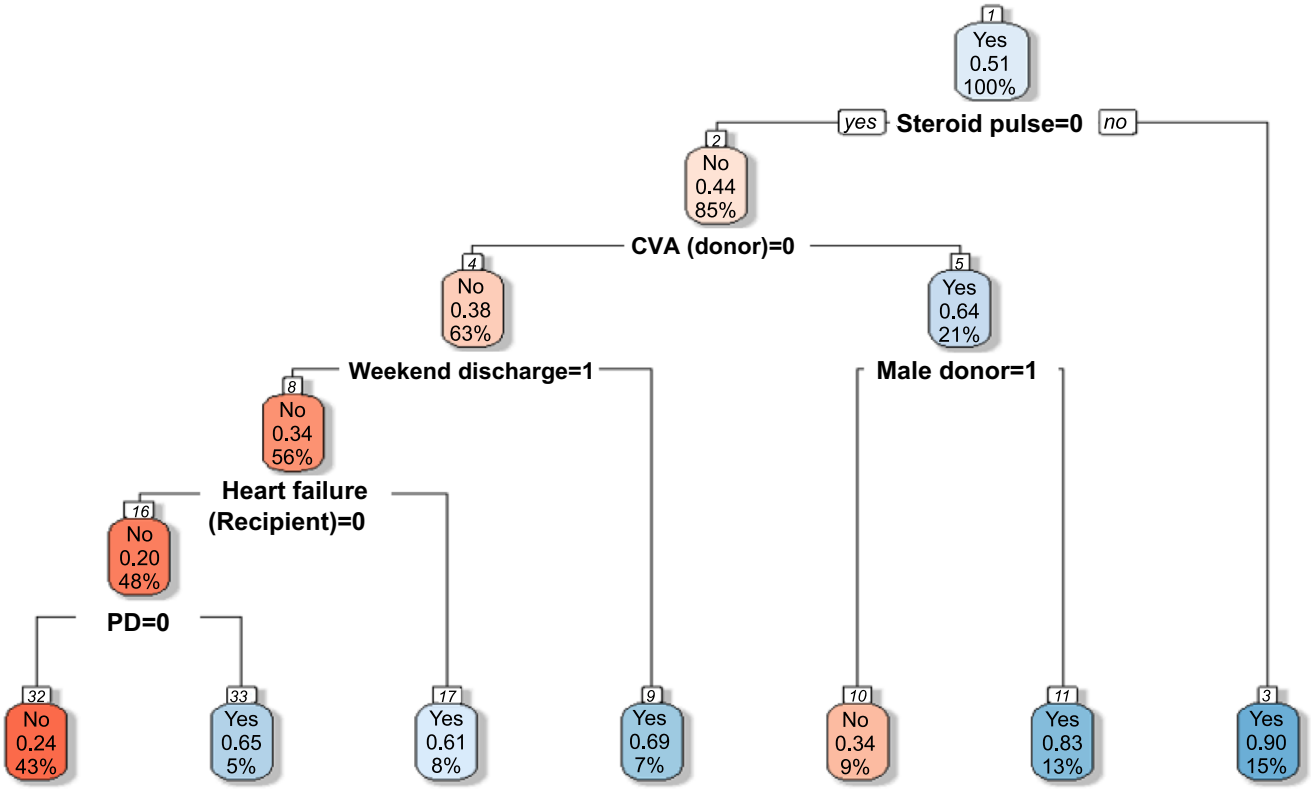

Figure 1. Decision tree for predicting early hospital readmission (EHR) after kidney transplantation. A value of "yes" indicates patients who were readmitted within 30 days (EHR=1, blue nodes), while "no" indicates non-readmitted cases (EHR=0, red nodes). CVA, cerebrovascular accident; PD, peritoneal dialysis.

failure (value=0), the DT proceeded to another split, where readmission probability increased to 65% if the recipient had received peritoneal dialysis (value=1).

We analyzed the importance of various features using the RF and XGBoost models, both of which demonstrated relatively high accuracy in predicting EHR post-KT. Figure 2 illustrates the importance of the best-performing RF and XGBoost models. Feature importance analysis in the RF model showed that steroid pulse therapy was the most influential feature, with a feature importance score of .12, greatly impacting the model's predictions. Other critical features included CVA (donor), heart failure (recipient), male sex (donor), and CVD (recipient), all of which played a vital role in predicting readmission. Since RF assesses feature importance by evaluating numerous DTs, these features could be key decision points across multiple trees. Similarly, analysis of the XGBoost model identified steroid pulse therapy as the most influential feature, aligning with the findings of the RF model.

The importance of steroid pulse therapy in the XGBoost model was even more pronounced, with a feature importance score of .19, compared with .12 in the RF model, indicating a relatively greater weight placed on this variable during prediction. This difference reflects the boosting mechanism of XGBoost, which iteratively emphasizes difficult-to-classify instances, thereby amplifying the contribution of key features such as steroid pulse therapy. Additional significant features included cold ischemic time (donor), the number of any other comorbid conditions (recipient), age (recipient), and dialysis duration (recipient). The XGBoost model, which utilizes a boosting algorithm, builds trees iteratively by correcting errors from previous iterations, resulting in a higher importance being assigned to some features.

Collectively, the results of the feature importance analysis from both models suggested that key features, including steroid pulse therapy, brain-dead donor due to CVA, recipient comorbid conditions, and dialysis-related factors, play a critical role in predicting EHR post-KT. Although RF and XGBoost assess differently, both models identified similar feature importance. A detailed analysis of specific features may further aid in improving the developed models' performance.

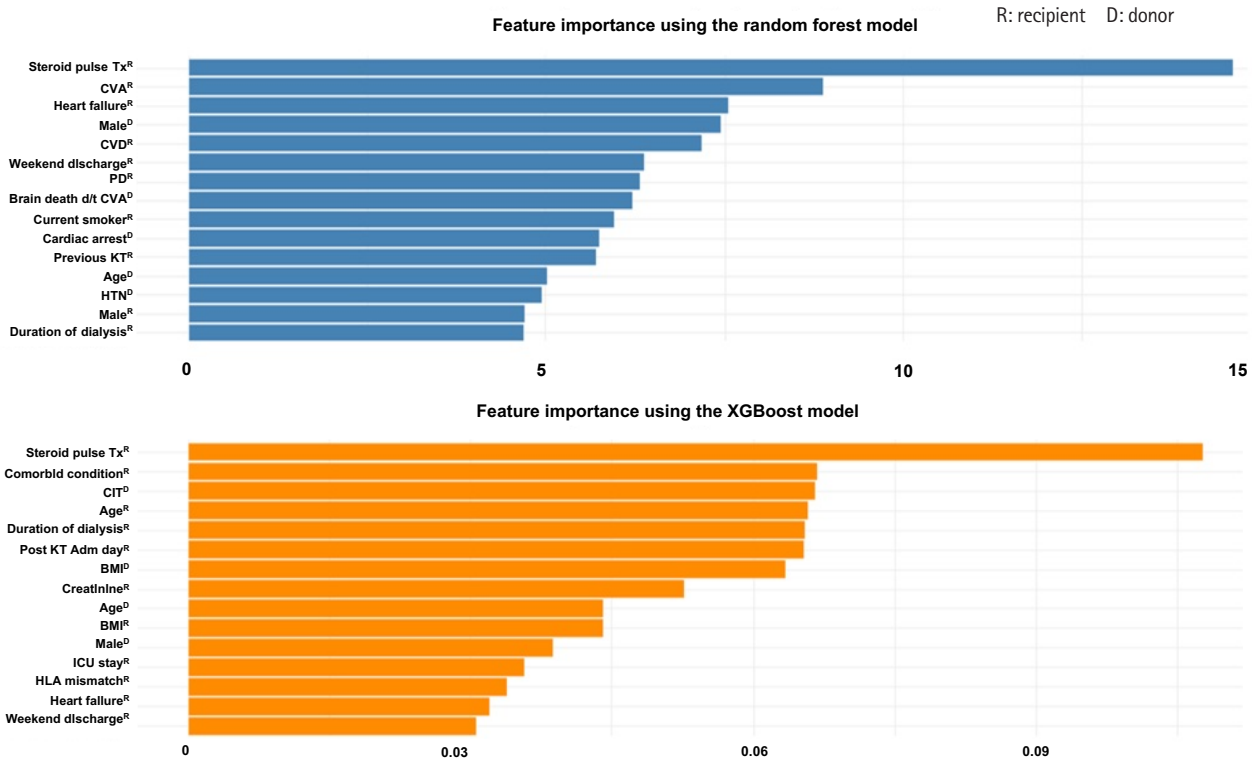

Figure 2. Comparison of feature importance between random forest and XGBoost models. Feature importance for early hospital readmission prediction using random forest (A) and extreme gradient boosting (XGBoost) (B). Steroid pulse therapy was the strongest predictor in both models, followed by cerebrovascular accident (CVA), comorbid conditions, and dialysis duration. Comorbid condition; the number of any other comorbid disease. CIT, cold ischemic time; CVA, cerebrovascular accident; BMI, body mass index; CVD, cardiovascular disease; d/t, due to; HLA, human leukocyte antigen; HTN, hypertension; ICU, intensive care unit; KT, kidney transplantation; PD, peritoneal dialysis; Tx, therapy.

Discussion

We developed and validated an ML-based model to predict EHR post-KT using a dataset from Korean KT recipients. The RF model tested on the test set demonstrated high predictive performance (ROC AUC=.82) and identified 15 key clinical predictors, including steroid pulse therapy, brain-dead donor due to CVA, and donor-related characteristics. These findings suggest that integrating this model into clinical workflows enhances individualized risk assessment and supports risk-based post-transplant care planning, particularly for high-risk populations. The early and data-driven identification of at-risk recipients can enable more precise allocation of follow-up resources, targeted nursing interventions, and closer clinical monitoring.

EHR occurred in 15.7% of KT recipients in this study, a rate slightly lower than those reported in studies from the United States (18%–47%) [12,15,18,25,35], Canada (22.4%) [24], and Korea (approximately 30%) [15,36]. Although direct comparisons are limited by differences in healthcare systems and recipient populations, variations in the operational definition of EHR likely contribute to these discrepancies. We strictly defined EHR as the first unplanned hospital readmission within 30 days of discharge from the index admission during which KT was performed, regardless of the number or type of admissions [24,25]. Previous studies have defined EHR more broadly or included planned readmissions (such as protocol biopsies or delayed procedures), leading to inflated reported rates [3]. Therefore, our more conservative definition may partly explain the lower EHR rate.

To our knowledge, this is the first study to develop and validate an ML-based prediction model for EHR using clinical data from Korean KT recipients. Our RF model achieved an ROC AUC of .82 with accuracies of .79 on the validation and test datasets, respectively. Although our dataset (N=470) is modest compared to national registries, it represents one of the most comprehensive Korean datasets incorporating recipient- and donor-level features. These findings have important implications for guiding risk-based follow-up strategies and personalized post-transplant care in Korean KT recipients. ML algorithms, including DT, RF, XGBoost, and SVM, were employed because of their ability to handle complex and non-linear clinical data. Compared with traditional regression methods, RF and XGBoost aggregate multiple DTs to optimize classification and assess feature importance, a feature proven effective in predicting readmission in transplant-specific and general medical populations [18,37]. For example, a recent US-based study involving >2,000 KT recipients reported a 30.7% EHR rate within 30 days and demonstrated that ML-based models outperformed logistic regression in risk prediction [18]. Our model achieved slightly higher predictive performance in a Korean context despite using fewer input features. This demonstrates that even localized datasets can yield meaningful and generalizable predictions to support early clinical decision-making.

Although traditional statistical approaches, including logistic regression, have been used to identify risk factors, they assume linear relationships and cannot effectively capture complex, non-linear interactions among multiple predictors [21,38]. However, ML methods, including RF and XGBoost, provide several advantages [39]. First, they require no assumptions about feature distributions or linearity and are less sensitive to multicollinearity. Second, these methods can automatically detect and incorporate higher-order interactions that might go unnoticed in traditional models [38]. Third, they are generally more robust to noise and overfitting, particularly when combined with techniques such as CV and bootstrap aggregation [40]. Recent studies have reinforced ML's clinical utility for predicting readmission risk in transplant populations. Arenson et al. [18] developed models based on clinical notes and EHR data in KT recipients that outperformed traditional models. Similarly, Orfanoudaki et al. [41] highlighted the role of metabolic features, including glucose variability, in readmission risk. These findings reinforce ML's clinical utility for accurate prediction and interpretability in identifying the most influential clinical features.

Here, RF and XGBoost yielded more stable and accurate predictions than logistic regression, providing interpretable rankings of predictor importance that can facilitate practical clinical implementation. Therefore, ML-based models can enhance risk stratification for EHR by identifying high-risk KT recipients who might otherwise be overlooked, ultimately supporting the delivery of tailored interventions and improved post-transplant care. Although the DT model showed limited generalizability with lower test-set performance, the RF and XGBoost models demonstrated more consistent and robust results. In particular, RF achieved stable accuracy across validation and test datasets, with balanced sensitivity, specificity, and F1-scores. Both RF and XGBoost maintained superior ROC AUC values and relatively narrow confidence intervals, supporting their reliability for clinical application [33,42,43].

In our study, feature importance analysis identified the top 15 EHR predictors in the highest-performing RF model. This EHR prediction model underscores the value of EHR in risk prediction by integrating features related to transplant complications, including the administration of steroid pulse therapy. It also incorporates recipient-specific factors, including pre-existing conditions (e.g.,

heart failure and CVD), demographics (e.g., age and sex), smoking status, and aspects of hospital management such as discharge timing (e.g., weekend discharges). Donor-related characteristics (e.g., age and sex), cause of brain death (e.g., CVA), and underlying conditions (e.g., hypertension) were incorporated to improve predictive accuracy.

Notably, steroid pulse therapy consistently ranked highest in both models, emphasizing its strong association with EHR risk—likely reflecting the occurrence of acute rejection episodes, which require such therapy and contribute to post-transplant complications. Other high-ranking features included donor-related factors (e.g., donor age, CVA as the cause of brain death, and cold ischemic time) and recipient characteristics (comorbidity burden, dialysis duration, ICU stay, and weekend discharge). These results underscore the complex, multifactorial nature of EHR risk and highlight the potential of ML-based models to uncover subtle, non-linear relationships that traditional statistical methods may miss. Although many of these variables—including donor characteristics and pre-existing comorbidities—are non-modifiable, the model provides valuable support for early identification of KT recipients at higher EHR risk. These predictors are statistically important in the model performance context; however, their inclusion does not imply causal relationships with EHR. For instance, variables including steroid pulse therapy likely reflect underlying clinical conditions (e.g., acute rejection) that precede readmission, rather than independently causing it. Accordingly, the model utility lies in risk stratification and informed decision-making, rather than directly guiding causal intervention. The model may assist in prioritizing surveillance and education strategies for at-risk patients from a nursing perspective, although such applications should be cautiously interpreted and in conjunction with clinical judgment.

Several previous studies predicted EHR post-KT using a limited set of features, typically restricted to recipient-related clinical factors or administrative data [15,24,25]. For instance, McAdams-DeMarco et al. [25] analyzed demographic and comorbidity data, while Lubetzky et al. [15] focused on discharge-level factors without fully integrating donor characteristics. By incorporating pre- and peri-transplant data, our broader feature set enabled the ML model to uncover complex interactions usually missed by traditional methods. Therefore, our study provides a more robust and generalizable predictive framework that can inform targeted interventions across different stages of transplant care.

EHR has been associated with various adverse post-transplant outcomes, including inferior graft function, increased mortality, and diminished quality of life [25]. Although our study focused on identifying EHR predictors rather than establishing causal pathways, acknowledging the downstream clinical consequences of EHR emphasizes the value of early risk stratification. For instance, while steroid pulse therapy is commonly administered for acute rejection, and acute rejection is frequently observed among readmitted recipients, these relationships should be interpreted as associative rather than causal [24,44,45]. A recent Canadian study reported a higher incidence of rejection among recipients who experienced EHR [24], suggesting that transplant-related complications coincide with early readmission events. Therefore, predictive models—when carefully interpreted—may support individualized monitoring and intervention strategies that could contribute to improved long-term outcomes. Donor characteristics, including donor age or type (e.g., living vs. deceased donor and donation after brain death vs. circulatory death), are strongly associated with rehospitalization [6]. However, the recipient characteristics were the most important predictors using the RF model in our study. These findings may not apply to other countries owing to disparities in organ acceptance policies and healthcare delivery systems [12,25,46].

Nevertheless, transplant programs worldwide, including in Korea, have recently expanded their recipient and donor pools to encompass more medically complex individuals, such as those classified as expanded criteria donors [47]. Consistent with previous regression studies conducted in the United States and Canada, our ML model identified the recipient's age and pre-existing comorbidities (e.g., heart disease) as factors associated with EHR post-KT. This finding aligns with reports by Famure et al. [24] and McAdams-DeMarco et al. [25], who demonstrated that older age and a higher comorbidity burden were significantly associated with increased readmission risk in a Canadian and the US cohort, respectively. As the KT recipient population ages and presents with a higher prevalence of comorbid conditions, this aspect is likely to become increasingly significant [48]. This is an important factor to consider in the future, particularly in Korea, which is entering an era of super-aging.

Early risk prediction is essential for effectively preventing readmission. Ideally, preventive measures should be implemented pre-discharge. Our study models aimed to predict EHR risk in KT recipients at an early stage. Our results will contribute to individualized evaluations, education, and treatment of KT recipients. Notably, our study builds on existing predictive factors and provides new insights that can improve KT outcomes and enhance the quality of life of Korean KT recipients. The integration of EHR risk assessment systems into electronic health record platforms can be achieved by developing medical record-based prediction

models. EHR alert systems can be designed for transplant care, enabling healthcare professionals, including transplant specialists, nurses, and physicians, to effectively allocate preventive interventions to KT recipients identified as high risk for EHR [49].

This study has some limitations. First, the predictive model was developed using retrospective data from a single university hospital without external validation, limiting its generalizability. External validation using multicenter datasets is necessary to ensure the model's robustness, reproducibility, and broader applicability. Second, although the model outperformed traditional logistic regression, key predictors, including steroid pulse therapy, raise concerns regarding clinical interpretability. Since steroid pulse therapy is typically administered in response to complications, including acute rejection, it may reflect a consequence of clinical deterioration rather than a true pre-discharge risk factor, making it less actionable for early intervention or discharge planning. Third, the study did not differentiate between the types, causes, or timing of readmissions—including preventable vs. non-preventable events—limiting the ability to tailor interventions or evaluate their effectiveness. Important post-discharge determinants of readmission, including outpatient follow-up adherence, social support systems, socioeconomic status, and patient self-management behaviors, were not included in the model, potentially omitting critical predictors of early readmission. Therefore, future research should incorporate a broader range of pre- and post-discharge variables, validate the model across diverse clinical environments, and explore cause-specific readmission patterns to enhance ML-based prediction tools' clinical utility and generalizability in KT care. Finally, one limitation of our approach is that categorical entries labeled as "unknown" (e.g., PRA and diabetes mellitus) were retained as separate levels in the model rather than being excluded or imputed. While this approach mirrors clinical uncertainty and enables the model to learn from missingness patterns, it may affect interpretability and model calibration. Future studies should explore alternative preprocessing strategies for unknown categories, including exclusion, multiple imputation, or sensitivity analyses to compare predictive performance and stability [50].

Conclusion

The models developed in this study can assist healthcare professionals—particularly transplant nurses and coordinators—in stratifying KT recipients by their risk of EHR, prioritizing post-discharge care and follow-up for high-risk individuals, and allocating targeted interventions, including closer monitoring or education when implementing early interventions to prevent EHR in KT recipients, particularly within the transplant care context. This algorithm facilitates the enrollment of recipients in EHR prevention programs and provides targeted interventions for various cohorts of KT recipients.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

The data that support the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.4040/jkan.25030.

Author Contributions

Conceptualization or/and Methodology: HJC. Data curation or/and Analysis: HJC. Funding acquisition: HJC. Investigation: HJC, JHY. Project administration or/and Supervision: HJC. Resources or/and Software: HJC, JHY. Validation: HJC. Visualization: HJC. Writing original draft or/and Review & Editing: HJC. Final approval of the manuscript: HJC.

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Multidimensional factors influencing the completion of advance directives among community-dwelling older Koreans

Hee-Ju Ji, Soong-Nang Jang

Red Cross College of Nursing, Chung-Ang University, Seoul, Korea

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Corresponding author:
Soong-Nang Jang
Red Cross College of Nursing, Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, Seoul 06974, Korea
E-mail: sjang@cau.ac.kr

Purpose: This study aimed to examine the multidimensional factors associated with the completion of advance directives (ADs) among community-dwelling older Koreans, guided by conceptual frameworks developed in Asian contexts.

Methods: Data from the 2023 National Survey of Older Koreans (sixth wave) were analyzed for 9,951 community-dwelling older Koreans aged 65 years or older. Complex sample cross-tabulation and binary logistic regression analyses were conducted.

Results: In total, 11.1% of community-dwelling older Koreans had completed an AD. Significant factors associated with AD completion were identified across four domains—personal situation: age, educational level, religion, and housing preference in the event of poor health; socio-cultural: presence of children, participation in social activities and satisfaction with social relationships; physical and illness: the number of chronic diseases; and value system: awareness of hospice and palliative services, participation in death preparedness education, and documentation of organ donation.

Conclusion: Among older Koreans, AD completion represents more than a documentation process; it reflects a complex decision-making process shaped by their values and life circumstances, underscoring the need for supportive interventions. As the highest AD completion rates are found among older adults, related policies should be aligned with older adult-centered policy frameworks.

Keywords: Advance directives; End-of-life care; Health services for the aged; Personal autonomy

Introduction

A key component of death preparedness—which entails discussing one's goals and preferences for end-of-life care before the potential loss of decision-making or communication capacity—is advance care planning (ACP) [1,2], whose key aspect is documentation [3]. Advance directives (AD) are a method for documenting care preferences [4]. An AD is a legal document in which individuals can specify their preferences for medical treatments at the end of life, should they lose their decision-making capacity [5]. An AD—as a documented outcome of ACP—is associated with reduced hospitalization rates, improved satisfaction with end-of-life care, and decreased decisional conflicts among medical surrogates [6-8].

In this context, many countries have established institutional frameworks to ensure that medical care aligns with individual treatment preferences [9]. In South Korea, the Act on Hospice and Palliative Care and Decisions on Life-Sustaining Treatment for Patients at the End of Life (LST Decision Act, enacted in 2016 and implemented in 2018) established the legal validity of AD. Upon completion, the AD is registered with a government-designated registry. If two physicians determine that a patient is at the end-of-life stage, the AD is reviewed by the attending physician or, if necessary, by two physicians. These decisions are then implemented in a healthcare institution with an institutional ethics committee.

As of March 2025, 84.8% of individuals having a registered AD were aged 65 years or older [10]. This may reflect older adults' closer proximity to death, greater likelihood of experiencing functional and cognitive decline and multimorbidity, and a more realistic awareness of end-of-life issues [9]. However, autonomy—a prerequisite for completing AD in older adults—cannot be defined solely by independence or decision-making capacity, as it is influenced by an interaction of factors, including health status, social relationships, interdependence, and a broader life context [11,12].

The Institute of Medicine has identified community-dwelling older adults as a key target group for ACP policy development [13,14]. As 88.5% of ADs in Korea were completed through community-based organizations in 2023 [15], exploring the factors influencing AD completion among community-dwelling older Koreans is particularly important. AD completion has a multidimensional nature, shaped not only by individual characteristics but also psychological, social, and institutional contexts [16]. However, previous studies on the factors influencing AD completion among community-dwelling older adults have primarily focused on readiness, including knowledge, attitudes, and preference for ACP [17-20]. Moreover, few studies have explored the complex factors influencing AD completion among older adults who have actually completed an AD [21,22].

Therefore, this study aims to examine the multidimensional factors associated with the completion of AD among community-dwelling older Koreans.

Methods

1. Study design

The study comprised a cross-sectional secondary data analysis using data from the 2023 National Survey of Older Koreans (6th wave), conducted in 2023.

2. Conceptual framework

Factors influencing AD completion operate across multiple dimensions [16,23] and are particularly shaped by cultural contexts [24]. To systematically analyze these multidimensional characteristics, this study adopted the conceptual framework proposed by Chan et al. [25], which classifies the factors influencing AD completion into six clusters: personal situation, socio-cultural, physical and illness, value system, conditional, and process of AD. This framework reflects cultural characteristics of Asian contexts, where family-centered decision-making, avoidance of death-related discussions, and prioritization of group harmony over individual autonomy are emphasized [25], and it is useful for explaining the multidimensional factors that influence AD completion.

However, this framework was originally developed in the context of palliative care units, where ADs are discussed and completed with healthcare professionals. In contrast, because AD completion among community-dwelling older adults in Korea primarily occurs through community-based organizations rather than healthcare institutions, the conditional and process factors—which presuppose discussions with healthcare professionals—were not relevant to the experiences of the study population. Accordingly, these two factors were excluded, and the framework was reconstructed into four groups of factors—personal situation, socio-cultural, physical and illness, and value system—based on the context of community-dwelling older Koreans and a review of prior studies, and was employed for the analysis (Figure 1).

The four groups of factors were defined as follows: personal situation (sociodemographic background and life context), socio-cultural (family perspectives and quality of social interactions, including presence of children), physical and illness (individual health status), and value system (attitudes toward death and end-of-life care). In particular, this study considered the presence of children as a key factor influencing the nature of family relationships and included it under socio-cultural factors. Physical and illness factors were defined as variables reflecting an individual's health status, whereas value system factors were defined as variables reflecting personal attitudes and perceptions regarding the purpose and meaning of ADs and end-of-life care.

Therefore, this study adapted and reconstructed the framework of Chan et al. [25] to align with the context of community-dwelling older Koreans and the characteristics of the dataset, with the aim of examining the multidimensional factors influencing AD completion in this population.

3. Description of primary data

The 2023 National Survey of Older Koreans (6th wave) is a nationwide survey conducted every 3 years since 2008, targeting adults aged 65 years or older. It is based on the Older Persons Welfare Act and aims to provide foundational data for the development of aging-related policies in Korea [26].

This nationwide survey applied a stratified cluster sampling method based on a complex sampling design to ensure its representativeness. Stratification was conducted in three stages based on Korea's (1) 17 administrative regions, (2) area type (urban ver-

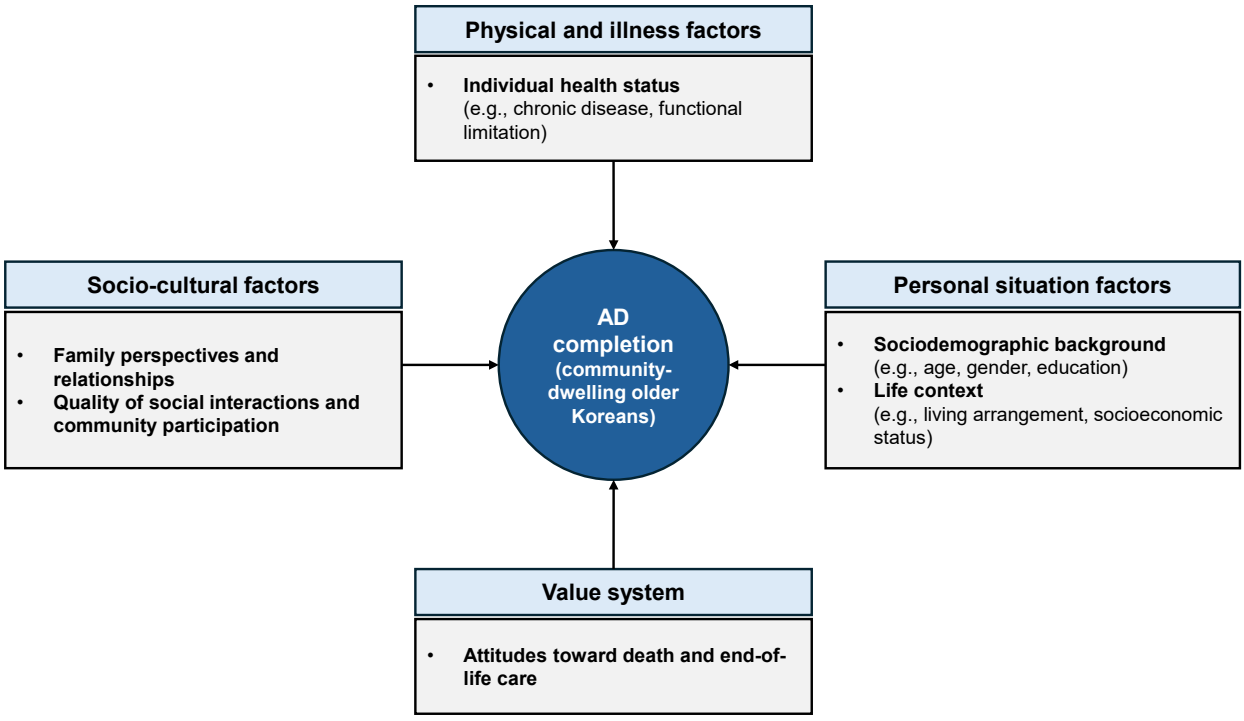

Figure 1. Study framework: multidimensional factors associated with advance directive (AD) completion.

sus rural), and (3) housing type (apartment versus non-apartment housing). Based on these criteria, 52 strata were constructed. Within each stratum, survey areas and sample households were selected, and a complete enumeration survey was conducted for all adults aged 65 years or older residing in the selected households [26].

4. Samples used for analysis

The 2023 National Survey of Older Koreans (6th wave) was conducted with a nationwide target population of 9.5 million adults aged 65 years or older. Data were collected from 10,178 older Koreans residing in 7,605 households across 977 survey areas. After excluding cases with incomplete responses, data from 10,078 older Koreans were made publicly available [26]. Analyses were conducted using data from 9,951 older Koreans who completed the survey through self-response.

5. Measurement

1) Dependent variable

An AD is a legal document in which individuals specify, in advance, the medical treatments they would accept or refuse in the event of losing their decision-making capacity in the future [5]. In this study, AD completion was measured using the item, "Have you completed advance directives in preparation for end-of-life care?" Responses were collected as a binary variable ("yes" or "no").

2) Independent variables

(1) Personal situation factors

Personal situation factors were assessed using the following variables: sex, age, educational level, religion, annual family income level, living status, life satisfaction, housing preference in the event of poor health.

Sex was categorized as male or female. Age was recategorized into four groups: 65–69 years, 70–79 years, 80–89 years, and 90 years or older. Educational level was categorized as follows: illiterate or barely literate, elementary school, middle school, high school, and college or higher. Religion was dichotomized as having a religion or not.

Family income level was measured as annual equivalized household income, calculated by dividing the total annual household income by the square root of the number of household members. This measure adjusts for household size to allow fair comparisons across households of different sizes. Using this variable, family income level was recategorized into quintiles (1st–5th) according to the original dataset classification.

Living status was categorized as living alone, living with a spouse, living with children, or other.

Life satisfaction was measured using the question, "How satisfied are you with your overall life?" Responses were recategorized into three groups: satisfied (very satisfied and satisfied), neutral, and dissatisfied (dissatisfied and very dissatisfied).

Housing preference in the event of poor health was assessed using the item, "Where would you prefer to live if your health deteriorated to the point where independent daily living became difficult?" Responses were categorized as follows: live at home, move in with family, move near family, senior housing residence, or senior care facility. Other responses were excluded from the analysis (n=12).

(2) Socio-cultural factors

Socio-cultural factors included presence of children, presence of friends or neighbors, participation in social activities, and satisfaction with social relationships.

Presence of children was recoded based on co-residing children and non-co-residing surviving children; respondents with at least one child in either category were classified as "having children" while those with no children in both categories were classified as "having no children."

The presence of friends or neighbors was assessed using the item, "Do you have close friends, neighbors, or acquaintances?" with responses classified as "yes" or "no."

Participation in social activities was defined according to previous research based on participation in at least one of the following within the past year [27,28]: hobby groups, alumni or peer groups, or political/social organizations. Respondents were classified as participants or non-participants depending on whether they had engaged or not engaged in any activity.

Satisfaction with social relationships was measured using the item, "How satisfied are you with your interactions with friends and neighbors, excluding family members?" Responses were recategorized into three groups: satisfied (very satisfied and satisfied), neutral, and dissatisfied (dissatisfied and very dissatisfied).

(3) Physical and illness factors

Physical and illness factors were assessed based on the number of chronic diseases and overall functional status.

The number of chronic diseases was assessed based on responses to the item, "Do you have any chronic diseases diagnosed by a physician, that lasted for 3 months or longer?" The number of reported conditions was categorized as 0, 1, 2, or ≥3.

Overall functional status was derived by combining measures of activities of daily living (ADL) and instrumental activities of daily living (IADL). ADL included seven items related to basic daily functions, such as dressing, washing, and mobility. IADL included ten items related to more complex functions, such as meal preparation, laundry, and medication management. Each item was rated as "independent," "partially dependent," or "fully dependent." Respondents were classified as having functional limitations if they reported "partially dependent" or "fully dependent" on at least one ADL or IADL item and having no functional limitations if they reported being "independent" on all items.

(4) Value system

Value system factors included awareness of hospice and palliative care services, participation in death preparedness education, and documentation of organ donation. Awareness of hospice and palliative care services was assessed using the item, "Are you aware of hospice and palliative care services?" with response options of "yes," "no," and "Have heard of it, but do not know well." Participation in death preparedness education was measured based on whether the respondent had ever attended such education programs ("yes" or "no"). Organ donation documentation was assessed using the item, "Have you registered for organ donation?" with responses of "yes" or "no."

6. Data analysis

The original data were downloaded on February 27, 2025, following approval from the Institutional Review Board (IRB). The data were collected using a complex sampling design; hence, stratification, clustering, and sampling weights were applied in the analysis.

Participants' characteristics were presented using the actual sample size (unweighted frequencies) and weighted estimates (percentages) based on complex sample weights. Differences in variables according to the AD completion status were examined using complex sample cross-tabulation analysis, and statistical significance was tested using the Rao-Scott chi-square test.

According to previous studies showing that AD completion in older adults is formed by the interaction of various factors [11,12], this study included all theoretically relevant variables and examined them using complex sample binary logistic regression to comprehensively capture the multidimensional factors influencing AD completion and to control for confounding effects among variables. Complex sample binary logistic regression analyses were performed using the svy command in Stata/MP ver. 18.0 (Stata Corp.) to account for the stratified multistage cluster sampling design. Sampling weights (post-stratification weights), stratification, and primary sampling units were specified according to

the original survey design defined by the survey organization. All analyses were performed using Stata/MP ver. 18.0 (Stata Corp.), with the significance level set at $p<.05$.

7. Ethical considerations

The 2023 National Survey of Older Koreans (6th wave) used in this study was approved by the IRB of the Korea Institute for Health and Social Affairs (approval no., 2023-078) and conducted with approval from Statistics Korea (approval no., 117071). This study involved secondary data analysis and was exempted from review by the IRB of Chung-Ang University (approval no., 1041078-20250107-HR-006). Accordingly, the original data were obtained from the providing institution without requiring additional informed consent from participants.

Results

According to the results, approximately 11.1% of older Koreans had completed an AD, corresponding to 1,109 respondents out of the total sample of 9,951 (actual unweighted frequencies). Differences in AD completion by factors were analyzed using the Rao-Scott chi-square test, and the main results are presented in Table 1.

1. Differences in factors of AD completion

Among personal situation factors, educational level showed a significant association with AD completion ($\chi^2=8.68$, $p<.001$). In the AD completion group, 13.3% of respondents had college-level or higher education, which was approximately twice the rate observed in the non-completion group (6.3%). Conversely, the proportion of respondents with no formal education or low literacy was 12.4% and 8.2% in the non-completion and completion groups, respectively. Religion also showed a significant association with AD completion ($\chi^2=28.21$, $p<.001$).

Life satisfaction was also significantly associated with AD completion ($\chi^2=3.23$, $p=.043$). The proportion of respondents reporting "satisfied" for life satisfaction was 46.1% in the AD completion group, compared to 39.5% in the non-completion group.

In addition, there was a significant difference in AD completion status according to housing preference in the event of poor health ($\chi^2=4.93$, $p<.001$). Among respondents who preferred to remain at home, 38.6% were in the AD completion group, compared to 50.2% in the non-completion group.

Table 1. Comparison of characteristics by advance directive completion status (N=9,951)

Characteristic	Total	Advance directive completion		
		Yes	No	Rao-Scott χ^2 (p)[a]
Personal situation factors				
Sex				0.13 (.722)
Male	3,824 (44.0)	426 (43.5)	3,398 (44.1)	
Female	6,127 (56.0)	683(56.5)	5,444 (55.9)	
Age (yr)				2.29 (.081)
65–69	3,243 (34.8)	325 (29.7)	2,918 (35.5)	
70–79	4,400 (41.1)	546 (45.9)	3,854 (40.5)	
80–89	2,135 (21.7)	222 (21.9)	1,913 (21.7)	
≥90	173 (2.4)	16 (2.5)	157 (2.4)	
Educational level				8.68 (<.001)
Illiterate or barely literate	1,435 (11.9)	121 (8.2)	1,314 (12.4)	
Elementary school	2,920 (28.2)	346 (29.7)	2,574 (28.0)	
Middle school	2,114 (21.4)	202 (17.7)	1,912 (21.8)	
High school	2,860 (31.5)	317 (31.1)	2,543 (31.5)	
College or more	622 (7.1)	123 (13.3)	499 (6.3)	
Religion				28.21 (<.001)
Yes	4,071 (60.0)	576 (49.3)	3,495 (61.3)	
No	5,880 (40.0)	533 (50.7)	5,347 (38.7)	
Family income level (/yr)				1.16 (.324)
1st quintile (lowest)	2,107 (20.0)	199 (18.5)	1,908 (20.2)	
2nd quintile	2,167 (20.0)	271 (20.1)	1,896 (19.9)	
3rd quintile (middle)	2,026 (19.9)	222 (18.6)	1,804 (20.1)	
4th quintile	1,910 (20.1)	202 (18.9)	1,708 (20.3)	
5th quintile (highest)	1,741 (20.0)	215 (23.9)	1,526 (19.6)	

(Continued on the next page)

Table 1. Continued

Characteristic	Total	Advance directive completion		
		Yes	No	Rao-Scott χ^2 (p)[a]
Living status				2.25 (.088)
Lives alone	3,423 (33.0)	383 (33.2)	3,040 (32.9)	
Lives with a spouse	5,419 (55.3)	647 (58.4)	4,772 (55.0)	
Lives with adult children	940 (10.0)	68 (7.5)	872 (10.3)	
Other	169 (1.7)	11 (0.9)	158 (1.8)	
Life satisfaction				3.23 (.043)
Good	3,983 (40.3)	505 (46.1)	3,478 (39.5)	
Average	5,110 (51.0)	528 (46.5)	4,582 (51.6)	
Bad	858 (8.7)	76 (7.5)	782 (8.9)	
Housing preference in the event of poor healthb)				4.93 (<.001)
Live at home	4,981 (48.9)	433 (38.6)	4,548 (50.2)	
Move in with family (cohabitation)	259 (2.5)	32 (3.8)	227 (2.4)	
Move near family (independent)	396 (4.3)	66 (6.0)	330 (4.1)	
Senior housing residence (no insurance)	1,489 (16.5)	211 (22.8)	1,278 (15.7)	
Senior care facility (insurance)	2,814 (27.7)	366 (28.8)	2,448 (27.6)	
Socio-cultural factors				
Presence of children				2.60 (.107)
Yes	9,410 (94.0)	1,067 (95.6)	8,343 (93.8)	
No	541 (6.0)	42 (4.4)	499 (6.2)	
Presence of friends or neighbors				4.85 (.028)
Yes	8,946 (89.8)	1,027 (92.6)	7,919 (89.5)	
No	1,005 (10.2)	82 (7.5)	923 (10.5)	
Participation in social activities				18.59 (<.001)
Yes	5,340 (53.3)	708 (34.6)	4,632 (46.0)	
No	4,611 (44.7)	401 (65.4)	4,210 (54.0)	
Satisfaction with social relationships				6.43 (.002)
Good	4,583 (45.3)	606 (52.9)	3,977 (44.4)	
Average	4,454 (45.1)	434 (39.6)	4,020 (45.8)	
Bad	914 (9.6)	69 (7.5)	845 (9.8)	
Physical and illness factors				
No. of chronic diseases				6.21 (<.001)
0	1,363 (14.1)	97 (10.7)	1,266 (14.4)	
1	2,163 (22.2)	184 (18.2)	1,979 (22.7)	
2	2,744 (28.1)	308 (27.3)	2,436 (28.2)	
≥3	3,681 (35.6)	520 (43.8)	3,161 (34.6)	
Overall functional status				1.20 (.274)
Limited	1,648 (17.7)	190 (19.7)	1,458 (17.4)	
Unlimited	8,303 (82.3)	919 (80.3)	7,384 (82.6)	
Value system				
Awareness of hospice and palliative services				12.62 (<.001)
Yes	1,355 (16.0)	242 (26.5)	1,113 (14.7)	
Heard of	4,195 (43.4)	394 (37.8)	3,801 (44.1)	
None	4,401 (40.5)	473 (35.7)	3,928 (41.2)	
Participation in death preparedness education				58.18 (<.001)
Yes	297 (4.2)	115 (13.6)	182 (3.0)	
No	9,654 (95.8)	994 (86.4)	8,660 (97.0)	
Documentation of organ donation				194.88 (<.001)
Yes	361 (4.5)	162 (14.6)	199 (2.3)	
No	9,590 (95.5)	947 (85.4)	8,643 (97.7)	

Values are presented as unweighted frequency (weighted %), unless otherwise stated. Weighted percentages are presented. Percentages may not total 100 because of rounding.
[a]Rao-Scott χ^2 test using complex sample design. [b]"Other" responses excluded (n=12).

Among socio-cultural factors, the presence of friends or neighbors was significantly associated with AD completion (χ^2=4.85, p=.028). Participation in social activities was also significantly associated with AD completion (χ^2=18.59, p<.001). Furthermore, satisfaction with social relationships showed a significant difference by AD completion status (χ^2=6.43, p=.002), with 52.9% of respondents in the AD completion group reporting high satisfaction, compared to 44.4% in the non-completion group.

Among physical and illness factors, the number of chronic diseases was significantly associated with AD completion (χ^2=6.21, p<.001), with the highest AD completion rate (43.8%) observed among respondents with three or more chronic diseases.

Within value system factors, all variables showed significant associations with AD completion: awareness of hospice and palliative care service (χ^2=12.62, p<.001), participation in death preparedness education (χ^2=58.18, p<.001), and documentation of organ donation (χ^2=194.88, p<.001).

2. Factors associated with AD completion

To comprehensively analyze the factors influencing AD completion, a complex sample binary logistic regression was performed using all variables included in the complex sample cross-tabulation analysis as independent variables. A total of 35 independent parameters were included in the regression model after dummy coding of categorical variables. The events per variable (EPV), calculated based on the number of AD completions (n=1,109), was approximately 31.7 (1,109/35), exceeding the recommended threshold of EPV ≥10 [29]. Therefore, the risk of overfitting in this analysis was considered to be low. Additionally, multicollinearity was assessed, with a mean variance inflation factor of 1.96, indicating no significant multicollinearity. The results are presented in Table 2.

Among personal situation factors, age was not significant in cross-sectional analyses but was significantly associated with AD completion in some categories in complex-samples logistic regression analyses. Compared to the 65–69 age group, the likelihood of AD completion was higher in the 70–79 (adjusted odds ratio [aOR], 1.50; 95% confidence interval [CI], 1.19–1.90) and 80–89 (aOR, 1.68; 95% CI, 1.13–2.50) age groups. No significant association was found between being aged 90 years or older and AD completion (aOR, 1.65; 95% CI, 0.77–3.55).

Educational level was also a significant factor. Compared to individuals who were illiterate or barely literate, those with a college degree or higher had a greater likelihood of completing an AD (aOR, 2.79; 95% CI, 1.60–4.84). The group with a religion was more likely to complete an AD than the group without a religion (aOR, 1.30; 95% CI, 1.09–1.54).

Housing preference in the event of poor health was also significantly associated with AD completion. Compared to those who preferred to remain at home, respondents who preferred living with family (aOR, 1.98; 95% CI, 1.20–3.30), living near family (aOR, 1.69; 95% CI, 1.05–2.73), in senior housing (aOR, 1.51; 95% CI, 1.11–2.04), or care facilities (aOR, 1.47; 95% CI, 1.09–1.98) were more likely to complete an AD.

Within socio-cultural factors, presence of children was significantly associated with AD completion (aOR, 1.57; 95% CI, 1.01–2.44). The group that participated in social activities was more likely to complete an AD compared to the group that did not participate (aOR, 1.42; 95% CI, 1.12–1.80). Satisfaction with social relationships also had a significant association with AD completion. The group with high satisfaction was more likely to complete an AD compared to that with low satisfaction (aOR, 1.58; 95% CI, 1.03–2.41).

Among physical and illness factors, the number of chronic diseases had a significant association with AD completion. Both the group with two chronic diseases (aOR, 1.50; 95% CI, 1.06–2.13) and the group with three or more chronic diseases (aOR, 2.07; 95% CI, 1.43–3.00) were more likely to complete an AD compared to that with no chronic diseases.

All the variables within the value system were significantly associated with AD completion. The group that was aware of hospice services was more likely to complete an AD compared to the group that was unaware (aOR, 1.53; 95% CI, 1.06–2.20). The group that had received death preparedness education was significantly more likely to complete an AD compared to the group that had not received such education (aOR, 2.58; 95% CI, 1.57–4.24). The presence of organ donation documentation was significantly associated with AD completion (aOR, 5.32; 95% CI, 3.27–8.67).

Life satisfaction and presence of friends or neighbors showed significant differences in the cross-tabulation analysis, and no significance was associated with AD completion in the complex sample logistic regression analysis.

Discussion

This study conducted a multidimensional analysis of the factors associated with AD completion among community-dwelling older Koreans aged 65 years or older, using nationally representative data. Its analysis showed that 11.14% of community-dwelling older Koreans had completed an AD, which is comparable to the official AD registration rate of 17.3% among adults aged 65 and

Table 2. Factors associated with advance directive completion (N=9,951)

Independent variable	Classification	Advance directive completion			
		Crude		Adjusted	
		OR (95% CI)[a]	*p*	aOR (95% CI)[a]	*p*
Personal situation factors					
Sex (ref: male)	Female	1.03 (0.89–1.18)	.721	1.10 (0.93–1.30)	.269
Age (yr) (ref: 65–69)	70–79	1.36 (1.11–1.65)	.003	1.50 (1.19–1.90)	.001
	80–89	1.21 (0.90–1.62)	.214	1.68 (1.13–2.50)	.011
	≥90	1.28 (0.64–2.57)	.486	1.65 (0.77–3.55)	.199
Educational level (ref: illiterate or barely literate)	Elementary school	1.60 (1.17–2.20)	.003	1.54 (1.11–2.12)	.009
	Middle school	1.23 (0.88–1.72)	.234	1.23 (0.85–1.79)	.271
	High school	1.49 (1.06–2.10)	.022	1.47 (0.98–2.20)	.063
	College or more	3.20 (2.01–5.09)	<.001	2.79 (1.60–4.84)	<.001
Religion (ref: no)	Yes	1.63 (1.36–1.95)	<.001	1.30 (1.09–1.54)	.004
Family income level (/yr) (ref: 1st quintile)	2nd quintile	1.10 (0.83–1.50)	.502	1.21 (0.94–1.57)	.141
	3rd quintile (middle)	1.01 (0.72–1.43)	.942	1.03 (0.75–1.41)	.845
	4th quintile	1.02 (0.72–1.43)	.926	1.02 (0.74–1.40)	.915
	5th quintile (highest)	1.33 (0.92–1.93)	.128	1.34 (0.92–1.96)	.127
Living status (ref: lives alone)	Lives with a spouse	1.06 (0.86–1.30)	0.61	1.11 (0.89–1.38)	.337
	Lives with adult children	0.72 (0.47–1.11)	0.14	0.71 (0.45–1.11)	.130
	Other	0.52 (0.25–1.06)	0.07	0.67 (0.33–1.38)	.276
Life satisfaction (ref: bad)	Average	1.07 (0.74–1.54)	.723	0.93 (0.61–1.43)	.756
	Good	1.38 (0.91–2.11)	.134	0.94 (0.57–1.56)	.814
Housing preference in the event of poor health (ref: lives at home)	Move in with family (cohabitation)	2.13 (1.28–3.53)	.003	1.98 (1.20–3.30)	.008
	Move near family (independent)	1.91 (1.13–3.21)	.015	1.69 (1.05–2.73)	.030
	Senior housing residence (no insurance)	1.88 (1.37–2.59)	<.001	1.51 (1.11–2.04)	.008
	Senior care facility (insurance)	1.35 (0.99–1.84)	.054	1.47 (1.09–1.98)	.013
Socio-cultural factors					
Presence of children (ref: no)	Yes	1.44 (0.92–2.23)	.109	1.57 (1.01–2.44)	.046
Presence of friends or neighbors (ref: no)	Yes	1.46 (1.04–2.04)	.029	1.26 (0.88–1.81)	.203
Social activity participation (ref: no)		1.61 (1.30–2.01)	<.001	1.42 (1.12–1.80)	.004
Social relationship satisfaction (ref: bad)	Average	1.13 (0.80–1.61)	.481	1.23 (0.81–1.86)	.320
	Good	1.56 (1.08–2.25)	.017	1.58 (1.03–2.41)	.037
Physical and illness factors					
Number of chronic diseases (ref: 0)	1	1.08 (0.78–1.51)	.643	1.23 (0.89–1.70)	.200
	2	1.31 (0.92–1.86)	.136	1.50 (1.06–2.13)	.022
	≥3	1.71 (1.18–2.48)	.005	2.07 (1.43–3.00)	<.001
Overall functional status (ref: limited)	Unlimited	0.86 (0.65–1.13)	.275	0.98 (0.75–1.27)	.878
Value system					
Awareness of hospice and palliative service (ref: no)	Heard of	0.99 (0.76–1.28)	.923	0.87 (0.67–1.13)	.307
	Yes	2.07 (1.42–3.02)	<.001	1.53 (1.06–2.20)	.023
Participation in death preparedness education (ref: no)		5.05 (3.20–7.98)	<.001	2.58 (1.57–4.24)	<.001
Documentation of organ donation (ref: no)		7.63 (5.49–10.59)	<.001	5.32 (3.27–8.67)	<.001

aOR, adjusted odds ratio; CI, confidence interval; OR, odds ratio; Ref, reference group.
[a]Complex sample analysis was conducted to aid in survey design and weighting.

above as of December 2024 [10]. This study was based on a previously proposed conceptual framework of factors influencing AD completion in Asian contexts [25]. It focused on four groups of factors: personal situation, socio-cultural, physical and illness, and value system.

Among the personal situation factors, age, educational level, religion, and housing preference in the event of poor health were significantly associated with AD completion.

The association between age and AD completion is consistent with previous studies [30,31]. However, prior research has typically treated age as a continuous variable or used 60 years as a cutoff, which limits the extent to which the characteristics of the oldest-old (nonagenarians) can be captured. In this study, no significant association was observed between AD completion and age among the nonagenarian group. This may be explained by two factors. First, the number of AD completions in this group was small (n=16), which may have limited the statistical power. Second, nonagenarians may represent a distinct subgroup of older Koreans with different physical and cognitive characteristics, requiring a differentiated approach [32]. Future research with a larger sample of nonagenarians is necessary to identify the patterns of AD completion in this population.

Sex was not significantly associated with AD completion. This result differs from previous studies [16,33]. It also differs from official statistics on AD registration, which show that among registrants aged 65 years and older, 66% are women and 33% are men [10]. This discrepancy may be attributable to differences between the study sample and the overall population of AD registrants. Our study focused only on community-dwelling older Koreans, whereas AD registration takes place not only in community settings but also in some healthcare institutions, which may have influenced the results. Therefore, future research should compare and analyze sex differences in AD registration across different settings and contexts, including both community and institutional environments.

Individuals with a college degree or higher were more likely to complete an AD compared to those who were illiterate or barely literate. This finding is consistent with previous studies reporting that educational attainment is significantly associated with AD completion [16,30,34]. This may be related to differences in access to health-related information and communication skills shaped by individuals' educational experiences [34], which can affect their engagement in autonomous decision-making regarding end-of-life care. Therefore, tailored interventions and educational support should be considered for individuals with lower educational levels.

In this study, participation in death preparedness education and awareness of hospice and palliative care services were significantly associated with AD completion. Thus, in addition to educational levels, access to information is a key factor influencing AD completion. Access to information can facilitate end-of-life discussions, which are essential for supporting AD completion. In this context, A randomized trial among older veterans found that an easy-to-read AD and interactive online education increased ACP documentation and engagement [35], suggesting that tailored information facilitates end-of-life discussions. Accordingly, strategies that address educational levels and information accessibility—tailored and multifaceted approaches, including face-to-face education—are necessary to support AD completion.

In this study, family income was not significantly associated with AD completion. This finding differs from previous studies that reported higher income was linked to an increased likelihood of AD completion [36]. Such a discrepancy may be interpreted in light of differences in institutional contexts between the United States and Korea. In the United States, AD completion operates as a voluntary registration system based on state laws [37], which may have made it difficult to sufficiently consider equity, thereby allowing income level to influence completion. In contrast, in Korea, the government designates and expands registration institutions and manages a centralized database to ensure universal access through an institutional management system. Accordingly, family income does not appear to have a direct effect on AD completion in Korea.

Among physical and illness factors, having two or more chronic conditions was significantly associated with a higher likelihood of AD completion, consistent with previous findings [16,34]. Furthermore, A higher likelihood of AD completion was observed among individuals who preferred informal caregiving such as moving in with family or near family, as their housing preference in the event of poor health. Informal caregiving is associated with place of death, which is considered an important indicator of the quality of death [38].

A preference for informal care implies that the individual expects that a family caregiver will be available to provide such care. Based on this premise, the findings of this study can be interpreted in two ways. First, as discussions regarding end-of-life preferences generally occur within a trusted environment [39], individuals who trust their family and prefer to receive care from them are more likely to engage in end-of-life discussions [40], and consequently, may also be more likely to complete an AD. Second, this may reflect a psychological attitude, common in Asian cultures, of not wanting to place a caregiving burden on family mem-

bers [34,41,42], which aligns with the perception that completing an AD can help reduce this burden [41]. These findings suggest that as chronic conditions accumulate, older Koreans tend to document their preferences for end-of-life medical care in advance to alleviate the caregiving burden on family members. On the surface, the tendency to rely on family and the desire not to place a caregiving burden on them may appear contradictory. However, since the older Koreans in this study responded based on a hypothetical future scenario rather than an actual situation, it is possible that both motivations coexisted.

In this context, the concept of "aging in place (AIP)" aims to support older adults in maintaining autonomy and independence while remaining in familiar community environments. In line with this goal, the Korean government is developing formal caregiving systems to promote AIP [43]. However, Korea's current legal framework restricts the implementation of withholding or withdrawing life-sustaining treatment in accordance with patients' ADs primarily to certain registered medical institutions, typically general hospitals, or higher-level facilities. Consequently, AD-related services are confined to institutional settings, which hinders their integration with community-based AIP initiatives. Therefore, it would be necessary to revise AD-related policies to facilitate implementation within community-based settings, facilitating more effective integration with AIP strategies.

In this study, the presence of children was identified as a significant factor associated with a higher likelihood of AD completion, whereas living status, reflecting family co-residence, was not significantly associated. Considering that AD functions as a documentation strategy within ACP [3], our findings should be interpreted within the broader ACP framework, within which previous studies have reported that individuals with children or a spouse were more likely to engage in ACP [20,44,45]. Moreover, the role of family is particularly salient in Asian contexts, where family-centered cultural characteristics shape ACP [25,46].

In particular, under the influence of filial piety values, adult children often play a leading role in end-of-life decision-making for older adults [47]. Thus, the existence of children as decision-making agents may be more important than whether or not family members live together. In line with this interpretation, several studies conducted in Asian contexts have reported that family opposition is a major barrier to AD completion [30,48]. In Asian contexts, family-centeredness is known to play a major role in shaping ACP, making it essential to consider the concept of relational autonomy—wherein patient autonomy is defined within family relationships—when developing ACP-related policies and clinical practices [49-51].

Taken together, these findings suggest that the presence of family members or living arrangements alone may not directly influence AD completion; rather, contextual factors, such as the quality of family relationships, cultural values, and decision-making dynamics, may be more significant. Therefore, future research should directly examine factors such as family interactions, communication processes, and role distribution within families to gain a deeper understanding of the family's influence on AD completion.

Among socio-cultural factors, participation in social activities and satisfaction with social relationships were significantly associated with AD completion. This finding is consistent with those of previous studies [52,53]—the autonomy of older adults is influenced by individual characteristics and social relationships. Older Koreans who have higher satisfaction with social relationships may experience enhanced autonomy through positive social relationships, which, in turn, can lead to greater engagement in AD completion.

Additionally, participation in social activities was also identified as a factor that increases the likelihood of AD completion. This may be because social activities foster group cohesion, promote the exchange and dissemination of health information, leading to changes in health behaviors [54], and serve as a means to alleviate social isolation and provide emotional support [52,55]. Therefore, it is necessary to establish an infrastructure that promotes social participation among older adults. Moreover, policy efforts are necessary to ensure that adequate information on ADs is accessible even to older adults, whose social participation is limited. This can be achieved by implementing tailored education and counseling programs through public institutions that maintain close contact with socially isolated older adults, and by promoting awareness of ADs through various media channels to enhance public understanding.

Within the value system, documentation of organ donation was associated with a higher likelihood of AD completion. One possible explanation is the low prevalence of both behaviors, which can inflate statistical significance. Another explanation is that both decisions share a common context of preparing for the end of life.

Previous studies have pointed out that these two decisions are difficult to implement concurrently under Korea's current institutional framework, and a decline in organ donation registration has been observed since LST Decision Act [53]. This issue may stem from a conflict between the two systems. As organ donation registration and AD completion are considered elements of end-of-life self-determination, legal and institutional adjustments are necessary to ensure that both decisions are supported.

This study has several limitations. First, as it was a cross-sectional secondary analysis of national survey data, causal relationships could not be determined. Second, as AD completion was assessed through self-reporting, the possibility of reporting bias cannot be ruled out. Furthermore, as the analysis included only cases completed through self-response, a potential exists for selection bias related to cognitive or functional status among the study participants. Third, given the large sample size, even relatively small effects may have reached statistical significance. In addition, the uneven distribution of certain independent variables (e.g., very low participation in death preparedness education or documentation of organ donation) resulted in wide confidence intervals for some estimates. These issues warrant caution in the interpretation of the findings. Fourth, although the survey included a wide range of variables related to the lives of older adults, it may not have captured all the relevant factors influencing AD completion, leaving the possibility of omitted variables. As this study focused on analyzing four groups of factors from the conceptual framework, it did not encompass all possible dimensions, such as conditional or process-related factors. Finally, although ADs represent a component of ACP, this study focused solely on the completion of AD documentation and did not encompass the broader processes of discussion or planning.

Nevertheless, as AD completion among older adults is influenced by multiple factors [11,12], this study provides a more comprehensive understanding by exploring these factors from a multidimensional perspective. Contrary to previous studies that focused mainly on attitudes or intentions toward ACP, this study uniquely examines actual AD completion behaviors, applying a conceptual framework that reflects Asian cultural characteristics.

In particular, the use of nationally representative survey data strengthens the relevance of its findings by reflecting the older adult population's characteristics. Considering the complex factors influencing AD completion among older adults, nursing practice across various care settings can play a key role in facilitating person-centered ACP discussions, helping to close the gap between the act of completing an AD and the realization of genuine self-determination.

Conclusion

This study used data from the 2023 National Survey of Older Koreans (6th wave) to analyze the factors associated with AD completion among community-dwelling older Koreans from a multidimensional perspective. Age, educational level, religion, housing preference in the event of poor health, participation in death preparedness education, and documentation of organ donation were significantly associated with AD completion. In particular, awareness of hospice and palliative service, presence of children, participation in social activities, satisfaction with social relationships, and number of chronic diseases were significantly related to AD completion.

These insights highlight the significance of viewing AD completion as a practical process of supporting autonomy within community-based policies for older adults by providing empirical evidence to promote the alignment and integration of end-of-life care policies. Future end-of-life decision-making policies should prioritize integrating AD processes into community-based care systems, while nursing interventions should focus on developing ACP promotion strategies and nurse-led counseling and education programs. Such approaches can help ensure that older adults are supported in achieving genuine self-determination at the end of life.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

The raw data in this study can be accessed through the Statistics Korea Micro Data Integrated Service website (https://mdis.kostat.go.kr/index.do) after agreeing to the 'User Agreement for Raw Data Access.' The dataset analyzed in this study was derived from the original raw data. The processed dataset is not publicly available; however, it can be requested.

Author Contributions

Conceptualization and/or Methodology: SNJ, HJJ. Data curation and/or Analysis: HJJ. Project administration and/or Supervision: SNJ. Resources and/or Software: HJJ. Validation: SNJ. Writing original draft or/and Review & Editing: SNJ, HJJ. Final approval of the manuscript: all authors.

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JKAN
Journal of Korean Academy of Nursing

Ten-year trends in research designs and keywords: a bibliometric comparison of the *Journal of Korean Academy of Nursing* and leading international nursing journals

Jin-Hee Park[1*], Hyun Kyoung Kim[2*], Gaeun Kim[3], Sun Hyoung Bae[1]

[1]College of Nursing · Research Institute of Nursing Science, Ajou University, Suwon, Korea
[2]College of Nursing, Kongju National University, Gongju, Korea
[3]College of Nursing, Keimyung University, Daegu, Korea

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Corresponding author:
Sun Hyoung Bae
College of Nursing, Ajou University, 164 World cup-ro, Yeongtong-gu, Suwon 16499, Korea
E-mail: shyoung@ajou.ac.kr

*These authors contributed equally as co-first authors.

Purpose: This study compared trends in research designs and keywords by analyzing the abstracts of four major nursing journals over the past decade, focusing on the *Journal of Korean Academy of Nursing* (JKAN) in comparison with the *International Journal of Nursing Studies* (IJNS), *Journal of Advanced Nursing* (JAN), and *Japan Journal of Nursing Science* (JJNS).

Methods: A bibliometric analysis was conducted, encompassing 5,522 abstracts published between 2015 and 2024. Research designs were first classified as "quantitative," "qualitative," or "other," and then further sub-classified based on international evidence-based frameworks. Text preprocessing was also conducted, and term frequency–inverse document frequency was applied to evaluate keyword importance. The 2015–2019 and 2020–2024 periods were compared to examine changes in both research designs and keyword importance.

Results: Compared to IJNS, JAN, and JJNS, JKAN published more instrument development and analytic studies but fewer randomized controlled trials and systematic reviews. Over time, the number of instrument development and mixed-methods studies in JKAN increased, while high-evidence designs remained scarce. Keyword analysis showed JKAN's emphasis on psychosocial themes such as self-efficacy, quality of life, and depression, whereas the other journals more often highlighted policy- and institution-related topics. Across journals, COVID-19 and patient safety emerged as important themes after 2020.

Conclusion: JKAN demonstrates strengths in methodological diversity within quantitative research and in digital health–related analytics. However, high-evidence study designs and policy-oriented keywords are underrepresented in JKAN. Strategic expansion toward randomized controlled trials, systematic review, global and digital health, and policy-relevant research is recommended to strengthen JKAN's international competitiveness.

Keywords: Bibliometrics; Data mining; Nursing research; Research design; Trends

Introduction

Globally, healthcare systems are confronting unprecedented challenges due to the increasing severity of complex health problems, such as aging, chronic disease, and infectious disease pandemics. These growing issues highlight the importance of empirical research and multidisciplinary perspectives, including treatment-based approaches as well as prevention, health management, and social determinants of health [1]. Concurrently, rapid advancements in Industry 4.0 and the digitalization of healthcare have led to advances in the application of digital health, big data, and artificial intelligence (AI)-based technology in nursing research and practical set-

tings [2]. These advances have led to important shifts in the structure and direction of nursing knowledge production [3,4]. Alongside accelerated globalization in nursing research, there has been clear diversification of research topics and refinement of methodologies, particularly in Science Citation Index Expanded (SCIE) international nursing journals [3-6].

The *Journal of Korean Academy of Nursing* (JKAN) is a SCIE journal with a long tradition and academic authority in the field of nursing in South Korea; it has played a central role in the growth and development of nursing in South Korea over the last several decades [7]. Recently, multidimensional efforts have been made to improve the quality and international standing of the journal, including efforts to reinforce research ethics, apply rigorous statistical analyses and internationalize the online submission system [4]. However, to further enhance the academic status and global competitiveness of JKAN in the context of the rapid globalization of nursing research, a strategic review of the current international academic environment, including collaboration between researchers, methodology refinement, social contributions, and clinical applicability, is needed. Such a review is expected to identify directions for JKAN development [4,8].

Various quantitative analysis techniques have recently been introduced to nursing, including text mining, network analysis, machine learning, and structural equation modeling, making quantitative analyses of large-scale text data feasible [9,10]. Text mining is a quantitative analytical tool for extracting topics and themes from large-scale academic text data and structuring the relationships between them. This approach is widely used to explore the structure and changes in academic discourse [3,5]. However, few empirical analyses have focused on the application of these analytic techniques at the level of nursing journals published in Korea and their position in relation to major international journals [3].

The purpose of this study was to compare trends in research designs and keywords based on abstracts published in major nursing journals over the last decade. In addition to JKAN, the *International Journal of Nursing Studies* (IJNS), *Journal of Advanced Nursing* (JAN), and *Japan Journal of Nursing Science* (JJNS), which have maintained positions near the top of the SCIE ranking, were included in the analyses. In particular, through a quantitative analysis of changes over the past 10 years, we aimed to obtain a broad view of research trends and the status of JKAN in the context of international research. We expect our findings to be used to explore strategic directions for improving the standing of JKAN as an international journal.

Methods

1. Research design

This study conducted a bibliometric analysis to examine and compare trends in research designs and keywords, using abstracts of articles published between 2015 and 2024 in JKAN and three leading SCIE nursing journals (IJNS, JAN, JJNS).

2. Data collection and preparation

The abstracts of scholarly articles published from 2015 to 2024 in four major nursing journals, namely JKAN, IJNS, JAN, and JJNS, were analyzed. The selection of target journals was based on several criteria. We prioritized general nursing journals indexed in the SCIE and ranked in Q1 or Q2 according to bibliometric indicators (e.g., H-index). Journals with a narrow focus on specific clinical skills or specialized domains were excluded in favor of those covering a broad spectrum of nursing topics. The final selection of the four journals was determined through a consensus process involving six PhD-prepared nursing researchers.

Abstracts were retrieved from the official journal websites and the PubMed database. The collected data were organized using EndNote software (Clarivate) and then exported to Microsoft Excel (Microsoft Corp.) for management. An initial total of 6,853 abstracts were retrieved. Of these, 1,155 records were excluded during the initial screening because they were not empirical research articles (e.g., editorials, corrections, and conference abstracts). An additional 176 records were removed due to the absence of an abstract or keywords. Finally, 5,522 abstracts were included in the analysis.

3. Text preprocessing

To prepare the abstract data for a keyword analysis using text mining techniques, text preprocessing was conducted in a Python-based Jupyter Notebook environment [11]. First, all keywords were converted to lowercase, and extraneous characters—such as parentheses, special symbols, and numbers—were removed to ensure uniformity. Synonymous terms were standardized by referencing the Medical Subject Headings (MeSH) thesaurus. For instance, the terms self-care, self_care, and self_management were normalized to self-care, while elderly, older adults, and aged people were unified as aged.

To preserve the semantic integrity of compound phrases, multiword expressions, such as mental health, are connected with an

underscore and treated as a single term (i.e., mental_health). Lemmatization was applied to reduce words to their base or root form (e.g., studies → study and interventions → intervention). Furthermore, semantically related terms, such as nurse and nursing, were consolidated into a single term (e.g., nurse).

Terms describing research design types, such as randomized controlled trial and randomized clinical trial, were also standardized (e.g., randomized_controlled_trial). A total of 20 key research design types were identified and consistently labeled. Finally, both general and domain-specific stopwords that offered minimal semantic value (e.g., effect, result, sample, and published) were removed to improve analytical precision.

Following preprocessing, a document-term matrix was constructed, and term frequency–inverse document frequency (TF-IDF) weights were calculated for each term. These weighted values formed the basis for identifying keyword importance and analyzing temporal trends.

4. Data analysis

All analyses were performed using Python ver. 3.10 (https://www.python.org/) in a Jupyter Notebook environment. The pandas library was used for data manipulation, matplotlib and seaborn libraries were employed for visualization, and scikit-learn was used for text mining operations.

Research design classification was guided by established international frameworks, including the National Institute for Health and Care Excellence [12] public health guideline methodology, Duke University Medical Center Library's typology of review types [13], Oxford Centre for Evidence-Based Medicine's research design glossary [14], and Standards for Reporting Qualitative Research (SRQR) [15]. Based on these references and through consensus among the research team, each article was classified into one of three major categories: quantitative, qualitative, or other.

Quantitative studies were further subdivided into experimental, observational, secondary data analysis, instrument development and validation, review, and special analytic studies. Qualitative studies were categorized into two groups: (1) traditional approaches grounded in explicit philosophical frameworks (e.g., phenomenology, grounded theory, ethnography, narrative inquiry, and case study) and (2) other approaches that, while not explicitly grounded in a particular philosophy, relied on distinct analytic techniques (e.g., qualitative descriptive studies, Q-methodology, content analysis, and thematic analysis) (Table 1). The frequency of each research design was calculated to determine the distribution across journals. The relative proportion of each design was also analyzed annually from 2015 to 2024. To assess temporal shifts, the study period was divided into the 2015–2019 and 2020–2024 periods, and the proportions of design types were compared between these two periods.

For the keyword analysis, TF-IDF scores were calculated for each year to assess the relative importance of keywords over time. The average TF-IDF score for each keyword across the entire decade (2015–2024) was then computed, and the top 20 keywords with the highest average scores were identified. The analysis period was further divided into the 2015–2019 and 2020–2024 periods. The top 15 keywords based on average TF-IDF scores were identified for each period. A comparison between the periods was conducted to identify persistent, emerging, and declining keywords, thereby revealing shifts in research focus over time.

5. Ethical considerations

This study was a bibliometric analysis based on existing literature and did not involve any human participants or identifiable personal data. Therefore, it was exempt from review by the Institutional Review Board.

Results

1. Research design types by journal

In total, 5,522 articles published between 2015 and 2024 in four target nursing journals (JKAN, IJNS, JAN, and JJNS) were analyzed. Overall, quantitative studies were the most prevalent, accounting for 76.0% of the articles, followed by qualitative studies (17.0%) and mixed-methods studies (4.6%) (Table 1).

JKAN exhibited the highest proportion of quantitative studies (85.4%), primarily comprising cross-sectional surveys (32.5%) and non-randomized controlled trials (non-RCTs) (22.8%). These were followed by instrument development and validation studies (14.7%) and systematic review (SR) and meta-analysis (6.8%). Qualitative studies accounted for 11.9% of articles in JKAN, with a majority (70.3%) employing traditional qualitative approaches.

IJNS similarly featured a high percentage of quantitative studies (86.1%). SR and meta-analysis were the most common designs (36.4%), followed by cross-sectional surveys (18.1%) and randomized controlled trials (RCTs) (13.3%). Qualitative studies represented 9.1% of publications, with 54.5% using other qualitative approaches.

JAN had a lower proportion of quantitative studies (67.4%) than IJNS, with cross-sectional surveys (35.6%), SR and me-

Table 1. Distribution of research designs and methodologies in four leading nursing journals between 2015 and 2024 (N=5,522)

Category	JKAN (n=621)	IJNS (n=1,457)	JAN (n=2,926)	JJNS (n=518)	Total (N=5,522)
Quantitative research	530 (85.4)	1,254 (86.1)	1,970 (67.4)	450 (86.9)	4,204 (76.0)
Experimental study					
RCTs	25 (4.7)	167 (13.3)	149 (7.6)	52 (11.6)	393 (9.3)
Non-RCTs	121 (22.8)	38 (3.0)	93 (4.7)	67 (14.9)	319 (7.6)
Observational study					
Cross-sectional survey	172 (32.5)	227 (18.1)	702 (35.6)	211 (46.9)	1,312 (31.2)
Longitudinal survey	21 (4.1)	85 (6.8)	130 (6.6)	29 (6.4)	265 (6.3)
Review					
Systematic review	6 (1.0)	243 (19.4)	231 (11.7)	11 (2.4)	491 (11.7)
Meta-analysis	31 (5.8)	213 (17.0)	156 (7.9)	11 (2.4)	411 (9.8)
Other review (e.g., scoping review, integrative review, literature review, etc.)	14 (2.6)	180 (14.4)	226 (11.5)	13 (2.9)	433 (10.3)
Methodological study					
Instrument development and validation	78 (14.7)	23 (1.8)	103 (5.3)	36 (8.1)	240 (5.8)
Concept analysis	10 (1.9)	7 (0.6)	51 (2.5)	3 (0.7)	71 (1.6)
Other methodology (e.g., diagnostic accuracy study, predictive model validation, intervention tool/protocol development, etc.)	3 (0.6)	0 (0.0)	9 (0.5)	0 (0.0)	12 (0.3)
Secondary data analysis	33 (6.2)	64 (5.1)	107 (5.4)	14 (3.1)	218 (5.2)
Special analyses					
Data mining and AI (e.g., text mining, network analysis, machine learning, judgment analysis, etc.)	12 (2.3)	1 (0.1)	7 (0.4)	2 (0.4)	22 (0.5)
Other special analyses (e.g., cost-benefit analysis, cost-utility analysis, etc.)	4 (0.8)	6 (0.4)	6 (0.3)	1 (0.2)	17 (0.4)
Qualitative research	74 (11.9)	132 (9.1)	673 (23.0)	57 (11.0)	936 (17.0)
Phenomenology	31 (41.9)	15 (11.4)	137 (20.4)	8 (14.0)	191 (20.4)
Grounded theory	20 (27.0)	23 (17.4)	88 (13.1)	12 (21.1)	143 (15.3)
Ethnography	1 (1.4)	8 (6.1)	43 (6.4)	0 (0.0)	52 (5.6)
Narrative research	0 (0.0)	4 (3.0)	13 (1.9)	2 (3.5)	19 (2.0)
Case study	0 (0.0)	10 (7.6)	30 (4.5)	2 (3.5)	42 (4.5)
Other qualitative approach (e.g., qualitative descriptive, Q-methodology, content/thematic analysis, etc.)	22 (29.7)	72 (54.5)	362 (53.7)	33 (57.9)	489 (52.2)
Mixed-methods research	15 (2.4)	53 (3.6)	174 (5.9)	10 (1.9)	252 (4.6)
Other research (discursive paper)	2 (0.3)	18 (1.2)	109 (3.7)	1 (0.2)	130 (2.4)

Values are presented as number (%).
AI, artificial intelligence; IJNS, *International Journal of Nursing Studies*; JAN, *Journal of Advanced Nursing*; JKAN, *Journal of Korean Academy of Nursing*; JJNS, *Japan Journal of Nursing Science*; non-RCTs, non-randomized controlled trial; RCTs, randomized controlled trial.

ta-analysis (19.6%), and RCTs (7.6%) being the predominant designs. Qualitative studies accounted for 23.0% of its articles—the highest proportion among the four journals—with 53.7% of these using other qualitative approaches. Mixed-methods studies were also relatively common in JAN (5.9%).

JJNS reported the highest proportion of quantitative studies (86.9%). The most frequent designs were cross-sectional surveys (46.9%), non-RCTs (14.9%), and RCTs (11.6%). Qualitative studies accounted for 11.0% of its articles, of which 57.9% utilized other qualitative approaches (Table 1).

2. Changes in research designs by journal

To examine temporal changes in research designs, the analysis period was divided into the 2015–2019 and 2020–2024 periods. The relative proportions of major research designs were then compared for each journal (Figure 1). While the ranking of the top research designs remained generally similar across all four journals, their proportions shifted between the two periods.

In JKAN, the proportion of non-RCTs decreased from 22.8% during the 2015–2019 period to 14.6% in the 2020–2024 period. In contrast, instrument development and validation studies in-

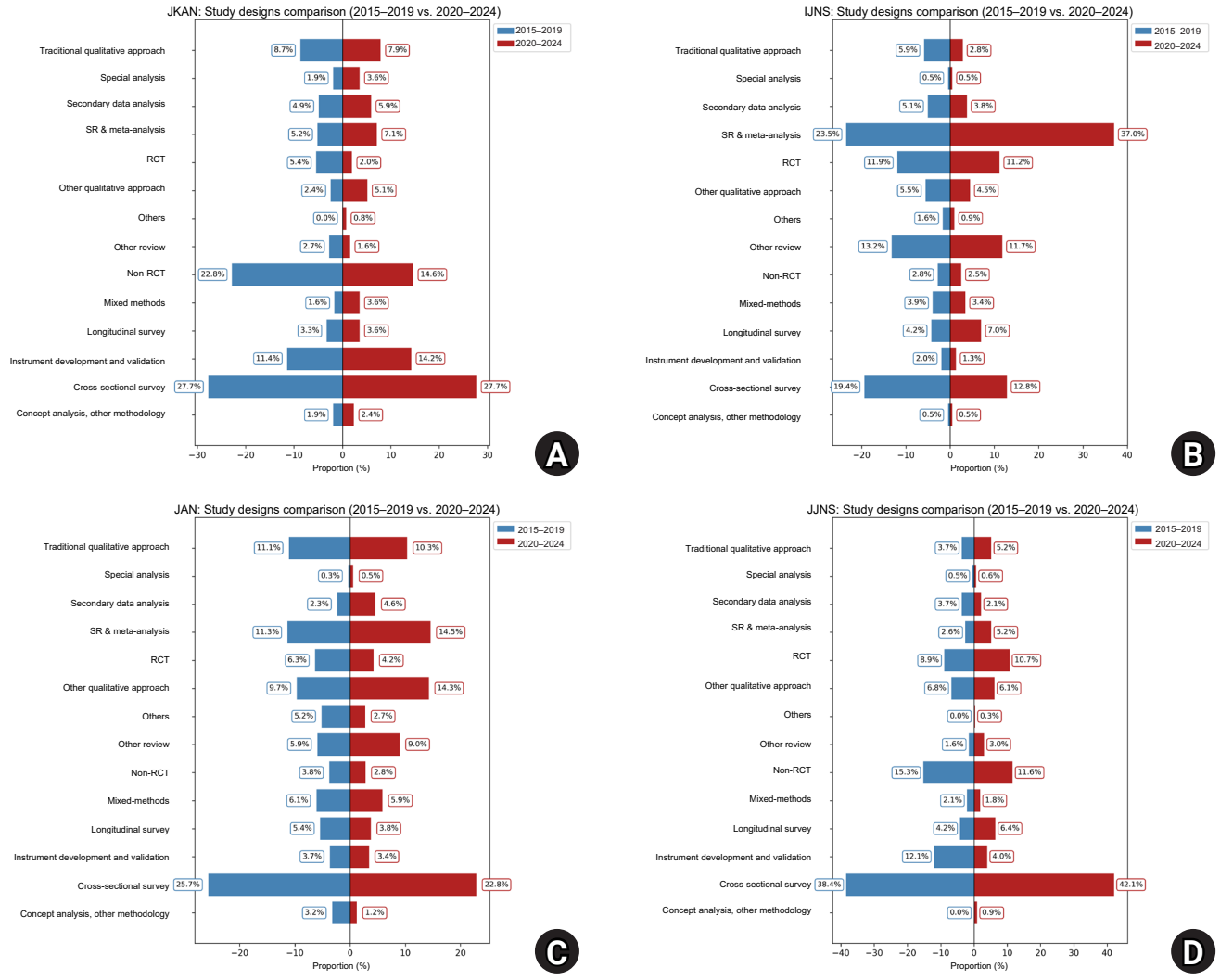

Figure 1. Changes in the distribution of study design types in the four major nursing journals, comparing the 2015–2019 and 2020–2024 periods. (A) *Journal of Korean Academy of Nursing* (JKAN): Study designs comparison (2015–2019 vs. 2020–2024). (B) *International Journal of Nursing Studies* (IJNS): Study designs comparison (2015–2019 vs. 2020–2024). (C) *Journal of Advanced Nursing* (JAN): Study designs comparison (2015–2019 vs. 2020–2024). (D) *Japan Journal of Nursing Science* (JJNS): Study designs comparison (2015–2019 vs. 2020–2024). RCT, randomized controlled trial.

creased from 11.4% to 14.2%. Other qualitative approaches (2.4% → 5.1%) and mixed-methods studies (1.6% → 3.6%) also increased (Figure 1A).

In IJNS, SR and meta-analysis showed a high relative proportion in both periods, with a substantial increase from 23.5% to 37.0%. Conversely, the proportions of cross-sectional surveys (19.4% → 12.8%), other reviews (13.2% → 11.7%), and RCTs (11.9% → 11.2%) all decreased. Similarly, qualitative and mixed-methods studies showed a slight decline in the 2020-2024 period compared with the 2015-2019 period (Figure 1B).

In JAN, the proportions of cross-sectional surveys (25.7% → 22.8%), RCTs (6.3% → 4.2%), and non-RCTs (3.8% → 2.8%) decreased. In contrast, SR and meta-analysis (11.3% → 14.5%), other reviews (5.9% → 9.0%), and secondary data analyses (2.3% → 4.6%) all increased. Other qualitative approaches rose from 9.7% to 14.3%, while mixed-methods research remained stable at approximately 6.0% in both periods (Figure 1C).

In JJNS, cross-sectional surveys increased substantially from 38.4% to 42.1%. RCTs (8.9% → 10.7%) and SR and meta-analysis (2.6% → 5.2%) also increased. Conversely, instrument development and validation studies (12.1% → 4.0%) and non-RCTs (15.3% → 11.6%) decreased. Traditional qualitative approaches increased from 3.7% to 5.2%, while other qualitative approaches decreased slightly from 6.8% to 6.1% (Figure 1D).

3. Analysis of relative keyword importance by journal

An analysis of the top 20 keywords with the highest average TF-IDF scores from 2015 to 2024 revealed that 'nurse,' 'aged,' and 'self-care' were common high-importance keywords across all four journals (Table 2).

In JKAN, 'nurse' demonstrated the highest importance (average TF-IDF=.251). The term 'covid19' ranked second (average=.133). Keywords related to psychosocial factors, including 'self-efficacy' (.115), 'aged' (.108), 'qol' (.105), and 'depression' (.100), were also highly ranked. In addition, terms associated with measurement and reproducibility, such as 'validity' (.084), 'statistical factor analysis' (.078), and 'reproducibility of result' (.069), were prominent.

In IJNS, top keywords included 'nurse' (.242), 'aged' (.157), 'self-care' (.133), 'dementia' (.120), and 'hospital' (.103). Psychosocial factors, such as 'depression' (.078), 'anxiety' (.048), and 'self-efficacy' (.049), were also notable. Furthermore, terms related to long term care and safety, including 'nursing home' (.080), 'long term care' (.054), and 'patient safety' (.065), were distinctive features of IJNS.

In JAN, 'nurse' had the highest average TF-IDF score among the four journals (.553), followed by keywords related to the life course, maternity, and infectious disease response, such as 'aged' (.125), 'self-care' (.101), 'midwife' (.100), and 'covid19' (.075). Measurement-related terms and psychological factors ('instrument development,' 'qol,' and 'self-efficacy') were also frequent, along with keywords in education and mental health ('nursing student,' 'nursing education,' 'mental health,' and 'burnout').

In JJNS, 'covid19' ranked highest (average TF-IDF=.135). Other highly ranked keywords included 'nurse' (.125), 'aged' (.095), 'self-care' (.076), and 'qol' (.075). Psychological factors, such as 'depression' (.054), 'anxiety' (.050), and 'social support' (.047), were also prominent. In addition, terms related to education and measurement, including 'health education' (.045), 'reliability' (.043), and 'validity' (.048), were identified.

4. Changes in keyword importance over time by journal

To investigate shifts in keyword importance, we calculated the average TF-IDF scores for the 2015–2019 and 2020–2024 periods. The top 15 keywords from each period were extracted and compared using bidirectional bar charts (Figure 2).

In JKAN, 'nurse,' 'self-efficacy,' 'adolescent,' 'aged,' 'health behavior,' 'qol,' 'critical care,' 'validity,' and 'depression' were prominent keywords in both periods. The importance of 'nurse' increased (from .038 to .054), ranking highest in both periods. In contrast, the relative importance of 'depression' (.027 → .014) and 'self-care'

Table 2. Top 20 keywords by mean TF–IDF scores in four leading nursing journals between 2015 and 2024

Rank no.	JKAN		IJNS		JAN		JJNS	
	Keywords	Mean TF-IDF	Keywords	Mean TF-IDF	Keywords	Mean TF-IDF	Keywords	Mean TF-IDF
1	nurse	.251	nurse	.242	nurse	.553	covid19	.135
2	covid19	.133	aged	.157	aged	.125	nurse	.125
3	self-efficacy	.115	self-care	.133	systematic review	.123	aged	.095
4	aged	.108	dementia	.120	qualitative research	.110	self-care	.076
5	qol	.105	hospital	.103	self-care	.101	qol	.075
6	depression	.100	literature review	.099	midwife	.100	nursing student	.058
7	validity	.084	nursing home	.080	covid19	.075	depression	.054
8	statistical factor analysis	.078	depression	.078	instrument development	.069	anxiety	.050
9	adolescent	.078	covid19	.074	critical care	.068	validity	.048
10	reproducibility of result	.069	intensive care	.066	meta-analysis	.068	social support	.047
11	self-care	.068	patient safety	.065	QOL	.067	health education	.045
12	health behavior	.066	RCTs	.063	depression	.067	reliability	.043
13	reliability	.064	QOL	.060	self-efficacy	.058	diabetes mellitus	.043
14	student	.059	long term care	.054	mental health	.058	nursing education	.042
15	psychological stress	.058	critical care	.053	nursing student	.055	attitude	.041
16	women	.058	palliative care	.052	dementia	.054	neoplasm	.041
17	child	.054	pressure ulcer	.051	anxiety	.049	pain	.041
18	psychological adaptation	.050	self-efficacy	.049	burnout	.046	self-efficacy	.040
19	knowledge	.048	anxiety	.048	nursing education	.044	Japan	.039
20	neoplasm	.048	pain	.047	hospital	.044	child	.039

IJNS, *International Journal of Nursing Studies*; JAN, *Journal of Advanced Nursing*; JJNS, *Japan Journal of Nursing Science*; JKAN, *Journal of Korean Academy of Nursing*; RCTs, randomized controlled trial; QOL, quality of life; TF-IDF, term frequency–inverse document frequency.

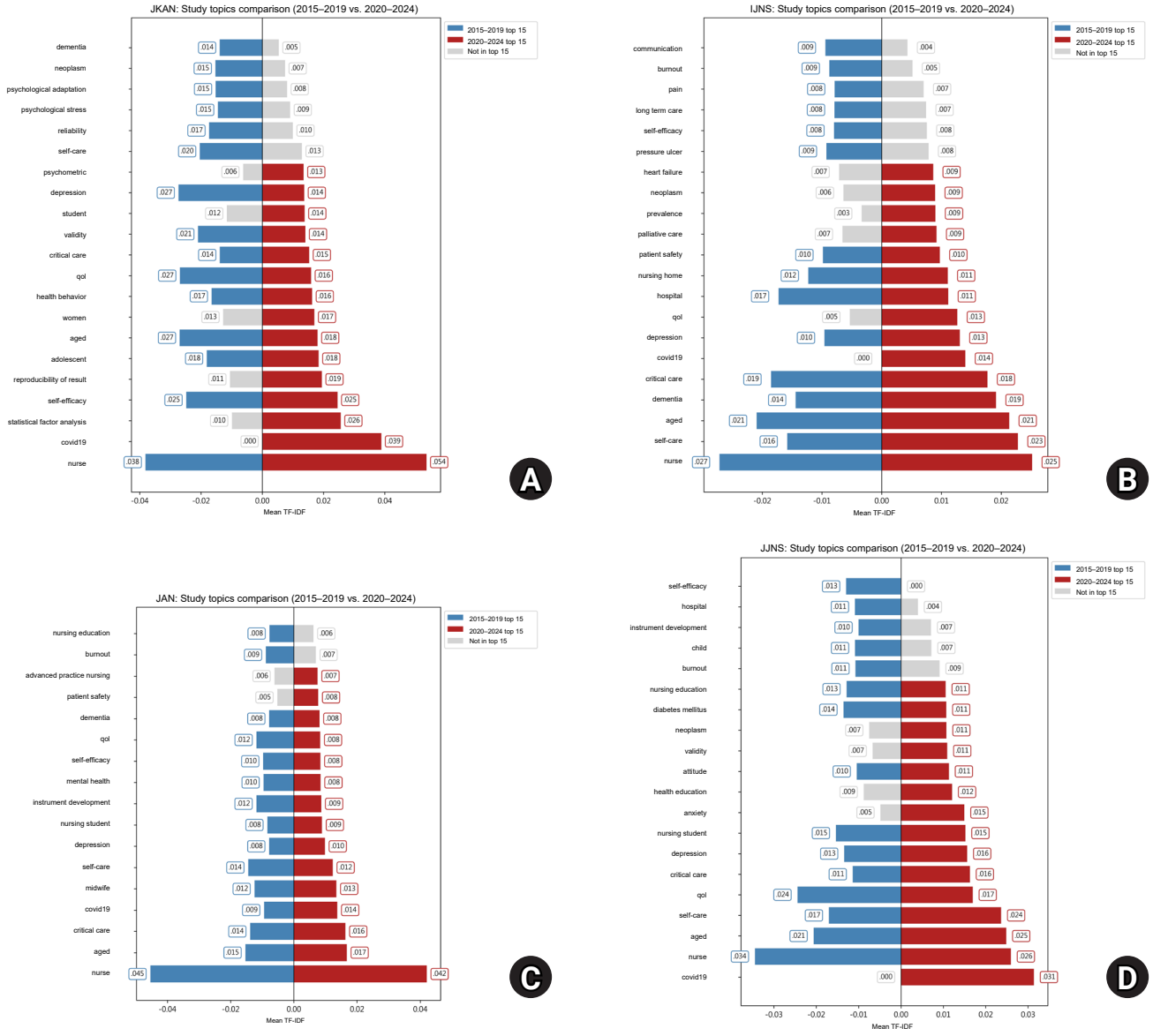

Figure 2. Changes in mean term frequency–inverse document frequency (TF-IDF) scores of study keywords across the four major nursing journals, comparing the 2015–2019 and 2020–2024 periods. (A) *Journal of Korean Academy of Nursing* (JKAN): Study topics comparison (2015–2019 vs. 2020–2024). (B) *International Journal of Nursing Studies* (IJNS): Study topics comparison (2015–2019 vs. 2020–2024). (C) *Journal of Advanced Nursing* (JAN): Study topics comparison (2015–2019 vs. 2020–2024). (D) *Japan Journal of Nursing Science* (JJNS): Study topics comparison (2015–2019 vs. 2020–2024).

(.020 → .013) decreased. In the 2020–2024 period, 'statistical factor analysis,' 'reproducibility of result,' and 'covid19' emerged as new high-ranking keywords (Figure 2A).

In IJNS, 'nurse,' 'self-care,' 'aged,' 'dementia,' 'critical care,' 'depression,' 'hospital,' 'nursing home,' and 'patient safety' remained important across both periods. However, the importance of 'communication' (.009 → .004), 'burnout' (.009 → .005), 'pain' (.008 → .007), and 'long term_care' (.008 → .007) declined in the 2020–2024 period. In contrast, 'qol,' and 'palliative care' emerged as new keywords in the 2020–2024 period (Figure 2B).

In JAN, the keyword composition showed little change between periods. Although the score for 'nurse' decreased slightly (.045 → .042), it remained the top keyword in both periods. The importance of 'nursing education' (.008 → .006) and 'burnout' (.009 → .007) declined in the 2020–2024 period, while 'patient safety' (.005 → .008) and 'advanced practice nursing' (.006 → .007) saw their TF-IDF scores rise and newly enter the top rankings (Figure 2C).

In JJNS, 'nurse,' 'aged,' 'self-care,' 'qol,' 'critical care,' 'depression,'

'nursing student,' and 'nursing education' were identified as top 15 keywords in both periods. The importance of 'self-efficacy,' 'instrument development,' and 'burnout' declined in the 2020-2024 period, while 'anxiety,' 'health education,' and 'validity' emerged as new high-ranking keywords (Figure 2D).

Discussion

We analyzed trends in the types of research designs and major keywords in nursing journals over the last 10 years in a comparative framework, with the aim of examining the current academic standing of JKAN and suggesting directions for future development. Academic leadership contributes to the link between clinical practice and research and is formed through high-quality education and professional development [16]. Within this context, the role of JKAN in advancing such leadership assumes considerable significance. The two axes analyzed in this study—research designs and keywords—could serve as important indices for identifying future directions in nursing research.

In the last 10 years, all four journals showed clear changes over time in the relative frequencies of various research designs. While JKAN maintained a consistent composition with an overall focus on quantitative research, during the 2020–2024 period, there were steady increases in the ratios of mixed-methods and instrument development and validation studies. Specifically, the ratio of mixed-methods studies increased from 1.6% to 3.6%, and the ratio of instrument development and validation studies increased from 11.4% to 14.2%. The ratio of other qualitative approaches rose from 2.4% to 5.1%. These findings reveal a shift in JKAN, previously focused on cross-sectional studies, toward the inclusion of more diverse research designs.

There were several differences between JKAN and the IJNS, JAN, and JJNS, reflecting several limitations of the journal. For the IJNS, during the same period, there was a large increase in the ratio of SR and meta-analysis from 23.5% to 37.0%, the ratio of RCTs was maintained above 11%, and there was a stable stream of high-standard evidence-based research being published. The JAN showed gradual increases in the ratios of secondary data analysis and SR and meta-analysis, while the JJNS showed increasing ratios of both RCTs and SR and meta-analysis in the 2020–2024 period. JKAN remained focused on non-RCTs studies and cross-sectional studies, and the ratios of RCTs and SR and meta-analysis remained low or stagnant. These trends suggest that JKAN is still skewed toward single-center cross-sectional studies. For JKAN to position itself as a top international journal, the diversification of research designs, which can generate high-quality results, is essential. In particular, designs such as SR, meta-analysis, RCTs, and secondary data analyses can improve applicability in nursing and policymaking; these designs should be actively encouraged at the level of editorial strategy.

Qualitative research accounted for 11.9% of all studies published in JKAN, of which the majority (i.e., 70.3%) used traditional qualitative approaches. This pattern differed markedly from that of other journals, which showed a clear preference for grounded theory and phenomenological studies. By contrast, qualitative research represented 9.1%, 23.0%, and 11.0% of all studies in IJNS, JAN, and JJNS, respectively; in each of these journals, more than half of qualitative studies used other qualitative approaches. These journals were expanding their research designs, focusing on empirical and applicable themes, such as patient experiences, nursing work, and policy appraisal. For example, in JAN, 53.7% of qualitative studies—and in IJNS, 54.5%—used other qualitative approaches, such as qualitative descriptive studies or based on content and thematic analyses. This suggests that, even though JKAN ensures the depth and theoretical basis of qualitative studies, the scope is somewhat narrow with regard to field-adjacent themes or practical applications. In international nursing, qualitative and mixed-methods studies have recently been applied to complex issues, such as infectious diseases, nurse staffing crises, digital healthcare, and health inequity.

Studies using analytic techniques, such as data mining, machine learning, or AI, accounted for a low percentage of all studies in JKAN, at 2.3%. However, this was still higher than the ratios in the other three journals. This suggests that a strength of South Korean research is in the fields of digital health and nursing informatics, and these techniques could be a basis for expansion to more refined analytical research, such as big data-based empirical studies and predictive model development. Digital research has been a key area in nursing, including digital literacy and the development of mobile health applications; personalized digital interventions are also being attempted [17]. Going forward, JKAN could be a pioneer in the digital transformation of nursing through reinforcing nursing leadership based on the World Health Organization's digital health strategy (2020–2025) and providing education in digital ethics [1].

Splitting the data into the two time periods of 2015–2019 and 2020–2024, we analyzed changes in the importance of keywords in major nursing journals. We demonstrated the shift in research keywords with changing social and public healthcare environments. First, patient-centric keywords, such as 'self-care' and 'critical care' showed consistently high rankings in all four journals. These results suggest that nursing research is focused on patients'

experiences and direct nursing behaviors, which are the essence of clinical nursing. In JKAN, in particular, the high importance of psychosocial keywords, such as 'qol,' 'depression,' and 'self-efficacy,' was maintained over a long period of time. The continued accumulation of research in these fields could be interpreted as a strength of JKAN.

Since the pandemic, 'covid-19' has shown a rapid increase in TF-IDF in all journals, emerging as a core keyword reflecting the current times. This is consistent with trends in global nursing research reported by Zhang et al. [10], who reported a shift in interest from 'nursing,' 'burnout,' and 'fear' during the pandemic to 'stress,' 'depression,' 'nursing student,' and 'public health.' Keywords in JKAN also reflected a focus on changes in the psychological health of nurses and nursing education during the pandemic, with terms such as 'covid19,' 'depression,' and 'nurse,' showing that the journal reacts promptly to time-sensitive social and public healthcare issues.

Among the nurse- and professional-related keywords, there was an increase in the importance of 'nurse' in all international journals. Themes related to nursing institutions and clinical systems, such as 'nursing home,' 'patient safety,' 'long-term care,' and 'advanced practice nursing' consistently occupied top positions in the IJNS and JAN. In JKAN, other than 'nurse,' relatively few keywords were directly related to nursing policies and institutions. These findings suggest that work-based research in nursing in South Korea could be improved in terms of policy connectedness. In the future, research including the expansion of the roles of nursing professionals, policy proposals, and improvements in organizational culture needs to be discussed actively through JKAN; this could allow JKAN to act as a platform for promoting knowledge production and facilitating communication between the policy and work sectors.

In terms of education-related keywords, performance-based psychology and competencies, such as 'self-efficacy,' 'nursing student,' 'nursing education,' and 'health education,' have been consistently highly represented in international journals. In JKAN, only the 'student' keyword showed a small increasing pattern in the 2020–2024 period. This demonstrates the relatively limited scope of keywords in JKAN related to education research. The education research currently published in JKAN is mainly focused on behavioral and psychological factors. A more structured/institutional approach is required to improve educator competencies, develop education programs, and increase the quality of nursing education.

In the list of top keywords in the TF-IDF analysis, there were almost no keywords related to global public healthcare issues, such as digital healthcare, climate change, and health equity. Several nursing journals, including JKAN, have not yet established these themes as central research areas. There is growing awareness of the need to conduct multidisciplinary research, including the digital transition and the response of international nursing policy. In the future, JKAN should accept more future-oriented keywords, such as 'digital health,' 'global healthcare,' 'health inequity,' and 'nursing informatics,' to adopt a strategic role as a research platform that links nursing work, policy, and education.

Our study had some limitations. First, although we analyzed the frequency and TF-IDF of keywords, focusing on studies published in four major nursing journals, the scope of journals included in the study was restricted. Therefore, the findings may not comprehensively reflect research trends across the field of nursing. Second, the metadata used in the thematic analysis were dependent on keyword data presented on the web page for each study; therefore, there is a possibility that actual research keywords were not thoroughly represented. Third, although the TF-IDF analysis is useful for quantitatively evaluating the importance of words, it cannot reflect the semantic context, relatedness, or structural relationships between keywords, limiting analyses of the multidimensional structure of research keywords. Fourth, in the analysis by year, we divided the 10-year period into the 2015–2019 and 2020–2024 periods. However, the disparity in the number of studies published between the 2015–2019 period (n=2,374) and the 2020–2024 period (n=3,148) could have affected the results. Fifth, after COVID-19, certain keywords temporarily became more prominent, and this phenomenon could have distorted the overall flow of research themes. Sixth, this study focused on quantitative analyses, and we were unable to perform qualitative analyses for an in-depth understanding of how each keyword in each study was actually used in context (i.e., information had to be inferred).

Conclusion

JKAN showed relatively low ratios of RCTs, SR, and meta-analysis, whereas instrument development and validation studies and data-based analytical studies were more prevalent than in other journals. This reflects the specific strengths of nursing in South Korea but also highlights the need to expand studies with higher levels of evidence (e.g., RCTs, SR, and big data-based research). International journals have steadily increased the representation of such designs, underscoring the need for similar strategic expansion in JKAN.

Keyword analysis revealed that other international journals addressed a wider scope of keywords—linking clinical practice, pro-

fessional roles, healthcare systems, and education—while JKAN tended to concentrate on a limited range of psychological competency keywords, such as 'nurse,' 'self-efficacy,' and 'nursing student.' This indicates a relative lack of institutional or policy-linked perspectives. Expanding research to encompass broader professional roles, policy development, and organizational culture could strengthen the journal's relevance and impact.

Themes related to the future healthcare environment, including digital technology, global nursing, and environmental issues, remain underrepresented across all journals. Actively incorporating these future-oriented themes could enable JKAN to respond to evolving healthcare demands, advance nursing education, and contribute to digital health and nursing systems, thereby enhancing the quality and international competitiveness of its research.

Article Information

Conflicts of Interest

All authors are members of the editorial board of the *Journal of Korean Academy of Nursing*. However, they were not involved in the editorial handling, peer review, or decision-making process for this manuscript. The authors declare no other conflicts of interest, financial or personal, that could inappropriately influence or be perceived to influence this work.

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Data Sharing Statement

The data that support the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Author Contributions

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상급실무제공자 역할로서 간호인력 활성화 방안: 혼합연구

김정혜[1], 전미경[2], 최수영[3], 이미미[4], 최수정[5]

[1]울산대학교 임상전문간호학, [2]국립창원대학교 간호학과, [3]제주대학교 간호대학, [4]서울대학교병원 감염관리센터, [5]성균관대학교 임상간호대학원

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Corresponding author:
Su Jung Choi
Graduate School of Clinical Nursing Science, Sungkyunkwan University, 115 Irwon-ro, Gangnam-gu, Seoul 06355, Korea
E-mail: sujungchoi@skku.edu

Strategies for expanding the role of advanced practice providers in the Korean nursing workforce: a mixed-methods approach

Jeong Hye Kim[1], Mi-Kyeong Jeon[2], Suyoung Choi[3], Mimi Lee[4], Su Jung Choi[5]

[1]Department of Clinical Nursing, University of Ulsan, Ulsan, Korea
[2]Department of Nursing, Changwon National University, Changwon, Korea
[3]College of Nursing, Jeju National University, Jeju, Korea
[4]Infection Control Center, Seoul National University Hospital, Seoul, Korea
[5]Graduate School of Clinical Nursing Science, Sungkyunkwan University, Seoul, Korea

Purpose: This study aimed to propose strategies for strengthening the nursing workforce by expanding their roles as advanced practice providers (APPs).

Methods: A mixed-methods approach was employed, consisting of five focus group interviews (FGIs) with 30 healthcare professionals (including 10 physicians) and a two-round Delphi survey with 49 experts. The FGIs explored practical insights from clinical settings, while the Delphi process validated and prioritized strategic recommendations through expert consensus.

Results: Four major themes emerged from the FGI analysis: (1) utilization of diverse APPs to ensure quality care, (2) expanding the scope of practice of APPs, (3) requirements to ensure the quality of APPs, and (4) strategies for sustainable management of the APP workforce. Building on these findings, the Delphi survey identified five strategic domains: "definition and qualifications," "scope of practice," "educational programs," "credentialing and regulation," and "support systems." Key areas of consensus included the need for mandatory clinical experience and specialty training, legal clarification of role boundaries, standardized curricula with certification mechanisms, and institution-led support systems such as task-specific job descriptions and recredentialing processes.

Conclusion: To effectively strengthen APP roles, it is essential to build on the existing advanced practice nurse (APN) framework, which already includes structured curricula and national certification. Furthermore, integrative strategies should be developed to incorporate experienced clinical nurses without APN licenses into the APN system.

Keywords: Advanced practice nursing; Credentialing; Nurse; Nurse practitioner; Scope of practice

서론

1. 연구의 필요성

많은 국내 의료기관은 의사 인력 부족 문제와 의료서비스 질 향상을 위한 방안으로 전문간호사,

전담간호사, physician assistant (PA), surgical assistant 등 다양한 명칭의 진료지원인력을 활용하고 있다[1]. 그러나 전문간호사를 제외하고는 대부분의 진료지원인력은 의료법상 명확한 법적 근거 없이 제도적 사각지대에서 의료현장의 공백을 보완하고 있다. 특히 2024년 2월, 의정갈등으로 전공의 대부분이 병원을 떠난 후, 정부는 보건의료기본법 제44조를 근거로 '간호사 업무 관련 시범사업'을 통해 간호사의 진료지원업무 수행을 허용했지만, 간호계는 여전히 법적 · 제도적 불안정성 속에서 업무를 수행하고 있다.

업무범위(scope of practice)는 환자의 안전을 보장하기 위해 특정 자격 또는 면허를 가진 의료인이 수행할 수 있는 업무의 범위를 규정한 것으로, 업무범위의 명확성은 임상 안정성과 직결된다[2]. 의료인의 업무범위가 불명확하거나, 최소한의 교육과 자격을 갖추지 않은 인력이 고난도 업무를 수행하는 경우, 환자안전에 심각한 위협이 될 수 있다[2]. 따라서 간호사가 전통적으로 수행해오던 업무범위를 넘어 진료지원업무를 수행하는 경우, 이를 위한 충분한 교육과 훈련, 임상경험을 기반으로 자격기준 및 관리체계가 마련되어야 한다.

미국은 1960년대부터 의사 부족과 의료비 절감 문제를 해결하고자 전문간호사제도를 도입하였고, 이들은 비의사 임상가(non-physician clinician)로서 환자 문제를 직접 사정하고 진단 · 처방 · 치료하는 등의 기능을 수행하는 상급실무제공자(advanced practice providers)로 자리매김하고 있다[1,3-5]. 상급실무제공자에는 전문간호사와 PA가 포함되며, 이들은 석사 이상의 학위과정을 이수하고, 일정 수준의 임상실습을 거쳐 자격시험을 응시한 후, 중앙기구를 통해 자격을 관리 받는다[5-7]. 이처럼 엄격한 교육과 자격관리체계에 기반한 상급실무제공자의 치료성과는 의사와 차이가 없고[6], 의료비용 감소, 의료의 질 향상, 환자의 우울, 불안 및 피로 감소 등에도 영향을 주는 것으로 보고되어[8], 향후 상급실무제공자 인력은 더욱 증가할 것으로 전망하고 있다[9]. 이러한 변화는 영국, 아일랜드와 같은 유럽 여러 국가에서도 유사하게 나타나고 있다[10]. 반면, 국내는 교육체계, 자격기준, 관리체계를 갖춘 전문간호사제도가 있고 PA제도는 없지만 전담간호사 중 상당수가 진료지원업무를 수행하고 있어, 본 연구에서는 광의의 의미로 전통적인 간호업무범위를 넘어서 진료지원업무를 수행하는 전문간호사와 전담간호사를 상급실무제공자로 정의한다.

'간호사 업무 관련 시범사업' 이전부터 법적 · 제도적 합의 없이 1만 명 이상의 간호인력이 진료지원업무를 수행해 왔고[11], 의정갈등이 1년 이상 지속되면서 그 수는 더 증가하고 있다. 시범사업 이전부터 전문의들은 진료지원업무의 일부를 간호인력에게 위임할 수 있기를 지속적으로 요청해 왔는데, 전국 전문의를 대상으로 한 조사에서는 검체 채취, 각종 배액관 관리, 시술 및 검사 보조 등의 업무는 90% 이상, 수술보조, 발사, 특수장치 관리, 위임된 약 처방 등의 업무도 80% 이상이 위임 가능하다고 응답하였다[12]. 입원전담전문의 역시 전문간호사와 팀 기반 진료를 수행할 수 있는 시스템 구축의 필요성을 제기한 바 있다[13].

이처럼 임상현장에서 상급실무제공자의 역할은 점차 확대되고 있음에도 불구하고, 진료지원업무를 수행하는 간호인력에 대한 교육, 자격, 법적 보호체계는 여전히 미비하다. 특히 국내는 미국과 달리 비간호직종이 상급실무제공자로 유입되는 경로인 PA 제도가 법적으로 없고, 현재 시범사업에서 진료지원업무는 간호사를 중심으로 운영되고 있어, 전담간호사를 기존 제도인 전문간호사제도로 통합하고, 자격기준과 교육과정, 관리체계를 정비하는 것이 시급하다[14]. 최근 제정된 간호법 제14조에서는 진료지원업무를 수행하는 간호사의 자격을 명시하고 있으며, 업무기준과 내용, 교육과정 등은 보건복지부령으로 정해질 예정이다. 이는 향후 진료지원업무를 수행하는 간호인력에 대한 체계적인 제도 정비의 필요성을 더욱 부각시키고 있다.

이에 본 연구는 상급실무제공자로서 진료지원업무를 수행하는 간호인력의 자격기준을 검토하여, 현재 제도적 보호 없이 임상에서 해당 업무를 수행 중인 전담간호사가 자격을 갖춘 인력으로 연계할 수 있는 현실적 방안을 모색하고자 한다.

2. 연구목적

본 연구는 임상현장 전문가 대상 포커스그룹 인터뷰와 델파이조사를 바탕으로, 상급실무제공자 역할을 수행하는 간호인력의 활성화 방안을 도출하고자 하며, 이를 통해 향후 관련 정책 수립을 위한 근거자료를 제공하고자 한다.

방법

1. 연구설계

본 연구는 상급실무제공자 역할을 수행하는 간호인력의 활성화 방안을 도출하기 위해 탐색적 순차형 혼합연구(exploratory sequential mixed-methods study) 설계를 적용하였다.

2. 연구단계

본 연구는 1단계에서는 임상 전문가를 대상으로 포커스그룹 인터뷰를 실시하여 상급실무제공자에 대한 인식, 역할 수행 경험, 제도적 개선 요구 등을 심층적으로 탐색하였고, 이를 바탕으로 전략 항목을 도출하였다. 2단계에서는 도출된 항목을 바탕으로 전문가 49인을 대상으로 2차에 걸친 델파이조사를 실시하여 각 전략의 타당성과 실행 가능성에 대한 합의 수준을 정량적으로 검토하였다.

1) 포커스그룹 인터뷰

(1) 연구 참여자

참여자는 전문간호사나 전담간호사제도를 운영하는 병원의 전문

간호사, 전담간호사, 간호관리자, 전문의를 대상으로 하였다. 공식적으로 10년 이상 전문간호사와 전담간호사제도를 운영하며 상급실무제공자로서 간호사를 활용하고 있는 서울에 위치한 2개의 상급종합병원과 전담간호사제도만을 운영하다 3년 이내에 공식적으로 전문간호사제도를 추가하여 운영하게 된 3개의 대전, 경기, 서울의 상급종합병원과 종합병원을 대상으로 참여자를 모집하였다. 상급실무제공자와 제도에 관한 인식과 경험을 구체적으로 설명할 수 있어야 하므로, 전문간호사와 전담간호사는 임상경력 3년 이상, 전문 또는 전담간호사 경력 6개월 이상인 자로 한정하였다. 단, 술기 위주의 처치 전담업무만 하는 자는 제외하고, 환자 사정 · 처방 · 기록 등 전반적인 환자관리 업무를 담당하는 자만 포함하였다. 간호관리자와 전문의는 전문 또는 전담간호사와 일한 경력이 6개월 이상인 자로 하였다. 참여자는 종합병원 또는 상급종합병원에서 근무하는 자로, 한국전문간호사협회에 본 연구의 목적과 방법을 설명 후 연구목적에 적합한 참여자를 추천 받는 목적적 표집과 참여자를 통해 추천을 받는 눈덩이 표집도 수행하였다[15]. 참여자는 모두 임상현장에서 진료업무를 수행하는 간호인력에 대한 풍부한 경험이 있는 자로 내외과를 포함한 진료과를 고려하여 대상자를 선정하였으며, 수술실, 회복실은 제외하였다. 일반적으로 포커스그룹 인터뷰는 그룹의 주제와 관련하여 공통된 특성을 가지고 선택된 4–8명으로 구성하는 것이 바람직하므로[16], 본 연구에서는 그룹에 6명씩 배정하여 면담을 진행하였다. 각 포커스그룹에는 상급실무제공자 도입시기, 상급실무제공자의 의료서비스 영역에 관한 동질한 특성을 유지하고, 직종 특성에 따른 편중을 최소화하고자 각 포커스그룹에는 동일 의료기관에서 근무하는 전문의 2명, 간호관리자 2명, 전문간호사 또는 전담간호사 2명을 배정하였다. 같은 의료기관 종사자라는 특성을 고려하여 면담에 참여하는 참여자들에게 미리 포커스그룹의 구성인원에 대해 소개하여, 위계나 직책에 따른 부담감이 없는지를 확인한 후 자발적인 참여의지를 밝힌 경우 면담에 참여하였다. 포커스그룹의 개수를 결정할 때 일반적으로 포화이론이 적용되는데[16], 본 연구에서는 5개 포커스그룹 인터뷰를 시행한 결과, 더 이상 새로운 의미 있는 진술이 도출되지 않아 자료가 포화상태에 도달하였다고 판단되어 더 이상의 참여자 모집을 중단하였다.

(2) 자료수집

2024년 10월 8일부터 12월 5일까지 다수의 포커스그룹 인터뷰를 진행한 숙련된 1명의 연구자(제2저자)가 대면면담을 주도적으로 진행하였고, 다른 1명의 연구자가 1개 이상의 대면면담에 참여하여 필드노트를 작성하며 인터뷰를 진행하였다. 5개 그룹에서 총 30명의 참여자로부터 자료를 수집하였다. 면담질문은 임상에서의 경험과 전문간호사와 관련된 선행연구를 바탕으로 연구자 간 회의를 통하여 선정하였다[17–19]. 도입 질문은 “상급실무제공자 역할을 수행하는 간호인력(전문간호사, [가칭]전담간호사)이라고 하면 어떤 생각이 떠오르십니까?”, 주요 질문은 “종합병원에서 근무하는 의료인으로써 상급실무제공자 역할을 수행하는 간호인력에 관한 경험은 어떠한가요?”이며 보조질문은 “병원에는 상급실무제공자를 배치하는 기준이 마련되어 있나요?”, “병원은 상급실무제공자로 근무하기 위한 자격기준(경력, 면허 등)이 따로 마련되어 있나요?”, “상급실무제공자를 위한 교육과정(병원, 진료과)이 따로 마련되어 있습니까?”, “상급실무제공자의 보상, 승진, 휴가, 교육 등을 관리하는 부서가 있습니까?”, “상급실무제공자의 업무범위 설정과정은 어떠한가요?”, “상급실무제공자 역할 정립을 위한 필수조건은 무엇인가요?”, “상급실무제공자 활성화에 걸림돌이 있습니까?”, “상급실무제공자 활성화를 촉진하는 것이 어떤 것이 있을까요?”였다. “마지막으로, “상급실무제공자와 관련해 추가로 더 말씀해 주실 것이 있나요?”라는 질문으로 면담을 종료하였다.

면담은 연구참여자들의 편의성, 접근성과 프라이버시를 고려하여 연구자가 직접 해당 의료기관에 방문하여 회의실이나 교육실과 같은 독립적인 공간에서 이루어졌다. 총 5개 의료기관에서 시행된 면담시간은 72–123분으로 평균시간은 95분이었다. 면담은 인사, 동의서 취득, 면담규칙 설명, 자기소개, 면담질문을 통한 인터뷰, 면담에 관한 디브리핑 및 감사인사 순으로 이루어졌다[16]. 면담은 먼저 연구참여자에게 자발적 참여 여부를 확인하고, 연구목적, 방법 등을 설명한 후 모든 인터뷰 내용은 녹음되어 필사됨을 설명하고 서면 동의를 받았다. 먼저, 친근한 분위기를 만들기 위해, 동의서 서명 후 포커스그룹 인터뷰에 참여하는 대상자의 일반적인 특성은 직종, 연령, 성별, 학력, 임상경력 등을 조사하였다. 면담은 사전에 준비한 질문지를 활용하여 진행하였으나, 질문 없이도 자연스럽게 논의가 이어지는 경우에는 흐름을 방해하지 않고 진행하였다. 면담 중에는 참여자의 진술 중 연구목적에 부합하는 경험이나 의견을 보다 심층적으로 파악하기 위해 면담을 진행하였으며, 그룹의 역동을 증진시키기 위해 다양한 참여자들이 발언할 기회를 제공하였다. 인터뷰를 진행하면서, “상급실무제공자들의 업무 중 문제발생 시 어떻게 병원과 진료과가 대처했나요?”, “상급실무제공자와 관련된 법적 지원은 어떠해야 한다고 생각하시나요?”, “실제적인 상급실무제공자들을 활용하고 있는 시점에서 추후 활성화를 위해 교육과정은 어떻게 이루어져야 한다고 생각하시나요?” 등의 질문이 추가되었다. 특히 연구자는 면담 중 중립성을 유지하기 위해 선입견이 담긴 질문이나 비언어적 표현을 배제하였다. 면담을 종료하기 전에는 연구자가 면담의 주된 내용을 디브리핑하여 참여자들의 경험이 제대로 전달되었는지를 확인하였다. 면담 진행 후 음성인식 기반 전사프로그램(네이버 클로바노트)을 활용하여 6시간 이내에 1차 필사를 완료하였으며, 필사 시에는 현장노트를 활용하여, 참여자들의 표정, 억양, 몸짓이나 분위기 등을 반영하는 비언어적 표현을 반영하였다. 48시간 이내에 다시 녹취된 인터뷰를 들으며, 최종 필사본을 작성하였다.

2) 델파이조사

문헌고찰과 포커스그룹 인터뷰를 통해 도출된 주제를 바탕으로 상

급실무제공자 역할을 수행하는 간호인력의 활성화 방안 초안을 도출하였으며, 이를 바탕으로 전문가 패널을 구성하여 델파이조사를 시행하였다. 델파이조사는 해당 분야에 대한 경험과 전문성을 갖춘 전문가의 합의를 도출하는 데 적합한 방법으로, 참여자는 관련 주제에 대한 실무 경험과 이해도를 갖추고 있어야 한다[20,21]. 본 연구에서는 상급간호실무 경험이 풍부한 전문가를 다음과 같이 구성하여 총 50명의 델파이 패널을 선정하였다: 전문간호사 경력 7년 이상 전문간호사 10명, 전담간호사 경력 7년 이상 전담간호사 10명, 전문간호사 또는 전담간호사와 협업 경험이 있는 임상경력 10년 이상 간호관리자와 전문의 각각 10명, 전문간호사 교육과정 운영 간호학 교수 10명. 설문조사 전 이메일을 통해 연구목적 및 연구방법 등에 대해 안내를 제공한 후 연구참여동의서를 작성하였고, 이후 자발적으로 참여한 자를 대상으로 연구를 진행하였다.

1차 설문지는 문헌고찰 및 포커스그룹 인터뷰 결과를 토대로 상급실무제공자로서 간호인력의 정의와 자격, 업무범위, 교육과정, 자격관리, 지원방안의 5개 영역과 10개 하위범주로 구성하였으며, 총 27개 항목으로 구성하였다. 각 항목은 4단계 Likert 척도(매우 부적절=1, 부적절=2, 적절=3, 매우 적절=4)로 응답하도록 하였고, 항목별 추가·삭제 및 수정의견을 기술할 수 있도록 구성하였다. 1차 조사는 2025년 2월 10일부터 2월 24일까지 이메일을 통해 진행되었고, 총 49명(98.0%)이 응답하였다.

2차 설문지는 1차 조사결과를 바탕으로 전문가 합의 수준과 항목 타당성을 분석하여 수정·보완되었다. 구체적으로는 내용타당도 비율(content validity ratio [CVR])이 .80 미만이거나, 합의도 .70 미만, 수렴도 .50 초과, 변이계수(coefficient of variation [CV]) .50 초과인 항목을 중심으로 재검토하였으며[22-25], 이 기준을 충족하였더라도 다수 전문가가 유사한 수정의견을 제시한 항목에 대해서는 연구팀 논의를 통해 문항을 보완하였다. 최종 2차 설문지는 이러한 기준을 반영하여 일부 항목을 삭제하거나 문구를 수정한 형태로 구성되었으며, 2차 조사는 2025년 3월 2일부터 3월 17일까지 진행되었고, 1차 응답자 중 총 48명(98.0%)이 응답하였다.

3. 자료분석

1) 포커스그룹 인터뷰

자료수집과 분석은 양방향적으로 진행하였다. 5명의 연구자들은 매 포커스그룹 인터뷰가 끝나면 면담내용을 전반적으로 살펴보고 디브리핑을 하였고, 자료분석은 Microsoft Excel (Microsoft Corp.)과 MAXQDA ver. 12.0 (VERBI Software)을 이용하여 Elo와 Kyngäs [26]가 제시한 귀납적 내용분석방법으로 진행하였다. 자료분석은 자료가 포화되어 자료수집을 중단한 후, 필사본과 현장노트를 활용하여 진행하였다. 준비단계에서 참여자들의 인터뷰를 문장단위로 읽으며 맥락을 유지하며 자료를 이해하고자 하였다. 이를 위해 연구자들은 녹음된 자료를 듣고, 동시에 필사본을 읽으면서 자료와 친숙해지고자 노력하였다. 조직화 단계에서는 반복적으로 인터뷰자료를 읽으면서 의미 있는 진술문을 개방코딩하고 하위범주를 생성하였다. 개방코딩 된 자료들을 다시 범주화하여 추상화하는 과정을 거쳐 연구결과를 보고하였다. 일반화와 추상화 과정에서 인터뷰 원자료로 돌아가 연구결과와 인터뷰 자료를 비교하면서 진술 맥락 속에서 의미가 분리되지 않았는지 확인하는 과정을 지속적으로 진행하였다. 연구자간 의견이 일치되지 않은 경우, 다시 원자료를 읽으며 의미를 파악하고, 연구현상이 충분히 설명될 때까지 연구자 간 토론을 거쳐 조직화 과정을 반복하였다. 총 7차례의 연구회의를 통해 모든 연구자들이 분석결과에 합의를 이루어 최종적으로 자료분석을 완료하였다. 참여자 검증은 간호관리자 1명, 전문의 1명, 전문간호사 1명을 대상으로 분석된 결과를 보여주고, 포커스그룹 인터뷰를 통해 전달하려고 했던 경험과 의견이 일치함을 확인하였다.

2) 델파이조사

델파이조사의 분석에는 IBM SPSS Statistics ver. 27.0 (IBM Corp.)과 Microsoft Excel (Microsoft Corp.)을 사용하였다. 1차 조사에서는 전문가 패널의 응답을 바탕으로 각 항목의 평균, 표준편차, CV, 사분위수 범위, 합의도, 수렴도, CVR을 산출하였다. CVR은 Lawshe [22]의 공식에 따라 계산되었으며, 패널 수에 따른 최소 CVR값을 기준으로 유의수준 .05에서 유의미한 항목을 선별하였다[22,23]. 본 연구에서는 1차 49명, 2차 48명의 전문가가 참여하였으며, 이에 따라 최소 CVR 기준값은 .29로 설정하였다.

합의도(degree of consensus)=1–(Q3–Q1)/Md(중위수), 수렴도(degree of convergence)=(Q3–Q1)/2의 공식으로 산출하였고, 각각 .70 이상, .50 이하일 때 의견이 합의된 것으로 판단하였다[23,24]. 총 항목의 신뢰도는 Cronbach's α 계수를 통해 검증하였으며, α값이 .70 이상일 경우 수용 가능한 신뢰도로 간주하였고, 안정도는 CV를 기준으로 .50 이하일 때 안정적인 응답으로 해석하였다[24,25].

4. 윤리적 고려

연구 시작 전 서울아산병원 임상연구심의위원회(Institutional Review Board [IRB])의 승인(IRB no., 2024-1096)을 받은 후 자료수집을 시작하였다. 포커스그룹 인터뷰와 델파이조사 자료수집 전에 참여자에게 연구목적과 방법을 설명하고 자발적으로 참여에 동의한 자를 대상으로 서면으로 동의서를 작성한 후 연구를 진행하였다. 포커스그룹 인터뷰의 경우 면담내용이 녹음되고 전사됨을 설명하였다. 본 연구에서 얻어진 개인정보는 개인정보 보호법에 따라 관리하고 연구 관련 자료는 연구 이외의 목적으로는 활용하지 않으며 연구 종료 후 3년간 보관한 뒤 파기할 예정임을 설명하였다. 대상자에게 연구 참여 후 소정의 사례금을 지급하였다.

결과

1. 포커스그룹 인터뷰

참여자는 전문간호사 6명, 전담간호사 4명, 간호관리자 10명, 전문의 10명이었으며, 이 중 여성은 25명이었으며, 평균 연령은 41.3±6.06세였다. 임상경력은 평균 16.03±6.02년이었다. 전문 또는 전담간호사의 근무부서는 진료과 병동 6명, 중환자실 3명, 투석실이 1명이었고, 간호관리자 5명은 병동, 5명은 중환자실에서 근무하였으며, 내과계 4명, 외과계 2명, 중환자의학과 2명, 소아청소년과 2명의 해당 분야 전문의가 참여하였다(Table 1). 포커스그룹 인터뷰를 분석한 결과, 717개의 의미 있는 진술에서 103개의 개방코드를 도출하였다. 이를 다시 11개로 범주화하였고 최종적으로 4개의 주제를 도출하였다(Table 2).

1) 주제 1: 의료의 질을 확보하기 위해 활용된 다양한 상급실무제공자

참여자들이 근무하는 의료기관은 모두 전문간호사나 전담간호사를 활용하여 부족한 의사의 업무를 전담하거나 환자안전을 확보하여 의료의 질을 보장하고 있었다. 참여자들의 소속 의료기관 중 일부는 2000년대 초반부터 전문간호사제도를 활용한 경우도 있고, 일부는 의정갈등 이후 전문/전담간호사제도를 시작하기도 하였다. 그러나 각 병원마다 상급실무를 제공하는 간호사의 직명을 다양하게 사용하고 있어 의료기관에서의 혼란은 가중되었고, 갑작스럽게 상급실무제공자의 수가 증가하면서 전문성에 대한 의문을 가지는 경우도 있었다.

(1) 다양한 상황에서 시작되고 활용된 상급실무제공자

상급실무제공자는 신경외과나 흉부외과 등의 필수 진료과에서 전공의가 부족하여 의료의 질 확보가 어려워지자, 전담간호사와 전문간호사라는 이름으로 활용되기 시작하였다. 또한 짧은 수련과정의 전공의보다는 숙련된 경험을 바탕으로 진료를 담당하여 환자안전을 확보하기 위해 종양내과, 신생아과, 호흡기내과 인공호흡기 관련 업무 등에서 이들을 활용하기도 하였다.

"제가 처음 신생아중환자실 주치의를 할 때, 신생아중환자실에

Table 1. General characteristics of participants in the focus group interviews (N=30)

No.	Age (yr)	Gender	Position	Clinical career (yr)	Practice area	Hospital type	Region
1	45	Woman	APN	22.50	Oncology medicine	Tertiary	Seoul
2	33	Woman	CPN	11.42	OBGY	Tertiary	Seoul
3	44	Woman	Nurse manager	21.67	Acute care surgery	Tertiary	Seoul
4	42	Woman	Nurse manager	18.67	OBGY	Tertiary	Seoul
5	39	Woman	Attending physician	14.50	Oncology medicine	Tertiary	Seoul
6	34	Woman	Attending physician	5.00	Acute care surgery	Tertiary	Seoul
7	48	Man	Attending physician	8.67	Hematology-oncology	Tertiary	Seoul
8	40	Woman	Nurse manager	17.50	Hematology-oncology	Tertiary	Seoul
9	30	Woman	CPN	6.42	Hematology-oncology	Tertiary	Seoul
10	40	Woman	Attending physician	6.17	CCM	Tertiary	Seoul
11	40	Woman	Nurse manager	17.50	Neurosurgical ICU	Tertiary	Seoul
12	29	Woman	APN	5.25	Neurosurgery	Tertiary	Seoul
13	42	Woman	Nurse manager	18.25	Neonatal ICU	Tertiary	Seoul
14	45	Woman	Nurse manager	22.50	Surgical ICU	Tertiary	Seoul
15	34	Woman	APN	10.42	Surgical ICU	Tertiary	Seoul
16	42	Woman	CPN	20.42	Pediatrics	Tertiary	Seoul
17	38	Woman	Attending physician	11.42	Pediatrics	Tertiary	Seoul
18	51	Man	Attending physician	20.75	Pediatrics	Tertiary	Seoul
19	41	Woman	APN	16.00	Medical ICU	Tertiary	Gyeonggi-do
20	45	Woman	Nurse manager	23.50	Surgical ICU	Tertiary	Gyeonggi-do
21	45	Woman	Attending physician	20.00	CCM	Tertiary	Gyeonggi-do
22	40	Woman	APN	14.75	Surgical ICU	Tertiary	Gyeonggi-do
23	43	Woman	Nurse manager	15.50	Medical ICU	Tertiary	Gyeonggi-do
24	52	Man	Attending physician	26.75	Thoracic surgery	Tertiary	Gyeonggi-do
25	56	Man	Attending physician	20.00	Nephrology	General	Daejeon
26	41	Man	Attending physician	13.00	Hematology-oncology	General	Daejeon
27	37	Woman	APN	14.75	Hematology-oncology	General	Daejeon
28	37	Woman	CPN	12.75	Hemodialysis room	General	Daejeon
29	42	Woman	Nurse manager	20.00	Internal medicine	General	Daejeon
30	45	Woman	Nurse manager	24.83	Hematology-oncology	General	Daejeon

APN, advanced practice nurse; CCM, critical care medicine; CPN, clinical practice nurse; ICU, intensive care unit; OBGY, obstetrics and gynecology.

Table 2. Experiences and perspectives of healthcare professionals working with advanced practice providers

Themes	Category
Utilization of diverse APPs to ensure quality care	Deployment and utilization of APPs across various clinical settings
	Government-led expansion of advanced practice roles amid physician-government conflicts
	Confusion caused by the diverse roles and titles of APPs
Expanding the scope of practice of APPs	Expanded roles of APPs
	Competencies required for APPs
Requirements to ensure the quality of APPs	Need for consensus on minimum experience and licensing requirements
	Certification and maintenance of qualifications for APPs
	Development of competency-based curricula including both theoretical and practical training for APPs
	Establishment of legal regulations regarding the scope of practice and determination of work boundaries using job descriptions
Strategies for sustainable management of APP workforce	Establishment of systematic human resource management frameworks
	Development of compensation systems for advanced practice work

APP, advanced practice provider.

서는 사실 전문간호사가 여기서는 너무 필수적으로 의사만큼, 의사보다 더 오히려 더 중요할 수 있다고 생각하거든요. (중략). 의료의 질은 결국에는 간호의 핸들링인데 전문간호사가 그것도 할 수 있고 메디컬 디시전이나 커뮤니케이션까지 할 수 있어서. (중략). 전공의가 없어도… 인력이 굉장히 없음에도 불구하고 이 인력이 굉장히 잘 활용하면 의료의 질을 높일 수 있죠." (참여자 17 전문의)

(2) 의정갈등 속 국가가 확대한 상급실무제공자

보건복지부는 의정갈등으로 떠난 의사의 자리를 상급실무제공자가 채울 수 있도록 (가칭)전담간호사라는 직무를 인정하고, 한시적으로 상급실무제공자와 관련된 업무 관련 시범사업을 시행하게 되었다. 의정갈등 전에는 상급실무제공자를 1명도 받기 어려웠는데, 지금은 진료과나 병동을 중심으로 특정 업무를 수행하는 처치전담간호사를 다수 선발하여 공백을 메꾸고 있다고 하였다.

"의정사태가 생기면서, 중환자실에서는 당직이나 아니면 전공의가 없을 때 이곳을 어떻게 채우고 환자를 돌볼 것인가 (중략). 다른 병원에서는 전문간호사가 있어서 잘 된다 이런 얘기를 듣고, 그럼 빠르게 우리 또 시작하자라고 얘기가 나와서 정말 그때 1–2주만에 저희가 시작했어요." (참여자 9 전담간호사)

(3) 다양한 직무와 직명으로 인해 혼란스러운 상급실무제공자

같은 진료과에서 같은 업무를 하더라도 선임자와 후임자를 각각 전문간호사와 전담간호사로 부르기도 하고, 일부 병원에서는 의사들이 '전문'이라는 표현을 사용하기 꺼려해 '마스터'라는 직명을 부여하기도 하였다. 특히 전공의 업무 중 일부만을 수행하는 처치 전담간호사가 생겨 기존 전담간호사와 같은 직명이나 직무가 달라 상급실무제공자 역할을 규정하는 데 혼란스러워 했다.

"저희 병원에서는 그러니까 이게 병원마다 이제 시스템을 다 다르게 갖추고 있다 보니 이걸 전체적으로 합치기가 어려운데, 일단 저희 병원 안에서는 일반 처치 전담(간호사), 특수 처치 전담(간호사)이 있고, 그리고 임상 전담간호사라고도 하고… 근데 간호사들이 굉장히 헷갈려 해요." (참여자 13 간호관리자)

2) 주제 2: 확대되고 있는 상급실무제공자의 업무범위

참여자들은 상급실무제공자의 업무범위는 보건의료환경에 따라 유동적으로 변화되어 왔으며, 환자 및 의료진 만족도 증가, 의료 관련 비용 감소 등으로 입증되면서 업무가 확대되고 있는 추세라고 하였다. 특히 봉합, 발사, 말초삽입형중심정맥카테터(peripherally inserted central catheter [PICC]) 삽입뿐만 아니라 전문간호사에게는 중심정맥관 삽입, 기도삽관 및 발관에 이르는 침습적인 처치까지 확대되었다. 이외에도 다학제팀의 일원으로 활동하며 간호사, 전공의와 타부서 직원 교육, 간호사의 기록 모니터, 진료 및 간호 관련 프로토콜 마련, 환자안전 관련 업무, 연구 등을 해야 한다고 하였다.

(1) 상급실무제공자의 확장된 업무

참여자들은 상급실무제공자의 역할이나 업무가 점차 확대되고 심화되고 있어, 간호와 치료의 영역을 넘나들며 최상의 진료결과를 이끌어내는 데 중요한 역할을 하고 있다고 하였다. 대상자 사정, 영상 및 진단검사 결과 확인, 위임에 의한 처방, 타과 자문의뢰, 침습적 처치, 상처 소독 및 배액관 관리뿐만 아니라, 간호사의 기록을 모니터링하고 중심정맥관 혈류감염(central line-associated bloodstream infections) 등을 관리하는 역할 등도 하고 있었다. 뿐만 아니라 해당 전문분야에 관해서 의료진에게 교육을 제공하고, 일부 전문의들은 생애말간호 면담과 같은 업무도 주도적으로 시행해 주기를 바라고 있었다. 참여자들은 상급실무제공자의 업무범위를 진료과와 부서의 특성에 따라 인턴 업무에서부터 전공의 4년차나 전임의와 의사결정

을 함께 하는 정도까지의 업무가 가능한 정도까지 업무의 수준을 다양하게 제시하였다.

"전공의 역할도 하지만 전공의 선생님들이 빠뜨린 거... (중략). 용량 같은 것도 신생아에 맞게 내야 되기 때문에 어떻게 내야 되는 거를 다 슈퍼바이저를 전문간호사가 하는 거예요. (중략). 2017년도부터 계속 그렇게 하고 있고 그때는 신생아중환자실 전공의가 줄면서 이렇게 더 하게 되었죠." (참여자 16 전담간호사)

(2) 상급실무제공자에게 필요한 역량

참여자들은 확장된 상급실무를 제공하기 위해서는 침습적 처치, 배액관 관리 등에 따르는 임상술기술과 분야에 대한 전문성은 기본적으로 갖추어야 할 역량이며, 문제해결능력과 새로운 업무를 파악하고 습득하는 능동성 역시 갖춰야 하는 역량이라고 하였다. 또 지속적으로 환자와 보호자들에게 상담과 교육을 제공해야 하므로 상담역량 역시 필요하다. 특히 전문의와 간호관리자들은 상급실무제공자에게 가장 중요한 역량으로 다학제 팀 내에서의 유연한 역할을 할 수 있는 의사소통능력과 사회관계 기술을 꼽았다. 이외에도 자신의 분야를 지속적으로 발전시킬 수 있는 연구역량과 리더십 역량, 윤리적 역량도 필요하다고 하였다.

"지금 할 수 있는 침습적 처치, 내가 바라는 처치는 아까 얘기 C-line, PICC, mid-line, A-line, 흉관 관리, 이런 침습적 처치와 의무기록 정리, 차팅 기술이라든지 이런 거는 교육을 받고 와서 직접 전문간호사들이 했으면 좋겠어요." (참여자 21 전문의)

"전문간호사, 전담간호사의 역할에서 전문적인 판단, 의사결정 능력 이런 부분이 좀 중요하다고 언급 드렸는데, 이런 업무에 있어서의 어떤 내용적인 측면 말고 태도의 측면에서 저는 가장 중요한 게 전문가라 하면 능동성이라고 생각을 하거든요." (참여자 3 간호관리자)

3) 주제 3: 상급실무제공자의 질을 담보하기 위한 조건

참여자들은 상급실무제공자의 최소한의 경력과 자격이 법적으로 규정되어야 하며, 이러한 자격은 일회성이 아니라 지속적으로 유지될 수 있도록 규제가 필요하다고 강조하였다. 또한 이들에게 필요한 교육과정을 보건복지부가 인증하는 기관 또는 단체를 통해 마련하고, 실제 근무하는 의료기관의 장이 업무범위를 명확히 규정해야 환자의 안전을 확보할 수 있다고 하였다. 단순히 임상경력과 자격만으로는 부족하며, 해당 진료과나 부서에서 실무전문교육과정을 일정 기간 수료한 후 업무에 투입되어야 한다고 제안하였다. 마지막으로, 근무 전 다면평가를 통해 실제 업무역량을 확인하고 근무 가능 여부를 판단하는 제도가 필요하다는 데 의견이 모아졌다.

(1) 최소 경력 및 자격에 관한 사항 합의 필요

지방의 참여자들은 현실적으로 전문간호사 자격 소지자를 구하기 어려워 전담간호사를 선발하여 운영한다고 하였다. 일부 의료기관은 전문간호사를 필수인력으로 고정하기는 부담스러워서 일반간호사로의 업무전환이 쉬운 전담간호사제도를 더 선호한다고 하였다. 참여자들은 병원의 종별과 위치에 따라 상급실무제공자의 최소 경력과 자격기준에 대해 다양한 의견을 제시하였으나, 환자안전과 의료의 질 보장을 국가 차원의 공통된 최소 기준 마련의 필요성에 대해서는 의견을 같이하였다. 상급종합병원에서는 최소 5년 이상의 임상경력과 석사 과정 이수를, 지방 의료기관에서는 최소 3년 이상의 경력과 해당 진료과에서의 3개월 이상 교육을 제안하는 등 차이를 보였다.

"경력 5년 이상에 전문간호사 있어야 되고 이렇게 했는데, 이게 당장 사람이 많이 필요한데, 그 기준이 되는 사람이 없더라고요." (참여자 7 전문의)

"자격이나 면허는 반드시 필요해요. 그거는 사회적인 합의라는 의미가 있어요. (중략) 그게 있어야 하지만 이들이 제대로 활동할 수 있고 치료를 제공하는 사람들이 애매한 부분에 서 있다가 위험에 휘말리지 않을 수가 있습니다." (참여자 26 전문의)

(2) 상급실무제공자의 자격인증 및 유지

참여자들은 상급실무제공자가 세부 전문의와 유사한 자격인증 및 유지체계를 도입해야 한다고 주장하였다. 강제적인 규정 없이 최신 의료지식을 따라가기에는 한계가 있으며, 이러한 규정은 의료기관에서도 상급실무제공자의 전문성을 유지하도록 동기를 부여한다고 하였다. 연수와 교육은 대한간호협회나 간호학회뿐만 아니라 의사협회나 관련 학회 등 다양한 기관에서 제공하는 프로그램에 참여할 수 있도록 해야 한다는 의견도 있었다. 또한 숙련도에 따라 직급과 업무를 구분하는 경력사다리제도(career ladder system)를 도입해 계층형 자격인증시스템을 마련해야 한다는 데 의견이 모아졌다.

"전문간호사협회에서 주관을 해서, 중환자협회, 응급의학회 이렇게 세분화돼 있는 진료과별 세션들이 있잖아요. (중략). 전문간호사 이상이면 이 세션에 참여해서 거기 핸즈오프 강의를 들으면 이제 이수증을 딴다든지... 교육 평점을 유지해 준다든지..." (참여자 14 간호관리자)

"이게 전문간호사제도 안에도 경력사다리제도가 좀 있어야 돼요. 전공의들 사이에는 chief, 간호사들 사이에는 책임간호사가 있는 것처럼…"(참여자 3 간호관리자)

(3) 상급실무제공자의 역량 기반 이론 및 실습교육과정 개발

참여자들은 역량 중심 구성된 이론교육과정과 실무 중심 실습과정을 반드시 병용하여야 한다고 목소리를 모았다. 특히 전문의들은 상급실무제공자들이 간호학적 관점을 뛰어넘어 증상 호소에 따른 건강

사정에서부터 검사 판독에 이르는 치료적 실무와 관련된 공통교육과정을 반드시 수료해야 함을 강조하였다. 공통교육과정은 보건복지부와 교육부에서 인증을 받아 공식적으로 운영되어야 하며, 현재와 같이 대학원 교육과정이 가장 현실적인 방법이라고 제안하였다. 의사의 역할을 대체하는 상급실무를 제공하는 경우에는 상급종합병원 이상의 의료기관에서 실습이 진행되어야 함을 강조하였다. 일부 참여자는 전임의 과정이 있는 종합병원에서도 실무이론교육과 실습을 진행할 수 있다고도 하였다. 상급실무는 매우 다양한 분야에서 제공되기 때문에 공통이론 및 실습과정만으로는 다양한 분야의 전문성을 획득하기 어려우므로 관련 학회나 상급종합병원 등에서 주관하는 실무 전문교육과정을 이수할 것을 제안하였다.

"어쨌든 의대 교육과정이 (중략) 질병의 병태생리나 질병을 진단하려는 거를 가장 어떻게 보면 우선시하거든요. 근데 이제 그런 면에서 전문간호사들이 가장 조금 약하다고 할 수 있죠. 그러니 상급실무제공자는 그런 교육과정이 필요하죠." (참여자 24 전문의)

(4) 직무범위 법제화 및 직무기술서를 활용한 업무범위 결정

참여자들은 상급실무제공자의 업무범위에 대한 법적 기준이 미비함이 가장 큰 활성화 걸림돌이라고 하였다. 현재의 시범사업 규정은 문제발생 시 책임소재가 불분명하며, 이를 보완해야 의료의 질을 보장하는 업무가 수행된다고 하였다. 한편, 참여자들은 상급실무와 관련된 법 규정이 미비한 경우, 상급실무를 제공하는 진료부서, 해당 전문의, 상급실무제공자 간에 상급실무에 대한 협의를 통해 직무기술서를 명문화해야 함을 언급하였다. 참여자들은 이러한 상급실무에 관한 직무기술서는 개인 간의 협약이 아니므로 병원장의 승인을 반드시 얻어 추후 발생 가능한 법적 문제를 미연에 방지해야 한다고 의견을 제시하였다.

"프로토콜 만드는 걸 지금 초안 세팅하고 하고 있거든요. (중략) 하나하나 다 프로토콜을 만들어 놔야지 나중에 혹시 문제가 됐을 때 저희도 보호를 받을 수 있고, 그리고 병원도 사실 그게 책임이나 이런 거에서 벗어날 수 있다고 생각해서 만들고 있어요." (참여자 12 전문간호사)

4) 주제 4: 안정적인 운영을 위한 대책

대부분의 참여자들은 의정갈등이 해결된 후에도 상급실무제공자를 활용하는 현재의 상황이 크게 변화하지 않을 것으로 예상하였다. 상급실무제공자는 전문의와 팀을 이루어 임상현장에서 의료의 질을 보장하는 중요한 역할을 수행하기 때문에, 안정적인 운영을 위해 인적 자원 관리와 보상체계 개선 등 체계적인 관리가 필요하다는 데 의견을 모았다. 특히 현실적인 문제를 해결하기 위한 행정적 지원과 적절한 보상이 필수적이라고 강조하였다.

(1) 인적 자원 관리를 위한 체계 마련

참여자들은 상급실무제공자가 과중한 업무와 열악한 근무환경으로 인해 소진(burnout)을 겪고 있다고 지적하였다. 이들은 인력이 부족하여 지속적인 업무 부담에 시달리고 있으며, 소속 부서와 관리부서가 일원화되지 않아 의료기관으로부터 보호받고 있다는 느낌이 부족하다고 하였다. 또한 승진의 기회도 마련되어야 한다고 하였다. 이에 따라 의료기관은 상급실무제공자를 위한 전담 행정관리부서를 신설하고, 인력 지원방안을 마련해야 한다는 의견이 제시되었다.

"승진이 없어요. 10년이 지나도 그냥 전문간호사 중에 원 오브 뎀이고 전문간호사의 시조새 이런 말이나 듣고 있는 그런 상황이라는 얘기죠. 그래서 여기도 체계를 만들어 줘야 돼요. (중략). 지금 제가 말씀드린 문제들이 해결이 되지 않으면 지속 가능한 것이 되기 쉽지 않아요." (참여자 25 전문의)

(2) 업무에 대한 보상제도 마련

상급실무제공자들은 일반간호사보다 높은 수준의 전문성을 요구받음에도 불구하고, 3교대 근무 일반간호사보다 낮은 급여를 받고 있었다. 참여자들은 획일화된 간호사 보수체계를 개선하여 적절한 보상을 마련해야 한다고 주장하였다. 구체적으로, 상급종합병원 평가나 중환자실 적절성 평가 등 의료기관 인증지표에 상급실무제공자의 고용 정도를 포함하여 이들의 중요성을 반영해야 한다고 제안하였다. 또한 이들이 수행하는 다양한 실무에 대해 별도의 의료수가를 마련하여 공정한 보상을 제공해야 한다고 강조하였다. 이를 통해 상급실무제공자의 동기 부여와 안정적인 인력 운영을 도모해야 한다고 주장하였다.

"상급실무제공자로서 일하는 간호사들의 직업적 안정성을 보장해 주고 그들의 그 권리를 좀 보장해 줄 수 있는 안전망들에 대한 고민은 있는가를 좀 생각을 해보면 좋을 것 같고, 그래서 사실 전문간호사의 최소 월급이 얼마여야 되나 좀 얘기가 있으면 좋겠다. (중략). 저는 의사가 간호사보다 많이 받아야 한다 이런 게 아니라, 수련과정에 있는 사람보다는 자격이 있는 상급실무를 하는 사람이 더 보수가 많아야 한다고 생각해요." (참여자 10 전문의)

2. 델파이조사

1) 전문가 패널의 일반적 특성

델파이 1차 조사에 참여한 49명의 전문가 중 여성은 42명(85.7%)으로 다수를 차지하였고, 평균 연령은 46.8세였다. 직종별로는 전문간호사, 전담간호사, 간호관리자, 간호학교수 각 10명(20.4%), 전문의 9명(18.4%)이었으며, 최종 학력은 석사(57.1%)가 가장 많았다. 해당 분야 경력은 평균 16.78±7.96년, 총 임상경력은 평균 19.92±8.85년이었다(Table 3).

Table 3. General characteristics of the Delphi panel (N=49)

Characteristics	Value
Gender	
Men	7 (14.3)
Women	42 (85.7)
Age (yr)	46.8±6.82 (33–62)
30–39	7 (14.3)
40–49	24 (49.0)
50–59	17 (34.7)
≥60	1 (2.0)
Position	
Advanced practice nurse	10 (20.4)
Clinical practice nurse	10 (20.4)
With APN certificate	7 (70.0)
Without APN certificate	3 (30.0)
Nurse manager	10 (20.4)
Nursing professor	10 (20.4)
Physician	9 (18.4)
Department: Surgical	5 (55.6)
Department: Medical	3 (33.3)
Department: Pediatrics	1 (11.1)
Education	
Bachelor's	2 (4.1)
Master's	28 (57.1)
Doctoral	19 (38.8)
Field experience (yr)	16.78±7.96 (1–37)
<10	4 (8.2)
10–19	30 (61.2)
20–29	10 (20.4)
≥30	5 (10.2)
Clinical experience (yr)	19.92±8.85 (2–37)
<10	5 (10.2)
10–19	17 (34.7)
20–29	19 (38.8)
≥30	8 (16.3)

Values are presented as number (%) or mean±standard deviation (min–max).
APN, advanced practice nurse.

2) 1차 델파이조사 결과

1차 델파이조사는 상급실무제공자로서 간호인력의 활성화를 위한 전략 도출을 목적으로, 상급실무제공 간호인력의 '정의와 자격,' '업무범위,' '교육과정,' '자격관리,' '지원방안' 총 5개 영역과 이에 따른 10개 하위범주, 총 27개 항목을 대상으로 조사를 시행하였다. 분석결과, 대부분 항목에서 적절성과 합의도가 높은 수준으로 나타났으나, 일부 항목은 CVR, 합의도 기준을 충족하지 못하거나 전문가 의견이 집중된 항목으로 확인되었다. 이에 따라 총 7개 항목을 수정하였고, 3개 항목은 삭제하였다. 삭제된 항목은 '상급실무제공 간호인력의 정의와 자격' 영역에서 "종합병원 이상의 의료기관에서 전문의를 포함한 다학제 전문가 의료팀의 일원으로 의료서비스를 제공하는 간호사" 항목, '자격관리' 영역에서 "전문 분야별 경력에 따른 계층형 자격인증 시스템 마련" 항목, 그리고 '지원방안' 영역에서 "대한간호협회 차원의 상급실무제공자 보수 규정안 마련" 항목이었다. 각 항목의 세부 분석결과는 Table 4와 같다.

3) 2차 델파이조사 결과

2차 조사는 1차 조사에서 수정 · 보완된 24개 항목으로 구성되었으며, 1차에 참여한 49명의 전문가 중 48명이 응답하였다. 분석결과, 대부분의 항목은 합의도(≥.70), 수렴도(≤.50), CV (≤.50), CVR (≥.29) 기준을 충족하여[23-25], 전문가 간 충분한 타당성과 합의에 도달하였다. 다만, 2개 항목의 경우 합의도가 .67로 기준에 다소 미치지 못하였으나, 수렴도와 안정도가 기준을 충족하여 전문가 간 의견이 안정적으로 수렴된 것으로 판단하였고, CVR 또한 .80 이상으로 내용타당성이 높아 최종 항목에 포함하였다(Table 4). 이는 델파이 연구에서 일부 기준 미충족 항목이라도 전문가들의 정성적 의견과 CVR을 종합적으로 고려해 최종 포함 여부를 결정할 수 있다는 기존 연구기준을 따른 것이다[24].

3. 상급실무제공자 역할을 수행하는 간호인력 활성화 방안 제안

상급실무제공자 역할을 수행하는 간호인력 활성화 방안은 정의와 자격, 업무범위, 교육과정, 자격관리, 지원방안 등 5개 영역과 이에 따른 10개 하위범주, 24개 항목으로 구성되었다(Table 5, Figure 1).

첫 번째 영역인 정의와 자격에는 2개의 하위범주와 4개의 항목이 포함되었다. 정의에 해당하는 하위범주에서는 상급실무제공자를 해당 분야의 전문지식과 임상경력, 탁월한 실무 역량을 바탕으로 환자의 건강문제를 해결하기 위해 직접 실무, 교육, 자문, 연구 등 상급 수준의 의료서비스를 제공하는 간호사로 규정하였다. 자격에 해당하는 하위범주에서는 종합병원 이상에서 최소 5년 이상의 임상경력을 보유하되 해당 분야에서 3년 이상의 경력을 갖춘 자, 간호사 면허와 함께 전문간호사 자격을 보유하거나 보건복지부에서 인정한 교육과정을 이수한 자, 그리고 업무 개시 전에 필수교육 및 현장실습을 이수한 자 등 3가지 모든 조건을 충족해야 함을 제시하였다.

두 번째 영역인 업무범위는 2개의 하위범주와 6개의 항목으로 이루어졌다. 업무범위 법제화에서는 상급실무제공자가 위임받아 수행할 수 있는 업무에 대한 법적 기준을 마련하고, 상급간호실무에 따른 수가 제정 및 의료기관 인증 관련 규정 제정을 포함한 3개의 항목이 제시되었다. 직무기술서 수립과 관련해서는 임상현장에서 상급실무제공자의 전문 역할을 개발하고, 역할과 책임을 명확히 정의하며, 업무범위와 책임에 대해 진료과와 협의과정을 거쳐야 함을 포함한 3개의 항목을 제시하였다.

세 번째 영역인 교육과정은 2개의 하위범주와 5개의 항목으로 구성되었다. 공통필수이론 및 실습교육과정의 표준화 하위범주에서는 상급실무제공자를 위한 교육과정을 마련하고, 이를 표준화하며, 교육과정 인증제도 마련, 대학원 과정 또는 보건복지부가 인정하는 기관에서의 공통필수이론 교육과 종합병원 이상의 의료기관에서 시행되는 실습교육 시행의 3개의 항목이 제시되었다. 전문교육과정 이수

Table 4. Comparison of Delphi rounds in developing a consensus on core competency indicators (round 1, N=49; round 2, N=48)

Domain	Item	Mean±SD		Consensus		Convergence		CV		CVR	
		R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
1. Definition and qualifications for APPs											
1-1. Definition of APPs	1-1-1	3.59±0.57	3.92±0.28	.75	1	.50	0	.16	.07	.92	1
1-2. Minimum qualification standards	1-2-1	3.35±0.66	3.19±0.49	.67	1	.50	0	.20	.15	.80	.92
	1-2-2	3.61±0.61	3.88±0.39	.75	1	.50	0	.17	.10	.88	.96
	1-2-3	3.35±0.72	3.27±0.49	.67	.67	.50	.50	.22	.15	.80	.96
2. Scope of practice of APPs											
2-1. Legal regulations regarding scope of practice	2-1-1	3.76±0.48	3.96±0.20	1	1	0	0	.13	.05	.96	1
	2-1-2	3.71±0.50	3.94±0.32	.75	1	.50	0	.13	.08	.96	.96
	2-1-3	3.69±0.51	3.92±0.35	.75	1	.50	0	.14	.09	.96	.96
2-2. Development of job description based on advanced practice	2-2-1	3.65±0.56	3.96±0.20	.75	1	.50	0	.15	.05	.92	1
	2-2-2	3.86±0.41	3.92±0.35	1	1	0	0	.11	.09	.96	.96
	2-2-3	3.76±0.52	3.94±0.24	1	1	0	0	.14	.06	.92	1
3. Educational programs for APPs											
3-1. Standardization of core theory and practicum curriculum	3-1-1	3.80±0.41	4.00±0.00	1	1	0	0	.11	0	1	1
	3-1-2	3.65±0.56	3.96±0.20	.75	1	.50	0	.15	.05	.92	1
	3-1-3	3.29±0.79	3.23±0.52	.67	.67	.50	.50	.24	.16	.67	.92
3-2. Mandatory completion of accredited advanced practice nursing education or specialty training	3-2-1	3.53±0.71	3.92±0.35	.75	1	.50	0	.20	.09	.84	.96
	3-2-2	3.39±0.84	3.79±0.62	.75	1	.50	0	.25	.16	.80	.88
4. Credentialing and regulation of APPs											
4-1. Establishment of certification system	4-1-1	3.76±0.56	3.96±0.20	1	1	0	0	.15	.05	.96	1
4-2. Establishment of a re-certification system	4-2-1	3.79±0.45	3.96±0.20	.75	1	.50	0	.12	.05	1	1
	4-2-2	3.49±0.71	3.90±0.37	.75	1	.50	0	.20	.10	.84	.96
5. Support systems for APPs											
5-1. Organizational system for human resource management	5-1-1	3.71±0.50	3.94±0.32	.75	1	.50	0	.13	.08	.96	.96
	5-1-2	3.67±0.52	3.98±0.14	.75	1	.50	0	.14	.04	.96	1
	5-1-3	3.49±0.62	3.81±0.49	.75	1	.50	0	.18	.13	.88	.92
5-2. Compensation for advanced practice roles	5-2-1	3.67±0.55	3.88±0.39	.75	1	.50	0	.15	.10	.92	.96
	5-2-2	3.59±0.61	3.90±0.31	.75	1	.50	0	.17	.08	.88	1
	5-2-3	3.53±0.62	3.85±0.46	.75	1	.50	0	.17	.12	.88	.92

APN, advanced practice nurse; APP, advanced practice provider; CV, coefficient of variation; CVR, content validity ratio; R1, Delphi round 1; R2, Delphi round 2; SD, standard deviation.

의무화 하위범주에는 해당 분야 실무를 위한 전문교육과정과 상급임상술기 교육프로그램 이수 등 2개의 항목이 포함되었다.

네 번째 영역인 자격관리는 2개의 하위범주와 3개의 항목으로 이루어졌다. 자격인증시스템 구축 하위범주에서는 표준화된 자격인증체계를 마련할 필요성을 제시하였으며, 정기적 재인증시스템 구축 하위범주에서는 해당 분야의 보수교육을 기반으로 한 재인증제도와 이를 다학제적으로 운영하는 방안 등 2개 항목이 포함되었다.

마지막으로, 다섯 번째 영역인 지원방안은 2개의 하위범주와 6개의 항목으로 구성되었다. 인적 자원 관리체계에서는 간호부 내 상급실무제공자 전담조직을 마련하고, 전담위원회를 구성하며, 승진체계를 갖추는 방안 등 3개의 항목이 제시되어 있다. 또한 보상체계와 관련해서는 상급실무제공자에게 별도의 수당을 지급하고, 경력 및 성과에 따른 보상체계를 마련해야 한다는 3개의 항목이 포함되었다.

고찰

본 연구는 포커스그룹 인터뷰 및 델파이조사를 통하여 상급실무제공자로서 간호인력의 활성화를 위한 방안을 제시하고자 시행되었다. 본 연구결과, 상급실무제공자 역할을 수행하는 간호인력 활성화 방안으로 상급실무제공자로서 간호인력의 정의와 자격, 업무범위, 교육과정, 자격관리, 지원방안 총 5개 영역과 그에 따른 10개 하위범주, 24개 항목으로 구성되었으며, 이를 중심으로 고찰하고자 한다.

첫 번째 영역인 상급실무제공자로서 간호인력의 정의와 자격을 살펴보면, 본 연구에서 상급실무제공자는 전문지식과 경력 및 탁월한 역량을 갖추고 상급수준의 의료서비스를 제공하는 자로 도출되었다. 그동안 국내 의료법은 진단, 검사, 처방 등의 업무는 의료영역으로 의사만이 할 수 있는 업무로 해석하고 있어 전문간호사조차도 업무

Table 5. Strategies for expanding the role of advanced practice providers in the nursing workforce

Domain	Item
1. Definition and qualifications for APPs	
1-1. Definition of APPs	1-1-1. Nurses who provide advanced-level medical services beyond direct nursing care, based on professional knowledge, clinical experience, and advanced competencies, to address patients' health problems.
1-2. Minimum qualification standards (must meet all three criteria)	1-2-1. At least 5 years of clinical experience in a general hospital or higher-level medical institution, including a minimum of 3 years of experience in the relevant specialty.
	1-2-2. Registered nurses who have obtained a APN certification or completed a specialty-specific education program accredited by the Ministry of Health and Welfare.
	1-2-3. Completion of required theoretical education and field practicum before starting the role (including clinical and nursing department evaluations).
2. Scope of practice of APPs	
2-1. Legal regulations regarding scope of practice	2-1-1. Establishment of legal standards for delegated tasks that APPs are authorized to perform (e.g., Medical Service Act, Nursing Act, Emergency Medical Services Act).
	2-1-2. Establishment of a reimbursement system based on advanced nursing practice.
	2-1-3. Establishment of institutional regulations related to accreditation (e.g., staffing standards for APPs).
2-2. Development of job descriptions based on advanced practice	2-2-1. Development of specialized roles for APPs in clinical practice.
	2-2-2. Clear definition of roles and responsibilities (e.g., scope of practice, prescription authority, etc.).
	2-2-3. Documentation of interdisciplinary agreements regarding roles and responsibilities, including confirmation by the relevant physician and approval by the hospital director.
3. Educational programs for APPs	
3-1. Standardization of core theory and practicum curriculum	3-1-1. Standardization of educational programs for APPs.
	3-1-2. Establishment of an accreditation system for APP education programs.
	3-1-3. Core theoretical courses provided by graduate-level institutions or institutions recognized by the Ministry of Health and Welfare, with practicum conducted at general hospitals or higher-level institutions.
3-2. Mandatory completion of accredited advanced practice nursing education or specialty training	3-2-1. Mandatory completion of role-specific specialty clinical training.
	3-2-2. Completion of training in advanced clinical procedures (e.g., endotracheal intubation, central venous catheter insertion and management), conducted by professional societies or advanced general hospitals.
4. Credentialing and regulation of APPs	
4-1. Establishment of certification system	4-1-1. Development of a standardized credentialing system.
4-2. Establishment of a re-certification system	4-2-1. Regular re-certification based on continuing education in the specialty.
	4-2-2. Multidisciplinary continuing education recognized for re-certification (e.g., courses offered by professional societies and physician CME programs).
5. Support systems for APPs	
5-1. Organizational system for human resource management	5-1-1. Establishment of a dedicated organizational unit for APPs within the nursing department (with cooperation from the clinical department for personnel management).
	5-1-2. Formation of a dedicated APP committee (for adjusting scope of practice, resolving ethical conflicts, etc.).
	5-1-3. Establishment of promotion pathways.
5-2. Compensation for advanced practice roles	5-2-1. Provision of APP-specific allowances.
	5-2-2. Development of a compensation system based on APP career levels.
	5-2-3. Development of a compensation system based on APP performance.

APN, advanced practice nurse; APP, advanced practice provider; CME, continuing medical education.

Figure 1. Expanding the role of advanced practice providers in the nursing workforce. APP, advanced practice provider.

범위에 제한이 있었음에도[14], 함께 일하는 의료진들은 전문간호사를 숙련된 의료서비스 제공자이자 파트너, 분야를 넘나드는 경력자로 평가하였고[18], 환자들도 전문간호사를 탁월성을 갖춘 의료전문가로 전문지식과 임상경험을 갖추고 서비스를 제공한다고 평가한 바 있다[19]. 의정갈등 이후 시범사업을 통해 간호사의 업무가 확대되면서 국내도 상급실무제공자서의 간호인력에 대해 좀 더 탁월한 역량을 갖추어야 한다는 인식이 커졌을 것으로 생각된다. 국제간호협회(International Council of Nurses)에서 전문간호사를 자율성을 가지고 간호의 범위를 넘어 주도적으로 대상자의 질병 치료와 건강 추구를 위해 신체사정, 진단, 검사, 처방 등 다양한 업무를 수행할 수 있는 인력으로, 최소 석사학위 이상의 교육을 통해 전문지식, 복잡한 의사결정기술 및 임상역량을 습득한 간호사로 정의하고 있어 유사함을 확인할 수 있었다[27].

본 연구에서 상급실무제공자로서 간호인력은 종합병원 이상에서 최소 5년 이상의 임상경력을 보유하되 해당 분야에서 3년 이상의 경력을 갖춘 자, 간호사 면허와 함께 전문간호사 자격을 보유하거나 보건복지부에서 인정한 교육과정을 이수한 자, 그리고 업무 개시 전에 필수교육 및 현장실습을 이수한 자 등 3가지 모든 조건을 충족해야 하는 것으로 도출되었다. 국내에서 전문간호사가 되기 위해서는 최소 3년 이상의 해당 분야 임상경력을 가지고 2년 이상의 석사 교육과정을 이수한 후 자격시험을 통과해야 하여 최소 5년 이상의 임상경력을 가지게 되므로[28], 충분한 자격요건을 갖추게 된다. 보건복지부는 현 의정갈등 상황에서 진료 공백에 대응하기 위해, 진료지원업무 수행자격 기준으로 전문간호사 자격 외에도 해당 분야의 보건복지부 인정 교육과정을 이수한 간호사를 포함하는 방안을 제시하였다. 그러나 본 연구의 포커스그룹 인터뷰와 델파이조사에서는 자격증 보유, 교육 이수, 법적 기반이라는 세 가지 요건을 모두 충족해야 상급실무제공자로서의 역할 수행이 가능하다는 점이 전문가들 사이에서 공통적으로 확인되었다. 이러한 측면에서 보면, 현행 전문간호사제도는 이미 이 세 가지 요건을 제도적으로 갖추고 있어, 향후 전담간호사제도의 전문간호사제도와의 일원화가 바람직한 방향일 수 있다. 실제로 본 연구에 참여한 다수의 전문가 패널이 이러한 통합 필요성을 제시하였으며, 국내 선행 연구도 전문간호사제도의 활용과 확대를 대안으로 제시하고 있다[14]. 2차 종합병원에서는 전문간호사 자격 소지자가 없는 경우가 대부분으로 선 업무 후에 일정 기간 동안 전문간호사 자격을 취득할 수 있는 유예기간을 두는 것에 대한 의견이 있었다. 상급실무제공자로서 업무 개시 전에 해당 분야의 필수교육 및 현장실습과정을 이수한 자 항목은 CVR은 .96으로 높게 나타났지만 합의도는 .67로 다소 낮았다. 이는 위의 3가지 조건을 모두 충족하기 위해서는 해당 분야의 임상경력이 있더라도 상급실무제공자로서 업무를 수행하는 데에 업무 개시 전 해당 분야의 필수교육 및 현장실습과정은 필수적인 요건이지만, 의료기관의 상황에 따라 달라 즉시 업무에 투입될 수밖에 없는 임상현장 상황이 반영된 것으로 생각된다.

두 번째 영역인 업무범위는 업무범위 법제화 하위범주에서 3개의 항목 모두에서 합의도와 CVR이 높게 나타났다. 상급실무제공자가 진료지원업무를 수행하는 데 있어서 업무범위 법제화는 필수적이다. 포커스그룹 인터뷰 결과에서도 법적 기준이 미비한 점이 활성화의 가장 큰 걸림돌이라고 지적하였다. 미국, 영국, 캐나다, 호주 등에서는 전문간호사가 의학적 진단을 내리고, 건강 사정, 약물 처방과 일

차진료 환경에서 자율적으로 환자 관리를 수행할 권한이 있다[29]. 법제화와 더불어 안전한 진료지원업무 수행을 위한 전문간호사 표준 업무기술서를 제시하여 다양한 의료기관에서 실무에 적용할 필요가 있다[14]. 따라서 직무기술서를 작성할 때는 구체적으로 기술한 후 함께 업무하는 진료과 의사와 합의하고 의료기관의 문서화된 협의가 이루어져야 한다. 또한 국내에서 전문간호사 행위에 대해 수가로 인정되는 행위는 가정간호 기본방문료, 교육상담료(암환자) 등 일부에 불과하며, 그나마도 전문간호사가 아니어도 수가를 받을 수 있거나 단독으로는 받기 어려운 수가도 있어 개선이 필요하다[30]. 미국의 경우에도 전문간호사가 수행하는 업무에 대해 의사의 직접적인 감독과 참여 여부에 따라 85%–100%까지 보상이 달라져서[31], 추후 이러한 점을 고려하며 수가 개발이 이루어져야 한다.

세 번째 영역인 교육과정 영역에서는 교육과정 표준화와 교육과정 인증제도 마련에 대한 합의도와 CVR이 높게 나타났다. 반면, 대학원 교육과정 또는 보건복지부가 인정하는 기관에서의 공통필수이론 교육과 종합병원 이상의 의료기관에서 실습교육 시행은 합의도가 .67로 다소 낮았다. 전문가 패널은 교육의 질과 전문성을 객관적으로 평가하는 인증제도는 중요하지만, 평가 위주의 획일화된 방법은 창의성 및 유연한 교육과정 운영이 제한될 수 있음을 우려하였다. 또한 종합병원 사이에서도 병원 간 격차가 크고, 현장의 어려움으로 일부 종합병원에서는 실습교육을 수행하기에 제한이 있다고 하였다. 반면, 포커스그룹 인터뷰에서는 임상에서 의사의 역할을 대체하는 상급실무를 제공하는 경우에는 상급종합병원 이상의 의료기관에서 실습이 진행되어야 한다고 의견을 제시하였다. 따라서 보건복지부의 인증을 받아 종합병원 이상의 의료기관에서 공식적으로 실습교육이 이루어져야 한다. 상급실무 전문교육과정 이수 의무화 하위범주를 살펴보면, 기도 내 삽관, 중심정맥관 삽입 · 관리는 '간호사 업무 관련 시범사업'에서 전문간호사가 수행할 수 있는 진료지원행위로 제시되어 있다. 반면, 전문가패널 중 이러한 행위는 의사 인력이 수행하더라도 익숙해질 때까지 상급자의 감독이 필요한 술기이고, 잘못 시행된 경우 환자에게 치명적인 결과를 초래할 수 있다는 우려를 표명하기도 하였다. 그러나 국외에서는 이미 골수천자, 기관 삽관, 기계 환기 등을 포함한 침습적 시술을 포함하여 역할의 확대가 이루어졌고[7,32,33], 전문간호사가 수행한 시술이 의사가 시술한 시술과 동일하다는 결과를 보고하고 있다[32]. 따라서 표준화된 교육과정을 통해 이러한 술기를 지속적으로 배우고 훈련하는 과정이 필요하다. 공통 술기인 경우 상급실무제공자 교육기관에서의 시뮬레이션 교육 등을 포함한 교육과정을 통해 익혀야 하고 해당 분야별 상급 술기의 경우 관련 진료과 학회와 협력하여 교육프로그램을 개발하는 것이 필요할 것으로 생각된다.

네 번째 영역인 상급실무제공자로서 간호인력의 자격관리에서는 자격인증시스템의 구축과 정기적 재인증시스템의 마련에 모두 동의하였다. 미국은 nurse practitioner, PA 모두 면허 유지를 위해서는 지속적인 교육과 정기적인 재인증이 요구된다[34,35]. 상급실무제공자는 간호뿐만 아니라 진료지원업무를 수행하므로 간호분야 보수교육뿐만 아니라 진료과 학회 등에서 시행하는 학술대회 및 연수교육도 보수교육 규정을 마련하여 일부 인정하는 것이 필요하지만, 현재 전문간호사를 위한 보수교육은 거의 없다[36]. 보수교육은 전문간호사의 역할 개발을 촉진하고 상급간호실무역량 향상에 중요한 역할을 한다[37]. 상급실무제공자를 위한 보수교육프로그램 개발이 절실히 필요하며, 다양한 보수교육체계 구축이 수반되어야 한다.

다섯 번째 영역인 지원방안 영역에서 인적 자원관리를 위한 조직체계에서 상급실무제공자를 위한 전담위원회 구성에 전적으로 동의하였다. 이 위원회에는 관리자뿐만 아니라 실제 업무를 수행하는 현장의 의견을 반영하기 위해 상급실무제공자도 반드시 포함되어야 한다. 전문가 패널에서는 승진체계는 필요하지만 관리자 트랙의 승진체계와는 다른 상급실무제공자를 위한 승진체계가 마련되어야 하고 각 의료기관에서의 규정이 필요하다고 제안하였다. 또한 포커스그룹 인터뷰에서도 상급실무제공자는 임상현장에서 전문의와 팀을 이루어 의료의 질을 보장하고 환자안전을 확보하는 데 중요한 위치에 있어 인적자원 관리와 보상체계 개선 등 체계적인 관리가 필요하다고 하였다. 환자 치료의 질을 높이기 위해선 상급실무제공자를 확보하는 것이 중요하므로, 전문직 발전모델(professional advancement model)에서는 이들에 대한 보상을 단순히 환자관리행위 자체에 대한 보상을 넘어, 이들의 역할을 향상시키고 전문성을 개발할 수 있도록 조직적으로 지원하는 보상을 제안하고 있다[38]. 본 연구에서 도출되지는 않았지만 인적 자원 개발을 위한 조직 지원, 다른 의료인과의 협업 촉진을 위한 의료시스템 구축 활용, 근무환경 개선, 의사결정 참여기회 보장에 대한 조직지원체계 구축이 요구된다.

의정갈등 이후 간호의 전문성을 유지하고 환자안전을 확보하기 위해 전문적 기술을 기반으로 상급실무를 수행할 수 있는 상급실무제공자의 역할은 더욱 중요하게 되었다. 상급실무제공자 교육은 대학원 수준의 엄격한 교육과정을 포함하며, 지속적인 교육과 전문성 개발은 역량 유지를 위해 권장되고 있다[39]. 따라서 유예기간을 두어 전문간호사 자격이 없지만 석사 학위를 소지한 기존 전담간호사는 한시적 특례제도를 이용해 자격시험을 치를 수 있는 기회를 줄 수도 있고, 경력이 충분한 전담간호사에게는 한시적으로 전문간호사 자격시험 기회를 주어 전문간호사로 통합을 고려해볼 수 있다[14]. 과도하게 세분화되어 있는 전문간호사 13개 분야의 통합도 필요하다[36]. 전문간호사 교육과정도 실습과목의 표준화와 임상추론역량을 강화하고 공통 핵심 술기를 습득할 수 있는 교육과정의 개선이 필요하다. 이러한 교육을 받고 전문간호사 자격을 취득한 후 의료기관에 배치되면 소속기관에서 요구되는 업무에 맞는 배치 전 교육도 이루어져야 할 것이다.

본 연구의 제한점으로는 첫째, 포커스그룹 인터뷰 대상인 의료진의 상당수가 상급종합병원에 근무하고 있어 연구결과를 일반화하기에 제한점이 있다. 두 번째로, 참여자 중 전담간호사의 비중이 전문간호사보다 낮아 표집 구성의 편중과 해석의 한계가 있다. 그럼에도

국내외 문헌고찰 및 포커스그룹 인터뷰, 전문가 패널을 통한 델파이 조사를 통해 다양한 방식의 연구방법을 통해 아직 국내에 정립되지 않은 상급실무제공자로서의 간호인력 활성화 방안을 정리한 것에 의의가 있다.

결론

본 연구는 상급실무제공자로서 진료지원업무를 수행하는 간호인력의 자격요건과 제도 기반을 정비하기 위한 정책 전략 도출을 목적으로, 포커스그룹 인터뷰와 델파이조사를 통해 전문가 합의과정을 수행하였다. 그 결과, 상급실무제공자 활성화를 위한 핵심 요건으로 자격, 교육, 법적 기반에 대한 실증적 근거를 도출하였다. 포커스그룹 인터뷰에서는 의정사태 이후 다양한 명칭의 간호인력이 진료지원업무를 수행하며, 이에 대한 질적 담보를 위해 제도 정비가 필요하다는 현장 의견이 제시되었다. 델파이조사에서는 자격요건과 교육기준에 대한 전문가 간 합의가 이루어졌다. 이를 바탕으로, 단기적으로는 보건복지부에서 인정하는 교육과정을 이수한 인력을 한시적 대안으로 활용하는 동시에, 장기적으로는 교육과정과 자격시험이 마련된 전문간호사제도를 통해 상급실무제공자를 일원화하여 육성하는 것이 바람직하다.

정책적으로는, 본 연구에서 도출된 자격요건이 향후 간호법 시행령 자격기준 설정의 근거로 활용될 수 있으며, 보건복지부의 지침 및 병원 진료지원 간호인력 운영기준 마련에도 기초 자료가 될 수 있다. 특히 전문간호사제도에 통합 가능한 전담간호사의 제도화 방안은 인력관리 효율성과 역할 정립에 기여할 수 있을 것이다. 실무적으로는, 의료기관 내 상급실무제공자를 위한 전담위원회를 구성하여 자격요건, 역할, 직무기술서를 체계화하고, 재인증체계와 보수교육 기준을 마련하여 제도의 지속 가능성을 확보할 필요가 있다. 마지막으로, 2025년 9월 전공의 복귀 이후, 상급실무제공자는 전공의와 병행하는 새로운 팀 진료체계 내에서 입원환자 관리 역할을 수행할 가능성이 높아질 것으로 보인다. 이에 대응하여 충분한 자격과 제도적 보호가 마련된 간호인력이 현장에 배치되어야 하며, 이는 환자안전과 간호인력 전문성 강화를 위한 필수조건이다.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

Please contact the corresponding author for data availability.

Author Contributions

Conceptualization or/and Methodology: JHK, SJC. Data curation or/and Analysis: JHK, MKJ, SC, ML, SJC. Funding acquisition: JHK, SJC. Investigation: JHK, ML, SJC. Project administration or/and Supervision: SJC. Resources or/and Software: MKJ, SC. Validation: JHK, SJC. Visualization: JHK. Writing: original draft or/and Review & Editing: JHK, MKJ, SC, ML, SJC. Final approval of the manuscript: all authors.

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간호사의 프리젠티즘이 이직의도에 미치는 영향에서 누락된 간호와 직무만족의 이중매개효과: 횡단적 예측적 상관관계 연구

천현선[1], 정석희[2], 김현경[2], 장형은[2]

[1]전북대학교 대학원 간호학과, [2]전북대학교 간호대학 · 간호과학연구소

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Corresponding author:
Seok Hee Jeong
College of Nursing·Research Institute of Nursing Science, Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, Jeonju 54896, Korea
E-mail: awesomeprof@jbnu.ac.kr

Effects of presenteeism on turnover intention in clinical nurses through the serial mediating roles of missed nursing care and job satisfaction: a cross-sectional predictive correlational study

Hyeonseon Cheon[1], Seok Hee Jeong[2], Hyun Kyung Kim[2], Hyoung Eun Chang[2]

[1]Department of Nursing, Graduate School, Jeonbuk National University, Jeonju, Korea
[2]College of Nursing·Research Institute of Nursing Science, Jeonbuk National University, Jeonju, Korea

Purpose: This study aimed to investigate the two-mediator serial mediation effect of missed nursing care and job satisfaction on the relationship between presenteeism and turnover intention in clinical nurses.

Methods: A cross-sectional predictive correlational study was conducted, and the participants were 208 clinical nurses working in advanced general hospitals in South Korea. Data were collected from October 6 to November 7, 2023 using self-reported questionnaires, including general characteristics, presenteeism, missed nursing care, job satisfaction, and turnover intention. Data were analyzed using IBM SPSS/WIN ver. 29.0 and PROCESS macro ver. 4.2.

Results: Missed nursing care and job satisfaction exhibited a double mediating effect on the relationship between presenteeism and clinical nurses' turnover intention. In addition, missed nursing care showed a mediating effect on the relationship between presenteeism and clinical nurses' turnover intention. Job satisfaction had a mediating effect on the relationship between presenteeism and clinical nurses' turnover intention. Presenteeism had a direct effect on missed nursing care, job satisfaction, and turnover intention. Missed nursing care exerted a direct effect on job satisfaction and turnover intention among clinical nurses. Job satisfaction had a direct effect on turnover intention.

Conclusion: To reduce nurses' turnover intention, it is essential to develop and implement programs focused on preventing presenteeism. Additionally, organizational initiatives should prioritize active support for nurses' health management, alleviating the shortage of nursing staff, augmenting job satisfaction, and improving the overall working environment.

Keywords: Job satisfaction; Nurses; Nursing care; Personnel turnover; Presenteeism

서론

1. 연구의 필요성

환자안전은 환자의 생명과 밀접하게 관련되어 있어 의료서비스를 제공하는 모든 단계에서 반드시 준수해야 하는 원칙이다[1]. 간호사는 환자안전에서 핵심적인 역할을 담당하는 의료인력으로서 그 역할이 매우 중요하다[2]. 그러나 의료기술의 발전과 환자의 간호요구도가 증가하면서 간호 업무량은 가중되고 있다[3]. 간호사의 가중된 간호 업무로 인해 환자에게 필수적으로 제공되어야 하는 간호가 전부 혹은 부분적으로 지연될 수 있는데, 이를 누락된 간호(missed nursing care)라 한다[4]. 누락된 간호는 필수적이고 공통적인 간호 업무가 누락되는 것으로 의료오류의 한 형태이다[4]. 지속적으로 환자의 상태를 감시하는 등의 중요한 간호가 누락될 경우 이는 입원 사망률 증가, 낙상, 감염, 욕창 등 환자 위해사건에 영향을 미치므로[5-7], 누락된 간호의 발생을 예방하는 것은 환자안전 측면에서 그 중요성이 더욱 강조되고 있다.

Kalisch 등[6]은 의료 질의 세 가지 측면인 구조, 과정, 결과적 관점[8]에서 누락된 간호모델을 제시하였다. 즉 병원 단위 및 직원 관련 특성들(구조)이 누락된 간호의 발생(과정)에 영향을 주며, 발생한 누락된 간호가 환자 및 간호사들(결과)에게 영향을 미친다고 설명한다. 이 모델은 누락된 간호가 단순히 개인의 실수가 아닌 구조적이고 체계적인 문제에서 발생한다는 점을 강조하고 있다[6]. 따라서 구조적 요인이 적절하게 관리되지 않으면 누락된 간호의 발생이 증가하여, 이는 환자안전과 간호사 직무만족, 이직 등 조직 전반에 부정적인 결과를 초래하므로, 누락된 간호를 줄이기 위한 다양한 구조적 요인을 규명하는 노력이 필요하다.

Kalisch 등[6]의 모델을 기반으로 누락된 간호 관련 국내 및 국외 문헌을 체계적 고찰 및 메타분석 한 선행연구에 따르면[7], 누락된 간호의 선행요인으로 간호사 영역에서는 간호사의 피로, 결근이, 병동 단위 특성 영역에서는 환자 대 간호사 비율, 업무량, 병동의 책무 등이, 그리고 근무환경 특성 영역에서는 간호근무환경, 환자안전분위기, 환자안전문화 등이 보고되었다[7]. 또한 누락된 간호의 결과요인으로 간호사 측면에서는 직무만족, 이직의도, 간호의 질, 소진이, 환자 측면에서는 환자위해사건, 투약오류, 낙상, 사망률, 병원감염, 욕창 등이 보고되어, 누락된 간호가 간호사 및 환자 측면에 부정적인 영향을 미치는 유의미한 효과크기가 확인되었다[7].

특히 Kalisch 등[6]이 제시한 누락된 간호 모델에서 결근은 구조적 요인으로 작용하여 누락된 간호를 증가시키고, 간호사의 직무만족을 저하시키며, 이직의도를 높이는 부정적인 결과를 초래하는 것으로 확인되었다. 누락된 간호의 선행요인 중 하나인 결근은 간호사의 인력 부족을 초래하여 간호사 한 명이 담당해야 할 환자 수를 증가시키고, 이는 간호사들에게 업무량 증가와 시간 압박을 유발하여 간호사들이 일부 간호를 누락하거나 우선순위가 낮은 간호 활동을 생략하게 하는 위험을 증가시키는 것으로 보고되고 있다[6]. 또한 결근으로 인한 인력 부족과 과중된 업무는 남은 간호사에게 스트레스와 피로를 가중시키며 누락된 간호의 발생을 더욱 증가시켜[6,7], 간호의 질 저하 및 간호사의 업무 성과에 심각한 문제로 이어질 수 있다. 간호사는 업무 특성상 대체 인력의 부족, 업무의 책임감, 질병의 중증도 여부, 동료에 대한 부담감 등의 이유로 결근을 쉽게 선택하지 못하는 게 현실이다. 이에, 간호사가 건강상태가 좋지 않은 상황에서도 출근을 하여 업무를 수행하는 경우가 빈번히 발생한다.

프리젠티즘이란 근로자가 건강문제를 가진 상태로 출근하여 업무를 수행할 때 생산성이 저하되는 현상을 의미한다[9]. 일찍이 경영학 등 타 분야에서는 결근을 대체하는 개념으로, 성과를 위해 조직이 관심 가져야 하는 현상으로 프리젠티즘에 주목해 왔다[10,11]. 근로자가 건강문제를 가진 상태에서 출근하여 업무를 지속할 경우, 근로자의 건강이 악화될 뿐만 아니라 생산성 저하가 발생되며, 이는 결과적으로 업무 누락, 업무 오류 등 업무수행에 부정적인 영향을 미친다[12,13]. 이에 인적 자원 관리 및 조직 성과 관리 측면에서 프리젠티즘과 결근율은 유사한 측면에서 다루어지고 있다[10-12,14]. 간호실무현장에서도 프리젠티즘에 대한 관심이 증대되면서 간호사가 건강문제를 가진 상태로 근무할 때 집중력 및 주의력 저하, 업무 중 반응시간 저하 등으로 효율적인 업무 수행이 어려워지고, 이로 인해 누락된 간호가 발생할 위험이 더욱 높다는 연구결과들이 보고되고 있다[13,15,16]. 또한 건강문제로 인한 생산성 저하를 경험한 간호사는 간호 업무 누락과 업무 수행능력 저하로 인해 업무에서 성취감을 느끼지 못하여 직무에 대한 만족도가 낮아지는 것으로 보고되고 있다[17,18]. 직무만족이 낮은 간호사는 직장에서의 긍정적인 경험이 감소되며, 이직의도에도 영향을 미친다[7,17,19]. 특히 프리젠티즘 상태가 지속되면 간호사의 건강상태 악화와 업무 스트레스가 누적되어 결국 이직으로 이어질 가능성이 높아지므로[13,14,20], 간호사의 프리젠티즘 관리는 매우 중요하다. 즉 간호사의 프리젠티즘 예방과 관리는 환자안전, 간호서비스 질, 조직 성과에 영향을 미치므로, 이를 이해하고 관리하는 것은 필수적이다. 그러나 국내 간호학 분야에서는 이들의 관계를 확인해 볼 수 있는 연구는 찾아보기 어려운 실정으로, 이를 실증적으로 탐색해야 할 필요가 있다.

한편, 누락된 간호는 직무만족에 부정적인 영향을 미치는 것으로 보고되고 있다[6,7]. 직무만족은 개인 자신의 직무경험에 대해 느끼는 전반적인 감정적 반응으로, 이는 직무에 대한 긍정적인 정서적 상태를 의미한다[21]. 간호사가 반복적으로 누락된 간호를 경험하게 되면 업무에 대해 만족감을 느끼기 어려워 직무만족이 낮아지고[6], 현재 직장에 대한 불만이 증가하여 이직의도가 높아지는 것으로 나타났다[6,22]. 간호사의 이직률이 높아지면 조직 내 간호 인력이 부족하게 되고 남아 있는 간호사에게 업무 부담을 가중시키며, 이로 인해 누락된 간호의 빈도가 더욱 증가하게 된다[5]. 이러한 상황은 간호사가 더욱 스트레스를 느끼고 직무만족이 저하되는 악순환으로 이어진다. 즉 누락된 간호의 발생은 직무만족을 낮추고 이직의도를 높이므

로, 간호사의 직무만족을 높이고 이직의도를 감소시키기 위해서는 누락된 간호를 최소화할 수 있는 접근이 필수적이다. 따라서 누락된 간호의 발생을 감소시키기 위해서는 누락된 간호와 직무만족, 이직의도 간의 관계를 파악하여 이를 개선하기 위한 포괄적인 전략을 마련하는 것이 필요하다. 이는 환자안전을 강화하고 간호서비스의 질을 향상시키는 데 중요한 역할을 할 뿐만 아니라, 인적 자원의 효율적인 관리에 기여할 수 있을 것으로 기대된다.

이상을 바탕으로 프리젠티즘은 누락된 간호에 영향을 미치는 변수이면서[13,16], 직무만족과는 부적 관련성이 있었으며[17,18], 이직의도에 영향을 주는 변수임을 확인할 수 있었다[13,20]. 또한 누락된 간호는 직무만족과 이직의도에 영향을 미치는 것으로 나타났다[6,22]. 즉 프리젠티즘은 간호사의 건강문제와 관련된 생산성 저하로 인해 업무 효율성과 정확성을 저하시켜 누락된 간호의 발생 가능성을 높이며[13,16], 이렇게 발생한 누락된 간호는 간호사의 직무 성취감과 만족도를 저하시켜 이직의도를 증가시키는 것으로 예측할 수 있다[6,22]. 특히 간호사들이 경험하는 이러한 현상은 다양한 요인들이 상호작용하는 복합적인 구조를 지닌 간호실무환경 내에서 발생하므로 이들 변수들 간의 관계는 다양한 측면에서 통합적으로 이해되어야 할 필요가 있다. 그러나 기존 연구들은 이들 변수들의 관계 중 일부 변수들 간의 관계 또는 직접효과만을 제시함으로써 프리젠티즘, 누락된 간호, 직무만족, 이직의도 간의 직간접 효과 및 주요 경로를 통합적으로 제시하지 못한 한계가 있다.

이에 본 연구에서는 프리젠티즘이 이직의도에 미치는 영향에서 누락된 간호와 직무만족이 이중매개하는 경로를 실증적으로 검증하고자 한다. 이러한 접근은 프리젠티즘이 간호 업무 누락을 초래하여 직무만족을 저하시키고 궁극적으로 이직의도로 이어지는 연쇄적 경로를 규명함으로써, 간호조직의 인적 자원 관리와 이직 예방을 위한 실질적이고 적용 가능한 전략수립에 중요한 근거를 제공할 것이다.

2. 연구의 목적

본 연구의 목적은 국내 간호사의 프리젠티즘, 누락된 간호, 직무만족 및 이직의도 정도를 파악하고, 간호사의 프리젠티즘이 이직의도에 미치는 영향에서 누락된 간호, 직무만족의 이중매개효과를 파악하기 위함이다. 구체적인 목적은 다음과 같다. 첫째, 대상자의 프리젠티즘, 누락된 간호, 직무만족 및 이직의도의 정도를 확인한다. 둘째, 대상자의 일반적 특성에 따른 이직의도의 차이를 확인한다. 셋째, 대상자의 프리젠티즘, 누락된 간호, 직무만족 및 이직의도 간의 상관관계를 확인한다. 넷째, 대상자의 프리젠티즘이 이직의도에 미치는 영향에서 누락된 간호, 직무만족의 이중매개효과를 확인한다.

방법

1. 연구설계

본 연구는 간호사의 프리젠티즘과 누락된 간호, 직무만족, 이직의도 정도를 알아보고, 간호사의 프리젠티즘이 누락된 간호와 직무만족의 이중매개를 통해 이직의도에 미치는 영향을 알아보고자 시도된 횡단적 예측적 상관관계 연구이다.

2. 연구대상

본 연구의 표적모집단은 국내 상급종합병원에서 재직 중인 간호사이며, 근접모집단은 국내의 상급종합병원에서 근무하고 온라인조사 접근이 가능한 간호사이다. 구체적인 대상자 선정기준은 현재 국내 상급종합병원에서 1년 이상 재직 중이며, 입원환자에게 직접간호를 제공하는 간호사(입원병동, 중환자실 등)이다. 제외기준은 입원병동이 아닌 외래나 행정부서 등에 근무하는 간호사 또는 일반간호사가 아닌 수간호사 이상의 관리자는 대상에서 제외하였다. 간호사가 독립적으로 자신의 역할에 적응하여 직무를 수행하는 기간이 최소 8–12개월 정도가 요구된다는 연구를 근거로[23], 본 연구에서는 1년 이상의 경력을 가진 간호사를 대상자 선정기준으로 정하였다. 대상자 수 산출을 위하여 G*Power program ver. 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf)을 이용하였다[24]. 회귀분석을 위해 유의수준(α) .05, 검정력(1–β) .90, 효과크기(effect size)는 중간 효과크기 .15를 기준으로 하여 독립변수 19개를 고려하여 최소 필요한 표본크기는 187명으로 산출되었다. 본 연구에서 대상자 수 산출 시 중간 효과크기를 사용한 근거는 선행연구들에서의 연구결과 값을 바탕으로 프리젠티즘과 이직의도의 상관관계 효과크기 값을 산출한 결과, ESr=.31의 중간 효과크기로 나타났기 때문이다[20,25]. 이에, 본 연구에서는 최종적으로 무응답률 약 17% 정도를 고려하여 총 224명의 간호사를 연구대상으로 선정하였다.

3. 연구도구

본 연구의 도구는 프리젠티즘, 누락된 간호, 직무만족, 이직의도, 대상자의 일반적 특성으로 구성된 조사지이며 구조화된 설문지를 사용하였다. 본 연구도구가 측정하는 시점은 프리젠티즘의 경우 지난 한 달 간의 경험을 바탕으로 하며, 그 외 도구들은 현재 시점에서의 일반적인 인식이나 태도 수준을 측정하였다. 모든 도구는 선행연구에서 타당도와 신뢰도가 검증된 도구로, 원저자 및 번역자에게 도구 사용의 승인을 받고 사용하였다.

1) 프리젠티즘

프리젠티즘은 근로자가 건강문제를 가진 상태로 출근하여 업무를

수행할 때 생산성이 저하되는 현상을 의미한다[9]. 본 연구에서는 Turpin 등[26]이 개발한 Stanford Presenteeism Scale (SPS-13)을 Lee [27]가 번안하고 수정 · 보완한 도구를 사용하였다. SPS-13 은 출근했지만 지난 4주간 발생한 건강문제로 인한 생산성 저하를 측정하기 위해 개발된 도구이며[26], 프리젠티즘의 핵심 특성인 생산성 저하를 'Work Impairment Scale'을 통해 수치화하여 평가하도록 설계되었다. 원 도구는 health condition 11문항, work impairment 10문항, work output 1문항의 총 3개 파트로 구성되어 있다. 구체적으로 health condition 파트는 응답자가 경험한 건강문제를 파악하는 선별 질문이며, work impairment 파트는 이러한 건강문제가 생산성 저하에 미치는 영향 정도를 측정하고, work output 파트는 전반적인 업무 성과에 대한 주관적 평가를 측정하는 상호보완적 구조로 구성되어 있다.

본 연구에서는 원 도구를 Lee [27]가 한국 근로자들에게 맞게 수정 · 보완한 '건강문제, 직무손실, 지각된 생산성'을 사용하였다. 한국형 도구는 각각 지난 1개월간의 건강문제 19문항, 직무손실 10문항, 지각된 생산성 1문항으로 구성되었다. 구체적으로 파트 1의 건강문제는 제시된 19개 질병 중 지난 1개월간 경험한 건강문제와 현재 치료 중인 건강문제, 그리고 이들 중 가장 신경 쓰이는 건강문제 1개를 선택하도록 하는 체크리스트로 구성되어 있다. 파트 2는 직무손실로, 지난 1개월간 경험한 가장 신경 쓰이는 건강문제가 직장 내 일상적인 업무상황에 영향을 준 정도를 측정하는 총 10문항으로 구성되어 있다. 직무손실은 5점 Likert 척도로 '언제나 그렇다' 1점에서 '전혀 그렇지 않다' 5점으로 측정되며, 부정문항은 역환산하여 사용하였다. 측정된 값은 도구 개발자가 제시한 방법인 '직무손실=(점수의 합–10)/40×100'의 환산법을 사용하여 100점 만점으로 환산되어 점수가 높을수록 직무손실이 높음을 의미한다[26]. 선행연구들에서 프리젠티즘 측정은 직무손실 10개 문항의 값을 사용하고 있어[27-29], 본 연구에서도 직무손실 측정값을 프리젠티즘 대표 값으로 사용하였다. 직무손실 도구의 개발 당시 내적 일관성 신뢰도 Cronbach's α는 .83이었고, Lee [27]의 연구에서 Cronbach's α는 .80, 본 연구에서의 Cronbach's α는 .82였다. 도구의 파트 3은 지각된 생산성 1문항의 단일 문항으로 구성되어 있다. 지각된 생산성은 '가장 신경 쓰이는 건강문제'가 있을 때, 업무 수행능력을 얼마나 발휘했는지를 측정하는 보완적 지표이다. 본 연구에서는 0점(전혀 발휘하지 못함)에서 100점(최대로 발휘함)까지의 범위 내에서 점수를 기재하여 자가보고하는 방식으로 측정한다. 해당 문항은 프리젠티즘의 부정적인 영향에 대한 주관적 인식을 탐색하기 위한 보조지표로 활용되었으며, 본 연구에서는 직무손실 해석 시 참고자료로 활용하였다.

2) 누락된 간호

누락된 간호는 간호사가 업무 중 환자에게 필요한 간호를 전부 혹은 부분적으로 생략하거나 지연시키는 행위를 의미한다[4]. 누락된 간호 도구는 Kalisch와 Williams [4]가 개발한 'MISSCARE Survey' 도구를 Cho 등[5]이 한국어로 번역한 도구를 사용하였다. 누락된 간호 도구는 누락된 간호의 유형과 빈도(Part A)와 원인(Part B)으로 구성되어 있다. 본 연구에서 Part A는 설문 응답 시 현재 시점에서 간호사가 일하는 동안 간호행위들을 얼마나 자주 빠뜨리게 되는지를 측정하는 문항이다. 누락된 간호의 유형과 빈도는 총 24문항으로, 각 문항은 '거의 빠뜨리지 않는다' 1점, '가끔 빠뜨린다' 2점, '자주 빠뜨린다' 3점, '항상 빠뜨린다' 4점의 Likert 척도로 측정되며, 해당 없는 경우에는 '해당 없음'에 체크하도록 구성되었다. 측정결과, 점수가 높을수록 누락된 간호의 정도가 높음을 의미한다. '누락된 간호의 유형과 빈도' 파트의 도구 개발 당시 내적 일관성 신뢰도 Cronbach's α는 .87, Cho 등[5]의 연구에서 Cronbach's α는 .89, 본 연구에서 Cronbach's α는 .90이었다. Part B인 누락된 간호의 원인은 의사소통 9문항, 물적 자원 3문항, 인적 자원 5문항의 3개 하위영역 총 17문항으로 구성되어 있다. 각 문항은 Likert 척도로 '이유가 아님' 1점에서 '중대한 이유' 4점으로 점수가 높을수록 누락된 간호와 관련이 높은 요인임을 의미한다. 본 '누락된 간호의 원인' 파트의 도구 개발 당시 내적 일관성 신뢰도 Cronbach's α는 .86, Cho 등[5]의 연구에서 Cronbach's α는 .90, 본 연구에서의 Cronbach's α는 .92, 하위영역별 Cronbach's α는 의사소통 .89, 물적 자원 .86, 인적 자원 .76이었다.

3) 직무만족

직무만족은 Taylor와 Bowers [21]가 개발한 General Satisfaction Scale을 Lee [30]가 번역한 도구를 사용하였다. 직무만족 도구는 6개의 기본요소인 급여, 상사, 조직, 직무 자체, 동료, 발전에 대한 만족을 포함한 총 7문항으로 설문 응답 시 현재 시점에서 간호사가 평소 가지고 있던 생각과 가까운 곳에 표시하도록 구성되어 있다. 각 문항은 Likert 5점 척도로, '매우 불만족' 1점에서 '매우 만족' 5점으로 점수가 높을수록 직무만족이 높음을 의미한다. 도구 개발 당시 내적 일관성 신뢰도 Cronbach's α는 .87, Lee [30]의 연구에서 Cronbach's α는 .81, 본 연구에서의 Cronbach's α는 .88이었다.

4) 이직의도

이직의도는 Mowday 등[31]과 Mobley 등[32]의 문헌을 토대로 Bozeman과 Perrewé [33]가 정리한 도구 'turnover cognitions items'를 Kim 등[34]이 한국어로 번역한 도구를 사용하였다. 이직의도 도구는 총 5문항으로 설문 응답 시 현재 시점에서 간호사의 느낌이나 생각과 가장 일치하는 곳에 표시하도록 구성되어 있다. 각 문항은 5점 Likert 척도이며 '전혀 그렇지 않다' 1점에서 '매우 그렇다' 5점까지 구성되어 있다. 긍정적인 진술문은 역환산하여 사용하였으며, 점수가 높을수록 이직의도가 높음을 의미한다. 도구 개발 당시 내적 일관성 신뢰도 Cronbach's α는 .92, Kim 등[34]의 연구에서 Cronbach's α는 .83, 본 연구에서의 Cronbach's α는 .86이었다.

4. 자료수집

본 연구의 자료수집은 온라인 자가 보고식 설문지를 사용하여 실시하였으며, 자료수집 기간은 2023년 10월 6일부터 11월 7일까지였다. 연구대상자 모집을 위해 병원코드 인증절차가 필요한 간호사 전용 온라인 커뮤니티와 연구자가 접근 가능한 대상자들에게 연구참여 모집안내문을 홍보하였다. 또한 연구참여자가 다른 대상자에게 본 연구를 소개하는 방식의 눈덩이 표집법을 함께 활용하여 자료수집을 진행하였다. 모집안내문에는 본 연구의 목적과 연구대상자의 선정기준을 구체적으로 명시하였으며, 이에 자발적으로 참여에 동의한 간호사를 대상으로 설문을 진행하였다. 참여를 원하는 대상자는 QR 코드(quick-response code)와 온라인 설문 링크를 통해 온라인 설문에 응답이 가능하도록 하였다. 먼저 연구에 대한 안내를 제공하고, 연구참여자 선정기준에 모두 해당하는 경우에만 연구참여 동의서를 확인할 수 있도록 한 후, 연구 동의서에 동의한 경우에 다음 설문단계로 진행할 수 있도록 하였다. 간호관리료 등급을 묻는 문항에서 원활한 응답을 돕기 위해 건강보험심사평가원 홈페이지(https://www.hira.or.kr/)를 확인하여 국내 전체 상급종합병원의 간호관리료 등급을 1개의 표로 만들어 제시하였다. 설문 응답에 대한 충실성을 높이고 회수율을 증가시키기 위해 온라인 설문 참여자에게 감사의 표시로 소정의 선물을 제공하였으며, 이를 통해 총 224부의 설문지가 회수되었다. 이 중 응답이 불충분한 자료 16부를 제외하고, 총 208부가 최종 자료분석에 사용되었다.

5. 윤리적 고려

본 연구는 기관생명윤리심의위원회(Institutional Review Board [IRB])의 승인을 받은 후 연구를 진행하였다(IRB no., JBNU-2023-08-009). 본 연구자는 자료수집 시 작성된 설문지를 기호화하여 처리하고 응답내용이나 개인정보는 비밀이 보장되며, 연구의 목적 외에는 사용되지 않을 것과 연구자만이 접근할 수 있는 보안파일에 별도로 3년간 보관 후에는 폐기될 것임을 명시하였다. 그리고 연구참여를 중단하거나 거부하더라도 불이익이 없으며 언제든지 참여를 철회할 수 있음을 설명문에 안내하였다. 또한 연구대상자의 윤리적 측면을 고려하기 위해 연구의 목적과 내용이 기재된 연구 안내문을 온라인 설문지의 첫 화면에 배치하여 읽도록 하며 연구자의 이름과 연락처를 기재하였다. 이를 읽은 후 자발적으로 연구참여에 동의한 경우 설문 진행이 가능하도록 화면을 구성하였으며, 연구대상자가 해당 화면을 저장 · 보관하도록 안내하여 서면 동의로 대체하였다.

6. 자료 분석방법

수집된 자료는 IBM SPSS/WIN ver. 29.0 프로그램(IBM Corp.)과 PROCESS macro ver. 4.2 프로그램(https://processmacro.org/index.html)[35]을 이용하여 통계분석을 시행하였다. 대상자의 일반적 특성 및 변수들의 빈도, 백분율, 총합, 평균 및 표준편차 등 기술통계로 산출하였고, 정규성 분포는 왜도, 첨도를 이용해 확인하였다. 일반적 특성에 따른 변수들의 차이는 등분산인 경우 independent t-test와 one-way analysis of variance를 이용하여 분석하였고, 사후 검정은 Scheffé test를 실시하였다. 이분산인 경우 Welch test로 분석하고 사후검정은 Games-Howell test를 실시하였다. 변수 간 상관관계는 Pearson's correlation coefficients를 이용하여 산출하였다. 측정도구의 내적 일관성 신뢰도는 Cronbach's α coefficients를 산출하였으며, 이때 설문문항의 응답범주에 '해당 없음'(not applicable) 항목이 포함된 누락된 간호 측정도구의 경우에는 해당 없음을 결측값(missing value)으로 처리한 후, 신뢰도를 산출하였다. 프리젠티즘이 이직의도에 미치는 영향에서 누락된 간호, 직무만족의 이중매개효과를 검증하기 위해 Hayes [35]가 개발한 SPSS PROCESS macro ver. 4.2의 model 6을 사용하였으며, 매개변수 간접효과의 통계적 유의성 검정은 부트스트래핑(bootstrapping) 방법을 활용하여 검증하였으며, 부트스트랩의 re-sampling 횟수는 50,000회로 설정하고, bias-corrected 95% 신뢰구간(confidence interval [CI])을 추정하여 검정하였다.

결과

1. 대상자의 일반적 특성에 따른 변수들의 차이

연구대상자 208명의 평균 연령은 31.2±5.48세였으며, 30–39세가 46.2%로 가장 많았다. 여성은 92.3%였고, 미혼이 63.9%로 가장 많았다. 종교는 무교가 70.7%였고, 학력은 간호학사인 경우가 78.4%로 가장 많았다. 총 간호사 평균 경력은 7.17±4.80년이었고, 현 병원 평균 근무기간은 6.28±4.59년이었으며, 현 부서 평균 근무기간은 3.94±3.01년으로 나타났다. 대상자 대부분은 일반간호사(84.6%)였으며, 교대근무는 94.7%로 가장 많았다. 근무부서는 중환자실이 33.2%로 가장 높은 비율을 보였고, 한 달 야간 근무 평균 일수는 6.00±2.51일이었다. 고용형태는 정규직이 99.0%이었고, 연 수입은 5,000만 원 이상 7,000만 원 미만이 56.3%로 가장 많았다. 간호관리료 등급은 1등급이 76.9%였고, 상급종합병원 소재 지역은 '도' 지역이 47.1%로 가장 많은 분포를 보였다. 일반적 특성에 따른 이직의도의 차이 검증결과, 결혼상태(t=2.32, p=.022), 최종학력(F=3.29, p=.022), 총 간호사 경력(F=3.32, p=.038), 한 달 야간 근무일수(F=3.06, p=.029)에 따라 통계적으로 유의한 차이가 있었다. 즉 미혼이 기혼보다 이직의도가 유의하게 높았고, 사후검정 결과, 전문학사가 대학원 석사졸업 이상보다, 총 간호사 경력이 1년 이상 5년 미만인 경우가 10년 이상인 경우보다 이직의도의 정도가 유의하게 높았다. 사후 검정에서 한 달 야간 근무일수는 유의한 차이가 없었다(Table 1).

Table 1. Differences in turnover intention according to nurses' general characteristics (N=208)

Characteristic	n (%) or M±SD	Turnover intention			Post-hoc[a]
		M±SD	t or F	*p*	
Age (yr)	31.2±5.48		2.02[b]	.140	
24–29	93 (44.7)	2.93±0.96			
30–39	96 (46.2)	2.92±0.95			
≥40	19 (9.1)	2.68±0.42			
Gender			−1.09	.285	
Men	16 (7.7)	3.05±0.52			
Women	192 (92.3)	2.89±0.94			
Marital status			2.32	.022	
Single	133 (63.9)	3.00±0.97			
Married	75 (36.1)	2.72±0.79			
Religion			3.58	.721	
No	147 (70.7)	2.92±0.94			
Yes	61 (29.3)	2.87±0.85			
Education level			3.29	.022	
Associate's degree[1]	7 (3.4)	3.34±1.25			1>4
College[2]	163 (78.4)	2.96±0.90			
University[3]	20 (9.6)	2.82±0.85			
≥Master's degree[4]	18 (8.6)	2.32±0.79			
Total clinical career (yr)	7.17±4.80		3.32	.038	
1–<5[1]	73 (35.1)	3.04±0.90			1>3
5–<10[2]	92 (44.2)	2.94±0.95			
≥10[3]	43 (20.7)	2.60±0.80			
Clinical career at current hospital (yr)	6.28±4.59		−2.09	.103	
<3	56 (26.9)	3.05±0.85			
3–<5	36 (17.3)	3.01±1.00			
5–<10	81 (38.9)	2.89±0.94			
≥10	35 (16.9)	2.58±0.81			
Clinical career at the current work (yr)	3.94±3.01		0.16	.926	
<1	27 (13.0)	2.97±0.77			
1–<3	69 (33.2)	2.84±0.93			
3–<5	44 (21.1)	2.92±0.86			
≥5	68 (32.7)	2.92±1.01			
Position			1.56	.120	
Staff nurse	176 (84.6)	2.94±0.91			
Charge nurse	32 (15.4)	2.67±0.95			
Shift pattern			−1.46	.146	
Non-shift	11 (5.3)	2.51±0.63			
Shift	197 (94.7)	2.92±0.93			
Work department			0.75	.562	
Medical ward	60 (28.8)	2.98±0.91			
Surgical ward	47 (22.6)	2.84±0.80			
Comprehensive nursing care ward	25 (12.0)	2.64±0.99			
Intensive care unit	69 (33.2)	2.96±0.95			
Others	7 (3.4)	3.00±1.18			
Night shift (day/mo)	6.00±2.51		3.06	.029	
0	9 (4.3)	2.51±0.78			
1–4	29 (13.9)	2.59±0.71			
5–6	111 (53.4)	2.89±0.92			
≥7	59 (28.4)	3.14±0.97			
Employment type			−0.62	.538	
Full time	206 (99.0)	2.90±0.92			
Contract	2 (1.0)	3.30±0.14			
Income (10,000 won)	5,492.13±1,254.23		1.48	.231	
2,400–<5,000	59 (28.4)	3.04±0.83			

(Continued on the next page)

Table 1. Continued

Characteristic	n (%) or M±SD	Turnover intention			Post-hoc[a]
		M±SD	t or F	*p*	
5,000–<7,000	117 (56.3)	2.89±0.95			
≥7,000	32 (15.3)	2.70±0.94			
Nursing management level			0.19	.852	
1st	160 (76.9)	2.91±0.92			
2nd	48 (23.1)	2.88±0.91			
Hospital location			0.19	.823	
Seoul	59 (28.4)	2.86±0.95			
Metropolitan city	51 (24.5)	2.97±0.91			
City	98 (47.1)	2.89±0.91			

M, mean; SD, standard deviation.
[a]By Scheffé test. [b]By Welch test.

2. 대상자의 프리젠티즘, 누락된 간호, 직무만족, 이직의도의 정도

프리젠티즘의 하위영역들 중, 지난 1개월간 경험하고 있는 건강문제 수의 평균은 3.63±2.67이었으며, 직무손실은 100점 만점에 평균 39.63±13.97점, 지각된 생산성은 100점 만점에 평균 72.90±17.95이었다. 누락된 간호의 유형에 따른 빈도의 평균은 '해당 없음'에 체크한 항목은 제외하고 분석하였으며, 그 결과 4점 만점에 평균 1.31±0.34이었으며, 환자와(또는) 가족에 대한 정서적 지지(1.91±0.83)에서 누락된 간호가 가장 많았고, 스스로 먹을 수 있는 환자를 위해 식사 챙기기(1.02±0.76)에서 누락된 간호가 가장 적었다. 누락된 간호의 원인은 4점 만점에 평균 2.62±0.62점으로 나타났으며, 하위요인의 구체적 평균 점수는 인적 자원 3.19±0.62, 의사소통 2.42±0.70, 물적 자원 2.26±0.89점 순으로 나타났다. 직무만족의 평균은 5점 만점에 2.84±0.81점, 이직의도 평균은 5점 만점에 2.90±0.92점이었다(Table 2).

3. 대상자의 프리젠티즘, 누락된 간호, 직무만족, 이직의도 간의 상관관계

대상자의 프리젠티즘은 누락된 간호(r=.41, *p*<.001), 이직의도(r=.41, *p*<.001)와 통계적으로 유의한 양의 상관관계가 나타났으며, 직무만족(r=–.46, *p*<.001)과는 통계적으로 유의한 음의 상관관계가 나타났다. 누락된 간호는 직무만족(r=–.33, *p*<.001)과 통계적으로 유의한 음의 상관관계를 보였고, 이직의도(r=.33, *p*<.001)와는 통계적으로 유의한 양의 상관관계가 나타났다. 직무만족은 이직의도(r=–.42, *p*<.001)와 통계적으로 유의한 음의 상관관계가 나타났다(Table 3).

4. 대상자의 프리젠티즘이 이직의도에 미치는 영향에서 누락된 간호와 직무만족의 매개효과

본 연구는 매개효과를 검정하기 전, 다중회귀분석의 가정인 종속변수의 자기상관과 독립변수 간 다중공선성을 검증하였다. 종속변수의 자기상관은 Durbin-Watson 지수를 산출한 결과, 2.07 (du=1.86<d <4-du=2.13)로 2에 가까우며 du(상한값)와 4-du(하한값) 사이에 존재하여, 종속변수가 자기상관 없이 독립적이었으므로 본 자료가 회귀분석을 실시하기에 적절한 자료임이 확인되었다. 독립변수 간 다중공선성은 분산팽창인자(variance inflation factor [VIF])와 공차(tolerance)로 확인한 결과, VIF는 1.16–2.61로 모두 10보다 작았으며, 공차는 .38–.86로 모두 0.1보다 크게 나타나 다중공선성은 없는 것으로 나타나 본 자료가 회귀분석을 실시하기에 적절한 자료임이 확인되었다[36]. 프리젠티즘과 이직의도의 관계에서 누락된 간호와 직무만족의 매개효과를 검정하기 위해 일반적 특성 중 종속변수인 이직의도에 유의한 차이를 보인 총 간호사 경력, 한 달 야간 근무일수, 결혼상태, 최종학력을 외생변수로 통제 후 검정하였다. 1단계로 독립변수인 프리젠티즘이 매개변수인 누락된 간호에 유의한 영향을 주는 것(X→M1, B=0.23, *p*<.001)으로 나타났으며, 프리젠티즘이 높아질수록 누락된 간호가 높아지는 것으로 나타났다. 2단계에서는 프리젠티즘과 누락된 간호가 직무만족에 미치는 영향을 분석한 결과, 직무만족에 대한 프리젠티즘의 직접효과는 유의한 것(X→M2, B=–0.57, *p*<.001)으로 나타났으며, 누락된 간호도 직무만족에 유의한 영향을 주는 것(M1→M2, B=–0.37, *p*=.025)으로 나타났다. 3단계에서는 프리젠티즘, 누락된 간호, 직무만족이 이직의도에 미치는 영향을 분석한 결과, 이직의도에 대한 프리젠티즘의 직접효과는 유의한 것(X→Y, B=0.32, *p*=.007)으로 나타났고, 누락된 간호(M1→Y, B=0.36, *p*=.047), 직무만족(M2→Y, B=–0.30, *p*=<.001)이 이직의도에 대한 직접효과는 유의한 것으로 나타났다(Table 4).

간호사의 프리젠티즘이 이직의도에 미치는 영향에서 누락된 간호와 직무만족의 간접효과의 통계적 유의성을 검증하기 위해 부트스트래핑(bootstrapping) 표본 50,000개를 추출하여 95% CI에서 분석하였다. Indirect 1은 프리젠티즘과 이직의도의 관계에서 누락된 간호의 간접효과는 통계적으로 유의한 것으로 나타났다(B=0.08; 95% CI, 0.01–0.17). Indirect 2는 프리젠티즘과 이직의도와의 관계에서 직무만족의 간접효과는 통계적으로 유의한 것으로 나타났다

Table 2. Levels of nurses' presenteeism, missed nursing care, job satisfaction, and turnover intention (N=208)

Variable	M±SD	Min	Max	Range
Presenteeism				
Health problem	3.63±2.67	0.00	13.00	0–19
Work impairment	39.63±13.97	0.00	87.50	0–100
Perceived productivity	72.90±17.95	4.00	100	0–100
Missed nursing care				
Part A (missed nursing care)	1.31±0.34	0.33	2.42	0–4
Ambulation 3 times per day or as ordered	1.23±1.03	0.00	4.00	0–4
Turning patient every 2 hours	1.50±0.87	0.00	4.00	0–4
Feeding patient when the food is still warm	1.06±0.73	0.00	3.00	0–4
Setting up meals for patients who feed themselves	1.02±0.76	0.00	4.00	0–4
Medications administered within 30 minutes of the scheduled time	1.34±0.63	0.00	3.00	0–4
Vital signs assessed as ordered	1.23±0.53	0.00	4.00	0–4
Monitoring intake/output	1.17±0.49	0.00	4.00	0–4
Full documentation of all necessary data	1.52±0.59	0.00	4.00	0–4
Patient teaching about procedures, tests, and other diagnostic studies	1.33±0.65	0.00	3.00	0–4
Emotional support to patient and/or family	1.91±0.83	0.00	4.00	0–4
Patient bathing/skin care	1.38±0.90	0.00	4.00	0–4
Mouth care	1.38±0.98	0.00	4.00	0–4
Hand washing	1.41±0.67	0.00	4.00	0–4
Patient discharge planning and teaching	1.11±0.45	0.00	4.00	0–4
Bedside glucose monitoring as ordered	1.11±0.42	0.00	4.00	0–4
Patient assessments performed each shift	1.16±0.45	0.00	3.00	0–4
Focused reassessments according to patient condition	1.30±0.59	0.00	4.00	0–4
IV/central line site care and assessments according to hospital policy	1.24±0.50	0.00	3.00	0–4
Response to call light is initiated within 5 minutes	1.07±0.64	0.00	4.00	0–4
PRN medication requests acted on within 15 minutes	1.28±0.61	0.00	4.00	0–4
Assess effectiveness of medications	1.44±0.65	0.00	4.00	0–4
Attend interdisciplinary care conference whenever held	1.73±1.23	0.00	4.00	0–4
Assist with toileting needs within 5 minutes of request	1.34±0.83	0.00	4.00	0–4
Skin/wound care	1.26±0.60	0.00	3.00	0–4
Part B (reason for missed nursing care)	2.62±0.62	1.06	4.00	1–4
Job satisfaction	2.84±0.81	1.00	5.00	1–5
Turnover intention	2.90±0.92	1.00	5.00	1–5

IV, intravenous; M, mean; Max, maximum; Min, minimum; PRN, as needed; SD, standard deviation.

Table 3. Correlation among nurses' presenteeism, missed nursing care, job satisfaction, and turnover intention (N=208)

Variable	Presenteeism	Missed nursing care	Job satisfaction
	r (*p*)	r (*p*)	r (*p*)
Missed nursing care	.41 (<.001)		
Job satisfaction	−.46 (<.001)	−.33 (<.001)	
Turnover intention	.41 (<.001)	.33 (<.001)	−.42 (<.001)

(B=0.17; 95% CI, 0.07–0.28). Indirect 3은 프리젠티즘과 이직의도의 관계에서 누락된 간호와 직무만족의 이중매개효과는 통계적으로 유의한 것으로 나타났다(B=0.03; 95% CI, 0.00–0.06) (Table 4, Figure 1).

고찰

본 연구는 간호사의 프리젠티즘과 이직의도의 관계에서 누락된 간호와 직무만족의 매개효과를 검증함으로써 간호사의 이직의도 감소에 기여할 수 있는 기초적인 자료를 제공하기 위해 시도되었다. 이에 본 연구의 주요 결과를 바탕으로 논의하고자 한다.

본 연구에 참여한 대상자의 평균 건강문제 수는 3.63개로 나타났으며, 이는 동일한 측정도구를 사용한 국내 간호사 대상의 연구에서 평균 건강문제 수인 3.14개[37], 3.62개[28]와 유사한 결과를 보였다. 이는 간호사들이 평균적으로 3개 이상의 건강문제를 가진 상태에서 근무하고 있음을 나타낸다. 이러한 건강문제를 가진 상태에서의 업

Table 4. Path coefficients and serial mediating effects (N=208)

Variable	B	SE	β	t	*p*	95% CI	F (p)	R^2
Direct effect								
Step 1: P → MNC	0.23	.04	.39	5.89	<.001	0.16 to 0.31	6.64 (<.001)	.19
Step 2: P → JS	−0.57	.10	−.39	−5.71	<.001	−0.76 to −0.37	8.30 (<.001)	.25
Step 2: MNC → JS	−0.37	.16	−.15	−2.25	.025	−0.69 to −0.05		
Step 3: P → TI	0.32	.12	.20	2.73	.007	0.09 to 0.55	9.17 (<.001)	.29
Step 3: MNC → TI	0.36	.18	.13	2.00	.047	0.00 to 0.72		
Step 3: JS → TI	−0.30	.08	−.27	-3.87	<.001	−0.45 to −0.15		
Indirect effect								
Total indirect effect	0.28	0.06[a)]				0.16 to 0.41		
Indirect effect 1: P → MNC → TI	0.08	0.04[a)]				0.01 to 0.17		
Indirect effect 2: P → JS → TI	0.17	0.05[a)]				0.07 to 0.28		
Indirect effect 3: P → MNC → JS → TI	0.03	0.01[a)]				0.00 to 0.06		
Total effect								
P → TI	0.60	.10	.37	5.71	<.001	0.39 to 0.81	7.88 (<.001)	.21

B, unstandardized estimate; β, standardized estimate; CI, confidence interval; JS, job satisfaction; MNC, missed nursing care; P, presenteeism; SE, standard error; TI, turnover intention.
[a)]Boot SE.

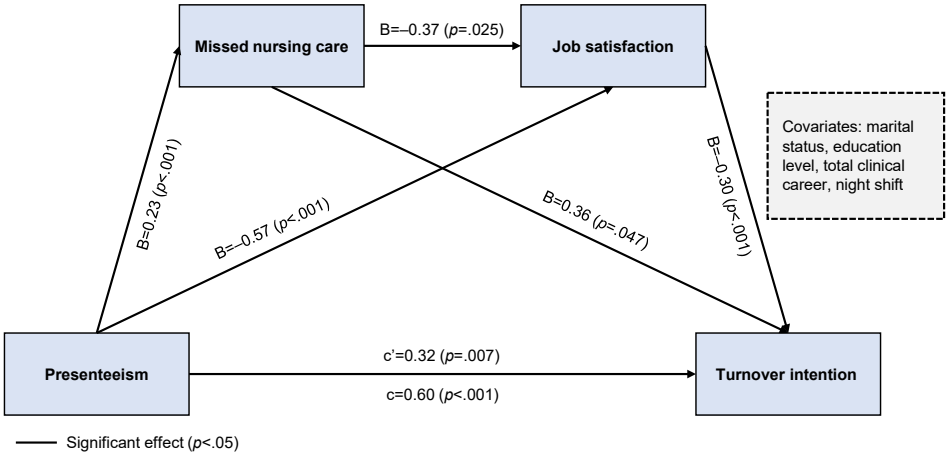

Figure 1. Mediating effects of missed nursing care and job satisfaction in the association between presenteeism and turnover intention of clinical nurses. c, total effect; c', direct effect.

무 수행은 생산성 저하로 이어져 프리젠티즘 발생 가능성을 높인다. 본 연구에서 직무손실의 경우 100점 만점에 평균 39.63점으로 나타났으며, 동일한 측정도구로 실시된 국내 종합병원 간호사 대상 연구는 평균 37.5점[37], 요양병원 간호사 대상 연구의 평균 38.0점[29]보다 약간 높은 수준으로 확인되었다. 또한 간호사의 지각된 생산성은 평균 72.90점으로 나타나, 건강문제로 인해 간호사들이 업무 수행 시 본인의 역량을 충분히 발휘하지 못하고 있음을 보여준다. 특히 상급종합병원의 경우 중증 환자의 비율이 높고, 신속하고 정확한 임상적 판단력과 간호사의 다양한 역할이 요구되며, 불규칙한 교대근무 등 여러 구조적 요인으로 인해 프리젠티즘 수준이 상대적으로 높게 나타난 것으로 해석할 수 있다[38]. 따라서 병원 조직은 간호사의 건강문제를 조기에 파악하여 건강문제가 있는 상태에서의 근무를 최소화할 수 있도록 함과 동시에 이로 인한 생산성 저하가 발생하지 않도록 대체인력 마련, 업무강도 적정화, 업무량 조절, 충분한 휴식시간 보장 등을 포함한 통합적 관리전략을 마련할 필요가 있다.

본 연구에서 대상자들의 누락된 간호는 4점 만점에 평균 1.31점으로 나타났다. 이는 동일한 측정도구를 사용하여 간호 · 간병통합서비스 병동 간호사를 대상으로 한 연구[39]에서 평균 1.33점, 비례할당 표집을 통해 상급종합병원과 종합병원 간호사를 대상으로 한 연구에서 평균 1.34점으로 나타나[22], 본 연구결과와 유사하였다. 이는 의료기관에서 간호 업무 누락이 발생하고 있음을 보여주며 지속적인 관리의 필요성을 나타낸다. 누락된 간호의 세부 항목을 살펴보면, 본 연구에서는 '환자와 가족에 대한 정서적 지지' 항목에서 상대적으로 누락빈도가 높게 나타났다. 상급종합병원과 종합병원 간호사를 대상

으로 한 연구와[22] 간호 · 간병통합서비스 병동 간호사를 대상으로 한 연구에서는[39] '다학제 간 집담회 참석하기' 항목의 간호 업무 누락빈도가 가장 높은 것으로 나타났다. 이러한 차이는 의료기관의 규모, 간호전달체계, 근무환경 등의 특성에 따라 항목별 간호 업무 누락에 다소 차이가 있을 수 있음을 시사한다. 다만 대체로 정서적 지지, 다학제 협력 등은 가시적 성과가 드러나지 않고 시간이 많이 소요되므로 우선순위에서 밀려 누락되는 경향이 있다[4,5,22,39]. 따라서 조직은 정서적 지지와 같은 간접간호가 지속적으로 수행될 수 있도록 간접간호 업무의 중요성에 대한 인식 개선과 실질적 지원체계를 마련해야 한다. 특히 인력 배치의 최적화, 간호기록 시스템 효율화, 협업 기반 환경 조성 등은 실무의 일관성과 질을 유지하는 데 도움이 될 것이다.

본 연구에서 직무만족은 5점 만점에 평균 2.84점이었다. 본 연구와 동일한 측정도구를 활용하여 비례할당으로 대상자를 표집한 간호사 대상의 연구에서 평균 3.15점으로 나타났고[22], 측정도구는 다르지만 간호 · 간병통합서비스 병동 간호사를 대상으로 한 연구에서 5점 만점에 평균 3.25점으로 나타난 결과를 통해[40], 본 연구대상자들의 직무만족이 상대적으로 더 낮은 수준임을 알 수 있었다. 이러한 결과는 상급종합병원 간호사가 높은 업무강도와 낮은 자율성으로 인해 직무 스트레스를 경험하며[6,38], 이러한 구조적 요인들이 직무만족에 부정적인 영향을 미친 것으로 해석된다. 간호사의 높은 직무만족은 조직의 생산성을 높이고 환자에게 질 높은 간호를 제공하므로[41], 개인의 만족뿐만 아니라 조직 관점에서도 직무만족을 향상시키기 위한 노력은 중요하다. 병원 조직은 간호사가 업무과정에서 자율성을 발휘할 수 있도록 업무환경을 개선하고, 간호 업무에 대한 정당한 평가와 보상체계를 마련하며, 조직 내 의사소통과 협력체계를 활성화하는 등 실질적인 전략을 모색할 필요가 있다.

본 연구결과, 이직의도는 5점 만점에 평균 2.90점으로 나타났다. 본 연구와 동일한 측정도구를 사용한 상급종합병원 간호사를 대상으로 한 연구에서 평균 2.84점으로 나타났고[34], 측정도구는 다르지만 대학병원 간호사를 대상으로 한 연구에서는 5점 만점에 평균 2.94점으로 나타나[42], 본 연구결과와 유사한 수준이었다. 간호사의 이직의도는 지속적인 관심과 관리가 요구되는 중요한 문제이며, 높은 수준의 이직의도는 직무스트레스 증가와 조직몰입 저하를 유발하여 병원의 운영 효율성과 간호서비스의 질에 부정적인 영향을 미칠 가능성이 있다[19]. 따라서 선행연구에서 실제 이직한 간호사들의 특성을 활용하여 이직예측모형을 제시한 것과 같이 조직차원에서 이직의도를 단순히 확인하는 것에만 그치는 것이 아니라 실제 이직을 예측할 수 있는 다양한 변인들을 파악할 필요가 있으며[43], 이를 통해 예측된 이직 위험군은 조기에 선별하여 장기적으로 조직에 정착할 수 있도록 상담과 멘토링 등 개별 맞춤형 중재를 제공할 필요가 있다.

본 연구에서 프리젠티즘은 누락된 간호를 증가시키고, 이는 직무만족을 감소시켜 이직의도를 높이는 이중매개 경로가 검증되었다. 이는 단일 매개효과만을 검증한 선행연구보다 더욱 구체적이고 통합적인 결과를 제시하고 있다[13,15,16]. 또한 선행 질적 연구에서 간호사들이 건강문제가 있음에도 불구하고 업무를 우선시하여 충분한 회복 기회를 갖지 못하고, 이로 인해 누적된 신체적 · 정서적 부담이 직무만족 저하로 연결된다는 실제 경험이 본 연구에서 확인되었다[44]. 따라서 프리젠티즘은 단순한 개인의 건강관리 차원을 넘어, 간호서비스 질과 조직 성과에 직접적인 영향을 미치는 핵심 관리변수로 인식하고 체계적으로 접근할 필요가 있다.

본 연구에서 프리젠티즘 상태의 간호사는 필수 간호 수행에 부정적인 영향을 미쳐 누락된 간호를 증가시키는 것으로 나타났다. 국내 간호사를 대상으로 프리젠티즘과 누락된 간호의 관계를 검정한 연구가 부족하여 직접적인 비교는 어려우나 미국 간호사를 대상으로 수행한 선행연구에서[13], 프리젠티즘이 누락된 간호에 유의한 영향을 미치는 요인으로 보고되어 본 연구결과와 유사하였다. 이는 프리젠티즘이 누락된 간호에 유의한 직접적인 영향을 미친다는 결과를 국내 간호 실무환경에서 처음으로 규명하였다는 점에서 의의가 있다. 건강문제를 가진 간호사는 업무속도, 판단력 및 주의력이 저하되어 필수적인 기본 간호 업무를 소홀히 할 가능성이 높다고 보고되고 있다[13,15,16]. 본 연구에서 누락된 간호가 직무만족을 유의하게 감소시키는 직접 경로가 확인되었는데, 이는 비례할당 표집을 사용한 간호사 대상의 선행연구에서 누락된 간호가 직무만족에 영향을 주는 요인으로 보고된 결과와 일치하였다[22]. 간호사는 필수적인 간호 업무를 충분히 수행하지 못했을 때 전문직으로서 지속적인 역할 갈등[6], 업무 수행에 대한 심리적 부담[6,7], 도덕적 고통감[6,45]을 느끼며, 이는 궁극적으로 간호사들에게 소진[7]과 직무만족 저하[6,7,22]를 유발한다. 즉 프리젠티즘이 누락된 간호를 증가시켜 직무만족을 저하시키는, 이러한 순차적인 관계는 간호사의 건강, 직무환경, 조직구조를 포괄적으로 고려한 통합적 접근이 필요함을 시사한다. 따라서 간호조직은 간호사의 건강관리 지원과 함께 적절한 업무량 조정과 인력 지원체계를 마련하여 프리젠티즘으로 인한 누락된 간호를 최소화해야 한다. 이는 간호사의 업무 부담과 역할 갈등을 줄이고 직무만족을 높일 수 있을 것이다.

본 연구에서 직무만족은 이직의도에 직접적인 영향을 미치는 것으로 나타났다. 간호사는 직무만족 수준이 높을수록 업무와 근무환경에 창의적이고 긍정적인 태도를 보여 업무 효율성이 향상되고, 현재 직장에 머무르고자 하는 재직의도가 높아진다[46]. 반면, 직무만족이 낮으면 이직의도가 높은 것으로 보고되고 있어 직무만족은 이직의도의 결정요인으로 제시되고 있다[19]. 특히 연구결과, 프리젠티즘이 누락된 간호를 증가시키고, 누락된 간호가 직무만족을 저하시킨다는 직접 경로가 확인됨에 따라, 건강문제를 가진 간호사의 업무 수행으로 인한 생산성 저하가 결과적으로 이직의도 증가로 이어질 수 있음을 시사한다. 본 연구에서 프리젠티즘이 이직의도에 직접적인 영향을 주는 것으로 나타났다. 이러한 결과는 프리젠티즘과 이직의도의 관계에 대해 국내 간호사를 대상으로 한 연구가 부족하여 직접 비교하기는 어려우나 국외 병원간호사를 대상으로 한 선행연구에서 프리

젠티즘이 높을수록 이직의도가 증가하는 연구결과와 유사하였다[13,20]. 국내 간호사를 대상으로 한 선행연구에서 수면장애, 피로 등이 이직의도에 영향을 미친다는 연구결과를 통해 건강문제로 인한 프리젠티즘이 이직의도와 밀접한 관련성이 있는 것으로 해석할 수 있다[47]. 조직에서는 결근에 대해 부정적인 시각을 가지고 있기 때문에 직원들이 아프더라도 출근하는 경향이 있으며[10,15], 관리자의 리더십 성향, 직장 문화, 간호 업무의 특성 등 조직적 요인으로 인해 간호사들은 불가피하게 프리젠티즘을 경험하게 된다[10,15]. 이러한 프리젠티즘은 건강 악화, 동료와의 관계 저하, 직무 불만족, 소진, 업무 효율성 감소 등 개인과 조직 모두에 부정적인 영향을 미치며, 이러한 부정적 경험은 궁극적으로 이직의도로 이어질 수 있다. 프리젠티즘을 감소시키기 위해서는 조직 차원에서 간호사가 건강문제가 있을 때 충분히 휴식을 취할 수 있는 환경 조성이 중요하다. 국외에서는 간호사가 건강상 문제가 있을 경우, 플로트 풀(float pool)이나 간호 인력 에이전시(nursing staffing agency) 등을 통해 대체인력을 지원받아 충분한 병가를 사용할 수 있도록 하는 체계를 갖추고 있다[48]. 현재 국내에서도 일부 상급종합병원에서 대체인력 운영을 시도하고 있지만, 대체인력 확보의 어려움과 추가 인력 운영에 따른 비용 문제 등으로 인해 현실적인 한계가 있는 실정이다[49]. 따라서 간호사의 병가 사용을 제도적으로 보장하고, 실질적으로 운영 가능한 탄력적이고 효율적인 대체인력 관리방안을 마련하기 위한 정책적 지원이 함께 이루어질 필요가 있다.

본 연구에서 프리젠티즘과 이직의도의 관계에서 누락된 간호는 매개효과가 있는 것으로 나타났다. 또한 본 연구에서 누락된 간호는 이직의도에 직접적인 영향을 미치는 것으로 나타나, 선행연구의 결과를 지지하였다[6,22]. 간호 업무 누락은 간호사의 업무 스트레스와 소진을 증가시키고 간호근무환경 및 조직 지원체계에 대한 불만이 높아져 결국 이직의도를 증가시키는 결과로 이어진다[6,7,22]. 따라서 간호 서비스의 질적 향상과 간호사의 이직의도를 낮추기 위해서는 프리젠티즘을 적극적으로 예방하고 관리할 필요가 있다. 이를 위해 간호사에게 휴식시간을 보장하는 등의 건강 친화적 근무환경을 조성하고, 업무량을 모니터링하여 업무가 집중되는 시간대에 추가 인력을 지원하는 등의 실질적인 관리방안은 프리젠티즘과 누락된 간호를 감소시켜, 간호사의 이직의도를 낮추는 데 기여할 수 있을 것이다. 그러나 본 연구는 프리젠티즘 대표값으로 직무손실 하위영역만을 사용하였다는 제한이 있어, 프리젠티즘의 다차원적 특성을 충분히 반영하지 못했다는 제한점을 가진다.

결론

본 연구를 통해 간호사의 프리젠티즘, 누락된 간호, 직무만족, 이직의도의 수준 및 이와 관련된 특성들이 파악되었으며, 간호사의 프리젠티즘은 이직의도에 직접적인 영향을 주었으며 누락된 간호와 직무만족을 통해 이직의도를 감소시키는 경로에서 이중매개효과가 있는 것으로 나타났다. 따라서 간호사의 이직의도를 감소시키기 위해서는 간호사의 프리젠티즘을 예방하기 위한 건강프로그램을 개발하고 적용하고, 병원 관리자와 간호사들에게 프리젠티즘의 중요성에 대한 인식을 높이고, 조직적 차원에서는 간호사의 건강관리에 적극적으로 지원할 수 있는 방안 마련과 동시에 누락된 간호의 감소와 직무만족을 향상시킬 수 있는 적절한 인력 확보 및 근무환경 개선, 간호사 처우 개선 등의 실질적 노력이 요구된다.

본 연구결과를 바탕으로 다음과 같이 제언하고자 한다. 첫째, 간호사의 프리젠티즘을 예방하기 위해 간호사들에게 정기적인 건강검진, 적절한 휴식시간 확보 등의 건강관리 지원과 함께 병가제도 개선, 근로조건을 개선할 것을 제언한다. 둘째, 간호사의 프리젠티즘과 이직의도의 관계에서 누락된 간호, 직무만족 이외에 다양한 매개요인 및 조절요인을 탐색하는 추가 연구를 실시할 것을 제언한다. 셋째, 간호사의 건강문제에 대한 실제적인 현상을 파악하고 질병상태에서 근무할 때의 경험에 대한 심층적 이해를 위한 질적 연구를 수행할 것을 제언한다. 넷째, 간호사의 프리젠티즘과 누락된 간호를 예방하여 직무만족을 높이고 이직의도를 감소시키기 위하여, 간호사 처우 개선과 간호사 1인당 환자 수 법제화 등 실질적인 정책을 개발하고 이를 적극적으로 실행할 것을 제언한다. 다섯째, 본 연구에서 프리젠티즘 측정을 위해 사용된 SPS-13 한국어판 도구는 타당성 확보를 위해 다양한 반복연구들이 이루어질 필요가 있으며, 간호실무현장을 반영하는 도구 개발을 위하여 간호사의 프리젠티즘 개념 분석 및 측정도구 개발을 위한 방법론적 연구 수행을 제언한다.

Article Information

Conflicts of Interest

Seok Hee Jeong serves as an editor of the *Journal of Korean Academy of Nursing* but has no role in the decision to publish this article. Except for that, no potential conflict of interest relevant to this article was reported.

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요양병원 간호사의 생애말 간호역량 측정도구 개발 및 평가

손숙연[1], 전미경[2]

[1]가야대학교 간호학과, [2]국립창원대학교 간호학과

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Corresponding author:
Mi-Kyeong Jeon
Department of Nursing,
Changwon National University, 20
Changwondaehak-ro, Uichang-gu,
Changwon 51140, Korea
E-mail: mkjeon@changwon.ac.kr

Development of an end-of-life care competency scale for nurses in long-term care hospitals: a psychometric validation study

Sookyeon Son[1], Mi-Kyeong Jeon[2]

[1]Department of Nursing, Kaya University, Gimhae, Korea
[2]Department of Nursing, Changwon National University, Changwon, Korea

Purpose: This study aimed to develop a scale to measure end-of-life care (EOLC) competency among nurses working in long-term care hospitals and to evaluate its validity and reliability.

Methods: Preliminary items were developed based on attributes and indicators identified through a conceptual analysis of EOLC competency. The initial version of the scale was refined through expert content validity assessment, item revision, and a pilot test. The main survey was conducted among 460 nurses in long-term care hospitals, and 409 valid responses were analyzed after excluding 51 incomplete or invalid cases. Data were analyzed using software-assisted item analysis, exploratory and confirmatory factor analyses, and assessments of convergent, discriminant, and criterion-related validity, as well as reliability testing.

Results: The initial 55 items were reduced to a final set of 30 items across seven dimensions. Model fit indices indicated good construct validity (χ^2/degrees of freedom=1.91, standardized root mean square residual=.06, root mean square error of approximation=.07, Tucker-Lewis index=.90, comparative fit index=.91), with a total explained variance of 70.2%. The scale demonstrated strong criterion-related validity (r=.76, p<.001), high internal consistency (Cronbach's α=.95; McDonald's ω=.95), acceptable test-retest reliability (r=.56, p<.001), and an intraclass correlation coefficient of .72 (95% confidence interval, .51–.84; p<.001).

Conclusion: The developed scale is a valid and reliable instrument for assessing EOLC competency among nurses in long-term care hospitals. It can be effectively utilized for educational assessment, training evaluation, and the measurement of program effectiveness in end-of-life care.

Keywords: Clinical competence; Long-term care; Nurses; Terminal care

서론

1. 연구의 필요성

우리나라의 기대수명은 2021년 기준 83.6세로 지속적으로 증가하고 있으나, 건강수명은 70.5세로 여전히 큰 차이를 보이고 있다[1]. 이로 인해 많은 노인들이 독립적인 일상생활을 유지하지 못하고 장기간 장기요양시설이나 의료기관에 머무르며 생애말을 보내고 있다[2,3]. 통계청과 장기요양

빅데이터 분석 결과에 따르면[4,5], 65세 이상 사망자의 약 77%가 의료기관에서 사망하였으며, 특히 장기요양 이용 노인의 경우 요양병원에서의 사망 비중이 36%로 가장 높게 보고되었다. 또한 보건복지부의 최근 발표에 따르면 병원급 사망자 증가분의 상당 부분이 요양병원에서 발생한 것으로 나타났다[6]. 이 현실을 고려할 때, 요양병원 간호사는 생애말 간호(end-of-life care)의 중요성과 그 특성을 충분히 인식하고, 이를 효과적으로 수행할 수 있는 역량을 갖추는 것이 요구된다.

생애말 간호는 환자와 가족이 삶의 마지막 시기에 직면하는 신체적 · 심리사회적 · 영적 요구를 완화하고 지지하는 포괄적 간호를 의미한다[7,8]. 영국의 국립보건임상연구원(National Institute for Health and Care Excellence) [8]과 국내 보건복지부의 제2차 호스피스 · 연명의료종합계획[9]에서는 생애말 간호를 사망 전 약 1년 이내의 환자와 가족을 위한 돌봄으로 정의하고 있다. 유사한 개념으로 혼용되는 임종간호(care in the last days of life)는 사망 수일 내 제공되는 간호를 의미하며, 호스피스 간호(hospice care)는 암 환자 및 일부 말기질환자를 대상으로 사망 전 6개월 동안 제공되는 간호로 정의된다[9]. 또한 완화간호(palliative care)는 질병 진단 시점부터 삶의 질 향상을 목표로 제공되는 돌봄으로 생애말 국면에 국한되지 않는다[10]. 따라서 본 연구에서는 연구의 초점을 명확히 하기 위해 생애말 간호라는 용어를 사용하였다.

간호사의 생애말 간호역량은 환자와 가족의 삶의 질 및 존엄성 유지를 위한 필수 요소이며, 역량이 부족할 경우 생애말 간호의 질 저하는 물론 환자 · 가족의 삶의 질 저하로 이어질 수 있다[11,12]. 국내에서 생애말 간호역량의 수준을 확인하는 연구는 보고되고 있으나, 이를 객관적으로 측정하고 평가할 수 있는 도구는 부재한 실정이다. 이에 선행연구에서는 Montagnini 등[13]이 개발한 Scale of End-of-Life Care in the Intensive Care Unit (EOLC-ICU)를 번역하고 수정 · 보완하여 사용하고 있다[14-18]. 그러나 국외에서 개발된 도구는 국내 의료환경, 제도, 문화적 차이 및 간호 현장의 고유한 특성을 충분히 반영하기 어려운 한계가 있다. 특히 Montagnini 등[13]의 도구는 종합병원 중환자실 간호사를 대상으로 개발되었으며, 이는 요양병원의 통합적 운영구조와 환자 특성과는 차이가 있다. 요양병원은 전문진료과와 병동이 엄격히 분리된 종합병원과 달리 통합적인 구조로 관리되며[19], 입원한 환자와 그 가족은 적극적인 치료보다 신체적 안위를 중심으로 한 완화 치료를 선호하는 경향이 크다[20-22]. 따라서 요양병원 간호사의 임상환경과 특성을 반영한 생애말 간호역량 도구의 개발이 필요하다.

최근 요양병원 간호사의 생애말 간호역량에 대한 개념분석을 통해, 포괄적 증상관리, 효과적인 의사소통, 상황에 따른 대처, 인간 중심 돌봄, 정보 제공과 교육, 자원관리, 리더십 발휘, 전문성 개발이 주요 속성으로 보고되었다[23]. 이러한 결과는 도구 개발을 위한 개념적 토대를 제공하였으며, 이를 기반으로 실제 임상현장에서 간호사의 역량을 측정 · 평가할 수 있는 타당하고 신뢰할 수 있는 도구 개발이 필요하다. 타당도와 신뢰도를 갖춘 측정도구는 간호사 교육 및 훈련의 기본 지침으로 활용될 수 있으며, 대상자의 현재 역량을 평가하는 데 유용하다[24]. 이에 본 연구는 요양병원 간호사의 생애말 간호역량에 대한 개념분석 결과를 토대로 도출된 속성을 측정 가능한 문항으로 구체화하고 그 타당도와 신뢰도를 검정하고자 한다[23]. 이는 요양병원 간호사의 생애말 역량을 평가할 수 있는 적합한 측정도구를 개발한다는 점에서 의의가 있으며, 나아가 간호사 교육과 훈련의 효과를 평가하고, 환자와 가족의 삶의 질 향상을 위한 실무적 · 교육적 · 정책적 근거를 마련할 수 있을 것이다.

2. 연구의 목적

본 연구의 목적은 요양병원 간호사의 생애말 간호역량을 측정하는 도구를 개발하고, 도구의 타당도와 신뢰도를 검정하는 것이다.

방법

1. 연구설계

본 연구는 요양병원 간호사의 생애말 간호역량을 측정하기 위한 도구를 개발하고, 개발된 도구의 타당도와 신뢰도를 검정하기 위한 방법론적 연구이다.

2. 도구의 개발과정

본 연구는 DeVellis [25]가 제시한 도구 개발과 도구 검정절차에 따라 체계적으로 수행되었다.

1) 도구 개발

(1) 도구의 구성요소 확인

DeVellis [25]가 제시한 도구 개발의 첫 단계는 측정하고자 하는 개념을 명확히 규정하는 것이다. 이에 본 연구에서는 연구팀이 수행한 개념분석 선행연구를 근거로 요양병원 간호사의 생애말 간호역량을 "환자가 인간의 존엄성을 지닌 독립적인 존재로서 생애말을 살아갈 수 있도록, 간호사가 포괄적 증상관리, 상황에 따른 대처, 효과적인 의사소통, 자원관리, 리더십 발휘, 인간 중심 돌봄, 정보 제공과 교육, 전문성 개발을 통합적으로 수행하는 역량"으로 이론적으로 정의하였으며[23], 포괄적 증상관리, 효과적인 의사소통, 상황에 따른 대처, 인간 중심 돌봄, 정보 제공과 교육, 자원관리, 리더십 발휘, 전문성 개발의 8개 속성과 51개의 지표를 도출하였다[23]. 본 연구에서는 이러한 이론적 정의를 토대로, 요양병원 간호사가 환자의 생애말 요구를 충족시키기 위해 실제 임상에서 발휘하는 측정 가능한 실천적 수행능력 수준으로 생애말 간호역량을 조작적으로 정의하였다. 이 조작적 정의를 기반으로 선행연구에서 도출된 속성과 지표를 도

구개발의 초기 구성요소로 확정하였으며[23], 이를 예비문항 개발의 이론적 근거로 활용하였다.

(2) 예비문항과 척도 결정

예비문항은 최종 도구 문항 수의 3–4배, 또는 지표별로 3–15개 정도의 문항으로 구성하는 것이 바람직하다고 권고되어[25], 각 속성별로 3–12개 문항을 구성하였다. 문항 개발 시 하나의 문항에 복합적인 의미가 담기지 않도록 하였으며, 모든 문항은 단일 상황을 반영하도록 구성하였다[25]. Likert 척도는 사회과학 분야에서 널리 사용되고 있는데, 중간점이 없는 경우 응답자가 사소한 단서에 영향을 받거나, 중립적인 의견을 가진 응답자가 강제로 긍정 또는 부정을 선택해야 하는 오류가 발생할 수 있다[26,27]. 이러한 근거를 바탕으로 본 연구에서는 중간점을 포함한 5점 Likert 척도를 사용하였다.

(3) 예비문항의 내용타당도 검정 및 문항검토

예비문항이 측정하고자 하는 개념의 속성을 적절히 반영하고 있는지를 확인하기 위해 내용타당도 검정을 실시하였다. 이를 위해 간호학과 교수 2인, 혈액종양내과 전문의 1인, 호스피스 전문간호사 2인, 요양병원 근무경력 10년 이상이면서 석사 이상 학력을 갖춘 간호사 2인 등 총 7명의 전문가로 구성된 전문가 집단을 구성하였다.

문항 수준 내용타당도 지수(item-level content validity index [I-CVI])와 척도 수준 내용타당도 지수/평균(scale-level content validity index/average [S-CVI/Ave])을 산출하였으며, 그 기준으로는 I-CVI는 .78 이상, S-CVI/Ave는 .90 이상인 문항을 선정하였다[28]. 아울러 예비문항의 맞춤법, 어휘 사용, 문장 흐름 및 문법적 적절성 등에 대해서는 국어국문학과 교수 1인의 검토를 통해 언어적 타당성을 확보하였다.

(4) 문항의 예비조사

예비조사는 경상남도 소재 요양병원에 근무하는 간호사를 대상으로 2022년 12월 20일부터 25일까지 실시하였다. 대상자는 요양병원 근무경력 1년 이상이며, 임종간호를 포함한 생애말 간호를 수행한 경험이 있는 간호사 20명으로, 본 조사에 적합하다고 판단되고 참여에 동의한 자로 선정하였다. 연구자가 직접 설문지를 배부하고 수거하였으며, 설문지는 예비문항으로 구성된 측정도구, 일반적 특성 문항, 문항의 이해 정도, 글자 크기 및 설문지 배치, 문항 길이의 적절성, 설문지의 보완 사항, 설문지 작성에 소요되는 시간 등을 포함하여 도구의 가용성을 확인하기 위한 자료로 구성하였다.

2) 도구 검정: 타당도와 신뢰도 검정

(1) 연구대상자

타당도와 신뢰도 검정을 위한 연구의 대상자는 경상남도 소재 요양병원에 근무하며, 총 임상경력 1년 이상인 간호사로 하였다. 측정도구의 타당도 및 신뢰도 검정을 위한 요인분석에 있어 Stevens [29]는 총 문항 수의 5–7배 이상의 표본이 필요하다고 하였고, Lee [30]는 최소 200명 이상의 표본 확보를 제안하였다. 이에 본 연구에서는 탐색적 요인분석과 확인적 요인분석을 모두 시행하여 구조타당도를 교차확인(cross-validation)하고자 하였으며, 예비문항 55문항의 7배에 해당하는 표본 수를 기준으로 삼고, 탈락률 15%를 고려하여 총 460부의 설문지를 배부하였다. 배부한 설문지 460부는 모두 회수되어 응답률은 100%였으며, 이 중 동의서 작성이 불충분한 13부, 임상경력 1년 미만인 12부, 불성실한 응답이 포함된 26부 등 총 51부를 제외하고, 최종적으로 409부를 자료분석에 활용하였다. 탐색적 요인분석에는 204부, 확인적 요인분석에는 205부를 사용하였다.

(2) 자료수집

자료수집 기간은 2023년 1월 3일부터 2월 1일까지였으며, 경상남도에 소재한 요양병원의 간호부서장에게 전화로 연구의 목적과 취지를 설명하고, 자료수집에 승낙한 28개 기관을 대상으로 하였다. 참여기관을 방문하기 전 간호부서장 또는 간호단위별 관리자와 설문지 배부방법과 방문시간을 의논한 후 연구자가 직접 각 의료기관을 방문하여 설문지를 배부하였다. 연구 설명문은 서면 동의서 및 설문지와 함께 제공되었으며, 내용을 충분히 이해하고 자발적으로 연구에 참여의사를 밝힌 대상자에게 서면 동의서를 작성하게 한 뒤 설문지를 작성하도록 하였다. 작성된 설문지는 제공된 서류봉투에 즉시 넣어 밀봉하여 지정된 장소에 보관하도록 하였으며, 연구자가 이를 직접 회수하였다.

(3) 자료분석

수집된 자료는 IBM SPSS ver. 25.0 (IBM Corp.)과 IBM AMOS ver. 22.0 (IBM Corp.) Jamovi ver. 2.2.5 (Jamovi forum)를 이용하여 분석하였다.

a. 구성타당도

구성타당도는 문항분석, 탐색적 요인분석, 확인적 요인분석, 수렴타당도와 판별타당도로 검정하였다.

i. 문항분석

문항분석은 문항의 적절성을 평가하여 부적절한 문항을 제거하기 위한 과정으로, 평균과 표준편차, 첨도와 왜도, 문항–총점 간 상관계수, 문항 제거 시 신뢰도 변화를 기준으로 실시하였다. 평균은 1.5–4.5, 표준편차는 0.15 이상, 왜도의 절대값은 2 이하, 첨도의 절대값은 7 이하일 때 수용 가능한 것으로 판단하였다. 문항–총점 간 상관계수는 .30–.80을 적정 기준으로 하였고, 바닥효과 및 천장효과는 각 문항의 최저 · 최고 점수 빈도가 30% 미만일 때 적절한 것으로 간주하였다[31].

ii. 탐색적 요인분석

탐색적 요인분석은 IBM SPSS ver. 25.0 (IBM Corp.) 프로그램을 이용하여 무작위 표본추출로 분할한 자료 중 204개를 사용하여 실시하였다. 요인추출 방법으로는 수집된 자료를 모집단의 표본으로 가정하고, 표본이 정규분포를 따른다는 전제하에서 모형의 적합도 검증이 가능한 최대우도법을 적용하였다[29,32]. 또한 본 연구의 변인들은 상호 관련성이 존재할 가능성이 높으므로, 요인 간 상관을 허용하는 사각회전방식(oblique rotation)인 직접 오블리민 회전(direct oblimin)을 사용하였다[25,33]. 요인분석 적합성은 Kaiser-Meyer-Olkin (KMO) 값이 .80 이상인지, Bartlett의 구형성 검정에서 p<.05인지 확인하였다[31]. 그리고 요인 수를 결정하기 위해 고유값(eigenvalue)이 1 이상이고, 누적분산비율은 총분산의 약 60% 이상을 설명하는 요인 수를 기준으로 하였으며, 스크리도표, 평행분석 결과, 적합도지수(root mean square error of approximation [RMSEA])를 함께 고려하였다. RMSEA 값이 .05 이하이면 적합도가 우수하고, .08 이하이면 수용 가능한 수준이며, .10을 초과할 경우 부적합한 것으로 판단하여 요인 수를 검토하였다[34,35]. 문항의 선별과정에서는 공통성, 요인적재량, 교차부하량, 구조행렬과 패턴행렬 등을 고려하여 문항을 삭제하면서 요인분석을 반복 시행하였다. 최종적으로 추출된 각 요인의 점수와 총점 간의 상관계수를 산출하였으며, r 값이 .30 미만이면 타당성이 낮고, .30–.50이면 수용 가능하며, .50을 초과하면 구성타당도가 양호한 것으로 간주하였다[36].

iii. 확인적 요인분석

확인적 요인분석은 탐색적 요인분석에 포함하지 않은 205개의 자료를 사용하였고, 모수 추정은 최대우도법으로 분석하였다. 모형의 적합도 평가는 카이제곱(χ^2), RMSEA, standardized root mean square residual (SRMR), comparative fit index (CFI), Tucker-Lewis index (TLI) 등의 적합도지수를 종합적으로 확인하였다. 또한 각 문항의 표준화 요인부하량은 ≥.50, ≤.95를 기준으로 검토하여 요인의 설명력을 평가하였다[37].

iv. 수렴타당도

문항간 수렴타당도(Item-level convergent validity)는 잠재요인을 설명하는 관측변수 간 일치성 검증으로, 표준화된 요인적재량이 .50–.95의 범위에 있고, 요인부하량의 유의성(critical ratio [C.R.])이 ≥1.96 (p<.05)이며, 평균분산추출지수(average variance extracted [AVE]) 값이 ≥.50, 개념 신뢰도(construct reliability [CR]) 값이 ≥.70일 경우 수렴타당도가 확보된 것으로 평가하였다[37]. 또한 본 연구에서는 개념적으로 관련된 도구인 Montagnini 등[13]이 개발하고 Lee [14]가 번역한 EOLC-ICU와의 상관관계 분석을 통해 도구간 수렴타당도(scale-level convergent validity)를 검증하였다. 이 도구는 지식 영역 12문항, 태도 영역 5문항, 행위 영역 11문항의 총 28문항으로 구성되어 있으며, 각 문항은 Likert 5점 척도로 측정된다. 점수가 높을수록 간호사가 인식한 생애말 간호역량이 높음을 의미한다. 도구의 신뢰도는 개발 당시 Cronbach's α=.92였으며, Lee [14]의 연구에서 Cronbach's α=.90으로 보고되었다. 상관계수의 해석은 Lee 등[38]이 제시한 기준을 참고하여 r=.40–.69 범위일 때 보통, r≥.70일 때 높음으로 해석하였다.

v. 판별타당도

판별타당도는 잠재요인 간 개념이 서로 구별되는지를 평가하기 위한 것이다. 본 연구에서는 이를 검증하기 위해 두 가지 방법을 사용하였다. 첫째, AVE 값이 요인 간 상관계수 제곱보다 큰 경우, 각 요인이 다른 요인과 충분히 구별된다고 판단하였다. 둘째, 요인 간 상관계수에 표준오차의 두 배를 더하고 빼서 산출한 신뢰구간에 1이 포함되지 않을 경우, 요인 간 상관이 완전하지 않음을 의미하므로 판별타당도가 확보된 것으로 해석하였다[36].

b. 신뢰도 검증

신뢰도는 동질성과 안정성 측면에서 검증하였다. 동질성은 내적 일관성 분석을 통해 확인했으며, Cronbach's α와 함께 McDonald's ω (omega)도 산출하였다. Cronbach's α는 가장 널리 사용되는 내적 일관성 지표이지만 문항 수나 문항 간 상관계수 크기에 민감하여 과소 · 과대 추정 가능성이 있는 반면, McDonald's ω는 요인부하량을 반영함으로써 이러한 한계를 보완할 수 있다는 점에서 병행 사용하였다[39]. 특히 2문항 요인에 대해서는 Spearman-Brown 계수를 산출하여 신뢰도를 확인하였다[40]. 안정성은 검사–재검사 신뢰도를 통해 검토하였다. 1차 조사에 참여한 의료기관 중 재조사에 동의한 간호사 60명을 대상으로 2–4주 간격으로 동일한 도구를 반복 측정하였으며, 이 중 부적절한 7부를 제외한 53부를 분석에 활용하였다. 두 시점 점수 간 일치도는 Pearson's 상관계수와 급내상관계수(intraclass correlation coefficient [ICC])를 산출하여 평가하였다.

c. 도구의 최적화

개발한 측정도구의 타당도와 신뢰도 검정 결과를 바탕으로 최종 요인을 명명하고, 이에 따라 문항을 확정하여 배열하였다. 또한 척도 점수 해석 기준을 설정하여 도구의 구조와 활용방안을 구체화하였다.

3. 윤리적 고려

본 연구는 국립창원대학교 생명윤리위원회의 승인(7001066-202206-HR-040) 후 진행하였다. 각 의료기관 간호부서장에게 자료수집 허락을 받은 후 대상자를 모집하였으며, 연구의 목적과 절차, 자발적 참여 및 철회 가능성, 수집된 자료의 익명성과 관리방법 등을 명시한 설명문을 제공한 후, 서면 동의를 작성한 후 진행하도록 하였다. 대상자가 언제든지 참여를 철회할 수 있으며, 철회로 불이익은

발생하지 않음을 안내하였다. 연구에 참여한 대상자에게는 감사의 의미를 담아 소정의 답례품을 제공하였다. 수집된 자료는 연구 종료 후 3년간 보관 후 영구 폐기할 예정이다.

결과

1. 도구 개발

1) 예비문항과 척도 작성

개념분석에서 확인한 주요 속성과 지표를 바탕으로 총 56문항을 개발하였다[23]. 각 속성별 문항 수는 포괄적 증상관리 12문항, 효과적 의사소통 8문항, 상황에 따른 대처 5문항, 인간 중심 돌봄 10문항, 자원관리 3문항, 리더십 발휘 6문항, 정보 제공과 교육 8문항, 전문성 개발 4문항으로 구성하였다. 척도는 Likert 5점 척도로 구성하였으며, '전혀 그렇지 않다' 1점부터 '매우 그렇다' 5점까지 점수가 부여되도록 하였다.

2) 내용타당도 검정

예비 56문항에 대해 전문가 7인을 대상으로 두 차례 내용타당도 검정을 실시하였다. 1차 검정에서는 I-CVI가 .78 미만인 문항 4개를 삭제, 문항 18개를 수정하고, 전문가의 제안에 따라 1개 문항을 추가하여 총 53문항을 선정하였다. 2차 검정에서는 I-CVI가 .67로 확인된 1개 문항을 삭제, 3개 문항을 추가로 수정하였다. 전체 도구의 S-CVI/Ave는 1차 .94, 2차 .99로 나타나 내용타당도가 적절한 것으로 확인되었다. 이에 따라 포괄적 증상관리 11문항, 효과적인 의사소통 7문항, 상황에 따른 대처 5문항, 인간 중심 돌봄 10문항, 자원관리 3문항, 리더십 발휘 5문항, 정보 제공과 교육 7문항, 전문성 개발 4문항으로 총 52문항이 예비문항으로 확정되었다.

3) 예비문항 검토 및 예비조사

(1) 예비문항 검토

내용타당도 검정을 통해 선정된 52문항에 대해 국어국문학과 교수에게 자문을 받아 문법, 어휘, 문장 흐름 등을 검토하였다. '생애말 환자와 가족'이라는 표현은 '생애말 환자와 그 가족'으로 수정하였으며, 의미 전달의 명확성을 높이기 위해 수식어, 서술어, 단어의 위치 등을 조정하였다. 또한 두 개의 문항에서 두 개의 질문이 포함되어 있어 분리하는 것이 바람직하다는 의견에 따라 해당 문항들을 분리하여 예비문항을 54문항으로 수정하였다.

(2) 예비조사

문항검토를 거쳐 선정된 54개의 예비문항에 대해 구성의 적절성을 5점 Likert 척도로 평가한 결과, 문항의 이해 정도는 3.00±0.56점, 글자크기의 적절성 3.95±0.69점, 문항 배치의 적절성 3.80±0.62점, 문항 길이의 적절성은 3.95±0.61점으로 나타났다. 기타 의견으로는 주어가 없어 주체가 불명확하다는 지적이 있어, 설문지 상단에 '나는 OO 할 수 있다'라는 문장을 삽입하여 문항의 응답 주체를 명확히 하였다. 또한 '생애말 환자의 통증 및 신체증상을 조절하기 위한 약물 또는 비약물 중재를 수행할 수 있다'의 문항에 대해서는 약물과 비약물 중재가 구분되어야 한다는 의견에 따라 해당 문항을 분리하고, 각 문항에 예시를 제시하는 것이 이해에 도움이 될 것이라는 의견을 반영하여 수정하였다. 이에 따라 최종 예비도구는 포괄적 증상관리 14문항, 효과적인 의사소통 7문항, 상황에 따른 대처 5문항, 인간 중심 돌봄 10문항, 자원관리 3문항, 리더십 발휘 5문항, 정보 제공과 교육 7문항, 전문성 개발 4문항으로 총 55문항이 확정되었다.

2. 도구의 검정

1) 대상자의 일반적 특성

도구 검정에 참여한 대상자의 평균 연령은 44.0±9.48세였고, 성별은 대부분 여성이었다. 최종학력은 전문학사 221명(54.0%), 학사 172명(42.1%), 대학원 재학 이상 16명(3.9%)으로 전문학사와 학사 이상이 비슷한 비율을 보였다. 총 경력은 평균 14.08±8.14년이었고, 이 중 10년 미만이 128명(31.3%)으로 가장 많았다. 요양병원 근무경력은 7.15±4.43년이었으며, 5년 미만 142명(34.7%), 5–10년 미만 141명(34.5%)으로 나타났다. 직위는 일반간호사가 298명(72.8%)으로 가장 높은 비율을 차지하였다. 생애말 간호경험은 338명(82.6%)이었고, 임종간호 및 호스피스 · 완화간호 교육 경험이 있는 대상자는 234명(57.2%)이었다. 또한 395명(96.6%)이 생애말 간호 교육의 필요성에 동의하였으며, 393명(96.1%)은 생애말 간호 교육에 참여할 의향이 있다고 하였다.

탐색적 요인분석과 확인적 요인분석을 위해 전체 대상자 409명을 무작위로 두 집단으로 나누고, 두 집단 간 일반적 특성에 대한 동질성 검정을 실시한 결과, 두 집단은 동질한 것으로 확인되었다(Table 1).

2) 구성타당도 검정

(1) 문항분석

개발된 도구의 문항을 분석한 결과(Supplementary Table 1), 평균은 2.97–3.89, 표준편차는 0.60–0.87로 나타나 평균의 극단값은 없었으며, 왜도는 –0.75 to –0.04, 첨도는 –0.22 to 1.96 범위로 정규성을 충족하였다. 바닥효과와 천장효과를 확인한 결과, 최소값과 최대값의 빈도가 30% 미만으로 극단치 집중현상은 없었다. 문항–총점 상관계수는 .46–.69까지 분포되어 삭제할 문항은 없었고, 문항 제거 시 전체 신뢰도에 영향을 주는 문항도 없었다. 전체 도구의 신뢰도는 Cronbach's α=.97로 매우 높은 수준이었다.

(2) 탐색적 요인분석

탐색적 요인분석은 204명의 자료를 대상으로 55문항에 대해 최대

Table 1. General characteristics of participants (N=409)

Characteristic	Total (n=409)	EFA (n=204)	CFA (n=205)	χ^2 or t	*p*
Gender				0.00	.992
Men	18 (4.4)	9 (4.4)	9 (4.4)		
Women	391 (95.6)	195 (95.6)	196 (95.6)		
Age (yr)				3.64	.303
<29	28 (6.8)	12 (5.9)	16 (7.8)		
30–39	104 (25.4)	53 (26.0)	51 (24.9)		
40–49	143 (35.0)	79 (38.7)	64 (31.2)		
≥50	134 (32.8)	60 (29.4)	74 (36.1)		
Mean±SD	44.0±9.48	43.4±8.84	44.6±10.06	−1.33	.185
Marital status				0.45	.501
Unmarried	96 (23.5)	45 (22.1)	51 (24.9)		
Married	313 (76.5)	159 (77.9)	154 (75.1)		
Religion				0.88	.348
Yes	222 (54.3)	106 (52.0)	116 (56.6)		
No	187 (45.7)	98 (48.0)	89 (43.4)		
Education level				1.04	.595
Diploma	221 (54.0)	112 (54.9)	109 (53.2)		
Bachelor's	172 (42.1)	86 (42.2)	86 (41.9)		
≥Master's	16 (3.9)	6 (2.9)	10 (4.9)		
Total nursing career (yr)				2.75	.431
<10	128 (31.3)	61 (29.9)	67 (32.7)		
10–15	98 (24.0)	56 (27.5)	42 (20.5)		
15–20	77 (18.8)	36 (17.6)	41 (20.0)		
≥20	106 (25.9)	51 (25.0)	55 (26.8)		
Mean±SD	14.08±8.14	13.96±7.35	14.20±8.87	−0.30	.762
Total nursing career at long-term care hospital (yr)				0.88	.831
<5	142 (34.7)	71 (34.8)	71 (34.6)		
5–10	141 (34.5)	74 (36.3)	67 (32.7)		
10–15	99 (24.2)	46 (22.5)	53 (25.9)		
>15	27 (6.6)	13 (6.4)	14 (6.8)		
Mean±SD	7.15±4.43	7.00±4.45	7.29±4.42	−0.65	.517
Position				2.99	.224
Staff nurse	298 (72.8)	156 (76.5)	142 (69.3)		
Charge nurse	26 (6.4)	10 (4.9)	168 (7.8)		
≥Head nurse	85 (20.8)	38 (18.6)	47 (22.9)		
EOLC experience				2.13	.145
Yes	338 (82.6)	163 (79.9)	175 (85.4)		
No	71 (17.4)	41 (20.1)	30 (14.6)		
Terminal care or hospice palliative care educational experience				0.29	.588
Yes	234 (57.2)	114 (55.9)	120 (58.5)		
No	175 (42.8)	90 (44.1)	85 (41.5)		
EOLC educational needs				1.28	.865
Disagree	14 (3.4)	6 (3.0)	8 (3.9)		
Agree	395 (96.6)	198 (97.0)	197 (96.1)		
Intention to participate EOLC educational				2.38	.666
Disagree	16 (3.9)	10 (4.9)	6 (2.9)		
Agree	393 (96.1)	194 (95.1)	199 (97.1)		
Experience of family death				1.08	.300
Yes	211 (51.6)	100 (49.0)	111 (54.1)		
No	198 (48.4)	104 (51.0)	94 (45.9)		

Values are presented as number (%) or mean±SD unless otherwise stated.
CFA, confirmatory factor analysis; EFA, exploratory factor analysis; EOLC, end-of-life care; SD, standard deviation.

우도법과 직접 오블리민 방식으로 수행하였으며, 총 7회 반복 분석을 통해 7개 요인의 30문항이 최종 추출되었다(Table 2).

요인분석 적합성 검토 결과, KMO=.92, Bartlett의 구형성 검정 결과, χ^2=8,082.09, p<.001로 통계적으로 유의하여 요인분석에 적합한 자료임이 확인되었다. 탐색적 요인분석에서 요인 수를 결정하는 것은 매우 중요한 절차로 다양한 방법을 사용해 종합적으로 판단하였다. 고유값 기준으로는 11개 요인이 추출되었고, 스크리 도표에서는 4개 요인이, 평행분석에서는 최대 7개 요인이 제시되었다. 이에 따라 4–7개 요인을 각각 지정하여 순차적으로 분석한 결과, 모든 조건에서 RMSEA는 .08 이하로 수용 가능한 수준이었다. 이러한 결과를 바탕으로 평행분석 결과와 누적 설명력 60% 이상 기준을 고려하여 최종 요인 수를 7개로 결정하였다. 이후 2차 분석부터 요인 수를 고정하고, 공통성이 .40 미만인 문항은 삭제하였으며, 구조행렬과 패턴행렬을 비교하여 공통적으로 삭제되는 문항을 제거하며 분석을 반복하였다. 최종 분석 결과, KMO=.90, Bartlett의 구형성 검정 결과 χ^2=3,901.95, degrees of freedom (df)=435, p<.001로 분석 적합성이 다시 확인되었다. 또한 고유값 기준으로 7개 요인이 추출되었으며, 누적 설명력은 70.2%로 나타났다. 각 요인 점수와 도구 총점 간 상관계수가 .33–.59 범위로 나타나, 전반적으로 구성타당도가 양호한 것으로 확인되었다[36].

(3) 확인적 요인분석

확인적 요인분석에는 무작위로 분할한 두 번째 205개의 표본을 사용하여 최대우도법을 적용해 분석을 시행하였다. 모형 적합도는 χ^2=793.73 (df=384, p<.001), χ^2/df=2.07, SRMR=.06, RMSEA=.07, TLI=.88, CFI=.89로 TLI와 CFI가 기준보다 약간 낮게 나타났다. 이에 수정지수(modification index)를 검토한 결과, 52번과 53번 문항 간의 공분산이 높게 나타났다. 두 문항은 모두 전문성 개발 요인(Factor 2)에 속하며, 각각 지속적 교육 및 연구 참여와 호스피스 · 완화간호 교육 참여를 측정하는 문항으로 두 문항 모두 교육 참여 역량이라는 동일한 의미 영역을 다루고 있다. 이러한 문항 간 내용적 중복과 응답자의 동일한 인식 패턴에서 기인한 방법 효과(method effect)를 고려할 때, 두 문항의 오차공분산을 허용하는 것은 이론적으로 타당한 조정으로 판단하여 공분산을 추가하였다[36,37,41]. 공분산을 추가한 결과, TLI=.90, CFI=.91로 기준(.90 이상)을 충족하여 수용 가능한 수준으로 확인되었다(Table 3). 요인 6은

Table 2. Final exploratory factor analysis (N=204)

Factor/items	Factor loading							Communality
	1	2	3	4	5	6	7	
Factor 1. End-of life care plan								
11. I am able to establish EOLC goals for patients at the EOL stage.	.90							.82
10. I am able to evaluate established nursing goals for patients at the EOL stage.	.83							.71
12. I am able to develop nursing plans based on advance care planning.	.80							.71
13. I am able to evaluate whether nursing plans based on advance care planning achieve desired outcomes.	.75							.64
Factor 2. Professional development								
53. I am able to participate in hospice and palliative care education or seminars to gain knowledge related to EOLC.		.81						.67
54. I am able to apply standard guidelines to manage pain and physical symptoms in patients at the EOL stage.		.80						.70
55. I am able to integrate a variety of knowledge types, including hospice and palliative care, when providing EOLC.		.78						.71
52. I am able to participate in continuing education and research related to EOLC.		.77						.60
Factor 3. Information provision and education								
46. I am able to explain the withholding and withdrawal of life-sustaining treatment to patients at the EOL stage and their families.			.86					.77
47. I am able to provide information about the patient's condition and appropriate nursing care to patients at the EOL stage and their families.			.80					.70
45. I am able to explain advance directives and life-sustaining treatment plans to patients at the EOL stage, their families, and other members of the relevant healthcare team.			.77					.61
48. I am able to explain changes in the conditions of patients at the EOL stage to their families.			.70					.61

(Continued on the next page)

Table 2. Continued

Factor/items	Factor loading							Communality
	1	2	3	4	5	6	7	
23. I am able to discuss the withholding and withdrawal of life-sustaining treatments with patients at the EOL stage or their families, when the patient's clinical condition worsens.			.63					.46
49. I am able to educate family members (i.e., caregivers) in advance regarding the symptoms that may occur during the EOL process.			.62					.50
Factor 4. Person-centered care and communication								
15. I am able to communicate in a way that allows patients at the EOL stage and their families to express their emotions.				−.89				.80
17. I am able to communicate with patients at the EOL stage in ways that consider their ages, values, religions, and cultural backgrounds.				−.70				.60
16. I am able to talk to patients at the EOL stage, or their families, about death and the dying process.				−.69				.50
30. I am able to identify the cultural needs (e.g., beliefs and rituals) of patients at the EOL stage and their families, and provide care accordingly.				−.67				.61
29. I am able to provide encouragement and support for patients at the EOL stage to empower them to carry out their daily activities as independently as possible.				−.65				.50
27. I am able to provide emotional, psychological, and spiritual care to promote comfort for patients at the EOL stage.				−.62				.54
Factor 5. Collaboration between team members								
19. I am able to communicate clearly and collaboratively with team members to provide effective EOLC.					−.89			.80
18. I am able to communicate and interact continuously with team members to address the needs and challenges of patients at the EOL stage and their families.					−.78			.65
20. I am able to document and share the challenges and needs of patients at the EOL stage and their families with team members.					−.78			.65
Factor 6. Resource management								
38. I am able to utilize and coordinate human and material resources to provide EOLC.						−.82		.73
37. I am able to carry out efficient task sharing with other team members during the EOLC process.						−.69		.60
Factor 7. Comprehensive symptom management								
1. I am able to continuously assess and evaluate pain and physical symptoms in patients at the EOL stage.							.73	.55
2. I am able to comprehensively assess the psychological, emotional, social, and spiritual needs of patients at the EOL stage.							.69	.52
3. I am able to perform pharmacological interventions to manage pain and physical symptoms in patients at the EOL stage.							.62	.41
5. I am able to identify and respond to physical and psychological changes during the dying process and imminent death in ways that maintain sensitivity.							.61	.41
4. I am able to perform non-pharmacological interventions to manage pain and physical symptoms in patients at the EOL stage.							.53	.41
Eigenvalue	11.81	2.23	1.90	1.69	1.29	1.14	1.01	
Explained variance (%)	39.37	7.45	6.32	5.62	4.30	3.80	3.36	
Cumulative explained variance (%)	39.37	46.82	53.13	58.748	63.04	66.84	70.21	
Kaiser-Meyer-Olkin					.90			
Bartlett's test of sphericity	χ^2=3,901.95, df=435, p<.001							

df, degrees of freedom; EOL, end-of-life; EOLC, end-of-life care.

2개 문항으로 구성되었으며, 표준화 요인부하량(λ)이 각각 .61과 .85로 양호하였고, 상호 상관이 높아 단일 요인으로 유지하는 것이 통계적으로 타당하였다(Table 4).

(4) 수렴타당도

문항간 수렴타당도는 표준화 요인부하량(λ) ≥.50, AVE ≥.50, CR ≥.70을 기준으로 검토하였다[37]. 요인부하량(λ)은 .59–.93으로 모두 .50 이상이었고, 요인부하량의 C.R.은 7.79–19.33으로 1.96 이상(p<.001)이므로 통계적으로 유의하였다. AVE 값은 .61–.86, CR는 .88–.95로 기준을 충족하여 수렴타당도가 확보되었다(Table 4). 또한 EOLC-ICU 도구와의 상관관계를 분석한 결과, 총점 간 상관계수는 .76 (p<.001)으로 높게 나타나 도구간 수렴타당도가 지지되었다(Table 5).

(5) 판별타당도

판별타당도는 요인 간 개념이 서로 분리되었는지 확인하기 위해 두 가지 기준에 따라 검토하였다[39]. 첫째, 각 요인의 AVE 값(.61–.86)은 요인 간 상관계수 제곱값(r^2=.21–.59)보다 높게 나타나 판별타당도의 기준을 충족하였다. 즉 인간 중심 돌봄과 의사소통(Factor 4)과 팀원 간 협력(Factor 5) 요인의 상관계수 제곱 값은 .59였으나, 두 요인의 AVE 값은 각 .61과 .86으로 더 높게 나타났다. 둘째, 상관계수±2×표준오차 값이 1을 포함하지 않아, 요인 간 개념이 서로 명확히 구분됨이 확인되었다(Supplementary Table 2, 3).

3) 신뢰도 검정

내적 일관성 검정 결과, 전체 도구의 Cronbach's α=.95, McDonald's ω=.95로 높게 나타났으며, 요인별 Cronbach's α=.79–.91의 범위를 보여 동질성이 확보되었다. 특히 2문항으로 구성된 제6요인의 경우 Cronbach's α=.79였고, Spearman-Brown 계수도 .79로 산출되어 수용 가능한 신뢰도가 확인되었다. 또한 검사–재검사 신뢰도 분석 결과, Pearson 상관계수 r=.56 (p<.001), ICC=.72 (95% CI, 0.51–0.84; p<.001)로, 일반적으로 .70 이상을 양호한 수준으로 간주하므로 검사–재검사 신뢰도가 확보되었다(Table 5).

4) 최종 측정도구의 요인 명명 및 확정

확인된 7개 요인은 각 요인에 포함된 문항의 의미와 특성을 반영하여 포괄적 증상관리(5문항), 생애말 간호계획(4문항), 인간 중심 돌봄과 의사소통(6문항), 자원관리(2문항), 팀원 간 협력(3문항), 정보제공과 교육(6문항), 전문성 개발(4문항)으로 명명하였다. 최종 도구는 총 30문항으로 구성된 5점 Likert 척도이며(Appendix 1), 총점은

Table 4. Confirmatory factor analysis (N=205)

Factor/item	B	SE	β	C.R. (p)	AVE	CR
Factor 1					.83	.95
11	1		.93	-		
10	0.93	0.05	.88	19.33 (<.001)		
12	0.84	0.05	.81	16.08 (<.001)		
13	0.85	0.06	.77	14.72 (<.001)		
Factor 2					.66	.88
53	1		.62	-		
54	1.29	0.14	.84	9.14 (<.001)		
55	1.23	0.13	.86	9.26 (<.001)		
52	0.95	0.10	.59	10.56 (<.001)		
Factor 3					.73	.94
46	1		.82	-		
47	0.83	0.07	.80	12.88 (<.001)		
45	0.95	0.08	.78	12.67 (<.001)		
48	0.72	0.06	.73	11.53 (<.001)		
23	0.65	0.08	.57	8.44 (<.001)		
49	0.88	0.07	.82	13.38 (<.001)		
Factor 4					.61	.90
15	1		.66	-		
17	1.18	0.13	.73	9.03 (<.001)		
16	1.00	0.13	.62	7.79 (<.001)		
30	1.05	0.13	.67	8.36 (<.001)		
29	0.98	0.12	.63	7.90 (<.001)		
27	1.15	0.13	.72	8.89 (<.001)		
Factor 5					.86	.95
19	1		.91	-		
18	0.96	0.06	.84	16.20 (<.001)		
20	0.88	0.06	.84	16.15 (<.001)		
Factor 6					.79	.89
38	1		.82	-		
37	0.80	0.07	.78	10.68 (<.001)		
Factor 7					.63	.90
1	1		.74	-		
2	0.93	0.11	.62	8.11 (<.001)		
3	0.91	0.12	.61	7.93 (<.001)		
5	0.89	0.11	.62	8.04 (<.001)		
4	1	0.11	.70	9.00 (<.001)		

AVE, average variance extracted; CR, construct reliability; C.R., critical ratio; SE, standard error.

Table 3. Fit indices of the confirmatory factor model (N=205)

Model	χ^2 (p)	χ^2/df	SRMR	RMSEA (95% CI)	CFI	TLI
Reference	>.05	≤3	<.08	≤.08	≥.90	≥.90
Hypothetical	793.73 (<.001)	2.07	.06	.07 (0.07–0.08)	.89	.88
Modified	730.01 (<.001)	1.91	.06	.07 (0.06–0.07)	.91	.90

CFI, comparative fit index; CI, confidence interval; df, degrees of freedom; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker-Lewis index.

Table 5. Convergent validity and internal consistency reliability (N=409)

Variable	Category	Factor							Total (*p*)
		1	2	3	4	5	6	7	
Convergent validity	Self-perceived EOLC competencies	.55 (<.001)	.61 (<.001)	.61 (<.001)	.64 (<.001)	.56 (<.001)	.55 (<.001)	.56 (<.001)	.76 (<.001)
Internal consistency reliability	Cronbach's α	.91	.86	.88	.85	.88	.79	.79	.95
	McDonald's ω	.90	.85	.89	.85	.88	–	.79	.95
	Spearman-Brown	–	–	–	–	–	.79	–	–
Test-retest	PCC	–	–	–	–	–	–	–	.56 (<.001)
	ICC (95% CI, *p*)	–	–	–	–	–	–	–	.72 (0.51–0.84; <.001)

Convergent validity was evaluated using Pearson's correlation coefficients (r) and corresponding p-values.
CI, confidence interval; EOLC, end-of-life care; ICC, intraclass correlation coefficient; PCC, Pearson correlation coefficient.

30–150점 범위로 점수가 높을수록 생애말 간호역량 수준이 높음을 의미한다.

고찰

급속한 고령화에 따라 생애말 간호는 삶의 질 향상과 존엄한 죽음을 위한 핵심 영역으로 부각되고 있으며, 장기요양 의료환경에서도 그 중요성이 지속적으로 강조되고 있다. 특히 요양병원은 노인성 질환 및 만성질환자가 주로 장기간 입원하는 특성을 지니고 있어 간호사의 생애말 간호역량은 환자와 가족의 삶의 질을 결정짓는 중요한 요소이다. 이에 본 연구는 요양병원 간호사의 생애말 간호역량을 체계적으로 측정할 수 있는 도구를 개발하고, 그 타당도와 신뢰도를 검정하고자 하였다. 본 연구는 선행 개념분석 연구에서 확인된 속성을 토대로 하되[23], 이를 문항 개발과 요인분석 등을 통해 7개 요인 30문항의 측정도구로 검증하였다는 점에서 단순한 개념 규명에 머물렀던 기존 연구와 차별성을 갖는다. 본 도구는 생애말 간호에 요구되는 다양한 역량을 포괄하는 동시에 요양병원이라는 특수한 간호환경을 반영함으로써 실무 적용 가능성과 활용도를 높였다는 점에서 의의가 있다. 본 논의에서는 개발된 도구의 구성 및 검정 결과를 중심으로 그 타당성과 신뢰도, 그리고 이상적 활용 가능성에 대해 고찰하고자 한다.

'포괄적 증상관리'는 통증뿐만 아니라 신체적, 심리·사회적, 정서적 및 영적 영역을 포함한 전반적인 사정과 중재를 의미하며, 이는 생애말 간호의 핵심 역량이다. 통증은 다차원적인 원인으로 발생하기 때문에 조기 식별과 관리가 주요하며, 간호사는 다양한 영역의 간호를 통합적으로 제공할 수 있는 역량을 갖추어야 한다[42]. 특히 장기 입원환자가 많은 요양병원 환경에서는 삶의 질 향상과 평온한 죽음을 맞이하기 위해 포괄적 증상관리의 역량은 필수적이라고 볼 수 있다.

'생애말 간호계획'의 요인은 포괄적 증상관리 요인과 분리되어 새로운 요인으로 도출되었다. 이는 암뿐만 아니라 다양한 만성질환을 지닌 요양병원 환자들의 복합적인 증상과 요구를 반영한 결과라고 해석된다. 이 역량은 환자와 그 가족의 요구를 파악하고 이에 따른 개별적 간호목표와 계획을 수립·평가하는 능력을 의미하며, Griffith [43]의 연구에서도 이러한 역량이 생애말 간호의 속성으로 나타나 본 연구결과와 일치하였다.

'인간 중심 돌봄과 의사소통' 요인은 생애말 간호의 주요한 역량으로, 적절한 소통은 치료적 관계를 형성하고 간호 제공을 용이하게 하지만, 미흡한 경우 환자의 의사결정과 간호 만족도에 부정적 영향을 미칠 수 있다[42,44]. 간호가 '무엇을 하는가'에 초점을 둔다면, 돌봄은 '어떻게 행하는가'에 중점을 두며[45], 인간 중심 돌봄은 대상자의 자율성과 존엄성을 존중하고 개별적 요구를 반영한 총체적 간호를 지향한다[46]. 따라서 문화적 요구와 정서적·심리적·영적 돌봄을 지원하고, 환자가 원하는 생애말 간호 목표를 달성할 수 있도록 효과적인 의사소통 역량이 요구된다.

'자원관리'는 간호사가 대상자의 다양한 요구를 효율적으로 해결하기 위해 업무를 조정하고, 인적·물적 자원을 적절히 연계·활용하는 역량을 의미한다. 생애말 과정에서는 종교적 지지, 경제적 부담 등 예기치 못한 문제가 발생할 수 있으며, 이러한 상황에서 간호사가 적절한 자원을 연결하는 것은 대상자와 그 가족의 안녕을 유지하는 데 핵심적이다. 이는 Liu와 Yuan [47]의 연구에서도 보고된 바와 같이, 생애말 간호에서 자원관리능력이 중요한 구성요소임을 보여준다. 따라서 본 연구에서 자원관리가 독립된 요인으로 도출된 결과는 이론적 타당성을 뒷받침함과 동시에 임상현장에서 간호사의 실제 역할을 구체화하는 실무적 의의를 갖는다.

'팀원 간 협력'은 간호 전달의 효율성을 높이고 생애말 간호의 질을 향상시키는 데 중요한 역할을 한다. 이 요인은 구성요소 확인 단계에서 '리더십 발휘' 속성에 포함되었던 협업 기능이 요인분석 과정에서 구체화된 결과로, 최종 도구의 문항들은 팀원과의 명확하고 협조적인 의사소통, 환자·가족 요구의 공유 및 기록, 지속적 상호작용을 반영한다. 따라서 본 연구에서 '팀원 간 협력'으로 명명된 것은 단순한 협업을 넘어 환자·가족 요구 해결을 위한 실질적 의사소통과 정보 공유를 강조한 결과라 할 수 있다. 이러한 협력 역량은 전문직 종 간 차이나 근무환경, 개인의 경험에 따라 달라질 수 있으며[48,49], 효과적인 협업을 통해 조화를 이루는 것이 요구된다[43,50]. 특히 요양병원에서는 간호보조인력을 포함한 다양한 인력이 생애말 간호에 관여하므로, 이들과의 협력은 양질의 간호 제공을 위한 핵심

요소이다[20].

‘정보 제공과 교육’은 환자와 그 가족이 죽음을 준비하고 사별을 대비할 수 있도록 돕는 중요한 간호역량이다[47]. 이를 통해 환자의 편안함을 증진하기 위해 생애말 치료 및 간호에 대한 정확하고 충분한 정보를 제공해야 하며, 가족이 의사결정을 내릴 수 있도록 지원하는 역량을 포함한다[22].

‘전문성 개발’은 생애말 간호와 관련된 정보와 지식을 습득하고 이를 실무에 적용하는 능력을 의미한다. 간호사가 스스로 역량 향상을 인식할 때, 생애말 간호 수행 중 발생하는 스트레스를 보다 효과적으로 수용하고 관리할 수 있다[47]. 선행연구에 따르면, 간호사들은 교육을 통해 생애말 환자 간호에 대한 준비도가 향상되었으며 실제로 간호 수행 역량과 질이 개선되었다고 보고하였다[42]. 따라서 전문성 개발은 환자와 그 가족뿐만 아니라 간호사 자신의 만족을 위해서도 중요한 역량이다.

이와 같은 속성을 바탕으로 요양병원 간호사의 생애말 간호역량은 환자의 요구를 포괄적으로 사정하고, 이에 따른 간호계획을 수립하며 인간 중심 돌봄을 실천하고, 효과적으로 의사소통을 하며, 생애말 시기에 환자와 그 가족이 필요로 하는 정보를 제공하고 교육하며, 자원을 효율적으로 관리하고, 팀원과 협력하며, 스스로의 전문성을 개발하는 통합적 역량이라고 할 수 있다.

개발된 도구의 타당도와 신뢰도 검증 결과에 대한 고찰은 다음과 같다.

본 연구에서는 요양병원 간호사의 생애말 간호역량을 신뢰롭고 타당하게 측정할 수 있는 도구를 개발하고자 총 409명의 자료를 바탕으로 내용타당도, 구성타당도, 수렴타당도 및 판별타당도를 검증하고 신뢰도 분석을 체계적으로 수행하였다.

내용타당도는 생애말 간호라는 복합적이고 민감한 개념의 특성을 반영하여 전문가 집단을 구성하여 2차례 반복된 검토과정을 통해 확보하였다. 이러한 전문가 검토를 통한 내용 정제는 도구의 이론적 타당성을 강화하는 핵심 절차로 간주된다[32,41].

탐색적 요인분석과 확인적 요인분석은 서로 다른 표본을 적용하여 요인구조를 교차적으로 탐색하고 검증하였으며, 이를 통해 도구의 구성타당성을 보다 엄격하고 과학적으로 입증하고자 하였다. 확인적 요인분석결과 모형의 적합도지수들은 권장기준을 충족하였고, 요인 간 상관도 또한 적절한 수준으로 확인되어 도출된 요인구조의 적합성과 구성타당성이 지지되었다. 선행연구에 따르면, 국내 간호 분야의 도구 개발은 구성타당도 검증이 주로 탐색적 요인분석에 국한되어 있으며[32], 기존 생애말 간호역량 도구[13]는 타당도 근거가 부족하다는 한계를 가진다. 이에 비해 본 연구는 교차검증을 포함한 다양한 절차를 통해 구성타당도를 체계적으로 입증했다는 점에서 의의가 있다. 특히 탐색적 요인분석 결과, 7개 요인 30문항이 도출되었으며, 누적 설명력은 70.2%로 사회과학 분야에서 권장하는 기준인 60%를 상회하였다[33].

최근 신뢰도 평가에서는 Cronbach’s α의 한계를 보완하기 위해 McDonald’s ω 활용이 강조되고 있으며[39], 본 연구에서도 이를 반영하여 전체 도구(ω=.95)와 하위 영역(ω=.79–.90) 모두에서 안정적인 내적 일관성을 확보하였다. 또한 검사–재검사 신뢰도 분석을 통해 Pearson 상관계수(r)=.56과 ICC=.72를 확보함으로써, 도구의 안정성이 입증되었다. 한편, 본 도구의 하위 영역 중 자원관리 요인은 2문항으로만 구성되었으나, Cronbach’s α와 Spearman–Brown 계수가 모두 .79로 동일하게 산출되어 수용 가능한 수준의 신뢰도가 확보되었다. 아울러 구성 신뢰도와 AVE 값 역시 기준치를 충족하여, 독립된 하위요인으로서의 수용 가능성이 검증되었다. 이는 선행연구에서도 보고된 바와 같이[40], 이론적 · 실증적 타당성이 확보된 경우 2문항 요인도 수용 가능하다는 논의와 일치한다. 그러나 본 연구에서는 다음과 같은 제한점이 있다. 첫째, 본 도구는 요양병원 간호사의 관점에서 생애말 간호역량을 도출하였으나, 실제 생애말 환자와 그 가족이 요구가 충분히 반영되었는지는 검토되지 않았다. 따라서 수혜자의 관점에서 요구되는 생애말 간호역량을 확인하는 후속 연구가 필요하다. 둘째, 개발한 도구의 실용성을 더욱 입증하기 위해 생애말 간호역량 수준이 높다고 평가되는 집단과 그렇지 않은 집단 간의 차이를 확인하는 연구가 요구된다. 셋째, 연구대상이 요양병원 간호사로 제한되어 있어, 본 도구를 급성기 병원의 임종 다빈도 부서 간호사 등 다양한 임상환경에 적용하는 데에는 한계가 있다. 따라서 본 도구가 보다 포괄적인 임상현장에서도 생애말 간호역량을 타당하게 측정할 수 있는지를 확인하기 위한 추가 연구가 필요하다.

이상의 결과를 종합하면, 본 연구에서 개발된 자가보고형 도구는 요양병원 간호사의 생애말 간호역량을 신뢰성과 타당성을 갖추어 효과적으로 측정할 수 있는 검증된 측정도구로 확인되었다. 향후 본 도구가 생애말 간호 관련 교육프로그램 개발과 임상현장 적용에 활용되어, 생애말 간호의 질 향상에 기여할 수 있을 것으로 기대된다.

결론

본 연구는 요양병원 간호사의 생애말 간호역량을 객관적으로 측정할 수 있는 도구를 개발하고, 그 타당도와 신뢰도를 검증하였다. 개발된 도구는 포괄적 증상관리, 생애말 간호계획, 인간 중심 돌봄과 의사소통, 자원관리, 팀원 간 협력, 정보 제공과 교육, 전문성 개발의 7개 요인, 총 30문항으로 구성되었다. 본 도구는 특수한 간호환경에서 요구되는 생애말 간호역량을 다차원적으로 반영하고 있다. 특히 탐색적 및 확인적 요인분석을 통해 이론적 구조를 정교하게 검증하였고, 내적 일관성과 검사–재검사 신뢰도를 통해 도구의 동질성과 안정성을 확보함으로써 측정의 신뢰성을 확보하였다. 따라서 본 연구에서 개발된 측정도구는 생애말 간호역량을 신뢰롭고 타당하게 측정할 수 있는 유용한 도구로, 생애말 간호역량 수준을 객관적으로 평가하는 데 그치지 않고, 임상실무, 간호 교육, 정책 개발 등 다양한 영역에서 폭넓게 적용될 수 있을 것이다.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Please contact the corresponding author for data availability.

Supplementary Data

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Appendix 1. End-of-life care competency scale for nurses in long-term care hospitals

번호	문항("나는 OO 할 수 있다.")	전혀 그렇지 않다	그렇지 않다	보통이다	그렇다	매우 그렇다
1	생애말 환자의 통증 및 신체 증상을 지속적으로 사정하고 평가할 수 있다.	1	2	3	4	5
2	생애말 환자의 심리 · 정서적, 사회적, 영적 측면을 포괄적으로 사정할 수 있다.	1	2	3	4	5
3	생애말 환자의 통증 및 신체 증상을 조절하기 위해 약물 중재를 수행할 수 있다. (예, 마약성 진통제, 항전간제, 항우울제 등)	1	2	3	4	5
4	생애말 환자의 통증 및 신체 증상을 조절하기 위해 비약물 중재를 수행할 수 있다. (예, 온요법, 냉요법, 맛사지, 이완요법 등)	1	2	3	4	5
5	임종기 과정 및 임박한 임종에서 나타나는 신체적, 정신적 변화 등을 민감하게 식별하여 대처할 수 있다.	1	2	3	4	5
6	생애말 환자에 대한 생애말 간호목표를 수립할 수 있다.	1	2	3	4	5
7	생애말 환자에 대한 수립되어 있는 간호목표를 평가할 수 있다.	1	2	3	4	5
8	사전치료계획에 따라 간호계획을 수립할 수 있다.	1	2	3	4	5
9	사전치료계획에 따라 수립된 간호계획의 결과를 평가할 수 있다.	1	2	3	4	5
10	생애말 환자와 그 가족이 자신의 감정을 표현할 수 있도록 소통할 수 있다.	1	2	3	4	5
11	생애말 환자 또는 그 가족과 죽음 및 죽어감에 대해 이야기할 수 있다.	1	2	3	4	5
12	생애말 환자의 연령, 가치관, 종교 및 문화적 배경에 맞추어 의사소통을 할 수 있다.	1	2	3	4	5
13	생애말 환자가 편안할 수 있도록 정서적, 심리적, 영적 돌봄을 제공할 수 있다.	1	2	3	4	5
14	생애말 환자가 가능한 한 스스로 일상생활을 할 수 있도록 격려와 지지를 제공할 수 있다.	1	2	3	4	5
15	생애말 환자와 그 가족이 지닌 문화적 요구(신념, 문화적 의식)를 확인하여 그에 맞는 돌봄을 제공할 수 있다.	1	2	3	4	5
16	생애말 간호 과정에서 팀원들과 효율적인 업무분담을 수행할 수 있다.	1	2	3	4	5
17	인적·물적 자원을 활용하고 연계하여 생애말 간호를 제공할 수 있다.	1	2	3	4	5
18	생애말 환자와 그 가족의 요구나 문제를 해결하기 위해 팀원들과 지속적으로 소통하고 교류할 수 있다.	1	2	3	4	5
19	생애말 간호를 효과적으로 제공하기 위해 팀원들과 명확하고 상호 협조적으로 의사소통을 할 수 있다.	1	2	3	4	5
20	생애말 환자와 그 가족의 문제나 요구를 기록하여 팀원들 간에 공유할 수 있다.	1	2	3	4	5
21	생애말 환자의 임상적 상태가 악화될 때 연명치료 중단과 유보에 대해 환자 또는 그 가족과 논의를 할 수 있다.	1	2	3	4	5
22	생애말 환자와 그 가족, 팀원들에게 사전연명의료의향서와 연명의료계획서에 대해 설명할 수 있다.	1	2	3	4	5
23	생애말 환자와 그 가족에게 연명치료 중단과 유보에 대해 설명할 수 있다.	1	2	3	4	5
24	생애말 환자와 그 가족에게 환자의 상태와 그에 맞는 간호내용에 대한 정보를 제공할 수 있다.	1	2	3	4	5
25	가족에게 생애말 환자의 상태변화를 설명할 수 있다.	1	2	3	4	5
26	가족(보호자)들에게 임종기 과정에서 나타날 수 있는 증상에 대하여 사전에 교육할 수 있다.	1	2	3	4	5
27	생애말 간호와 관련된 보수교육과 연구에 참여할 수 있다.	1	2	3	4	5
28	생애말 간호와 관련된 지식을 얻기 위해 호스피스완화간호 교육이나 세미나 등에 참여할 수 있다.	1	2	3	4	5
29	생애말 환자의 통증 및 신체적 증상을 조절하기 위해 표준지침을 적용할 수 있다. (임종돌봄임상지침)	1	2	3	4	5
30	생애말 간호 제공 시 호스피스완화 간호뿐만 아니라 다양한 지식을 통합할 수 있다.	1	2	3	4	5

역문항 없음. 요인별 문항 번호: 포괄적 증상관리: 1, 2, 3, 4, 5 ; 생애말 간호계획: 6, 7, 8, 9 ; 인간중심돌봄과 의사소통: 10, 11, 12, 13, 14, 15; 자원관리: 16, 17; 팀원 간 협력: 18, 19, 20;정보제공과 교육: 21, 22, 23, 24, 25, 26; 전문성 개발: 27, 28, 29, 30.

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Validity and reliability of the Security Neglect Subscale of the Child Neglect Scale in vulnerable Chinese children: a methodological study

Zexi Su

School of Social Development, Shandong Women's University, Jinan, China

RESEARCH PAPER

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Corresponding author:
Zexi Su
School of Social Development,
Shandong Women's University, Jinan
Shandong 250030, China
E-mail: 18733909575@163.com

Purpose: Security neglect is common among vulnerable children. The Child Neglect Scale (CNS) is widely used to screen children for neglect. However, little is known about the accuracy of the Security Neglect Subscale when administered in isolation. This study aimed to examine the reliability and validity of the Security Neglect Subscale of the CNS among vulnerable children in China.

Methods: Cluster sampling was used, and 242 vulnerable children participated in the study. Data were analyzed using IBM SPSS ver. 28.0 and Amos ver. 28.0, and the test construct validity of the CNS Security Neglect Subscale was analyzed through confirmatory factor analysis. In addition, convergent and discriminant validity, as well as reliability, were evaluated.

Results: The construct validity of the nine-item CNS Security Neglect Subscale was confirmed by a two-factor structure. The modified model fit the data well, as shown by a normed chi-square of 2.48, a comparative fit index of .97, a Tucker-Lewis index of .96, and a root mean square error of approximation of .08. The model had acceptable convergent and discriminant validity for each structure. The Cronbach's α coefficient was .87 overall, and values for the two factors ranged from .78 to .93.

Conclusion: The findings of this study support the satisfactory psychometric properties of the CNS Security Neglect Subscale, indicating its utility in evaluating security neglect in vulnerable children in China.

Keywords: Child abuse; Reproducibility of results; Validation study

Introduction

Neglect is frequently characterized as the failure to meet essential needs [1]. Childhood neglect is prevalent in all societies as an adverse childhood experience. Previously, the concept of child neglect has lacked a uniform operational definition. The definition of neglect may be related to the type of neglect, severity, duration, or even to the age of the child [2]. In recent years, several researchers have suggested that defining the concept of child neglect should be informed by child development theory. Child development theory suggests that children have specific developmental needs at different stages of growth, and that if these needs are not met, they will be hindered from adapting smoothly across developmental stages. Therefore, in this study, neglect is considered to be when a child's fundamental physical or psychological needs are not met, resulting in a risk of harm or less-than-optimal development [3]. Child neglect exerts profound and enduring adverse effects on minors' developmental outcomes [4]. In previous research, neglect and abuse often appeared together, or neglect was used as a category of abuse [5]. Today, however, many researchers believe neglect should be distinguished from abuse and should be given adequate attention [6]. The consequences of neglect are more insidious than those of abuse and are a more pervasive form of victimization [7]. Childhood neglect exposure elevates lifelong vulnerability to multisystemic impairments spanning physical health, psychological

functioning, and social adaptation [8].

Safety is a crucial aspect of children's needs [9]. Children are more vulnerable to environmental risks than adults. Creating a safe physical environment is crucial for children. It affects their development over time and protects them from the immediate risk of accidental injury. Accidental injury is the leading cause of disability and death in children. Most of these deaths are preventable [3]. Children may be unable to recognize risks or make informed choices to protect their health, unlike adults [10]. The World Health Organization states that environmental hazards can exist wherever children live, play and learn [11]. Moreover, vulnerable children exposed to multiple suboptimal physical and social environments may face more significant safety threats [12]. The United Nations Convention on the Rights of the Child states that children must have the opportunity to grow and develop in the healthiest and safest environment possible (Article 6) and that children should be adequately protected by their guardians. Children exposed to the best possible physical and social environment from an early age have a better chance of growing up healthy and happy. Adverse early childhood experiences are significantly associated with poor health outcomes, lower educational achievement, economic dependence, heightened risks of violence and criminal behavior, as well as substance abuse and depression [13]. Moreover, these can increase the burden and costs to society, including the health system [13]. Because of the implications of security neglect for areas such as child health and public health, nurses must conceptualize and measure security neglect when counselling children, especially vulnerable children.

While high-quality, evidence-based assessments are fundamental to good practice and crucial for measuring security neglect, few validated tools currently exist specifically for this purpose [14]. A global systematic review conducted by the UK's National Institute for Health and Care Excellence (NICE) of guidance on child abuse and neglect found no high-quality evidence to demonstrate the predictive validity of existing assessment tools for identifying neglect [15]. A study found that only the Child Neglect Index (CNI) and a modified version of the Maltreatment Classification System (MMCS) met the inclusion criteria after a systematic search for child neglect measurement tools [9]. The CNI was found to be short and easy to use, but did not cover all situations. The MMCS was also noted to have flaws, and some researchers felt that it was time-consuming and difficult to administer practically, and not worth testing [9].

Chinese scholars have created several tools to assess child neglect. The Childhood Trauma Questionnaire (CTQ), developed by Bernstein and Fink [16] in 1998, is one of the most recognized instruments in the world for measuring childhood maltreatment. In 2004, Chinese scholars revised the Chinese version of the CTQ to measure child abuse and neglect in China, including emotional neglect and physical neglect [17]. Although the Chinese version of the CTQ showed good reliability and validity [18], it only has 10 items to assess neglect, which may not be able to describe the complete picture of child security neglect. Yang [6] developed the Chinese Cultural Context-Based Child Neglect Scale (CNS), which consists of four subscales: security neglect, physical neglect, communication neglect, and emotional neglect. Security neglect has been defined as ignoring safety hazards in a child's development and living environment. The CNS has been used to evaluate child neglect in several Chinese studies and has good reliability and validity [19]. The CNS has a total of 38 items and is used to assess neglect experienced by children. The full version of the CNS is time-consuming to examine. The Security Neglect subscale can help caregivers and researchers closely monitor and quickly track child security neglect. Researchers have also found a two-factor structure or dimensionality characteristic of the CNS Security Neglect Subscale [6]. However, the psychometric properties of the CNS have not been validated for use in a group of vulnerable children. Some items in the original scale must be revised to accommodate vulnerable children. In addition, the reliability and validity of the Secure Neglect Subscale when administered alone have not been examined.

Therefore, this study aimed to test the validity and reliability of the CNS Security Neglect Subscale among vulnerable children. The results will provide evidence for future research to measure and understand the status and future development of child security neglect among vulnerable children.

Methods

1. Study design

This study examined the validity and reliability of the Child Security Neglect Subscale in the psychometric measurement to determine whether the scale can be used in research with vulnerable children.

2. Setting and sample

The data of this study were collected from July to October 2024. There are five cooperating counties in Shandong Province, China, for the Vulnerable Child Assessment Programme from which we randomly chose, by cluster sampling, a particular county. This

study surveyed all vulnerable children registered with the government in this county. We collected survey responses that included 253 vulnerable children.

Inclusion criteria for all participants were (1) age 5–18 years; (2) normal cognitive development and ability to understand Chinese; and (3) consent to participate in the study. Following screening, 11 ineligible participants were excluded (six did not complete the survey, and five had intellectual disabilities that prevented them from answering the questionnaire). The group that withdrew from the study was not significantly different from the current study sample in terms of age and gender. Ultimately, data from a total of 242 participants were included in the statistical analyses. Evidence from cognitive science indicates that children can fulfil the requirements for answering questionnaires [20]. At the age of 5, children are already able to describe internal mental states, including perceptual, emotional, cognitive, and physiological states [21]. This critical stage is the ideal time for early intervention services to prevent subsequent developmental problems. Therefore, the criteria for sample inclusion in this study were set at 5–18 years of age. If any participant was too young to fully understand the questions, the interviewers would proactively interpret the questions for them. According to the recommendations by Costello and Osborne [22] for determining sample size for confirmatory factor analysis, the item ratio of a 20:1 sample has higher accuracy, and our sample size met this criterion.

3. Instruments

The CNS is a retrospective self-report scale to evaluate neglect of children. It includes emotional neglect, security neglect, physical neglect, and communication neglect. Security neglect is defined as the neglect of safety hazards in the environment in which a child is growing up and living, thereby placing the child at risk of health and life hazards. It is scored on a 4-point Likert scale (from '1=none' to '4=always'), with higher scores indicating more severe neglect. In the original study, the scale had an overall Cronbach's α coefficient of .85, a split-half coefficient of .81, and a retest coefficient of .89. In previous studies, the CNS had good reliability and validity in research samples among Chinese children [6].

The Security Neglect Subscale, which is the focus of this study, was analyzed to assess the presence of some safety hazards in the child's growing environment due to the guardian's negligence, which may lead to a risky situation for the child. There were nine items containing two factors (e.g., Parents told me to be careful when crossing the street; Parents told me how to do when I am in danger locked me up alone in the house; ignored by my parents when telling them that my peers were bullying me). Some of the items were revised to accommodate groups of vulnerable children (by replacing "parents" with "guardians" in items 1, 2, 3, 4, 6, and 8). Items 1, 2, 3, 4, and 6 are reverse scored.

4. Data collection

Firstly, the researcher contacted the local government and established a cooperative relationship. After fully explaining the purpose of the study, the questionnaire was submitted to the local government, and a trial survey was conducted. Thirty vulnerable children were randomly selected as a sample, and the researcher further revised and improved the questionnaire after analysis, according to which a specific implementation plan was formulated. It then entered the formal survey phase. Data were collected through face-to-face interviews. Before the interviewers collected the data, the researcher trained them in uniformity and standard instructions during the interview process, controlling the interview time and data checking and entry after the information collection was completed.

5. Data analysis

IBM SPSS ver. 28.0 and IBM SPSS AMOS ver. 28.0 statistical software (IBM Corp.) were used to analyze the data. Firstly, item analyses were performed. Normality was evaluated using skewness and kurtosis coefficients, with absolute values below 3 for skewness and below 10 for kurtosis serving as the criteria for all variables [23]. Item contribution was assessed by analyzing the item-total correlation (≥.30) [24].

Confirmatory factor analysis (CFA) assessed the scale's construct validity. Kaiser-Meyer-Olkin (KMO) and Bartlett's test were used to assess the suitability of the data for factor analysis [23]. CFA is suitable for applying instruments with a defined factor structure based on theoretical foundations to examine new populations. As recommended by Hu and Bentler [25], CFA uses normed chi-square (χ^2/degrees of freedom [df]), comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA) to assess model fit. Acceptable fit was indicated by χ^2/df ≤3.0, RMSEA ≤.08, GFI ≥.90, NFI ≥.90, CFI ≥.90, and TLI ≥.90 [26].

The items' convergent validity was assessed using average variance extracted (AVE) and composite reliability (CR). The criteria for satisfactory convergent validity were set at AVE ≥.50 and CR ≥.70 [27]. Item discriminant validity was determined by comparing the AVE values to the squared values of the correlation coeffi-

cients for each subdomain of the Security Neglect Subscale [28].

Cronbach's α coefficient assessed the tool's internal consistency reliability, with coefficients >.70 considered sufficient [29]. In this study, $p<.05$ indicates statistical significance.

6. Ethical considerations

This study has been authorized by the original developers of the CNS tool. Ethical approval for this study was granted by the Institutional Review Board at Shandong Women's University (approval no., sdwu-20240506-01). This study obtained cooperation with the local government through which the survey was conducted, and the final data was obtained. The researcher submitted the questionnaire to the government staff before data collection. After reviewing the questionnaire and receiving approval from the researcher's organization and the government where the survey was conducted, the questionnaire and procedures of this study were safe for the participants. Written informed consent was obtained from participants and their guardians.

Results

1. Participants' characteristics

Of these participants, 134 (55.4%) were boys and 108 (44.6%) were girls. Regarding educational level, the majority of participants, 43%, were enrolled in primary school and below, followed by junior high school (33.1%) and senior high school (18.6%). Among the vulnerable children, 30 (12.4%) were from intact families, 114 (47.1%) were from single-parent families, and 49 (20.2%) were orphans (Table 1).

2. Item analysis

The skewness of the items ranged from −2.87 to −1.42, and the kurtosis ranged from 1.23 to 9.30. The absolute value of the skewness was less than 3, the absolute value of the kurtosis was less than 10, and the items met normality. The corrected item-total correlation coefficients ranged from .41 to .74, so no items were deleted (Table 2).

3. Validity

1) Construct validity

The KMO was .85, and Bartlett's sphericity test was significant (χ^2=1,330.02, $p<.001$), indicating suitability for factor analysis. The CFA model of the measurements was fitted to the data (Table 3). The Security Neglect Subscale is composed of nine items in two dimensions. The results of the CFA were as follows: χ^2/df=3.42,

Table 1. Descriptive characteristics of participants (N=242)

Characteristic	Category	N (%)
Gender	Women	108 (44.6)
	Men	134 (55.4)
Age (yr)	5–12	113 (46.7)
	13–18	129 (53.3)
Education	Primary school or less	104 (43.0)
	Junior school	80 (33.1)
	High school	45 (18.6)
	Dropout	2 (0.8)
	Missing	11 (4.5)
Family type	Complete family	30 (12.4)
	Orphan	49 (20.2)
	Single-parent family	114 (47.1)
	Step-family	3 (1.2)
	Others	36 (14.9)
	Missing	10 (4.2)

Table 2. Item-analysis

Item	M±SD	Corrected item-total correlation
1. Guardians gave me some information about safety.	3.53±0.70	.71
2. Guardians told me to be careful about water, electricity, and fire.	3.55±0.69	.74
3. Guardians told me to be careful when crossing the street.	3.53±0.73	.74
4. Guardians told me what to do when I'm in danger.	3.61±0.65	.71
5. Nobody is at home to take care of me or to protect me.	3.74±0.67	.43
6. Guardians warned me not to play with matches, lighters, knives, or sharp things.	3.77±0.58	.48
7. Guardians locked me in the house alone.	3.67±0.64	.70
8. Guardians ignored me when told I was being bullied by my peers.	3.75±0.70	.51
9. When I was a child, I was often left alone by myself.	3.74±0.63	.41

SD, standard deviation.

Table 3. Results of model fit tests for different models

Model	MI	χ^2/df	RMSEA	IFI	TLI	CFI
Original model		3.42	.10	.95	.93	.95
Error covariance model for items 1 and 2	11.22	2.73	.08	.97	.95	.97
Error covariance model for items 2 and 3	10.51	2.48	.08	.97	.96	.97

CFI, comparative fit index; IFI, incremental fit index; MI, modification index; RMSEA, root mean square error of approximation; SRMR, standardized root mean squared residual; TLI, Tucker-Lewis index.

NFI=.93, TLI=.93, CFI=.95, and RMSEA=.10. However, among the model fit indices, the RMSEA values were not met. To improve the model fit, this study confirmed the error term's modification index and set the covariance between items 1 and 2, 2 and 3. As a result, the CFA model fitted the data very well: χ^2/df=2.48, NFI=.96, TLI=.96, CFI=.97, and RMSEA=.08.

2) Convergent validity

This study assessed the convergent validity of items in the Security Neglect Subscale (Table 4). The standardized factor loadings of the modified model ranged from .60 to .91. Additionally, the AVE values for each dimension were .73 and .48, respectively, and the CR values were .79 and .93, respectively. The AVE value for the security neglect dimension was slightly less than .50. Although the AVE for the security neglect dimension fell marginally below the conventional threshold of .50, a more conservative assessment of the scale's internal structure supported the adequacy of convergent validity when CR exceeded .60 [30].

When the two factors' AVE values were compared to the squared correlation coefficients (r^2=.15), the AVE values were greater. These findings provide evidence that the subscales have good discriminant validity.

3) Reliability

Internal consistency reliability was verified by calculating Cronbach's α coefficient. The Cronbach's α coefficient for the nine items of the Security Neglect Subscale was .87, and for the two factors, it was .78 and .93, respectively.

Discussion

This study validated the validity and reliability of the CNS Security Neglect Subscale in vulnerable children. The original scale was revised to accommodate vulnerable children. The psychometric properties were assessed in 242 children aged 5–18. The results showed that the 9-item CNS Security Neglect Subscale had good validity and reliability in assessing the security neglect status of vulnerable children in China. The use of this instrument may contribute to a full understanding of vulnerable child security neglect, leading to positive outcomes for children's subsequent development. The CNS Security Neglect subscale demonstrates significant advantages over existing measurement tools. Through self-reports from a child's perspective, groups of vulnerable children experiencing security neglect are quickly identified using concise question items. This facilitates timely intervention or referral for services.

In this study, the wording was carefully considered to ensure the appropriateness of the tool in order to accommodate the vulnerable child population. For example, the key consideration was that a significant proportion of vulnerable children have incomplete family structures, so we changed the subject of neglect in the original scale from parents to guardians. The CFA was used in this study to confirm the structural validity of the Security Neglect Subscale. The two-factor structure remained stable in the group of vulnerable children, and the fit was fundamentally satisfactory. The present study model fit was improved by allowing correlated measurement errors. This strategy has been used in many studies [31,32]. Model fit indices are reported both prior to and following correlated error incorporation to clarify inter-model differences. The factor loadings for all items in this study ranged between .60 and .91. These findings are consistent with the original study of this tool [6].

AVE and CR were additionally examined to verify items' accurate and consistent representation of their target constructs. While security neglect's AVE fell marginally below the recommended threshold, satisfactory CR values confirmed adequate convergent validity for its items. Discriminant validity was also tested through CFA methods and supported in the current study.

The internal consistency of the Security Neglect Subscale was assessed using the Cronbach's α coefficient. The subscale and both factors in the current study showed good internal consistency (Cronbach's α coefficients of .78 and .93). Item-total correlations were also calculated to determine the relationship between items and scale scores. It is recommended that item-total correlations for items should be above .20 [33]. In the present study, item-total correlations ranged between .41 and .74, which indicates sufficient internal consistency of the scale.

Although hidden, child neglect is closely linked to children's

Table 4. Convergent validity test

Domain	Estimate	SE	*p*	CR	AVE	Cronbach α	Inter-subscale correlation
Factor 1				.93	.73	.93	.39
1	0.87						
2	0.88	0.05	<.001				
3	0.91	0.06	<.001				
4	0.82	0.05	<.001				
7	0.78	0.06	<.001				
Factor 2				.79	.48	.78	
5	0.68						
6	0.75	0.11	<.001				
8	0.60	0.12	<.001				
9	0.74	0.11	<.001				
Total						.87	

AVE, average variance extracted; CR, composite reliability; SE, standard error.

functional development [3]. This study clarifies whether vulnerable children are neglected and to what extent during interventions. Such insights help monitor guardianship status and guide efforts to improve guardians' safety literacy [34], reducing unintentional injuries [35] and unlawful abuse [35,37]. Nurses, as the largest healthcare professional group within the field of child and family care, offer fresh perspectives for advancing public health solutions to child neglect [38]. Universal screening through comprehensive health services (i.e., screening all families at primary healthcare facilities) can eliminate the stigma associated with selective screening [39], reduce the likelihood of overlooking high-risk families, and facilitate early identification of patient needs using concise psychosocial tools. When risks or adverse effects are identified, it is crucial to take decisive action to protect children. This may involve follow-up when situations are ambiguous and collaborating with other professionals, such as social workers, when additional family support is deemed necessary. If vulnerable children reach a critical level of harm, nurses may report cases of neglect to child protection services. Nurses play a pivotal role in public health responses, and this study provides healthcare practitioners with a concise screening tool to support their professional practice.

There are some limitations to this study. Firstly, this study did not validate the retest reliability of the tool. We could not find participants again because the data came from a collaboration with the government to collect data. Future studies should validate the instrument's consistency by assessing its retest reliability. Second, this study was conducted in a county in Shandong Province, China. However, there is a great deal of variation between regions in China and a large population. Whether the findings of this study can be generalized to vulnerable children in other regions needs to be validated in future studies. Third, the final model incorporated correlated error terms. Future studies should streamline items with content redundancy.

Conclusion

The present study confirms that the CNS Security Neglect Subscale is a valid and reliable instrument for assessing the security neglect status of vulnerable children. Our findings confirm two factors in the CNS Security Neglect Subscale. Researchers can adopt intervention strategies according to the level of security neglect. In the future, it is necessary to validate the reliability and validity of the Security Neglect Subscale with larger sample sizes and to broaden our understanding of the impact of security neglect on vulnerable child health outcomes.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

Please contact the corresponding author for data availability.

Author Contributions

Zexi Su conceived and designed the study, analyzed the data, and wrote the entire manuscript.

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A qualitative exploration of acute stroke patients' experiences with aphasia in Korea

Jiyeon Kang[1], Hyunyoung Heo[2]

[1]College of Nursing, Dong-A University, Busan, Korea
[2]Stroke Care Unit, Dong-A University Hospital, Busan, Korea

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Corresponding author:
Hyunyoung Heo
Dong-A University Hospital, 26 Daesingongwon-ro, Seo-gu, Busan 49201, Korea
E-mail: auvoir@naver.com

Purpose: This study aimed to explore the lived experiences of patients with acute stroke-related aphasia within the Korean healthcare context.

Methods: A qualitative research design using inductive content analysis was employed, following the Consolidated Criteria for Reporting Qualitative Research guidelines. Fourteen adults with acute stroke-related aphasia participated in one-on-one, in-depth interviews conducted between January and May 2025. Participants were recruited through purposive sampling until theoretical saturation was reached. Data were analyzed using an inductive qualitative content analysis approach.

Results: Five main categories emerged: "suddenly trapped in silence" described the abrupt loss of language, including the inability to articulate intended words and understand others; "emotional impact" captured psychological shock and feelings of loss; "communication crisis" encompassed expressive difficulties, exclusion from decision-making, and social withdrawal; "patient-centered interaction" highlighted supportive communication, empathic care, and active engagement by others; and "emerging hope" reflected signs of recovery, self-directed efforts, and anticipation of improvement. These categories converged into the overarching theme, "communication beyond language," illustrating how patients sought meaningful interaction despite linguistic limitations.

Conclusion: Acute aphasia extends beyond a language disorder to encompass profound emotional and social experiences. Although communication barriers exist, meaningful interaction remains possible through empathetic, person-centered approaches. Healthcare professionals should recognize that patients with aphasia retain cognitive competence despite expressive limitations. These findings underscore the need to integrate emotional sensitivity into clinical care and to develop training programs that enhance person-centered communication skills in stroke rehabilitation settings.

Keywords: Acute stroke; Aphasia; Communication; Patient-centered care; Qualitative research

Introduction

Stroke represents a major public health burden worldwide. The World Stroke Organization estimates that almost 12 million people experience a new stroke each year and that one in four adults aged ≥25 years will suffer a stroke during their lifetime [1]. In Korea, the number of stroke patients increased by approximately 7.5%, from 607,862 in 2020 to 653,275 in 2024 [2], reflecting an aging population and improved survival rates.

Aphasia is one of the most disabling consequences of stroke, resulting from damage to language-dominant cortical and subcortical regions. Patients may experience difficulties with speaking, understanding, reading, writing, and symbol recognition [3]. Analysis of more than 4 million admissions for acute ischemic stroke in the US National Inpatient Sample revealed that 16.9% of patients had aphasia, with the proportion having increased from 13.3% in 2003 to 21.9% in 2014 [4]. A recent meta-analysis of 36 studies involving 31,058 patients reported an overall prevalence of post-stroke aphasia of 34% [5]. Data on the prevalence of aphasia in Korea remain scarce. A 2022 analysis of the Korean Stroke Cohort for Functioning and Rehabilitation

found that 46.5% of stroke survivors reported experiencing communication impairments, including aphasia, 6 months after stroke onset [6]. Aphasia is associated with higher mortality rates, longer hospital stays, and increased healthcare costs [4]. Individuals with aphasia are also more likely to experience post-stroke depression; in one cohort study, the odds of depressive symptoms were over seven-fold higher in people with aphasia compared to those without [7]. Loss of language function impairs social participation and return to work, contributing to social isolation and anxiety [8].

Although spontaneous recovery occurs, language recovery is often incomplete. Prospective studies indicate that stroke survivors regain approximately 70% of their maximal potential language function within 90 days [9], with the most rapid improvements occurring within the first 2 weeks [10]. Despite this recovery pattern, many patients in the acute phase have a limited understanding of their condition and receive insufficient information about communication strategies, which hampers interactions with healthcare professionals [11]. A recent audit by the Australian Stroke Foundation, involving 3,122 patients with aphasia across 126 hospitals, reported that while those requiring interpreters had similar access to care, they were less likely to have their mood assessed, experienced longer median hospital stays, received more caregiver training, and were less likely to achieve independence at discharge [12]. These findings illustrate how communication difficulties can compromise the quality of acute care and discharge outcomes.

Although qualitative studies have begun to explore the experiences of individuals with post-stroke aphasia, most have focused on communication barriers in general. Carragher et al. [13] highlighted patients' frustration at being perceived as cognitively impaired through the theme "I am not mad, I am not deaf," while Loft et al. [14] emphasized patients' desire to be treated as equal human beings by healthcare professionals. However, these studies did not comprehensively address the broader range of challenges faced by patients during the acute phase. Furthermore, in Korea, stroke research has predominantly focused on physical disabilities, with limited investigation of the subjective experiences of patients with aphasia, particularly during the acute stage. Existing Korean studies have analyzed experiences of chronic aphasia [15] or healthcare providers' perspectives on communicating with aphasic patients [16], but there remains a significant gap in research investigating the communication difficulties and actual needs of patients with acute aphasia.

Given these research gaps, we conducted a qualitative content analysis to comprehensively explore the lived experiences of patients with acute post-stroke aphasia in Korea. Qualitative content analysis enables systematic coding and thematic interpretation of participants' narratives, providing valuable insights when prior knowledge is limited [17,18].

The purpose of this study was to gain an in-depth understanding of the experiences of patients with acute stroke-related aphasia in the Korean healthcare context. By illuminating these experiences from the patients' perspective, this study seeks to inform healthcare professionals and contribute to the development of more patient-centered care approaches for individuals with acute aphasia. Our research question was: "What are the experiences of patients with acute stroke-related aphasia during their hospitalization?"

Methods

1. Study design

This study employed a qualitative content analysis approach. We adhered to the 32-item Consolidated Criteria for Reporting Qualitative Research checklist [19].

2. Participants

Fourteen adults with acute stroke-related aphasia who were admitted to a university hospital in Busan participated in this study. The acute phase of stroke was defined as within 7 days after onset [20]; participants were identified during this period, but interviews were conducted once their communication abilities had sufficiently improved to allow participation.

The inclusion criteria were as follows: (1) age ≥19 years; (2) ability to express thoughts and experiences through verbal or nonverbal means (e.g., gestures, writing, or simple speech despite residual impairments such as dysarthria); and (3) capacity to understand the study purpose and provide informed consent. Patients with residual language impairments were included to reflect the diversity of aphasia experiences and enhance representativeness. We excluded individuals with a history of aphasia prior to the current stroke or with pre-existing cognitive impairment.

Participants were recruited through purposive sampling. One author screened potential participants by observing patients in the stroke intensive care unit and reviewing medical records. Brief conversations were conducted to assess whether participants could communicate sufficiently for an interview. We aimed for variation in age, gender, and aphasia type. Eligible candidates received detailed information about the study and provided written informed consent.

Data collection and analysis proceeded iteratively. We began with purposive sampling and subsequently employed theoretical sampling and constant comparative analysis, selecting each new participant based on insights from prior interviews. After the ninth interview, content began to recur; by the 13th interview, no new codes had emerged. In qualitative research, data saturation is achieved when additional data provide little or no new information [21]. Following this principle, we determined that saturation had been reached and concluded enrollment after the 14th interview.

3. Data collection

Data were collected between January and May 2025 through one-to-one in-depth interviews. A semi-structured format was adopted to ensure interviews covered key topics while allowing participants to share their stories in their own words. Prior to each interview, the interviewer met with participants to explain study objectives, obtain informed consent, and establish rapport. Building trust and creating a comfortable atmosphere were essential for obtaining honest and rich accounts; this involves attentive listening, demonstrating genuine interest and empathy, and explaining the research purpose without judgment.

Most participants were interviewed once; follow-up interviews were conducted when clarification or elaboration was needed. Interviews lasted 30–50 minutes and were conducted at the participants' current location of care. For patients in the intensive care unit, interviews were conducted at the bedside with careful attention to safety and patient stability. For patients who had been transferred to general wards, interviews were conducted at locations preferred by the participant, such as at the bedside, in lounge areas, or in private conference rooms. One participant (Participant 3) who had been discharged was interviewed in a conference room adjacent to the stroke intensive care unit during their outpatient follow-up visit, as requested by the participant. All interview locations were chosen to ensure privacy and comfort.

The semi-structured interview guide began with broad, open-ended questions such as "Can you describe what it was like when you first lost your speech?" and "What challenges are you experiencing now?" or "What challenges did you experience when you were in the hospital because of aphasia?" for the discharged patients. The interview then explored more specific aspects, including difficulties in daily activities, support systems, and perceived improvements. The interviewer employed follow-up questions and probes tailored to participants' responses while maintaining a neutral stance to encourage unrestricted disclosure (Figure 1).

When verbal communication was challenging, participants were encouraged to use writing or gestures; family members' statements were considered supplementary information, depending on the participant's communication ability. During each interview, the interviewer documented brief field notes to capture non-verbal cues such as facial expressions, body language, mood, and the overall environment.

Interviews were audio-recorded using two digital recorders with participants' permission. Recorded content was transcribed verbatim using an artificial intelligence transcription program, ClovaNote (Naver). Transcripts were verified against the recordings to ensure accuracy, and field notes were used to contextualize the data during analysis.

4. Data analysis

Data were analyzed using inductive qualitative content analysis, following the approach described by Graneheim and Lundman [17]. Initially, two researchers read and reread each verbatim transcript to grasp the overall narrative, then divided the text into meaning units—words, phrases, or sentences that reflected participants' experiences of aphasia. These meaning units were condensed to shorten the text while preserving core meaning and labeled with codes. Codes with similar content were grouped into subcategories, which were further clustered into broader categories based on shared characteristics. Finally, we constructed overarching themes that conveyed the potential meaning of the categories.

Qualitative content analysis is inherently iterative and reflexive [18]; therefore, researchers continually revisited transcripts, meaning units, codes, and categories, refining them as new data were collected. Each interview was analyzed within 1 week of completion so that emerging insights could inform subsequent interviews. Preliminary categories and themes were presented to three nurses with more than 5 years of experience in stroke intensive care to obtain peer feedback, which helped verify that findings resonated with clinical experience.

5. Rigor

To ensure the trustworthiness of our qualitative findings, we applied the criteria of credibility, dependability, and transferability as articulated by Lincoln and Guba [22] and elaborated by Graneheim and Lundman [17].

Credibility was addressed through purposive sampling that

Interview guide
Introduction (5–10 minutes) • Explanation of research purpose and interview process • Consent for recording and assurance of anonymity • Simple questions to create a comfortable atmosphere **Main interview (30–45 minutes)** **Main question 1: "Can you describe what it was like when you first lost your speech?"** Probing questions "What symptoms did you experience first because of aphasia?" "How did you realize you couldn't speak?" "How did you feel at that time?" "Was it a sudden loss or did it happen gradually?" **Main question 2: "What challenges are you experiencing now?" or "What challenges did you experience when you were in the hospital because of aphasia?"**[a)] Probing questions "What difficulties did you face during hospitalization due to aphasia?" "What was helpful to you in coping with the difficulties caused by aphasia?" "How was communication with the medical staff?" "What strategies did you use to communicate?" "What kind of help did you want from others?" "When did you first realize you were recovering, and how did you feel at that moment?" "What did you do to help your speech recover?" "What is the one moment you remember most?" **Wrap-up (5 minutes)** • Check if there are additional stories participants would like to share • Express gratitude for the participation

Figure 1. Semi-structured interview guide. [a)]For the participants who have already been discharged.

captured variation in demographic characteristics and aphasia subtypes, alignment of recruitment with the study aim, and continuation of interviews until no new information emerged. Member checking was conducted by inviting one participant (Participant 1) to review the derived categories and themes, which strengthens credibility and confirmability by ensuring that interpretations resonate with participants' experiences. We also conducted a meeting with three stroke intensive care nurses to compare emergent categories with clinical practice.

Dependability was achieved by having all interviews conducted by the same researcher using a common semi-structured guide, and through iterative analysis whereby insights from earlier interviews informed subsequent data collection and coding. Throughout the study, we maintained an audit trail that recorded methodological decisions, analytical steps, and team discussions.

Transferability was enhanced by providing thick description of the research context, participant characteristics, data collection procedures, and analytical processes. We explicitly linked categories to illustrative quotations, enabling readers to judge the relevance of our findings to their own settings.

6. Researcher background and qualifications

One author has conducted and published multiple qualitative studies, providing methodological expertise. The other author, who conducted the interviews, has over 10 years of clinical experience in a stroke intensive care unit, including caring for patients with aphasia and conducting stroke research. Prior to data collection, the interviewer completed formal qualitative research training, practiced with rehearsal interviews, reviewed recordings, and consulted experienced colleagues to improve interviewing and analytical skills.

7. Ethical considerations

This study was conducted following approval from the Dong-A

University Hospital Institutional Review Board (approval number: DAUHIRB-24-211). All participants provided written informed consent and were informed of their right to withdraw from the study at any time without penalty. All data are stored securely and will be destroyed 3 years after study completion.

Results

1. Participant characteristics

A total of 14 patients with acute stroke participated in the study. Participants ranged in age from 35 to 81 years, with eight being men. The most common etiology was left middle cerebral artery infarction (n=10). Aphasia types included motor aphasia (n=7), global aphasia (n=5), and sensory aphasia (n=2). At the time of interviews, 10 participants continued to experience residual language deficits, including dysarthria (Table 1).

2. Content analysis findings

Analysis of interview transcripts yielded 42 codes derived from a total of 371 meaning units, which were synthesized into 13 subcategories and subsequently clustered into five main categories. Participants' loss of the ability to speak and understand was captured in the category "suddenly trapped in silence," which was closely linked to "emotional impact." Negative interactions caused by communication barriers were represented as "communication crisis," while healthcare staff's supportive and empathetic care was categorized as "patient-centered interaction." As language abilities gradually returned, participants experienced "emerging hope." These five categories were ultimately integrated into the overarching theme "communication beyond language" (Table 2, Figure 2).

1) Category 1: Suddenly trapped in silence

The category "suddenly trapped in silence" vividly captures participants' experiences of abrupt language function loss following stroke onset. This category comprises two subcategories: "words stuck in the mouth," reflecting the struggle to articulate words despite the intention to speak, and "loss of meaning in language," denoting the inability to convey or comprehend meaning through language.

(1) Words stuck in the mouth

Participants described profound difficulty expressing what they intended to say, despite having clear awareness of the words they wished to produce. At times, speech was abruptly blocked, leaving words "stuck" and unable to flow, while in other instances, unintended sounds emerged without volitional control. These symptoms appeared suddenly at stroke onset, and some participants also reported unusual sensations around their lips.

> "It felt like the process of saying, 'Daddy's girl, let's wash,' was already in my brain, but the words would not come out. It just stopped here (pointing to his mouth). It wouldn't progress beyond 'Da… Da… Da….' Why wasn't it working? Why? It was so frustrating, constantly feeling this way." (P6, M/35, 3 days after onset)

Table 1. Characteristics of the participants (N=14)

No.	Gender/age (yr)	Diagnosis	Type of aphasia	Days from onset (day)[a]	Residual language impairments
1	F/51	Lt. MCA infarction	Motor aphasia	8	Present
2	M/49	Lt. MCA infarction	Sensory aphasia	2	Present
3	M/48	Lt. MCA infarction	Motor aphasia	40	Present
4	F/78	Lt. MCA infarction	Global aphasia	4	Absent
5	F/39	Transient ischemic attack	Motor aphasia	2	Absent
6	M/35	Rt. MCA infarction	Motor aphasia	3	Absent
7	F/81	Lt. MCA infarction	Global aphasia	2	Present
8	M/64	Multiple infarction	Motor aphasia	15	Present
9	F/63	Lt. MCA infarction	Motor aphasia	6	Present
10	F/72	Lt. MCA infarction	Global aphasia	3	Absent
11	M/62	Lt. MCA infarction	Global aphasia	4	Present
12	M/74	Lt. MCA infarction	Global aphasia	5	Present
13	M/67	Lt. MCA infarction	Motor aphasia	3	Present
14	M/56	Rt. cortical ICH	Sensory aphasia	7	Present

F, female; ICH, intracerebral hemorrhage; Lt., left; M, male; MCA, middle cerebral artery; Rt., right.
[a]At the time of the interview.

Table 2. Experience of aphasia in acute stroke

Theme	Category	Sub-category	Code
Communication beyond language	Suddenly trapped in silence	Words stuck in the mouth	Clear words in mind
			Speech flow blocked
			Distorted speech output
			Altered sensation in the lips
		Loss of meaning in language	Speech perceived as meaningless sounds
			Unable to understand even my own speech
			Only lip movements perceived
			Inability to read written text
	Emotional impact	Psychological shock	Unexpectedness
			Confusion
			Fear
			A sense of life-ending despair
		Feeling lost	Uncertainty about the future
			Worries about making a living
			Concerns about family
			Self-pity
	Communication crisis	Difficulties in expression	Inability to express basic needs
			Inability to engage in small talk
			Incomplete expression of intentions
			Misunderstandings
		Exclusion from decision-making	Decisions discussed solely with caregivers
			Being treated like a child
		Reluctance and withdrawal	Speaking feels exhausting
			Reluctance to speak
			Giving up on speaking
	Patient centered interaction	Supportive communication	Encouraged to speak slowly
			Being listened to patiently
			Facilitating speech
		Empathic care	Showing attentive concern
			Providing anticipatory assistance
			Instilling hope for recovery
		Active engagement	Initiating interaction
			Making efforts to sustain conversation
	Emerging hope	Gradual but inconsistent recovery	Words suddenly come out and are heard
			Fluctuating speech ability
			Different pace of recovery for words
			Still clumsy speech
		Self-directed efforts	Alternative communication
			Speech practice
			Reading and writing practice
		Anticipation of recovery	Relief
			From fear to hope

(2) Loss of meaning in language

Several participants described sudden inability to comprehend spoken language, perceiving others' speech as incomprehensible sounds or as if the speaker's mouth was moving silently. They also reported difficulty understanding their own utterances and struggled to recognize or read written letters.

"At first, I couldn't understand anything—it was just buzzing sounds. As I gradually improved, I was able to catch words little by little. I tried reading books, but the readability was so poor. I

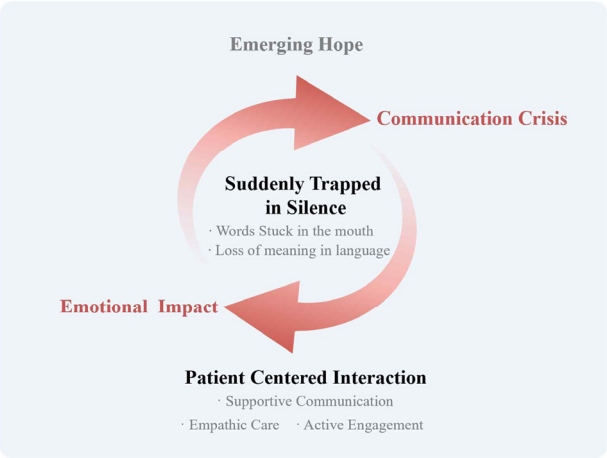

Figure 2. Experience of aphasia in acute stroke.

tried to read a book called *The Vegetarian*, but I couldn't understand it at all. The readability was poor, and even when I watched YouTube, I still couldn't make sense of it." (P2, M/49, 2 days after onset)

2) Category 2: Emotional impact

The abrupt loss of language function evoked profound negative emotions among participants. Their accounts were clustered into two subcategories: "psychological shock" and "feeling lost." Collectively, these experiences illustrate the overwhelming emotional impact of aphasia following stroke.

(1) Psychological shock

The sudden inability to speak brought participants an overwhelming sense of shock, confusion, and fear. Several described experiencing despair at the moment they realized they had lost the language essential for daily life, with some perceiving it as the end of their existence.

"For a moment—really, just for a moment—I was completely speechless. 'Oh my God, I really cannot speak.' I was so worried, thinking, 'What should I do?'… No, I just couldn't speak, so I thought, 'Oh my God, what should I do? I guess I can't speak. I guess I'm really becoming mute…' My life is just over, it's over. If I can't speak, isn't it completely over now?" (P10, F/72, 3 days after onset)

(2) Feeling lost

Many participants reported that, beyond the immediate frustration of being unable to speak, their greatest concerns centered on economic survival and the ability to support their families. These real-life pressures often overshadowed the pain of aphasia itself, compounding their sense of despair. The feeling of being lost and uncertain was particularly intense among younger and socially active participants.

"It was the day I disappeared. The day I disappeared. Why am I here? Why am I alive? The first thing that came to my mind was, 'How can I, who can't speak, live? How could I live without speaking?' My children were young, so I worried about finances. I felt lost, afraid of becoming a burden to them. Would my family have to support me? Why am I even here? I was out of my mind." (P1, F/51, 8 days after onset)

3) Category 3: Communication crisis

The diverse communication difficulties that participants encountered following aphasia onset were consolidated into the category "communication crisis." This category comprises three subcategories: "difficulties in expression," "exclusion from decision-making," and "reluctance and withdrawal." Collectively, these findings highlight the multifaceted communication challenges participants faced with healthcare professionals during acute hospitalization.

(1) Difficulties in expression

In the early stages, participants were unable to communicate even their most basic physiological needs to nursing staff. They struggled to engage in simple conversations, and some also had difficulty understanding others, often becoming trapped in their own thoughts, which led to frequent misunderstandings. Several participants described experiencing extreme frustration throughout the communication process.

"I wanted to tell them to take me to the bathroom because I needed to go, but the words wouldn't come out. They just wouldn't come out of my mouth. I kept saying it inside myself… but there was no one there, and I just ended up peeing. I kept trying to say, 'I want to go to the bathroom, I want to go to the bathroom,' but no one understood. I struggled so much, no matter how hard I tried. I really needed to go, but they didn't take me… What should I say? I had already wet myself when I came in the ambulance, and it happened here at the hospital too. What should I say about this? I really wanted to say something, but I couldn't… nothing came out." (P7, F/81, 2 days after onset)

(2) Exclusion from decision-making

Several participants reported being excluded from conversations and treatment decisions due to their inability to speak. They felt humiliated and uncomfortable when medical staff treated them as if they were incapable of understanding, or when decisions were made solely in consultation with family members. Despite their impaired speech, participants emphasized that they retained the capacity to think and feel.

"The levin tube… was really mean. He just put it in without my consent. The tube went from my nose all the way down my throat, and it was so painful. If he had explained it to me in advance, I would have understood… But he just slammed the tube in without any explanation. That's why I felt so bad. It was really bad." (P8, M/64, 15 days after onset)

"When they talk to me, they act like I'm stupid or a baby… so it feels a little negative. I'm just an ordinary person, but they treat me like I'm stupid or a baby… so it feels a little frustrating." (P2, M/49, 2 days after onset)

(3) Reluctance and withdrawal

Repeated communication failures caused participants to become increasingly hesitant to engage in interactions. Many feared that their incomplete speech would inconvenience or frustrate others, and even attempts at conversation with medical staff often felt uncomfortable or irritating. Some participants expressed embarrassment about their impaired speech, which led them to avoid communication altogether.

"The nurse kept talking to me, and I was a little annoyed. I wanted to talk but I couldn't, so it was annoying… No, it wasn't that bad. I just got annoyed because I couldn't speak, but she kept making me talk…" (P12, M/74, 5 days after onset)

4) Category 4: Patient-centered interaction

This category highlights the efforts of healthcare professionals to maintain meaningful communication with patients despite language limitations. Participants described helpful approaches that included "supportive communication," "empathic care," and "active engagement." Collectively, these strategies demonstrate how medical staff sought to preserve patients' dignity and foster therapeutic relationships, even in the face of aphasia-related challenges.

(1) Supportive communication

Participants emphasized that when medical staff listened attentively and waited without rushing, they felt psychological stability. This supportive attitude encouraged them to attempt communication at their own pace, even if speech was slow or fragmented.

"There was no inconvenience. The doctors and nurses all waited patiently for me to speak. I found that incredibly kind. They said, 'It's okay. If you have anything to say, we'll wait, so please speak slowly,' and I was able to speak comfortably." (P6, M/35, 3 days after onset)

(2) Empathic care

Participants expressed gratitude for medical staff's proactive efforts to assess their needs and provide assistance without being asked. Such attentiveness offered reassurance, as if someone understood them despite the language barrier. This consideration not only alleviated the burden of communication but also provided significant psychological comfort. They emphasized that positive messages regarding the possibility of recovery served as their greatest source of strength throughout treatment.

"I couldn't speak, but the nurses did everything for me. They took care of everything… Even when I was lying down like this, they changed my clothes. If my clothes rode up, they pulled them down for me. If my position was uncomfortable, they even turned me to the side." (P9, F/63, 6 days after onset)

"When I heard that there was a problem, the only feedback that mattered was whether it would get better. I was really grateful when the doctor said it would get better, and I was thankful at that time (crying)…" (P6, M/35, 3 days after onset)

(3) Active engagement

Participants highlighted the importance of medical staff actively engaging with them to overcome communication barriers. The willingness of staff to approach, ask questions, and persistently seek ways to facilitate understanding was perceived as powerful support. Such efforts not only promoted communication but also fostered trust and reassurance.

"The effort to help me understand what I didn't understand—trying to explain it step by step while mimicking it—was tremendous effort. I don't think there's anything more helpful to the patient than that. In my opinion, being there for the patient is the most important thing." (P13, M/67, 3 days after onset)

5) Category 5: Emerging hope

The gradual restoration of language function brought about emotional changes that fostered hope, which were integrated into

the category "emerging hope." This category encompassed three subcategories: "gradual but inconsistent recovery," "self-directed efforts," "anticipation of recovery." Together, these subcategories illustrate how participants' experiences of language improvement instilled optimism and strengthened their determination to persevere in the recovery process.

(1) Gradual but inconsistent recovery

Participants described early signs of improvement when words unexpectedly emerged or when they were able to comprehend others' speech. They described their language recovery as inconsistent and unpredictable. At times, speech flowed smoothly with clear pronunciation, only to stop abruptly without reason. The pace of recovery varied not only across different words but also across different aspects of language function. Although participants expressed frustration with imprecise speech and inaccurate pronunciation, they acknowledged that their language abilities were gradually improving.

"I was trying to speak… and the words just came out. Oh my, I'm talking. The words just came out without me knowing. It wasn't as clear as this, but my voice was still there." (P10, F/72, 3 days after onset)

"When I swear, it comes out incredibly well. But I can't even pronounce my own name properly." (P6, M/35, 3 days after onset)

(2) Self-directed efforts

Despite severe language limitations, participants actively sought ways to communicate through gestures and writing. They also engaged in self-directed practices such as speaking exercises, reading, and note-taking. Through these repeated efforts, they reported experiencing gradual improvements in their language abilities.

"So, when I'm on the phone, I have to say my name, and here (pointing to his head) it makes sense, but it doesn't come out of my mouth, so I practice on my own… The name is the same, but the actual pronunciation is different every time. I've also tried saying other people's names on my own. Sometimes it works, and sometimes it doesn't work well." (P13, M/67, 3 days after onset)

(3) Anticipation of recovery

As their speech gradually returned, participants experienced relief and expressed optimism about continued improvement. Although their speech remained incomplete, they articulated hope and confidence in the possibility of further recovery.

"At first, I was so scared… but now that I can speak a little… I think things will get better. I'll be okay." (P2, M/49, 2 days after onset)

Discussion

To explore the experiences of aphasia among patients with acute stroke during hospitalization, we conducted in-depth one-on-one interviews with 14 participants. Through qualitative content analysis, five categories emerged, encompassing the sudden loss of language, its psychological and emotional consequences, communication challenges, supportive patient-centered interactions, and the recovery process. Together, these categories were integrated into the overarching theme "communication beyond language," illustrating how patients with acute aphasia sought and experienced meaningful interaction despite language limitations.

The first category, "suddenly trapped in silence," vividly illustrates the abrupt loss of language function, in which familiar words suddenly become unspoken or incomprehensible. Previous studies have described the aphasia experience as "living in a foreign country" [23] or "I am not mad, I am not deaf" [13]. Compared with these earlier accounts, the subcategories and codes identified in our study capture more specific and realistic aspects of language loss, particularly the disruption of both motor and sensory functions of speech. The phenomenon reported by participants—clearly formulating words internally but being unable to vocalize them—represents a novel and often disconcerting experience for both patients and their caregivers [24]. This study highlighted that the onset of acute aphasia is abrupt and unpredictable, leaving patients and their families little time to recognize or come to terms with the condition. Nurses caring for patients with aphasia should therefore provide practical information about these symptoms and respond with empathy to help reduce confusion and anxiety among patients and their families.

The second category, "emotional impact," reflects the profound psychological and emotional consequences of sudden language loss. Previous studies have emphasized the importance of early intervention, noting that emotional turmoil in the initial stages of aphasia can hinder recovery and exacerbate social isolation. Moss et al. [25] suggested that achieving emotional stability should be considered a top priority in the treatment and recovery of patients with aphasia. Similarly, Kao and Chan [26], in a large-scale cohort study, found that patients with aphasia had a 1.73-fold higher risk of developing depression within 1 year after stroke, warning that

early psychological shock may progress to chronic depression. Nevertheless, in clinical practice, acute stroke management often overshadows attention to patients' psychosocial concerns. This challenge is compounded in patients with aphasia, who face significant barriers to expressing their emotions, making it difficult for clinicians to accurately assess their psychological state. To address this gap, Baker et al. [27] emphasized the importance of early identification of emotional states using mood screening tools, and Murphy et al. [28] reported that the Stroke Aphasia Anxiety and Mood Screen is an effective instrument for detecting anxiety and depression even in the presence of language limitations.

The third category, "communication crisis," captures the restricted communication experienced by patients during acute hospitalization that results from language loss, a difficulty most evident in interactions with medical staff. Similar findings have been reported in previous studies. Anemaat et al. [29] noted that the majority of negative experiences among patients with aphasia arise from hospital-based communication with healthcare providers. Carragher et al. [13] further emphasized that when medical staff focus exclusively on physical problems or lack appropriate communication skills, patients' feelings of being misunderstood and alienated are exacerbated. A qualitative study also reported that while nurses acknowledged the importance of communication with patients with aphasia, they often encountered practical barriers that hindered effective interaction. In turn, these challenges left nurses with feelings of guilt and underscored the need for systematic training to improve communication [16]. Consequently, practical guidelines and educational programs for interacting with patients with acute aphasia are essential, along with environmental and institutional support within hospitals [11,30]. Such institutional support may include provision of audiovisual materials and augmentative and alternative communication tools, access to quiet consultation spaces, and multidisciplinary, team-based communication systems [30].

The fourth category, "patient-centered interaction," reflects the positive attitudes and behaviors of healthcare professionals as experienced by patients despite profound language limitations. Prior studies have demonstrated that even among patients with severe communication difficulties, therapeutic relationships can be cultivated through authentic and respectful communication, which significantly influences the overall treatment process [31]. Patients are more likely to actively participate in communication when they feel equally respected; conversely, when medical staff adopt a task-oriented approach, communication remains constrained, even with the use of augmentative and alternative communication tools [14]. In contrast, strategies such as maintaining a calm tone of voice, establishing eye contact, employing appropriate humor, and demonstrating respect have been shown to facilitate meaningful exchanges [32]. These findings suggest that patient-centered interactions rely less on specific communication techniques and more on healthcare providers' attitudes and patients' perception of being valued. As the closest caregivers to patients, nurses play a pivotal role in fostering communication and trust through person-centered approaches [33].

The final category, "emerging hope," illustrates how patients with acute aphasia gradually regained emotional optimism as their language abilities began to recover. Language functions often improve within weeks of stroke onset, with expressive abilities typically recovering more quickly than comprehension [10]. Consistent with this pattern, participants reported faster recovery of specific words and speech production than of language comprehension. Nevertheless, the recovery process was described as erratic, fluctuating, and often incomplete. Post-stroke aphasia can persist into the chronic stage and present in diverse ways depending on lesion location and rehabilitation intensity [34]. These findings indicate that recovery from aphasia is shaped not only by the natural course of neurological healing but also by patient motivation and sustained effort. Accordingly, nurses should work collaboratively with patients to recognize and reinforce signs of recovery, providing encouragement that helps patients sustain hope throughout the rehabilitation process.

The 2025 European Stroke Society guidelines recommend expanding the goals of aphasia rehabilitation beyond language restoration to encompass everyday communication, social participation, and enhanced quality of life. They further propose a range of strategies, including high-intensity individualized speech therapy, integration of digital tools, and group-based interventions [35]. Additionally, innovative approaches are emerging, such as simulation-based nurse training programs designed to strengthen patient advocacy and enhance emotional empathy [36]; Aphasia-GPT, an artificial intelligence-driven program that supports language expression by reflecting patients' intentions and context [37]; and digital platforms enabling home-based language self-training [38]. Within this context, nurses caring for patients with aphasia can apply the person-centered communication strategies identified in this study to support practical communication and optimize the impact of these cutting-edge interventions.

This study provides an in-depth exploration of the experiences of acute stroke patients with aphasia during their hospitalization. Its primary contribution lies in capturing the distinctive features of the acute phase—abrupt language loss, profound confusion, and the complex interplay between urgent medical decisions and

communication barriers. While previous research has largely focused on post-stroke aphasia, few studies have examined the acute phase, when patients experience the most severe communication crises amid intensive treatment and critical decision-making.

The findings advance both theoretical understanding and clinical practice. First, by illuminating patients' perspectives during the acute phase, this study reveals that aphasia extends beyond a linguistic impairment to encompass deep emotional and psychosocial challenges requiring holistic care. Second, the themes and categories identified provide an empirical foundation for developing person-centered nursing interventions tailored to the acute stage. Third, these insights inform clinical education by highlighting the need to equip healthcare professionals to address the multifaceted difficulties faced by patients with acute aphasia.

For nursing practice, the results underscore the importance of early psychological assessment, empathetic communication, and active patient engagement in decision-making. Nurses should provide timely information about aphasia, recognize early signs of recovery, and foster hope while supporting patients' autonomy throughout the recovery process.

This study has several limitations. First, stroke patients often experience multiple physical symptoms, including hemiplegia, in addition to language impairment. These comorbidities may have influenced participants' descriptions of their aphasia experience. Although the authors carefully examined participants' accounts to distinguish language-specific experiences, the potential influence of physical impairments cannot be completely excluded. Second, due to the nature of aphasia, some participants continued to face communication challenges; although repeated confirmation and nonverbal strategies were employed to supplement interviews, not all experiences may have been fully conveyed. Third, data beyond the scope of the interview guide—such as patients' experiences with family members—may not have been comprehensively captured. Fourth, this study was conducted at a single institution in Korea, which may limit the transferability of findings to other healthcare settings or cultural contexts. Future research should therefore incorporate family interviews to provide a more holistic understanding of patients' experiences with aphasia and include multi-site studies to enhance generalizability.

Conclusion

This qualitative study explored the experiences of 14 patients with acute stroke-related aphasia through in-depth interviews. Qualitative content analysis revealed the overarching theme of "communication beyond language," encompassing five interconnected categories that illuminate the complex journey from language loss to emerging hope. Participants described the profound emotional shock of suddenly losing language function, which included difficulties in speaking and understanding speech. They experienced significant communication challenges, exclusion from decision-making processes, and, at times, withdrawal from social interactions. However, person-centered interactions with healthcare professionals—characterized by supportive, respectful, and encouraging approaches—played a crucial role in helping participants maintain hope and motivation for recovery. Based on these findings, we recommend that nurses integrate consideration of the emotional and psychosocial dimensions of aphasia into communication interventions in clinical practice. The development and implementation of comprehensive nursing education and systematic training programs are essential to strengthen person-centered communication skills and improve care for patients with acute aphasia.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

Please contact the corresponding author for data availability.

Author Contributions

Conceptualization or/and Methodology: JK, HH. Data curation or/and Analysis: JK, HH. Funding acquisition: JK. Investigation: HH. Project administration or/and Supervision: JK. Resources or/and Software: JK, HH. Validation: JK, HH. Visualization: JK, HH. Writing: original draft or/and Review & Editing: JK, HH. Final approval of the manuscript: all authors.

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당뇨병케톤산증 환자의 재입원 위험요인: 체계적 문헌고찰 및 메타분석

지혜림[1], 황선경[2]

[1]부산대학교병원 응급의료센터, [2]부산대학교 간호대학, 간호과학연구소

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Corresponding author:
Sun-Kyung Hwang
College of Nursing, Pusan National University, 49 Busandaehak-ro, Mulgeum-eup, Yangsan 50612, Korea
E-mail: skhwang@pusan.ac.kr

Risk factors for the readmission of patients with diabetic ketoacidosis: a systematic review and meta-analysis

Hyerim Ji[1], Sun-Kyung Hwang[2]

[1]Emergency Medical Center, Pusan National University Hospital, Busan, Korea
[2]College of Nursing, Research Institute of Nursing Science, Pusan National University, Yangsan, Korea

Purpose: This study aimed to identify risk factors associated with the readmission of patients with diabetic ketoacidosis (DKA) through a systematic review and meta-analysis.

Methods: A systematic literature review was conducted in accordance with the PRISMA guidelines. Relevant studies were retrieved from international databases (PubMed, EMBASE, Cochrane Library, CINAHL, PsycINFO, and Web of Science) and Korean databases (RISS, KoreaMed, KMbase, KISS, and DBpia). Study quality was evaluated using the Newcastle-Ottawa Scale. Meta-analysis was performed using a random-effects model with the Hartung-Knapp-Sidik-Jonkman adjustment to account for the limited number of studies and heterogeneity.

Results: Fifteen studies were included in the review, and eight were eligible for meta-analysis. From the systematic review, 21 risk factors for DKA readmission were identified and categorized into five domains: demographic, socioeconomic, diabetes-related, comorbidity, and health-behavioral factors. In the meta-analysis, significant risk factors included low income, psychiatric disorders, and discharge against medical advice.

Conclusion: This study demonstrates that DKA readmissions result from the complex interplay of multiple clinical and social factors. By identifying these risk factors and suggesting risk-stratification criteria, the findings may support the development of tailored interventions, such as self-management education, integrated mental health care, structured discharge planning, and coordinated post-discharge follow-up.

Keywords: Diabetic ketoacidosis; Meta-analysis; Patient readmission; Risk factors; Systematic review

서론

1. 연구의 필요성

당뇨병은 만성 대사 질환으로, 세계적으로 약 8억 3천만 명이 당뇨병을 앓고 있으며[1], 환자, 가족, 의료제공자, 그리고 의료시스템에 막대한 부담을 초래하는 질환이다[2]. 특히 고혈당 위기는 당뇨병 환자에서 생명을 위협하는 고혈당 응급상황으로 당뇨병케톤산증(diabetic ketoacidosis)과 고혈당고삼투질상태(hyperglycemic hyperosmolar state)가 이에 해당된다[3]. 당뇨병케톤산증은 인슐린 부족으로 인한 고혈당, 케톤혈증, 대사성 산증이 특징적이고, 고혈당고삼투질상태는 심각한

고혈당, 높은 혈청 삼투압, 탈수의 특징을 보인다[4,5].

당뇨병 환자들에게 고혈당 위기를 유발하는 주요 요인으로는 감염, 특히 요로 감염과 폐렴, 치료불이행 등이 보고되었다[6,7]. 당뇨병케톤산증과 고혈당고삼투질상태는 제1형 및 제2형 당뇨병 환자 모두에서 발생할 수 있지만, 당뇨병케톤산증은 주로 제1형 당뇨병 환자, 특히 청소년기와 25세 이하의 젊은 성인에서 더 흔하게 나타나는 반면[8-10], 고혈당고삼투질상태는 제2형 당뇨병을 가진 성인 및 고령 환자들에게 더 자주 보고된다[3]. 미국 질병통제예방센터 자료에 따르면[11], 2020년 미국 성인 당뇨병 환자 1,000명당 당뇨병케톤산증으로 인한 입원은 8.8건으로, 이는 1,000명당 입원이 1.1건인 고혈당고삼투질상태로 인한 입원보다 약 8배 높게 나타났다. 또한 최근 10년간 당뇨병케톤산증의 입원율은 전 세계적으로 55% 증가하였으며, 이에 따른 의료비 부담 또한 지속적으로 증가하고 있다[12-14].

당뇨병케톤산증으로 입원한 환자는 생명을 위협하는 사건이나 사망 및 병원 재입원의 가능성이 높은 집단으로 인식되고 있으며, 재입원한 당뇨병케톤산증 환자 중 반복 입원과 높은 의료 이용을 가진 고위험군인 "재발성 당뇨병케톤산증(recurrent diabetic ketoacidosis)"에 대한 관심이 집중되고 있다[15]. Shaka 등[16]의 연구에 따르면, 제1형 당뇨병 환자에서 당뇨병케톤산증의 30일 재입원율은 20.2%에 달하며 재입원 환자의 경우, 첫 번째 입원에 비해 사망위험이 두 배 이상 높았으며 입원비용과 입원기간 또한 증가했다. 또한 제1형 당뇨병 환자의 의료비 중 당뇨병케톤산증 관련 비용이 25% 이상을 차지하며, 이 중 반복되는 당뇨병케톤산증 입원에 사용되는 의료비가 절반 이상을 차지했다[3]. 이러한 사망률 통계와 만성적인 혈당 조절 불량으로 인한 신장병증, 망막병증, 심혈관질환 등의 만성 합병증의 영향을 고려할 때[17], 이 고위험 환자군을 조기에 식별하고 특성을 파악하여 적절한 중재를 시행하는 것은 환자의 임상결과를 개선하고 급성 치료 이용을 최소화하며, 의료비 지출을 줄이는 데 중요한 역할을 할 수 있다[17,18]. 따라서 당뇨병케톤산증 환자의 재입원 위험요인을 파악하고 이를 해결하기 위한 전략 수립의 근거를 마련하는 것은 환자 치료의 질을 향상시키고, 의료비 절감뿐만 아니라 의료시스템의 효율적 운영에도 기여할 수 있을 것이다.

당뇨병케톤산증의 재입원과 관련된 위험요인으로는 인슐린 중단 및 누락 등의 치료비순응, 연령, 성별, 당뇨병 유형, 동반질환, 동반 정신질환, 사회경제적 요인, 알코올 및 물질 남용, 흡연 등이 다양하게 보고되고 있다[19-23]. 그러나 연구 간 결과가 일관되지 않으며 유의미한 위험요인이 다르게 나타나 명확한 당뇨병케톤산증의 재입원 위험요인을 파악하는 데 어려움이 있다. 특히 기존 연구들은 개별 위험요인에 집중하거나 제한된 범주만을 다루는 경향이 있어 재입원과 관련된 요인을 포괄적으로 이해하는 데 한계가 있다. 그러므로 체계적 문헌고찰 및 메타분석을 통해 당뇨병케톤산증의 재입원 위험요인에 대한 최근까지의 연구동향을 파악하고, 기존 연구결과를 종합적으로 분석 및 평가하여 신뢰할 수 있는 근거를 제공하는 것이 필요하다. 이에 본 연구는 당뇨병케톤산증 재입원 위험요인을 인구통계학적, 사회경제적, 당뇨병 관련, 동반질환, 건강행태 요인으로 체계적으로 분류하여 고찰하고, 이를 바탕으로 재입원 고위험군을 선별하고 예방을 위한 중재방향을 제시하고자 한다. 나아가 당뇨병케톤산증 환자의 재입원 예방을 위한 전략 및 중재프로그램 개발을 위한 기초자료를 마련하고자 한다. 이를 통해 예방 가능한 재입원을 감소시켜 불필요한 의료이용과 비용을 줄임으로써, 보다 합리적이고 효율적인 의료자원의 활용에 기여할 수 있을 것이다.

2. 연구목적

본 연구의 목적은 당뇨병케톤산증 환자의 재입원 위험요인을 체계적으로 분석하고 메타분석을 통해 주요 요인들의 영향을 정량적으로 평가하는 것이며, 구체적인 내용은 다음과 같다.

첫째, 당뇨병케톤산증 환자의 재입원 위험요인을 조사한 연구를 체계적으로 고찰한다.

둘째, 당뇨병케톤산증 환자의 재입원 위험요인을 파악한다.

셋째, 당뇨병케톤산증 환자의 재입원 위험요인들의 효과크기를 산출한다.

방법

1. 연구설계

본 연구는 당뇨병케톤산증 환자의 재입원 위험요인을 파악하고 그 효과크기를 산출하기 위한 체계적 문헌고찰 및 메타분석 연구이다. 연구계획 후 PROSPERO에 등록하여 진행하였다(CRD42025638378).

2. 연구대상

본 연구는 당뇨병케톤산증 환자의 재입원과 관련된 위험요인을 규명하기 위해 population, exposure, comparator, outcome (PECO) 기준을 적용하여 연구질문을 구성하였다. PECO는 관찰 연구에서 노출과 건강결과 간의 연관성을 평가하는 데 널리 활용되는 틀로, 본 연구에서도 이를 기반으로 연구대상, 노출 요인, 비교군, 결과 변수를 명확히 정의하였다[24].

1) 자료 선정기준 및 배제기준

(1) 선정기준

연구대상(population)은 만 18세 이상의 성인 당뇨병케톤산증 환자이며, 노출(exposure)은 재입원의 주요 위험요인, 결과(outcome)는 당뇨병케톤산증으로 인한 재입원으로 설정하였고, 사전에 특정 비교군을 제한하지 않았다. 연구대상을 성인으로 제한한 이유는 소아 및 청소년기 환자는 신체적 · 심리사회적으로 급격한 발달과정에 있으며, 당뇨병 관리의 주체가 보호자에서 환자 본인으로 이행되고,

소아 진료체계에서 성인 진료체계로의 전환과 같은 특성을 보이는 등 성인과는 상이한 관리양상을 나타내기 때문이다[8,9]. 따라서 본 연구는 실제 임상현장에서의 적용 가능성과 결과 해석의 일관성을 고려하여 성인 당뇨병케톤산증 환자를 대상으로 제한하였다.

(2) 배제기준

재입원에 대한 중재효과를 평가한 중재연구와 시간적 선후관계 파악이 불가능하고 재입원과 위험요인 간의 인과관계 분석이 어려운 단면연구, 개별 환자가 아닌 인구 수준의 재입원율 변화를 분석한 트렌드 연구는 제외하였다. 또한 응급실이나 외래에서 진료받고 입원하지 않은 환자, 임신성 당뇨병을 진단받은 임산부가 대상인 연구, 초록만 게재된 연구, 전문을 확인할 수 없는 연구 또한 문헌에서 제외하였다.

2) 문헌 검색

문헌 검색과 문헌 선정과정은 체계적 문헌고찰 및 메타분석 보고지침(Preferred Reporting Items for Systematic Reviews and Meta-Analysis [PRISMA])의 체계적 문헌고찰 흐름도를 바탕으로 하였다[25]. 문헌 검색은 대학 소속 의학도서관 사서의 도움을 받아 검색식을 구성한 후, 검색연도의 제한 없이 2024년 12월까지 출판된 문헌을 대상으로 수행하였다. 문헌 선정 및 자료추출은 2025년 1월 1일부터 2025년 1월 31일까지 진행하였다. 문헌 검색은 국외 데이터베이스인 MEDLINE (PubMed), EMBASE, CINAHL, Cochrane Library, PsycINFO, Web of Science와 국내에서 수행된 연구들을 탐색하기 위해 RISS, KoreaMed, KMbase, KISS, DBpia의 국내 데이터베이스를 이용하여 수행하였다. 그리고 선행 논문의 참고문헌 및 인용문헌을 찾는 방법으로 수기 검색을 추가로 시행하였다. 검색어는 MeSH (Medical Subject Headings) term과 Emtree를 확인 후 검색어 간 불리언 연산자로 조합하였고 검색식으로 대상자는 hyperglycemic crisis OR diabetic ketoacidosis OR hyperglycemic emergency OR diabetic emergency, 결과는 readmission OR rehospitalization OR recurrent admission OR recurrent hospital admission OR recurrent hospitalization 조합으로 국외 데이터베이스를 검색하였다(Appendix 1). 국문 검색어로 연구대상은 고혈당 위기 OR 당뇨병케톤산증 OR 당뇨병케톤산혈증 OR 당뇨병케톤혈증, 결과는 재입원으로 검색하였다. 본 연구에서 노출은 재입원 위험요인으로 설정하였으나, 재입원 위험요인을 직접 보고한 연구는 제한적이었다. 이에 따라 검색전략 수립 시 관련 문헌의 누락을 최소화하기 위해 재입원을 중심으로 검색어를 설정하고, 이후 검색된 문헌 중에서 재입원과 관련된 위험요인을 다룬 문헌을 최종 포함 대상으로 선정하였다.

3) 문헌 선정과정

국내 데이터베이스를 통해 검색한 결과, 당뇨병케톤산증 환자의 재입원 관련 연구는 찾아볼 수 없었다. 이에 본 연구는 국외 문헌을 중심으로 당뇨병케톤산증 환자의 재입원 위험요인에 대한 체계적 문헌고찰과 메타분석을 수행하였다.

국외 데이터베이스를 통해 총 747편의 문헌이 검색되었다. 중복문헌 188편을 제외한 559편의 문헌이 채택되었고, 이 중 제목과 초록을 검토하여 연구설계 및 주제, 연구대상자와 관련성이 없는 505편을 제외한 54편의 문헌을 1차로 선정하였다. 이 과정에서 검색된 문헌은 모두 영어로 출판된 문헌이었다. 이후 초록만 게재되어 전문을 확인할 수 없는 33편을 제외한 21편의 문헌의 전문을 검토하였다. 전문을 확인한 후 어린이가 포함된 문헌 4편과 청소년이 포함된 문헌 3편을 추가로 제외하여 14편의 문헌이 선정되었으며, 수기 검색을 통해 채택된 1편의 문헌을 포함하여 최종 15편의 문헌이 선정되었다(Figure 1). 모든 문헌의 선정과 배제과정은 2명의 연구자에 의해서 독립적으로 시행되었다. 연구자 간 의견 불일치가 있는 경우 충분한 논의를 통해 합의를 도출하였으며 추가적인 합의가 필요한 부분은 없었다.

3. 자료의 질 평가

본 연구에서 최종 선정된 문헌 중 코호트 연구와 환자-대조군 연구는 관찰연구의 질 평가 도구인 Newcastle-Ottawa Quality Assessment Scale (NOS)를 적용하여 문헌의 방법론적 질을 평가하였다[26]. 코호트 연구는 '선택(selection),' '비교 가능성(comparability),' '결과(outcome),' 환자-대조군 연구에서는 '선택(selection),' '비교 가능성(comparability),' '노출(exposure)'의 각 3가지 영역에서 총 8문항으로 평가한다. 평가방법은 각 항목에서 문항들의 근거의 질이 높은 경우 '*'을 부여하고, 각 항목에서 측정된 '*'의 개수의 총합으로 평가하였다. '비교 가능성' 항목에서는 최대 두 개의 '*'를 부여할 수 있다. 점수범위는 0–9점이고, 총점이 높을수록 연구의 질이 높다고 간주하였으며, 총점이 7점 이상인 문헌을 'good quality'로 간주하여 최종 분석에 포함하였다[27]. 개별 연구의 질 평가는 메타분석과 질 평가 경험이 있는 연구자와 공동연구자가 각각 독립적으로 시행하여 일치도를 확인하였고, 평가자 간의 의견이 불일치한 경우는 문헌을 재검토하여 평가자 간 논의를 통한 합의점을 이루었다.

4. 자료분석

선정된 15편의 문헌(Appendix 2)을 저자, 연구수행 연도, 연구수행 국가, 연구설계, 표본 특성, 재입원율, 재입원 위험요인으로 분류하여 코딩하였다. 본 연구에서 자료분석의 초점은 당뇨병케톤산증 환자의 재입원 위험요인을 파악하는 것이므로, 1차 코딩과정이 끝나면 각 문헌으로부터 추출한 재입원의 위험요인을 인구통계학적 요인, 사회경제적 요인, 당뇨병관련 요인, 동반질환 요인, 건강행태 요인의 5개의 범주로 나누어 자료를 분석하였다.

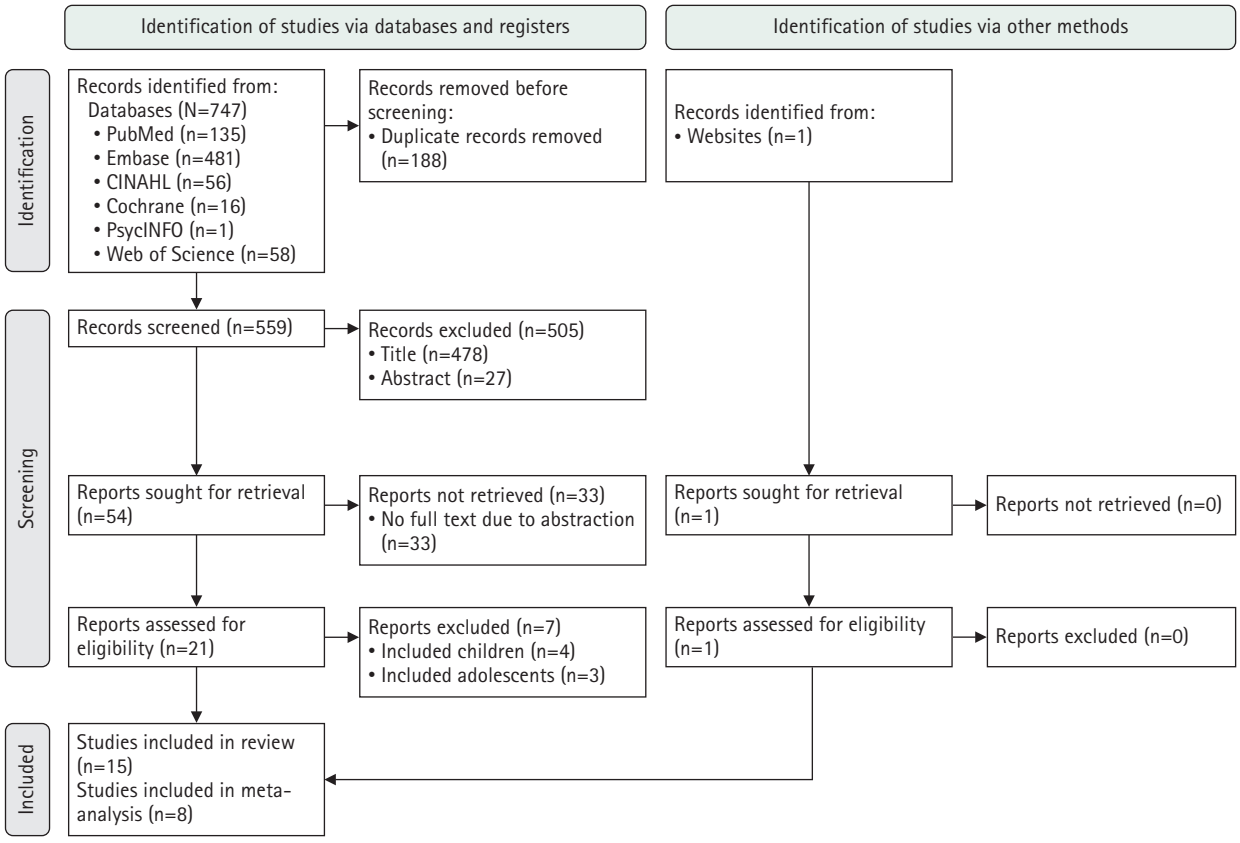

Figure 1. Flow chart for study selection.

본 연구에서는 메타분석 대상 문헌을 선정하기 위해 체계적 문헌고찰에 포함된 문헌 중 대조군 없이 재입원 환자만을 대상으로 단일군의 특성을 보고한 연구[20], 다변량 회귀분석 결과만을 제시하고, 그룹 간 기초통계량이나 단변량 분석결과가 제시되지 않아 효과크기 산출이 불가능한 연구[28,29], 재입원 여부에 따른 비교를 위한 효과크기 산출에 필요한 통계치가 보고되지 않은 연구[18,30,31]는 제외하였다. 또한 체계적 문헌고찰에 포함된 연구는 대부분 코호트 연구였고, 1편의 환자-대조군 연구[21]가 포함되어 연구설계가 상이한 연구들을 함께 메타분석을 수행하는 것은 적절하지 않아 제외하였다(Supplementary Table 1). 이에 따라 최종적으로 8편의 문헌을 대상으로 메타분석을 수행하였다. 각 연구에서의 재입원 위험요인에 대한 노출군과 비노출군의 비교를 통해 보고된 효과크기를 병합하여 평균 효과크기를 산출하였으며, 분석 가능한 동일한 독립변수 또는 정량적 데이터가 보고된 경우에 한해 메타분석을 수행하였다.

선정된 문헌의 일반적 특성은 빈도와 백분율로 구하였으며, 각 연구에서 보고된 빈도, 비율, 평균, 표준편차 등의 기초통계량으로부터 R program (The R Foundation for Statistical Computing)을 사용하여 표준화된 효과크기를 산출하였고, forest plot을 통해 각 문헌에서 산출된 결과지표의 효과크기 방향과 신뢰구간을 확인하였다. 작은 표본에서는 효과크기가 과대 추정되는 경향이 있으므로, 연속형 변수의 표준화된 평균차이(standardized mean difference [SMD]) 산출 시 표본 수 보정을 위해 Hedge's g를 사용하였다. 이는 0.20–0.50 미만은 작은 효과, 0.50–0.80 미만은 중간 효과, 0.80 이상은 큰 효과크기를 의미한다[32]. 결과 지표의 특성에 따라 서로 다른 효과크기 지표를 사용하였는데, 이분형 자료에는 승산비(odds ratio [OR])나 위험비(risk ratio [RR])와 같은 상대적 효과 지표가 적합하며, 연속형 자료는 평균차이(mean difference [MD]) 또는 단위가 다른 경우 SMD로 변환하여 통합하는 것을 권고하고 있다[32]. 이에 본 연구에서는 성별, 저소득 여부, 동반질환 유무, 자의퇴원, 흡연, 음주 등 이분형 변수에는 OR를 로그변환한 값(log OR)을 사용하여 두 집단 간 사건 발생의 상대적 위험을 추정하였다. 반면, 연령, 당뇨병 유병기간, hemoglobin A1c (HbA1c)와 같은 연속형 변수는 연구별 측정단위가 상이하므로 비교 가능성을 확보하기 위해 SMD를 산출하였다. 따라서 본 연구는 각 결과 지표의 속성에 따라 적절한 효과크기 지표를 사용하여 메타분석을 시행하였다.

동질성 검증은 Q값, I^2 값을 통해 확인하였다. Q값은 메타분석에 있어서 각 효과크기들의 관찰된 분산을 의미하며, 이는 표집오차 분산과 실제 연구 간 분산을 모두 포함하는 총 분산을 의미한다. 이 Q 통계치는 효과크기의 동질성을 검증하는 데 사용되며 메타분석에 사용된 연구 수에 영향을 많이 받는다. I^2 값은 총 분산에 대한 실제 분산의 비율(%)로, 일반적으로 이질성에 대한 판단은 총 분산에 대한 실제분산의 비율(I^2)이 50% 이상이고 동질성 검증 통계치 Q값의 p값

이 0.10 미만인 경우, 연구들 간에 통계적 이질성이 존재한다고 해석하였다[32]. 본 연구의 메타분석에 포함된 연구들은 다양한 국가 및 환경에서 수행된 점을 고려하여, 보다 다양한 집단에 일반화하여 적용하기 위해서 랜덤효과모형으로 분석하였다[33]. 연구 수가 2편에 불과한 변수는 인종, 노숙, 무직, 당뇨병 진단 연령, 고혈압, Charlson 동반질환지수(Charlson comorbidity index [CCI]), 우울증, 치료 비순응, 자의퇴원 등 9개였다. 이처럼 포함 연구 수가 적거나 이질성이 존재할 가능성이 높은 경우, 전통적인 DerSimonian-Laird 방법은 제1종 오류를 과대 추정할 수 있다는 한계가 보고되어 왔다[34]. 이에 보다 보수적이고 안정적인 추정을 위해 Hartung-Knapp-Sidik-Jonkman (HKSJ) 보정을 적용하고, 연구 간 분산(τ^2)은 Sidik-Jonkman 추정치를 사용하였다. 또한 출판편향 검증을 위해서 시각적 검정방법으로 funnel plot을 사용하였다. Funnel plot에서는 효과크기 데이터의 편향이 없다면 좌우 대칭적인 모습을 보이며, 비대칭인 경우는 데이터의 편향이 있음을 나타낸다[35]. 그리고 메타분석에 포함된 문헌을 대상으로 당뇨병 유형에 따른 하위그룹 분석을 하고자 하였으나, 제1형 당뇨병 환자 대상으로 보고한 연구 6편만으로 추가 분석을 시행하였다. 제2형 당뇨병 환자만을 대상으로 한 연구는 없었고, 제1형과 제2형 당뇨병 환자를 함께 포함한 문헌은 당뇨병 유형별로 결과 구분이 불가하여 하위그룹 분석에 포함하지 않았다[36,37].

결과

1. 체계적 문헌고찰

1) 체계적 문헌고찰 대상 연구 관련 특성

본 연구의 체계적 고찰에 포함된 문헌은 총 15편으로, 연구 관련 특성을 출판연도, 연구유형, 연구설계별로 분석하였다. 출판연도는 2010년에서 2020년에 출판된 연구가 8편(53.3%), 2020년 이후 연구가 7편(46.7%)이었다. 출판국가는 미국이 7편(46.7%)으로 가장 많았고, 그 다음으로는 영국 2편(13.3%), 캐나다 2편(13.3%), 이스라엘 2편(13.3%), 호주, 대만에서 각 1편(6.7%)씩 출판되었다. 연구설계는 후향적 코호트 연구 14편(93.3%), 환자-대조군 연구가 1편(6.7%)이었다. 각 문헌에서 제시한 재입원율은 4.1%에서 많게는 36.0%까지 나타났다(Table 1).

2) 재입원 위험요인

본 연구에서 당뇨병케톤산증 환자의 재입원과 관련된 위험요인은 인구통계학적(3개), 사회경제적(4개), 당뇨병 관련(4개), 동반질환(5개), 건강행태(5개)로 총 21개의 요인을 도출하였다. 이는 체계적 문헌고찰에 포함된 15편의 연구에서 제시된 재입원 위험요인 중, 유사하거나 중복되는 개념을 통합하고, 2편 이상에서 반복적으로 언급된 요인을 중심으로 선정하였다. 이러한 선정기준은 문헌 간 변수 정의 및 분석방법의 이질성을 고려하여, 메타분석의 일관성과 포괄성을 확보하기 위한 목적에서 설정되었다.

인구통계학적 요인에서는 연령, 성별, 인종 등 3가지 요인이 확인되었다. 연령이 낮을수록[10,18,21,22,28,30,36], 여성이 남성보다[10,16,19,30,37], 그리고 비백인 환자에서[21,29] 재입원 위험이 높았다. 사회경제적 요인은 보험 유형, 소득수준, 노숙, 직업 상태 등 4가지로 나타났다. Medicare·Medicaid 등 공공 건강보험 가입자[10,29,37], 낮은 소득수준[10,18], 노숙자나 무직인 경우[28,38] 재입원률이 높았다. 당뇨병 관련 요인은 당뇨병 유형, 유병기간, 진단 연령, HbA1c 수치 등 4가지로 나타났다. 제1형 당뇨병 환자[21,30,37], 유병기간이 긴 환자[18,22,30], 어릴 때 당뇨병을 진단받은 환자[18,22,36]에서 재입원 위험이 높았으며, HbA1c 수치가 높을수록 혈당 조절이 불량하여 재입원 가능성이 증가하였다[18,19,22,28,36]. 동반질환 요인은 고혈압, 신장질환, Charlson 동반질환지수(CCI), 우울증, 정신질환의 5가지였다. 고혈압 또는 신장질환이 있는 환자[16,37], Charlson 동반질환지수(CCI)가 높은 환자[16,19,37], 그리고 우울증[18,37]이나 기타 정신질환을 가진 환자[15,19,20]에서 재입원율이 유의하게 높았다. 건강행태 요인은 치료 비순응, 자의퇴원, 흡연, 음주, 약물남용의 5가지로 나타났다. 치료에 비순응하거나[19,22,31], 자의퇴원을 한 경우[10,16,37], 흡연[10,28,38], 음주[19], 약물남용[21,37–39]이 있는 경우 재입원 위험이 높았다.

3) 질 평가

최종 15편의 문헌은 NOS를 사용하여 14편의 코호트 연구와 1편의 환자-대조군 연구에 대한 질 평가를 시행하였다. 14편의 코호트 연구의 질 평가 평균점수는 7.4점으로 14편의 논문이 모두 채택되었다. 8편의 문헌은 단일 기관에서 시행되었고, 6편의 문헌은 미국 및 영국의 전국 데이터베이스 자료를 사용하거나 캐나다의 5개 병원과 미국의 11개 병원의 자료를 사용하여 분석하였기에 '선택' 영역에서는 6편의 문헌이 질 평가조건들을 모두 만족하였다. '비교 가능성' 영역에서는 14편의 문헌에서 혼란변수를 통제하기 위한 주요 변수의 통제가 이루어졌다. '평가' 영역에서는 14편 문헌 모두 전자의무기록을 이용하여 데이터를 수집하였고, 최소 1년에서 최대 15년의 충분한 추적기간을 확보했다. 그러나 대부분의 문헌에서 추적관찰의 적절성을 평가하는 과정에서 이탈률에 대한 구체적인 언급이 부족하여, 해당 평가항목에서 최대 점수를 부여하지 못하고 총 3점 중 평균 2점을 받았다(Table 2).

1편의 환자-대조군 연구의 질 평가점수는 8점으로 채택되었다. '선택' 영역에서는 환자군 모집이 체계적으로 수행되어 대표성이 확보되었고 대조군은 동일한 데이터베이스에서 선정되어 모집단의 일관성이 보장되어 질 평가조건들을 모두 만족하였다. '비교 가능성' 영역에서는 다변량 로지스틱 회귀분석을 통한 혼란변수 조정으로 질 평가조건을 충족하였다. 전자의무기록을 통해 환자군과 대조군에게 동일한 방법으로 노출 평가가 적용되었지만, 비응답률에 대한 명시

Table 1. Characteristics of studies included in the systematic review and meta-analysis

No.	Author (year)	Country	Study design	Study date	Type of DM	Sample			Readmission (%)	Significant factors (p<.05)
						Size	Gender	Age (yr)		
1	Azevedo et al. [31] (2014)	Canada	Retrospective matched cohort	2002–2009	T1DM T2DM	76	F (35) M (41)	38.6±12.9	One or more prior DKA episodes (36.0)	New diagnosis of DM, insulin use, no medication, noncompliance, infection, follow-up with a general practitioner
2	Del Degan et al. [19][a] (2019)	Canada	Retrospective cohort	2007–2017	T1DM	212	F (102) M (110)	36.0±12.2	Within 1 year after discharge (33.4)	Alcohol or illicit drug abuse, higher HbA1c, poor adherence to insulin, psychiatric illness
3	Everett et al. [10][a] (2019)	USA	Retrospective cohort	2010–2015	T1DM	181,284	F (88,132) M (93,152)	35 (25–49)[b]	Two or more hospitalizations (22.0)	Young age, female gender, resident of the state of hospitalization, low income, Medicare/Medicaid insurance, disposition (facility transfer), AMA discharge
4	Gibb et al. [18] (2016)	UK	Retrospective cohort	2007–2012	T1DM	298	F (134) M (164)	21–55	Within 30 days after DKA discharge (–)	Longer duration of DM, younger age at DM diagnosis, high social deprivation, high HbA1c, antidepressant use
5	Golbets et al. [36][a] (2021)	Israel	Retrospective cohort	2004–2017	T1DM T2DM	385	F (226) M (159)	45.1±20.0	Only the second DKA episode (27.0)	HbA1c >9, younger age at DM diagnosis
6	Hare et al. [38][a] (2021)	Australia	Retrospective cohort	2013–2017	T1DM	128	F (59) M (69)	35 (26–48)[b]	Multiple DKA admissions within the same year (13.0)	Current smoker, unemployed, illicit substance use
7	Hurtado et al. [37][a] (2019)	USA	Retrospective cohort	2010–2014	T1DM T2DM	479,590	F (228,525) M (251,065)	42.4±16.3	Repeated DKA admission within 30 days of discharge (12.3)	CCI ≥3, AMA discharge, drug use, older age, female gender, T1DM, prolonged LOS (≥5 days), hypertension, heart failure, respiratory failure, ESRD, depression, smoking, low obesity, Medicare/Medicaid insurance
8	Liao et al. [28] (2022)	Taiwan	Retrospective cohort	2016–2019	T1DM T2DM	256	F (111) M (145)	52.2±17.6	30-day readmission: 90 days: 4.1; 1 year: 11.5; 2 year: 15.3	Young age, smoking, hyperthyroidism, hypoglycemia during hospitalization, higher effective osmolality, previous admission history
9	Lohiya et al. [20] (2013)	USA	Retrospective cohort	2006–2012	T1DM T2DM	80	F (51) M (29)	43.0±15.7	At least one recurrent hospitalization (-)	-
10	Lyerla et al. [21] (2021)	USA	Retrospective case control	2017–2019	T1DM T2DM	265	F (107) M (158)	45.0±15.0	During long-term follow-up (18.0)	African American race (vs. white non-Hispanic), other race/ethnicity, young age, T1DM, homeless, drug abuse
11	Michaelis et al. [22][a] (2021)	Israel	Retrospective cohort	2011–2017	T1DM	160	F (91) M (69)	38.0±18.0	Two or more DKA episodes within 1 year (31.0)	Young age, pre-existing DM, longer duration of DM, poor glycemic control (before admission and after discharge), noncompliance to insulin
12	Peedikayil et al. [39][a] (2024)	USA	Retrospective cohort	2019–2020	T1DM	243	F (104) M (139)	34.0±11.6	Within 30 days considered as recurrent (26.0)	Substance use disorder (cannabis, tobacco, psychoactive substance)

(Continued on the next page)

Table 1. Continued

No.	Author (year)	Country	Study design	Study date	Type of DM	Sample			Readmission (%)	Significant factors (p<.05)
						Size	Gender	Age (yr)		
13	Shaka et al. [16][a] (2021)	USA	Retrospective cohort	2018	T1DM	112,964	F (56,615) M (56,349)	35[b]	At least one DKA hospitalization during 2-year period (12.5)	High mean age, female gender, CCI ≥3, AMA discharge, hypertension, CKD, smoking
14	Xu et al. [29] (2020)	USA	Retrospective cohort	2015–2016	T1DM T2DM	531	F (282) M (249)	46.0±18.0	Readmission with primary diagnosis of DKA (13.9)	Medicare insurance, high Elixhauser index, endocrine consultation (reducing readmission rate)
15	Zhong et al. [30] (2018)	UK	Retrospective cohort	1998–2013	T1DM T2DM	264,687	-	T1DM: 46.7±17.7 T2DM: 66.4±13.2	Two or more times with DKA (T1DM: 12.7; T2DM: 6.2)	Young age, female gender, longer duration of DM, T1DM, glucose-lowering drugs, high CCI

Values are presented as number, mean±standard deviation, or median (IQR), unless otherwise stated.
AMA, against medical advice; CCI, Charlson comorbidity index; CKD, chronic kidney disease; DKA, diabetic ketoacidosis; DM, diabetes mellitus; ESRD, end-stage renal disease; F, female; HbA1c, hemoglobin A1c; IQR, interquartile range; LOS, length of stay; M, male; T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus.
[a]Studies included in Meta-Analysis. [b]Indicates median (IQR).

적 언급이 없어 '노출' 영역의 일부 항목에서 질 평가조건을 충족하지 못하였다(Table 2).

2. 메타분석

체계적 문헌고찰 과정에서 선정된 15편의 문헌 중에서 메타분석 대상 문헌의 요건을 충족하지 못한 6편을 제외하고 9편의 문헌 중 연구설계가 상이한 1편을 제외한 8편의 코호트 설계 문헌을 대상으로 메타분석을 수행하였다[10,16,19,22,36-39]. 본 메타분석에 포함된 8편의 연구들은 당뇨병케톤산증으로 입원한 환자 중 재입원 여부를 기준으로 비교군을 설정하였다. 구체적으로 8편의 연구에서 모두 재입원군은 2회 이상 입원한 환자군으로, 비교군은 단일 입원 환자군으로 구분하였는데, 이 중 2편은 퇴원 후 30일 이내 재입원 여부를 기준으로 재입원군과 비교군을 구분하였다[16,37].

1) 재입원 위험요인의 효과크기

인구통계학적 요인은 연령, 성별의 2개의 변수를 고려하여 총 8편의 문헌에서 15개의 효과크기를 산출하였다[10,16,19,22,36-39]. 모든 변수에 대해 랜덤효과모형을 적용하여 분석한 결과, 연령, 성별은 모두 통계적으로 유의하지 않았다(Table 3).

사회경제적 요인은 보험, 저소득의 2개의 변수를 고려하여 총 5편의 문헌에서 8개의 효과크기를 산출하였다[10,16,19,37,39]. 모든 변수에 대해 랜덤효과모형을 적용하여 분석한 결과, 저소득은 4개의 연구결과로부터 이질성이 확인되었고(I^2=95.14, Q=19.19, p<.001), 효과크기 log OR은 0.18 (95% confidence interval [CI], 0.10–0.26; t=7.05, p=.006)로 유의하게 나타났다. 반면, 보험은 통계적으로 유의하지 않았다(Figure 2, Table 3).

당뇨병 관련 요인은 당뇨병 유병기간, HbA1c의 2개의 변수를 포함하여 총 5편의 문헌에서 8개의 효과크기를 산출하였다[19,22,36,38,39]. 모든 변수에 대해 랜덤효과모형을 적용하여 분석한 결과, 당뇨병 유병기간과 HbA1c는 모두 통계적으로 유의하지 않았다(Table 3).

동반질환 요인으로는 신장질환과 동반 정신질환을 포함하였으며, 이 두 변수를 보고한 7편의 문헌으로부터 총 7개의 효과크기를 산출하였다[16,19,22,36-39]. 모든 변수에 대해 랜덤효과모형을 적용하여 분석한 결과, 동반 정신질환은 3개의 연구에서 보고되었으며, 이질성이 매우 낮게 나타났다(I^2=1.99, Q=0.27, p=.876). 효과크기(log OR)는 1.04 (95% CI, 0.61–1.46)로 나타났으며, 이는 결과 사건의 발생 위험이 유의하게 증가함을 의미한다(t=10.44, p=.009). 반면, 신장질환은 통계적으로 유의하지 않았다(Figure 2, Table 3).

건강행태 요인은 자의퇴원, 흡연, 음주, 약물남용의 4개의 변수를 포함하여 총 7편의 문헌에서 13개의 효과크기를 산출하였다[10,16,19,22,36-38]. 모든 변수에 대해 랜덤효과모형을 적용하여 분석한 결과, 자의퇴원은 2개의 연구결과로부터 동질성이 확인되었으

Table 2. Quality assessment of studies

Study	Selection				Comparability		Outcome (exposure)		Total score (0–9)
Cohort study (n=14)	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Outcome of interest not present at start of study	Comparability of cohorts on the basis of the design	Assessment of outcome	Follow-up long enough for outcomes to occur	Adequacy of follow-up of cohorts	
Azevedo et al. [31] (2014)		*	*	*	**	*	*		7
Del Degan et al. [19] (2019)	*	*	*	*	**	*	*		8
Everett et al. [10] (2019)	*	*	*	*	**	*	*		8
Gibb et al. [18] (2016)		*	*	*	**	*	*		7
Golbets et al. [36] (2021)		*	*	*	**	*	*		7
Hare et al. [38] (2021)		*	*	*	**	*	*		7
Hurtado et al. [37] (2019)	*	*	*	*	**	*	*		8
Liao et al. [28] (2022)		*	*	*	**	*	*		7
Lohiya et al. [20] (2013)		*	*	*	**	*	*		7
Michaelis et al. [22] (2021)		*	*	*	**	*	*		7
Peedikayil et al. [39] (2024)		*	*	*	**	*	*		7
Shaka et al. [16] (2021)	*	*	*	*	**	*	*		8
Xu et al. [29] (2020)	*	*	*	*	**	*	*		8
Zhong et al. [30] (2018)	*	*	*	*	**	*	*		8
Case-control study (n=1)	Adequate definition of cases	Representativeness of the cases	Selection of controls	Definition of controls	Comparability of cases and controls on the basis of the design	Assessment of exposure (blinding)	Same method of ascertainment for cases and controls	Non-response rate	
Lyerla et al. [21] (2021)	*	*	*	*	**	*	*		8

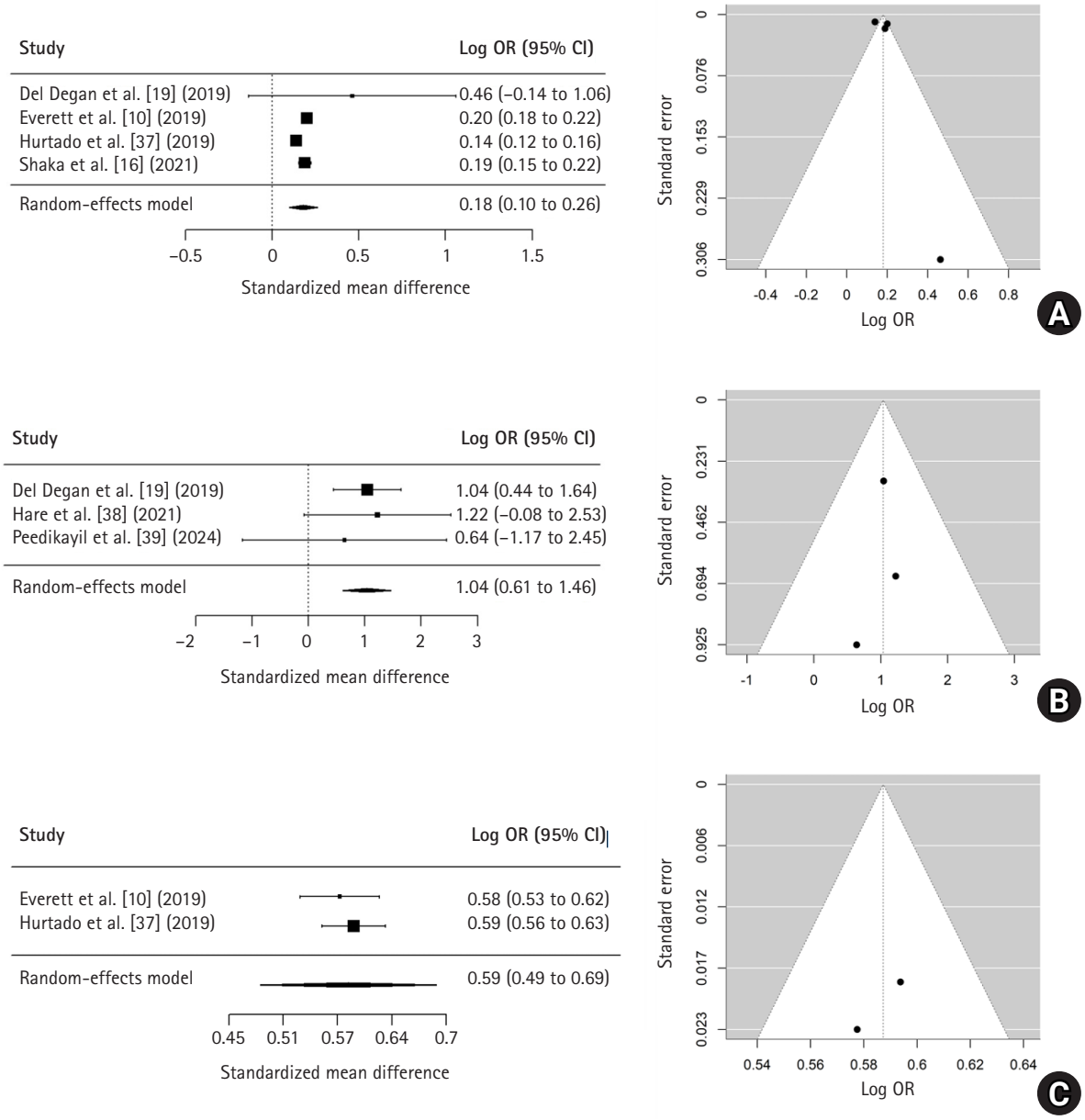

Figure 2. Forest plots(left) and funnel plots(right) of significant risk factors for diabetic ketoacidosis (DKA) readmission. (A) Low income. (B) Psychiatric disorder. (C) Against medical advice (AMA) discharge. CI, confidence interval; OR, odds ratio.

며(I^2=3.71, Q=0.30, p=.585), 그 효과크기 log OR은 0.59 (95% CI, 0.49–0.69; t=73.82, p=.009)로 유의하게 나타났다. 반면, 흡연, 음주, 약물남용은 통계적으로 유의하지 않았다(Figure 2, Table 3).

따라서 메타분석 결과, 저소득층, 동반 정신질환이 있는 경우, 그리고 자의퇴원한 경우는 당뇨병케톤산증 환자의 재입원 위험과 유의한 양의 연관성을 보였다.

2) 추가 분석

본 연구는 메타분석에 포함된 8편의 문헌 중 제1형 당뇨병 환자만을 대상으로 결과를 보고한 6편의 문헌을 이용하여 추가 분석을 수행하였다[10,16,19,22,38,39] (Supplementary Table 2). 인구통계학적 요인은 연령, 성별을 포함하였으나, 통계적으로 유의미하지 않았다. 사회경제적 요인은 보험, 저소득을 포함하였으며, 저소득만이 유의미한 영향을 보였다(p=.022). 당뇨병 관련 요인은 HbA1c를 포함하였으며, 통계적으로 유의미하지 않았다. 동반질환 요인은 정신질환을 포함하였으며, 정신질환(p=.009)은 재입원과 유의미한 관련성을 보였다. 건강행태 요인은 흡연, 음주를 포함하였으며, 음주(p=.002)가 재입원과 유의미한 관련성을 보였다.

Table 3. Results of the meta-analysis (N=8)

Risk factors	k	ES	95% CI	95% PI	t	*p*	Homogeneity test			Model
							I^2	Q	*p*	
Demographic										
Age	7	−0.10[a]	−0.28 to 0.08	−0.56 to 0.35	−1.35	.224	99.14	59.04	<.001	Random
Female gender	8	0.09[b]	−0.18 to 0.36	−0.62 to 0.81	0.82	.441	99.39	48.47	<.001	Random
Socioeconomic										
Medical insurance	4	0.74[b]	−0.68 to 2.16	−2.32 to 3.80	1.66	.195	99.97	4,557.26	<.001	Random
Low income	4	0.18[b]	0.10 to 0.26	−0.05 to 0.41	7.05	.006	95.14	19.19	<.001	Random
Diabetes-related										
DM duration	3	−0.63[a]	−2.85 to 1.59	−4.95 to 3.69	−1.22	.346	95.07	44.45	<.001	Random
HbA1c	5	0.32[a]	−0.02 to 0.66	−0.40 to 1.04	2.63	.058	67.83	10.98	.027	Random
Comorbidity										
Renal disease	4	0.50[b]	−1.10 to 2.11	−2.67 to 3.67	0.99	.393	99.83	1,198.50	<.001	Random
Psychiatric disorder	3	1.04[b]	0.61 to 1.46	0.47 to 1.60	10.44	.009	1.99	0.27	.876	Random
Health behavior										
AMA discharge	2	0.59[b]	0.49 to 0.69	0.47 to 0.70	73.82	.009	3.71	0.30	.585	Random
Smoking	4	0.48[b]	−0.69 to 1.64	−1.99 to 2.94	1.31	.283	99.88	27.42	<.001	Random
Alcohol	4	0.54[b]	−0.31 to 1.38	−0.95 to 2.02	2.02	.137	59.71	13.36	.004	Random
Drug abuse	3	0.67[b]	−0.07 to 1.42	−0.68 to 2.02	3.87	.061	49.84	2.35	.309	Random

AMA, against medical advice; CCI, Charlson comorbidity index; CI, confidence interval; DM, diabetes mellitus; ES, effect size; HbA1c, hemoglobin A1c; PI, prediction interval.
[a]Standardized mean difference. [b]Log odds ratio.

3) 출판편향 검증

재입원 위험요인의 출판편향을 검증하기 위하여 funnel plot을 확인한 결과는 Figure 2와 같다. 본 연구에서 효과크기들의 대칭 정도를 funnel plot을 통해 시각적으로 확인하였으나, 메타분석에 포함된 문헌의 수가 10편 미만으로 출판편향이 평가되지 못하였다. 비대칭 정도의 통계적 유의성을 판단하기 위한 Egger's linear regression method도 각 변수별 포함되는 문헌 수가 10편 미만으로 통계적 안정성이 보장되지 않는다고 판단하여 진행하지 않았다[40]. 따라서 메타분석에 포함된 문헌 수가 적을 경우 funnel plot의 비대칭성은 우연에 의해 발생할 수 있으며, 실제 출판편향을 반영하지 않을 수 있으므로 해석에 주의가 필요하다.

고찰

본 연구는 체계적 문헌고찰과 메타분석을 통해 당뇨병케톤산증 환자의 재입원과 관련된 위험요인을 확인하였다. 체계적 문헌고찰 결과, 본 연구에 포함된 15편의 연구 중 7편이 2020년 이후 발표된 것으로, 최근 5년간 당뇨병케톤산증의 재입원에 대한 연구가 집중적으로 이루어졌음을 알 수 있었다. 이는 당뇨병케톤산증 재입원에 대한 임상적 중요성과 관심이 증가하고 있음을 반영한다. 출판국가 중에서 미국이 7편으로 가장 많았는데, 이는 방대한 전자건강기록 데이터를 통한 후향적 접근으로 재입원에 대한 연구가 보다 용이했음을 보여준다[10,16,37].

본 체계적 문헌고찰에서는 당뇨병케톤산증의 재입원과 관련된 위험요인을 총 21개로 도출하였으며, 이를 인구통계학적 요인, 사회경제적 요인, 당뇨병 관련 요인, 동반질환 요인, 건강행태 요인의 다섯 범주로 분류하였다. 이는 재입원이 단일 요인이 아닌 상호 연관된 여러 요인들에 의해 복합적으로 영향을 받는다는 점을 시사한다. 인구통계학적 특성과 사회경제적 요인은 질병의 경과와 당뇨병 자가관리 능력에 영향을 미치며[10,21,37], 이러한 요인들이 복합적으로 작용하여 재입원 위험을 높일 수 있다. 특히 저소득층에서 재입원 위험이 높았는데, 이는 경제적 부담으로 인한 인슐린 사용 제한이나 자가관리 부족 가능성과 관련된다[20,21]. 이러한 결과는 의료접근성이 낮은 사회경제적 취약계층이 반복적인 재입원 위험에 노출되어 있음을 보여주며, 단순한 의료이용의 문제가 아닌 건강형평성과 직결되는 사회적 구조의 문제로 해석될 수 있다. 따라서 퇴원 이후의 연속적 관리의 필요성이 강조되며, 취약계층을 대상으로 한 방문간호, 추적관리, 공공자원 연계와 같은 맞춤형 중재가 요구된다. 여러 선행연구에서도 초기 퇴원 교육의 중요성이 반복적으로 보고되었으므로[16,18,19,41], 퇴원 직후의 집중 교육 및 지속적인 사후 개입이 재입원 예방에 핵심적 역할을 할 수 있을 것이다. 당뇨병 관련 요인 중 제1형 당뇨병, 긴 유병기간, 조기 진단, 높은 HbA1c 수치 등은 재입원율을 높이는 주요 임상적 요인으로 확인되었으며, 특히 높은 HbA1c 수치는 당뇨병 관리가 제대로 되고 있지 않음을 의미하고 혈당 조절이 불량할수록 재입원 위험이 증가함을 시사한다[10,18,20-22,28,36]. 혈당 조절의 실패는 인슐린 치료의 비순응, 전문적인 추적관찰 및 지속적인 관리의 부족, 그리고 불충분한 환자 교육 등 자가관리 부족과 밀접하게 연관된다[19,20,29,36]. 따라서 당뇨병케톤산증의 재입원 예방을 위해서 임상적 치료와 더불어 자가관리 역량 강화가 필수적이며, 혈당 모니터링, 인슐린 순응, 식이 및 운동 조절

등은 재입원 위험을 낮추는 핵심 요소로[16,21,22,28,39], 체계적인 교육과 퇴원 후 지속적인 지원을 통해 개선될 수 있다. 따라서 HbA1c 수치가 높고 혈당 조절에 어려움이 있는 환자를 조기 선별하고, 맞춤형 교육 및 추적관리를 제공하는 것은 재입원율 감소를 위한 효과적인 전략이 될 수 있다.

아울러 재입원은 질병의 임상적 특성뿐만 아니라 동반질환 및 건강행태 요인과도 밀접한 관련이 있었다. 고혈압, 신장질환, 우울증, 정신질환과 같은 동반질환 역시 재입원 위험을 높이는 요인으로 나타났으며, 이러한 질병군 또한 상호 연관성을 가진다. 우울증을 포함한 정신질환이 동반된 환자에서 인슐린 순응도 저하가 일관되게 보고되었고[19,42,43], 심리적 요인을 함께 관리하는 것 또한 필수적이라고 하였다[19]. 특히 정신건강 문제는 치료비순응, 약물남용, 자의퇴원과 같은 부정적인 건강행태와 연결되어 악순환을 초래할 수 있다[18,19,37,38]. 이 중 자의퇴원은 치료가 완료되지 않은 상태에서의 조기 퇴원으로 이는 재입원 증가로 이어질 수 있으며[28,43], 이러한 건강행태 요인은 단순히 환자 개인의 의지나 선택의 문제가 아닌, 사회적 지지 부족[44,45], 정신건강서비스 접근성의 제한[31,36,45], 퇴원 후 연계 부족[46] 등과 같은 구조적 요인과도 깊은 관련이 있다. 이는 퇴원 후 지속적인 관리와 통합적 지원체계 마련의 필요성을 강조한다.

본 연구의 메타분석은 포함된 연구 수가 적고 연구 간 이질성이 존재한다는 방법론적 한계를 고려하여 초기 단계부터 보수적인 추정치를 제공하는 HKSJ 보정을 적용한 결과, 저소득층과 동반 정신질환, 자의퇴원이 당뇨병케톤산증 환자의 재입원과 유의하게 관련되었다. 이는 HKSJ 보정에 따라 표준오차와 신뢰구간이 확대되면서 불확실성이 보다 엄격하게 반영된 결과로, 체계적 문헌고찰에서 반복 확인된 기존 근거와 일치한다. 아울러 낮은 사회경제적 지위와 동반 정신질환은 Soh 등[42]이 보고한 당뇨병 환자의 30일 내 재입원 위험요인에 대한 메타분석 결과와도 유사하여, 본 연구결과의 타당성을 뒷받침한다. 다만 포함 연구 수의 제한과 재입원의 정의 및 추적기간의 이질성으로 인해 효과 추정은 보수적으로 해석해야 하며, 본 연구의 결과는 새로운 위험요인을 발견했다기보다는, 당뇨병케톤산증 환자의 재입원이 사회경제적 요인, 동반질환, 건강행태 요인의 상호작용으로 설명될 수 있음을 정량적으로 보완하는 참고자료로 해석하는 것이 타당하다.

선행연구에 따르면[47], 제1형 당뇨병은 제2형 당뇨병보다 퇴원 후 6개월 이내 당뇨병케톤산증 재발 위험이 더 높은 것으로 보고되었다. 본 연구에서 제1형 당뇨병 환자군을 대상으로 추가 분석을 실시한 결과, 제1형 당뇨병 환자군에서도 저소득층과 동반 정신질환이 재입원과 유의한 관련성을 보였으며, 이는 사회경제적 취약성과 정신건강 문제가 당뇨병케톤산증 환자의 재입원에 핵심적 요인임을 재확인한 결과이다. 제1형 당뇨병은 주로 소아 · 청소년기에 발병하여 장기간의 질병 경과와 자가관리 부담이 누적되므로[8-10], 경제적 취약성과 정신건강 문제의 영향이 더욱 두드러질 수 있으며[10,18], 또한 유병기간이 긴 환자일수록 합병증의 누적과 자가관리 동기 저하로 인해 재입원 위험이 높아질 수 있다[18,22,30]. 이러한 결과는 향후 경제적 · 정신사회적 지원 및 건강행태 개선을 포함한 다차원적 접근의 필요성을 보여준다.

본 연구는 체계적 문헌고찰 및 메타분석을 통해 당뇨병케톤산증 환자의 재입원 위험요인을 종합적으로 정리하고 다양한 국가와 환자 데이터를 포함하여 기존 근거를 보완하였다. 또한 명확한 문헌 선정 기준, 다중 데이터베이스를 활용한 체계적인 검색전략, 문헌 질 평가를 통해 분석의 일관성과 투명성을 확보하고자 하였다. 아울러 제1형 당뇨병 환자군을 대상으로 한 추가 분석을 통해 기존 문헌에서 반복적으로 보고된 위험요인의 적용 가능성을 검토하였다. 이러한 접근은 사회경제적 요인, 동반질환, 건강행태 요인의 중요성을 재확인함으로써, 향후 사회적 취약계층에 대한 조기 개입, 지역사회 기반 연계서비스, 정신건강 관리 및 치료 연계, 환자 맞춤형 자가관리 교육 강화 등 예방전략을 설계할 때 참고할 수 있는 보완적 근거를 제공한다는 점에서 의의가 있다. 다만 이러한 의의 역시 포함 연구 수가 적고 이질성이 존재하는 현존 근거의 범위 내에서 이해되어야 한다.

본 연구는 다음과 같은 제한점을 가진다. 첫째, 포함된 연구들 간의 이질성이 존재하며, 일부 변수는 문헌 수가 적어 효과추정의 신뢰구간이 넓어졌다는 한계가 있다. 이를 보완하기 위해 보수적 추정을 위한 HKSJ 보정을 적용하였다. 이 방법은 추정치의 불확실성을 반영할 수 있으나, 그 결과 일부 변수의 유의성이 소실되어 최종적으로 확인된 위험요인의 수가 제한적이라는 점에서 해석에 신중함이 필요하다. 따라서 본 연구결과는 당뇨병케톤산증 환자의 재입원 위험요인이 없다는 것을 의미하기보다는, 현존 근거의 정밀도가 충분하지 않음을 반영하는 것으로 이해해야 한다. 또한 메타분석에 포함된 문헌 수가 적어 출판편향에 대한 회귀검정이나 보정분석을 수행하지 못하였다는 한계가 있다. 둘째, 대부분의 문헌이 후향적 연구로 설계되어 인과관계 해석에 제한이 있으며, 특히 본 연구에 포함된 문헌은 모두 국외 연구로 연구결과의 대부분이 국외 의료환경에 기반하고 있어, 국내 의료환경에 직접 적용하기에는 주의가 필요하다. 따라서 국내 환자군을 대상으로 한 대규모의 전향적 연구 및 중재연구가 필요할 것이다. 셋째, 본 연구는 성인 환자만을 대상으로 하였기 때문에 소아 및 청소년 환자에 대한 일반화에는 제한이 있으며, 향후 연령대별 특성을 고려한 포괄적인 분석이 요구된다. 넷째, 본 연구에 포함된 문헌들은 재입원을 '1회 이상' 또는 '30일 이내' 재입원으로 정의하고 재입원 추적기간 또한 30일이나 1년, 연구기간 전체 등으로 상이하여, 재입원 차수에 따른 하위그룹 분석을 수행하지 못하였고 효과크기 비교에 제한이 있었다. 이러한 재입원 빈도 및 추적기간의 차이는 재입원율뿐 아니라 위험요인과의 관련성에도 영향을 줄 수 있으며, 이는 본 메타분석에서 이질성을 유발하는 요인 중 하나로 작용했을 가능성이 있다. 마지막으로, 제1형과 제2형 당뇨병 환자를 구분하여 비교한 하위그룹 분석이 이루어지지 않았다. 이는 당뇨병 유형별 특성을 반영한 보다 정밀한 분석을 통해 향후 유형별 재입원

위험요인을 규명하고 맞춤형 중재전략을 개발하는 데 기초자료로 활용될 수 있을 것이다.

결론

당뇨병케톤산증은 당뇨병 환자에서 발생하는 심각하지만 예방 가능한 합병증이므로, 본 연구는 당뇨병케톤산증의 재입원 위험요인에 대한 체계적 검토와 보완적 정량화를 통해, 재입원이 단일 요인보다는 개인적 · 임상적 특성과 사회적 환경이 복합적으로 작용하여 발생한 결과임을 나타낸다. 특히 혈당 조절 불량, 동반 정신질환, 치료비 순응, 자의퇴원과 약물남용, 음주, 흡연 등은 재입원 위험과 관련된 변화 가능한 요인으로, 이는 향후 환자 맞춤형 자가관리 교육과 정신건강 관리, 퇴원 후 관리시스템 강화 등 다양한 중재전략을 고려할 필요가 있을 것이다. 다만, 본 연구는 포함된 연구 수가 적고 이질성이 존재하며, 모든 문헌이 국외 연구에 해당한다는 점에서 국내 의료환경에 직접 적용하기에는 한계가 있다. 따라서 본 연구결과는 확정적인 결론이라기보다 현존 근거를 정리하고 보완한 보조적 근거로 이해되어야 하며, 향후 국내 의료환경을 반영한 대규모 전향적 연구 및 중재연구가 요구된다.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

Please contact the corresponding author for data availability.

Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.4040/jkan.25072.

Author Contributions

Conceptualization or/and Methodology: HJ, SKH. Data curation or/and Analysis: HJ, SKH. Funding acquisition: SKH. Investigation: HJ, SKH. Project administration or/and Supervision: SKH. Resources or/and Software: HJ, SKH. Validation: HJ, SKH. Visualization: HJ. Writing original draft or/and Review & Editing: HJ, SKH. Final approval of the manuscript: all authors.

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Appendix 1. Search strategy (international databases, domestic databases)

DB	No.	Search query	Results
PubMed	#1	"diabetic ketoacidosis"[MeSH Terms]	7,902
	#2	"hyperglycemic cris*"[Title/Abstract] OR "hyperglycemia cris*"[Title/Abstract] OR "hyperglycaemic cris*"[Title/Abstract] OR "hyperglycemic state*"[Title/Abstract] OR "hyperglycemia state*"[Title/Abstract] OR "hyperglycaemic syndrome*"[Title/Abstract] OR "hyperglycemic syndrome*"[Title/Abstract] OR "hyperglycemia syndrome*"[Title/Abstract] OR "hyperglycemic emergenc*"[Title/Abstract] OR "hyperglycaemic emergenc*"[Title/Abstract] OR "diabet* emergenc*"[Title/Abstract] OR "diabet* ketoacidos*"[Title/Abstract] OR "diabet* acidos*"[Title/Abstract] OR "diabet* ketos*"[Title/Abstract]	10,210
	#3	#1 OR #2	12,893
	#4	"patient readmission"[MeSH Terms]	24,780
	#5	"readmission*"[Title/Abstract] OR "re admission*"[Title/Abstract] OR "rehospitaliz*"[Title/Abstract] OR "rehospitalisa*"[Title/Abstract] OR "re hospitaliza*"[Title/Abstract] OR "recurrent admission*"[Title/Abstract] OR "recurrent dka admission*"[Title/Abstract] OR "recurrent hospital admission*"[Title/Abstract] OR "recurrent hospitalization*"[Title/Abstract]	60,353
	#6	"readmit*"[Title/Abstract] AND ("hospital"[Title/Abstract] OR "patient*"[Title/Abstract])	10,636
	#7	#4 OR #5 OR #6	65,213
	#8	#3 AND #7	135
Embase	#1	'diabetic ketoacidosis'/exp OR 'diabetic ketoacidosis'	22,787
	#2	((hyperglycemic OR hyperglycemia OR hyperglycaemic) NEAR/2 (crisis OR crises)):ti,ab	415
	#3	(hyperglycaemic:ti,ab OR hyperglycemic:ti,ab OR diabet*:ti,ab) AND next:ti,ab AND emergenc*:ti,ab AND ((diabet* NEAR/1 (ketoacidos* OR acidos* OR ketos*)):ti,ab)	67
	#4	#1 OR #2 OR #3	22,951
	#5	'hospital readmission'/exp	114,003
	#6	readmission*:ti,ab OR 're admission*':ti,ab OR rehospitaliz*:ti,ab OR rehospitalisa*:ti,ab OR 're hospitaliza*':ti,ab OR 'recurrent admission*':ti,ab OR 'recurrent dka admission*':ti,ab OR 'recurrent hospital admission*':ti,ab OR 'recurrent hospitalization*':ti,ab	109,100
	#7	readmit*:ti,ab AND (hospital:ti,ab OR patient*:ti,ab)	23,475
	#8	#5 OR #6 OR #7	147,786
	#9	#4 AND #8	481
CINAHL	#1	(MH "diabetic ketoacidosis") OR (TI (hyperglycemic crisis OR hyperglycemia crisis OR hyperglycaemic crisis OR hyperglycemic state OR hyperglycemia state OR hyperglycaemic syndrome OR hyperglycemic syndrome OR hyperglycemia syndrome OR hyperglycemic emergency OR hyperglycaemic emergency OR diabetes emergency OR diabetes ketoacidos OR diabetes acidosis OR diabetes ketosis) OR AB (hyperglycemic crisis OR hyperglycemia crisis OR hyperglycaemic crisis OR hyperglycemic state OR hyperglycemia state OR hyperglycaemic syndrome OR hyperglycemic syndrome OR hyperglycemia syndrome OR hyperglycemic emergency OR hyperglycaemic emergency OR diabetes emergency OR diabetes ketoacidos OR diabetes acidosis OR diabetes ketosis))	8,801
	#2	((MH "readmission") OR (TI((readmission OR re-admission OR rehospitalization OR rehospitalisation OR re-hospitalization OR recurrent admission OR recurrent DKA admission OR Recurrent Hospital Admission OR recurrent hospitalization))) OR AB ((readmission OR re-admission OR rehospitalization OR rehospitalisation OR re-hospitalization OR recurrent admission OR recurrent DKA admission OR Recurrent Hospital Admission OR recurrent hospitalization)))	17,777
	#3	#1 AND #2	56
Cochrane	#1	(hyperglycemic OR hyperglycemia OR hyperglycaemic) NEAR/2 (crisis OR crises):ti,ab,kw	45
	#2	(hyperglycaemic OR hyperglycemic OR diabet*) NEXT emergenc*:ti,ab,kw	16
	#3	diabet* NEAR/1 (ketoacidos* OR acidos* OR ketos*):ti,ab,kw	1,028
	#4	[Diabetic Ketoacidosis] explode all trees	224
	#5	#1 OR #2 OR #3 OR #4	1,062
	#6	[Patient Readmission] explode all trees	1,693
	#7	readmission*:ti,ab,kw OR re-admission*:ti,ab,kw OR rehospitaliz*:ti,ab,kw OR rehospitalisa*:ti,ab,kw OR re-hospitaliza*:ti,ab,kw OR "recurrent admission":ti,ab,kw OR "recurrent DKA admission":ti,ab,kw OR "Recurrent Hospital Admission":ti,ab,kw OR "recurrent hospitalization":ti,ab,kw	13,491
	#8	(readmit*:ti,ab,kw AND (hospital:ti,ab,kw OR patient*:ti,ab,kw))	937
	#9	#6 OR #7 OR #8	13,857
	#10	#5 AND #9	16

(Continued on the next page)

Appendix 1. Continued

DB	No.	Search query	Results
Web of Science	#1	(ALL=(diabetic ketoacidosis)) OR ALL=("hyperglycemic cris*"[tiab] OR "hyperglycemia cris*"[tiab] OR "hyperglycaemic cris*"[tiab] OR "hyperglycemic state*"[tiab] OR "hyperglycemia state*"[tiab] OR "hyperglycaemic syndrome*"[tiab] OR "hyperglycemic syndrome*"[tiab] OR "hyperglycemia syndrome*"[tiab] OR "hyperglycemic emergenc*"[tiab] OR "hyperglycaemic emergenc*"[tiab] OR "diabet* emergenc*"[tiab] OR "diabet* ketoacidos*"[tiab] OR "diabet* acidos*"[tiab] OR "diabet* ketos*"[tiab])	10,325
	#2	((ALL=(patient readmission)) OR ALL=((readmission*[tiab] OR re-admission*[tiab] OR rehospitaliz*[tiab] OR rehospitalisa*[tiab] OR re-hospitaliza*[tiab] OR "recurrent admission*"[tiab] OR "recurrent DKA admission*"[tiab] OR "recurrent hospital admission*"[tiab] OR "recurrent hospitalization*"[tiab]) OR (readmit*[tiab] AND (hospital[tiab] OR patient*[tiab]))))	36,876
	#3	#1 AND #2	58
RISS	#1	당뇨병케톤산증 OR 당뇨병케톤산혈증 OR 당뇨병케톤혈증	114
	#2	재입원	167
	#3	#1 AND #2	0
Korea-Med	#1	(diabetic ketoacidosis[MH]) OR ((((((((("hyperglycemic crisis"[TIAB] OR "hyperglycemia crisis"[TIAB]) OR "hyperglycaemic crises"[TIAB]) OR "hyperglycemic state"[TIAB]) OR "hyperglycemia state"[TIAB]) OR "hyperglycaemic syndrome"[TIAB]) OR "hyperglycemia syndrome"[TIAB]) OR "hyperglycemic emergency"[TIAB]) OR "hyperglycaemic emergency"[TIAB]) OR "diabetic emergency"[TIAB]) OR "diabetic Ketoacidosis"[TIAB])	220
	#2	((readmission[ALL] OR rehospitalization[ALL]) OR "recurrent admission"[ALL])	443
	#3	#1 AND #2	0
KMbase	#1	diabetic ketoacidosis	143
	#2	(readmission) OR (rehospitalization) OR (recurrent admission)	226
	#3	#1 AND #2	0
KISS	#1	당뇨병케톤산증 OR 당뇨병케톤산혈증 OR 당뇨병케톤혈증	160
	#2	재입원	167
	#3	#1 AND #2	0
DBpia	#1	당뇨병케톤산증 OR 당뇨병케톤산혈증 OR 당뇨병케톤혈증	104
	#2	재입원	225
	#3	#1 AND #2	0

Appendix 2. Included studies in systematic review

A1. Azevedo LC, Choi H, Simmonds K, Davidow J, Bagshaw SM. Incidence and long-term outcomes of critically ill adult patients with moderate-to-severe diabetic ketoacidosis: retrospective matched cohort study. J Crit Care. 2014;29(6):971-977. https://doi.org/10.1016/j.jcrc.2014.07.034

A2. Del Degan S, Dubé F, Gagnon C, Boulet G. Risk factors for recurrent diabetic ketoacidosis in adults with type 1 diabetes. Can J Diabetes. 2019;43(7):472-476. https://doi.org/10.1016/j.jcjd.2019.01.008

A3. Everett E, Mathioudakis NN. Association of socioeconomic status and DKA readmission in adults with type 1 diabetes: analysis of the US National Readmission Database. BMJ Open Diabetes Res Care. 2019;7(1):e000621. https://doi.org/10.1136/bmjdrc-2018-000621

A4. Gibb FW, Teoh WL, Graham J, Lockman KA. Risk of death following admission to a UK hospital with diabetic ketoacidosis. Diabetologia. 2016;59(10):2082-2087. https://doi.org/10.1007/s00125-016-4034-0

A5. Golbets E, Brandstaetter E, Sagy I, Zimhony-Nissim N, Lipnitzki I, Musa H, et al. Predictors and outcomes of recurrent diabetic ketoacidosis in Israeli adults. Diabetes Metab Syndr. 2021;15(5):102276. https://doi.org/10.1016/j.dsx.2021.102276

A6. Hare MJL, Deitch JM, Kang MJY, Bach LA. Clinical, psychological and demographic factors in a contemporary adult cohort with diabetic ketoacidosis and type 1 diabetes. Intern Med J. 2021;51(8):1292-1297. https://doi.org/10.1111/imj.14877

A7. Hurtado CR, Lemor A, Vallejo F, Lopez K, Garcia R, Mathew J, et al. Causes and predictors for 30-day re-admissions in adult patients with diabetic ketoacidosis in the United States: a nationwide analysis, 2010-2014. Endocr Pract. 2019;25(3):242-253. https://doi.org/10.4158/EP-2018-0457

A8. Liao WT, Lee CC, Kuo CL, Lin KC. Predicting readmission due to severe hyperglycemia after a hyperglycemic crisis episode. Diabetes Res Clin Pract. 2022;192:110115. https://doi.org/10.1016/j.diabres.2022.110115

A9. Lohiya S, Kreisberg R, Lohiya V. Recurrent diabetic ketoacidosis in two community teaching hospitals. Endocr Pract. 2013;19(5):829-833. https://doi.org/10.4158/EP13057.RA

A10. Lyerla R, Johnson-Rabbett B, Shakally A, Magar R, Alameddine H, Fish L. Recurrent DKA results in high societal costs: a retrospective study identifying social predictors of recurrence for potential future intervention. Clin Diabetes Endocrinol. 2021;7(1):13. https://doi.org/10.1186/s40842-021-00127-6

A11. Michaelis M, Shochat T, Shimon I, Akirov A. Features and long-term outcomes of patients hospitalized for diabetic ketoacidosis. Diabetes Metab Res Rev. 2021;37(6):e3408. https://doi.org/10.1002/dmrr.3408

A12. Peedikayil J, Reddy S, Nair R, Gunasekaran U, Nelson C, Shakoor M, et al. Social and metabolic characteristics associated with multiple DKA admissions at a large county hospital. J Endocr Soc. 2024;8(3):bvad173. https://doi.org/10.1210/jendso/bvad173

A13. Shaka H, Aguilera M, Aucar M, El-Amir Z, Wani F, Muojieje CC, et al. Rate and predictors of 30-day readmission following diabetic ketoacidosis in type 1 diabetes mellitus: a US analysis. J Clin Endocrinol Metab. 2021;106(9):2592-2599. https://doi.org/10.1210/clinem/dgab372

A14. Xu AC, Broome DT, Bena JF, Lansang MC. Predictors for adverse outcomes in diabetic ketoacidosis in a multihospital health system. Endocr Pract. 2020;26(3):259-266. https://doi.org/10.4158/EP-2018-0551

A15. Zhong VW, Juhaeri J, Mayer-Davis EJ. Trends in hospital admission for diabetic ketoacidosis in adults with type 1 and type 2 diabetes in England, 1998-2013: a retrospective cohort study. Diabetes Care. 2018;41(9):1870-1877. https://doi.org/10.2337/dc17-1583

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노인의 디지털헬스리터러시 관련 변인: 체계적 문헌 고찰 및 메타분석

박진화, 문은주
대구가톨릭대학교 간호대학

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Corresponding author:
Eun Ju Mun
College of Nursing, Daegu Catholic University, 33 Duryugongwon-ro 17-gil, Nam-gu, Daegu 42472, Korea
E-mail: quffndi@hanmail.net

Variables influencing digital health literacy in older adults: a systematic review and meta-analysis

Jin Hwa Park, Eun Ju Mun

College of Nursing, Daegu Catholic University, Daegu, Korea

Purpose: This study aimed to synthesize existing evidence on digital health literacy (DHL) among older adults and to estimate the associations between related influencing factors through a systematic literature review and meta-analysis.

Methods: A systematic review and meta-analysis were conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and Meta-Analysis of Observational Studies in Epidemiology (MOOSE) guidelines. Literature searches were performed across PubMed, EMBASE, Cochrane Library, CINAHL, RISS, and DBPIA. The search and screening process was conducted from December 24, 2023, to March 31, 2025. Effect sizes (ESr) using correlation coefficient for each variable were calculated, and meta-analyses were performed using Microsoft Excel and R version 4.3.1.

Results: Forty-seven variables were identified, including two demographic, six physical, six behavioral, 23 psychosocial, and 10 cognitive factors. Meta-analysis results showed that physical, behavioral, psychosocial, and cognitive factors had significant effects on DHL. Among these, digital information level (ESr=.62; 95% confidence interval [CI], 0.55 to 0.69) within the cognitive domain and technophobia (ESr=–.55; 95% CI, –0.47 to –0.40) within the psychosocial domain demonstrated the largest ESr.

Conclusion: Among factors influencing DHL, digital information level and technophobia showed the strongest associations. These findings suggest that improving DHL in older adults requires a dual approach targeting both cognitive and psychosocial dimensions—enhancing digital information skills while reducing technophobia—to effectively support digital engagement and health empowerment in this population (PROSPERO registration number: CRD42023487486).

Keywords: Aged; Digital health; Health literacy; Meta-analysis as topic; Systematic reviews as topic

서론

1. 연구의 필요성

디지털 기술의 발전에 따라 일상생활에서 노인의 디지털 헬스 기기 및 인터넷 사용이 증가하였으며[1], 특히 coronavirus disease 2019 (COVID-19) 팬데믹 이후 디지털 헬스 기술의 사용은 노인의 건강관리에 있어 중요한 요소로 자리잡았다[2]. 디지털 헬스는 사물인터넷, 빅데이터 분석, 인공지능, 모바일 헬스 등 건강분야에서 디지털 기술 활용을 포함하는 eHealth의 개념을 확장한 것이다[3]. 노인은 디지털 헬스 기술에 대한 접근성이 높아졌지만[2] 새로운 기술 사용에 대한 불안, 청각 및 시각 장애, 인지능력 저하, 학습능력 저하 등 다양한 생리적, 심리적 요인으로[1,4] 디지털 헬스

기술 사용에 어려움을 겪고 있다[5,6]. 또한 노인은 디지털 기기를 통해 획득한 건강정보를 올바르게 이해하고 사용할 수 있는 능력인 디지털헬스리터러시(digital health literacy [DHL])가 젊은 성인에 비해 부족한 것으로 보고되고 있다[2,6,7].

DHL은 디지털 헬스 기술의 발전으로 점점 더 관심을 받게 되었으며[3], COVID-19 팬데믹으로 병원 폐쇄와 사회적 거리 두기가 불가피한 상황에서 노인의 건강한 삶을 유지하기 위한 중요한 수단이 되었다[8-10]. DHL은 노인이 자신의 건강 문제를 해결하기 위해 디지털 헬스 기술을 받아들이고 사용할 수 있는 자신감을 향상시킨다[8]. 그러므로 디지털 헬스 기술을 통해 획득한 건강정보의 격차를 해소하고, 건강형평성을 향상시키기 위해서는 노인의 DHL 현황과 관련 변인을 파악하여 이를 개선하기 위한 노력이 필요하다[11].

DHL은 "health literacy" 개념에서 시작하였으며[12], 전자의료기록과 전자건강기록의 발전에 따라 등장한 e헬스리터러시(electronic health literacy [EHL]) 개념이 시간이 지나면서 점차 발전한 것이다[3,11]. EHL은 개인이 인터넷에서 정보를 검색하고, 이해하고, 평가할 수 있는 능력으로 인터넷에서 제공되는 건강정보의 검색에 초점이 맞춰져 있다[13]. 반면, DHL은 개인이 인터넷뿐 아니라 모바일 기기, 소셜 네트워크, 건강 관련 애플리케이션 등을 포함한 디지털 소스에서 제공되는 건강정보를 찾고, 이해하고, 사용하는 능력으로[4,5], 콘텐츠의 자체 생성 및 추가, 개인정보 보호를 포함한 웹에서의 상호작용에 중점을 둔다[14]. 디지털 기술의 혁신적인 발전으로 이전에 건강정보에 접근하고, 처리하는 경로가 인터넷 등 통신기술을 활용한 것에서 점차 디지털 헬스 기술로 확장되었다는 점에서 DHL과 EHL의 개념이 유사하여[3], 여러 선행연구에서 DHL과 EHL를 동일한 의미로 사용하고 있다[7,15].

최근 몇 년 동안 DHL 관련 연구에서 여전히 수행 연도와 관계없이 EHL 개념이 사용되고 있는 점을 고려하여[11], DHL의 개념에 EHL 개념을 포함하여 노인의 DHL 관련 변인들과 영향력을 종합적으로 살펴볼 필요가 있다. 하지만 지금까지 선행연구에서는 DHL보다 EHL 개념에 초점을 맞추어 한정적으로 이루어졌으며[4,6,16-18], 노인의 DHL 관련 변인을 체계적으로 고찰한 연구는 부족하다. 노인의 DHL 문헌 고찰 연구가 있으나[11], 문헌 고찰 연구는 포함된 개별 연구의 결과를 합성하여 통합 추정치를 생성하기보다는 문헌을 분석적으로 재해석하는 질적 분석을 사용한다는 점에서[19] 노인의 DHL과 관련 변인들과의 관계를 정량적으로 파악하는 데 제한적이다.

이에 본 연구에서는 노인의 DHL 관련 변인에 대한 연구결과들을 종합적이고 체계적으로 파악하고 메타분석을 통해 노인의 DHL 관련 변인의 효과크기를 객관적으로 분석함으로써 향후 노인의 DHL 연구 방향성 제시 및 DHL 향상을 위한 프로그램 개발을 위한 근거를 제공하고자 수행되었다.

2. 연구목적

본 연구의 목적은 노인의 DHL 관련 변인에 대한 선행연구를 체계적으로 고찰하고 메타분석을 함으로써, 노인의 DHL를 향상시키는 위한 전략 및 중재프로그램 개발을 위한 기초자료를 제공하는 것이다. 구체적인 목적은 다음과 같다.

첫째, 국내외 노인의 DHL 관련 연구의 일반적 특성을 확인한다.

둘째, 국내외 노인의 DHL 관련 연구의 질 평가를 실시한다.

셋째, 국내외 노인의 DHL 관련 변인을 파악하고, 각 변인별 효과크기를 산출하여 통계적 유의성을 검정한다.

방법

1. 연구설계

본 연구는 국내외 노인의 DHL 관련 변인을 조사한 선행연구 결과를 종합한 체계적 문헌 고찰 및 메타분석 연구이며, PROSPERO에 등록하였다(등록번호: CRD42023487486). 본 연구는 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 그룹이 제시한 체계적 문헌 고찰 지침[20]과 Meta-Analysis Of Observational Studies in Epidemiology (MOOSE) 가이드라인[21]에 따라 수행하였다.

2. 문헌 선정기준 및 배제기준

본 연구에서는 국내외 노인의 DHL 관련 변인은 무엇인가를 핵심질문으로 하였으며, 문헌 선정기준은 PICOs-SD 프레임워크에 따라 정의하였다. 대상(participants)은 노인을 대상으로 한 국내외 연구로, 연구마다 노인의 연령 제시가 다양하여 연령에 제한을 두지 않았다. 중재(intervention)는 DHL과 관련 변인의 관계를 양적으로 제시한 연구, 연구설계(study design)는 연구결과에 통계량이 제시되어 효과크기를 환산 가능한 횡단적 조사연구로 선정하였다. 노인의 DHL 관련 연구의 포괄적인 검색을 위하여 대조군(comparison)과 결과(outcome)를 제시하지 않았다. 문헌 제외기준은 (1) 노인 대상자를 구분하지 않은 연구, (2) 관련 변인 또는 상관관계를 제시하지 않은 중재연구, 개념분석 연구, 질적 연구, (3) 학위논문, (4) 원문확인 불가 연구, (5) 프로토콜 또는 예비연구, (6) 포스터, 초록, 단행본 및 사례연구였다.

3. 문헌검색 및 선정

문헌검색은 2명의 연구자가 독립적으로 국내외 학술지에 게재된 문헌을 검색하였으며, DHL 개념이 지속적으로 발전하고 있으므로 문헌검색 시작은 제한을 두지 않았다. 최초 문헌검색 기간은 2023년

12월 24일부터 2024년 1월 12일까지, 추가 문헌검색은 2024년 1월 12일부터 2025년 3월 31일까지이다. 국내 문헌은 RISS, DBPIA에서 수기로 검색하였으며, 국외 문헌은 PubMed, EMBASE, Cochrane Library, CINAHL에서 검색하였다.

검색어는 한국어로 '노인 OR 노년 OR 시니어' AND '디지털헬스리터러시 OR 모바일헬스리터러시 OR e헬스리터러시 OR 디지털리터러시 OR 디지털건강문해력 OR 인터넷헬스리터러시 OR 인터넷건강문해력 OR 컴퓨터리터러시'를 조합하였다. 영어로는 'Aged OR elder* OR old* OR aged person OR aging OR senior' AND 'computer literac* OR digital health literacy OR digital health OR digital literacy OR digital disparity OR digital divide OR technology literacy OR technology disparity OR technology divide OR health technology literacy OR mhealth literacy OR m-health literacy OR mobile health literacy OR mobile health education OR ehealth literacy OR e-health literacy OR electronic health literacy OR internet literacy OR internet health literacy OR telehealth literacy OR tele-health literacy OR online literacy OR telemedicine literacy OR tele-medicine literacy OR electronic health information OR electronic health information literacy OR web based health literacy'를 조합하였다(Appendix 1).

수집된 문헌은 EndNote ver. X20 프로그램(Clarivate)을 사용하여 분류하였다. 최초 문헌검색에서 중복문헌 8,398편을 제거한 후 14,893편의 연구가 포함되었으며, 두 명의 연구자가 제목과 초록을 읽은 후 독립적으로 선별하여 126편의 논문을 선택하였다. 126편의 원문을 확인하여 DHL의 개념을 포함하지 않은 연구 19편, 전체 성인을 대상으로 한 연구에서 노인을 구분하지 않는 연구 19편, DHL과 관련 변인의 양적인 데이터를 확인할 수 없는 연구 53편, 초록 발표, 기사, 보고서 7편, 원문이 확인되지 않는 연구 11편을 제외하였다. 문헌 선택 시 연구자 간의 의견 불일치가 있을 경우 중립적인 제3의 연구자에게 검토할 예정이었으나 불일치는 없어 17편의 연구를 선택하였다. 추가 문헌검색에서 중복문헌 800편을 제거한 3,360편을 두 명의 연구자가 독립적으로 제목과 초록을 읽은 후 선별하여 60편을 선택하였으며, 60편의 원문을 확인하여 DHL의 개념을 포함하지 않은 연구 8편, 전체 성인을 대상으로 한 연구에서 노인을 구분하지 않는 연구 23편, DHL과 관련 변인의 양적인 데이터를 확인할 수 없는 연구 18편, 원문이 확인되지 않는 연구 1편을 제외하였다. 문헌 선택 시 연구자 간 의견 불일치는 없어 10편의 연구를 선택하여, 최종 27편의 연구를 선택하였다(Figure 1, Appendix 2).

4. 문헌의 질 평가

본 연구에서 문헌의 질 평가는 Joanna Briggs Institute (JBI) [22]의 "Critical Appraisal Checklist for Analytical Cross Sectional Studies"의 8개 항목을 사용하였다. 본 평가도구는 연구대상자 선정

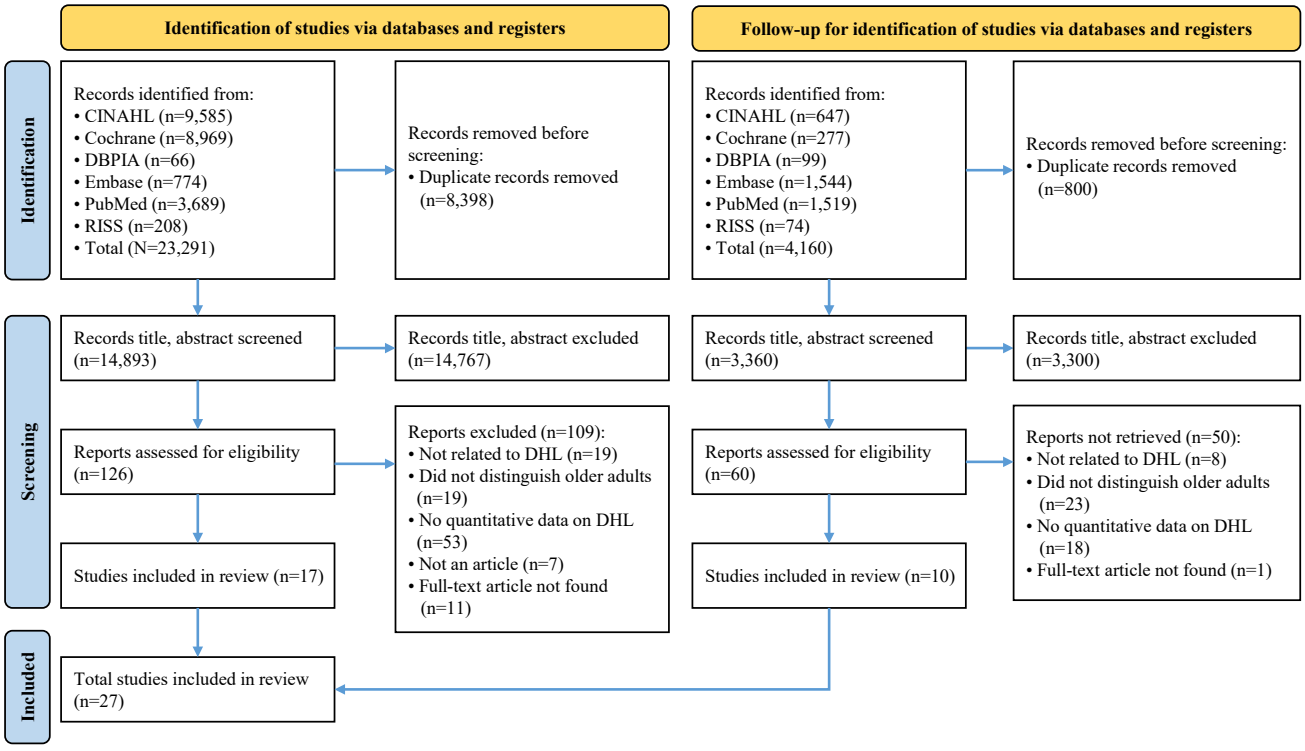

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram: study selection process. DHL, digital health literacy.

2개 문항(JBI 문항 1, 4번), 자료수집 환경 및 방법 1개 문항(JBI 문항 2번), 독립변수의 신뢰도와 타당도의 적절성 1개 문항(JBI 문항 3번), 종속변수의 신뢰도와 타당도 적절성 1개 문항(JBI 문항 7번), 자료분석법 1개 문항(JBI 문항 8번), 교란변수 관련 2개 문항(JBI 문항 5, 6번)의 총 8문항으로 구성되어 있다. 각 문항은 '예, 아니오, 불명확함'으로 예 1점, 그 외는 0점으로 평가하였다. 문헌의 질 평가는 연구자 2인이 독립적으로 실시한 결과를 종합하여 평가자 간 의견이 일치하지 않는 경우 연구자들의 논의를 통해 합의점을 도출하였다.

5. 자료수집 및 분석

고찰한 논문의 코딩은 저자, 연도, 연구 수행 국가, 표본크기, 연구환경(setting), 표본추출 방법, 대상자 평균 나이와 표준편차, 이론 사용, 만성질환 포함, DHL 정도, DHL 측정도구, 관련 변인 및 상관계수(r) 값을 개별적으로 추출하여 Microsoft Excel 2020 프로그램(Microsoft Corp.)에 기록하였다. 연구자 1인이 이에 대한 서식을 작성하고, 추출한 내용의 정확성을 확보하기 위하여 연구자 2인이 독립적으로 분석을 실시한 후 교차 검토하였다.

최종 선정 문헌에서 추출된 DHL 관련 변인들 중 의미가 유사한 변인들은 2인의 연구자가 합의하여 관련 변인의 정의와 측정도구를 확인 후 하나의 변인으로 통합하였다. 노인의 DHL 관련 변인은 선행연구를 기반으로 인구학적, 신체적, 행동적, 심리사회적, 인지적 요인으로 분류하고[6], 관련 변인과의 관계를 정적 관계(+), 부적 관계(-), 관계 없음(not significant)으로 제시하였다. 인구학적 특성에 따라 DHL 차이를 보고한 연구들이 있었으나 성별, 연령을 제외한 인구학적 특성의 하위 범주 분류에서 차이가 있었고, 메타분석을 위한 통계값을 제시하지 않아 연령, 성별만을 포함하였다. 메타분석은 R ver. 4.3.1 (The R Foundation for Statistical Computing) 프로그램을 활용하여 분석하였으며, 2개 이상의 사례 수가 연구된 변인에 대한 상관계수(r) 값을 Fisher's Z로 변환하여, 다시 상관계수(r) 값으로 제시하였다. 최종 도출된 효과크기 해석은 Cohen [23]의 기준에 따라 효과크기 상관계수(ESr)가 .10보다 작을 경우 작은 효과크기, .30 정도이면 중간 효과크기, .50 이상이면 큰 효과크기로 판단하였고, 95% 신뢰구간을 적용하여 통계적 유의성을 검증하였다.

모형의 선택은 연구 국가, 노인 연령 기준, 측정도구, 연구환경의 차이 등을 고려하여 각 연구마다 동일한 모집단의 효과를 추정한 것으로 보기 어려워[24,25], 랜덤효과모형(random effect model)을 사용하여 분석하였다. 개별 연구결과들 간의 통계적 이질성(heterogeneity)은 forest plot, Cochran Q값 및 I^2값을 이용하여 분석하였다[24]. Q값의 유의확률이 0.10 이하이고, I^2가 50%를 넘으면 이질성의 정도가 상당하여[26], 이질성의 원인을 파악하기 위한 조절효과분석이 필요하지만[24], 본 연구에서 조절변수당 최소 10개의 개별 연구를 포함한 관련 변인이 없어 조절효과분석을 생략하였다.

출판편의를 검증은 깔때기 그림(funnel plot)과 Egger's 회귀분석을 통해 평가하였고, Egger's 회귀분석에서 출판편향이 의심되는 경우 추가적으로 trim-and-fill 분석을 통해 출판편향의 정도가 연구결과에 어느 정도 영향을 주는지 확인하였다[24].

6. 윤리적 고려

본 연구는 대구가톨릭대학교 생명윤리위원회에서 심의면제를 받았다(IRB No. CUIRB-2023-E013).

결과

1. 체계적 문헌 고찰

1) 분석 대상 문헌의 일반적 특성

본 연구에서 분석한 문헌은 총 27편의 조사연구이며, 출판연도는 2019년부터 2025년까지로 2019년 1편(3.7%), 2020년 2편(7.4%), 2021년 1편(3.7%), 2022년 6편(22.2%), 2023년 7편(25.9%), 2024년 7편(25.9%), 2025년 3편(11.2%)이었다. 연구는 5개의 국가에서 시행되었으며, 중국 11편(40.7%), 한국 11편(40.7%), 홍콩 3편(11.2%), 미국 1편(3.7%), 스웨덴 1편(3.7%)이었으며, 연구환경(setting)은 지역사회 23편, 병원 3편, 요양원 1편이었다. 노인의 연령 기준은 60세 이상 14편(51.9%), 65세 이상 13편(48.1%)이었으며, 질환을 가진 대상자 연구 6편(22.2%)으로 만성질환 3편, 당뇨병 1편, 만성폐쇄성폐질환 1편이었고, 독거노인을 대상으로 한 연구는 3편이었다. 총 연구대상자 수는 19,489명으로 범위는 68–6,183명이었고, 표본추출은 확률적 방법 5편(18.5%), 비확률적 방법 19편(70.3%), 표본추출 방법을 제시하지 않은 연구 3편(11.2%)이었다. 연구대상자의 평균 연령 범위는 64.5–77.9세였고, 평균 연령을 제시하지 않은 연구가 6편(22.2%)이었다.

EHL 개념을 측정한 연구는 22편(81.5%)이었으며, 8문항의 eHEALS를 중국어로 번안한 CeHEALS를 사용한 연구가 10편(45.4%)으로 가장 많았으며, eHEALS 6편(27.3%), 한국어로 번안한 KeHEALS 6편(27.3%) 순이었다. DHL 개념을 측정한 연구는 5편(18.5%)으로 34문항의 DHTL-AQ 2편(40.0%), 12문항으로 수정한 DHLI 1편(20.0%)이었으며, DHL 개념을 사용하였으나 KeHEALS로 측정한 연구가 2편(40.0%)이었다.

이론 및 개념적 기틀을 제시한 연구는 8편(29.6%)으로 정보획득포괄적 모델(comprehensive model of information looking), e헬스사용통합적 모델(integrative model of eHealth use), EHL 모델(electronic health literacy model), 기술준비수용 모델(technology readiness and acceptance model), 건강생성이론(Salutogenesis), 지식-태도-행동(KAB) 모델, 건강역량강화이론(health empowerment theory), 만성질환자기관리모델(chronic disease self-management model)이었다(Table 1).

2) 노인의 디지털헬스리터러시 관련 변인

본 연구에서 분석한 문헌 총 27편에서 노인의 DHL 관련 변인들을 인구학적, 신체적, 행동적, 심리사회적, 인지적 5개 요인으로 분류한 결과는 다음과 같다(Table 2).

인구학적 요인에는 연령 12편(44.4%), 성별 12편(44.4%)이었고, 나머지 연구에서는 연령, 성별과 DHL 관계를 제시하지 않았다. 신체적 요인은 객관적, 주관적 신체 건강수준으로[6], 건강 관련 삶의 질 2편(7.4%), 인지기능 3편(11.2%), 만성질환 수 3편(11.2%), 주관적 건강상태 6편(22.2%), 수면 문제 1편(3.7%), 성공적 노화 1편(3.7%)이 포함되었다. 행동적 요인은 건강 관련 행동의 실천 정도로[6], 복약이행도 1편(3.7%), 지속적 사용의도 1편(3.7%), 건강증진행동 5편(18.5%), 건강정보탐색행동 1편(3.7%), 모바일 헬스 사용 1편(3.7%), 자기관리행동 4편(14.8%)이 포함되었다. 심리사회적 요인은 사회적 적응력과 정서적 반응으로[6], 미래에 대한 불안 1편(3.7%), 우울증 1편(3.7%), 가족 돌봄 1편(3.7%), 일반적 자기효능감 7편(25.9%), 건강불안 1편(3.7%), 건강성격(친화성, 성실성, 외향성, 신경증, 개방성) 1편(3.7%), 정보 만족도 1편(3.7%), 정보 자기효능감 1편(3.7%), 개인 성향(혁신주의, 낙천주의) 1편(3.7%), 외로움 1편(3.7%), 심리적 고통 1편(3.7%), 자아정체성 1편(3.7%), 일관성(sense of coherence) 1편(3.7%), 사회적 고립 1편(3.7%), 사회적 지지 6편(22.2%), 사회적 자본 3편(11.2%), 기술적 자기효능감 1편(3.7%), 기술공포증 2편(7.4%)이 포함되었다. 마지막으로, 인지적 요인은 정보를 이해하고 활용, 인식하는 능력으로[6], 노화에 대한 태도 1편(3.7%), 디지털 헬스 기술 사용 태도 1편(3.7%), 디지털 정보화 수준 2편(7.4%), 교육 참여 동기 1편(3.7%), 헬스리터러시 1편(3.7%), 인식된 eHealth 중요성 1편(3.7%), 인식된 eHealth 유용성 2편(7.4%), 인식된 편리성 1편(3.7%), 인식된 앱디자인 중요성 1편(3.7%), 웹 검색 기술 1편(3.7%)이 포함되었다.

3) 논문의 질 평가

최종 선택된 27편의 연구에 대해 연구자 2인이 독립적으로 질 평가를 실시한 후 논의를 통해 합의점을 도출하여 품질 평가점수가 0–4점일 때 낮은 품질, 5–7점일 때 중간 품질, 8점일 때 높은 품질로 분류하였다[27,28]. 모든 연구에서 대상자 선정기준에 대하여 상세히 제시하였으나, 모집단에 대한 정의를 제시하지 않은 연구 6편(22.2%), 연구환경(setting)이 제시되지 않은 연구 3편(11.1%), 타당도와 신뢰도가 검증된 도구를 사용하였으나 독립변수의 타당도와 신뢰도를 제시하지 않은 연구 3편(11.1%), 종속변수의 타당도와 신뢰도를 제시하지 않은 연구 2편(7.4%)이었다. 교란요인을 확인한 연구는 24편(88.9%)이었으며, 교란요인에 대한 대처전략을 제시한 연구는 20편(74.1%)이었다. 따라서 본 연구에 포함된 모든 문헌들의 품질 평가점수가 6점 이상으로 질적 수준이 수용 가능하다고 판단되었다(Table 3). 평가자 간의 질 평가에 대한 신뢰도를 확인하기 위해 Cohen's Kappa계수를 계산한 결과, Kappa=.83으로 나타났다.

Table 1. Characteristics of studies included in systematic review and meta-analysis

No.	Author (year)	Country	Setting	Participants	Sample size	Sampling	Age (yr)	Concept	DHL scale	DHL degree	Theory
1	Chae [A1] (2024)	Korea	Community	≥65	132	Convenience	71.6±4.73	EHL	KeHEALS	3.90±0.52	No
2	Cai et al. [A2] (2024)	China	Community	≥65	578	Random	70.1±6.13	EHL	CeHEALS	2.39±0.30	No
3	Cao et al. [A3] (2023)	China	Community	≥60	4,218	Stratified and multistage	71.9±7.2	EHL	CeHEALS	12.57±10.00	No
4	Choi [A4] (2022)	Korea	Community	≥60	186	Convenience	75.6±5.98	EHL	KeHEALS	28.76±6.41	No
5	Cui et al. [A5] (2021)	China	Community	≥60	1,201	Stratified cluster	70.1±6.29	EHL	eHEALS	17.24±9.34	No
6	Dai et al. [A7] (2024)	China	Community	≥60	413	Convenience	70.8±6.71	EHL	eHEALS	23.26±6.00	IMeHU
7	Ghazi et al. [A8] (2023)	Sweden	Community	≥65	490	NR	77.9±7.49	EHL	eHEALS	3.44±1.27	No
8	Hu et al. [A6] (2023)	China	Hospital	≥60, CD	235	Convenience	NR	EHL	CeHEALS	22.11±8.59	CMI
9	Hwang et al. [A9] (2024)	Korea	Community	≥65, living alone	140	Convenience	76.3±4.67	DHL	DHTL-AQ	6.64±7.46	No
10	Hwang et al. [A10] (2025)	Korea	Community	≥65, living alone female	145	Convenience	77.5±4.83	DHL	DHTL-AQ	4.85±6.92	No
11	Jiang et al. [A11] (2023)	China	Hospital	≥65, COPD	230	Convenience	NR	EHL	CeHEALS	24.66±6.86	EHL model
12	Kim et al. [A12] (2023)	Hong Kong	Community	≥60	306	Convenience	NR	EHL	eHEALS	3.42±0.81	TRAM

(Continued on the next page)

Table 1. Continued

No.	Author (year)	Country	Setting	Participants	Sample size	Sampling	Age (yr)	Concept	DHL scale	DHL degree	Theory
13	Kim et al. [A13] (2023)	Korea	Community	≥65, DM	252	Convenience	72.1±5.28	EHL	KeHEALS	2.93±1.01	No
14	Kim and Sung [A14] (2022)	Korea	Hospital	≥65, cancer	140	Convenience	70.8±5.33	DHL	KeHEALS	22.22±7.7	No
										2.78±0.97	
15	Lee et al. [A15] (2019)	Korea	Community	60–79, female	203 (60s:135, 70s: 68)	Convenience	NR	EHL	eHEALS	60s:24.31±7.99	No
										70s:17.07±9.51	
16	Leung et al. [A16] (2022)	Hong Kong	Community	≥60	266	NR	64.5±4.26	DHL	DHLI	2.83±0.46	Salutogenesis
17	Li et al. [A17] (2020)	China	Community	≥60	1,201	Stratified cluster	70.0±6.0	EHL	CeHEALS	17.24±9.34	No
										2.16±1.17	
18	Luo et al. [A18] (2025)	China	Community	≥60	1,658	Convenience	72.1±5.28	EHL	CeHEALS	23.18±6.81	No
19	Nam and Ha [A19] (2024)	Korea	Community	≥65, CD, living alone	91	Convenience	NR	EHL	KeHEALS	24.75±7.71	No
20	Park [A20] (2024)	USA	Community	≥65	191	Convenience	70.9±4.30	EHL	CeHEALS	27.63±7.82	No
21	Ryu and Chae [A21] (2024)	Korea	Community	≥65	150	Quota	70.8±4.92	EHL	KeHEALS	31.34±4.13	No
										3.92±0.52	
22	Son and Han [A22] (2025)	Korea	Community	≥65	197	Convenience	71.7±5.94	DHL	KeHEALS	21.97±8.38	No
23	Song and Shin [A23] (2020)	Korea	Community	≥65	102	Convenience	70.0±4.84	EHL	KeHEALS	28.35±5.01	No
24	Wang et al. [A24] (2022)	China	Community	≥60	425	Convenience	NR	EHL	eHEALS	16.54±4.177	KAB model and health empowerment
25	Wong et al. [A25] (2022)	Hong Kong	Community	≥60	68	NR	71.7±6.0	EHL	CeHEALS	25.0±8.7	Health empowerment
26	Wu et al. [A26] (2022)	China	Nursing home	≥60, CD	289	Convenience	68.6±5.36	EHL	CeHEALS	19.15±9.60	CDSM
27	Zhu and Yang [A27] (2023)	China	Community	≥60	6,183	Convenience	72.6±5.36	EHL	CeHEALS	21.17±8.25	No

Values are presented as number or mean±standard deviation unless otherwise stated.
CD, chronic disease; CDSM, chronic disease self-management model; CMI, comprehensive model of information looking; COPD, chronic obstructive pulmonary disease; DHL, digital health literacy; DM, diabetes mellitus; EHL, electronic health literacy; IMeHU, integrative model of eHealth use, KAB model, knowledge, attitude, behavior model; NR, not report; TRAM, technology readiness and acceptance model.

Table 2. Classification of factors related to digital health literacy and results of studies

Category	Related variables	MA	Correlation with DHL		
			+	−	NS
Demographic	Age	O		[A7,A9,A10,A11,A14,A18,A19,A22,A23]	[A4,A8,A15]
	Sex (male)	O	[A8,A19,A22,A27]	[A7]	[A3,A9,A11,A14,A16,A18,A23]
Physical	HRQoL	O	[A6,A27]		
	Cognitive function	O	[A9,A17]		[A4]
	No. of chronic diseases	O		[A10,A27]	[A4]
	Perceived health status	O	[A4,A7,A9,A10,A20,A23]		
	Sleep problem	X	[A9]		
	Successful aging	X	[A1]		
Behavioral	Adherence of medication	X	[A19]		
	Continued usage intention	X	[A12]		
	Health-promoting behavior	O	[A5,A17,A23,A24]		[A15]
	Health information-seeking behavior	X	[A4]		
	m-health use	X	[A13]		
	Self-care behavior	O	[A24,A25,A26]		[A22]
Psychosocial	Anxiety about the future	X		[A16]	
	Depressive symptoms	X		[A27]	
	Family care	X	[A6]		
	General self-efficacy	O	[A9,A11,A14,A18,A22,A24,A26]		
	Health agreeableness	X		[A6]	
	Health anxiety	X			[A20]
	Health conscientiousness	X	[A6]		
	Health extraversion	X			[A6]
	Health neuroticism	X		[A6]	
	Health openness	X	[A6]		
	Information satisfaction	X	[A16]		
	Information self-efficacy	X	[A8]		
	Innovativeness	X	[A12]		
	Loneliness	X		[A10]	
	Optimism	X	[A12]		
	Psychological distress	X		[A7]	
	Self-identity	X	[A2]		
	Sense of coherence	X	[A16]		
	Social isolation	X			[A10]
	Social support	O	[A1,A11,A13,A18,A26]		[A14]
	Social capital	O	[A2]		
	Cognitive social capital	O	[A3]	[A5]	
	Structure social capital	O	[A3,A5]		
	Technological self-efficacy	X	[A21]		
	Technophobia	O		[A11,A18]	
Cognitive	Aging attitudes	X	[A11]		
	Attitude toward using DHT	X	[A12]		
	Digital information level	O	[A14,A21]		
	Educational participation motivation	X	[A2]		
	Health literacy	X	[A19]		
	Perceived eHealth importance	X	[A4]		
	Perceived eHealth usability	O	[A4,A12]		
	Perceived ease of use	X	[A12]		
	Perceived importance of app design	X	[A13]		
	Web search skills	X	[A11]		

DHT, digital health technology; +, positive correlation; -, negative correlation; O, literature included in the meta-analysis; X, literature not included in the meta-analysis.

2. 메타분석

본 연구의 체계적 문헌 고찰을 통해 선정된 문헌 27편 중 24편이 메타분석에 포함되었으며, 사례 수(k)가 2개 이상인 변인은 연령, 성별, 건강 관련 삶의 질, 인지기능, 만성질환 수, 주관적 건강상태, 건강증진행위, 자기관리행위, 일반적 자기효능감, 사회적 자본, 사회적 지지, 기술공포증, 디지털 정보화 수준, 인식된 eHealth 유용성으로 총 14개이었다. 메타분석을 위해 14개 변인의 효과크기를 상관계수(r)로 일원화하였으며[24], 연령의 경우 연구마다 연령대 구분에 차이가 있어 연령과 DHL 정도의 관계를 상관계수로 제시한 연구 2편만을 분석에 포함하였다. 성별의 경우 남성과 여성의 DHL 평균 점수와 표준편차를 모두 제시한 연구 8편에서 평균점수와 표준편차를 이용하여 R 프로그램에서 Cohen's d를 구한 후, 다시 상관계수(r)로 변환하였다[24]. 사회적 자본은 전체 상관계수 만을 제시하였거나 전체 상관계수 없이 하위 요인별(구조적, 인지적) 상관계수 만을 제시하여 분석에서 제외하였다. 따라서 DHL 관련 변인 총 13개, 사례 수 51개에 대해 메타분석을 실시하였다.

1) 요인별 효과크기

노인의 DHL 관련 변인을 인구학적, 신체적, 행동적, 심리사회적, 인지적 5개 요인으로 범주화하여 랜덤효과모형을 적용하여 분석한 결과, 인구학적 요인의 변인은 연령, 성별 총 2개 변인, 사례 수 10개로 효과크기 상관계수는 ESr=.02 (95% confidence interval [CI], –0.13 to 0.17)로 통계적으로 유의하지 않았다. 신체적 요인의 변인은 건강 관련 삶의 질, 인지기능, 만성질환 수, 주관적 건강상태로 총 4개 변인, 사례 수 13개로 효과크기 상관계수는 ESr=.22 (95% CI, 0.11 to 0.32)로 중간 효과크기를 나타냈으며, 통계적으로 유의하였다. 행동적 요인의 변인은 건강증진행위, 자기관리행위 총 2개 변인, 사례 수 9개로 효과크기 상관계수는 ESr=.40 (95% CI, 0.30 to 0.48)으로 중간 효과크기를 나타냈으며, 통계적으로 유의하였다. 심리사회적 요인의 변인은 일반적 자기효능감, 사회적 지지, 기술공포증으로 총 3개 변인, 사례 수 15개로 효과크기 상관계수는 ESr=.23 (95%

Table 3. Quality assessment of studies

No.	Authors (year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
1	Chae [A1] (2024)	Y	Y	Y	Y	Y	Y	Y	Y	8
2	Cai et al. [A2] (2024)	Y	Y	Y	Y	Y	Y	Y	Y	8
3	Cao et al. [A3] (2023)	Y	Y	Y	N	Y	Y	Y	Y	7
4	Choi [A4] (2022)	Y	Y	N	Y	Y	Y	N	Y	6
5	Cui et al. [A5] (2021)	Y	Y	N	Y	Y	Y	Y	Y	7
6	Hu et al. [A6] (2023)	Y	Y	Y	N	Y	Y	Y	Y	7
7	Dai et al. [A7] (2024)	Y	Y	Y	Y	Y	Y	N	Y	7
8	Ghazi et al. [A8] (2023)	Y	Y	Y	Y	Y	Y	Y	Y	8
9	Hwang et al. [A9] (2024)	Y	Y	Y	Y	Y	Y	Y	Y	8
10	Hwang et al. [A10] (2025)	Y	Y	Y	Y	Y	Y	Y	Y	8
11	Jiang et al. [A11] (2023)	Y	Y	Y	Y	Y	Y	Y	Y	8
12	Kim et al. [A12] (2023)	Y	Y	Y	Y	Y	N	Y	Y	7
13	Kim et al. [A13] (2023)	Y	N	Y	Y	Y	Y	Y	Y	7
14	Kim and Sung [A14] (2022)	Y	Y	Y	N	Y	Y	Y	Y	7
15	Lee et al. [A15] (2019)	Y	Y	Y	Y	Y	Y	Y	Y	8
16	Leung et al. [A16] (2022)	Y	Y	N	Y	Y	Y	Y	Y	7
17	Li et al. [A17] (2020)	Y	Y	Y	Y	Y	Y	Y	Y	8
18	Luo et al. [A18] (2025)	Y	Y	Y	Y	Y	Y	Y	Y	8
19	Nam and Ha [A19] (2024)	Y	Y	Y	Y	Y	Y	Y	Y	8
20	Park [A20] (2024)	Y	Y	Y	Y	Y	Y	Y	Y	8
21	Ryu and Chae [A21] (2024)	Y	Y	Y	Y	Y	Y	Y	Y	8
22	Son and Han [A22] (2025)	Y	Y	Y	Y	Y	Y	Y	Y	8
23	Song and Shin [A23] (2020)	Y	Y	Y	Y	Y	Y	Y	Y	8
24	Wang et al. [A24] (2022)	Y	Y	Y	Y	Y	Y	Y	Y	6
25	Wong et al. [A25] (2022)	Y	Y	Y	Y	Y	N	Y	Y	7
26	Wu et al. [A26] (2022)	Y	Y	Y	N	Y	Y	Y	Y	7
27	Zhu and Yang [A27] (2023)	Y	Y	Y	Y	Y	Y	Y	Y	8
	MR (%)	100	94	100	88	100	94	100	100	

Q1: Were the criteria for inclusion in the sample clearly defined?; Q2: Were the study subjects and the setting described in detail?; Q3: Was the exposure measured in a valid and reliable way?; Q4: Were objective, standard criteria used for measurement of the condition?; Q5: Were confounding factors identified?; Q6: Were strategies to deal with confounding factors stated?; Q7: Were the outcomes measured in a valid and reliable way?; Q8: Was appropriate statistical analysis used?
MR, match rate; Y, yes; N, no.

CI, 0.04 to 0.40)으로 중간 효과크기를 나타냈으며, 통계적으로 유의하였다. 인지적 요인의 변인은 디지털 정보화 수준, 인식된 eHeatlh 유용성으로 총 2개 변인, 사례 수 4개로 효과크기 상관계수는 ESr=.50 (95% CI, 0.33 to 0.64)로 큰 효과크기를 나타냈으며, 통계적으로 유의하였다(Table 4).

이질성 분석결과, 인구학적 요인(I^2=89.2%, Q=83.50, p<.001), 신체적 요인(I^2=91.5%, Q=141.47, p<.001), 행동적 요인(I^2=84.9%, Q=52.93, p<.001), 심리사회적 요인(I^2=98.8%, Q=1,168.35, p<.001), 인지적 요인(I^2=86.5%, Q=22.16 p<.001)은 이질성이 높은 것으로 나타났다(Table 4).

2) DHL 관련 변인들의 효과크기

DHL 관련 변인 총 13개에 대한 효과크기는 랜덤효과모형을 적용하여 분석하였으며, 디지털 정보화 수준 ESr=.62 (95% CI, 0.55 to 0.69), 기술공포증 ESr=–.55 (95% CI, –0.47 to –0.40)로 큰 효과크기를 나타냈으며, 통계적으로 유의하였다. 건강증진행위 ESr=.42 (95% CI, 0.32 to 0.50), 자기관리행위 ESr=.38 (95% CI, 0.17 to 0.55), 일반적 자기효능감 ESr=.37 (95% CI, 0.28 to 0.46), 인식된 eHealth 유용성 ESr=.37 (95% CI, 0.29 to 0.44), 사회적 지지 ESr=.33 (95% CI, 0.24 to 0.42), 인지기능 ESr=.28 (95% CI, 0.18 to 0.36), 주관적 건강상태 ESr=.26 (95% CI, 0.16 to 0.36), 만성질환 수 ESr=–.15 (95% CI, –0.25 to –0.04) 순으로 중간 효과크기를 나타냈으며, 통계적으로 유의하였다. 마지막으로 성별은 ESr=.10 (95% CI, 0.02 to 0.18)으로 작은 효과크기를 나타냈으며, 통계적으로 유의하였다(Table 4, Supplementary Figure 1).

이질성을 분석한 결과, 연령(I^2=94.7%, Q=18.70, p<.001), 성별(I^2=73.4%, Q=26.30, p<.001), 건강 관련 삶의 질(I^2=98.2%, Q=56.97, p<.001), 인지기능(I^2=51.0%, Q=4.08, p=.130), 주관적 건강상태(I^2=72.2%, Q=18.00, p=.003), 건강증진행위(I^2=76.9%, Q=17.33, p=.002), 자기관리행위(I^2=90.6%, Q=32.05, p<.001), 일반적 자기효능감(I^2=79.6%, Q=29.48, p<.001), 사회적 지지(I^2=76.9%, Q=21.68, p=.001), 기술공포증(I^2=96.7%, Q=29.91, p<.001)은 이질성이 높은 것으로 나타났다. 만성질환 수(I^2=0.0%, Q=0.13, p=.714), 디지털 정보화 수준(I^2=0.0%, Q=0.02, p=.890), 인식된 eHealth 유용성(I^2=0.0%, Q=0.54, p=.461)은 이질성이 없는 것으로 나타났다(Table 4).

3) 출판편의에 대한 검정

출판편의를 검증하기 위해 인구학적, 신체적, 행동적, 심리사회적, 인지적 요인으로 범주화하여 깔대기 도표(funnel plot)을 확인하였다(Supplementary Figure 2). 그 결과, 인구학적, 신체적, 행동적, 심리사회적, 인지적 요인 모두 가운데 선을 기준으로 비대칭을 이루었다. 이에 객관적인 출간오류 분석을 위해 Egger's 회귀분석을 실시한 결과, 인구학적 요인(standard error [SE]=2.04, t=0.51, p=.621), 신체적 요인(SE=1.48, t=0.74, p=.472), 행동적 요인(SE=2.18, t=–1.60, p=.149), 심리사회적 요인(SE=5.13, t=0.44, p=.665)의 출판편의는 없는 것으로 나타났다. 인지적 요인은 사례 수가 4개로 Egger's 회귀분석을 시행하지 못하여 민감도 분석 방법의 하나인 trim-and-fill을

Table 4. Effect size of related factors for digital health literacy of older people

Related variables	k	ESr	95% CI	Z	p	Homogeneity test		
						Q	p	I^2
Total overall effect size	51	.24	.16 to .32	5.80	<.001	1944.89	<.001	97.4
Demographic factors	10	.02	–.13 to .17	0.25	.802	83.50	<.001	89.2
Age	2	–.35	–.68 to .11	–1.48	.136	18.70	<.001	94.7
Sex (male)	8	.10	.02 to .18	2.56	.010	26.30	<.001	73.4
Physical factors	13	.22	.11 to .32	3.90	<.001	141.47	<.001	91.5
HRQoL	2	.33	–.04 to .62	1.77	.077	56.97	<.001	98.2
Cognitive function	3	.28	.18 to .36	5.70	<.001	4.08	.130	51.0
No. of chronic conditions	2	–.15	–.25 to –.04	–2.68	.007	0.13	.714	0.0
Perceived health status	6	.26	.16 to .36	4.84	<.001	18.00	.003	72.2
Behavioral factors	9	.40	.30 to .48	7.50	<.001	52.93	<.001	84.9
Health-promoting behavior	5	.42	.32 to .50	7.87	<.001	17.33	.002	76.9
Self-care behavior	4	.38	.17 to .55	3.40	.001	32.05	<.001	90.6
Psychosocial factors	15	.23	.04 to .40	2.39	.003	1168.35	<.001	98.8
General self-efficacy	7	.37	.28 to .46	7.16	<.001	29.48	<.001	79.6
Social support	6	.33	.24 to .42	6.58	<.001	21.68	.001	76.9
Technophobia	2	–.55	–.47 to –.40	–3.16	.002	29.91	<.001	96.7
Cognitive factors	4	.50	.33 to .64	5.33	<.001	22.60	<.001	86.5
Digital information level	2	.62	.55 to .69	12.35	<.001	0.02	.890	0.0
Perceived eHealth usability	2	.37	.29 to .44	8.51	<.001	0.54	.461	0.0

CI, confidence interval; ESr, effect size; HRQoL, health related quality of life; I^2, the proportion of true variance; k, number of cases; Q, Q-value between subgroups.

시행하였다. 그 결과, 1개의 사례를 투입했을 때 효과크기가 여전히 통계적으로 유의하여 본 연구의 결과에 큰 영향을 주지 않는 것으로 결론을 내릴 수 있었다[24].

고찰

본 연구는 노인의 DHL 관련 변인들을 규명하고, 관련 변인들의 효과를 객관적이고, 통합적으로 제시하고자 시도된 체계적 문헌 고찰 및 메타분석 연구이다. 본 연구에서 분석된 문헌은 총 27편으로, 2019년부터 연구가 시작되어 2022년 이후 급격히 증가하였다. 이를 통해 노인의 DHL에 대한 관심이 COVID-19 팬데믹 이후 급격히 증가하였음을 알 수 있다. 이는 COVID-19 팬데믹 동안 노인이 감염 위험과 사회적 거리두기로 인한 고립감이라는 이중적 위험에 처하게 되면서 의사소통과 건강정보 전달 측면에서 DHL의 중요성이 더욱 부각된 것과 관련이 있다[8,11].

분석된 문헌 27편 중 22편(81.5%)에서 EHL 개념을 사용하였고, 24편(88.9%)에서 eHEALS 도구를 사용하여 측정하였다. 반면, DHL 개념을 사용하였으나 KeHEALS를 사용하여 측정한 문헌이 2편(7.4%)인 것으로 보아[7,15], 현재는 EHL과 DHL 개념이 혼용되고 있으며, 점차 EHL에서 DHL로 넘어가는 과도기임을 알 수 있다[3]. 하지만 DHL 개념에서는 건강정보를 획득, 평가, 적용하는 능력뿐 아니라 건강정보를 통합하여 의사소통하고 그 과정에서 개인정보를 보호하는 능력까지 평가한다[11]. 이러한 점에서 eHEALS가 연구대상자의 DHL 개념을 완전히 반영하지 못한다는 비판을 받아왔으나[6,29], 그럼에도 eHEALS가 대부분의 연구에서 사용되고 있는 이유는 여러 언어로 번역되어 노인을 대상으로 신뢰도와 타당도가 확보된 도구이기 때문이다[30-33]. DHL을 측정할 수 있는 digital health literacy instrument (DHLI)가 2017년 개발되고[14], Kim 등[34]의 연구에서 DHLI가 노인을 대상으로 eHEALS에 비해 신뢰할 수 있는 도구로 확인되었지만 eHEALS에 비해 문항 수가 많으며, 아직 노인을 대상으로 도구의 신뢰도와 타당도가 충분히 확인되지 않은 점에서 연구자가 적극적으로 사용하는 데 제한이 있다. 이에 향후 연구에서 노인의 DHL 관련 변인을 탐색하기 위해서는 EHL 개념보다 DHL의 개념을 측정할 수 있는 도구를 사용하는 것이 필요하다.

노인을 대상으로 한 자기보고식 설문조사방식은 객관성이 부족하며[11], 반구조화 인터뷰 및 대면 인터뷰와 같은 성과 기반 측정방식이 더 신뢰할 수 있는 것으로 나타났다[4,35]. 그러므로 노인의 DHL을 보다 정확하게 평가하기 위한 다양한 측정방법을 고려해야 하지만, 다양한 임상환경과 개인의 성향에 따라 측정결과가 달라질 수 있으므로[4], 연구자들은 성과 기반 측정 시 지지적인 환경을 제공하고 노인의 개인적 성향을 파악할 필요가 있다.

본 연구에 포함된 총 27편 연구의 질 평가를 수행한 결과, 포함된 모든 연구들의 질적 수준이 높았지만 일부 연구에서는 대상자 산출에 대한 명확한 근거 없이 대상자를 모집하였다. 대상자 수는 상관관계 계수 및 효과크기의 차이를 야기하므로[4,24], 적절한 대상자의 수 산정과 근거의 제시가 필요하다. 또한 노인을 대상으로 하였지만 모집단에 대한 이론적 정의 없이 60세 이상 14편(51.9%), 65세 이상 13편(48.1%)으로 다르게 선정하였고, 27편의 연구 중 18편(66.7%)의 연구에서 편의표집 방법을 사용하였다. 편의표집은 연구자의 선택편향이 발생하여 모집단에 대한 통계적 추론이 어렵다는 문제점이 있으므로[36], 향후 연구에서 연구자가 연구설계 단계에서부터 노인의 대표성을 확보할 수 있는 표본 선정과정을 제시하여 선택편향 가능성과 추론의 오류 가능성을 최소화하기 위한 노력이 필요하다.

본 연구의 체계적 문헌 고찰에서 확인된 DHL 관련 변인은 총 47개로 분석의 편의를 위해 선행연구를 참고하여 인구학적, 신체적, 행동적, 심리사회적, 인지적 5개 요인으로 분류하였다[6]. 그 결과, 인구학적 요인 2개, 신체적 요인 6개, 행동적 요인 6개, 심리사회적 요인 23개, 인지적 요인 10개로 심리사회적 요인과 관련된 변인이 가장 많이 연구되었고, 관련 변인 중 가장 많이 연구된 변인은 연령 12편, 성별 12편, 일반적 자기효능감 7편, 사회적 지지 6편, 주관적 건강상태 6편이었다. 이는 DHL 관련 변인 중 인구학적 요인에 해당하는 연령과 성별이 가장 많이 연구되었다고 제시한 메타분석 연구[5]와 노인의 DHL에 영향을 미치는 요인으로 디지털 기기를 통한 건강관리에 대한 자신감, 사회적 지지를 제시한 문헌 고찰 연구[11] 결과와 유사하였다.

노인의 DHL 수준이 높을수록 디지털 기기를 통해 건강정보에 더 잘 접근하고, 자기효능감과 디지털 기기의 유용성에 대한 인식 및 태도가 긍정적으로 향상되어 디지털 기기 사용의 의지와 건강 관련 행위의 실천이 증가한다[37]. 이처럼 각 요인별 관련 변인은 명확히 분류되기보다 복수의 요인에 동시에 속하거나 각 요인이 상호작용하며 연속적으로 이어지는 구조로 작용하기도 한다. 이에 노인의 DHL 향상을 위해서는 개념적 기틀을 기반으로 하여 다차원적 요인을 고려하는 것이 필요하지만 분석된 문헌 27편 중 이론 및 개념적 기틀을 제시한 연구는 8편으로 개념적 기틀 없이 유사한 관련 변인을 반복 측정하고 있음을 알 수 있다. 그러므로 향후 개념적 기틀을 기반으로 다차원적인 요인을 포함한 연구설계와 요인간 구조적 경로를 검증할 수 있는 연구가 필요하다[16].

메타분석 결과, 인지적 요인의 디지털 정보화 수준과 심리사회적 요인의 기술공포증이 효과크기 상관계수가 큰 것으로 나타났다. 디지털 정보화 수준은 디지털 기기를 조작하여 문제를 해결하고, 찾아낸 정보를 활용하는 능력을 의미한다[7,38]. 노인은 나이가 들면서 새로운 것을 이해하고 습득하는 능력이 저하되어 디지털 기술 활용에 어려움을 겪게 되면서 디지털 기술 사용에 대한 사회의 높은 요구와 개인의 낮은 능력 사이의 갈등으로 인한 긴장, 무력감 등을 느끼고, 이로 인해 기술공포증이 증가한다[39]. 그러므로 향후 노인의 DHL 향상을 위한 중재 제공 시 인지적, 심리사회적 측면을 우선적으로 고려해야 하며, 노인의 디지털 정보화 수준 향상과 기술공포증 감소에 중점을 두어야 한다.

심리사회적 요인의 일반적 자기효능감은 노인의 DHL과 건강증진행동, 자기관리행동 사이의 관계에서 매개변수로 작용하며[40], DHL이 높을수록 디지털 기술 사용에 대한 자신감이 향상된다[8]. 반대로 노인이 자기효능감이 높으면 디지털 헬스 기기에 대한 이용의도를 높이며[7], 변화에 대한 적응력과 새로운 기술에 대처할 수 있는 능력이 향상되어 DHL 향상에 영향을 미치는 것으로 나타났다[35]. 또한 노인의 DHL은 가족[11,17], 친구[7]와 같은 의미 있는 주변인에 달려있으며, 노인이 인식하는 사회적 지지가 높을수록 DHL을 직접적으로 향상시킨다[5,39]. 반대로 노인의 DHL이 높을수록 사회적 네트워크가 확대되어 사회활동에 참여할 가능성이 높고, 인터넷을 통해 건강정보의 교류가 활발한 것으로 나타났다[41].

행동적 요인에서 건강증진행위와 자기관리행위가 중간 효과크기를 나타났으며, 이는 노인의 DHL의 수준이 높을수록 건강 관련 행위가 증가하는 것으로 나타난 메타분석 연구결과와 일치하였다[4,18]. DHL은 노인이 건강한 생활습관을 유지, 개선할 수 있는 역량을 강화하며, 건강 관련 의사결정에 참여할 수 있도록 하여 건강결과를 개선한다[8]. 하지만 만성질환을 가진 노인은 건강한 노인에 비해 DHL이 더 낮은 것으로 나타났으며[8,18], 질병 관련 특성[6], 신체기능 저하[11] 등은 DHL과 건강 관련 행위와의 관계에 영향을 줄 수 있으므로[18], 간호사가 DHL 향상을 위한 중재 제공 시 이러한 요인을 통제하는 것이 필요하다.

본 연구결과, 인구학적 요인의 연령은 노인의 DHL과 관련이 없는 것으로 나타나 노인의 연령 증가가 낮은 DHL을 예측하는 요인이 아님을 확인되었다. Estrela 등[5]의 연구에서 연령 증가로 인해 DHL의 정도가 낮은 것이 아니라 노화와 함께 나타나는 신체적 변화와 만성질환의 합병증 증가가 DHL에 영향을 미칠 수 있다고 하였다. 또한 노인 내에서도 연령별로 교육수준, 경제상태 등 다양한 차이를 보이므로[11], 향후 연구에서 노인을 하나의 집단이 아닌 인구사회학적 특성에 따라 더욱 세분하여 노인의 DHL 관련 변인을 파악해야 한다[42].

DHL 관련 변인 13개 중 연령, 성별, 건강 관련 삶의 질, 인지기능, 주관적 건강상태, 건강증진행위, 자기관리행위, 일반적 자기효능감, 사회적 지지, 기술공포증 10개 변인에서 이질성이 높게 나타났다. 높은 이질성의 원인을 파악하기 위해 해당 문헌을 수기로 재검토하여 이질성에 대한 원인을 탐색하였다. 본 연구에 포함된 문헌은 횡단적 조사연구로 각 연구별로 거주형태(지역사회, 요양원, 병원), 노인의 정의(60세 이상, 65세 이상), 만성질환 포함 여부, 측정도구에 차이가 있었다. 또한 대상자의 선정기준에서 인터넷을 사용하거나 스마트폰을 소지한 노인을 포함한 연구는 이를 사용할 수 없는 노인이 제외되어 연구 간 이질성이 높은 것으로 예상된다. 이질성이 높은 경우 연구결과의 일반화 가능성에 영향을 미칠 수 있으므로[25], 이질성을 줄이기 위해 향후 연구에서 노인에 대한 모집단의 정의를 통해 노인의 특성을 대표할 수 있는 대상자 선정이 필요하다.

본 연구의 체계적 문헌 고찰을 통해 선정된 문헌 27편 중 24편이 메타분석에 포함되었으며, 3편[9,42,43]이 제외되었다. 제외된 사유는 성별에 따른 DHL 평균 점수와 성별에 따른 DHL 평균 점수를 제시하지 않은 연구[9,42], 사회적 자본에서 전체 상관계수 만을 제시하였거나[42] 전체 상관계수 없이 하위 요인별 상관계수 만을 제시한 연구[43]였다. 또한 메타분석을 위해서는 관련 변인에 대한 사례 수가 2개 이상이어야 하므로[24], 사례 수가 1개인 관련 변인은 제외하였다. 이에 향후 본 연구의 메타분석에서 사례 수가 1개로 나타난 변인에 대한 반복 연구가 누적된 후 이 변인들을 포함한 체계적 문헌 고찰 및 메타분석의 추가 연구가 필요하다.

본 연구의 제한점은 첫째, 노인의 DHL 관련 변인을 원인, 매개, 결과 변수 등으로 구분하지 않고 상관계수로 제시하여 관련 변인들의 인과적 추론에는 제한점이 있다. 둘째, 본 연구의 분석 문헌 간 이질성이 높았으며, 이질성의 원인 탐색을 위하여 조절효과 분석이 필요하지만 조절변수당 최소 10편의 문헌이 수집되지 않아 조절효과분석을 시행하지 못한 제한점이 있다. 셋째, 출판편의에 대한 검정결과, 인지적 요인의 경우 사례 수가 4개로 깔때기 그림(funnel plot)이 비대칭적으로 나타났다. 그러나 사례 수가 10개 미만일 경우 반드시 출판편향이 있음을 의미하지 않으며, 효과크기 추정치의 이질성으로 인해 비대칭적으로 나타날 수 있다[44]. 다만 미발표된 연구가 배제됨으로써 발생할 수 있는 출판편의 가능성을 완전히 배제할 수 없다는 제한점이 있다. 마지막으로 DHL 개념은 계속적으로 발전하고, EHL 개념과 차이점이 있지만[11], 본 연구에서 DHL과 EHL에 대한 구분 없이 함께 연구되었다는 제한점이 있다.

그럼에도 본 연구는 문헌검색에서 국내외 노인을 대상으로 영어 이외의 언어로 시행된 연구를 포함하였고, 분석된 논문의 질적 수준이 높은 연구결과를 얻었다는 데 의의가 있다. 또한 이전의 시행된 단편적인 연구의 결과를 종합하여 노인의 DHL과 디지털 정보화 수준, 기술공포증의 효과크기 상관계수가 크다는 것을 확인하였다는 점에서 간호학적 의의가 있다. 이에 노인의 DHL을 향상시키기 위해서는 디지털 정보화 수준과 기술공포증 정도를 확인함으로써, 디지털 접근성에서 소외될 위험이 높은 노인의 DHL 향상을 위한 프로그램 개발의 근거를 제공할 수 있을 것으로 기대된다.

결론

본 연구에서 노인의 DHL의 관련 변인을 규명하고, 메타분석을 통해 관련 변인별 효과크기 상관계수를 확인한 결과, DHL 관련 변인들 중 디지털 정보화 수준, 기술공포증이 효과크기 상관계수가 큰 것으로 나타났다. 이를 통해 노인의 DHL 향상을 위해서는 디지털 정보화 수준 향상과 기술공포증 감소에 중점을 두어야 함을 알 수 있다.

본 연구의 결과를 통해 다음과 같이 제언한다. 첫째, 노인에 대한 정의 없이 반복적으로 유사한 관련 변인만을 반복 시행하지 않기 위해 연구의 설계 단계에서부터 노인의 특성을 반영할 수 있는 연구설계가 필요하다. 둘째, 본 연구에서 DHL 관련 변인 중 효과크기 상관

계수가 큰 것으로 나타난 디지털 정보화 수준, 기술공포증 변인의 사례 수는 2개로 나타났다. 메타분석에서 사례 수가 적은 경우 결과의 신뢰성이 낮아질 수 있으므로[25], 이들 변인을 포함한 반복 연구를 실시하여 노인의 DHL과의 관계를 명확하게 확인하는 연구를 제언한다. 셋째, 연구자들은 노인의 DHL을 보다 정확하게 평가하기 위한 적합한 도구의 개발 및 다양한 측정방법을 고려해야 한다.

Article Information

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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Data Sharing Statement

Please contact the corresponding author for data availability.

Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.4040/jkan.25112.

Author Contributions

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Appendix 1. Search strategy to identify relevant data from database

Number	Search query
CINAHL: Results 1st search (n=9,585), 2nd search (n=647)	
#1	(MH "Computer Literacy") OR computer literac* OR digital health literacy OR digital health OR digital literacy OR digital disparity OR digital divide OR technology literacy OR technology disparity OR technology divide OR health technology literacy OR mhealth literacy OR m-health literacy OR mobile health literacy OR mobile health education OR ehealth literacy OR e-health literacy OR electronic health literacy OR Internet literacy OR internet health literacy OR telehealth literacy OR tele-health literacy OR online literacy OR telemedicine literacy OR tele-medicine literacy OR electronic health information OR electronic health information literacy OR web based health literacy
#2	(MH "Aged+") OR old* OR aged person OR aging OR senior OR ((older* OR elder* OR aged) AND people) OR ((older* OR elder*) AND adult*)
#3	S1 AND S2
PubMed: Results 1st search (n=3,689), 2nd search (n=1,519)	
#1	"Computer Literacy"[Mesh] OR "computer literac*"[TIAB]
#2	digital health literacy[TIAB] OR digital health[TIAB] OR digital literacy[TIAB] OR digital disparity[TIAB] OR digital divide[TIAB] OR technology literacy[TIAB] OR technology disparity[TIAB] OR technology divide[TIAB] OR health technology literacy[TIAB] OR mhealth literacy[TIAB] OR m-health literacy[TIAB] OR mobile health literacy[TIAB] OR mobile health education[TIAB] OR ehealth literacy[TIAB] OR e-health literacy[TIAB] OR electronic health literacy[TIAB] OR Internet literacy[TIAB] OR internet health literacy[TIAB] OR telehealth literacy[TIAB] OR tele-health literacy[TIAB] OR online literacy[TIAB] OR telemedicine literacy[TIAB] OR tele-medicine literacy[TIAB] OR electronic health information[TIAB] OR electronic health information literacy[TIAB] OR web based health literacy[TIAB]
#3	"Aged"[Mesh] OR "Aged"[TIAB] OR "Elderly"[TIAB]
#4	"old*"[TIAB] OR "aged person"[TIAB] OR "aging"[TIAB] OR "senior"[TIAB] OR ((older*[TIAB] OR elder*[TIAB] OR aged[TIAB]) AND people[TIAB]) OR ((older*[TIAB] OR elder*[TIAB]) AND adult*[TIAB])
#5	#1 OR #2
#6	#3 OR #4
#7	#5 AND #6
Cochrane Library: Results 1st search (n=8,969), 2nd search (n=277)	
#1	MeSH descriptor: [Computer Literacy] explode all trees
#2	computer literac* OR ((digital OR technology OR mhealth OR m-health OR mobile OR ehealth OR e-health OR electronic OR Internet OR telehealth OR tele-health OR online OR telemedicine OR tele-medicine) NEAR/4 (literac* OR disparity OR divide)) OR mobile health education OR electronic health information OR web based health literacy
#3	#1 OR #2
#4	MeSH descriptor: [Aged] explode all trees
#5	old* OR aging OR senior ((ag* OR older* OR elder*) NEAR/2 (person* OR people OR adult*))
#6	#4 OR #5
#7	#3 AND #6

Appendix 2. Included studies

A1. Chae Y. Mediating effects of social support on the relationship between e-Health literacy and successful aging in older adults. J Korean Acad Rural Health Nurs. 2024;19(2):121-129. https://doi.org/10.22715/jkarhn.2024.19.2.121

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