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Special Issue on Digital Era Education for Women's Health and Well-being  
Guest Editor: Sook Jung Kang

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### Aims and Scope

The *Korean Journal of Women Health Nursing* is a primary source of information for meeting the challenges of providing optimal healthcare for women. The journal aims to be a core resource for cutting-edge advancements and clinical applications of new nursing practice, therapeutic protocols for managing health problems in women, and innovative research on gender-based issues that impact treatment and nursing care.

Its scope includes the latest clinical and research papers on health issues that affect women throughout their lifespan. The emphasis is on clinical nursing practice and education on the social science components relevant to women's health issues. It also includes nursing care, education, and research methodology for ante-, intra-, and post-partum women, middle-aged and elderly women's health, socio-cultural issues, and therapies. Its regional focus is mainly Korea, but it also welcomes submissions from researchers all over the world.

### About the Journal

The *Korean Journal of Women Health Nursing* (KJWHN) is a peer-reviewed official journal of the Korean Society of Women Health Nursing of the Republic of Korea (South Korea). It was launched in 1995 under its previous title, the *Journal of Korean Women's Health Nursing Academic Society* (Vol. 1, No. 1 in 1995 to Vol. 6, No. 1 in 2000; pISSN: 1225-9543), and the Journal of Korean Academy of Women's Health Nursing (Vol. 6, No. 2 in 2000 to Vol. 7, No. 2 in 2001, pISSN: 1225-9543).

Since June 2012 it has continued under the current title, the *Korean Journal of Women Health Nursing* Vol. 18, No. 2 in 2012 to present; pISSN: 2287-1640, eISSN: 2093-7695). The official abbreviated title is *Korean J Women Health Nurs*. It is published quarterly on the last day of every March, June, September, and December. Any supplementary or special issues may be published. The number of print copies per issue is 60. The copyright, including the right of online transmission, is owned by the Korean Society of Women Health Nursing. This journal is supported by a Korean Federation of Science and Technology Societies grant funded by the Korean government (Ministry of Science and ICT).

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# Why do editors of local nursing society journals strive to have their journals included in MEDLINE? A case study of the *Korean Journal of Women Health Nursing*

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## Congratulations on the *Korean Journal of Women Health Nursing* becoming a MEDLINE journal

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I discovered that the *Korean Journal of Women Health Nursing* (KJWHN) has been listed as a MEDLINE journal on the “Journals Recently Accepted for Inclusion in MEDLINE” website ([https://www.nlm.nih.gov/medline/medline\\_new\\_titles.html](https://www.nlm.nih.gov/medline/medline_new_titles.html)) on August 26, 2023. This list of recently accepted journals was published on August 25, 2023 (EST). I was thrilled to see KJWHN on the list, as it is a member journal of both the Korean Council of Science Editors and the Korean Association of Medical Journal Editors, organizations where I have served as president. I extend my congratulations to the editors, society executives, and all society members for their hard work in getting the journal listed in MEDLINE—the United States National Library of Medicine’s (US NLM) premier bibliographic database that contains more than 29 million references to journal articles in life sciences with a concentration on biomedicine.” Another important partner was the publisher, which provides services such as XML and homepage production, English proofreading, and manuscript editing. It is indeed a significant challenge for an academic society in Korea to have a journal listed in MEDLINE. KJWHN is only the third journal in the nursing category in Korea to receive this honor. This accomplishment is a testament to the tireless efforts of all society members, particularly the expertise of the editor-in-chief, Dr. Sue Kim, who has held this position since January 2020.

## Benefits of becoming a MEDLINE journal

Why do editors of local nursing society journals strive for inclusion in MEDLINE? In addition to the reasons previously cited for other journals [1], the primary advantages of being a MEDLINE journal include being searchable on PubMed and being indexed with Medical Subject Headings (MeSH) keywords. KJWHN was approved for listing in PubMed Central (PMC) on July 30, 2022. Consequently, its full text has been searchable in PMC, and its abstracts have been accessible in PubMed since the first issue of 2020 [2]. Therefore, it was already searchable in PubMed through its indexing in PMC. Now, as a MEDLINE journal, the addition of MeSH indexing is another significant benefit. Research articles indexed with MeSH keywords are more likely to be viewed by researchers worldwide than those without MeSH indexing, due to the enhanced sensitivity and speci-

ficacy of search results that MeSH provides.

There are other advantages of becoming a MEDLINE journal, although KJWHN has already attained them. For instance, a third advantage is that a MEDLINE journal is searchable in the Scopus database. “For the majority of MEDLINE titles, Scopus has agreements with the publishers directly and receives the content from them. There are around 125 titles for which Scopus has permission to cover, and MEDLINE supplies directly to Scopus” [3]. The fourth advantage is exemption from the review of scientific quality during the PMC application process. Since KJWHN was already indexed in Scopus [4] and successfully passed the PMC process in 2022 [2], these two benefits are not applicable. The fifth advantage is the eligibility to add previous articles to PubMed and PMC, regardless of their language, if appropriate XML files are provided. This retrospective indexing is typically limited to the same journal title.

## Criteria of high scientific quality

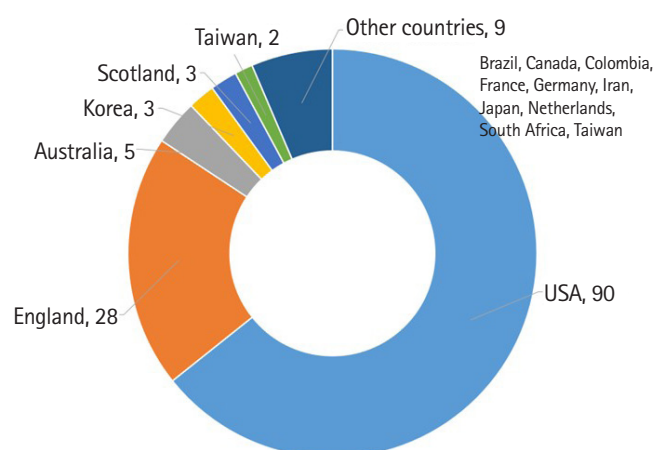
In addition to the five measurable benefits of being a MEDLINE journal, the most significant advantage is the enhanced prestige of the journal brand. This is because the journal’s content undergoes rigorous evaluation by experts from the Literature Selection Technical Review Committee (LSTRC) in the same field, ensuring the scientific quality of the content. This assessment of scientific quality is independent of citation frequencies. The LSTRC evaluates five aspects: scope and coverage, editorial policies and processes, scientific rigor of article content, production and administration, and impact. From my years of observation and analysis of why many Korean biomedical journals fail the MEDLINE evaluation process, I believe that the critical concept of acceptable scientific rigor centers on the following issues:

- Is the study design stated and the main text described according to the corresponding reporting guidelines?
- Is there a hypothesis statement in an experimental or analytic study?
- Is there a sample size estimation for a study with a hypothesis statement?
- Is the statistical analysis appropriate?
- Is the background for variable selection explained?
- Is the interpretation reasonable and not exaggerated?

KJWHN passed those evaluation items successfully according to the LSTRC Journal Review Summary Report dispatched to the journal.

## Narrow path to MEDLINE coverage for nursing society journals from non-English speaking countries

A list of nursing journals currently indexed in MEDLINE is available in [Supplementary Table 1](#). The search term in the NLM Catalog was “currentlyindexed AND (nursing [title] OR nurse [title]).” Out of 141 results, one was removed since it was not a nursing journal. Of the remaining 140 journals, only 22 (15.76%) originate from countries other than the United States and England. With the acceptance of KJWHN, Korea now ranks fourth among countries in terms of MEDLINE journals in the nursing category, a position it shares with Scotland ([Figure 1](#)). The dominance of the United States and England may be attributed to the prevalence of large commercial publishers in these two countries. Of the 140 journals, 12 (8.6%) are published by nursing societies or associations, while the remaining 128 are published by commercial publishing companies ([Supplementary Table 1](#)). This trend is also observed in other scientific journals, as it is difficult for journals affiliated with an academic society to compete with those published by commercial publishers, primarily due to budget constraints or a lack of expertise in editing and publishing. Consequently, many society journals outsource their publishing to local publishers, a common practice in Korea. Outsourcing, however, requires a substantial budget, which can be provided by the society and/or the authors through article processing charges. Given the stringent criteria for MEDLINE indexing ([https://www.nlm.nih.gov/medline/medline\\_statistic](https://www.nlm.nih.gov/medline/medline_statistic)).

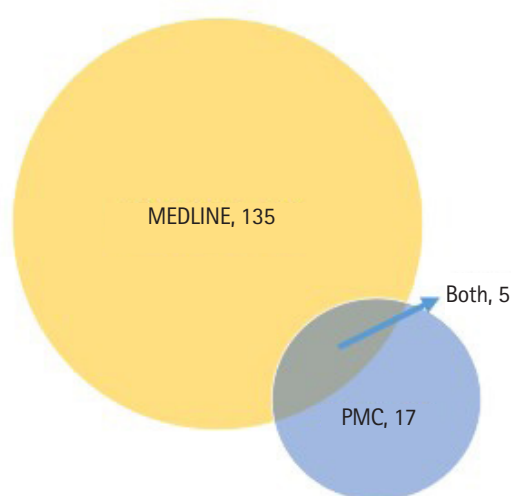


**Figure 1.** Number of MEDLINE journals in the nursing category according to country (as of August 30, 2023).

tics.html), Korean nursing society journals have started with PMC indexing [5] to ensure their discoverability in PubMed.

## Being indexed in MEDLINE and PMC

KJWHN is listed in MEDLINE and PMC simultaneously. Of the 24 nursing journals currently indexed in PMC (Supplementary Table 2) by the search term “journalspmc AND (nursing [title] OR nurse [title])” two should be removed: one journal’s title was changed, and the other entry corresponds to the proceedings from a single event. Based on this list, another Korea-based journal, *Child Health Nursing Research*, has also been indexed in PMC [5], but it has yet to be included in MEDLINE. Thus, out of the 22 PMC journals and 140 MEDLINE journals, the following five are indexed in both databases: *Investigación y educación en enfermería*, published in Colombia; *International Journal of Community based Nursing and Midwifery*, published in Iran; *Korean Journal of Women Health Nursing*, published in Korea; *Curationis*, published in South Africa; and *Nursing Open*, published in the United States (Figure 2). MEDLINE journals are exempted from the evaluation of scientific quality for PMC indexing; therefore, providing full-text PMC XML is the only remaining step. This raises a question: why don’t the remaining 135 MEDLINE nursing journals deposit their full-text PMC XML files to PMC? Of the 140 MEDLINE nursing journals, 128 are published by commercial publishing companies, which typically do not support open access policies. The exception to this is *Nursing Open*, which has deposited its full-text PMC XML files to PMC.



**Figure 2.** The number of nursing journals indexed in MEDLINE, PubMed Central (PMC), and both (as of August 30, 2023).

Among the eight MEDLINE, non-PMC journals not published by commercial publishing companies, two are open access and therefore eligible for deposit to PMC: *Revista da Escola de Enfermagem da U S P.* in Brazil and *Journal of Korean Academy of Nursing in Korea*. The decision to deposit full-text XML files to PMC ultimately lies with the publisher. The remaining six journals offer free access (1), require a subscription (4), or do not provide full text on the journal’s website (1) (Supplementary Table 1).

## What should local nursing society journals do to be eligible for MEDLINE?

Numerous information technologies have already been introduced to scholarly journal publishing. Standard journal publishing techniques or requirements include a secure URL address for the journal homepage, Journal Article Tag Suite XML [6], digital object identifiers [7], the cited-by function, Crossmark, Metrics, and a manuscript management system. Adopting these technologies or platforms is essential for survival in the journal market. However, beyond these technologies, the content of the article remains paramount. As previously mentioned, the editor must verify if the journal meets the criteria for evaluation by the LSTRC. Among the five evaluation topics, scientific rigor presents the greatest challenge. Therefore, it is crucial to adopt the appropriate study design and corresponding reporting guidelines to present the results in a logical and lucid manner. Providing an algorithm for the study design can be helpful [8,9], as well as clearly stating the appropriate study design and the corresponding reporting guidelines for a journal [10].

## Further work to maintain listing in MEDLINE

To consistently meet the scientific quality standards set by the US NLM, it is crucial that a journal adheres to the industry’s best practices. Being listed in MEDLINE is the initial step towards elevating the journal to an internationally top-tier level. The following recommendations are proposed: first, uphold ethical standards under a distinct “Ethics statement” heading; and second, ensure scientific rigor by clearly defining the study design and corresponding reporting guidelines. Like many other local society journals, KJWHN required assistance and thus hired full-time staff to work for the journal. Since all editorial work is voluntary, editor burnout may occur due to the heavy load of reviewing, editing, and administration. One potential solution to this issue could be to increase the article processing charge on

the author's side, which would make it possible to hire professional staff. It is my hope that editors will be able to continue their work without experiencing burnout and find joy and satisfaction in their voluntary roles.

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## Authors' contributions

All work was done by Huh S.

## Conflict of interest

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Further details on supplementary materials are presented online (available at <https://doi.org/10.4069/kjwhn.2023.09.11.01>).

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## Special issue on digital era education: Tracing digital health transformation in women's health nursing

Sook Jung Kang

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The coronavirus disease 2019 (COVID-19) outbreak started in December, 2019 in the Chinese city, Wuhan. As of September 2023, we are emerging from the COVID-19 pandemic, and it has changed our health care settings as well as nursing care environments. One of the biggest changes from the pandemic is that the digital era has come to our daily life and has affected nursing care, nursing education, and research. However, did the digital era come due to the pandemic? Many researchers and nurses before and right after the COVID-19 pandemic had foreseen that digital technology or telemedicine will be one of the main issues for nursing practice, education, and research in our current era. Jeong [1] emphasized the usefulness of artificial intelligence, machine learning, and deep learning and pushed for educating nurses in clinical settings and incorporating digital technology in the nursing curriculum. While COVID-19 may have accelerated this transformation process, the digital technology was already coming to our field of health care.

*The Korean Journal of Women Health Nursing* is publishing this special issue on 'Digital era education for women's health and well-being' because now is the time to reflect on the changes introduced by widespread digital technology and assess unmet needs relating to women's health. We are also challenged to rethink our expectations of what we can do with digital technology and what need to be done with further. Recognizing the importance of digital technologies in shaping the future of global health, the World Health Organization's "Global Strategy on Digital Health 2020–2025" outlines principles and key components of digital health care and stated that countries around the world need to be prepared and equipped with digital health skills [2]. Recently, the International Council of Nurses has issued position statement about digital health transformation and nursing practice [3]. The position statement, announced on September 1, 2023, defines digital health as "the field of knowledge and practice associated with the development and use of digital technologies," which is beyond the concept of e-health. The statement enumerates important recommendations in terms of global health nursing and responsibilities of national nurses' associations, as well as what to expect for nurses, nurse educators, researchers, and policy influencers [2].

This special issue contains evidence of the digital transformation for women's health, including women with cancer [4] and older adults [5], critical appraisal of mobile apps for pregnant women [6] and women's health education using YouTube [7], and presents new challenges to incorporate artificial intelligence into simulation [8]. However, more evidence regarding interventions and frameworks and/or models that can enhance rigor of digital health-incorporated research is needed. Also, since digital health can raise the issue of ethical concerns regarding health equity, increased

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workload for nurses, and information safety, the specific ramifications of those issues in relation to women's health require further dialogue and study. Finally, as digital health is rapidly evolving, support of up-to-date education and training is needed for nurses and nursing students so that they are empowered and competent for the next step of trans-digital health care settings.

We hope you enjoy this special issue and share your comments and critiques through letters to the Editor.

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All work was done by Kang SJ.

## Conflict of interest

Sook Jung Kang has been editorial board member of the *Korean Journal of Women Health Nursing* since January 2022. Also, she served as a guest editor for this special issue. She was not involved in the review process of this editorial. Otherwise, there was no conflict of interest.

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# Delivery of healthcare and healthcare education in the digital era and beyond: opportunities and considerations

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## Introduction

The coronavirus disease 2019 (COVID-19) pandemic brought unprecedented challenges to societies worldwide. Countries, industries, and the general public had to adjust their operations to accommodate imposed restrictions or requirements, such as physical distancing and sanitization. Healthcare agencies had to pivot promptly to address exponentiating healthcare needs, including vaccination, treatment, and management of COVID-19-related illness. Schools and workplaces had to swiftly find alternative modes for delivering instruction and to continue offering their services. These circumstances allowed widespread utilization of the innovative technologies from the fourth industrial revolution [1] (i.e., Industry 4.0). This article outlines changes observed in the healthcare and healthcare education settings in the digital era and the subsequent opportunities and considerations.

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## Healthcare settings

In clinical practice settings, telehealth or telemedicine has been highlighted as a solution for conducting remote assessment and consultation during times of physical isolation. In early 2020, the American College of Obstetricians and Gynecologists made recommendations for providers to consider increasing familiarity with telehealth, and hospitals adopted telehealth to care for high-risk obstetric patients [2,3]. As part of their Global Strategy on Digital Health 2020-2025, the World Health Organization defines telemedicine as the delivery of healthcare service(s) by healthcare professionals using telecommunication technologies for the exchange of information aimed at advancing the health of individuals and communities [4]. Telehealth utilizes innovative technologies such as web or videoconferencing, social communication apps, and other communication media for assessment, diagnosis, treatment, and prevention of illness and injuries. Other technologies supporting telehealth's convenience include biomedical sensors that measure biometrics, and fifth-generation (5G), and Wi-Fi networks that allow for the information to be stored and accessed in the cloud.

Beyond the benefits of reducing potential exposure to viruses during in-person visits, telehealth can promote access to healthcare by eliminating the need for a mode of transportation or the time needed to travel [5]. This can be liberating for individuals with mobility restrictions or caregiver responsibilities. In particular, telehealth can allow childbearing or pregnant women who may have

other competing roles and priorities to access their provider at their location of convenience in a timely manner [6]. As an example, Bonciani et al. [7] provided antenatal classes online during the COVID-19 pandemic to support them throughout their maternal care and found this approach to be valuable in reaching more women during pregnancy. Similarly, Álvarez-Pérez et al. [8] created massive open online courses to promote digital health literacy for pregnant and lactating women in Europe. A recent systematic review reported that the use of patient-centered decision support tools enabled through digitalization and new technology increased pregnant women's knowledge and satisfaction regarding maternity care [9]. A telehealth lifestyle intervention was also studied to reduce excess gestational weight gain in overweight or obese pregnant women, suggesting its potential utility in improving healthy behaviors in this population [3].

In addition to the potential benefits of telehealth in promoting pregnant and lactating women's knowledge, satisfaction, or health behaviors, burgeoning evidence suggests the effectiveness of telehealth in supporting women's mental health. Koç et al. [10] conducted a systematic review and reported evidence of the effectiveness of telehealth on the mental health of women with breast cancer, such as reduced symptoms of depression, anxiety, and fear of relapse as well as improved cognitive function and psychological strengths. Similarly, a recent meta-analysis of women with postpartum depression showed significantly lower scores of anxiety and Edinburgh Postnatal Depression Scale in the telehealth group than in the control group [11]. Other obstetric and gynecologic health outcomes found to be improved by telehealth interventions include fewer scheduled outpatient visits in the case of high-risk obstetrics, early access to medical abortion services, and higher oral contraception rates [12]. The use of artificial intelligence (AI) to promote preventive interventions in areas where conditions and outcomes are sex- and gender-based, such as risk-screening for cardiovascular disease, is another area to be further explored [13].

Though the pandemic accelerated the utilization of advancements from the fourth industrial revolution, technologies such as robotics were already in use prior to the pandemic, especially in healthcare settings. Based on a cohort study of 169,404 patients in 73 hospitals in the United States, Sheetz et al. [14] reported a rising trend in the use of robotic surgery for all general surgery procedures, from 1.8% in 2012 to 15.1% in 2018. In Korea, Ryu et al. [15] reported robot-assisted nipple-sparing mastectomy as a feasible and acceptable surgical technique. For early-stage cervical cancer, Alfonso et al. [16] found that there is no survival difference between robotic and open radical hysterectomy, based

on a nationwide population-based cohort study in Sweden.

The rapid advancement of technology in the practice setting justifies healthcare providers in incorporating those technologies in a healthcare context and guiding clients to utilize those resources, as applicable. Simultaneously, it is important to understand the challenges inherent to technology-enhanced solutions such as telehealth, notably the digital divide and limited access to internet or telehealth devices; these limitations should be carefully considered to ensure health equity [17,18]. This leaves healthcare educators to consider the expanded definition of practice-ready graduates as well as the competencies required to be successful in the rapidly evolving high-tech healthcare environment.

## Healthcare education settings

Prior to the pandemic, traditional education in healthcare was characterized by in-person lectures, labs, and clinical experiences. Seasoned educators would agree that hands-on experiential learning in person was by far the most common instructional method. In the early phases of the COVID-19 pandemic, when social gatherings including campus activities and classroom instructions were prohibited, educators had to transition courses online over a very short period of time. Traditional lectures were delivered online synchronously using web or videoconferencing technology such as Zoom or Microsoft Teams [19]. Some lectures were recorded and uploaded to learning management systems such as Blackboard and Canvas, and students were granted access to watch them asynchronously. The latter option was also used as an alternative offering to students who might not have access to high-speed internet or those who had to miss synchronous sessions due to illness or childcare responsibilities.

When students were not allowed in clinical settings but were allowed in labs on campus, in-person clinical simulations using technologies such as high-fidelity manikins were used to supplement clinical teaching and learning. When students were not allowed on campus, remote/distance simulations employing web conferencing technologies were conducted in which instructors or actors served as standardized patients. This allowed students to care for the patient in a given scenario [19].

As companies started to release more online simulation products using AI (e.g., AI chatbot), educators were empowered to provide their students with more opportunities to practice and demonstrate their understanding and competence. The AI-powered simulations allow students to have a dialogue and foster their communication skills [20].

More recently, immersive technology using wearable devices

has become more accessible in the educational arena. Students can now use headsets or head-mounted displays to enter a virtual, augmented, or mixed-reality setting and engage with the environment using kinesthetic haptic devices [21]. Universities and companies have leveraged this technology to create scenario-based virtual simulations [20]. The simulations allow students to practice clinical reasoning in two-dimensional as well as three-dimensional environments. They also let students demonstrate not only their understanding, through answering exam questions or writing care plans, but also their ability to apply it to a given situation. Technology can enrich students' learning experiences by providing additional exposure to diverse scenarios in a safe and immersive environment. These advances invite higher education administrators to reconsider the role that their institutions can play in graduating students who are truly prepared to enter fast-evolving industries.

Many schools of nursing are building culture and infrastructure to promote innovation and to position not only their students but others' to lead innovations in health systems [22]. As an example, the University of Pennsylvania's School of Nursing offers an online open-access platform with resources to yield innovative solutions for problems in healthcare [23]. Universities or colleges equipped with the awareness and tools to expose students to future possibilities, with educators who are nimble and open to leading change, and with the financial capacity and a solid foundation to encourage innovation, may find themselves in a leading position.

## Opportunities and considerations

High-quality information and content are saturated and available on demand, through platforms such as Google, YouTube, Apple, Netflix, or Hulu. Animations feature advanced technology—software and hardware—that is personalized and deeply incorporated into daily lives. A 2021 movie titled *Ron's Gone Wrong* features a personalized robot companion that is portrayed as integral to school-age students' social lives, similar to having a smartphone. Even a movie released in 2014 titled *Big Hero 6* features Baymax, a personalized healthcare companion robot with the capacity to provide treatment based on assessment as well as to care and be a person's closest friend [24]. Since then, *Big Hero 6* was turned into a television series, and in summer 2022, *Baymax!* premiered as its own series [25,26]. Baymax is also referred to as a “nurse/robot” [27].

Generation Z, currently entering higher education and the workforce, grew up watching these movies and television series

and having access to AI agents such as Apple's Siri and Amazon's Alexa. Generation alpha, amid or entering K-12 education, is growing up with further evolved AIs, such as ChatGPT and DALL-E2 [28,29]. The value of higher education and professionals is being questioned, since news articles have reported exam types for which ChatGPT performed at or near the passing threshold, including the United States Medical Licensing Exam and bar exams, as well as the Scholastic Aptitude Test, Graduate Record Examination, USA Biology Olympiad, and a range of Advanced Placement examinations [30,31].

At minimum, this calls for educators to reflect on our practices and consider the need to emphasize higher-order thinking. What do you do with the information, and what questions do you ask to gather the information needed to solve problems and achieve the goal at hand? In the United States, the National Council of State Boards of Nursing launched the Next Generation National Council Licensure Examination for Registered Nurses examination in April 2023, which emphasizes clinical judgment skills as an essential skill for nurses to demonstrate [32,33]. The American Association of Colleges of Nursing released guidelines on essential competencies for nursing education in spring 2021 [24]. Colleges of nursing have begun to shift towards a competency-based education model and incorporate technology as supplemental learning tools in the curriculum to promote opportunities to practice application and demonstrate competencies.

Healthcare administrators are also called upon to explore the implications of emerging technology and the evolving expectations of our healthcare consumers and the incoming workforce [34]. Some hospitals have already begun to implement telehealth. Telehealth is supported by Medicaid, Medicare, and commercial healthcare plans in many states in the United States [35–37]. More companies and even public schools are considering offering spaces that allow their employees to seek telehealth visits without having to leave their workplace. This means that the point of care could shift to our communities and homes. The role nurses play in care coordination beyond the acute care setting would become more emphatic. Exposure to the paradigm shift, the changing role of nurses, and the subsequent need to reflect these changes by educating practice-ready nurses is vital.

For both education and healthcare, the core value may lie within personalized and person-centered approaches. It would not be surprising to see a healthcare consumer preferring care that meets their needs, fits their lifestyle, and has an interdisciplinary team collaborating and utilizing enhanced technology specifically to meet clients' needs. A team of healthcare professionals who can provide personalized holistic care would be undoubtedly

welcomed. Similarly, students will likely prefer education that meets their needs, fits their lifestyles, and has a specialized student success team collaborating and utilizing enhanced technology to provide student-centered, personalized, holistic support.

Some important considerations arise as we look into embracing technology developments and their utilization in the education and healthcare industries. For providers of service-oriented education or healthcare, the cost to build and maintain infrastructure for advanced technology cannot be disregarded and should be carefully budgeted for. It is also important to keep health and education equity at the forefront in making decisions so that consumers are granted equal access to the services provided.

As more private data is collected, stored, and transmitted, all parties involved need to be vigilant about information privacy and cybersecurity. Face and voice recognition, used commonly now, could be dangerous if misused in combination with machine-learning technology. The ever-larger number of devices and cloud services used by individuals could provide additional entry points for security breaches. While it comes with its own limitations, blockchain technology may be used to promote the security and privacy of sensitive information protected by the Health Insurance Portability and Accountability Act, to leverage its features such as decentralization, immutability, transparency, and traceability [38].

The general public's level of comfort in sharing their personal information and measures to accommodate various levels of preference should be considered. For example, in a survey recently conducted in Sweden by Belfrage et al. [39], the general public's trust in the ability of healthcare to protect electronic patient data was high (81.9%). There were individuals with low levels of trust, however, who preferred to be asked for permission before their personal data could be used and who were less open to allowing it.

It would be prudent to consider current and future providers' perceptions and their needs as well. A mixed methods study conducted in Germany involving 80,000 medical students showed that most students reported a positive attitude towards digital applications in medicine. Thirty-eight percent of the students did not feel ready to answer questions related to AI because it was not formally covered in the curriculum, suggesting a need to incorporate digital content into the curriculum [40]. A cross-sectional survey of gynecologists in Germany showed that 67.3% of respondents would like to use telemedicine, 73.2% would use it during follow-up at the treatment phase, and 51.5% would opt for telecounseling to improve care [41].

Jarva et al. [42] reported that healthcare professionals perceive

digital health competence to be focused on the ability to provide patient-centric care by evaluating the feasibility of using digital health services jointly with more traditional methods. Opportunities should be available to continue improving our understanding of the changing landscape of digital healthcare and the roles that healthcare providers play in this environment. Conversely, opportunities should be offered for healthcare providers to provide feedback and shape how technology can best be leveraged in educational and healthcare settings.

## Conclusion

Advanced communication and connectivity technologies provide exciting, geographically boundless opportunities to promote global collaboration. The innovative technologies of Industry 4.0 are only forecasted to grow. The COVID-19 pandemic forced many around the globe to be flexible and open-minded, to think outside-the-box, and be innovative thinkers to overcome the enormous range of challenges that it brought us. While technology comes with its own concerns, it has demonstrated its positive utility in securing access to education and healthcare.

South Korea is referred to as an innovative, high-technology society with a strong infrastructure, such as pervasive 5G wireless technology [43,44]. Smart technology is well integrated into daily activities, and the general public has access to affordable internet and technology [45-47]. This infrastructure presents an opportunity for the country to lead in education and healthcare in the digital era and beyond. While there is no one-size-fits-all solution to the delivery of healthcare and healthcare education in the digital era, there is no question that technology could be leveraged to address certain barriers to healthcare and healthcare education. By the same token, several aspects, such as digital literacy and the digital divide, need to be carefully considered to prevent unintended consequences. Having a clear end goal—the promotion of health and well-being of our students and patients—will keep us moving in the right direction.

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## Authors' contributions

All work was done by Chung SY.

## Conflict of interest

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# Technology-based self-management interventions for women with breast cancer: a systematic review

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**Purpose:** Since technology-based interventions can facilitate convenient access to healthcare for women with breast cancer, it is crucial to understand innovative approaches to maintaining the effectiveness of these interventions. Therefore, we conducted a systematic review of technology-based self-management interventions for women with breast cancer in six countries. We analyzed the characteristics of these interventions and examined their diverse health outcomes.

**Methods:** Six databases were systematically searched to extract research articles using the keywords “breast cancer,” “technology,” and “self-management.” The search was carried out up until June 12, 2023. From the 1,288 studies retrieved from the database search, 10 eligible papers were identified based on inclusion/exclusion criteria. Two authors independently extracted and compared the data from these articles, resolving any discrepancies through discussion.

**Results:** Most of the 10 studies utilized web- or mobile-based technology, and one used artificial intelligence-based technology. Among the 12 health-related outcome variables, quality of life and symptom distress were the most frequently mentioned, appearing in six articles. Furthermore, an analysis of the intervention programs revealed a variety of common constructs and the involvement of managers in the self-management intervention.

**Conclusion:** Incorporating key components such as self-management planning, diary keeping, and communication support in technology-based interventions could significantly improve the self-management process for breast cancer survivors. The practical application of technology has the potential to empower women diagnosed with breast cancer and improve their overall quality of life, by providing timely and sustainable interventions, and by leveraging available resources and tools.

**Keywords:** Breast neoplasms; eHealth; mHealth; Self-management; Technology

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## Introduction

Various factors, including advancements in treatment methods, early detection screenings, and improved surgical techniques, have contributed to a notable increase in breast cancer survival rates. In the United States, the 5-year survival rate for breast cancer patients was 91% in 2018 [1]. Meanwhile, in South Korea, the rate rose from 77.9% between 1993 and 1995 to 93.8% between 2016 and 2020 [2]. With these trends, breast cancer survivors

may live for many decades. Therefore, it is crucial to develop strategies aimed at enhancing their quality of life while effectively managing the risks of recurrence and mortality.

Breast cancer treatment can lead to psychological and emotional side effects. These not only negatively affect the patient's quality of life but also result in increased economic burdens, such as productivity losses. As such, it is crucial to provide ongoing interventions and management to support breast cancer patients

## Summary statement

### • What is already known about this topic?

Promoting self-care and implementing health programs can improve patient outcomes. Furthermore, providing ongoing interventions and management is crucial for supporting patients with breast cancer during and after treatment.

### • What this paper adds

Apart from web-/mobile-based technologies, new artificial intelligence-based technologies are increasingly utilized. Although the measured outcomes vary across studies, numerous studies evaluated the quality of life and symptom distress.

### • Implications for practice, education, and/or policy

Self-management programs are an effective supplemental tool for the physical and psychological needs of women with breast cancer. However, further research is needed to ensure the ongoing application of technology-based self-management programs.

during and after their treatment [3]. Encouraging self-care and implementing programs that promote healthy lifestyle habits can enhance health outcomes, boost self-efficacy, and lower the risks of cancer recurrence and mortality [4]. Exercise and diet play a significant role in maintaining a healthy lifestyle, which is essential for the well-being of breast cancer patients. Therefore, interventions designed to improve lifestyle habits, including various exercise routines and dietary changes, have been introduced [5,6]. However, these interventions tend to have only short-term effects, highlighting the need to devise strategies that extend their benefits [7,8].

Since the onset of the coronavirus disease 2019 pandemic, eHealth platforms such as websites and video conferencing have seen rapid expansion [9,10]. Telemedicine has provided scalable and flexible methods for healthcare support, effectively replacing many in-person appointments and ensuring continuity of care [11]. Technology-based interventions involve the use and implementation of technological tools or methodologies in the design, development, and distribution of healthcare solutions to target participants [12]. These interventions also utilize readily accessible devices like smartphones, the internet, or mobile sensors to monitor, reinforce, or provide convenient and cost-effective healthcare services to individuals in need of medical care [12]. Notably, technology-based interventions have demonstrated high patient preference in terms of acceptability and utility, fostering patient-centered care through standardization [13]. They also allow breast cancer survivors to share their experiences and provide immediate feedback to healthcare professionals, facilitating real-time interaction [14]. Therefore, technology-based interventions offer patients a convenient and engaging way to continuously receive health assessments, education, symptom man-

agement, self-management enhancement, and psychosocial support [15,16].

Moreover, various technologies, such as online chat platforms, diary writing, video-based education, video games, websites, social media platforms, and mobile applications, have been utilized to promote health and provide psychosocial support for breast cancer survivors [17,18]. Given the intensive and long-term treatment required by breast cancer patients, along with their self-management needs, the provision of timely care is crucial for improving overall self-management in this group [19,20]. Consequently, these technology-based self-management interventions allow breast cancer survivors to access timely and effective treatments. They offer a broad array of resources and tools that can improve their health outcomes and foster their psychosocial well-being [21-23].

The effects of mobile health interventions on physical activity and patient-reported health outcomes, such as quality of life, stress, fatigue, and sleep, in patients with breast cancer have been increasingly examined through systematic reviews [24,25]. However, many of these studies have concentrated on a single type of technology or health outcome, making it challenging to assess the intervention's acceptability among the target population and the overall trends in which variables self-management programs have been applied and their effectiveness. Consequently, a study that includes various technology-based interventions, such as mobile health, eHealth, and artificial intelligence (AI), and evaluates functionality acceptance, utility, engagement, and long-term management should be undertaken. This would provide the necessary information for developing innovative technology-based interventions and minimizing unnecessary costs [26]. The variety in intervention approaches and outcome assessments in technolo-

gy-based self-management interventions for breast cancer complicates comparisons, and systematic literature reviews that include interventions using multiple media are scarce. Therefore, this systematic review was conducted with the aim of improving our understanding of technology-based self-management interventions and assessing various health outcomes during and after treatment, thereby providing directions for future research. The findings of this study will contribute to the foundational knowledge of intervention development by understanding the characteristics and outcomes of technology-based self-management interventions for women with breast cancer. The review questions were:

1. What do technology-based self-management programs consist of, and what do they provide to women with breast cancer?
2. What outcomes have been evaluated among women with breast cancer after self-management programs?
3. What is the structure of technology-based self-management programs?

## Methods

### Study design

This systematic literature review, which focused on technology-based self-management programs for women with breast cancer, adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [27].

### Eligibility criteria

To clarify the inclusion criteria and devise an effective search strategy, we utilized the PICO (Population/Intervention/Control/Outcome) framework [28]. The population for this study comprised women diagnosed with breast cancer, specifically those undergoing treatment and survivors who had completed treatment. The intervention involved a technology-based approach incorporating elements of self-management. This systematic review did not employ a comparison group. While the outcome was not restricted, it was necessary to measure one or more quantitative outcomes to assess the effectiveness of the self-management interventions. We included studies written in either English or Korean that were published in peer-reviewed academic journals.

In this context, technology-based interventions refer to the application of information communication technologies in facilitating the delivery of education and care for health-related conditions [28]. These interventions can be broadly categorized into two types: internet-based and mobile-based [29]. Therefore, in this study, technology-based interventions encompass all inter-

net- and mobile-based technologies utilized in providing health-related information and care to women diagnosed with breast cancer.

Studies were excluded if they: (1) were review papers, editorials, case studies, or protocols, (2) did not specifically address women's health in relation to breast cancer, and (3) failed to provide detailed information about the intervention.

Our primary outcome of interest was symptoms directly associated with the disease. Secondary outcomes included aspects of psychological health such as quality of life, depression, and anxiety, among others. Physical health factors, including fatigue, diet, and physical activity, were also of interest. Additionally, we considered other health-related outcomes, such as medication compliance.

### Search strategy

From May 23 to June 12, 2023, two researchers comprehensively retrieved studies in five English databases and two Korean databases. These databases included PubMed, the Cumulative Index to Nursing and Allied Health Literature, PsycINFO, Web of Science, Cochrane Central Register of Controlled Trials, Research Information Sharing Service, and Data Base Periodical Information Academic ([Appendix 1](#)). The researchers used the following keywords for each database: (breast cancer) AND (mobile OR m-health OR e-health OR web OR app\* OR technology-based OR artificial intelligence OR AI OR chatbot OR telehealth OR digital health) AND (self-management OR self-help OR self-care OR self-guided OR self-administ\*) AND (program OR intervention). There were no restrictions on the publication date, and search sets were combined using Boolean operators. Additionally, the researchers conducted backward and forward searches of the identified publications to locate other relevant materials.

### Study selection and data extraction

Studies were selected in accordance with the PRISMA guidelines. Following the pooling of literature search results, any duplicates were eliminated. Two independent reviewers assessed the titles and abstracts based on the inclusion and exclusion criteria of the studies. Subsequently, the full text of potentially relevant studies was reviewed by two individuals, who then made the selection. Any disagreements between the reviewers were resolved through discussion. The number of studies excluded, along with the reasons for their exclusion, were recorded in a PRISMA flowchart, as depicted in [Figure 1](#).

Using a Microsoft Excel template, two reviewers extracted data from each of the listed studies. The detailed information includ-

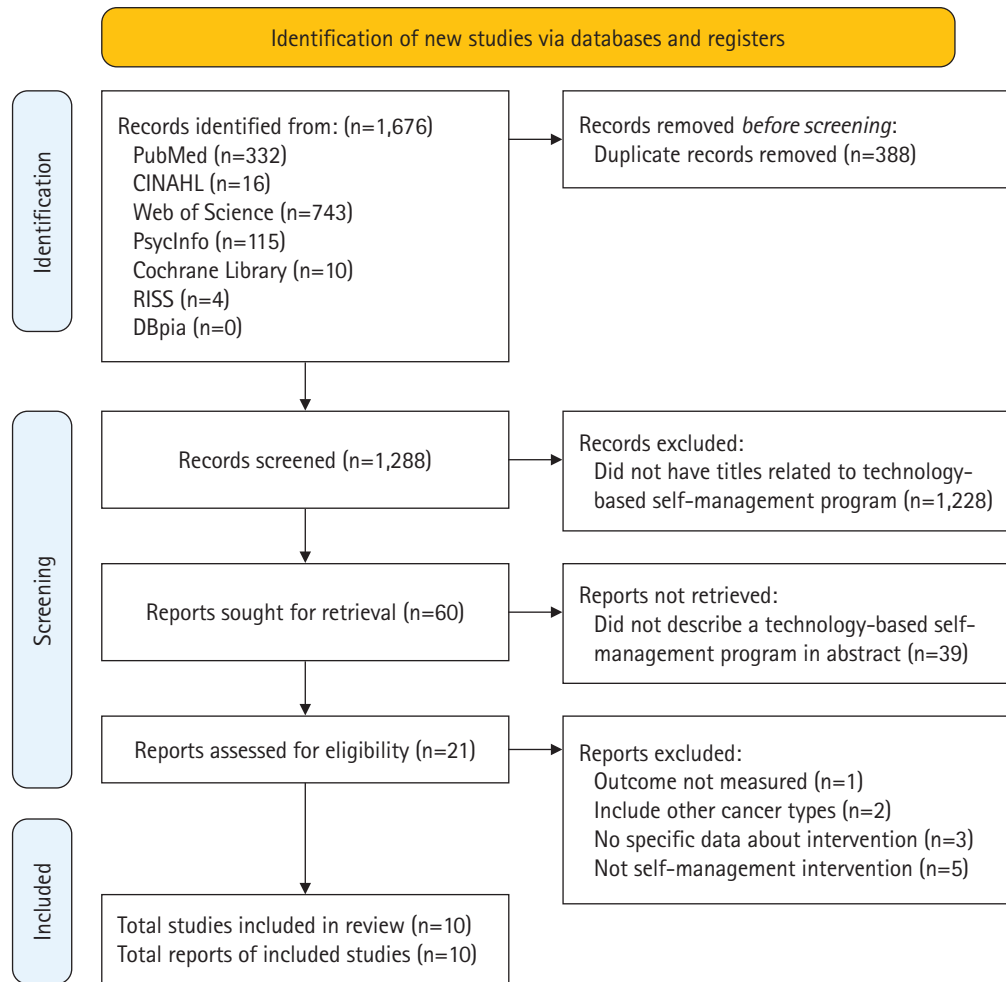


Figure 1. PRISMA 2020 flow diagram of the literature search.

ed the first author, publication year and country, study design, sample/population, sample size, main intervention, control group, study outcome, main findings, and intervention characteristics (technology, program contents, duration, session, intervention manager, intervention manager involvement, and follow-up). The extracted data were subsequently cross-verified to ensure the accuracy of the data extraction process.

### Assessment of risk of bias

Two independent reviewers assessed the quality of the studies included in this review. Any disagreements that arose were resolved through discussion. Specifically, the quality of randomized controlled trials (RCTs) was evaluated using the Cochrane Risk of Bias 2.0 (RoB 2.0) tool. For nonrandomized interventional studies, the Risk of Bias in Nonrandomized Studies-of Interventions (ROBINS-I) tool was employed. The RoB 2.0 tool's evalu-

ation algorithm was used for each domain to determine whether there was a "low risk," "some concerns," or "high risk" of bias. The ROBINS-I tool identified five categories of bias risk across seven domains: "low risk of bias," "moderate risk of bias," "high risk of bias," "very high risk of bias," and "no information."

## Results

### Characteristics of selected studies

Out of 1,288 studies identified through an electronic database search, 10 (Appendix 2) were included in this review following a full-text screening, which were named from A1 to A10 [30-39]. Studies with unmeasured outcomes or those that did not focus on self-management interventions were excluded (Figure 1). Three of the studies (A2, A5, and A8) were conducted in the United States, two (A1 and A10) in Europe (specifically the

Netherlands and Norway), three (A3, A4, and A7) in East Asia (South Korea), and two (A6 and A9) in the Middle East (Egypt and Iran). Seven of the included studies were RCTs, two were nonrandomized interventional (i.e., quasi-experimental) studies (A6 and A7), and one was a cross-sectional study (A5). The sample sizes ranged from 24 to 355. The control intervention was primarily usual care (80%), with two studies providing an educational booklet (A3 and A4). In the majority of the studies (70%), the follow-up period was identical to the program duration, and the post-test was conducted immediately after the program's conclusion (A2, A3, A4, A5, A6, A8, and A9). Three studies followed up on program outcomes at 2, 3, and 6 months after the program ended (A1, A7, and A10).

Risk of bias

Figure 2 shows the methodological quality of the RCTs. Using the RoB 2.0 tool, we conducted a Cochrane risk of bias analysis on the RCTs. Three of the seven RCTs did not report allocation concealment (A1, A3, and A8), which raised potential concerns

regarding selection bias. Given the inherent characteristics of psychosocial interventions, it is challenging to blind participants, which inevitably resulted in performance bias in four studies (A1, A3, A8, and A9). Two studies failed to detail their approach to handling missing data (A3 and A8), thereby elevating the risk of detection bias. However, no significant attrition bias or reporting bias was observed.

Figure 3 depicts the methodological quality of non-RCTs. Using the ROBINS-I tool, we conducted a Cochrane risk of bias analysis on the non-RCTs. All three non-RCTs demonstrated a high risk of detection bias due to the absence of a description of how dropouts and missing data were handled (A5, A6, and A7). Furthermore, the absence of a control group or a well-defined description of the control group presented a high risk for the classification of the intervention (A5 and A6).

Technology

The interventions could be broadly categorized into two primary types: those that relied on internet platforms and those that depended on mobile platforms. Of the 10 articles included in our final sample (Table 1), five utilized mobile-based interventions (A2, A3, A5, A6, and A7), four employed web-based interventions (A1, A4, A8, and A10), and one used a web-based intervention that incorporated a chatbot (A9). A common theme across these studies was the assertion that technology-based interventions, such as web-based and mobile-based programs, can pro-

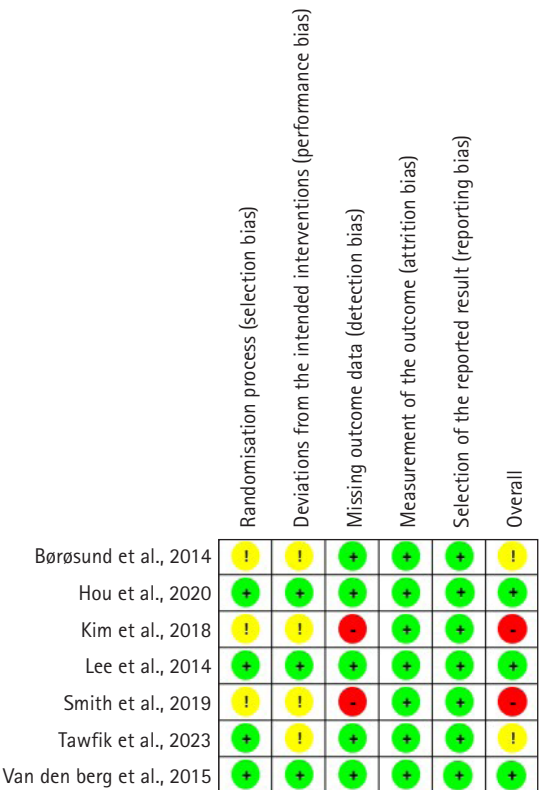


Figure 2. Risk of bias summary of randomized controlled trials using the Cochrane Risk of Bias 2.0 (RoB 2.0) tool.

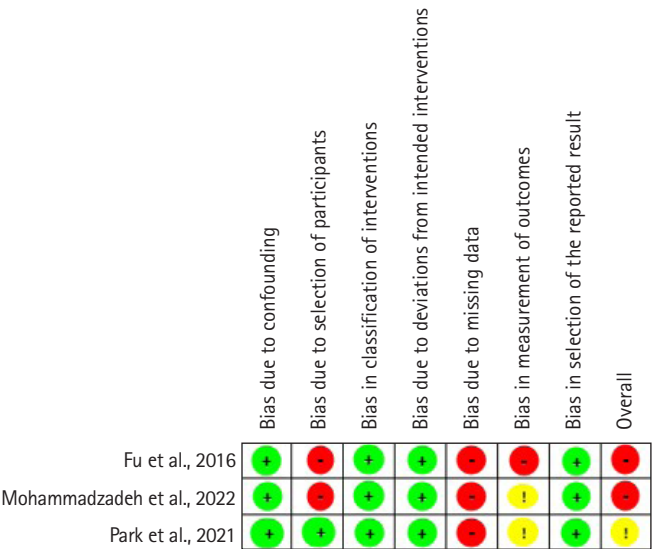


Figure 3. Risk of bias summary of non-randomized controlled trials using the Risk of Bias in Nonrandomized Studies-of Interventions (ROBINS-I) tool.

**Table 1.** Characteristics of the included studies (N=10)

No.	Study	Year	Country	Study design	Sample/ population	Sample size	Main intervention (program name)	Control group	Study outcomes 1: primary 2: secondary	Main findings
A1	Børresund et al. [30]	2014	Norway	RCT	167 breast cancer patients	I (PPC): 45 I (WebChoice): 64 C: 58	I (PPC): internet-based patient-provider communication service I (WebChoice): Web-based illness management system, which included IPPC	Usual care	1) - Symptom distress - Anxiety - Depression 2) - Self-efficacy	The WebChoice group reported significantly lower symptom distress, anxiety, and depression compared with the usual care group. The IPPC group reported significant lower depression scores compared with the usual care group, but no differences were observed for symptom distress or anxiety. No significant differences in self-efficacy were found among the study groups.
A2	Hou et al. [31]	2020	United States	RCT	112 breast cancer patients	I: 53 C: 59	Breast cancer self-management support (BCSMS)	Usual care	QoL	The mean total QoL summary scores were significantly higher among the experimental group versus the control group, respectively, at 3 months.
A3	Kim et al. [32]	2018	South Korea	RCT	72 breast cancer patients with clinical stage IV	I: 36 C: 40	A mobile game-based intervention (ILOVE-BREAST)	Educational booklet	1) - Time spent on education - Compliance with medication - Physical side effects - Anxiety - Depression - QoL	The use of the mobile game was associated with lower rates of chemotherapy-related side effects, such as nausea, fatigue, numbness of hand or foot, and hair loss, than the control group. The game group exhibited better QoL during chemotherapy. However, there were no significant differences in terms of depression and anxiety scales.
A4	Lee et al. [33]	2014	South Korea	RCT	59 breast cancer patients who had completed primary cancer treatment within 12 months	I: 29 C: 28	Web-based self-management exercise and diet intervention program (WSEDI)	Educational booklet	1) - Exercise and intake of F&V - Dietary quality 2) - HRQOL - Anxiety and depression - Fatigue - Stage of change - Perceived self-efficacy	Participants who engaged in at least moderate-intensity aerobic activity for at least 150 minutes per week, consumed five servings of F&V each day, and saw general gains in nutritional quality, physical functioning and appetite loss (HRQOL), fatigue, motivational readiness, and self-efficacy
A5	Fu et al. [34]	2016	United States	Cross-sectional design	355 breast cancer survivors	NA	The-Optipal-Lymph-Flow-health IT system (TOLF)	NA	1) - Symptoms of pain, soreness, aching, tenderness - Number of lymphedema symptoms 2) Symptom distress/QoL related to pain and symptoms	A significant difference in symptom distress or impact on between breast cancer survivors with lymphedema and those without lymphedema. Themes from the qualitative data included empowerment, high-quality information, loving avatar simulation videos, easy accessibility, and user-friendliness.

(Continued to the next page)

Table 1. Continued

No.	Study	Year	Country	Study design	Sample/ population	Sample size	Main intervention (program name)	Control group	Study outcomes 1: primary 2: secondary	Main findings
A6	Mohammadzadeh et al. [35]	2022	Iran	Quasi-experimental	24 breast cancer patients	I: 24 C: None	Self-management mobile application (NI)	NA	1) - QoL (negative feelings, positive feelings, cognitive problems, pain, sexual interest, energy/fatigue, social avoidance, financial problems, benefits, distress-family, appearance, distress-recurrence)	The use of the application showed the most significant changes in QoL, including social avoidance, negative feelings, sexual function, sexual interest, and pain.
A7	Park et al. [36]	2021	South Korea	Quasi-experimental	60 breast cancer patients who developed amenorrhea while receiving chemotherapy	I: 27 C: 24	Self-management program with an integrative cognitive-behavioral intervention	Usual care	1) Menopausal symptoms 2) - Self-efficacy - QoL (physical well-being, emotional well-being, functional well-being)	In the intervention group, menopausal symptoms were significantly improved compared to the control group at the follow-up test. In the follow-up test, the intervention group's self-efficacy and QoL significantly improved, whereas that of the control group decreased.
A8	Smith et al. [37]	2019	United States	RCT	86 adult breast cancer survivors with chronic pain	I: 34 C: 52	Reimagine	Usual care	1) - Depression - Fatigue 2) - Pain severity - Pain interference - Self-efficacy - (User satisfaction)	Reimagine has an effect on depression and fatigue symptoms for breast cancer survivors. Online programs can be a feasible and effective alternative to in-person support.
A9	Tawfik et al. [38]	2023	Egypt	RCT	150 breast cancer patients	I (ChemoFreeBot): 50 I (Education): 50 C: 50	I (ChemoFreeBot): Self-care intervention by interacting with a chatbot I (Education): Face-to-face education on self-care techniques to manage chemotherapy side effects	Usual care	1) - The frequency, severity, and distress of physical and psychological chemotherapy-related side effects 2) - Usability of the chatbot	Significant differences were found between the three groups in terms of the physical symptom frequency, severity, and distress; the psychological symptoms frequency, severity, distress, and the effectiveness of self-care behaviors.
A10	van den Berg et al. [39]	2015	Netherlands	RCT	135 breast cancer patients who had completed curative primary treatment 2 to 4 months	I: 63 C: 72	Web-based self-management intervention (BREATH)	Usual care	1) - Distress - Empowerment 2) - Negative adjustment (fatigue, helplessness, fear of cancer recurrence) - Positive adjustment (self-efficacy, remoralization, personal control, acceptance)	Intervention group reported significantly less distress than comparison group with a small-to-medium effect size, but empowerment was not affected. There were no between-group differences in primary outcomes during follow-up.

C, control group; F&amp;V, fruits and vegetables; HRQOL, health-related quality of life; I, intervention group; NA, not applicable; NI, no information; QoL, quality of life; RCT, randomized controlled trial.

vide patient-centered care. This allows patients to evaluate their symptoms at any time and from any location. A unique feature of the mobile-based programs was the inclusion of an innovative training system that used avatar simulation videos to help breast cancer survivors develop self-care skills (A5). Additionally, the web-based program that utilized an AI chatbot offered personalized education tailored to women's needs. This allowed women to engage in individual conversations and receive customized information based on their specific questions (A9).

## Programs

### Constructs

The results identified several common constructs in the self-management programs (Table 2). The most commonly observed constructs were those related to the provision of information and communication to assist patients in effectively managing their condition (A1 and A2). Constructs associated with assessment, as well as planning with a diary to improve patients' knowledge, encourage proactive actions, and efficiently monitor their progress, were also prevalent (A1, A3, A4, and A7). Numerous programs focused on specific symptom management and self-care strategies, aiming to equip patients with the necessary skills and knowledge to manage their symptoms and overall health effectively (A5, A6, and A7). Additionally, a handful of programs incorporated cognitive-behavioral therapy and cognitive reframing to offer personalized support, foster active participation, and enhance patients' comprehension and coping abilities (A8 and A10).

### Manager involvement

Five of the 10 studies incorporated the involvement of intervention managers during the interventions (A1, A3, A6, A7, and A8). The strategies varied among the studies. In one study, users were given access to a "Contact Us" section within the app, which allowed them to pose questions at any time (A6). Another study conducted weekly interviews with participants via cell phone throughout the duration of the study. This consistent communication enabled healthcare personnel to continuously monitor and support the patients, providing a uniform and personalized intervention experience (A3). A different strategy involved offering a platform for patients to seek assistance from healthcare personnel at their treatment hospital. This platform enabled patients to ask questions, share experiences, and receive advice from oncology nurses. If necessary, the nurses could also direct further inquiries to physicians and social workers, ensuring comprehensive support and expertise (A1). In another study, participants

received regular weekly feedback via email, which encouraged them to consistently engage with the website, learn about self-management, and maintain their health diary. This continuous communication and feedback loop was designed to foster active participation and adherence to the intervention among patients (A7). In a separate study, an online group meeting was facilitated by masters who were equipped with a prepared and certified Pillar Guide (A8).

### Health-related outcomes

Table 3 lists the health-related outcome variables in the 10 self-management programs. For women with breast cancer, these 10 articles discussed 12 health-related outcome variables. With respect to the primary outcome, the program exhibited positive effects in diminishing pain symptoms (A5, A6, and A8) and mitigating distress and side effects (A1, A3, A5, A9, and A10). It also effectively managed menopausal symptoms (A7). Regarding psychological health, a secondary outcome, the program yielded encouraging results in reducing anxiety (A1 and A4), depression (A1, A4, and A8), fear of cancer recurrence (A10), and in improving quality of life (A2, A3, A5, A6, and A7), self-efficacy (A4, A8, and A10), and empowerment (A10). In terms of physical health, the program was beneficial in alleviating fatigue (A4, A6, A8, and A10) and enhancing dietary quality (A4). Additionally, the program showed positive outcomes in relation to medication compliance (A3).

## Discussion

This systematic review examined technology-based self-management programs designed for supportive care in women with breast cancer, focusing on their content and outcomes. Generally, the methods employed in these self-management programs are somewhat limited, and there is a broad range of variation in both content and outcome variables across different studies. Nevertheless, this review can offer guidance on the factors that should be considered when developing and implementing more effective technology-based self-management programs for women with breast cancer.

Web-based technology currently dominates the field of self-management programs for women with breast cancer, with mobile technology, utilizing devices such as smartphones and tablets, coming in second. Web-based intervention programs have long been favored for their ability to provide timely information and support when necessary [40,41]. Concurrently, the use of mobile technology in self-management interventions for

**Table 2.** Description of the interventions (N=10)

No.	Study	Year	Technology	Program construct/contents	Duration	Session	Intervention manager	Involvement of intervention manager
A1	Børåsund et al. [30]	2014	Web-based	1) Symptom assessment 2) Advice 3) Information 4) Communication 5) Electronic diary	12 months	Access any time as needed	Nurse Physician Social worker	Online communication with patients and advice
A2	Hou et al. [31]	2020	Mobile-based	1) Evidence or knowledge about breast cancer 2) Exercise and rehabilitation after surgery 3) Diet and nutrition for breast cancer patients 4) Emotional support to prevent anxiety and depression 5) A personal health record for tracking treatment and side effects 6) Social resource information 7) Experience sharing 8) Expert consulting.	12 weeks	Access any time as needed	Nurse	None
A3	Kim et al. [32]	2018	Mobile-based	1) Education for preventing side effects of anticancer drugs 2) Support for the prevention of side effects of anticancer drugs 3) Encouragement of mood and activity	3 weeks	> 30 minutes a day, 3 times per week	Nurse	Interview every week via cell phone
A4	Lee et al. [33]	2014	Web-based	1) Assessment 2) Education (tailored information provision) 3) Action planning (goal setting, scheduling, keeping a diary) 4) Automatic feedback	12 weeks	Access any time as needed	Nurse	None
A5	Fu et al. [34]	2016	Mobile-based (avatar simulation videos)	1) Building self-care skills based on research-based, easily-integrated-into-daily routine self-care strategies to lessen lymphedema symptom burden 2) Symptom evaluation 3) Daily lymphatic exercises 4) Strategies for an optimal body mass index 5) Situational self-care strategies	12 weeks	Access any time as needed	NI	None
A6	Mohammadzadeh et al. [35]	2022	Mobile-based	1) Information acquisition 2) Lifestyle management 3) Psychological management 4) Symptom management 5) Change compatibility	9 weeks	Access any time as needed	NI	Question and answer via application

(Continued to the next page)

Table 2. Continued

No.	Study	Year	Technology	Program construct/contents	Duration	Session	Intervention manager	Involvement of intervention manager
A7	Park et al. [36]	2021	Mobile-based	1) Education and information module - Showing self-management techniques for menopause-related symptoms and health issues experienced by breast cancer patients with CIA 2) Communication module for coaching and providing psychosocial support - Included a self-help group and a community consisting of consultations with healthcare providers 3) Health diary for self-management	12 weeks	Access any time as needed	Healthcare providers (physicians, breast cancer center coordinators)	Regular weekly feedback by email
A8	Smith et al. [37]	2019	Web-based (online+self-paced videos+live classes)	1) Required activities - Attending one online introductory group meeting, - Viewing videos - Completing cognitive reframing and mind-body exercises 2) Curriculum teaches two major skill sets - Solution-focused thinking about stressors - Cognitive reframing 3) Mind-body exercises - Such as guided imagery and meditation	18 weeks	Access any time as needed	Masters (prepared and certified Pillar Guide)	Online group meeting
A9	Tawfik et al. [38]	2023	AI-based (chatbot)	1) Dialogue with a chatbot - Select from a list of commonly experienced chemotherapy-related side effects and the chatbot then provides a detailed answer	6 weeks	Access any time as needed	Nurse	None
A10	van den Berg et al. [39]	2015	Web-based	1) Cognitive-behavioral therapy and including information 2) Assignment 3) Assessment 4) Video	16 weeks	Access any time as needed	NI	None

AI, artificial intelligence; CIA, chemotherapy-induced amenorrhea; NI, no information.

**Table 3.** Comparison of the health-related outcomes of the included studies (N = 10)

Health-related outcomes	Categories	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	Total
Primary outcomes	Symptoms of pain					✓	✓		✓			3
	Symptom distress/side effect	✓		✓		✓				✓	✓	5
	Menopausal symptoms							✓				1
Secondary outcomes	Anxiety	✓		✓	✓							3
	Depression	✓		✓	✓				✓			4
	Fatigue				✓		✓		✓		✓	4
	Fear of cancer recurrence										✓	1
	Compliance to medication			✓								1
	Dietary quality				✓							1
	Self-efficacy	✓			✓			✓	✓		✓	5
	Quality of life		✓	✓	✓	✓	✓	✓				6

individuals with chronic diseases is on the rise, due to its accessibility and portability. This technology enables patients to self-monitor their symptoms at any time and place [36,42].

Five of the 10 studies included in this review focused on mobile-based interventions. Of these, four studies employed applications, with the exception of the study of Fu et al. [34], which incorporated avatar simulation videos. Mobile applications are viewed as highly suitable and effective tools for self-management. They offer the ability to monitor not only specific symptoms, but also physiological indicators and daily activities such as diet and exercise [43]. Consequently, mobile applications can be effectively used not only for tracking post-treatment symptoms in women with breast cancer, but also for promoting health. It is suggested that further studies be conducted to monitor daily activities like diet and exercise among women with breast cancer using mobile applications. This could serve as a method for promoting the health of women with breast cancer.

In the study of Tawfik et al. [38], which is the most recently published study among those included, an AI chatbot was used for a self-management intervention. The study found that ChemoFreebot, an AI technology, significantly impacted women's self-care behaviors and mitigated chemotherapy-related side effects [38]. AI chatbots are acknowledged as effective self-management tools, as they can minimize the need for face-to-face consultations and offer further evaluation and self-management advice based on the patient's response [44]. Considering research that suggests cancer patients require more personalized and tailored information [45], AI chatbots could be a valuable tool for enhancing self-management. While there is still some technical work to be done, AI chatbots hold promise as a health-care tool and signify a substantial technological advancement

[44]. Currently, this self-management program primarily employs web and mobile technologies, but it is progressing by integrating newly developed technologies. Therefore, it is recommended to further develop a self-management program using AI to demonstrate its effectiveness. Moreover, the effectiveness of AI-based interventions should be compared with web/mobile-based self-management programs to determine which technologies can most effectively deliver self-management programs.

The outcomes assessed by self-management programs for women with breast cancer can be categorized into physical symptoms and psychological factors associated with the disease. Physical symptoms, such as menopausal symptoms, fatigue, and pain, showed considerable variation across the studies included. Among the psychological factors, quality of life was the most frequently measured. However, the instruments used to gauge quality of life varied significantly across the studies [31,34,35], complicating the comparison of results. Despite this, the implementation of self-management programs has consistently demonstrated an improvement in quality of life. To strengthen the evidence of a program's effectiveness, future studies could employ the same instrument to evaluate quality of life or examine the sustainability of the effectiveness. Following quality of life, self-efficacy was the second most frequently measured factor. According to the trans-theoretical model, self-efficacy is a determinant that can instigate behavioral change and ultimately enhance quality of life [46]. This factor also serves as a crucial psychosocial resource for self-management programs to be effective for participants [37]. Therefore, self-efficacy is not only a factor that can be positively influenced by self-management programs, but it is also a key determinant for participants to maintain self-management and carry out positive changes.

Regarding the constructs of self-management programs, we found that despite variations in specific program structure and content across different studies, several elements were consistently present. These elements encompassed the provision of information via educational materials, symptom self-management, plan creation, and the provision of psychological support through communication. The integration of these constructs into self-management programs is intended to empower patients, enhance their knowledge and skills, improve symptom management, and foster overall well-being. It is noteworthy that the use of a health diary as a self-management tool effectively bolstered self-efficacy in self-management [30,33,36]. This health diary incorporated self-management strategies, goal-setting activities, and a self-report form [36]. Participants were encouraged to evaluate their daily execution of health-enhancing behaviors and record the extent of their implementation as part of their self-management process [30,33]. This, in turn, motivated them to refine their behaviors and adopt healthier lifestyle patterns [33]. The use of a health diary played a significant role in enhancing self-efficacy in self-management. Its purpose aligns with the objectives of self-management programs, which are to motivate patients to self-manage by enhancing their disease understanding, and to enable them to monitor their health changes and respond appropriately. Given that programs incorporating these elements effectively reduce symptoms and improve self-management, it may be beneficial to consider these elements when designing self-management programs.

Another interesting finding of this review is that the programs' structure incorporated a communication component, which enabled patients to share their experiences. In one study, patients had the opportunity to participate in online forum discussions, allowing them to anonymously exchange messages with other patients or use a blog platform. This feature provided patients with the reassurance that someone was available to address their concerns, thereby offering psychological support [34]. In a similar vein, another study included a community section where patients could share their thoughts and experiences [36], and senior survivors and healthcare professionals could distribute uplifting information [31]. Social support plays a pivotal role in the life of a cancer patient, potentially transforming their lives by bolstering their will to live [47]. Therefore, patient-to-patient communication within the self-management program could be a key factor in enhancing the program's effectiveness.

In some studies, intervention managers utilized a variety of strategies, such as being continuously available, conducting regular interviews, and providing consistent feedback throughout

their involvement in the program. However, many of the studies included did not involve the intervention manager at any stage in the program, instead allowing participants to navigate the program independently. The results indicated a significant positive impact on outcomes immediately following the intervention program [31,35]. Shi et al. [48] conducted a systematic review of mobile-based self-management programs for symptoms related to chemotherapy in breast cancer patients undergoing treatment and found that a self-management program without an intervention manager had a significantly positive effect. This aligns with our findings, suggesting that a well-structured self-management program can be effective for participants without the need for advice or feedback from an intervention manager. However, Harrington [49] argued that the "involvement of the intervention manager" is a crucial factor in enhancing participants' health-related outcomes in self-management programs. Support from healthcare providers is reported to be particularly necessary for application-based interventions. Therefore, further research is required to determine whether the effectiveness of the self-management program varies depending on the need for an intervention manager.

This study has several limitations. First, the outcomes varied across the studies, and the tools used were different. Therefore, caution should be taken in interpreting the results. Second, this review only included studies using quantitative measures; thus, important insights from qualitative research may have been missed. Third, many studies did not describe attrition rates or refusals, raising questions about selection bias.

This systematic review offers insights into the structure, measured outcomes, and effectiveness of technology-based self-management programs for women with breast cancer. The most commonly utilized technologies in these programs are web- and mobile-based; however, there has been a recent trend towards incorporating new technologies. No consistent trends in study outcomes were observed due to the significant variation across studies. Despite this, we identified several promising findings within individual studies, particularly the significance of self-efficacy and key components of self-management programs. It's also important to consider certain factors when designing a self-management program for women with breast cancer, such as the crucial role of communication and the potential inclusion of an intervention manager. Future research should continue to evaluate and confirm the effectiveness of technology-based self-management programs for women with breast cancer, with the aim of helping these women overcome their physical and psychological challenges and enhance their quality of life.

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## Authors' contributions

Conceptualization: All authors; Formal analysis: An HJ, Choi GE; Writing—original draft: An HJ, Choi GE; Writing—review & editing: All authors.

## Conflict of interest

Sook Jung Kang has been editorial board member of the *Korean Journal of Women Health Nursing* since January 2022. Also, she served as a guest editor for this special issue. She was not involved in the review process of this editorial. Otherwise, there was no conflict of interest.

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## Data availability

Please contact the corresponding author for data availability.

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## Appendix 1. Search Strategy

Database		Formula	Number of literatures
PubMed	S1	Advanced / All field / breast cancer Filters: Full text, Journal Article, English	418,433
	S2	Advanced / All field / (mobile) OR (m-health) OR (e-health) OR (web) OR (app*) OR (technology-based) OR (artificial intelligence) OR (AI) OR (chatbot) OR (telehealth) OR (mobile platform) OR (digital health*) Filters: Full text, Journal Article, English	1,575,991
	S3	Advanced / All field / (self-management) OR (self-help) OR (self-care) OR (self-guided) OR (self-administ*) Filters: Full text, Journal Article, English,	267,655
	S4	Advanced / All field / (program) OR (intervention) Filters: Full text, Journal Article, English	
	S5	S1 AND S2 AND S3 AND S4	501
CINAHL	S1	Advanced search, no field selected breast cancer Limiters: Full text Expanders: Apply equivalent subjects Narrowed by Language: English Search modes: Boolean/Phrase	32,088
	S2	Advanced search, no field selected "mobile" OR "m-health" OR "e-health" OR "web" OR app OR "technology-based" OR "artificial intelligence" OR "AI" OR "chatbot" OR "telehealth" OR "mobile platform" OR digital health Limiters: Full text Expanders: Apply equivalent subjects Narrowed by Language: English Search modes: Boolean/Phrase	76,117
	S3	Advanced search, no field selected "self-management" OR "self-help" OR "self-care" OR "self-guided" OR self-administ Limiters: Published Date: 2020.1-2021.3, Full text Expanders: Apply equivalent subjects Narrowed by Language: English Search modes: Boolean/Phrase	20,045
	S4	Advanced search, no field selected "program" OR "intervention" Limiters: Published Date: 2020.1-2021.3, Full text Expanders: Apply equivalent subjects Narrowed by Language: English Search modes: Boolean/Phrase	176,635
	S5	S1 AND S2 AND S3 AND S4	303
Cochrane Library	S1	Advanced search breast cancer Document type: journal article, Language: English	628
	S2	Advanced search (mobile OR (m-health) OR (e-health) OR (web) OR (app*) OR (technology-based) OR (artificial intelligence) OR (AI) OR (chatbot) OR (telehealth) OR (mobile platform) OR digital health*) Document type: journal article, Language: English	8,738
	S3	Advanced search ((self-management) OR (self-help) OR (self-care) OR (self-guided) OR self-administ) Document type: journal article, Language: English	1,165

(Continued to the next page)

## Appendix 1. Continued

Database		Formula	Number of literatures
Web of science	S4	Advanced search ((program) OR (intervention)) Document type: journal article, Language: English	9,088
	S5	S1 AND S2 AND S3 AND S4	10
	S1	Advanced search breast cancer Restrict results by languages and document types: English, journal article Publication Years: 2020–2021	653,564
	S2	Advanced search ((mobile) OR (m-health) OR (e-health) OR (web) OR app OR (technology-based) OR (artificial intelligence) OR (AI) OR (chatbot) OR (telehealth) OR (mobile platform) OR digital health) Document type: Article, Language: English	1,194,787
	S3	Advanced search ((self-management) OR (self-help) OR (self-care) OR (self-guided) OR self-administ) Document type: Article, Language: English	54,301
PsycINFO	S4	Advanced search ((program) OR (intervention)) Publication date: 2020–2021 Document type: Article, Language: English	6,207,431
	S5	S1 AND S2 AND S3 AND S4	743
	S1	Advanced search / Anywhere breast cancer Record type: Scholarly Journals Language: English	6,592
	S2	Advanced search / Anywhere ("mobile" OR "m-health" OR "e-health" OR "web" OR app OR "technology-based" OR "artificial intelligence" OR "AI" OR "chatbot" OR "telehealth" OR "mobile platform" OR digital health) Record type: Scholarly Journals Language: English	130,976
	S3	Advanced search / Anywhere ("self-management" OR "self-help" OR "self-care" OR "self-guided" OR self-administ) Record type: Scholarly Journals Language: English	36,583
RISS	S4	Advanced search / Anywhere ("program" OR "intervention") Record type: Scholarly Journals Language: English	519,343
	S5	S1 AND S2 AND S3 AND S4	115
	S1	Advanced search 유방암 구분: 국내학술논문 원문유무: 원문있음 Language: Korean	3,817
	S2	Advanced search 모바일 헬스   애플리케이션   서비스 디자인   웹기반   디지털 기술   기술기반   인공지능   모바일플랫폼 구분: 국내학술논문 원문유무: 원문있음 Language: Korean	83,343

(Continued to the next page)

## Appendix 1. Continued

Database		Formula	Number of literatures
	S3	Advanced search 증상관리   자기관리   맞춤형 구분: 국내학술논문 원문유무: 원문있음 Language: Korean	18,873
	S4	Advanced search 프로그램   중재 구분: 국내학술논문 원문유무: 원문있음 Language: Korean	218,599
	S5	S1 AND S2 AND S3 AND S4	4
DBpia	S1	유방암   모바일 헬스   애플리케이션   서비스 디자인   웹기반   디지털 기술   기술기반   인공지능   모바일 플랫폼 AND 증상관리   자기관리   맞춤형 AND 프로그램   중재 Journal Article	0

**Appendix 2.** Studies included in this review

- A1. Børøsund E, Cvancarova M, Moore SM, Ekstedt M, Ruland CM. Comparing effects in regular practice of e-communication and Web-based self-management support among breast cancer patients: preliminary results from a randomized controlled trial. *J Med Internet Res*. 2014;16(12):e295. <https://doi.org/10.2196/jmir.3348>
- A2. Hou IC, Lin HY, Shen SH, Chang KJ, Tai HC, Tsai AJ, et al. Quality of life of women after a first diagnosis of breast cancer using a self-management support mHealth app in Taiwan: randomized controlled trial. *JMIR Mhealth Uhealth*. 2020;8(3):e17084. <https://doi.org/10.2196/17084>
- A3. Kim HJ, Kim SM, Shin H, Jang JS, Kim YI, Han DH. A mobile game for patients with breast cancer for chemotherapy self-management and quality-of-life improvement: randomized controlled trial. *J Med Internet Res*. 2018;20(10):e273. <https://doi.org/10.2196/jmir.9559>
- A4. Lee MK, Yun YH, Park HA, Lee ES, Jung KH, Noh DY. A Web-based self-management exercise and diet intervention for breast cancer survivors: pilot randomized controlled trial. *Int J Nurs Stud*. 2014;51(12):1557-1567. <https://doi.org/10.1016/j.ijnurstu.2014.04.012>
- A5. Fu MR, Axelrod D, Guth AA, Rampertaap K, El-Shammaa N, Hiotis K, et al. mHealth self-care interventions: managing symptoms following breast cancer treatment. *Mhealth*. 2016;2:28. <https://doi.org/10.21037/mhealth.2016.07.03>
- A6. Mohammadzadeh Z, Eghtedar S, Ayatollahi H, Jebraeily M. Effectiveness of a self-management mobile app on the quality of life of women with breast cancer: a study in a developing country. *BMC Womens Health*. 2022;22(1):446. <https://doi.org/10.1186/s12905-022-02020-5>
- A7. Park JH, Jung YS, Kim JY, Bae SH. Mobile web-based self-management program for breast cancer patients with chemotherapy-induced amenorrhoea: a quasi-experimental study. *Nurs Open*. 2022;9(1):655-665. <https://doi.org/10.1002/nop2.1113>
- A8. Smith SK, MacDermott K, Amarasekara S, Pan W, Mayer D, Hockenberry M. Reimagine: a randomized controlled trial of an on-line, symptom self-management curriculum among breast cancer survivors. *Support Care Cancer*. 2019;27(5):1775-1781. <https://doi.org/10.1007/s00520-018-4431-7>
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- A10. van den Berg SW, Gielissen MF, Custers JA, van der Graaf WT, Ottevanger PB, Prins JB. BREATH: web-based self-management for psychological adjustment after primary breast cancer--results of a multicenter randomized controlled trial. *J Clin Oncol*. 2015;33(25):2763-2771. <https://doi.org/10.1200/JCO.2013.54.9386>

# Content and quality of YouTube regarding women's health: a scoping review

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**Purpose:** This scoping review investigated the content and quality of YouTube videos on women's health.

**Methods:** A literature search of the Cochrane Library, PubMed, Embase, CINAHL, ERIC, and RISS databases was performed using the keywords “(‘youtube’/exp OR youtube OR ‘social media’/exp OR ‘social media’ OR ((‘social’/exp OR social) AND (‘media’/exp OR media))) AND (‘female health care’ OR ((‘female’/exp OR female) AND (‘health’/exp OR health) AND (‘care’/exp OR care)))” from February 21 to 27, 2023. Peer-reviewed analytic studies in English or Korean that focused on women's health using YouTube were included.

**Results:** The review identified 21 articles that covered various themes related to women's health, such as breast cancer, urinary disease, sexual health, pelvic organ prolapse, the human papillomavirus vaccine, Papanicolaou smears, contraception, women's health information during the coronavirus disease 2019 pandemic, obstetric epidural anesthesia, and placenta accreta. However, the overall quality of the content was low, inaccurate, unreliable, and misleading.

**Conclusion:** This scoping review demonstrated that YouTube videos on women's health covered diverse topics, but the quality of the content needed improvement. More reliable and high-quality videos produced by academic institutes and healthcare professionals specializing in women's health are needed for social media to be usable as a reliable source of women's health information. The high number of views and shares received by the videos underscores the importance of providing accurate and reliable information on women's health.

**Keywords:** Information sources; Review; Social networking; Women's health

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## Introduction

Social media is a term that refers to websites and social network services that facilitate electronic communication and the exchange of information, ideas, and messages. Examples of social media platforms include YouTube, Twitter, Instagram, Facebook, and TikTok. Among these platforms, YouTube is a popular form of social media due to its ability to deliver information quickly and easily through video [1]. Since anyone can upload videos to

YouTube, it has high accessibility and widespread popularity. However, due to the open nature of this platform, there is a proliferation of fake news, and the accuracy and reliability of the information presented can often be low. During the coronavirus disease 2019 (COVID-19) pandemic, the need for health information increased, but social engagement declined, leading many people to prefer online resources such as YouTube over in-person advice from specialists [2]. Even after restrictions due to the pandemic have been lifted, and medical professionals can provide

## Summary statement

### • What is already known about this topic?

Social media videos on YouTube have several advantages, such as being visually appealing, easily accessible, widely popular, and containing various types of content. However, problems remain with accuracy, reliability, and trustworthiness.

### • What this paper adds

This study provides insights into the quality and impact of YouTube videos on women's health. Although the videos cover various health problems that affect women, the overall quality and reliability of the information presented in these videos were found to be low.

### • Implications for practice, education, and/or policy

Healthcare professionals should create a variety of reliable and high-quality YouTube videos that offer useful and informative interventions for women's health. This should involve a process of verifying the reliability and quality of the information contained in these videos.

health information in face-to-face settings, most people still search for information on YouTube and other sources on the internet, which can significantly impact their decisions [2,3].

YouTube has become a popular source of health information because it contains a vast amount of information, and YouTube videos can be produced quickly and are easy to share [4]. People often turn to YouTube for medical advice on disease diagnosis and treatment options, as well as for educational information on coping strategies as patients [5].

Women experience health problems and issues throughout their lives, regardless of their location or region. In both Eastern and Western cultures, women are often reluctant to disclose their health problems or seek treatment from obstetricians and gynecologists [6]. As a result, women with health problems may turn to YouTube to obtain health information. However, given that anyone can post information on YouTube, it is crucial to perform reliability appraisals of health information [5]. For this reason, we conducted a review of published papers to investigate the types of information related to women's health that YouTube viewers access and to evaluate the quality and reliability of the information presented.

A scoping review aims to identify the characteristics and objectives of a study by providing a preliminary assessment. One advantage of conducting a scoping review is that it offers an overview of the latest research, and the results can be rapidly integrated into policies [7]. A disadvantage, however, is that bias may occur because the quality appraisal of research, typically employed in systematic reviews, is not required [7]. To address this limitation, we incorporated quality appraisal into our study.

The objectives of conducting this scoping review were to examine YouTube-related papers concerning women's health, identify prevalent women's health-related themes, and evaluate the quality of the videos. Analyzing the themes and quality of women's health-related YouTube videos can offer evidence for their use as a women's health nursing intervention, as well as implications for women's health nursing practice and research. The overall goal of this study was to analyze the subjects and quality of women's health-related issues featured in YouTube videos. More specifically, this study aimed to examine the topics and content of YouTube videos, along with their effects and outcomes.

## Methods

### Study design

In this study, we carried out a scoping review of the literature to evaluate the content and quality of YouTube videos related to women's health. The thematic analysis phase followed the review methodology framework of Grant and Booth [7], as well as the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA ScR) reporting guideline, which outlines the assessment criteria for an evidence-based systematic review [8].

### Review process

The scoping review research process involved the following six steps: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarizing, and reporting the results [9].

### 1) Identifying the research question

The research question of this study was defined as “What is the quality and content of YouTube videos related to women’s health?”

### 2) Identifying relevant studies

The inclusion criteria for literature selection were as follows: (1) articles written in English or Korean; (2) articles from peer-reviewed journals; (3) content analysis papers focused on YouTube videos related to women’s health; and (4) descriptive, experimental, and analytical studies. The exclusion criteria were: (1) gray literature such as protocol studies, theses and dissertations for degrees, qualitative research, systematic reviews, working papers, preprints, conference presentations, reports, magazine articles, and letters; and (2) articles lacking full text. Detailed selection criteria were determined based on the research questions outlined in the participant, intervention, comparison outcome, setting, time-study design (PICOST-SD) framework [10].

*Participants:* Women

*Intervention:* Video regarding health care or health problems through YouTube

*Comparison:* Information not delivered through YouTube

*Outcome:* Quality, reliability, content, usefulness, accuracy, and effectiveness

*Setting:* Social media platforms including YouTube

*Time:* Cross-sectional, pre-, post-, pre-post-, or repeated-measures study

*Study design:* Descriptive, correlational, experimental or content analysis study

### 3) Study selection

Two researchers (JHK and HKK) independently performed the processes of literature search, extraction, quality assessment, and analysis. From February 21 to 27, 2023, they conducted a literature search using a total of six search engines, which included three core databases such as the Cochrane Library, PubMed, and Embase, and other databases such as Cumulative Index to Nursing and Allied Health Literature (CINAHL) Complete, Education Resources Information Center (ERIC), and Research Information Sharing System (RISS) [11]. The search utilized advanced search techniques, MeSH terms, Emtree (Elsevier’s authoritative life science thesaurus), natural language, synonyms, and Boolean operators. The following search terms were used in each search engine: in Cochrane Library, the search keyword used was “YouTube AND Health care in Title, Abstract, Keyword”; in PubMed, “YouTube\* AND Healthcare\*” was used; in Embase, “(‘youtube’/exp OR youtube OR ‘social media’/exp

OR ‘social media’ OR ((‘social’/exp OR social) AND (‘media’/exp OR media))) AND (‘female health care’ OR ((‘female’/exp OR female) AND (‘health’/exp OR health) AND (‘care’/exp OR care)))” was used; in CINAHL complete, “YouTube AND Health care AND Female” was used; in ERIC, “YouTube AND Female AND nursing health care” was used; and in RISS, “YouTube health” was used. In 2023, a search was conducted for peer-reviewed journal articles written in English or Korean that were fully accessible.

### 4) Charting the data

The search yielded a total of 36 articles published between 2019 and 2023 in Cochrane Library, 322 articles published between 2008 and 2023 in PubMed, 178 articles published between 2009 and 2023 in Embase, 16 articles published between 2012 and 2023 in CINAHL Complete, 99 articles published between 2004 and 2023 in ERIC, and 58 articles published between 2013 and 2022 from RISS. Of the 709 articles initially retrieved, 18 were excluded due to overlapping content: five articles were found in both the Cochrane Library and PubMed, 12 in both the Cochrane Library and Embase, and one in both PubMed and Embase. The titles and abstracts of the remaining articles were thoroughly screened, and those unrelated to women’s health using YouTube were eliminated. This process resulted in 21 articles, including two from the Cochrane Library, 16 from PubMed, none from Embase, two from CINAHL Complete, none from ERIC, and one from RISS. We also conducted a manual search through the reference lists of the articles and identified an additional four relevant articles. Two of these articles were included, bringing the total number of articles to 23. We read the full texts of all 23 articles and selected 21 articles for the final analysis, excluding one article that presented only a simple preference survey and another article that was related to nurses’ health but not to women’s health (Figure 1).

### 5) Collating, summarizing, and reporting the results

The researchers extracted data independently according to research objectives, produced case reports, and synthesized the data from 21 articles [12-32]. The extracted data items were as follows: first author, publication year, country, content, theme, study design, subjects, number of subjects, evaluators, outcomes, measurement scales, effects, and conclusion. In cases where the extracted data differed between the researchers, the content was harmonized through a meeting.

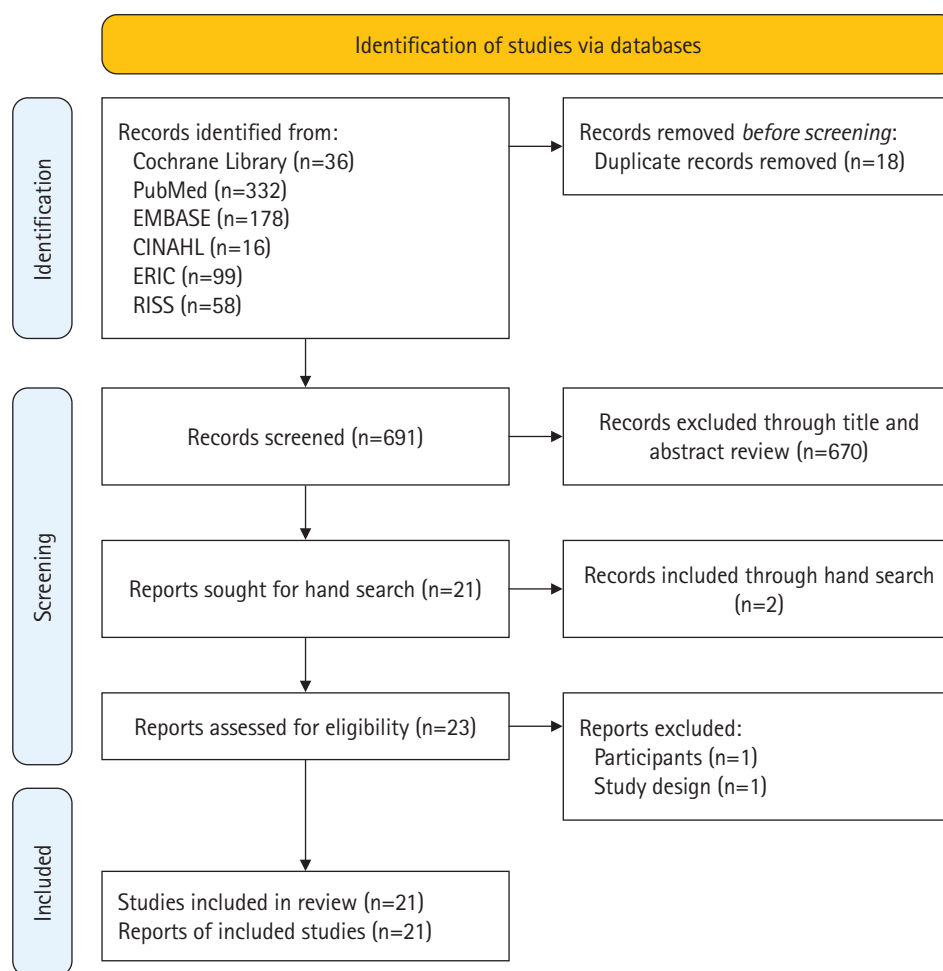


Figure 1. Flow diagram for the literature search.

## Results

### Themes and content of women's health-related YouTube videos

The articles [12-32] retrieved in this study were published between 2011 and 2023. Turkey had the highest number of publications with nine articles [16,18-23,26,32] followed by the United States with four [12,13,29,31], and Germany with two [25,28]. Additionally, there was one article each from Britain [17], Japan [14], South Korea [27], Saudi Arabia [15], Canada [24], and Italy [30]. The themes covered by the included studies comprised incontinence [12,20,23], breast cancer [18,19], and breast cancer examinations [24], arm exercise after breast cancer surgery [26], BRCA mutation test [29], pelvic organ prolapse [28], human papillomavirus (HPV) vaccines [13], Papanicolaou (Pap) smear tests [21], women's health information [14], female

physical examinations [15], contraception [17], pregnancy information during COVID-19 [16], postpartum sexuality [22], obstetric epidural anesthesia [25], placenta accreta [30], sexual education [27], female urethroplasty [32], and female urinary tract infection [31] (one study each). There were 17 content analyses [12,13,15-16,18-20,23-26,28-32], two randomized studies [14,17], and two quasi-experimental studies [22,27]. This study included 18 studies that analyzed English-language YouTube videos [12-15,17,19-26,28-32], as well as three studies [12,28,31] that also analyzed videos shared on other social media platforms, including TikTok, Facebook, Twitter, Instagram, and LinkedIn. Additionally, one study [16] analyzed YouTube videos in Turkish, and another [27] analyzed videos in Korean. The number of videos analyzed varied from 5 to 4,718, and the number of reviewers ranged from two to 11 (Table 1).

## The effects and outcomes of women's health-related YouTube videos

The outcome variables used in the included studies comprised content quality [12,18,19,21,23,25,26,30,31], accuracy [16,18,19,31,32], reliability or credibility [21,23,26,30-32], usefulness [15,24,28], view count [14,29], sharing count [14], video length [29], tone [13], source [13], clarity [16], actionability [20], satisfaction [17], acceptance [22], penetration [22], understandability [20], readability [28], education quality [30], sexual knowledge [27], sexual attitudes [27], and parent-child relationships [27]. The measurement tools included DISCERN (a set of quality criteria developed for written consumer health information) [18,19,21,23,26,30,31], self-developed tools [16,22,24,25,28], the Global Quality Score (GQS) [21,26,30,32], Journal of American Medical Association (JAMA) [19,23], view count [14,29], Female Urethroplasty-Specific Checklist Score (FUSCS) [32], National Cancer Development Association (NCDA) [16], medical information content index (MICI) [18], Patient Education Materials Assessment Tool (PEMAT) [20], Alexa score [28], sharing count [14], Video Power Index (VPI), sexual knowledge [27], sexual attitudes [27], parent-child relationships [27], credibility [31], usefulness [12], message tone [13], and source [13].

Informative content related to incontinence was found in 47% of videos on that topic, while commercial content was present in 40.0% [12]. Only 33.0% of videos about the HPV vaccine had a positive tone, whereas a higher percentage had a negative tone [13]. No statistically significant difference was found between the video allocation group and the viewing group in terms of view count and sharing count for women's health-related videos [14]. In addition, 34.5% of videos related to female physical examinations were found to be useful [15]. Among the videos related to Pap smears, 62.0% had false information. In the videos related to women's health during COVID-19 pandemic [21], only 4% of the information was accurate despite 40% of the content being clear [16]. There were no statistically significant differences in accuracy and satisfaction related to contraception between the YouTube and non-YouTube viewing groups [17]. Videos related to breast cancer had low average content quality scores of  $2.9 \pm 1.0$  and low accuracy of  $5.3 \pm 2.8$  [18]. Other studies also found that videos related to breast cancer had low average content quality scores of  $26.70 \pm 10.99$  and low accuracy scores of  $2.23 \pm 0.97$  [18]. Videos related to incontinence showed low understandability ( $57.9 \pm 19.8$ ) and low actionability ( $44.7 \pm 35.9$ ) [20]. Postpartum sexuality videos were deemed acceptable by 84% of healthcare professionals and 87% of patients [22]. Inconti-

nence-related videos had an average content quality score of  $38.2 \pm 11.5$  [23]. Only 4.3% of the respondents found videos related to breast cancer examinations to be very useful [24]. A significant portion of epidural anesthesia videos, ranging from 42% to 49%, were deemed inappropriate for not adhering to the aseptic technique [25]. Furthermore, 80% of the videos on arm exercise after breast cancer surgery were found to be useful, but 47.6% contained misleading information [26]. Sexual education videos led to a 36.67-point increase in sexual knowledge scores, and significant increases in scores for sexual attitudes ( $t = -6.66, p < .01$ ) and parent-child attachment ( $t = -4.40, p < .01$ ) were observed [27]. The videos related to pelvic organ prolapse were found to be useful by 73.3% of the respondents. However, the readability of the videos was rated slightly difficult (10.4 points) [28]. The videos related to BRCA mutation testing produced by healthcare professionals had a higher number of viewers, with 71 viewers compared to 29 for videos produced by consumers [29]. The quality of content for videos related to placenta accreta was found to be higher in those produced by professionals, with education quality rated at 82.6% and reliability at 26.2%, which were higher than for the videos produced by consumers [30]. Videos related to female urethroplasty produced by universities or hospitals had higher levels of reliability and accuracy compared to those produced by urologists [32]. In addition, the female urinary tract infection videos on YouTube had higher content quality and reliability, but more misleading information, than those on TikTok [31] (Table 2).

## Discussion

This scoping review is a significant contribution as it examined studies that analyzed YouTube videos related to women's health, identified their content and themes, and analyzed their effects and outcomes. With more people turning to social media platforms for health information, especially during and after the recent pandemic, this review is important because it used analytical studies to evaluate the accuracy, reliability, and quality of women's health information posted on YouTube [12-32]. The study highlights that videos on various themes related to women's health have been posted on YouTube, with breast cancer being the most prevalent and popular theme. There was a total of five studies [18,19,24,26,29] on videos related to breast cancer, including two [18,19] on breast cancer itself and one each on gene testing [29], cancer screening [24], and rehabilitation postoperation [26]. The second most prevalent theme was female urinary diseases, which were covered in three studies [12,20,23], includ-

**Table 1.** Content and themes of selected studies (N=21)

Study	Publication year	Country	Content and themes	Study design	Subjects	Number of subjects	Evaluators
Sajadi and Gold-man [12]	2011	United States	Urinary incontinence	Content analysis	YouTube, Facebook, and Twitter videos in English	30 YouTube 30 Facebook 30 Twitter	Several healthcare professionals
Briones et al. [13]	2012	United States	HPV vaccine	Content analysis	YouTube videos in English	172 out of 350 YouTube	Three coders
Kiriya et al. [14]	2018	Japan	Women's health information	Randomized controlled trial	YouTube videos in English	4718 out of 8353 YouTube	Three (obstetrics, gynecology, and midwife)
Abdulghani et al. [15]	2019	Saudi Arabia	Female physical examinations	Content analysis	YouTube videos in English	457 YouTube	Two authors
Gursoy and Peker [16]	2020	Turkey	Pregnancy information during COVID-19	Content analysis	YouTube videos in Turkish	42 out of 100 YouTube	Two gynecologists
Stephenson et al. [17]	2020	Britain	Contraception in young women	Randomized controlled trial	YouTube videos in English	Experimental : 464 Control : 463	11 authors
Yuksel and Cakmak [18]	2020	Turkey	Breast cancer	Content analysis	YouTube videos in Turkish	76 out of 133 YouTube	Two doctors
Yurdaisik [19]	2020	Turkey	Breast cancer	Content analysis	YouTube videos in English	50 YouTube	Two professors
Baran and Yilmaz Baran [20]	2021	Turkey	Urinary incontinence	Content analysis	YouTube videos in English	112 out of 150 YouTube	Two (urologist and gynecologist)
Parabhoi et al. [21]	2021	Turkey	Pap smear examinations	Content analysis	YouTube videos in English	200 YouTube	Two physicians
Rosen et al. [22]	2021	Turkey	Postpartum sexuality	Quasi-experimental design	YouTube videos in English	5 YouTube	Advisory team
Salman and Bayar [23]	2021	Turkey	Female incontinence	Content analysis	YouTube videos in English	40 out of 100 YouTube	Two urologists
Brar et al. [24]	2022	Canada	Breast cancer examination	Content analysis	YouTube videos in English	162 out of 200 YouTube	Two authors
Flinspach et al. [25]	2022	Germany	Obstetric epidural anesthesia	Content analysis	YouTube videos in English	16 out of 600 YouTube	11 healthcare professionals
Güloğlu et al. [26]	2022	Turkey	Arm exercises after breast cancer surgery	Content analysis	YouTube videos in English	172 out of 350 YouTube	Two (surgeon and physiotherapist)
Hong [27]	2022	South Korea	Sexual education	Quasi-experimental design	YouTube videos in Korean	9 parent-child pairs	One author
Hüsch et al. [28]	2022	Germany	Pelvic organ prolapse	Content analysis	YouTube, Google, Facebook, LinkedIn, and Instagram videos in English	30 YouTube	Seven authors
Laforet et al. [29]	2022	United States	BRCA mutation test	Content analysis	YouTube videos in English	100 YouTube	Four authors
Collà et al. [30]	2022	Italy	Placenta accreta	Content analysis	YouTube videos in English	39 out of 64 YouTube	Two investigators
Tam et al. [31]	2022	United States	Female urinary tract infections	Content analysis	YouTube and TikTok videos in English	50 YouTube 50 TikTok	Three urologists
Sahin et al. [32]	2023	Turkey	Female urethroplasty	Content analysis	YouTube videos in English	47 out of 38 YouTube	Two urologists

HPV: human papillomavirus; COVID-19: coronavirus disease 2019.

**Table 2.** Outcomes and effects of selected studies (N=21)

Study	Outcomes	Measurement scales	Effects	Conclusions
Sajadi and Goldman [12]	Content quality	Usefulness	Information: 47.0% Commercial: 40.0%	Insufficient useful content
Briones et al. [13]	Source Tone	Type of source Tone of message	News: 36.1% Positive tone: 33.0%	The majority of videos had a negative tone and were disapproving regarding the HPV vaccine
Kiriya et al. [14]	Shares Views	Share count View count	Shares: 0.9%/1.1%, $p = .53$ Views: 5.1%/5.3%, $p = .44$	Not effective
Abdulghani et al. [15]	Usefulness	Accuracy of knowledge and demonstration	Highly useful: 34.5% Useful: 47.7%	Various uses for medical education
Gursoy and Peker [16]	Content quality Reliability	DISCERN GQS	Useful: 37.9% Misleading: 62.0%	Misleading information
Stephenson et al. [17]	Clarity Accuracy	Developed scale NCDA	Clarity: 40.0% Accuracy: 3.0%	Low-quality and unreliable information
Yuksel and Cakmak [18]	Effectiveness Satisfaction	Contraception effectiveness Satisfaction	OR, 0.87; 95% CI, 0.60–1.27 OR, 0.93; 95% CI, 0.69–1.25	No statistically significant difference between the two groups
Yurdaisik [19]	Content quality Accuracy	DISCERN MICI	$2.9 \pm 1.0$ (1–5) <sup>†</sup> $5.3 \pm 2.8$ (1–5) <sup>†</sup>	Low-quality and untrustworthy
Baran and Yilmaz Baran [20]	Content quality Accuracy	DISCERN JAMA	$26.70 \pm 10.99$ (15–75) <sup>†</sup> $2.23 \pm 0.97$ (0–4) <sup>†</sup>	Poor overall quality
Parabhoi et al. [21]	Understandability Actionability	PEMAT VPI	$57.9\% \pm 19.8\%$ $44.7 \pm 35.9$ (0–100) <sup>†</sup>	Not understandable and actionable for users
Rosen et al. [22]	Acceptance Penetration	Developed scale	Healthcare providers: 84% Patients: 87%	Acceptable and effective to disseminate evidence
Salman and Bayar [23]	Content quality Reliability	DISCERN JAMA	$38.2 \pm 11.5$ (15–75) <sup>†</sup> $1.4 \pm 0.6$ (0–4) <sup>†</sup>	Average level of quality
Brar et al. [24]	Usefulness	Developed scale	Very useful: 4.3% Moderate: 17.9% Somewhat: 39.5% Not useful: 38.3%	Necessary to create reliable and useful YouTube videos
Flinspach et al. [25]	Content quality	Developed scale	Aseptic technique followed: 42%–49%	Unsuitable for self-study due to serious errors
Güloğlu et al. [26]	Content quality Reliability	DISCERN GQS	Useful: 80.0% Misleading: 47.6%	Important to protect patients from musculoskeletal system complications
Hong [27]	Sexual knowledge Sexual attitudes Parent-child relation	Sexual knowledge Sexual attitudes Parent-child relationship	Increase of 36.67 points $t = -6.66$ , $p < .01$ $t = -4.40$ , $p < .01$	Effective for improving sexual perception and parent-child relationship
Hüsch et al. [28]	Usefulness Readability	Developed scale Alexa score	Useful: 73.3% Readability: 10.4	Valuable content but fairly difficult to read
Laforet et al. [29]	View Length	View count Length (minute)	Professionals: 71, Consumers: 29 Professionals: 7.6, Consumers: 7.3	Professional YouTube is positive
Collà et al. [30]	Content quality Education quality	DISCERN PEMAT	Professionals: 3, Consumers: 2 Professionals: 82.6%, Consumers: 66.7%	Overall content quality is low
Tam et al. [31]	Reliability Accuracy	GQS FUSCS	Professionals: 26.2%, Consumers: 9.1% Academic: 4, Urologist: 3 Academic: 36.8%, Urologist: 63.2%	Academic videos have more adequate quality and content
Sahin et al. [32]	Content quality Credibility Accuracy	DISCERN Credibility Misinformation	YouTube: 5, TikTok: 3, $p < .001$ YouTube: 5, TikTok: 2, $p < .001$ YouTube: 5, TikTok: 3, $p = .003$	YouTube is a valuable source

HPV: human papillomavirus; DISCERN: quality criteria for consumer health information; GQS: Global Quality Score; NCDA: National Cancer Development Association; OR: odds ratio; CI: confidence interval; MICI: medical information content index; JAMA: Journal of the American Medical Association; PEMAT: Patient Education Material Assessment Tool; VPI: Video Power Index; FUSCS: Female Urethroplasty-Specific Checklist Score.

<sup>†</sup>Possible range.

ing one on urethroplasty [32] and one on urinary tract infection [31]. The third most prevalent theme was sex-related, with two studies [22,27]: one on postpartum sexuality [22] and the other on sex education for girls in upper elementary grades [27]. This study sheds light on the wide range of women's health topics that are covered on YouTube, indicating significant public interest in these areas. However, the analyses suggest that gynecology diseases are the most frequently discussed topics, with a heavy focus on breast cancer and urinary disorders, while obstetrics-related videos tend to only cover epidural anesthesia [25] and placenta accreta [30]. Thus, this study highlights the need for women's healthcare professionals to create more gynecology and obstetrics-related videos, which should undergo rigorous analysis and cover a broader range of themes related to women's health.

The study synthesized the results of previous studies to analyze the effects and outcomes of YouTube videos related to women's health. The overall quality of YouTube content was low, with low ratings for usefulness, accuracy, and reliability. The study also revealed that videos produced by healthcare professionals were generally of higher quality and contained less fake information than those produced by consumers [23]. Videos produced by academic institutions were also found to have higher quality of content, reliability, and accuracy [32]. Although there has been a strong demand for healthcare information since the COVID-19 pandemic, large amounts of unverified information have spread via the internet, and non-professional videos have potentially had adverse effects. Of the various resources on the internet, those with the most reliable and high-quality information are from research centers and professional societies [33]. Therefore, this study emphasizes the importance of healthcare professionals producing and validating videos, with institutions being preferred producers [32]. Compared to other social media platforms, such as TikTok, Facebook, and Instagram, YouTube was found to have higher quality and reliability of content, indicating that it can be an effective tool for disseminating information related to women's health [28], as long as accurate information is provided.

Although the quality of YouTube content related to women's health was generally low [12,18,19,21,25,30] and average level of quality [23], this study found some positive outcomes in the quality of video content. According to the DISCERN total score system, content quality was classified as excellent (63–75), good (51–62), average (39–50), poor (28–38), and very poor (<28). In a systematic review of web-based resources related to complementary and alternative therapy, the DISCERN score averaged

56.13 (standard deviation, 10.25) out of 75 points [34], which was higher than the results of this study. For instance, arm and shoulder exercises after breast cancer surgery posted on YouTube were found to be useful in 80% of cases and considered to be valuable educational tools for preventing musculoskeletal complications due to their high quality and reliability [26]. These findings suggest that YouTube videos can be a helpful tool for providing direct visual assistance and practical guidance, rather than just general knowledge about diseases and conditions. The COVID-19 pandemic has increased the demand for information on pregnancy [16], but the reliability of YouTube videos related to this topic was found to be low. This emphasizes the need for more reliable YouTube videos, especially for vulnerable populations such as pregnant women who may have difficulties obtaining information through face-to-face education during the pandemic [35].

Most YouTube videos related to women's health focus on changing knowledge rather than skills or attitudes [12–32]. However, in videos that aim to teach techniques, the rate of adherence to aseptic technique was low, ranging from 42% to 47% [25]. The reliability of the procedure was also found to be low, highlighting the need for accurate and reliable videos produced by healthcare professionals. In a study on postpartum sexuality, the experimental group that watched a YouTube video showed a more positive attitude toward sex and felt more comfortable discussing it than the control group that did not watch the video [22]. While most videos have educational purposes to improve knowledge and skills, changing people's attitudes can also be a useful intervention technique on YouTube. For example, videos with a negative tone about HPV vaccination tend to receive more "likes," suggesting that viewers may be more drawn to negative aspects of a topic rather than positive ones [13]. Therefore, it is important for both consumers and researchers to be aware of the socio-cultural prevalence of fake news and misleading information on women's health issues that lack scientific evidence [22].

This study has several limitations. First, there may be themes and effects related to YouTube videos on women's health that have not been identified since the analyses were conducted indirectly through studies that reviewed these videos. Furthermore, due to the constantly changing nature of YouTube, the results may not accurately reflect the current reality of women's health-related videos on the platform. Second, only videos produced in English, Korean, and Turkish were included in the analysis, so videos made in other languages were not represented. Third, content analytical and experimental studies were analyzed

together, which could lead to problems with comparability.

Nonetheless, this study underscores the importance of producing more high-quality videos on a wider range of topics related to women's health, utilizing the benefits of prevalence and accessibility offered by YouTube. To ensure the reliability and quality of content, it is recommended that videos be produced by healthcare professionals and that institutions, rather than individuals. Even after the pandemic, YouTube videos are expected to continue to be an important educational resource, as they have become a critical source of information about women's health in a non-face-to-face society.

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## Authors' contributions

All work was done by Kim JH and Kim HK.

## Conflict of interest

Hyun Kyoung Kim has been the associate editor of the *Korean Journal of Women Health Nursing* since 2022. She was not involved in the review process of this study. Otherwise, there was no conflict of interest.

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## Data availability

Please contact the corresponding author for data availability.

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# Quality evaluation of pregnancy-related mobile applications in South Korea: a descriptive study

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**Purpose:** This study aimed to describe the characteristics of mobile applications (apps) related to pregnancy in South Korea and evaluate their quality.

**Methods:** We conducted a systematic search for pregnancy-related apps available in Korea in two app stores as of April 29, 2022. The quality of apps was assessed using the Korean translation of the Mobile Application Rating Scale for objective quality with four subdomains (engagement, function, aesthetics, and information) and four items for subjective quality.

**Results:** In total, 163 apps were selected and reviewed. Both the objective and subjective quality of the apps were found to be desirable, with scores exceeding 3 out of 5 (range, 34–82). All subdomain scores in the objective quality assessment were also desirable. Among the four objective quality subdomains, aesthetics received the highest scores, followed by information, function, and engagement. In terms of subjective quality, the scores for a comprehensive overall evaluation, continuous use, and recommendation exceeded 3 out of 5, with the exception of payment. Only a small number of apps ( $n=4$ , 2.9%) were backed by a reliable authority, such as an expert review. Significant differences were observed in the objective quality of apps across different content categories ( $F=3.86$ ,  $p=.003$ ).

**Conclusion:** Most pregnancy-related apps had desirable levels of objective and subjective quality. However, app content experts seldom provide reviews. It is crucial for nurses to recommend apps to expectant mothers that offer dependable content, regularly updated with the latest information.

**Keywords:** Mobile applications; Pregnancy; Program evaluation; Quality improvement

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## Introduction

The growing demand for health information has been accompanied by an increasing trend of exploring health-related information using internet searches and mobile applications (apps) [1]. People in their 20s and 30s, who are typically familiar with electronic devices, frequently download and use apps related to health or exercise. Interestingly, men have been found to use exercise apps more frequently than women [2]. With the widespread use of smartphones, access to apps is increasing across all age groups. Notably, 60% of active seniors in their 50s are proac-

tive smartphone users [3]. Apps are now more popular for obtaining health-related information than traditional visits to medical institutions [4]. In Italy, women were found to be more engaged in e-health than men, and younger people demonstrated higher access to and usage of e-health apps [5]. A study revealed that mobile app-based health promotion programs provided individual feedback on health status and monitored health/behavioral changes using apps that focused on diet, physical activity, and a healthy lifestyle. The study also found that app users exhibited better health outcomes than nonusers [6].

Women experiencing pregnancy and childbirth are increasing-

## Summary statement

### • What is already known about this topic?

Many pregnancy-related applications (apps) are available to the general public, but it is difficult to find apps recommended through a systematic quality evaluation process.

### • What this paper adds

Most pregnancy-related apps currently available in Korea were found to be of desirable objective and subjective quality. Expert supervision and up-to-date app content seem to be lacking.

### • Implications for practice, education, and/or policy

Nurses should help pregnant women choose high-quality pregnancy apps that are up-to-date and offer expert reviews.

ly moving away from traditional sources of information such as physicians, nurses, family, and friends. Instead, they are turning to e-health platforms like the internet and mobile apps for advice on physical activity and pregnancy [7]. Many pregnant women express a desire for healthcare providers to recommend reliable internet sites for obtaining pregnancy-related information [8]. A prior study revealed that 96% of American women aged between 18 and 49 use smartphones. These devices provide easy access to apps at any time and place and have been shown to positively influence physical activity behaviors, demonstrating the benefits of smartphone apps [9]. For American women navigating pregnancy, childbirth, and the postpartum period, apps have become a widely used resource and communication channel. They offer information on managing health during pregnancy, caring for infants and children, and parenting [10]. Most pregnancy and childbirth-related apps fall under the categories of health/fitness, medical care, or education. Their functions typically include information provision, education, tips or advice, pregnancy tracking and monitoring, meditation, and goal achievement [11]. Pregnancy-related mobile health apps can motivate individuals to adopt lifestyle changes that promote optimal health during pregnancy. They provide necessary information and support decision-making [7]. Furthermore, these apps serve as a conduit for accurate information and behaviors related to caring for their children. This includes raising awareness among pregnant women about reduced fetal movement, weight monitoring, and breastfeeding [12]. The most common reasons for seeking pregnancy-related information on the internet include the need to enhance knowledge about pregnancy, insufficient information from healthcare providers [13], anonymity, rapid search capabilities, and the convenience of access at any time and place [14].

The proliferation of health information through mass media

and the internet has led to an increase in concerns about the credibility and accuracy of the information provided. Pregnant women who rely on internet-sourced information often perceive the quality of the information they find as good or very good. The majority find it useful, with over 50% reporting a significant influence on their decision-making processes [15]. However, there is a high risk of exposure to unverified information due to a lack of proper scrutiny regarding the quality and reliability of the information. This can lead to unnecessary worry or misinformation [7], especially when the information is not discussed with healthcare providers [16]. It is important to exercise caution as inaccurate information disseminated through apps can potentially harm pregnant women and their fetuses [17]. The responsibility for the accuracy of the content in pregnancy and childbirth apps lies with the developers. Currently, there are no regulations addressing inappropriate information or uncertain evidence, and the guidelines for app development are significantly lacking in medical-related industrial regulatory criteria [18]. Recent studies assessing apps have highlighted that many health apps are rarely reviewed or approved by healthcare providers, nor do they have peer review systems in place to ensure the content and quality of information [18,19]. Moreover, while the benefits of apps that support decision-making during pregnancy are emphasized, it has been noted that there is a lack of rigorous assessments of content quality [11]. An evaluation of 10 pregnancy and childbirth-related apps in Australia found them to be highly useful in providing health information and education, monitoring various health-related behaviors, and offering advice, tips, and strategies. Furthermore, a 2-year follow-up evaluation of updates and content changes showed an increase in quality assessment scores, indicating an improvement in the quality of the apps [13].

Previous research examining the features of pregnancy and

childbirth apps available in app stores, as well as their quality, has been conducted in the United States, Spain, and Australia [1,10-12]. The most frequently addressed topics were “weight gain,” “nutrition,” “fetal development,” “physical activity,” and “changes during pregnancy,” with the primary usage being self-monitoring or goal setting [1,11]. Past studies have shown that app usage can effectively enhance health behaviors such as improving knowledge, promoting physical activity, and encouraging a healthy diet among pregnant women. One study underscored the positive influence of apps on behavioral changes, citing an app designed to promote weight gain and increased consumption of fruits and vegetables during pregnancy, which had beneficial effects on childbirth outcomes [12]. The majority of previous studies evaluating apps were systematic reviews [1,11-13] of studies that implemented interventions using existing or newly developed apps, based on their intended purpose, and confirmed their effectiveness. Despite the growing number of health apps related to pregnancy and childbirth in South Korea’s mobile app market, most apps are used without any verification of their effectiveness [20].

In South Korea, research has been conducted on the quality assessment of apps designed for patients with hypertension or diabetes mellitus. However, it is challenging to find studies that explore the features of pregnancy/childbirth-related apps or evaluate their quality using standardized tools. Consequently, this study sought to identify pregnancy/childbirth-related apps through a systematic search in the South Korean app market, examine their characteristics, and evaluate their quality from both subjective and objective perspectives. This study aims to provide a foundation for selecting apps that offer accurate and appropriate information for expectant mothers.

The aim of this study was to explore the features of mobile apps pertaining to pregnancy or childbirth that are available in South Korea, and to evaluate their quality.

## Methods

**Ethics statement:** This study was exempted by the Institutional Review Board of Chungnam National University as it evaluated the quality of mobile apps currently in use.

### Study design

This descriptive study was conducted to assess the quality of apps related to pregnancy or childbirth.

### Study sample

The study sample consisted of pregnancy and childbirth-related

apps found in the mobile app markets of iTunes and Google Play Store in South Korea. The apps selected for this study were those that were free, contained content related to pregnancy or childbirth and were available in the Korean language. In cases where an app was listed in both app stores under the same name, only one was chosen for the study. Apps were excluded from the study if they could not be downloaded due to technical issues, required payment, lacked pregnancy or childbirth-related content, were classified as games or entertainment without any educational or health-related purpose, were not relevant to pregnancy or childbirth, were solely designed to track menstruation and ovulation, or included in-app purchases such as games, shopping features, or ad-supported community apps.

From April 15 to April 29, 2022, the keywords “pregnancy” and “childbirth” were used to search the android app store (Google Play Store) and the iOS (iTunes). This search yielded names, categories, and descriptions, along with photos of various apps. In total, 201 apps were found in the android app store and 175 in the iOS store. Of these, 18 were paid apps, with 10 found in the android store and eight in the iOS store. Additionally, 52 apps were unrelated to the topic, with 49 in the android store and three in the iOS store. Furthermore, 16 apps were not available in Korean, with 14 in the android store and two in the iOS store. After applying selective criteria, a total of 290 apps (128 from the android store and 162 from the iOS store) were chosen for the initial analysis. There were 27 apps that appeared in both app stores. Given the prevalence of the android system in South Korea, these 27 duplicated apps were included in the android app store list, and their counterparts in the iOS were removed.

In the second phase of analysis, 263 apps were selected for review: 128 from the android store and 135 from the iOS store. Each app was individually examined to determine if it met the exclusion criteria. Fourteen malfunctioning apps were excluded, three from the android store and 11 from the iOS store. Additionally, 86 apps with irrelevant content were also excluded: 38 from the android store and 48 from the iOS store. Consequently, the final analysis included a total of 163 apps: 87 from the android store and 76 from the iOS store (Figure 1).

### Instruments

#### *Quality of mobile applications*

The Mobile Application Rating Scale (MARS), developed by Stoyanov et al. [20] and subsequently translated into Korean, was utilized to measure the quality of mobile apps. The strength of MARS lies in its multidimensional approach to app assessment and the fact that it was designed based on a comprehensive

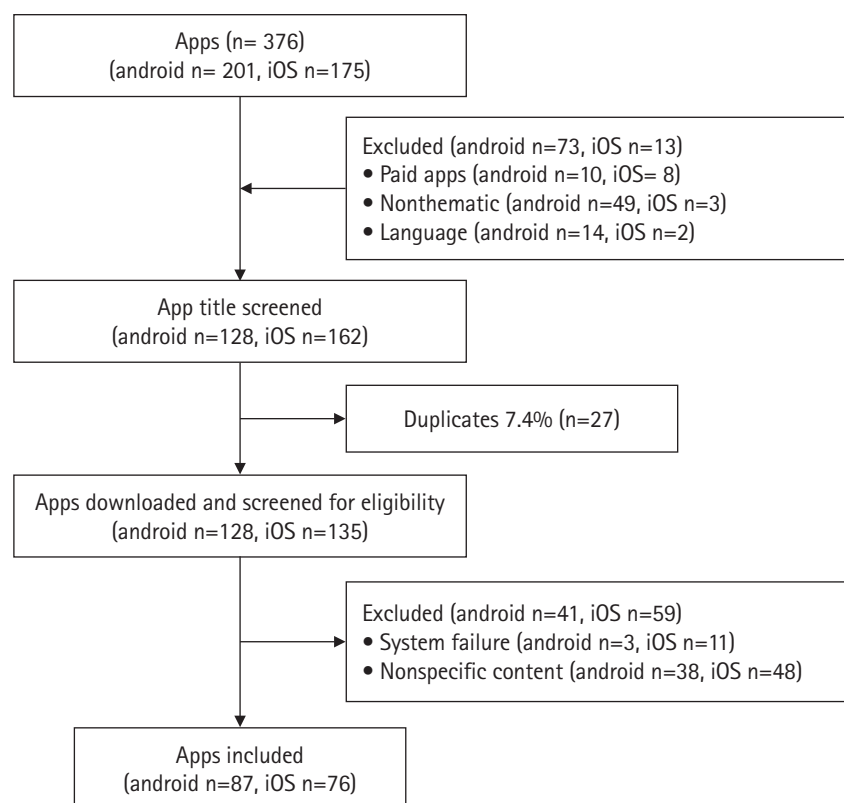


Figure 1. Flow sheet for the application (app) selection process.

review of the literature [21]. MARS is divided into two sections: a basic section, which evaluates the fundamental characteristics of apps (including app classification and quality ratings) and an app-specific section, which examines additional aspects related to the impact of apps on users' health behaviors.

The section on app classification encompasses focus, theoretical background/strategies, age group, and technical aspects of the app. However, this study only scrutinized focus, which is composed of 12 items that an app targets (increase happiness/well-being, mindfulness/meditation/relaxation, reduce negative emotions, depression, anxiety/stress, anger, behavior change, alcohol/substance use, goal setting, entertainment, relationships, physical health, and others).

The section on app quality ratings comprised a total of 23 items. These were divided into an objective assessment across four dimensions (engagement, functionality, aesthetics, and information) and a subjective assessment. The engagement dimension included five items: entertainment, interest, customization, interactivity, and target group. The functionality dimension was made up of four items: performance (accuracy and speed), ease of use, navigation, and gestural design. The aesthetics dimension,

with three items, covered layout, graphics, and visual appeal. The information dimension, the largest with seven items, evaluated the accuracy of the app description, goals, quality and quantity of information, visual information, credibility, and evidence base. Each item was rated on a 5-point scale, ranging from inappropriate (1 point) to very good (5 points), or from strongly disagree (1 point) to strongly agree (5 points). The overall quality assessment score, which ranged from 4 to 20 points, was calculated by adding up the mean scores of the four dimensions (each ranging from 1 to 5 points). Higher scores in each dimension of the objective assessment section indicated better app quality. In this study, item number 19 in the information dimension ("Has the app been trialed/tested; must be verified by evidence in published scientific literature?") was excluded from the score calculation. This was due to the lack of available information in the apps included in this study that could be used to assess this item. The subjective assessment included four items (recommendation, intention to continue use, intention to purchase, and overall assessment) to gauge satisfaction with the app. While the intention to purchase was scored at 1, 3, and 5 points, the other three items were scored on a 5-point scale (1 to 5 points). The mean of the

four item scores (ranging from 1 to 5 points) was then calculated. A higher score in the subjective assessment indicated greater satisfaction with the app. MARS demonstrated high internal consistency ( $\alpha = .90$ ) and interrater reliability of  $r = .79$  [21]. Following the precedent set by a previous study [20], which established a midpoint of 3 points on a 5-point scale (1 to 5 points) as a criterion, scores greater than 3.0 were assessed as desirable. This criterion was also applied in the current study. The app-specific section categorized the purpose of app use into six categories (awareness, knowledge, attitudes, intention to change, help seeking, and behavior change).

While the original creators of MARS did not stipulate the number of raters needed, it is crucial that if multiple raters are involved, they should have a comprehensive understanding of the MARS items and their relevance to the app themes [21]. In this study, we followed the procedure for ensuring interrater reliability [22]. Two researchers specializing in women's health nursing used all the apps for a minimum of 2 weeks and independently evaluated them using the assessment tool. Subsequently, the assessment results from the two raters were compared. In cases where the assessment scores differed, a consensus was reached through the presentation of evidence and discussion of validity. This study ensured reliability with interrater reliability scores of  $r = .71$  and  $r = .72$  for the apps in the android and iOS stores, respectively.

#### *Mobile application characteristics*

The characteristics of the apps included the app stores selling them, the category suggested by the developer based on the content, the oversight of the authority, and the update frequency (less than 6 months, 6 months to less than 1 year, and 1 year or longer). Nine categories were discerned by examining the details registered by the developer in the app stores. However, the categories registered by the developer were not specifically categorized, and there were instances of duplication or ambiguity due to the developer's arbitrary classification. As a result, the researchers of this study restructured and categorized them into "health/exercise," "childbirth/parenting," "role-playing/simulation," "lifestyle/social networking," "family," and "information" based on the app content. During this recategorization, the "medical care" category was frequently identified in the app stores. However, the "childbirth/parenting" category was distinctly categorized in the android app store, providing android users with more specific pregnancy-related categories than the iOS. Conversely, the categorization was not as clear in the iOS, as apps related to pregnancy/childbirth were grouped under the

"medical care" category. While the "childbirth/parenting" category included the "information" dimension, apps that contained records and behavioral changes related to childbirth and parenting were classified under the childbirth/parenting category. In contrast, the "information" category included apps that simply provided newsletters or support programs for pregnant women.

#### **Data collection and data analysis**

The research team examined the features of the apps chosen for this study through a questionnaire. The quality of these apps was independently evaluated by two raters using a mobile app quality assessment tool. The scores from each rater were compared, and if a discrepancy of 3 points or more was found, the raters discussed their findings and reached a consensus on the final score. The data were analyzed using SPSS for Windows (ver. 26; IBM Corp., Armonk, NY, USA). A frequency analysis was performed on the app characteristic variables, and descriptive statistics were used for the total score and each dimension score of the app quality ratings. To compare quality assessment scores by category, additional tests such as the t-test, one-way analysis of variance, and *post hoc* test (when necessary) were conducted.

## **Results**

#### **Characteristics of apps related to pregnancy and childbirth**

Out of 163 apps related to "pregnancy" and "childbirth," 60 were exclusively registered on the android app store, while 76 were only available on the iOS. Additionally, 27 apps were registered on both platforms. For the purpose of this study, apps that were duplicated across both platforms were included in the android app store's list. The most common category was health/exercise ( $n = 92$ , 56.4%), followed by childbirth/parenting ( $n = 31$ , 19.0%), role-playing/simulation ( $n = 23$ , 14.1%), lifestyle/social networking ( $n = 9$ , 5.5%), family ( $n = 6$ , 3.6%), and information ( $n = 2$ , 1.4%).

Only four apps (2.9%) had been reviewed by credible authorities. Of the 87 android apps, three stated that they had consulted with experts from the Korean Society of Ultrasound in Obstetrics and Gynecology and the Korean Pediatric Society. Among the 76 iOS apps, one claimed to have received advice from a yoga expert. As of July 31, 2022, the average update cycle was 367.6 days, with 66.8% of apps being updated within a year. More apps did not offer in-app purchases ( $n = 92$ , 56.5%) compared to those that did ( $n = 71$ , 43.5%) (Table 1).

#### **Quality assessment of pregnancy-related mobile apps**

In the categorization of apps by 12 focus areas, three areas (anxi-

**Table 1.** Characteristics of the pregnancy-related mobile applications (app) (N=163)

Characteristics	Categories	n (%)
Operating system	Android	87 (53.3)
	iOS	76 (46.7)
Categories	Health/exercise	92 (56.4)
	Childbirth/parenting	31 (19.0)
	Role-playing/simulation	23 (14.1)
	Lifestyle/Social networking	9 (5.5)
	Family	6 (3.6)
	Information	2 (1.4)
Reliable authority	Yes	4 (2.5)
	No	159 (97.5)
Update cycle	< 6 months	82 (50.3)
	6 months to 1 year	9 (5.6)
	> 1 year	72 (44.1)
In-app purchases	Yes	71 (43.5)
	No	92 (56.5)

ety/stress, anger, and alcohol/substance use) had no corresponding apps. Of the remaining nine focus areas, the most prevalent category was enhancing happiness/well-being, with 54 apps accounting for 33.1% of the total. This was followed by action/change ( $n = 34$ , 20.8%), game ( $n = 19$ , 11.6%), goal setting ( $n = 19$ , 11.6%), relationships ( $n = 14$ , 8.5%), physical health ( $n = 13$ , 7.9%), mindfulness/meditation/relaxation ( $n = 5$ , 3.0%), reducing negative emotions ( $n = 3$ , 1.8%), and depression ( $n = 2$ , 1.7%) (Table 2).

The mean score for the objective quality assessment was  $3.74 \pm 0.45$ . The subdomain with the highest mean score was aesthetics, scoring  $3.90 \pm 0.52$ . This was followed by information ( $3.81 \pm 0.53$ ), functionality ( $3.79 \pm 0.75$ ), and engagement ( $3.46 \pm 2.38$ ). All these scores exceeded the benchmark score of 3.0 out of 5.0, indicating that both the overall objective quality and the quality of each dimension were satisfactory. The mean score for the subjective quality assessment was  $3.35 \pm 0.62$ . The highest mean score was for the intention to purchase, which was  $3.56 \pm 0.98$ . This was followed by the intention for continuous use ( $3.52 \pm 0.68$ ) and recommendation ( $3.35 \pm 0.62$ ).

**Table 2.** Quality evaluation of pregnancy-related mobile applications (apps) (N=163)

Characteristics	Categories	n (%) or mean $\pm$ SD	Item mean $\pm$ SD
Focus	Increasing happiness/well-being	54 (33.1)	
	Action/change	34 (20.8)	
	Game	19 (11.6)	
	Goal setting	19 (11.6)	
	Relationship	14 (8.5)	
	Physical health	13 (7.9)	
	Mindfulness/meditation/relaxation	5 (3.0)	
	Reducing negative emotions	3 (1.8)	
	Depression	2 (1.7)	
Objective quality	Engagement		3.46 $\pm$ 2.38
	Functionality		3.79 $\pm$ 0.75
	Aesthetics		3.90 $\pm$ 0.52
	Information		3.81 $\pm$ 0.53
	Total	3.74 $\pm$ 0.45	
Subjective quality	Recommendation		3.35 $\pm$ 0.62
	Continuous use		3.52 $\pm$ 0.68
	Purchase		3.56 $\pm$ 0.98
	Comprehensive evaluation		2.61 $\pm$ 0.86
	Total	3.35 $\pm$ 0.62	
App-specific goals	Knowledge		3.66 $\pm$ 0.67
	Help seeking		3.37 $\pm$ 0.71
	Intention to change		3.16 $\pm$ 0.45
	Attitude		3.14 $\pm$ 0.42
	Behavior change		3.11 $\pm$ 0.93
	Awareness		2.91 $\pm$ 0.59

Among the six categories of app-specific usage purposes, knowledge ( $3.66 \pm 0.67$ ) received the highest score. This was followed by help seeking ( $3.37 \pm 0.71$ ), intention to change ( $3.16 \pm 0.45$ ), attitudes ( $3.14 \pm 0.42$ ), behavior change ( $3.11 \pm 0.93$ ), and awareness ( $2.91 \pm 0.59$ ) (Table 2).

### Quality assessment of mobile apps by characteristics

The total score of objective quality assessment significantly differed according to the content category ( $F = 3.86, p = .003$ ). The dimensions of engagement ( $F = 3.75, p = .003$ ), functionality ( $F = 4.38, p = .001$ ), and aesthetics ( $F = 2.63, p = .026$ ) also showed significant differences. However, the post hoc test did not reveal any significant differences in group comparisons. When examining the quality assessment scores for the engagement dimension by app category, apps within the childbirth/parenting category ( $4.13 \pm 0.50$ ) and family category ( $4.10 \pm 0.55$ ) scored higher, while those in the information category ( $2.90 \pm 1.55$ ) scored the lowest. In the functionality dimension, apps in the childbirth/parenting category ( $4.13 \pm 0.62$ ) and role-playing/simulation category ( $4.10 \pm 0.48$ ) scored higher, while those in the information category ( $2.87 \pm 0.88$ ) scored the lowest. In the aesthetics dimension, apps in the childbirth/parenting category ( $4.04 \pm 0.45$ ) scored the highest, while those in the information category ( $3.00 \pm 1.41$ ) scored the lowest. There were no significant disparities in the subjective assessment scores when categorized based on app content. Apps within the childbirth/parenting category ( $14.55 \pm 1.67$ ) and the family category ( $14.50 \pm 1.51$ ) demonstrated higher overall subjective assessment scores. Conversely, apps in the information category ( $11.50 \pm 6.36$ ) exhibited the lowest score.

There were no significant differences in the subjective assessment scores when categorized based on app content. Apps within the childbirth/parenting category ( $14.55 \pm 1.67$ ) and the family category ( $14.50 \pm 1.51$ ) demonstrated higher overall subjective assessment scores. Conversely, apps in the information category ( $11.50 \pm 6.36$ ) exhibited the lowest score.

Additionally, there were no significant differences observed between the objective and subjective assessment scores regarding the supervision of an authority, up-to-date content, and in-app purchases (Table 3).

## Discussion

This study evaluated the objective and subjective quality of pregnancy and childbirth-related apps available in the android and iOS in South Korea. The results confirmed that the quality of

Table 3. Differences in scores of objective and subjective quality by application (app) characteristics (N=163)

Characteristics	Objective quality						Subjective quality, total	
	Engagement		Functionality		Aesthetics		Total	
	Mean $\pm$ SD	F (p)	Mean $\pm$ SD	F (p)	Mean $\pm$ SD	F (p)	Mean $\pm$ SD	F (p)
Content category								
Health/exercise	3.58 $\pm$ 0.75	3.75 (.003)	3.79 $\pm$ 0.44	4.38 (.001)	3.73 $\pm$ 0.44	2.63 (.026)	63.76 $\pm$ 8.85	3.86 (.003)
Childbirth/parenting	4.13 $\pm$ 0.50		4.13 $\pm$ 0.62		4.04 $\pm$ 0.45		70.33 $\pm$ 7.71	
Role-playing/simulation	3.98 $\pm$ 0.61		4.10 $\pm$ 0.48		3.86 $\pm$ 0.66		68.55 $\pm$ 9.24	
Lifestyle/social networking	3.86 $\pm$ 0.75		3.83 $\pm$ 0.72		3.74 $\pm$ 0.34		66.22 $\pm$ 11.04	
Family	4.10 $\pm$ 0.55		3.87 $\pm$ 0.51		3.94 $\pm$ 0.74		69.16 $\pm$ 8.97	
Information	2.90 $\pm$ 1.55		2.87 $\pm$ 0.88		3.00 $\pm$ 1.41		50.00 $\pm$ 22.62	
Update cycle								
< 6 months	3.74 $\pm$ 0.69	1.32 (.269)	3.81 $\pm$ 0.52	3.01 (.053)	3.72 $\pm$ 0.59	3.07 (.050)	64.67 $\pm$ 9.52	0.91 (.652)
6 months to 1 year	4.17 $\pm$ 0.71		4.16 $\pm$ 0.46		4.14 $\pm$ 0.52		71.40 $\pm$ 9.34	
> 1 year	3.79 $\pm$ 0.84		3.98 $\pm$ 0.48		3.85 $\pm$ 0.36		66.69 $\pm$ 9.50	
Reliable authority								
Yes	4.05 $\pm$ 0.85	0.70 (.480)	4.06 $\pm$ 0.68	0.63 (.527)	4.00 $\pm$ 0.72	0.71 (.476)	65.93 $\pm$ 9.39	0.06 (.802)
No	3.79 $\pm$ 0.75		3.90 $\pm$ 0.53		3.82 $\pm$ 0.53		67.00 $\pm$ 14.58	
Paid app								
Yes	3.78 $\pm$ 0.71	0.01 (.993)	3.91 $\pm$ 0.49	0.23 (.813)	3.81 $\pm$ 0.06	0.01 (.985)	66.16 $\pm$ 8.31	0.65 (.799)
No	3.78 $\pm$ 0.77		3.89 $\pm$ 0.54		3.81 $\pm$ 0.56		65.84 $\pm$ 10.26	

these apps was desirable, exceeding the benchmark score of 3.0 proposed by a prior study [20].

The apps were updated on average every 367 days, with a significant variation in update frequency ranging from as little as 10 days to as much as 2,192 days. Apps related to community, music, and pregnancy diaries were updated within a 30-day period, while 33.2% of apps took more than a year to receive an update. This suggests that users should verify the timeliness of the information provided. Furthermore, only 2.9% of apps provided information about regulatory oversight, which could raise concerns about their credibility. As such, users should check for the presence of credibility indicators, and developers should include reviewer information to assure users of their app's credibility.

The apps included in this study had an objective quality score of 3.86 points, suggesting a higher quality of pregnancy and childbirth-related apps in Korea compared to the 2.94 points scored in a similar Spanish study [11]. This discrepancy in quality assessment scores may be attributed to the nature of the app content. The higher score in this study could be due to the inclusion of apps that addressed both the physical and mental aspects of pregnancy and childbirth. In contrast, the previous study [11] focused on apps related to physical activities during pregnancy, reflecting the specificity of the content. In this study, the function dimension, one of the objective quality assessment dimensions, received the highest quality assessment score. This finding aligns with the Spanish study [11], where the function dimension also scored highest (4.00 points). However, this study demonstrated higher scores in the aesthetics, engagement, and information dimensions than those in the Spanish study (aesthetics, 3.00 points; engagement, 2.60 points; and information, 2.60 points). The high score in the function dimension in the Spanish study could be due to the selection of apps that promote changes in physical activity and positive lifestyle information during pregnancy, which can potentially enhance maternal and fetal health. Conversely, negative pregnancy outcomes can adversely affect maternal behavior changes. Meanwhile, the information dimension received the lowest scores in both this study and the Spanish study. This could be because the information dimension lacked sufficient items to evaluate whether the apps were well-sourced, used as academic resources, included reliable visuals, were regularly updated, or were reviewed by a reliable authority during development.

Significant differences were observed in the total objective quality assessment scores, as well as the scores for engagement, function, and aesthetics dimensions, based on the app content category. Specifically, apps in the childbirth/parenting, family,

and role-playing/simulation categories, which garnered high user interest, scored highly in the objective quality assessment. The engagement dimension scores were higher for apps in the childbirth/parenting, family, role-playing/simulation, and lifestyle/social networking categories. This is likely to have been because apps in the childbirth/parenting and family categories offer features that allow mothers and partners to engage by monitoring their baby's status and sharing information during pregnancy. Additionally, apps in the role-playing/simulation and lifestyle/social networking categories provide numerous opportunities for direct user participation. High scores in the aesthetics dimension were found among apps in the childbirth/parenting and role-playing/simulation categories, underscoring the importance of aesthetic appeal in these categories. Finally, the function dimension scores were higher for apps in the childbirth/parenting, family, and role-playing/simulation categories. This could be attributed to the fact that these apps offer both functionality and information. For instance, they may use three-dimensional technology to provide pregnancy-related information, animate the childbirth process in a flash format, or allow users to visually track their status by entering their gestational weeks or other information.

Nurses can recommend pregnancy and childbirth-related apps to pregnant women as educational tools. These apps can help track health status, provide basic information, and visually depict the fetus's condition, location, and size. However, if the quality of these mobile apps is not assured, they could pose risks to the health management and healthy lifestyle of pregnant women. Therefore, nurses should guide pregnant women through the process of verifying the currency and expertise of apps via the app information before installation. This ensures the use of safe and reliable health management resources for both the pregnant women and their fetuses. To enhance the reliability of app information, it is crucial for app developers to collaborate with clinical experts. This collaboration can help organize useful content and ensure expert supervision. Developers should also aim to categorize apps clearly based on content and guarantee that the information is evidence-based and current. This will ensure that pregnancy and childbirth-related apps can be used effectively. Users who choose and utilize these apps should select those that provide up-to-date information by checking for regular updates. If they discover issues regarding the quality and quantity of information in the app content, they should raise their concerns with the app developers. Additionally, they should seek advice from healthcare providers involved in the pregnancy and childbirth process.

This study underscores the necessity of employing high-quality apps in practice to offer a range of informed medical services to pregnant women. Furthermore, it is crucial to carry out qualitative studies to verify the impact of app usage on the health management of pregnant women. Future research should also include quantitative studies on their experiences with app usage.

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## Authors' contributions

Conceptualization: All authors; Data collection: Cho H, Yi F; Formal analysis: All authors; Writing—original draft: Cho H, Ahn S; Writing—review & editing: All authors.

## Conflict of interest

Sukhee Ahn has been President of the Korean Society of Women Health Nursing since January 2022 and the statistics editor of the *Korean Journal of Women Health Nursing* since January 2020. She was not involved in the review process of this study. Otherwise, there is no conflict of interest to declare.

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## Data availability

Please contact the corresponding author for data availability.

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# 여성 노인의 디지털 정보활용능력이 우울에 미치는 영향: 사회적 지지의 매개 효과를 중심으로

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## The effect of digital literacy on depressive symptoms among older Korean women: a mediation analysis focusing on the role of social support

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**Purpose:** The purpose of this study was to investigate the relationship between digital literacy and depressive symptoms, as well as the mediating role of social support in this relationship, among older women (60 years and older) in Korea.

**Methods:** This study analyzed data from the User Experience Evaluation Survey, which was conducted by the Ewha Institute for Age Integration Research to improve the accessibility of digital information for older adults research from May to September 2020. Survey data on depressive symptoms, digital literacy, and social support were analyzed using descriptive statistics, Pearson correlation coefficients, and multiple regression.

**Results:** The factors influencing depressive symptoms among older women included work status ( $B=-.19, p=.01$ ), social support ( $B=-.17, p<.001$ ), self-rated health ( $B=-.13, p=.003$ ), and digital literacy ( $B=-.10, p=.005$ ), which had an explanatory power of 33%. In addition, social support played a mediating role in the relationship between digital literacy and depressive symptoms ( $B=-.05, SE=.02; 95\% CI, -.09 \text{ to } -.02$ ).

**Conclusion:** The findings of this study support the need to develop and apply interventions that promote digital literacy among older women to mitigate depressive symptoms by increasing social support.

**Keywords:** Depressive symptoms; Digital divide; Digital literacy; Older women; Social support

**주요어:** 우울; 디지털 격차; 디지털 정보활용능력; 여성 노인; 사회적 지지

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## Summary statement

### • What is already known about this topic?

Digital literacy can improve older adults' mental health and social relationships, but older women are often marginalized in terms of digital literacy.

### • What this paper adds

Digital literacy decreased depressive symptoms in this sample of older women aged 60 years and over. This relationship was partially mediated by increased social support.

### • Implications for practice, education, and/or policy

These findings indicate the importance of digital literacy in promoting older women's mental health through increasing social support, calling for the development of customized digital literacy education for older women to prevent and alleviate depressive symptoms.

## Introduction

전 세계적으로 디지털 기술의 변화는 급속하게 이루어지고 있고, 그 예로 생성형 인공지능의 등장을 들 수 있으며, 이로 인하여 매우 빠른 속도로 교육, 여가, 의료, 문화 등 전반적인 생활양식의 변화가 일어나고 있다[1]. Social Network Services (SNS)를 사용한 가족 및 지인들과의 교류, 뉴스 등 각종 정보의 교환, 음악이나 사진 등의 취미생활뿐 아니라 은행 업무, 병원 예약, 장보기 등 이제는 언제 어디서나 디지털 기기 없는 삶을 생각하기 힘들다. 이러한 변화로 인하여 삶이 편리해진 면이 있지만, 급속한 변화에 따라가지 못하는 사람들은 사회적 소외를 경험하게 되는 부정적인 면도 존재한다[2]. 고령층은 이러한 디지털 격차(digital divide)를 보이는 대표적인 집단이다. 한국지능정보사회진흥원의 2021 디지털 정보격차 실태조사 보고서에 따르면 우리나라 만 55세 이상 고령층의 모바일 스마트 기기 보유율은 81.6%에 달하고 있지만, 고령층의 디지털 정보화 역량 수준은 2021년 비고령층의 53.9%에 머무르고 있으며 디지털 정보화 활용 수준도 72.3%에 머무르고 있다[3]. 고령층 중에서도 특히 여성은 디지털 소외를 겪는 대표적인 집단이라고 할 수 있다[2]. 위의 보고서에 따르면 고령층의 디지털 정보화 수준은 전 영역에서 여성보다 남성에서 높게 나타났으며[3], 선행연구마다 연령 기준이 조금씩 다르지만 55세 이상[4] 또는 60세 이상의 고령층을 대상으로 하는 연구에서[5] 고령층 여성의 디지털 이용경험 및 정보역량 수준이 고령층 남성보다 낮게 나타났다.

디지털 격차 문제는 단순히 디지털 이용능력 차이의 문제가 아닌 삶의 만족도와 우울 등 정신건강에 영향을 주는 문제이기 때문에 더욱 중요하다[6,7]. 노년기에 접어들며 가족 관계의 축소, 은퇴 등으로 인한 사회적 관계 축소 등 노년기는 사회적 관계가 축소되는 시기여서 노인들은 소외감 등으로 시간을 보내는 경우가 많아진다[8]. 이러한 상황에서 디지털 정보활용능력은 시간을 보낼 수 있는 유용

한 도구가 될 수 있다. SNS나 소셜미디어를 통해 지인과 대화 나누기, 사진이나 영상 주고받기, 음악 공유하기, 동영상 시청 등을 할 수 있어 다양한 정보를 서로 주고받고, 취미나 여가생활을 공유할 뿐만 아니라 배움에 대한 욕구도 충족할 수 있다[4,8].

선행연구에서는 인터넷 사용이 사회적 관계망을 확장하고[9], 사회활동 만족도와 사회활동을 높이며[6], 디지털 정보활용 교육을 통하여 노인의 사회적 지지를 높일 수 있다고 하였다[10,11]. Lim 등[12]은 노인들을 대상으로 한 연구에서 디지털 정보활용능력이 개인의 사회 참여와 배제를 결정짓는 기준이 되며, 사회적 상호작용을 가능하게 하는 필수적인 역량이라고 하였다. 특히 여성일 경우 디지털 정보활용능력이 높을수록 사회활동 만족도가 높아지는 것으로 보고되었다[6]. 하지만 현재의 고령층이 살아온 시대에서 여성은 남성에 비해 사회 참여 기회가 적었으므로, 직장 내 업무를 위한 컴퓨터 사용 등의 디지털 교육을 받을 기회도 거의 없었다. 따라서 현재 여성 노인들은 디지털 활용능력을 통해 사회관계를 넓히는 데 제한적일 수 있으며, 향후 디지털 정보활용능력을 높임으로써 사회활동에 대한 만족도를 더욱 높일 수 있음을 시사한다[13].

한편 우울은 노년기에 흔히 발생하는 정신건강 질환으로, 2020년 노인실태조사에 따르면 한국 노인 중 약 13.5%가 우울을 경험하는 것으로 나타났다[14]. 이 조사에 따르면 노년층 중에서도 남성보다 여성이 우울증상을 갖고 있는 비율이 높았고, 연령이 높을수록 우울의 비율이 높은 것으로 나타났다. 많은 선행연구에서 사회적 지지가 노인의 우울을 감소한다고 하였다[15,16]. 특히, 가족과 배우자의 정서적 지지가 많을수록 우울이 감소하는 것으로 나타났다[15]. 이와 함께, 디지털 활용이 노인들의 우울을 낮춘다는 선행연구들도 있다[17,18]. Morris 등[19]은 이러한 디지털 활용이 노인들의 우울증을 감소시키는 사회적 연결의 매개 역할을 할 수 있다고 하였다. 하지만, Park과 Chung [20]은 디지털 정보활용능력이 우울 증상에 미치는 영향에 대한 최근 연구에서 사회적 네트워크의 매개

효과가 유의미하지 않음을 보고하기도 하였다.

본 연구에서는 선행연구를 바탕으로 여성 노인의 우울에 대한 개입의 단초를 얻기 위하여 여성 노인의 디지털 정보활용능력이 우울에 미치는 영향을 알아보고, 이 관계에서 사회적 지지의 매개 효과를 알아보고자 한다. 선행연구를 기반으로 [21] Figure 1과 같은 연구모형을 제시하였으며, 구체적인 연구목적은 다음과 같다.

- (1) 여성 노인의 디지털 정보활용능력이 우울에 미치는 영향을 파악한다.
- (2) 여성 노인의 디지털 정보활용능력과 우울의 관계에서 사회적 지지의 매개 효과를 알아본다.

## Methods

**Ethics statement:** This study was a secondary analysis using anonymized data. The original study obtained informed consent from participants and adhered to the Declaration of Helsinki.

### 연구 설계

본 연구는 여성 노인의 디지털 정보활용능력이 우울에 미치는 영향을 알아보고, 이 관계에서 사회적 지지의 매개 효과를 검증하고자 이화여자대학교 연령통합고령사회연구소의 2020년 ‘노인의 디지털 정보접근성 향상을 위한 사용자 경험 평가조사’ 원시 자료를 이용한 이차 자료분석 연구로 매개 효과 분석 설계이다.

### 연구 자료

본 연구에서는 노인복지관 이용자들을 대상으로 노인의 디지털 이용에 대한 연구에서 수집한 자료를 이차적으로 사용하였다(unpublished literature). 원 자료는 유의적 표집방법을 이용하여 2020년 5월에서 9월까지 서울 시내 노인복지관 다섯 군데에서 수집하였다. 노인복지법 시행규칙 제24조에 따라 노인복지관 이용자는 60세 이상의 노인이므로, 본 연구는 60세 이상의 노인들을 대상으로 진행되었다. 복지관 게시판을 통하여 연구에 관심있는 참여자를 모집하였으며 본 연구의 목적을 이해하고 연구참여 동의서에 자발적으로

서명한 노인들만 연구에 참여하였다. 적절한 대상자 수는 G\*Power 3.1.9.7 [22] 프로그램을 이용하여 산출하였다. 중간 효과크기 .15 [9,15], 검정력 .95, 유의수준 .05, 예측 변수 8개일 때 필요한 최소 대상자 수는 160명이었다. 예측 변수에는 디지털 정보활용능력과 사회적 지지 및 대상자의 특성 변수(연령, 결혼 여부, 교육 수준, 가구 소득, 주관적 건강 상태, 근로 상태)를 포함하였다. 데이터 수집은 노인복지관에서 연구 참여자가 직접 설문지에 응답하는 방식으로 이루어졌으며, 필요한 경우에는 연구보조원이 도움을 주었다. 총 376부의 설문지를 회수하였다. 본 연구에 필요한 자료는 익명 처리된 상태로 전달받아 분석을 시행하였으며 전체 자료에서 여성 노인 설문지 246부 중 누락된 응답이 포함된 설문지를 제외한 총 197부를 최종 자료 분석에 이용하였다.

### 연구 도구

#### 우울

우울은 단축형 Center for Epidemiological Studies Depression Scale Short Form (CES-D) 척도[23]의 한국판 도구[24]를 활용하여 측정하였다. 본 척도는 총 10문항으로 이루어져 있으며, ‘극히 드물었다(주 1일 미만; 1점)’에서 ‘대부분 그랬다(주 5일 이상; 4점)’의 4점 Likert 척도로 측정한다. 본 분석에는 합산 점수를 사용하였다(가능 점수 범위, 10–40점). 점수가 높을수록 우울 정도가 높은 것을 의미한다. 원 척도의 신뢰도는 .82였으며[23], 본 연구에서 Cronbach’s  $\alpha$ 는 .81이었다.

#### 디지털 정보활용능력

본 연구에서 디지털 정보활용능력은 컴퓨터, 인터넷, 모바일 등의 활용능력을 의미하며 Shin과 Lee [25]가 개발한 디지털 문해력 측정도구 중 ‘ICT 기본 역량’ 하위요인 5문항을 이용하여 측정하였다. 예시 문항으로 ‘나는 스마트 기기를 일상생활에 활용할 수 있다’, ‘나는 인터넷을 활용해 폭넓은 정보를 습득할 수 있다’, ‘나는 인터넷을 통해 다른 사람에게 정보를 제공할 수 있다’ 등이 있다. 각 문항들은 ‘전혀 그렇지 않다(1점)’에서 ‘매우 그렇다(5점)’까지 5점 척도로 구성되어 있으며, 분석에는 모든 문항의 평균 점수를 사용하였다(가능 점수 범위, 1–5). 점수가 높을수록 디지털 정보활용능력의 수준이 높은 것으로 해석한다. 원 도구의 신뢰도는 .86이었으며[25] 본 연구에서 Cronbach’s  $\alpha$ 는 .95였다.

#### 사회적 지지

사회적 지지는 Medical Outcome Study Social Support Scale (MOS-SSS) [26]를 Lim 등 [27]이 한국어로 수정 및 번역한 내용 중에서 정서적/정보적 지지 8문항을 사용하였으며, 여기에는 ‘사람들이 나를 보살펴주고 있다’, ‘사람과 정서적인 지지를 받고 있다고 생각한다’, ‘개인사나 가정사에 대해 이야기할 사람이 있다’ 등이

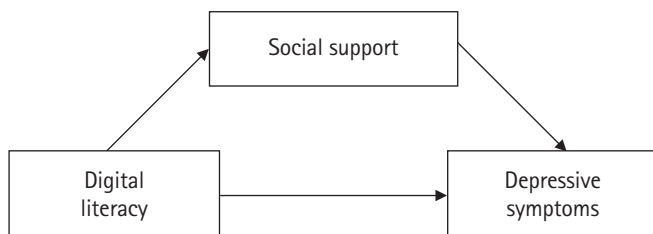


Figure 1. Conceptual framework of the study.

포함되어 있다. ‘전혀 그렇지 않다(1점)’에서 ‘매우 그렇다(5점)’까지 5점 Likert 척도를 사용하였으며 모든 문항의 평균 점수를 분석에 사용하였다(가능 점수 범위, 1-5). 점수가 높을수록 사회적 지지 정도가 높음을 의미한다. Lim 등[27]의 연구에서 신뢰도는 .96이었으며, 본 연구에서는 .87이었다.

### 사회인구학적 특성

본 연구에서는 주요 변수들 간의 관계를 보다 명확히 하기 위해 우울과 관련이 있는 사회인구학적 특성(연령, 교육 수준, 결혼 상태, 가구 월 평균 소득, 근로 상태, 주관적 건강 상태)을 통제변수로 사용하였다.

### 자료 분석 방법

자료는 IBM SPSS statistics ver. 27.0 (IBM Corp., Armonk, NY, USA)와 SPSS Process Macro를 이용하여 다음과 같이 분석하였다.

- (1) 참여자의 인구사회학적 특성과 주요 변수의 특성을 빈도와 백분율, 평균과 표준편차, 왜도와 첨도로 분석하였다.
- (2) 주요 변수 간의 상관관계를 Pearson correlation coefficients로 분석하였다.
- (3) 디지털 정보활용능력과 우울의 관계에서 사회적 지지의 매개 효과를 검증하기 위해서 Hayes [28]가 제안한 SPSS PROCESS Macro Model 4를 사용하였다.
- (4) 매개 효과의 유의도를 검증하기 위해서 부트스트랩 표본 5,000개를 추출하여 95% 신뢰구간(confidence interval, CI)을 분석하였다.

## Results

연구 참여자의 인구사회학적 특성을 살펴보면(Table 1), 평균 연령은 72.9세(표준편차, 4.84)였으며, 범위는 60세에서 88세였다. 교육 수준은 고등학교 졸업 이하가 145명(73.2%), 대학교 졸업이 44명(22.2%), 대학원 졸업이 9명(4.5%)으로 나타났다. 현재 기혼 상태인 참여자는 104명(52.5%)이었다. 가구 월 평균 소득은 100만 원 미만이 51.5%로 가장 많았고, 100만-200만 원이 21.2%, 200만-300만 원이 15.2%로 그 뒤를 이었다. 근로 상태는 노인일자리사업 참여자가 54.0%로 가장 많았고, 무직/은퇴(30.3%), 무급 가족종사자(9.1%), 임금 근로자(4.5%), 자영업자(2.0%) 순이었다. 주관적 건강

상태는 보통이 53.0%로 가장 많았으며, 좋음(28.8%), 매우 좋음(8.6%), 나쁨(8.1%), 매우 나쁨(1.5%) 순이었다. 복지관에서 스마트폰이나 컴퓨터 활용수업을 들어본 적이 있는지에 대해서는 51.5%가 있다고 응답하였다.

### 주요 변수 기술통계

주요 변수의 기술통계는 Table 2와 같다. 연구 대상자들의 우울은

Table 1. Demographic characteristics (N=197)

Variable	Mean $\pm$ SD or n (%)
Age (year)	72.90 $\pm$ 4.84 (range, 60-88)
Level of education	
≤ High school	145 (73.2)
College	44 (22.2)
≥ Graduate school	9 (4.5)
Marital status	
Married	104 (52.5)
Unmarried	94 (47.5)
Monthly household income (KRW)	
< 1 million	102 (51.5)
1 million-2 million	42 (21.2)
2 million-3 million	30 (15.2)
3 million-4 million	12 (6.1)
> 4 million	12 (6.1)
Work status	
Employed	9 (4.5)
Self-employed	4 (2.0)
Family business (unpaid)	18 (9.1)
Job program for seniors	107 (54)
Unemployed	60 (30.3)
Self-rated health	
Very good	17 (8.6)
Good	57 (28.8)
Moderate	105 (53.0)
Bad	16 (8.1)
Very bad	3 (1.5)
Have taken ICT classes	
Yes	102 (51.5)
No	96 (48.5)

KRW: Korean won (1 million KRW=roughly 800 US dollars); ICT: information and communication technology.

Table 2. Characteristics of the main variables (N=197)

Variable	Mean $\pm$ SD	Possible range	Data range	Skewness	Kurtosis
Depressive symptoms	18.19 $\pm$ 5.29	10-40	10-34	0.72	0.47
Digital literacy	3.24 $\pm$ 1.09	1-5	1-5	-0.21	-0.75
Social support	3.32 $\pm$ 0.87	1-5	1-5	-0.38	0.08

최소 10, 최대 34의 범위 안에서 평균 18.19 (표준편차, 5.29)로 약간 낮은 수준이었다. 디지털 정보활용능력은 최소 1, 최대 5의 범위에서 평균 3.24 (표준편차, 1.09)로 나타났고, 사회적 지지는 최소 1, 최대 5의 범위에서 평균 3.32 (표준편차, .87)로 두 변수 모두 중간 정도 수준인 것으로 나타났다. 변수의 정규성을 확인하기 위해 왜도와 첨도를 확인한 결과, 왜도가  $\pm 2$ 보다 작고 첨도가  $\pm 7$ 보다 작아 정규성 가정을 충족하였다고 판단하였다[29].

### 주요 변수 간의 관계

본 연구에서 대상자의 우울과 디지털 정보활용능력은 부적 상관관계( $r = -.38, p < .001$ )가 있는 것으로 나타났고, 우울과 사회적 지지도 부적 상관관계( $r = -.41, p < .001$ )를 나타냈다. 디지털 정보활용능력과 사회적 지지는 약한 양의 상관관계( $r = .34, p < .001$ )가 있는 것으로 나타났다(Table 3).

### 디지털 정보활용능력이 여성 노인의 사회적 지지와 우울에 미치는 영향

먼저 회귀분석을 시행하기 전에 상승변량(variance inflation factor) 값을 확인하여 최종 분석에 투입된 모든 변수들의 다중공선성을 확인하였다. 그 결과 모든 변수의 상승변량 값은 1.14–1.26으로 다중공선성의 문제를 가지지 않는 것으로 확인하였다[30]. 구체적으로

회귀분석 결과를 살펴보면, 첫 번째 모델에서 사회적 지지 정도에 영향을 미치는 변수는 디지털 정보활용능력이 유일하였다( $B = .29, p < .001$ ). 즉, 디지털 정보활용능력이 높을수록 사회적 지지가 높아지는 것으로 나타났다. 사회적 지지를 설명하는 모델의 설명력은 15%였다(adjusted  $R^2 = .15$ ).

여성 노인의 우울에 유의미한 영향을 미치는 요인은 주관적 건강 상태( $B = -.13, p < .01$ ), 근로상태( $B = -.19, p < .05$ ), 디지털 정보활용능력( $B = -.10, p < .01$ ), 사회적 지지( $B = -.17, p < .001$ )로 나타났다. 본 연구의 모델에 포함된 변수들이 우울을 설명하는 설명력은 33%였다(adjusted  $R^2 = .33$ ) (Table 4).

### 디지털 정보활용능력이 우울에 미치는 영향에서 사회적 지지의 매개 효과

부트스트래핑을 이용한 Process Macro의 매개 효과 검정 결과 디지털 정보활용능력이 우울에 미치는 영향에 대한 사회적 지지의 매개 효과( $B = -.05, SE = .02; 95\% \text{ CI}, -.086 \text{ to } -.022$ )는 95% CI에 0을 포함하지 않으므로 유의한 것으로 나타났다(Table 5). 따라서 디지털 정보활용능력이 높아지면 사회적 지지 정도가 높아지고, 우울이 감소하는 것으로 드러났다(Figure 2).

## Discussion

본 연구는 서울 지역 복지관 이용 여성 노인을 대상으로 디지털 정보활용능력이 우울에 미치는 영향과 그 관계에서 사회적 지지의 매개 효과를 검증하였다. 본 연구 결과 여성 노인의 디지털 정보활용능력이 우울을 낮춰주는 것으로 나타났으며, 이 관계에서 사회적 지지가 매개 효과를 갖는 것으로 나타났다. 이러한 결과는 디지털 교육 프로그램이 사회적 지지 수준을 높인다는 선행연구[9]와 유사하고 디지털 정보활용능력이 사회적 네트워크와 우울에 영향을 미친다는 선행

Table 3. Correlations among the key variables (N=197)

Variable	r (p)	
	Depressive symptoms	Digital literacy
Depressive symptoms	1	
Digital literacy	-.38 (<.001)	1
Social support	-.41 (<.001)	.34 (<.001)

Table 4. Multivariate regression model of depressive symptoms among older women (N=197)

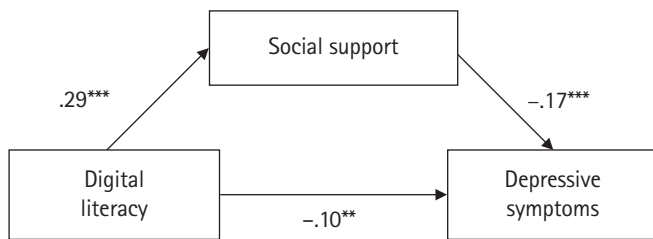
Variable	Social support				Depressive symptoms			
	B	SE	t	p	B	SE	t	p
Age	.02	.01	1.54	.126	-.01	.01	-0.85	.394
Marital status <sup>†</sup>	.09	.13	0.68	.496	-.10	.07	-1.46	.146
Level of education	-.05	.06	-0.81	.419	-.02	.03	-0.68	.499
Monthly household income	.11	.05	1.97	.050	-.02	.03	-0.58	.562
Self-rated health	.05	.08	0.61	.542	-.13	.04	-3.04	.003
Work status <sup>†</sup>	.11	.14	0.78	.438	-.19	.07	-2.56	.011
Digital literacy	.29	.06	4.63	<.001	-.10	.04	-2.87	.005
Social support					-.17	.04	-4.42	<.001
F (p)	4.81 (<.001)				11.50 (<.001)			
Adjusted R <sup>2</sup>	.15				.33			

<sup>†</sup>The reference groups were marital status (married) and work status (working).

**Table 5.** Mediation analysis of the relationship between digital literacy and depressive symptoms (N=197)

Path	Direct effect	Indirect effect	Total effect	95% CI
Digital literacy → social support → depressive symptoms	-.10	-.05	-.15	-.086 to -.022

CI: Confidence interval.

**Figure 2.** The mediation model of depressive symptoms.  
 $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

연구[20]와 부분적으로 일치하는 결과이지만[20], 이에 더하여 여성 노인들을 대상으로 디지털 정보활용능력이 우울에 미치는 영향에서 사회적 지지의 매개 효과를 보여주었다는 점에서 선행연구와 차별된다. 디지털 정보활용능력으로 가족이나 친구에게 전화를 하고 메시지를 주고받으며 기존의 관계를 강화할 뿐만 아니라 새로운 관계를 형성할 수도 있어서, 이러한 사회적 관계가 우울의 감소에 도움을 준 것으로 해석된다.

본 연구 결과를 토대로 다음과 같이 논의하고자 한다. 본 연구의 주요 결과는 여성 노인의 디지털 정보활용능력과 우울의 사이에서 사회적 지지의 매개 효과를 검증한 것이다. 우울에 대한 적절한 개입 방법으로 디지털 정보활용능력 교육을 들 수 있다. 많은 지자체, 도서관, 노인복지관에서 디지털 교육이 이루어지고 있지만 이러한 교육이 노인의 정신건강에 미치는 영향에 대한 효과성 평가는 거의 이루어지고 있지 않은 실정이다. Yoon 등[10]이 디지털 리터러시 교육이 노인의 우울을 감소하고 인지능력을 높이는 데 효과가 있으며, 실생활에서의 편리함 증진, 자신감 향상, 배움에 대한 욕구 향상, 사회적 관계망 강화 및 형성의 효과가 있다고 보고하였지만, 더 많은 효과성 평가 연구가 필요하다. 그러한 연구결과를 바탕으로 체계적인 디지털 교육 커리큘럼을 마련하고, 개인의 욕구에 맞는 수준별, 맞춤형 교육을 진행해야 할 것이다. 초고령 사회 진입을 목전에 둔 현 상황에서, 지자체, 복지관, 도서관, 경로당 등 지역사회 기반의 단체를 통한 노인 디지털 교육을 체계적으로 수행할 수 있는 인력도 개발해야 할 것이다.

또한, 본 연구에서 여성 노인의 디지털 정보활용능력과 우울의 관계에서 사회적 지지의 매개 효과가 검증되었다. 디지털 정보활용능력이 사회적 지지 수준에 영향을 미치는 것은 노인들이 인터넷 활용을 통해 사회적 관계망을 확장하고, 사회적 지지가 높아지며[11], 온라인을 통해 이미 알고 있던 친구나 지인과 소통함으로써 사회관계

가 증가한다는 선행연구와 일치하는 것이다[10]. 즉, 여성 노인들이 스마트폰을 이용해서 자신의 가족, 친구, 지인들과 소통의 기회를 더 많이 가지고, 이에 더해 새로운 인적 네트워크를 가지게 되면서 사회적 지지가 높아지며, 그 결과 우울을 낮추는 것이다.

디지털 정보활용능력이 사회적 지지에 영향을 미치는 부분은 두 가지로 나누어 살펴볼 수 있다. 첫째, 여성들은 스마트폰을 이용해서 가족, 친구, 지인들과 소통하는 것을 즐겨하며, 디지털 정보활용능력이 높으면 지인과의 접촉 및 소통이 많아지고 이는 온라인 상에서만 아니라 오프라인 만남 등으로도 이어져 대면과 비대면 모두를 통한 사회적 지지 수준을 높일 수 있다. 또 다른 가능성으로는, 온라인 상에서 새로운 관계를 구축하고 인간관계를 확장함으로써 사회적 지지 기반을 넓혀갈 가능성도 있다. 아직 우리나라 노인들이 온라인 상에서 모르는 사람들을 만나 새로운 관계를 맺는 행동에 대한 연구가 많지 않지만, Yoon 등[17]의 연구 결과를 참고해볼 만하다. Yoon 등[17]은 사회적 네트워크의 두 종류인 결속형(bonding)과 가교형(bridging) 사회자본의 개념을 이용하여 노인의 온라인 사회관계를 측정하였다. 결속형은 이미 알고 있는 사람들과의 사회적 네트워크로 가족, 친구 등 기존의 관계가 더욱 강화되는 사회자본이다. 반대로 가교형 사회자본은 서로 다른 배경을 가진 개인들이 자발적으로 관계를 만들 때 발생한다. Yoon 등[17]은 결속형 온라인 사회관계가 우울을 낮추는 효과가 있는 반면 가교형 온라인 사회관계는 우울에 영향을 미치지 않았다고 보고하였다. 즉, 온라인 상의 상호작용을 통하여 이미 알고 있는 지인들과의 결속을 다졌을 때, 이것이 사회적 지지 정도를 높여주고 우울을 낮추는 결과로 이어졌다는 것이다. 이러한 점에서 본 연구 결과를 해석해볼 수 있겠다.

본 연구의 제한점은 다음과 같다. 먼저 전국적인 확률 표집이 아닌 서울시 노인복지관 이용자를 대상으로 표본을 수집하였기 때문에 해당 결과를 일반화하기에는 한계가 있다. 추후 연구에서는 전국적인 표본과 노인복지관 비이용자를 포함한 좀 더 대표성 있는 표본을 대상으로 연구를 진행해야 할 것이다. 또한, 사회적 지지가 높을수록 자녀나 손자녀들에게 디지털 기기 이용방법을 배우는 기회가 증가하는 등의 이유로 디지털 정보활용능력이 높을 수 있다. 디지털 정보활용능력과 사회적 지지의 관계에 대한 좀 더 면밀한 연구가 진행되어야 할 것이다. 이러한 한계점에도 불구하고 본 연구는 디지털 소외계층으로 꼽히는 여성 노인들을 대상으로 디지털 정보활용능력과 우울의 관계에서 사회적 지지의 매개 효과를 검증하고, 여성 노인들의 우울 예방 및 개선을 위한 개입의 단초를 제공했다는 의의가 있다.

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## Authors' contributions

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## Conflict of interest

The authors declared no conflict of interest.

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## Data availability

Please contact the corresponding author for data availability.

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# What factors influence continuous usage intention of head-mounted display-based virtual reality content?: a cross-sectional survey

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**Purpose:** The aim of this study was to explore the continuous usage intention of head-mounted display-based virtual reality (HMD-based VR) content among college students. The study also sought to understand how this intention is influenced by factors related to personal cognition, social aspects, VR content, and HMD-related elements.

**Methods:** This descriptive correlational study used a self-report questionnaire to survey 217 students from two universities in Korea who had prior experience with HMD-based VR content.

**Results:** The mean score for continuous usage intention of HMD-based VR content was  $2.59 \pm 0.57$  points (range, 1–5 points). Regarding the average frequency of HMD-based VR content usage, 64.5% of participants reported using it 1 to 2 times, while 91.7% indicated a total HMD-based VR usage period of less than 6 months. Factors such as personal cognition, VR content, social aspects, and HMD-related elements had explanatory power of 35.1%, 10.7%, 4.4%, and 2.5%, respectively, for the continuous usage intention of HMD-based VR content. Additionally, engagement ( $\beta = .45$ ,  $p < .001$ ), influential others ( $\beta = .37$ ,  $p < .001$ ), environmental support ( $\beta = -.18$ ,  $p = .030$ ), and cyber sickness ( $\beta = -.21$ ,  $p = .001$ ) were identified as having a significant influence.

**Conclusion:** When developing HMD-based VR content, strategies to improve users' personal cognition should be included. Additionally, it is necessary to develop strategies that enhance enjoyment and interest in the content, while also facilitating ongoing social support. Furthermore, coping strategies should be devised that take into account cyber sickness, a potential side effect of these devices.

**Keywords:** Head-mounted display; Health services; Intention; Virtual reality

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## Introduction

The integration of information and communications technology (ICT) with services and content from various industries has ushered in new changes and experiences for users. Notably, the availability of related hardware has propelled virtual reality (VR) to the forefront, offering content for gaming, educational, and training experiences across diverse industries [1]. The immersive capabilities

of VR facilitate user engagement in achieving specific goals by enabling active interaction with virtual three-dimensional (3D) content [2]. In the healthcare field, VR is being innovatively utilized for purposes such as medical staff training, pain management, 3D disease visualization, remote early diagnosis, and patient education. Reports suggest that VR has had a positive impact as a novel educational and training tool, as well as a promising aid for disease diagnosis and treatment [3-5].

## Summary statement

### • What is already known about this topic?

In the healthcare industry, virtual reality (VR) technology is extensively utilized for staff training, disease diagnosis, and patient care. Specifically, head-mounted displays (HMDs) are chosen to fully leverage the immersive potential of VR.

### • What this paper adds

Personal cognition was the most significant factor that explained the continuous usage intention of HMD-based VR content.

### • Implications for practice, education, and/or policy

When creating VR content using HMD technology, it is important to incorporate strategies that enhance user cognition, maintain enjoyment and interest, and facilitate ongoing social support.

To maximize leverage the immersive capabilities of VR, users are required to don equipment such as a head-mounted display (HMD), data glove, and data suit. The HMD, in particular, enhances immersion by isolating the user from their external environment, thereby enabling a more authentic VR experience [2]. This makes it a popular choice when developing VR programs for the healthcare sector. However, the widespread commercial adoption of HMD-based VR has been impeded by uncomfortable side effects, such as cyber sickness, which can occur during the VR experience [2,6]. Furthermore, questions persist about the sustainability of the novelty effect, which typically boosts performance in the early stages [7]. The challenges associated with HMD-based VR usage have been a topic of discussion for some time, with no straightforward solutions on the horizon [8,9]. Additionally, the majority of studies have primarily focused on cyber sickness [2,8,9], leading to a misconception that advancements in virtual headset technology are the sole solution to the issues associated with HMD. This could potentially hinder the exploration of diverse methods that could encourage sustained use of HMD-based VR content.

Most studies have examined technology acceptance in relation to VR use, and it is difficult to find studies that have attempted to identify and incorporate the needs of consumers who use HMD-based VR. HMD-based VR is not merely a single form of technology, but also a tool that can enhance user satisfaction and promote health benefits through experiential effects. Therefore, the testing and development of HMD-based VR should not be solely based on findings regarding technology acceptance. Particularly in the healthcare sector, where the focus is on the emotional and behavioral aspects of humans, it is crucial to identify and meet the diverse needs of service consumers for the HMD-based VR technology service market to expand and flourish.

Thus, this study aimed to offer strategic insights for the creation of technology that can enhance user satisfaction and encourage ongoing use. This is achieved by considering relevant factors from the development phase of HMD-based VR content, with a focus on health promotion in the healthcare sector. For the successful completion of a specific task, it is crucial to embrace the technology or service and identify the factors that enable its sustainability. Factors influencing the use and ongoing intention to use ICT, such as mobile apps, can be broadly categorized into personal and technological characteristics [10]. Trice and Treacy [11] have noted that key factors affecting personal ICT usage include design and implementation process variables (e.g., overall implementation strategy, accuracy of user expectations, and top management support), information system characteristics (e.g., response time, accuracy, relevance, stability, and security), individual differences (e.g., age, experience, educational level, and cognitive style), and task characteristics (e.g., complexity and uncertainty). In light of this, the current study categorized the various characteristics that could influence the ongoing intention to use HMD-based VR content into four groups: personal cognition, social factors, VR content, and HMD-related factors. The aim was to identify the specific influence of each of these factors.

The specific objectives of this study were as follows. First, we aimed to identify personal characteristics associated with continuous usage intention among individuals with experience of using HMD-based VR content. Second, we sought to determine the degree of personal cognition (self-efficacy and innovative propensity), social factors (influential others and environmental support), VR content factors (engagement, functionality, aesthetics, and presence), and HMD-related factors (cyber sickness and physical discomfort) in relation to the continuous usage intention of HMD-based VR content. Third, we aimed to identify the distri-

bution of levels of personal cognition, social factors, VR content factors, and HMD-related factors according to individuals' experiences with HMD-based VR content. Fourth, we investigated the correlations between the continuous usage intention of HMD-based VR content and personal cognition, social factors, VR content factors, and HMD-related factors. Fifth, we aimed to determine the influence of personal cognition, social factors, VR content factors, and HMD-related factors on the continuous usage intention of HMD-based VR content.

## Methods

**Ethics statement:** This study was approved by the Institutional Review Board of Gachon University (1044396-201905-HR-074-01). Informed consent was obtained from the participants.

### Study design

This descriptive correlational study aimed to explore the influence of personal cognition (self-efficacy and innovative propensity), social (influential others and environmental support), VR content (engagement, functionality, aesthetics, and presence), and HMD-related factors (cyber sickness and physical discomfort) on the continuous usage intention of HMD-based VR content. This study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology; <http://www.strobe-statement.org/>) reporting guidelines.

### Study participants

Participants were selected through convenience sampling from two universities in cities Asan and Incheon. These students had prior experience with HMD-based VR content and were recruited in December 2019. To boost the participation rate, trained research assistants approached students in the universities' libraries and cafeterias, where they verbally explained the purpose and methods of the research. Eligible and willing participants were then asked to complete a questionnaire in a private setting, seal it in an unmarked envelope, and submit it to the researcher. Upon completion of the questionnaire, participants received a small token of appreciation. Based on similar previous studies [12,13], the minimum sample size needed for linear multiple regression analysis was determined to be 167, using  $\alpha = 0.05$ , a medium effect size  $f = 0.15$ , power = 0.95, and 19 predictors. To account for the possibility of incomplete responses, a total of 240 students were recruited. Of these, 239 surveys were received (a response rate of

99.6%). After discarding questionnaires with incomplete or insincere responses, the questionnaires from 217 participants were used for the analysis.

### Measurements

Continuous usage intention, personal cognition-related factors, social factors, VR content factors, and HMD-related factors were measured (55 items in total, taking 20 minutes). The use of all the measurements in this study was approved by the original developers and translators of the Korean versions.

#### *Continuous usage intention of head-mounted display-based virtual reality content*

To measure the continuous usage intention of HMD-based VR content, three items from the Smartphone App Use Intention Scale developed by Park et al. [13] were partially revised in accordance with the objective of the present study (i.e., revised to "I have the intention to continue using HMD-based VR content"). Each item in the instrument is scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher mean scores indicating higher continuous usage intention of HMD-based VR content (possible range, 1–5 points). The reliability of the instrument was shown by a Cronbach's  $\alpha$  of .73 in the study by Park et al. [13] and .91 in the present study.

#### *Personal cognition factors*

**Self-efficacy:** To measure confidence in successfully using HMD-based VR content, four items from the Self-Efficacy Regarding Smartphone App Scale developed by Park et al. [13] were partially revised in accordance with the objective of the present study (i.e., revised to "I can use HMD-based VR content well"). Each item in the instrument is scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher mean scores indicating higher self-efficacy for using HMD-based VR content (possible range, 1–5 points). The reliability of the instrument was shown by a Cronbach's  $\alpha$  of .77 in the study by Park et al. [13] and .86 in the present study.

**Innovative propensity:** To measure the level of novelty-seeking and accepting change, three items from the "Innovative propensity regarding smartphone app scale" developed by Park et al. [13] were partially revised in accordance with the objective of the present study (i.e., revised to "I tend to use new devices or content earlier than others"). Each item in the instrument is scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher mean scores indicating higher innovative propensity (possible range, 1–5 points). The reliability of the instrument was

shown by a Cronbach's  $\alpha$  of .86 in the study by Park et al. [13] and .84 in the present study. In addition to subscale scores, a total score was calculated (possible range, 1–5 points) for this study.

#### *Social factors*

**Influential others:** To measure the influence of others on participants' use of HMD-based VR content, three items from the four-item "Social influence on healthcare app by smartphone scale" developed by Sim et al. [14] were revised in accordance with the objective of the present study (i.e., revised to "People who have an influence on me believe I should use HMD-based VR content"). Each item in the instrument developed by Sim et al. [14] is scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher mean scores indicating greater encouragement from people (possible range, 1–5 points). The reliability of the instrument was shown by a Cronbach's  $\alpha$  of .86 in the study by Sim et al. [14] and .91 in the present study.

**Environmental support:** To measure the degree to which the environment supports the use of HMD-based VR content, one item consisting of "My surrounding environment mostly supports my use of HMD-based VR content" was scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher scores indicating higher level of environmental support.

In addition to subscale scores, a total score was calculated (possible range, 1–5 points) for this study.

#### *Virtual reality content factors*

**Engagement:** The level of engagement related to entertainment, interest, customization, interactivity, and target group of the content was assessed. Among 20 items in the Mobile App Rating Scale developed by Stoyanov et al. [15] for assessing engagement, functionality, aesthetics, information, and subjective quality of mobile apps, five items were revised in accordance with the objective of the present study (i.e., revised to "Is the HMD-based VR content entertaining to use?"). Each item in the instrument is scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher mean scores indicating a more positive perception of content engagement (possible range, 1–5 points). The reliability of the engagement subscale of the instrument was shown by a Cronbach's  $\alpha$  of .89 in the study by Stoyanov et al. [15] and .89 in the present study.

**Functionality:** The level of functionality related to performance, ease of use, navigation, and gestural design of the content were assessed. Four items related to functionality in the study of Stoyanov et al. [15] were revised for the present study (i.e., revised to "How easy is it to learn how to use the HMD-based VR content?"). Each

item in the instrument is scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher mean scores indicating more positive perception of content functionality (possible range, 1–5 points). The reliability of the functionality subscale of the instrument was shown by a Cronbach's  $\alpha$  of .80 in the study by Stoyanov et al. [15] and .91 in the present study.

**Aesthetics:** The level of aesthetics related to the layout, graphics, and visual appeal of the content was assessed. Three items related to aesthetics in the study of Stoyanov et al. [15] were revised for the present study (i.e., revised to "Is arrangement and size of buttons/icons/menus/content on the screen appropriate?"). Each item in the instrument is scored on a 5-point Likert scale (1, "not at all" to 5, "very much so"), with higher mean scores indicating more positive perception of content aesthetics (possible range, 1–5 points). The reliability of the aesthetics subscale of the instrument was shown by a Cronbach's  $\alpha$  of .86 in the study by Stoyanov et al. [15] and .84 in the present study.

**Presence:** To measure presence (i.e., the feeling of being within an environment mediated by media), six items from the presence scale used by Lu [16] were partially revised in accordance with the objective of the present study (i.e., revised to "Once I finished using the VR content, I felt like I'd returned to reality after completing a trip"). Each item in the instrument is scored on a 5-point Likert scale (1 = "not at all" to 5 = "very much so"), with higher mean scores indicating higher presence (possible range, 1–5 points). The study by Lu [16] did not report the reliability of the scale. In the present study, the reliability of the six-item presence scale was shown by a Cronbach's  $\alpha$  of .80. In addition to subscale scores, a total score was calculated (possible range, 1–5 points) for this study.

#### *Head-mounted display-related factors*

**Cyber sickness:** To measure the symptom of motion sickness that occurs during VR experience, 16 items from the Simulator Sickness Questionnaire developed by Kennedy et al. [17] were used (i.e., "I felt general discomfort"). Each item in the instrument is scored on a 5-point Likert scale (1, "no symptoms" to 5, "severe symptoms"), with higher mean scores indicating higher cyber sickness (possible range, 1–5 points). The reliability of the scale was not reported by the developer [17] but was shown to be good by a Cronbach's  $\alpha$  of .95 in the present study.

**Physical discomfort:** To measure the physical discomfort participants felt when wearing HMD, seven items were developed by the research team based on the results of the study by Eoh et al. [18], which measured discomfort when wearing a face mask and glasses (i.e., developed and used "I felt my nose being pressed

when wearing an HMD”). The appropriateness of the questions was assessed through expert and face validity testing with five experts in HMD-VR research and technology development. Each item in the instrument is scored on a 5-point Likert scale (1, “no discomfort” to 5, “severe discomfort”), with higher mean scores indicating higher physical discomfort (possible range, 1–5 points). The reliability of the physical discomfort scale used in the present study was shown by a Cronbach’s  $\alpha$  of .88. In addition to subscale scores, a total score was calculated (possible range, 1–5 points) for this study.

### *Sociodemographic characteristics*

The following characteristics were assessed (nine items): age, sex, average number of HMD-based VR content usage, total HMD-based VR usage period, experience using entertainment VR content, experience using education VR content, experience using healthcare VR content, intention to purchase HMD-based VR content, and intention to purchase HMD.

### **Data analysis**

The collected data were analyzed using IBM SPSS ver. 19.0 (IBM Corp., Armonk, NY, USA). Major variables were checked for a normal distribution (Kolmogorov-Smirnov test), and two-tailed  $p$ -values of  $< .05$  were considered significant. The general characteristics of the participants and related variables were expressed as frequency, percentage, mean, and standard deviation. The reliability of the variables was quantified using Cronbach’s  $\alpha$ . Differences in continuous usage intention of HMD-based VR according to the participants’ characteristics were analyzed using parametric tests (independent  $t$ -test, one-way analysis of variance) and nonparametric tests (Mann-Whitney U-test, Kruskal-Wallis test) in consideration of the normality of the data distribution. Correlations were computed using Pearson correlations. The influence of the characteristics of the participants and personal cognition, social, VR content, and HMD-related factors on continuous usage intention of HMD-based VR content was analyzed using hierarchical multiple regression analysis. Before performing hierarchical multiple regression analysis, the regression model was constructed after confirming the absence of multicollinearity between the variables.

## **Results**

### **Participants’ characteristics and differences in continuous usage intention of head-mounted display-based virtual reality content**

The majority of individuals with experience using HMD-based

VR were 20 to 29 years of age (71.0%), with 57.6% being male. When asked about the frequency of VR usage, the most common response was 1 or 2 times, accounting for 64.5% of responses. The most common duration of total VR usage was less than 6 months (91.7%). Conversely, the least common frequency of VR usage was 6 times, reported by only 2.8% of respondents. Similarly, a total VR usage period of 12 months or more was the least common response (also 2.8%). An overwhelming majority of participants (98.6%) reported having used VR for entertainment purposes. However, only a small proportion of participants had experience using VR for educational (6.5%) and healthcare (3.2%) purposes. Meanwhile, 25.8% and 25.3% of participants expressed an intention to purchase HMD-based VR content and HMDs, respectively. The continuous usage intention of HMD-based VR content was significantly higher among those aged 10 to 19 years ( $p < .001$ ), males ( $p < .001$ ), those with experience using healthcare content ( $p = .019$ ), those intending to purchase HMD-based VR content ( $p < .001$ ), and those intending to purchase HMDs ( $p < .001$ ) (Table 1).

### **Level of continuous usage intention of head-mounted display-based virtual reality content and personal cognition, social, virtual reality content, and head-mounted display-related factors**

The mean score for continuous usage intention of HMD-based VR content was close to the mid-point of the scale, at  $2.59 \pm 0.57$ . The self-efficacy score was  $2.49 \pm 0.59$  points, the innovative propensity score was  $2.51 \pm 0.64$  points, and the total score for personal cognition factors was  $2.50 \pm 0.57$  points. The influential others score was  $3.02 \pm 0.99$  points, the environmental support score was  $3.12 \pm 1.12$  points, and the total score for social factors was  $3.07 \pm 0.99$  points. The engagement score was  $3.61 \pm 0.77$  points, the functionality score was  $3.55 \pm 0.83$  points, the aesthetics score was  $3.55 \pm 0.78$  points, the presence score was  $3.26 \pm 0.83$  points, and the total score for VR content factors was  $3.49 \pm 0.67$  points. The total score for HMD-related factors was  $2.38 \pm 0.74$  points, while that for cyber sickness was  $2.17 \pm 0.80$  points and the mean physical discomfort score was  $2.59 \pm 0.90$  points (Table 2).

### **Distribution of personal cognition, social, virtual reality content, and head-mounted display-related factors according to the experience of using virtual reality content by type**

The scores for personal cognition, social, and VR content factors were  $2.51 \pm 0.56$ ,  $3.07 \pm 0.99$ , and  $3.49 \pm 0.66$  points among those with experience using VR content for entertainment, respectively,

**Table 1.** Participants' characteristics and differences in continuous usage intention of HMD-based VR content (N=217)

Characteristics	Categories	n (%)	Continuous use intention of HMD-based VR content, Mean $\pm$ SD	F/H/t/U (p)
Age (year)	10s	56 (25.8)	2.92 $\pm$ 0.53	23.43 (< .001)
	20s	154 (71.0)	2.48 $\pm$ 0.58	
	30s	7 (3.2)	2.28 $\pm$ 0.41	
Sex	Male	125 (57.6)	2.76 $\pm$ 0.60	3.86 (< .001)
	Female	92 (42.4)	2.46 $\pm$ 0.55	
Average number of times using HMD-based VR content	1–2	140 (64.5)	2.54 $\pm$ 0.61	4.33 (.115)
	3–5	71 (32.7)	2.66 $\pm$ 0.55	
	$\geq 6$	6 (2.8)	2.94 $\pm$ 0.56	
Total HMD-based VR usage period (month)	> 6	199 (91.7)	2.59 $\pm$ 0.60	0.20 (.907)
	6–12	12 (5.5)	2.54 $\pm$ 0.54	
	$\geq 12$	6 (2.8)	2.70 $\pm$ 0.51	
Experience using VR content for entertainment	Yes	214 (98.6)	2.59 $\pm$ 0.58	387.50 (.533)
	No	3 (1.4)	2.38 $\pm$ 1.09	
Experience using VR content for education	Yes	14 (6.5)	2.53 $\pm$ 0.60	1,299.50 (.589)
	No	203 (93.5)	2.59 $\pm$ 0.59	
Experience using VR content for healthcare	Yes	7 (3.2)	3.10 $\pm$ 0.48	1,113.00 (.019)
	No	210 (96.8)	2.57 $\pm$ 0.59	
Intention to purchase HMD-based VR content	No	81 (37.3)	2.28 $\pm$ 0.61	29.05 (< .001)
	Not sure	80 (36.9)	2.64 $\pm$ 0.47	
	Yes	56 (25.8)	2.97 $\pm$ 0.47	
Intention to purchase HMD	No	92 (42.4)	2.28 $\pm$ 0.55	30.67 (< .001)
	Not sure	70 (32.3)	2.71 $\pm$ 0.50	
	Yes	55 (25.3)	2.95 $\pm$ 0.49	

HMD: head-mounted display, VR: virtual reality.

F (p): Test statistic and *p*-value obtained from one-way analysis of variance. H (p): Test statistic and *p*-value obtained from the Kruskal-Wallis test. t (p): Test statistic and *p*-value obtained from independent t-test. U (p): Test statistic and *p*-value obtained from the Mann-Whitney U-test.**Table 2.** Mean scores for continuous usage intention of HMD-based VR content and its influencing factors (N=217)

Variable	Mean $\pm$ SD <sup>†</sup>
Continuous usage intention of HMD-based VR content	2.59 $\pm$ 0.59
Personal cognition factors	2.50 $\pm$ 0.57
Self-efficacy	2.49 $\pm$ 0.59
Innovative propensity	2.51 $\pm$ 0.64
Social factors	3.07 $\pm$ 0.99
Influential others	3.02 $\pm$ 0.99
Environmental support	3.12 $\pm$ 1.12
VR content factors	3.49 $\pm$ 0.67
Engagement	3.61 $\pm$ 0.77
Functionality	3.55 $\pm$ 0.83
Aesthetics	3.55 $\pm$ 0.78
Presence	3.26 $\pm$ 0.83
HMD-related factors	2.38 $\pm$ 0.74
Cyber sickness	2.17 $\pm$ 0.80
Physical discomfort	2.59 $\pm$ 0.90

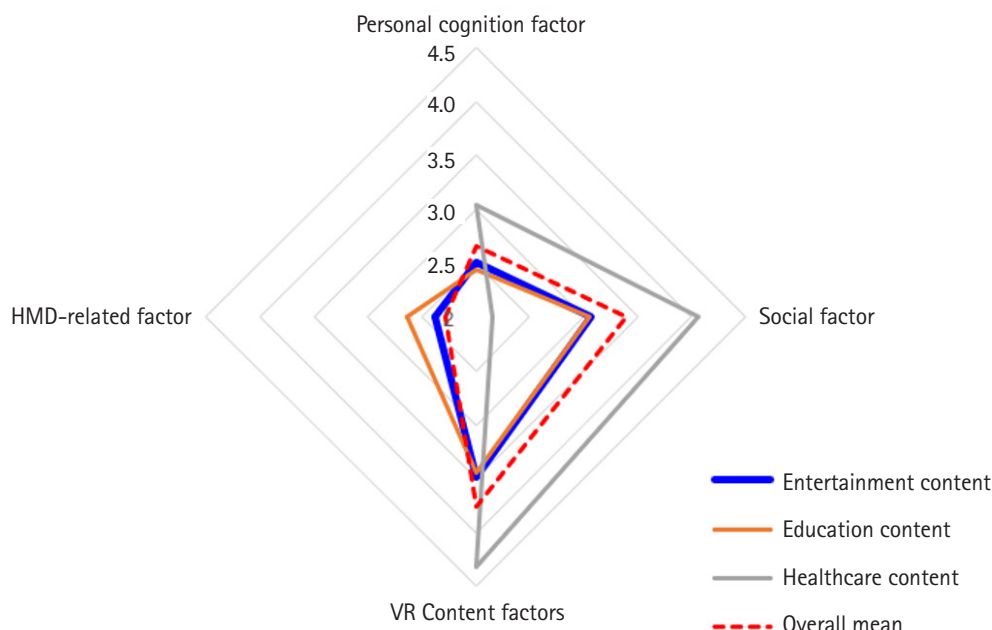
HMD, head-mounted display; VR, virtual reality.

<sup>†</sup>Possible range, 1–5.

and 2.44  $\pm$  0.62, 3.06  $\pm$  1.11, and 3.44  $\pm$  0.80 points among those with experience using VR content for education. Conversely, participants who had experience using VR content in healthcare settings demonstrated notably higher scores of 3.04  $\pm$  0.55, 4.07  $\pm$  0.97, and 4.32  $\pm$  0.50 points, respectively. Regarding HMD-related factors, those with experience using healthcare VR content had the lowest score of 1.84  $\pm$  0.79 points. However, individuals who had used VR content for entertainment and education had higher scores, with 2.38  $\pm$  0.73 and 2.64  $\pm$  1.04 points, respectively (Figure 1).

### Correlations between continuous usage intention of head-mounted display-based virtual reality content and study variables

The participants' continuous usage intention of HMD-based VR content showed statistically significant positive correlations with self-efficacy ( $r = 0.59$ ,  $p < .001$ ), innovative propensity ( $r = 0.46$ ,  $p < .001$ ), influential others ( $r = 0.52$ ,  $p < .001$ ), environmental



**Figure 1.** Distribution of personal cognition, social, VR content, and HMD-related factors according to the experience of using VR content by type. HMD, head-mounted display; VR, virtual reality.

**Table 3.** Pearson correlation coefficients between factors and continuous usage intention of HMD-based VR content (N=217)

Factor	Categories	r (p)
Personal cognition factors	Self-efficacy	.59 (<.001)
	Innovative propensity	.46 (<.001)
Social factors	Influential others	.52 (<.001)
	Environmental support	.42 (<.001)
VR content factors	Engagement	.67 (<.001)
	Functionality	.54 (<.001)
	Aesthetics	.47 (<.001)
	Presence	.35 (<.001)
HMD-related factors	Cyber sickness	-.29 (<.001)
	Physical discomfort	-.14 (.039)

HMD, head-mounted display; VR, virtual reality

r (p): Test statistic and p-value obtained from Pearson correlation test.

support ( $r = 0.42, p < .001$ ), engagement ( $r = 0.67, p < .001$ ), functionality ( $r = 0.54, p < .001$ ), aesthetics ( $r = 0.47, p < .001$ ), and presence ( $r = 0.35, p < .001$ ). However, the continuous usage intention of HMD-based VR content demonstrated statistically significant, albeit weak, negative correlations with cyber sickness ( $r = -0.29, p < .001$ ) and physical discomfort ( $r = -0.14, p = .039$ ) (Table 3).

#### Factors influencing continuous usage intention of head-mounted display-based virtual reality content

Model 1, which incorporated personal cognition factors, explained approximately 35.1% of variance in the continuous usage intention of HMD-based VR content ( $F = 57.96, p < .001$ ). Self-efficacy ( $\beta = .53, p < .001$ ) was identified as a variable with significant influence. When social factors were added in model 2, the explanatory power for the continuous usage intention of HMD-based VR content rose to approximately 39.5% ( $F = 34.62, p < .001$ ). This suggests that social factors contributed an additional explanatory power of approximately 4.4%. In model 2, both self-efficacy ( $\beta = .46, p < .001$ ) and influential others ( $\beta = .32, p < .001$ ) were identified as variables with significant influence. In model 3, the inclusion of VR content factors increased the explanatory power for the continuous usage intention of HMD-based VR content to approximately 50.2% ( $F = 26.19, p < .001$ ). This indicates that VR content factors contributed an additional explanatory power of approximately 10.7%. In this model, self-efficacy ( $\beta = .18, p = .039$ ), influential others ( $\beta = .30, p < .001$ ), and engagement ( $\beta = .50, p < .001$ ) were identified as variables with significant influence. Finally, in model 4, the addition of HMD-related factors increased the explanatory power for the continuous usage intention of HMD-based VR content to approximately 52.7% ( $F = 22.98, p < .001$ ). This suggests that HMD-related factors

contributed an additional explanatory power of approximately 2.5%. In model 4, influential others ( $\beta = .37, p < .001$ ), environmental support ( $\beta = -.18, p = .030$ ), engagement ( $\beta = .45, p < .001$ ), and cyber sickness ( $\beta = -.21, p = .001$ ) were identified as variables with significant influence (Table 4).

## Discussion

Investigating the continuous usage intention among users is crucial for achieving a product's goals and securing a competitive market advantage [18]. However, the continuous usage intention of HMD-based VR content among users is not currently well understood. Therefore, this study aims to provide foundational data to support the expansion and growth of HMD-based VR content in the healthcare market.

This study found that the continuous usage intention for HMD-based VR content was at the mid-point (2.59 points). This may be attributed to the participants' negative perception of their experiences. This conclusion is supported by the low usage rate, with 64.5% of respondents using it only 1 or 2 times, and the short usage duration, with 91.7% of respondents using it for less than 6 months. Furthermore, only about a quarter of the participants expressed an intention to purchase HMD-based VR content and HMDs, indicating a low inclination to make a personal investment in HMD-based VR, which reaffirms their negative perception of their experiences. The continuous usage intention of a specific product or service is determined by user satisfaction [19,20]. Therefore, to encourage the continuous usage of HMD-based VR content, efforts must be made from various angles to enhance user satisfaction. In the healthcare field, HMD-based VR

**Table 4.** Factors Influencing Continuous Usage Intention of HMD-based VR Content (N=217)

Model	Predictors	Categories	$\beta$	t (p)	R <sup>2</sup>	Adj R <sup>2</sup>	$\Delta$ Adj R <sup>2</sup>	F (p)
1	(Constant)			7.27 (<.001)	.59	.35	.35	57.96 (<.001)
	Personal cognition factors	Self-efficacy	.53	6.91 (<.001)				
		Innovative propensity	.08	1.08 (.282)				
2	(Constant)			7.27 (<.001)	.63	.40	.044	34.62 (<.001)
	Personal cognition factors	Self-efficacy	.46	5.64 (<.001)				
		Innovative propensity	-.01	-0.17 (.866)				
	Social factors	Influential others	.32	3.54 (<.001)				
		Environmental support	-.08	-0.98 (.330)				
3	(Constant)			3.88 (<.001)	.71	.50	.11	26.19 (<.001)
	Personal cognition factors	Self-efficacy	.18	2.08 (.039)				
		Innovative propensity	-.02	-0.28 (.778)				
	Social factors	Influential others	.30	3.36 (<.001)				
		Environmental support	-.18	-2.17 (.031)				
	VR Content factors	Engagement	.50	5.71 (<.001)				
		Functionality	-.03	-0.30 (.763)				
		Aesthetics	.03	0.39 (.695)				
		Presence	-.03	-0.56 (.574)				
4	(Constant)			4.23 (<.001)	.73	.53	.025	22.98 (<.001)
	Personal cognition factors	Self-efficacy	.16	1.81 (.072)				
		Innovative propensity	-.05	-0.65 (.514)				
	Social factors	Influential others	.37	4.11 (<.001)				
		Environmental support	-.18	-2.19 (.030)				
	VR Content factors	Engagement	.45	5.18 (<.001)				
		Functionality	-.01	-0.10 (.922)				
		Aesthetics	.00	0.06 (.956)				
		Presence	-.03	-0.44 (.662)				
	HMD-related factors	Cyber sickness	-.21	-3.33 (.001)				
		Physical discomfort	.11	1.81 (.072)				

Adj., adjusted; HMD, head-mounted display; VR, virtual reality.

F (p): Overall test statistic and p-value for the regression model.

content is being developed and utilized for staff training, patient education, and patient management. Continuous usage, as opposed to one-time usage, is crucial to achieve these objectives [3,4]. Therefore, not only content development but also a strategic approach to foster interest and enjoyment, which will encourage continuous usage, must be considered.

There were positive correlations between personal cognition factors (self-efficacy and innovative propensity) and the continuous usage intention of HMD-based VR content. This correlation also demonstrates a high explanatory power for continuous usage intention, accounting for 35.1% of the variance. Notably, models 1, 2, and 3 from the hierarchical multiple regression analysis indicate that self-efficacy is a significantly influential variable, warranting further attention. Self-efficacy in relation to a specific information technology refers to the confidence in one's ability to readily adopt and utilize the technology without hesitation [21]. The low self-efficacy score (2.49) in this study suggests that participants found it challenging and had a negative perception of using HMD-based VR content. Therefore, to enhance the continuous usage intention of HMD-based VR content, it is necessary to implement specific strategies that can help users understand and learn how to use the technology more easily. These strategies could include user manuals and instructional videos. Additionally, future research should aim to identify the specific challenges users may encounter when using HMD-based VR content. This research should be conducted from the user's perspective, rather than the technology developer's perspective, to uncover potential solutions.

Social factors, along with the influence of others and environmental support, demonstrated a significant positive correlation with continuous usage intention. However, these factors only accounted for 4.4% of the explanatory power. In the hierarchical multiple regression analysis, models 2, 3, and 4 indicated that the influence of others is a significant variable, warranting careful attention. Social factors play a role in the adoption and sustained use of new information technology [22]. As such, strategies that reinforce encouragement and support from peers and content operators can enhance the intention for continuous use, rather than solely depending on user willingness. Specifically, for healthcare content that necessitates expert medical knowledge to promote health, strategies should be implemented to enable relevant experts to provide information, recommend usage, and encourage continued use.

The factors of engagement, functionality, aesthetics, and presence, all of which are elements of VR content, demonstrated significantly positive correlation with continuous usage intention.

However, their explanatory power was limited to only 10.7%. Hierarchical multiple regression models 3 and 4 confirmed that engagement is a significant influencing variable. Conversely, presence, previously identified in studies as a key variable for the success likelihood of VR content in the market [23,24], did not exhibit statistical significance in this study. These findings suggest that while presence may offer enjoyment and an incentive to begin using VR content, it alone cannot induce sustained usage. Therefore, to foster continuous usage intention, the characteristics of the target group should be taken into account from the content development stage. This includes incorporating strategies that can continually enhance engagement, such as entertainment and interest.

As HMD-related factors, cyber sickness and physical discomfort showed significant negative weak correlations with the continuous usage intention of HMD-based VR content, with an explanatory power of only 2.5%. The physical adverse effects of HMD, such as cyber sickness, act as a major deterrent to the use of HMD-based VR [8]. The low incidence of cyber sickness reported in this study may be due to the fact that the questionnaire was not administered immediately following HMD use. Cyber sickness is a critical issue that needs to be addressed to encourage more active VR use [2,6]. It was also identified as a significant influencing variable in the hierarchical multiple regression analysis of model 4. Therefore, when considering continuous usage intention, it's important to take into account the characteristics of the target group, such as their health status and age, from the content development stage. This allows for the adjustment of factors that could induce cyber sickness, including movement, graphics, and the visual appeal of content. Implementing restrictions on content usage time and device application methods may also be beneficial.

This study had the following limitations. First, the continuous usage intention of HMD-based VR content in the healthcare field was assessed by examining basic variables such as self-efficacy, innovative propensity, and social support, due to a lack of prior studies related to VR content in healthcare. As such, further investigation into associations with various health-related variables and influencing factors is necessary. Second, the participants ranged in age from 10 to 39 years, with more than half being male, and only 3.2% having experience using healthcare VR content. This limits the generalizability of the findings to groups who are not familiar with this technology. In future studies, the distribution of age and experience with healthcare VR content should be taken into account when selecting participants. Studies that include a broader age range and focus on healthcare VR content use will provide more specific insights into maintaining usage intention for health promotion.

Nevertheless, this study explored the continuous usage intention of healthcare content by examining personal cognition, social, VR content, and HMD-related factors. In conclusion, this study found that participants who had experience with healthcare content scored higher in areas of personal cognition, social aspects, and VR content compared to those without such experience. Interestingly, they scored lower in HMD-related factors. Therefore, to effectively employ HMD-based VR content in health education, it would be beneficial to simplify the content for ease of use and provide comprehensive instructions on how to use it. From a social standpoint, crafting expert guidance on content usage and promoting its continued use could prove beneficial. In terms of VR content, creating and supplying engaging and captivating strategies that take into account user characteristics could be advantageous. Regarding HMDs, it would be prudent to preemptively test for factors that could potentially lead to physical side effects such as cyber sickness. Developing content that considers performance, graphics, and usage time that could trigger such adverse effects is also recommended. Furthermore, it would be essential to devise strategies to address any issues that may arise.

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## Conflict of interest

The authors declared no conflict of interest.

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## Data availability

Please contact the corresponding author for data availability.

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# 조기진통 사정 알고리즘은 실습 시 조기진통 관련 지식, 임상수행자신감, 교육만족도에 유효한가?: 유사실험 연구

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## Does a preterm labor-assessment algorithm improve preterm labor-related knowledge, clinical practice confidence, and educational satisfaction?: a quasi-experimental study

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**Purpose:** Preterm birth is increasing, and obstetric nurses should have the competency to provide timely care. Therefore, training is necessary in the maternal nursing practicum. This study aimed to investigate the effects of practice education using a preterm-labor assessment algorithm on preterm labor-related knowledge and clinical practice confidence in senior nursing students.

**Methods:** A pre-post quasi-experimental design with three groups was used for 61 students. The preterm-labor assessment algorithm was modified into three modules from the preterm-labor assessment algorithm by March of Dimes. We evaluated preterm labor-related knowledge, clinical practice confidence, and educational satisfaction. Data were analyzed with the paired t-test and repeated-measures analysis of variance.

**Results:** The practice education using a preterm-labor assessment algorithm significantly improved both preterm labor-related knowledge and clinical practice confidence (paired  $t=-7.17$ ,  $p<.001$ ; paired  $t=-5.51$ ,  $p<.001$ , respectively). The effects of the practice education using a preterm-labor assessment algorithm on knowledge lasted until 8 weeks but decreased significantly at 11 and 13 weeks after the program, while the clinical practice confidence significantly decreased at 8 weeks post-program.

**Conclusion:** The practice education using a preterm-labor assessment algorithm was effective in improving preterm labor-related knowledge and clinical practice confidence. The findings suggest that follow-up education should be conducted at 8 weeks, or as soon as possible thereafter, to maintain knowledge and clinical confidence, and the effects should be evaluated.

**Keywords:** Algorithms; Clinical competence; Knowledge; Premature obstetric labor

**주요어:** 알고리즘; 임상수행; 지식; 조기진통

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## Summary statement

### • What is already known about this topic?

Preterm birth is increasing, and obstetric nurses need to have the competency to provide timely care. There are many simulation-based programs for maternal practicum, but programs applying preterm labor assessment algorithms in the maternal nursing practicum are rare.

### • What this paper adds

The practice education using a preterm-labor assessment algorithm was effective in improving preterm labor-related knowledge and clinical practice confidence.

### • Implications for practice, education, and/or policy

This practice education using a preterm-labor assessment algorithm can be applied to maternal practicum education. We recommend follow-up education at 8 weeks to maintain knowledge and clinical confidence. Further research also needs to evaluate the lasting effect of one-time education and repeated education programs.

## Introduction

임상간호 실습교육은 임상현장에서 일하게 될 간호학생의 대처능력 및 비판적 사고능력과 임상수행능력을 향상시키며[1], 이론 지식을 실무에 적용할 수 있도록 훈련하는 중요한 교과과정이다. 그러나 임상실습지인 병원은 환자의 안전 및 권리를 우선하므로, 간호학생이 환자에게 직접 간호를 수행하는 것을 제한하는 경우가 많이 있다[2]. 이에 따라 간호대학에서는 임상에서 직접 환자에게 적용하기 어려운 술기나 집중적인 훈련이 필요한 사례들을 중심으로 시뮬레이션 실습교육을 하고 있다[3].

분만실 실습이 어려운 상황에서[4] 고위험 임신부 관리를 위한 집중치료실(maternal-fetal intensive care unit, MFICU)이 마련된 점은 바람직한 방향이지만, 임신부의 중증도가 높아 간호학생은 대상자를 만나는 것조차 어렵다. 고위험 임신 합병증 중 조기진통은 임신 34~36주는 중증도, 임신 34주 미만은 중증으로 분류되며 37주 미만의 조산은 고위험 분만에 해당되는데, 모자보건 의료 종사자들은 고위험 임신부를 잘 찾아내는 것이 중요하다[5].

조기진통 임부를 구별해내기 위해서는, 임신 37주 이전이면서 자궁경부의 개대와 소실을 동반하고 규칙적인 자궁 수축, 생리통 같은 통증, 질 분비물의 증가, 골반 압박감 등의 증상[6]이 있는지 평가할 필요가 있다. 또한, 자궁 수축보다 자궁경부의 변화가 먼저 일어나거나[7], 자궁경부 변화 없이 자궁 수축만 계속되는 조기진통도 있을 수 있으므로[8], 분만실 간호사는 정상 임부의 증상과는 다른 조기진통 임부가 보이는 증상을 구별하기 위한 건강 사정을 해야 한다. 그리고 산과 의사에게 즉각적인 보고가 필요한 조산위험 상황인지 혹은 추가적인 검사가 이루어져야 할 상황인지에 따라 체계적으로 수행하여야 한다[9,10].

분만실 간호사가 체계적인 수행을 하기 위해서는 자궁경관 개대 정도와 자궁경관 길이 및 조기 양막 파수 여부에 따른 임상적 결정

을 할 수 있는 훈련[11]이 필요하며, 이는 간호학생 때부터 실습교육에서 다룰 필요가 있다. 분만실 간호사들이 조산위험 여부에 대한 임상적 의사결정을 내리는 데 도움이 되는 가이드라인으로 조기진통 사정 도구(Preterm Labor Assessment Toolkit, PLAT)가 있다. 이는 의료의 질 향상과 임상적 의사결정을 위해 질병과 증상 관리 과정을 시각화한 임상 가이드라인으로[11], 신속한 의사결정이 이루어지도록 지원할 수 있어[12] 임상경험이 적은 간호사에게 유용하다[13]. 그러므로 아직 임상경험이 적고 고위험인 조기진통 임부를 간호한 경험이 거의 없는 간호학생들에게도 도움이 될 것으로 예상되나, 임상에서 직접 적용하기는 어려우므로 시뮬레이션 실습에서 PLAT를 적용하여 조기진통 관리를 숙련할 필요가 있다.

한편 간호학생을 위한 분만 관련 시뮬레이션 교육은 임상적 의사결정을 돕는 구체적인 지침보다는 정상분만 과정 및 산욕기 간호 모델로서 팀 기반 학습을 적용한 시뮬레이션 교육[14], 정상분만 간호에 대한 이론 교육 후 3주 뒤 시나리오와 표준화 환자를 활용한 시뮬레이션 교육[15]들이다. 이론 교육에서 분만 과정을 배우지만, 자궁경부 개대 3 cm 이상 여부, 자궁경관 길이 20 mm 미만 여부, 태아 섬유결합소(fetal fibronectin, fFN) 양성 여부와 같은 요소를 포함하여 임상적 의사결정을 하는 알고리즘 교육은 찾아 보기 어렵다.

MFICU 간호사 역량강화 교육 프로그램을 운영해온 Kim [16]은 PLAT에 제시된 조기진통 사정 알고리즘을 국내에 발표한 후, MFICU 간호사를 위한 교육자료로 사용해 왔다[17]. 조기진통 위험 사정을 통해 적시에 필요한 중재를 하기 위해서는 ‘자궁경부 개대 3 cm 이상’, ‘fFN 양성’, ‘20 mm 미만의 짧은 자궁경관 길이’의 기준[11]을 명확히 알고 이 알고리즘에 따른 관리를 하는 훈련이 필요하다. 특히 MFICU 실습의 기회를 갖지 못하는 간호학생들에게는 조기진통을 사정하는 알고리즘 교육이 유익할 것으로 생각된다. 그러므로 먼저 알고리즘을 적용한 단기간의 실습교육이 조기진통 관련 지식과 임상수행자신감 향상에 기여하는지 살펴볼 필요가 있

다. 또한, 단기교육의 지속 효과는 4주 혹은 8주로 보고되고 있어 [18,19] 본 연구에서도 알고리즘을 적용한 실습교육의 지속 효과를 함께 평가할 필요가 있다.

이에 본 연구에서는 조기진통의 발생기전 및 임상증상과 조기진통 사정 알고리즘에 대한 교육을 제공하고 이를 통합 수준의 시뮬레이션 실습교육에 적용함으로써(이하 조기진통 알고리즘 적용 실습이라고 함) 간호학생의 조기진통 관련 지식과 임상수행자신감에 미치는 효과를 평가하고자 하며, 구체적인 연구목적은 다음과 같다.

첫째, 조기진통 알고리즘 적용이 조기진통 관련 지식과 임상수행자신감에 미치는 단기 효과를 비교한다.

둘째, 조기진통 알고리즘 적용이 조기진통 관련 지식과 임상수행자신감에 미치는 지속 효과를 비교한다.

셋째, 조기진통 알고리즘 적용 실습교육에 대한 교육 만족도를 평가한다.

## Methods

**Ethics statement:** This study was conducted as part of clinical practicum and was exempted from the Institutional Review Board of Soonchunhyang University (No. 202106-SB-062-02). All procedures adhered to the principles of the Declaration of Helsinki.

### 연구 설계

본 연구는 조기진통 알고리즘 적용 실습의 단기 효과와 지속 효과를 파악하기 위한 사전-사후 유사실험 연구(pre-post quasi-experimental design)이다. 본 연구는 Table 1과 같이 정해진 실습 스케줄에 따른 통상적인 교육과정에 의해 설정된 3개 그룹에 조기진통 알고리즘 중재 처치를 제공하고 사전조사와 사후조사를 각 3회씩 실시하였다. 교육의 지속 효과 평가 시기는 기존 시뮬레이션 교육 효과 연구에서 8주에 실시한 설계[18,19]를 참고하여, 본 연구에서는 그룹 3이 교육 후 8주가 되는 시점에서 2차 사후조사를 실시하였다.

### 연구 절차

실험군인 그룹 1, 2, 3은 2021년 9월 1일부터 10월 7일까지 7주(추석연휴 주간 미운영) 사이에 각 그룹당 2일, 그룹은 2주 간격을 두고 순차적으로 통합실습 실습 일정에 따라 진행하였다. 실습 전 시

점(T0)에 사전조사(Y1, Y2), 실습 후 시점(T1)에 사후조사(Y3, Y4, Y7)가 이루어졌다. 알고리즘 적용 실습교육 효과의 지속성 평가를 위한 2차 사후조사(Y5, Y6)는 그룹 3이 실습을 종료한 후 8주차가 되는 시점(T2)인 2021년 12월 2일에 실시하였다. 자료 수집 방법은 온라인 Google 설문 양식을 통해 진행하였으며 소요시간은 약 20분 정도이다(Table 1).

### 연구 대상

본 연구의 대상은 간호학과 4학년 1학기에 여성건강간호학 이론 수업과 임상실습(분만실 혹은 산부인과 병동)을 마친 학생으로서, 연구 당시 4학년 2학기 재학 중이며, 동일 학기에 '통합실습 2' 교과목에서 1가지 모듈을 2주 간격으로 실시하는 4가지 모듈 중 하나로서, 32주 5일 임부여성의 임상증상 표현 '배가 조여요' 모듈을 수행하는 학생이다. 통상적인 교육의 일환으로 진행하기 때문에 4학년 학생 전원(63명)을 대상으로 하였다. 평가 당일 COVID-19 확진으로 2명이 제외되어 최종 연구 대상자는 61명이 되었다. 이는 G-power 3.1.9.7 for Windows 프로그램을 활용, 효과 크기( $d$ )=0.4, 유의수준( $\alpha$ )=0.05, 검정력( $1-\beta$ )=.80으로 산출된 표본 수는 52명과 탈락률 10%를 고려한 표본 수 58명을 충족했다. 실습 조 편성 및 일정은 실습교육 코디네이터에 의해 작성되었으며, 4가지 모듈 실습 중 분만 모듈은 3개조로 편성하였고 조별 대상자 수는 Table 1과 같다.

### 연구 도구

#### 조기진통 관련 지식

본 연구에서는 여성건강간호학 교재[6]를 바탕으로 조기진통 산모 간호 시 필수적인 핵심지식을 평가하기 위해 정상분만과 차별화되는 조기진통의 사정 및 간호에 관한 지식을 설문 문항으로 작성하였다. 이는 2021년 고위험 MFICU 간호사 보수교육에서 참석자들의 지식 변화를 알아보기 위해 개발된 20문항에 대해, 조기진통이나 조산과 관련된 문항으로 적합한지 여성건강간호학 교수 7인에게 도구의 내용 타당도를 검토받았다. 6-10인의 전문가일 경우 내용타당도 지수(content validity index) .78 이상이 권장되어[20], 본 연구에서는 .80 이상인 15문항을 선정하였다. 각 문항에 대하여 정답은 1점, 오답은 0점으로 처리하였고 점수(가능 범위, 0-15)가 높을수록 지식 점수가 높은 것을 의미하며, 본 연구에서 KR-20 신뢰도는 .78로 나타났다.

Table 1. Study design and process

Experimental group	Pretest (T0)	Intervention	Posttest (T1)	2nd posttest (T2)
Group 1 (n = 22)	Y1, Y2	X	Y3, Y4, Y7	Y5, Y6 (13th week after posttest)
Group 2 (n = 20)	Y1, Y2	X	Y3, Y4, Y7	Y5, Y6 (11th week after posttest)
Group 3 (n = 19)	Y1, Y2	X	Y3, Y4, Y7	Y5, Y6 (8th week after posttest)

Y1, Y3, Y5: preterm labor-related knowledge; Y2, Y4, Y6: clinical practice confidence; Y7: educational satisfaction.

### 임상수행자신감

본 연구에서 임상수행자신감은 간호사를 대상으로 개발된 자가보고형 임상수행능력 평가도구인 6영역 척도(six-dimension scale) [21]를 간호대학생에게 적용한 도구[22]의 문항 중 본 연구에 맞지 않았던 문항을 수정하였고, 개발자와 변안자에게 모두 사용 승인을 받았다. 수정한 이유는 기존 문항에서 간호 대상 및 간호수행과 관련된 내용이 명확하게 기술되어 있지 않고 모호하였기 때문이다. 본 연구에서 수정한 사항은 간호 대상에 환자, 가족을 포함하고 간호수행 내용에 활력징후의 정확한 항목들, 투약 시 5 right, 간호 문제를 추가하였다. 도구의 문항 수는 변경없이 원래의 도구에서 정한 바와 같이 간호과정 5문항, 간호 술기 5문항, 교육 및 협력 5문항 총 15문항이며, '매우 못한다' 1점에서 '매우 잘한다' 5점으로, 점수(가능 범위, 15-75)가 높을수록 임상수행자신감이 높음을 의미한다. 기존 연구의 Cronbach's  $\alpha$ 는 .94 [22]이었고, 본 연구에서도 Cronbach's  $\alpha$ 가 .94로 나타났다.

### 교육 만족도

본 연구에서 조기진통 알고리즘 시뮬레이션 실습교육에 대한 만족도 조사는 Song과 Hong [23]이 개발한 역할극을 통한 임상교육 만족도를 수정한 10문항으로 측정하였다. 수정된 부분은 문항의 주어를 '의사-환자 역할극'에서 '조기진통 증상 분류를 이용한 시뮬레이션 수업'으로 변경하였고, 간호대학생을 대상으로 조사하기 위해 '진단능력 향상', '비내시경 기술 향상', '면담능력 향상' 등의 문항을 제외한 총 10문항으로 구성하였다. 5점 Likert 척도로 '전혀 그렇지 않다' 1점, '매우 그렇다' 5점으로 측정하여 점수(가능 범위, 10-50)가 높을수록 조기진통 알고리즘 시뮬레이션 실습교육 만족도가 높음을 의미한다. 도구 개발 당시 신뢰도는 Cronbach's  $\alpha$  .88, 본 연구에서는 Cronbach's  $\alpha$  .96이었다.

### 연구 중재: 조기진통 사정 알고리즘 교육과 적용

#### 조기진통 사정 알고리즘 교육자료 내용 확정

조기진통 사정 알고리즘 교육자료는 PLAT에 포함된 조기진통 분류 알고리즘[11]을 본 연구자가 한국어로 번역·수정한 후 여성건강간호학 교과목을 20년 이상 담당해온 교수의 감수를 받았다. 양막 파수를 확인할 수 있는 임상적 진단 방법 중 의료기관별로 시행 여부가 달라지는 검사인 Ferning, Amnisure와 그 외 배양검사인 group B streptococcus culture, bacterial vaginosis screen 등은 제외하였다. 간호대학생의 수준에서 학습 및 적용 가능하도록 '임부와 태아 상태를 조산사 또는 담당의에게 알린다'는 내용은 '담당의에게 알린다'로 수정하였다.

#### 조기진통 알고리즘 적용을 위한 교육과 훈련

전체적인 교육 흐름 및 시간은 Supplementary Table 1과 같이 이루어졌다.

#### (1) 교육 내용과 교육 방법

각 그룹은 평가일 전날 오후 3시부터 '조기진통 알고리즘 적용을 위한 교육'을 받았다. 교육 내용은 PLAT의 내용을 이해할 수 있도록 조기진통의 정의, 조산 위험성 사정의 필요성, fFN 양성 의미와 해석, 자궁경부 길이를 측정하는 의미와 해석, 무자극검사(non-stress test) 결과 해석에 따른 조기진통 사정 알고리즘, 알고리즘에 따른 조산 위험성에 대한 임상적 판단, 조산 위험성 분류에 따른 투약, 산소 투여 등의 중재로 구성되었다.

이 때 조산 위험성은 PLAT에 제시된 기준을 따라 임부가 호소하는 임상증상, 양막 파수 여부, 자궁경부 개대 정도, fFN 검사 결과, 자궁경관 길이를 통해 임상적 판단을 하게 되는데, 다음과 같이 고위험(high risk), 불분명(equivocal), 저위험(low risk)으로 나뉜다. 이를 바탕으로 예시 자료를 이용하여 32주 5일인 임신 여성의 세 가지 임상 상황별로 판단할 사항과 판단하는 근거를 교육하였다. COVID-19 범유행 상황이었어서 평가일 전날 시청각 자료(Power Point)를 활용하여 온라인(Zoom)을 통해 교육을 제공하였다(Supplementary Table 1).

#### • 상황 ① 자궁경부 3 cm 개대

→ 평가: 다른 조건과 관계없이 경부 개대가 3 cm 이상이면 고위험으로 판정

#### • 상황 ② 자궁경부 1 cm 개대, 자궁경관 길이 19 mm

→ 평가: 경관 길이가 20 mm 미만이므로 경부 개대가 3 cm 미만 일지라도 고위험으로 판정

#### • 상황 ③ 자궁경부 1 cm 개대, 자궁경관 길이 22 mm, fFN (+)

→ 평가: 경부 개대가 2 cm 미만이고 자궁경관 길이가 20 mm 이상이므로 불분명으로 판단하여 경과 관찰을 함. fFN (+) 결과는 1주일 이내 분만 예측의 참조치에 해당

(※경부 개대 2 cm 이상이고 fFN (+)이면 다른 조건과 관계없이 고위험으로 분류)

#### (2) 알고리즘 기반 시나리오 작성

실습 학생들은 교육받은 조기진통에 대한 이론 교육과 세 가지 상황별 알고리즘을 반영하여 시나리오와 간호계획을 작성하였다. 시나리오는 사전에 공지한 조별로 소그룹 방에서 90분간 토의하며 작성하도록 하였다. 시나리오 작성 후 시나리오를 제출하도록 하였고 연구자와 공동 연구자 2명이 시나리오의 적절성 여부를 검토하여 피드백을 제공하였다.

#### (3) 알고리즘 적용 연습

실습 학생들은 알고리즘 기반 시나리오를 바탕으로 상황별 판단을 적용하는 훈련을 하였다. 알고리즘 적용에 필요한 술기로 질 내진과 양수파막검사(pH paper [UNIV pH 1-11] for nitrazine test)를 환자 시뮬레이터인 SimMom 3G (Laerdal, Stavanger, Norway)를 대상으로 연습하였다. 두 가지 검사 모두 알고리즘을 통해 검사할

목과 결과를 연결해 보기 위한 목적으로 실시하였으며, 학생들이 작성한 조기진통 관리 알고리즘에 관한 조별 역할극을 간호사 1과 간호사 2의 2인 1조로, 1개 조 당 30분씩 진행하였다.

#### (4) 알고리즘 적용 실습(Supplementary Figure 1-4)

알고리즘 적용은 SimMom 3G, 표준화 환자, 지속적인 모니터링이 이뤄지는 분만 시뮬레이션 환경에서 이루어졌다. 양수파막검사는 간호학생의 “아래로 흐르는 느낌이 있나요?”라는 질문에 표준화 환자는 “그런 느낌이 없어요”로 답하도록 하였다. SimMom 3G는 상황별 임부의 심박수, 호흡 횟수, SpO<sub>2</sub>, 태아 심박수, 자궁 수축 곡선과 자궁 수축 시 자궁 내 압력 등의 변화 값을 지속적으로 모니터링하는 기기로 사용하였고, 표준화 환자는 사전에 평가 대본을 숙지하도록 하였으며 평가 당일 아침에 훈련 대본을 보면서 특정 시점에서 증상을 호소하거나 간호학생에게 질문하도록 하였다. 세 가지 상황을 반영한 3개의 코팅 카드를 가지고 실습 학생이 내진 행위를 수행하면 3가지 상황 중 하나의 상황에 맞는 자궁경부 개대 정도와 경관 길이를 알려주었다. 이 때 세 가지 상황에 따라 그 범위 안에 있는 기준으로 연구자와 공동 연구자 2명이 정보를 제공하면 학생들은 그 정보에 맞는 알고리즘의 임상경로를 따라 필요한 행위를 하도록 훈련하였다.

간호학생들은 모니터에 나타난 자궁 수축 시 자궁 내 압력과 표준화 환자의 진통 사정을 통한 자궁 수축 특성을 통합하여 담당교수에게 보고하면, 교수는 세 가지 임상 상황별 지시사항을 알리고 필요한 처치를 하도록 하였다. 고위험일 경우 자궁 수축 억제제 투여를 지시하였고, 이 약물의 부작용으로 고혈당을 의심하여 혈당검사를 하면 교수가 혈당 수치를 불러주었으며, SPO<sub>2</sub>가 90% 미만으로 떨어지는 경우에는 산소 투여 등의 과정이 이루어지도록 진행하였다. 고위험을 판단하기에 자궁 수축 특성이 불분명할 경우 계속 관찰한 후 다시 알고리즘 적용 상황이 발생하는지 판단하고 사정을 반복하도록 하였다. 알고리즘 적용 실습이 끝난 학생은 녹화된 본인의 영상을 확인하도록 하였다.

#### (5) 디브리핑(Debriefing)

전체 알고리즘 적용 실습이 끝난 후 해당 그룹의 실습학생, 표준화 환자, 연구자, 공동 연구자가 함께 알고리즘 적용 실습에서 느낀

점에 대해 의견을 나누었으며 수행 과정을 분석하고 성찰하는 시간을 가졌다. 디브리핑에 활용한 성찰일지 문항은 ‘알고리즘 적용에서 어려운 점은 무엇이었나요?’와 ‘시뮬레이션 실습이 끝난 후 알고리즘이 어떻게 도움이 되었나요?’의 총 2문항으로 학생들이 자유롭게 기술하도록 하였다. 표준화 환자는 서울-경기 Clinical Performance Examination 컨소시엄에서 활동 중이며 3년 동안 참여해오고 있는 출산 경험이 있는 여성으로, 2주 전에 상황, 시나리오 흐름도가 포함된 표준화 환자 훈련 대본을 제공하였고 실습 당일 추가적으로 회의를 하여 반응과 표현을 숙지하고 있었다. 표준화 환자는 디브리핑에도 참여하여 개선방향을 설명하여 주었다.

#### 자료 분석 방법

본 연구에서 수집된 자료는 IBM SPSS ver. 26.0 (IBM Corp., Armonk, NY, USA)을 이용하여 분석하였다.

- 1) 연구 대상자의 일반적 특성과 교육 만족도는 빈도, 백분율, 평균 및 표준편차로 파악하였다.
- 2) 조기진통 알고리즘 적용 실습 전후 조기진통 관련 지식과 임상수행자신감의 변화, 실습 종료 후 교육 효과는 대응표본 t검정 (paired t-test), 그룹 간 비교는 분산분석(analysis of variance, ANOVA), 알고리즘 적용 실습교육의 지속 효과는 반복 측정(repeated-measures) ANOVA로 분석하였다.

## Results

#### 대상자의 일반적 특성

본 연구에 참여한 대상자의 평균 연령은 23.6 ( $\pm 2.53$ )세로 25세 이하 47명(77.0%), 26세 이상 14명(23.0%)이었다. 대상자 중 여학생은 58명(95.1%), 남학생은 3명(4.9%)이었다. ‘간호과정과 비판적사고’ 교과목 성적은 평균 85.0 ( $\pm 7.45$ )점, 4학년 1학기 여성건강간호학 1 성적은 평균 87.0 ( $\pm 7.35$ )점이었다. 1학기 동안 분만실 실습은 33명(54.1%), 산부인과 실습은 28명(45.9%)이었다.

#### 조기진통 알고리즘 적용 실습의 단기 효과

##### 조기진통 관련 지식

조기진통 알고리즘 적용 실습교육이 조기진통 관련 지식에 미친 단

**Table 2.** Changes in preterm labor-related knowledge over time (N=61)

Group	Mean $\pm$ SD		Paired t	p
	Pretest (T0)	Posttest 1 (T1)		
Total	9.97 $\pm$ 1.80	12.16 $\pm$ 1.74	-7.17	<.001
Group 1 (n = 22)	9.59 $\pm$ 1.68	12.36 $\pm$ 2.17	-4.77	<.001
Group 2 (n = 20)	10.05 $\pm$ 1.61	11.85 $\pm$ 1.42	-4.10	<.001
Group 3 (n = 19)	10.32 $\pm$ 2.11	12.26 $\pm$ 1.52	-3.55	.002
F (p)	0.86 (.430)	0.49 (.615)		

기 효과를 파악하기 위해 T0에서 세 그룹의 동질성을 평가한 결과, 유의한 차이가 없어( $F=0.86$ ,  $p=.430$ ) T0 시점에서 세 그룹의 동질성이 확인되었다. 전체 대상자의 교육 전과 후의 조기진통 관련 지식의 평균점수는 T0 시점( $9.97 \pm 1.80$ )보다 T1 시점( $12.16 \pm 1.74$ )에서 통계적으로 유의하게 증가하였다( $t=-7.17$ ,  $p<.001$ ). 또한, 각 그룹별 실습교육 전후 차이를 살펴본 결과, 그룹 1 ( $t=-4.77$ ,  $p<.001$ ), 그룹 2 ( $t=-4.10$ ,  $p<.001$ ), 그룹 3 ( $t=-3.55$ ,  $p=.002$ ) 모두 지식 점수가 유의하게 상승하였다(Table 2).

#### 임상수행자신감

조기진통 알고리즘 적용 실습교육이 임상수행자신감에 미친 효과를 파악하기 위해 T0에서 세 그룹의 동질성을 평가한 결과, 유의한 차이가 없어 세 그룹의 동질성이 확인되었다( $F=0.83$ ,  $p=.441$ ). 전체 대상자의 교육 전후 임상수행자신감의 평균점수는 T0 시점( $52.70 \pm 6.87$ )보다 T1 시점( $59.77 \pm 7.59$ )에서 통계적으로 유의하게 증가하였다( $t=-5.51$ ,  $p<.001$ ). 또한, 각 그룹별 실습교육 전후 차이를 살펴본 결과, 그룹 1 ( $t=-3.42$ ,  $p=.003$ ), 그룹 2 ( $t=-2.32$ ,  $p=.032$ ), 그룹 3 ( $t=-3.88$ ,  $p=.001$ ) 모두 임상수행자신감이 유의

하게 상승하였다(Table 3).

#### 조기진통 알고리즘 적용 실습교육의 지속 효과

조기진통 알고리즘 적용 실습의 지속 효과는 마지막 그룹 3의 실습교육이 끝나고 8주차가 되는 시점(그룹 2: 11주째, 그룹 1: 13주째)에서 전체 실습학생을 대상으로 이루어졌으며 그 결과는 Figure 1과 같다.

#### 조기진통 관련 지식

조기진통 관련 지식에 있어 시간 경과에 따른 알고리즘 실습교육의 지속 효과를 반복 측정 ANOVA로 살펴본 결과, 각 시점에서 세 그룹 간 유의한 차이가 없었으나 세 그룹 각각의 평균점수는 유의하게 증가하였다( $F=11.64$ ,  $p=.001$ ). Bonferroni 사후검정 결과 조기진통 관련 지식 점수는 T0 시점보다 T1 시점에서 유의하게 높았고, T0 시점보다 T2 시점의 지식 점수가 유의하게 높았다. 그러나, T1 보다는 T2 시점에서 지식이 유의하게 감소하였다(Table 4). 그룹별로 T1, T2 시점의 조기진통 관련 지식의 평균점수를 비교한 결과, 그룹 3은 실습교육 8주째인 T2 시점의 평균점수와 T1 시점의 평균

Table 3. Changes in clinical practice confidence over time (N=61)

Group	Mean $\pm$ SD		Paired t	p
	Pretest (T0)	Posttest 1 (T1)		
Total	52.70 $\pm$ 6.87	59.77 $\pm$ 7.59	-5.51	<.001
Group 1 (n=22)	51.36 $\pm$ 6.89	58.55 $\pm$ 8.05	-3.42	.003
Group 2 (n=20)	54.10 $\pm$ 7.57	59.90 $\pm$ 7.47	-2.32	.032
Group 3 (n=19)	52.79 $\pm$ 6.07	61.05 $\pm$ 7.36	-3.88	.001
F (p)	0.83 (.441)	0.55 (.579)		

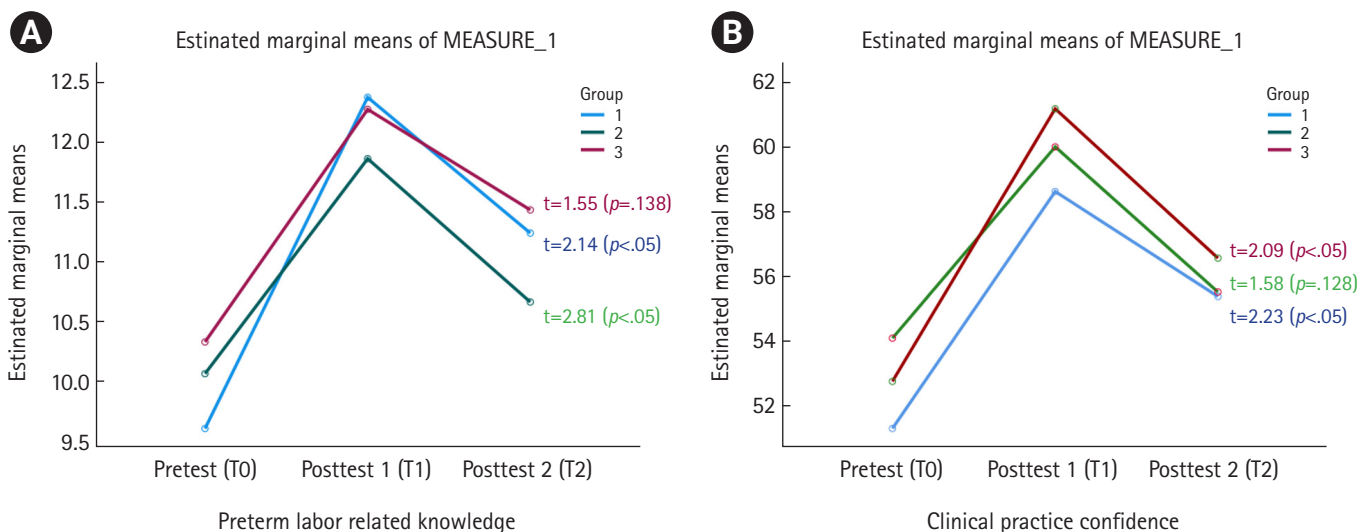


Figure 1. Changes in three groups over time (t-value: T1-T2 difference). (A) Preterm labor-related knowledge. (B) Clinical practice confidence.

**Table 4.** Repeated-measures ANOVA for preterm labor related knowledge and clinical practice confidence (N=61)

Variable	Time	Mean $\pm$ SD	Sum of squares	F (p)	Bonferroni
Knowledge	T0	9.99 $\pm$ 0.23 <sup>a</sup>	37.70	11.64 (.001)	a < b, a < c, b > c
	T1	12.16 $\pm$ 0.23 <sup>b</sup>			
	T2	11.10 $\pm$ 0.25 <sup>c</sup>			
Confidence	T0	52.70 $\pm$ 6.87 <sup>d</sup>	281.87	19.45 (<.001)	d < e, d < f, e > f
	T1	59.77 $\pm$ 7.59 <sup>e</sup>			
	T2	55.77 $\pm$ 7.00 <sup>f</sup>			

ANOVA: analysis of variance; CI: confidence interval.

점수 사이에 유의한 차이가 없었다( $t=1.55$ ,  $p=.138$ ). 그룹 2는 교육 후 11주째인 T2 시점의 평균점수가 T1 시점보다 유의하게 감소하였고( $t=2.81$ ,  $p<.05$ ), 그룹 1은 교육 후 13주째인 T2 시점의 평균점수가 T1 시점보다 유의하게 감소하였다( $t=2.14$ ,  $p<.05$ ) (Figure 1A).

#### 임상수행자신감

임상수행자신감에 있어 시간 경과에 따른 알고리즘 실습교육의 지속 효과를 반복 측정 ANOVA로 살펴본 결과, 각 시점에서 세 그룹 간 유의한 차이가 없었으나 세 그룹의 각각의 평균점수는 유의하게 증가하였다( $F=19.45$ ,  $p<.001$ ). Bonferroni 사후검정 결과 임상수행자신감은 T0 시점보다 T1 시점에 유의하게 높았고, T0 시점보다 T2 시점 점수가 유의하게 높게 나타났다. 그러나 T2시점의 임상수행자신감은 T1 시점보다 유의하게 감소하였다(Table 4). 그룹별로 T1, T2 시점의 임상수행자신감의 평균점수를 비교한 결과, 그룹 3은 교육 후 8주째인 T2 시점의 평균점수가 T1 시점보다 유의하게 감소하였다( $t=2.09$ ,  $p<.05$ ). 그룹 2는 교육 후 11주째인 T2 시점의 평균점수가 T1 시점보다 유의하게 감소하였고( $t=2.23$ ,  $p<.05$ ). 그룹 1은 교육 후 13주째인 T2 시점의 평균점수가 T1 시점과 비교하여 감소 경향을 보였으나  $p<.05$ 수준에서는 유의하지 않았다( $t=1.58$ ,  $p=.128$ ) (Figure 1B).

#### 조기진통 알고리즘 적용 실습교육 만족도

실습학생의 모두 4학년 2학기 재학생으로, 조기진통 알고리즘 적용 시뮬레이션 실습교육 만족도는 실습 직후에 평균 45.30 ( $\pm 5.35$ )점으로 전체적인 만족도가 높았다. 세부 문항별로 살펴보았을 때 ‘앞으로 후배들의 실습교육으로 조기진통 증상 분류를 이용한 시뮬레이션 수업을 하는 것에 찬성한다.’가 최고점이었고(4.62 $\pm$ 0.61), ‘조기진통 증상 분류를 이용한 시뮬레이션 수업을 통하여 조기진통 산모 간호에 자신감을 얻었다.’가 최하점(4.21)으로 모든 문항에서 4점 이상으로 나타났다(Supplementary Table 2).

## Discussion

본 연구는 PLAT의 조기진통 사정 알고리즘을 적용한 후 조기진통 관련 지식과 임상수행자신감에 미치는 단기 효과와 교육 프로그램의 지속 효과 및 교육 만족도를 평가하였다. 이에 본 연구 결과를 바탕으로 조기진통 알고리즘 적용 실습의 효과에 대하여 논하고자 한다.

먼저 본 연구 결과 조기진통 알고리즘 적용 실습은 실습 전과 비교하였을 때 실습 직후 조기진통 관련 지식, 임상수행자신감을 유의하게 향상시켰다. 이는 프로토콜을 기반으로 한 알고리즘이 지식을 향상시킨다는 연구[24], 알고리즘 기반 교육 프로그램이 간호사의 지식 향상에 효과가 있다는 연구[25]와 시뮬레이션 실습교육 후 지식이 향상되었다는 연구[26]와 맥을 같이 하는 결과라고 평가할 수 있다. 또한 본 연구에서 교육 후 임상수행자신감이 향상된 결과는, 알고리즘 기반의 상부 위장관 출혈 간호 시나리오를 간호대학생을 대상으로 시뮬레이션 교육 후 간호수행자신감, 만족도가 향상되었다는 연구 결과[27]와 유사하였다. 간호 제공자마다 일관성이 있으며, 정확하고 시기 적절한 간호중재를 제공할 수 있는 알고리즘이 임상 판단력을 향상시키고[28], 임상 판단력이 높을수록 간호수행자신감이 향상된다는[29] 연구들을 지지하는 결과이다. 본 연구에서도 임신 37주의 의미가 조산을 결정하는 기준이라는 점, 임신 37주가 되지 않은 임부에서 자궁경관 3 cm 개대는 3 cm 미만과 달리 다른 어떤 조건과 관계없이 조산으로 진행될 고위험 분만 상황이라는 점, fFN 검사 결과 양성인 조기진통이 일어날 가능성이 높고 조산으로 이어질 수 있는 결과라는 알고리즘을 미리 익히고, 유사한 상황에서 그 알고리즘을 적용하는 실습을 통해 임상 판단력과 임상수행자신감을 향상하는 데 기여하였을 것으로 생각한다.

다음으로 조기진통 알고리즘 적용 실습교육의 조기진통 관련 지식의 지속 효과를 분석한 결과, 그룹 3 (알고리즘 적용 실습교육 후 8주째)에서만 교육 직후 점수와 비교하여 유의한 감소가 없는 것으로 나타나 교육 후 8주까지 교육 효과가 지속된 것으로 추정할 수 있다. 반면, 그룹 2 (알고리즘 적용 실습교육 후 11주째)와 그룹 1 (알고리즘 적용 실습교육 후 13주째)은 조기진통 관련 지식이 교육 직후와 비교하였을 때 통계적으로 유의하게 감소하였다. 그러나 세 그룹 모두 실습교육 전 지식 점수와 비교하여 유의한 감소가 없었

다. 즉 알고리즘 실습교육을 하는 것이 하지 않았을 때보다 짧게는 8주, 길게는 13주까지 지식에 주는 교육 효과가 지속된다고 보여진다. 알고리즘 교육의 지속 효과에 관한 선행연구가 거의 없어 간호 학생의 심폐소생술 교육의 지속성을 살펴보았다. 심폐소생술 교육 후 8주까지는 지식이 유지되었지만 6개월 후에 유의하게 감소하는 결과[30]에 비추어 볼 때, 교육 후 8-13주에 재교육이 필요할 것으로 보인다. 이는 간호사의 산후출혈 시뮬레이션 교육 효과가 9개월 후에 사전 결과와 비슷한 수준으로 감소하였다는 결과[31]와 비교할 때, 교육 대상자가 학생인가 간호사인가에 따라 다를 수 있다는 점, 기억해야 할 내용의 양, 해당 교육 외 결과에 영향을 줄 수 있는 요인들을 더 탐색하여 재검토할 필요가 있다.

한편, 임상수행자신감의 경우 본 연구에서는 그룹 3 (알고리즘 적용 실습교육 후 8주째)과 그룹 2 (알고리즘 적용 실습교육 후 11주째)에서 통계적으로 유의한 감소가 있었으나, 그룹 1 (알고리즘 적용 실습교육 후 13주째)은 감소 경향은 보였으나 유의하지는 않았다. 그러나 세 그룹 모두 실습교육 전보다는 유의한 감소가 없었다. 즉 알고리즘 실습교육을 하는 것이 하지 않았을 때보다 짧게는 8주, 길게는 13주까지 임상수행자신감에 미치는 교육 효과가 지속되는 것으로 보인다. 본 연구 결과는 수행자신감이 8주까지는 유지되었으나 6개월 후에 유의하게 감소한다는 결과[30]와 비교할 때 교육 후 13주-6개월 사이에 어느 시점에서 재교육이 필요할지에 대한 후속 연구가 필요하다. 아울러 임상수행자신감 향상에 기여하기 위해서는 표준화된 가이드라인과 프로토콜[25], 일관성이 있고 정확하며 시기 적절한 간호중재를 제공할 수 있는 알고리즘[28]이어야 한다는 점에서 추후 연구에서는 국내 전문가들과 함께 표준화된 알고리즘 프로토콜을 업데이트할 필요가 있다.

다음으로 본 연구에서 조기진통 알고리즘 시뮬레이션 실습교육 만족도는 평균 45.30점으로 비교적 높은 점수를 보였다. 이는 조산사의 주산기 시뮬레이션 교육의 만족도 평가에서 시뮬레이션 실습 후 임상추론 및 임상적 의사결정과 관련된 항목이 가장 낮았던 결과[32]와 비교할 때 임상적 의사결정을 돕는 알고리즘이 실습교육 만족도를 높일 수 있었다고 추정된다. 또한, 본 연구에서 만족도 세부 항목 중 '앞으로 후배들의 실습교육으로 조기진통 증상 분류를 이용한 시뮬레이션 수업을 하는 것에 찬성한다'가 4.62점으로 가장 높은 점수를 나타내어 조기진통 사정 알고리즘을 적용한 시뮬레이션 실습교육을 계속할 필요가 있을 것으로 생각한다.

본 연구에서는 간호대학생에게 처음으로 PLAT의 조기진통 사정 알고리즘을 적용하고 이 알고리즘 실습교육의 단기 효과와 지속 효과를 기술하였으나 다음과 같은 제한점이 있다. 첫째, 본 연구는 통상적인 교육과정 속에 이루어졌기 때문에 실습교육 적용 시기와 조사 시기 등을 무작위 실험설계로 진행하지 못한 간헐적 시계열 설계로서, 조기진통 사정 알고리즘의 교육 효과를 비교할 대조군이 없다는 제한점이 있다. 둘째, 본 연구에서는 3개조로 나누어 기간이 달랐던 점과 지속 효과를 평가하는 시기가 교육 후 8주차, 11주차,

13주차와 같이 일치하지 않았다. 이에 본 연구 결과는 시점별 해석에 주의를 기울일 필요가 있으며, 추후 연구에서는 이러한 제한점을 고려한 연구설계와 반복 연구를 제안한다. 또한 본 연구에서는 조기진통 임부의 임신 주수를 지정하였으나 조기진통 임부의 임신 주수의 변화를 부여하고 자궁경부 봉축술과 같은 조건을 포함한 알고리즘을 개발할 것을 제안한다. 한편 본 연구에서 효과크기  $d=0.4$ 를 채택하였으나  $d=0.25$  [30],  $d=0.5$  [2],  $d=0.6$  [25]과 같이 다양하여 연구설계와 효과크기 측면의 검토가 필요하다.

이러한 제한점에도 불구하고 본 연구는 자궁경부 개대 및 자궁경관 길이, fFN 검사 결과를 포함한 PLAT의 조기진통 사정 알고리즘을 적용하고 이에 대한 단기 효과와 지속 효과를 확인한 국내 최초의 연구로서 앞으로 더 개발할 필요성을 보여주었다는 의의가 있다고 생각한다. 또한, 본 연구의 대상자는 4학년 2학기 재학생으로 정규 교과과정에서는 조기진통의 이론 수업을 듣지 않았던 학생이었음에도 불구하고 알고리즘 적용 실습교육이 효과적이었으므로, 실습교육 기간을 좀 더 늘리고 적절한 시기에 재교육을 실시한다면 조기진통 관련 지식과 임상수행자신감이 더 오래 지속될 것으로 생각된다.

결론적으로 본 연구 결과를 통해 조기진통 사정 알고리즘을 적용한 실습교육이 간호학생의 지식과 임상수행자신감을 향상시키는 효과적인 교육 방법이 될 수 있음을 밝혔다라는 의의가 있다. 알고리즘을 통해 지식을 시나리오 상황에 적용하는 임상 판단 과정을 훈련해 봄으로써 간호학생의 임상 역량을 향상시켜 장래에 분만실 신규 간호사가 되었을 때 임상수행자신감을 갖고 안전한 출산에 기여할 수 있기를 기대한다.

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Conceptualization: Choi HY, Kim JI; Formal analysis: Choi HY; Writing-original draft: Choi HY; Writing-review & editing: Choi HY, Kim JI.

## Conflict of interest

The authors declared no conflict of interest.

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## Data availability

Please contact the corresponding author for data availability.

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## Supplementary materials

Further details on supplementary materials are presented online (available at <https://doi.org/10.4069/kjwhn.2023.08.17>).

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# 문제중심학습 기반 가상현실 시뮬레이션 교육이 간호대학생의 비판적 사고능력, 문제해결능력 및 자기효능감에 미치는 효과: 유사실험 연구

송영아, 김민경

안산대학교 간호학과

## Effects of a virtual reality simulation integrated with problem-based learning on nursing students' critical thinking ability, problem solving ability, and self-efficacy: a non-randomized trial

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**Purpose:** This study analyzed the effects of virtual reality simulation-based problem-based learning on nursing students' critical thinking ability, problem-solving ability, and self-efficacy in the nursing care of women undergoing induction of labor.

**Methods:** A nonequivalent control group pretest and posttest design was employed. The study participants included 52 nursing students (24 in the experimental group and 28 in the control group). The experimental group took a problem-based learning (PBL) class in the first week, and then engaged in self-directed learning using virtual reality simulation. In the second week, lectures about emergency nursing care for induction of labor and drug administration were given. The control group participated in PBL in the first week and lectures in the second week. The study was conducted from April 17 to May 19, 2023. Data were analyzed using the chi-square test, Fisher exact test, analysis of variance, and the independent t-test.

**Results:** Before-and-after differences between the two groups were statistically significant in problem solving ability ( $t=-5.47, p<.001$ ) and self-efficacy ( $t=-5.87, p<.001$ ). Critical thinking ability did not show a statistically significant difference between the two groups. The score for satisfaction with the virtual reality simulation program was  $3.64\pm 5.88$  out of 5 in the experimental group.

**Conclusion:** PBL education using a virtual reality simulation was found to be an effective way of teaching. Although convenience sampling was used, PBL education using virtual reality can be used as an educational strategy to enhance nursing students' problem-solving ability and self-efficacy.

**Keywords:** Problem-based learning; Problem solving; Self-efficacy; Simulation; Virtual reality

**주요어:** 문제중심학습; 문제해결; 자기효능감; 시뮬레이션; 가상현실

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## Summary statement

### • What is already known about this topic?

Virtual reality simulations help improve self-efficacy and nursing knowledge in nursing practice education. However, it is necessary to confirm the effectiveness of teaching methods combined with problem-based learning in nursing classes.

### • What this paper adds

A teaching method that combined problem-based learning and virtual reality simulation was effective in promoting self-efficacy and problem-solving skills in women's health nursing classes.

### • Implications for practice, education, and/or policy

The combination of problem-based learning and a virtual reality simulation was an effective teaching method for nursing students. Applying this integrative method in women's health nursing classes will improve students' competence.

## Introduction

현대 사회가 빅데이터 시대로 전환되면서 정보는 중요한 자원으로 대두하였다. 교육 분야에서도 막대한 정보량으로 교수-학습자의 역할 변화가 요구되고 있다. 지식 전달에 초점을 맞추던 암기 위주의 교육에서, 수많은 정보 중에서 학습자가 스스로 필요한 데이터를 파악하고 선택하여 문제를 해결해야 하는 형태로 변화되었기 때문이다. 이에 대학은 통합적 사고력을 갖춘 창의적 인재를 육성하기 위해 학습자를 고려하여 다양한 교수법을 연구하고 있다[1].

이런 관점에서 대학은 교수가 주도하는 전통적 강의형식을 탈피하고 학습자 중심의 교육활동을 강조하고 있다. 플립드러닝(flipped learning), 블렌디드 러닝(blended learning), 문제중심학습법(problem-based learning), 팀 러닝(team-based learning, TBL), 프로젝트 기반 학습 등이 학습자 중심의 교수학습방법의 예이다[1-3].

문제중심학습은 많은 연구에서 긍정적 학습 효과가 보고된 교수 학습방법 중 하나이다. 문제중심학습은 지식의 습득과 이해에 초점을 두지 않고, 지식과 관련된 문제상황을 해결하는 과정을 중시한다. 따라서 학습이 발생하는 문제해결 도출과정에 주안점을 두고 수업 절차를 구성하는 것이 특징이다[4]. 교수자는 실제 임상에서 발생하는 비구조화된 문제상황을 제시하고, 학습자는 문제를 해결하기 위해 자신의 지식을 바탕으로 고민하고 동료 학습자와 의견을 나눈다. 그 과정에서 추론과 응용을 해봄으로써 지식의 확장과 전이를 경험할 수 있다. 결론적으로 학습자는 문제상황을 해결하는 과정을 통해 창의력, 자기효능감, 비판적 사고력, 문제해결능력을 향상할 수 있기 때문에, 복잡하고 다양한 임상 상황에서 의미 있는 정보를 구별하고 판단해야 하는 문제중심학습은 효과적인 학습방법으로 주목받고 있다[5,6].

간호사는 단순질환보다 복잡한 건강문제가 많은 임상현장에서 근무하므로 대상자의 상황에 대하여 비판적으로 사고하여 문제를 해결해야 한다. 특히 대상자의 상태가 갑자기 변화하는 경우, 간호

사는 그 상황에 맞는 지식을 통합적으로 적용하여 빠르고 논리적인 의사결정을 해야 한다. 문제중심학습은 학습 내용에 대한 심층적 이해를 도울 뿐만 아니라 간호문제로 학습을 전이하여 문제해결력의 향상을 꾀할 수 있으므로 간호학 교육에 적절한 교수법이라 할 수 있다[7,8].

하지만 학습자가 주어진 문제를 해결하려는 목적의식이 있을지라도 비판적 사고력을 갖추지 못했거나, 문제중심학습이 학습자에게 부담으로 작용한다면 실질적인 학습 효과를 기대하기는 어렵다[9]. Kim 등[10]은 문제중심학습에서 자기효능감을 효과적으로 증진하려면 학습자가 교육에 참여하는 활동도 중요하지만, 편안한 환경에서 자신의 의지로 반복하며 학업을 수행할 수 있는 과정이 필요하다고 강조하였다. 따라서 학습자가 자신에 맞추어 학습 속도를 조절하고 능동적으로 참여하여 최적의 학습 효과를 창출할 수 있도록 문제중심학습을 설계해야 한다.

가상현실 시뮬레이션(virtual reality simulation)은 4차 산업 확대로 교육현장에 도입된 온라인 콘텐츠이다. 이는 임상 현장을 기반으로 한 시나리오로 구성되며, 각 상황에 대한 임상적 판단을 통해 문제해결능력의 함양을 기대한다[11,12]. 가상현실 시뮬레이션이 학습 실재감이 있고 공간 제약은 없다는 장점 때문에, COVID-19 범유행 상황이 발생한 후 많은 대학이 교육목표 달성을 위해 실습의 대체 교육으로 활용하고 있다. 간호교육에서는 성인간호학실습, 아동간호학실습 등 대부분 실습 교과목에서 가상현실 시뮬레이션을 적용하고 있다[13]. 국내 연구를 살펴보면 가상현실 시뮬레이션을 활용한 실습교육은 학습 속도의 유연성을 높이고 반복 수행이 가능하여 학습자의 지식과 실습만족도를 향상시키는 것으로 보고된다[14]. 또한 가상현실 시뮬레이션은 임상수행능력, 간호수행자 신감, 그리고 문제해결능력의 일부 하위 영역을 향상하는 효과가 있었다[11]. 이러한 점은 가상현실 시뮬레이션을 간호학실습에서 이론수업으로 확대 적용할 가능성을 시사한다. 이미 언급한 바와 같이 비판적 사고가 요구되는 이론 수업에서 학습 내용을 깊이 있

게 이해하기 위해 문제중심학습을 도입했다 하더라도 학습자가 적은 부담으로 스스로, 반복적으로 접근 가능할 때 학습 효과가 나타난다. 이때 가상현실 시뮬레이션을 함께 적용한다면 문제중심학습을 보완하는 긍정적 효과를 얻을 수 있을 것이다. 두 가지 교수법의 시너지 효과를 창출하려면 가상현실 시뮬레이션이 문제해결과정 중 탐색 과정, 중재 선택, 선택한 결과의 확인과 평가가 가능하다는 장점을 활용하여[11] 수업을 구성할 때 학습자에게 다양한 해결방안을 고민하고 적용해볼 수 있는 기회를 제공하도록 순서를 고려해야 한다. 가상현실 시뮬레이션과 문제중심학습을 융합한 이론수업은 COVID-19 범유행 중에 온라인 콘텐츠 학습을 경험하고 디지털 사용에 친숙한 현 세대의 특성을 생각할 때 문제중심수업 효과보다 더 높은 학습 효과를 보여줄 것이다[9]. 이러한 점에 착안하여 다양한 지식을 통합한 사고력을 요구하는 간호교육에서 비판적 사고를 촉진하고 자신감을 향상할 수 있도록 가상현실 시뮬레이션 자기주도학습과 문제중심학습법을 결합한 교수법을 구상하게 되었다.

우리 사회는 만혼과 고령 임신이 증가하면서 임신과 분만 합병증 발생률이 증가하고 이에 따라 유도분만 역시 계속 증가하고 있다. 유도분만 상황은 산부와 태아 상태에 대한 통합적 이해와 관찰이 요구되므로 간호사의 정확한 지식, 비판적 사고와 문제해결능력이 매우 중요하다. 그러나 사생활 보호 요청과 출산을 저하로 분만실 임상실습 참여조차 점점 더 어려워지고 있다.

이에 본 연구에서는 간호 학생이 유도분만 상황을 정확히 이해하고 다양한 지식을 통합하여 비판적으로 사고할 수 있도록, 유도분만에 대한 문제중심학습과 가상현실 시뮬레이션 교육을 융합한 교수법을 설계하고 그 효과를 파악하고자 한다.

본 연구의 목적은 유도분만 산부 간호에서 문제중심학습 기반 가상현실 시뮬레이션 교육이 간호대학생의 비판적 사고능력, 문제해결능력 및 자기효능감에 미치는 효과를 검증하고 학습자의 가상현실 시뮬레이션 교육만족도를 확인하기 위함이다.

연구 가설은 다음과 같다.

- (1) 가설 1. 문제중심학습 기반 가상현실 시뮬레이션 교육에 참여한 실험군은 일반 문제중심학습에 참여한 대조군과 비판적 사고성향 점수에 차이가 있을 것이다.
- (2) 가설 2. 문제중심학습 기반 가상현실 시뮬레이션 교육에 참여한 실험군은 일반 문제중심학습에 참여한 대조군과 문제해결능력 점수에 차이가 있을 것이다.
- (3) 가설 3. 문제중심학습 기반 가상현실 시뮬레이션 교육에 참여한 실험군은 일반 문제중심학습에 참여한 대조군과 자기효능감 점수에 차이가 있을 것이다.

## Methods

**Ethics statement:** Obtaining informed consent was exempted by the Institutional Review Board of Ansan University (2023-04-001) because there was no sensitive information and the survey was anonymously treated. To encourage voluntary participation a professor independent to the research team explained the study purpose, principles of confidentiality, right to withdraw, and ensured that participation was not related to grading. The program was offered to comparison group students after completion of the study (28 students participated).

### 연구 설계

본 연구는 유도분만 상황 시나리오의 문제중심학습 기반 가상현실 시뮬레이션을 경험한 실험군과 일반 문제중심학습에 참여한 대조군의 비판적 사고성향, 문제해결능력, 자기효능감의 차이를 검증하고, 가상현실 시뮬레이션 교육만족도를 확인하기 위한 비동등성 대조군 전후 시차설계(nonequivalent control group non-synchronized design)를 적용한 유사실험 연구이다(Figure 1).

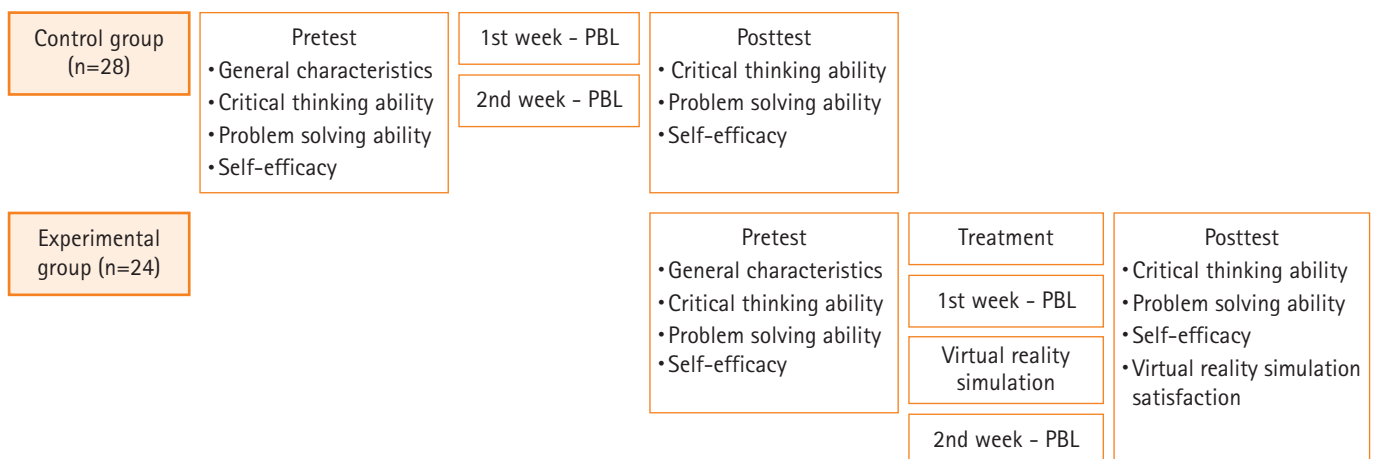


Figure 1. Research design. PBL: problem-based learning.

## 연구대상 및 표집

본 연구는 경기도 소재의 A대학교 간호학과 학생을 대상으로 다음 선정기준을 적용하여 편의표집하였다. 구체적 기준은 다음과 같다.

- (1) 본 연구의 목적을 이해하고 자발적으로 동의서에 서명한 자
- (2) 간호학과 교과목 여성건강간호학 I 이수자
- (3) 가상현실 시뮬레이션 실습교육 무경험자

표본 크기는 Cohen [15]이 제시한 표를 근거로 설정하였고, G-power 3.1.2 프로그램을 활용하였다. Yang과 Hong [16]의 연구에 근거하여 효과크기( $d$ ) = .80, 검정력( $1-\beta$ ) = .80, 유의수준( $\alpha$ ) = .05으로 분석하였을 때 각 군에 26명씩 산출되었다. You와 Yang [11]의 중도탈락률(10%)을 고려하여 각 군에 30명씩 배정하였다.

실험군 중 COVID-19 감염 결석( $n=2$ )과 개인 사정( $n=2$ )으로 2주차 대면 수업에 참여하지 못했으며, 가상현실 시뮬레이션에 참여하지 않은 2명을 포함하여 총 6명의 탈락으로 최종 24명이 분석에 포함되었다. 대조군은 COVID-19 감염으로 2주차 대면 수업에 참여하지 못한 2명을 제외한 최종 28명이 분석에 포함되었다(Figure 2).

## 연구 도구

### 비판적 사고성향

비판적 사고성향은 Yoon [17]이 개발한 비판적 사고성향 측정도구를 사용하였다. 본 도구는 7개의 하위영역으로 구분하여, 지적열정/호기심 5문항, 신중성 4문항, 자신감 4문항, 체계성 3문항, 지적

공정성 4문항, 건전한 회의성 4문항, 객관성 3문항 등 총 27문항으로 구성되며, 각 문항은 '전혀 그렇지 않다' 1점에서 '매우 그렇다' 5점의 Likert 척도로, 점수가 높을수록 비판적 사고성향이 높음을 의미한다. 이 중 2문항(4, 14)은 부정문항으로 점수의 일관성을 위해 역환산 처리하였다. 도구 개발 당시 신뢰도는 Cronbach's  $\alpha$  계수는 .84이고 본 연구에서 Cronbach's  $\alpha$ 는 .83이었다.

### 문제해결능력

문제해결능력은 한국교육개발원에서 Lee 등[18]이 개발한 문제해결능력 진단지를 사용하였다. 이 도구는 총 45문항으로 각 문항은 5점 Likert 척도로 측정되며 점수가 높을수록 임상수행능력이 높음을 의미한다. 이 중 2문항(8, 10)은 부정문항으로 점수의 일관성을 위해 역환산 처리하였다. 도구 개발 당시 신뢰도는 Cronbach's  $\alpha$  계수는 .84, Lee 등[18]의 연구에서의 Cronbach's  $\alpha$ 는 .94이었으며, 본 연구에서 Cronbach's  $\alpha$ 는 .88이었다.

### 자기효능감

자기효능감 측정을 위해 19.DiIorio와 Price [19]가 개발한 'Neuroscience Nursing Self-efficacy Scale'을 Kim [20]이 수정·보완한 자기효능감 도구를 본 연구자가 유도분만간호 사례에 맞게 수정하였다. 이 도구는 총 17문항으로, '전혀 잘 할 수 없다' 0점에서 '아주 확실히 할 수 있다' 10점의 11점 Likert 척도로 0-170점의 범위를

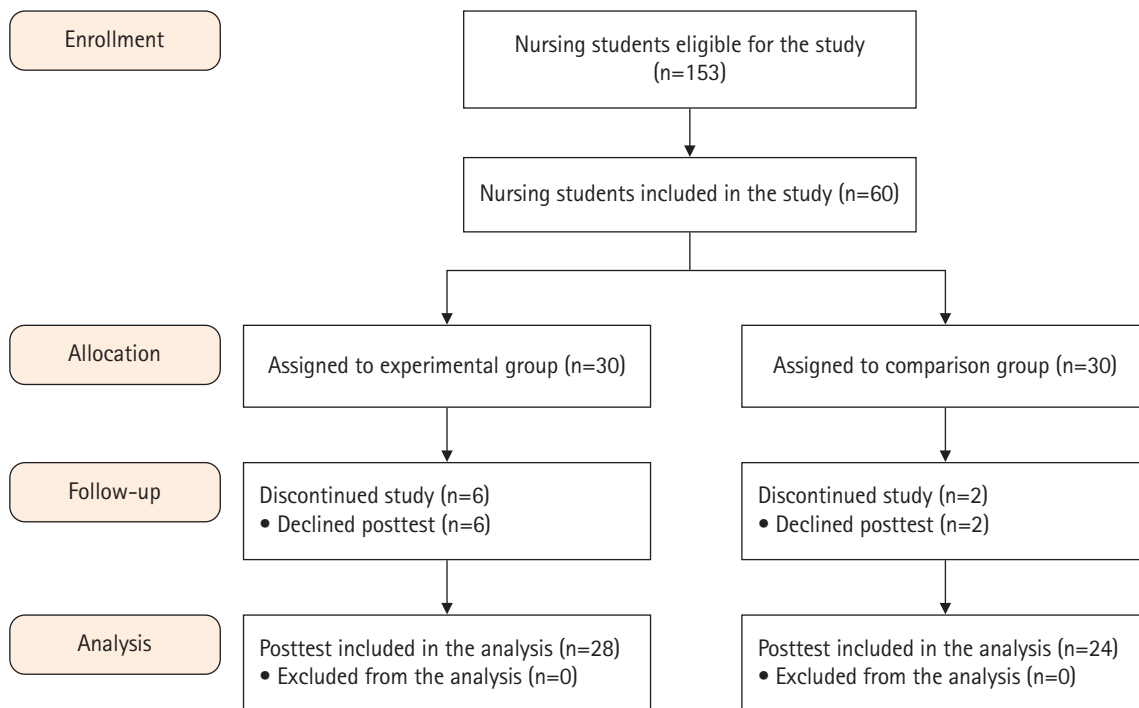


Figure 2. Flow diagram in this study.

맞는다. 점수가 높을수록 자기효능감이 높음을 의미한다. Kim [20]의 연구에서 도구의 신뢰도 Cronbach's  $\alpha$ 는 .95였고 본 연구의 Cronbach's  $\alpha$ 는 .96이었다.

### 가상현실 시뮬레이션 교육만족도

가상현실 시뮬레이션 교육만족도를 측정하기 위하여 Oh와 Kim [21]이 개발한 10문항을 원저자의 허락을 받아 수정·보완하여 사용하였다. 프로그램 진행의 내용, 수행 시간, 구성 등의 적절성 등에 대하여 '매우 그렇지 않다(1점)'에서 '매우 그렇다(5점)'까지의 5점 Likert 척도로 측정하였으며, 점수가 높을수록 프로그램 교육만족도가 높음을 의미한다. Oh와 Kim [21] 연구에서 Cronbach's  $\alpha$ 는 .95였으며, 본 연구에서의 Cronbach's  $\alpha$ 는 .93이었다.

### 자료 수집

본 연구는 안산시에 소재한 1개 대학에서 여성건강간호학 II 교과목을 수강하는 간호학과 3학년 학생 중 자발적으로 연구 참여에 동의한 자를 대상으로 시행하였다. 해당 강의에 참여하지 않는 연구자가 연구 목적과 방법, 자료 처리와 폐기, 참여하지 않을 권리, 수업 및 평가와 무관함을 충분히 설명하고 연구 참여 동의서를 받은 후 수행하였다. 연구 기간은 2023년 4월 17일부터 5월 19일까지 1개월로 웹 설문지를 활용하여 수집하였다. 해당 대학은 6개반(A-F반)으로 구분되어 있으며, 3개반씩 이론강의와 임상실습이 교차하여 진행되었다. D-F반이 임상실습을 하는 4월 24일에서 5월 5일의 2주 동안 A-C반은 학교에서 대면 수업을 진행하였다. 따라서 A-C반을 대조군으로 배정하여 일반 문제중심학습을 하였다. 이어서 A-C반이 임상실습을 하는 5월 8일에서 5월 19일의 2주 동안에는 D-F반을 실험군으로 임의 배정하여 학교에서 대면 수업으로 문제중심학습 기반 가상현실 시뮬레이션 교육을 하였다. 연구 기간 내 이론 반과 실습 반의 접점이 없어 실험 처치에 대한 오염과 확산을 최소화하였다.

설문 소요시간은 20분 정도였으며, 연구 참여자에게는 설문 완료 후 소정의 선물을 제공하였다. 대상자들은 2학년 2학기에 여성건강간호학에서 여성건강개념과 임신과 임부간호, 분만생리와 산부간호를 학습하였다.

### 연구 진행절차

#### 문제중심학습 기반 가상현실 시뮬레이션 교육 설계

대조군과 실험군 설정은 실험 처치의 확산을 예방하기 위해 비동등성 대조군 전후 시차설계를 하였다. 이론수업을 먼저 진행하는 반(A-C반)을 대조군, 임상실습을 마치고 2주 후 이론수업에 참여하는 D-F반을 실험군으로 배정하였다. 대조군과 실험군 각각 문제중심학습 시작 전에 웹 설문지를 통해 일반적 특성, 비판적 사고성향, 문제해결능력, 자기효능감을 조사하였다.

두 집단에게 동일한 유도분만 패키지를 적용하여 문제중심학습

교수법을 진행하였다. 두 군은 동일하게 조당 4-5명, 6-7개 조로 구성하였다. 대조군의 1주차 수업은 유도분만 상황에 대한 문제중심학습이다. 문제중심학습 수업에서 사용한 모듈은 가상현실 시뮬레이션 "labor induction due to gestational diabetes"를 기반으로 구성하였다. 학습자는 유도분만 시나리오를 제공받고 문제해결 접근 방법에 따라 협동학습을 하며 상호 피드백을 하였다. 2주차 수업은 '더 알고 싶은 것(learning issues)'을 동료와 함께 학습하며 학습 결과를 공유하고, 조별 성찰저널(reflective journal)을 작성하고 제출하도록 하였다. 수업은 유도분만에 대한 교수자의 강의와 조별 발표에 대한 교수자의 피드백으로 마무리하였다.

실험군의 1주차 수업은 대조군과 동일하게 진행하였으며, 1주차 수업 종료 후 가상현실 시뮬레이션 프로그램에 대한 내용과 절차를 e-Class에 공지하였다. 본 연구에서 적용한 가상현실 시뮬레이션 프로그램은 Laerdal Medical Korea 2020의 vSim for Nursing이다. 각 시나리오는 'Core'와 'Complex'로 구분되고, 시나리오마다 6단계로 구성되어 있다. 1단계는 'suggested reading'으로 학습 목표, 학습 내용, 대상자 정보가 제시되고, 2단계 'pre-simulation quiz'에서 vSim 사례에 대한 퀴즈를 통해 지식을 평가하며 정답과 해설을 제공한다. 3단계 vSim에서 학습자는 가상현실 시뮬레이션 환경에서 간호사정, 대상자 교육, 의사소통, 간호중재 선택, 의사지시 확인 등 간호를 수행한다. 학습자가 수행한 결과는 백분율(%)과 함께 피드백을 제공받을 수 있다. 시뮬레이션 종료 후 4단계 'post-simulation quiz'에서 vSim을 통해 얻은 지식을 재확인한다. 5단계 'document assignments'는 학습에 도움이 되는 과제물이 있으며, 6단계 'guide reflection question'은 시뮬레이션 과정에 대한 성찰 질문이 제시된다. 본 연구에서는 모성간호영역(vSim for Nursing Maternity) 중 oxytocin을 사용한 유도분만간호 "labor induction due to gestational diabetes" 모듈을 선택하였다.

실험군은 가상현실 시뮬레이션을 2주차 수업 전까지 완료하도록 하였다. 수료 기준은 100점 만점에 80점 이상으로 제시하였으며, 평균 3.5회(최소 2회-최대 5회) 반복학습을 수행하였다. 2주차 수업은 대조군과 동일하게 진행하였다.

총 2주간의 중재가 종료된 후, 각각 대조군과 실험군에게 웹 설문지를 통해 비판적 사고성향, 문제해결능력, 자기효능감을 조사하였으며, 실험군은 가상현실 시뮬레이션 교육만족도를 추가 조사하였다.

### 자료 분석

수집된 자료 분석은 IBM SPSS ver. 23.0 (IBM Corp., Armonk, NY, USA)을 이용하여 분석하였다. 정규분포 유무를 확인하기 위해 Kolmogorov-Smirnov test를 실시하였다. 대상자의 일반적 특성과 각 변수의 값은 빈도, 백분율, 평균과 표준편차로 분석하였으며, 두 집단 간 동질성 검정은 카이제곱 검정, Fisher 정확 검정, 독립 t-검정, 분산분석으로 분석하였다. 두 집단 간 차이 검정은 독립 t-검정을 이용하여 분석하였다. 측정도구의 신뢰도는 Cronbach's coef

**Table 1.** Homogeneity of general characteristics and dependent variables between the experimental and control groups (N=52)

Characteristic	Categories	n (%) or M $\pm$ SD		$\chi^2$ or t or F (p)
		Experimental group (n = 24)	Control group (n = 28)	
Age (year) <sup>†</sup>		22.7 $\pm$ 1.92	22.71 $\pm$ 1.88	-0.22 (.826)
	21–25	22 (91.7)	24 (85.7)	0.45 (.674)
	26–28	2 (8.3)	4 (14.3)	
Sex <sup>†</sup>	Male	3 (12.5)	6 (21.4)	.720 (.480)
	Female	21 (87.5)	22 (78.6)	
Grade point average <sup>†</sup>	4.0–4.5	8 (33.3)	5 (17.9)	2.35 (.325)
	3.0–3.9	9 (37.5)	16 (57.1)	
	2.0–2.9	7 (29.2)	7 (25.0)	
Motivation for choosing nursing major <sup>†</sup>	Employment	10 (42.3)	12 (42.9)	2.14 (.570)
	Recommendation from others	4 (16.7)	8 (28.6)	
	Aptitude	8 (33.3)	5 (17.9)	
Preferred learning method <sup>†</sup>	High school grades	2 (8.3)	3 (10.7)	6.65 (.132)
	Lecture	13 (54.2)	22 (78.6)	
	Discussion	4 (16.7)	0 (0.0)	
	Self-study	3 (12.5)	2 (7.1)	
	Problem-based learning	3 (12.5)	2 (7.1)	
	Practical class	1 (4.2)	2 (7.1)	
Interpersonal satisfaction <sup>†</sup>	Very high	3 (12.5)	3 (10.7)	1.63 (.734)
	High	10 (41.7)	8 (28.6)	
	Ordinary	9 (37.5)	15 (53.6)	
	Low	2 (8.3)	2 (7.1)	
Critical thinking ability		92.21 $\pm$ 9.15	94.25 $\pm$ 7.02	-0.89 (.379)
Problem solving ability		152.50 $\pm$ 11.39	152.93 $\pm$ 12.42	0.13 (.897)
Self-efficacy		97.88 $\pm$ 19.63	94.93 $\pm$ 25.14	-0.47 (.664)

<sup>†</sup>Fisher exact test.**Table 2.** Differences in dependent variables between groups (N=52)

Variable	Group	Mean $\pm$ SD			t	p
		Pretest	Posttest	Difference		
Critical thinking ability	Experimental	92.21 $\pm$ 9.15	103.75 $\pm$ 10.18	9.50 $\pm$ 9.33	-1.47	.149
	Control	94.25 $\pm$ 7.02	99.11 $\pm$ 12.33	6.89 $\pm$ 8.41		
Problem solving ability	Experimental	152.50 $\pm$ 11.39	192.75 $\pm$ 14.85	40.25 $\pm$ 18.18	-5.47	<.001
	Control	152.93 $\pm$ 12.42	167.96 $\pm$ 17.43	15.04 $\pm$ 15.97		
Self-efficacy	Experimental	97.88 $\pm$ 19.63	142.00 $\pm$ 13.91	44.13 $\pm$ 23.82	-5.87	<.001
	Control	94.93 $\pm$ 25.14	112.36 $\pm$ 21.10	17.43 $\pm$ 28.36		

ficients  $\alpha$ 로 산출하였다

## Results

### 대상자의 일반적 특성과 사전 동질성 검증

실험군과 대조군의 일반적 특성과 종속변수에 대한 사전 동질성 검증은 다음과 같다(Table 1). 두 집단의 평균 연령, 성별, 간호학과 입학 동기, 선호하는 학습방법, 대인관계 만족도는 실험군과 대조군

간에 유의한 차이가 없어 두 군의 일반적 특성은 동질한 것으로 나타났다(Table 1). 측정변수의 사전 동질성을 검증한 결과, 두 집단의 비판적 사고성향, 문제해결능력, 자기효능감 점수는 통계적으로 유의하지 않아 동질한 특성을 가진 그룹으로 나타났다(Table 1).

### 문제중심학습 기반 가상현실 시뮬레이션 교육의 효과 검증

실험군의 비판적 사고성향은 사전 91.21  $\pm$  9.15점, 사후 103.75  $\pm$  10.18점으로 총 9.50  $\pm$  9.33점이 상승했으며, 대조군의 비판적 사고

**Table 3.** Satisfaction with the virtual reality simulation program (N=22)

Item	Mean $\pm$ SD
I've developed an interest in induction delivery nursing.	3.81 $\pm$ 0.79
Repeated learning with this program is helpful.	3.79 $\pm$ 0.78
The screens used for this program (communication, prescription, nursing intervention selection, etc.) are appropriate.	3.75 $\pm$ 0.62
The program's pre and post quizzes are appropriate.	3.69 $\pm$ 0.64
The learning content of this program is interesting.	3.67 $\pm$ 0.65
It is good that this program feels like a real situation.	3.67 $\pm$ 0.71
The learning time is appropriate.	3.62 $\pm$ 0.80
I can understand and perform well according to the content of this educational program.	3.54 $\pm$ 0.83
The content of this program is easy to understand.	3.42 $\pm$ 0.80
The language used in this program is appropriate.	3.42 $\pm$ 0.80
Total	3.64 $\pm$ 5.88

성향은 사전  $94.25 \pm 7.02$ 점에서 사후  $99.11 \pm 12.33$ 점으로  $6.89 \pm 8.41$ 점 상승하였다. 그러나 비판적 사고성향의 두 그룹 간 사전-사후 차이는 통계적으로 유의하지 않아( $t = -1.47, p = .149$ ) 제1가설은 지지되지 않았다.

문제해결능력은 실험군이 사전  $152.50 \pm 11.39$ 점, 사후  $192.75 \pm 14.85$ 점으로  $40.25 \pm 18.18$ 점 상승하였고, 대조군의 문제해결능력은 사전  $152.93 \pm 12.42$ 점, 사후  $167.96 \pm 17.43$ 점으로  $15.04 \pm 15.97$ 점 상승하였다. 두 그룹 간 사전-사후 차이를 검증한 결과 실험군이 대조군보다 통계적으로 유의하게 문제해결능력이 상승한 것으로 나타나( $t = -5.14, p < .001$ ) 제2가설은 지지되었다.

자기효능감은 실험군이 사전  $97.88 \pm 19.63$ 점, 사후  $142.00 \pm 13.91$ 점으로  $44.13 \pm 23.82$ 점 상승하였고, 대조군은 사전  $94.93 \pm 25.14$ 점, 사후  $112.36 \pm 21.10$ 점으로  $17.43 \pm 23.36$ 점 상승하였다. 자기효능감의 두 그룹 간 사전-사후 차이를 검증한 결과 실험군이 대조군보다 유의하게 상승한 것으로 나타나( $t = -5.87, p < .001$ ) 제3가설은 지지되었다(Table 2).

### 가상현실 시뮬레이션 교육만족도

가상현실 시뮬레이션(vSim for Nursing)을 경험한 후 실험군의 가상현실 시뮬레이션 교육만족도는 Table 3과 같다. 가상현실 시뮬레이션 프로그램에 대한 교육만족도는 5점 만점 중  $3.64 \pm 5.88$ 점이었다. 만족도가 가장 높았던 항목은 유도분만간호에 대한 관심도 상승( $3.81 \pm 0.79$ 점)이었으며, 다음으로 반복학습의 유용성( $3.79 \pm 0.78$ 점)과 가상현실 시뮬레이션 화면의 구성충실도( $3.75 \pm 0.62$ 점) 순으로 높았다. 반면 본 프로그램이 영어로 구현되기 때문에 사용언어( $3.42 \pm 0.80$ 점)와 이해도( $3.42 \pm 0.80$ 점)에 대한 만족감이 가장 낮았고, 가상현실 시뮬레이션 프로그램 사용에 대한 설명과 수행( $3.54 \pm 0.83$ 점)에서 만족도가 낮았다.

## Discussion

유도분만은 산모와 태아 상태에 대한 동시 판단이 필요하며 약물 부작용과 제왕절개분만 상황처럼 예상치 못한 상황을 염두에 두어야 한다. 특별한 문제가 발생하지 않는다 하더라도 분만 진행에 따라 산모의 불안과 진통이 증가하므로 통합적인 간호가 필요하다. 이에 본 연구는 간호대학생이 유도분만간호에 대해 정확한 지식을 기반으로 빠른 상황 판단과 정보의 선택, 그리고 문제해결능력의 함양을 위해 학습자가 능동적으로 참여하고 상호작용할 수 있는 문제중심학습 기반 가상현실 시뮬레이션 교육을 간호대학생에게 적용한 결과를 토대로 논의하고자 한다.

본 연구에서 문제중심학습 후 가상현실 시뮬레이션 교육을 적용한 실험군이 문제중심학습만을 적용한 대조군보다 유의하게 향상된 변수는 문제해결능력과 자기효능감이다. 문제해결능력에 대한 연구 결과는 간호대학생에게 가상현실 시뮬레이션 프로그램으로 성인간호 시나리오를 제공했을 때 문제해결능력이 상승한 You와 Yang [11]의 연구 결과와 유사하였으며, 천식아동간호에 대한 가상현실 시뮬레이션의 실습교육 효과를 확인한 연구에서 문제해결능력 점수가 유의하게 상승하였다는 보고와도 유사하다[22]. 가상현실 시뮬레이션의 큰 장점은 반복적 학습이 가능하고 학습 실재감이 있다는 것이다. 그러나 가상 공간에서 학습이 진행되므로 사전 지식이 없다면 학습자 간 격차가 학습의 장애요인이 될 수 있다. You와 Yang [11]은 실험군에게 5개의 성인간호학 질환 시나리오를 제공하며 지속적으로 질의응답을 격려하였고, Kim 등[22]은 천식아동간호 가상현실 시뮬레이션을 진행하기 전 천식아동간호에 대한 강의를 통해 이론에 대한 학습을 제공하였다. 두 연구 모두 문제중심학습을 사전에 채택하지는 않았으나 가상현실 시뮬레이션의 한계점을 인지하고 최소한의 보완책을 마련한 것으로 볼 수 있다. 이 점을 고려하여 연구팀은 교수법 구성 시 문제중심학습을 사전에 실행하여 어려움은 동료와 함께 해결하여 학습의 부담감을 줄이고 비판적 사고를 촉진하도록 돕고, 이후 가상현실 시뮬레이션을 배치하

여 학습자가 반복적으로 속도를 조절하며 자기주도학습을 통해 문제를 해결하도록 하였다. 학생들은 본 연구에서 제시한 가상현실 시뮬레이션(vSim for Nursing) 수료 점수인 최소 80점 이상에 달성할 때까지 최소 2번부터 최대 5번까지 평균 3.5회의 학습을 수행하였다. Kim [23]은 웹 기반 선행학습 횟수가 증가할수록 간호에 대한 자기주도적 학습능력이 높아진다고 하였다. 따라서 신속하고 정확한 판단이 요구되는 상황을 실재감이 있는 가상현실 시뮬레이션 시나리오에 적용하는 것은 가상의 임상상황을 스스로 반복하며 경험함으로써 문제해결능력을 향상하는 데 효과적이라 할 수 있다[11].

그러나 융합적 교수법이 모두 효과적인 것은 아니다. 온라인 간호술기 프로그램인 'Nursing Skills'를 활용하여 간호대학생의 기본 간호학 실습에서 블렌디드 러닝을 적용한 Jho [24]의 연구에서는, 메타 인지는 유의하게 증가하였으나 문제해결능력은 교육 전후 차이가 나타나지 않았다. 온라인 간호술기 프로그램은 가상현실 프로그램이지만 시나리오로 구현되지 않기 때문에 학습 실재감이 낮을 수 있으며, 단순 술기로 암기에는 도움이 될 수 있으나 상위 개념인 문제해결능력을 촉진하기는 어려울 수 있다[24]. Jho [24]의 연구에서 학습자는 매주 온라인으로 자가학습을 한 후 교수자 강의에 참여하였다. 만일 학습자의 선수지식이 부족하면 온라인에서 학습 점수가 낮고, 이로 인해 학습동기가 생기지 않아 문제해결능력에 영향을 미칠 것으로 생각된다. 이러한 점을 고려하면, 여성건강간호학에서 문제중심학습 기반 가상현실 시뮬레이션 교수법은 유도분만과 같이 모성-태아 상황을 다각적으로 판단해야 하거나 복잡한 간호문제 학습에서 문제해결능력을 향상할 수 있는 매우 효과적인 방법이라 볼 수 있겠다.

자기효능감은 '어떤 상황에서 적절한 행동을 할 수 있다는 기대와 신념', 즉 '과제를 수행하는 데 있어 자신이 그 과제를 성공적으로 수행할 수 있을 거라는 능력에 관한 신념'을 의미한다[25]. 본 연구에서 문제중심학습 후 가상현실 시뮬레이션 교육 후 자기효능감의 효과에 대한 결과는 가상현실 시뮬레이션 교육이 간호대학생의 자기효능감에 긍정적이라는 기존 연구 결과에 부합하는 결과이다[25]. 그러나 본 연구 결과와 다르게 가상현실을 활용한 수업에 참여한 실험군과 강의식 수업에 참여한 대조군 간의 자기효능감은 유의한 차이를 보이지 않았다는 보고도 있다[12]. Kim과 Kim [12]의 연구는 가상현실을 활용하여 병원 환경 지식을 학습하는 기본간호학 수업으로 대상자들의 지식은 향상되었으나 병원 물품이나 위치, 기구 확인 위주로 과제의 난이도가 낮았으므로 학업적 자기효능감이 낮게 나타난 것으로 생각할 수 있다[12]. 자기효능감은 단방향의 학습보다 학습 실재감이 있는 대리경험이나 실제적 수행경험, 상호작용을 통한 칭찬과 격려로 형성될 수 있다[12]. 자신감이 높을수록 자기효능감 역시 높아진다[26]. You와 Yang [11]은 가상현실 시뮬레이션을 적용한 후 간호수행자신감을 비교하였는데, 실험군과 대조군 간에 교육 전후 차이가 유의한 것으로 나타났다. Kim [27]은 자기조절학습전략과 자기효능감은 상관관계가 있어 자기조절능력이

높은 학습자일수록 학습과정에 고도의 자기효능감을 보여줄 뿐 아니라 괄목한 만한 수준의 성과를 달성한다고 하였다. 가상현실 시뮬레이션 프로그램은 학습 과정에서 학습자 스스로 컴퓨터를 클릭하며 직접 중재를 선택하고 확인하는 작업이 필요하며, 피드백 확인 후 반복학습이 가능하다. 또한 과정에 대한 평가를 시작으로 확인할 수 있어 학습자가 노력하면서 점수가 상승할 수 있다는 자신감을 갖도록 하며 주어진 상황에 익숙해지면서 자기효능감이 높아졌을 것으로 생각된다. 가상현실 시뮬레이션은 자신을 포함한 환경을 조절하고 성취 목표를 위해 피드백을 관리하는 자기조절학습을 가능하게 한다. 변화가 빠른 의학 기술에 적응하고 최신 정보를 학습하며 현장에 적용하기 위해서 자기조절학습은 매우 중요한 요인이다[28]. 그러므로 학습자들이 자기조절학습을 통해 자기효능감을 높일 수 있는 교수 설계가 이루어져야 할 것이다.

본 연구에서 비판적 사고성향은 실험군과 대조군 간의 점수 차이가 통계적으로 유의하지 않았다. 기존 연구에서 간호대학생을 대상으로 정상 신생아간호에 대한 블렌디드 시뮬레이션 교육에서 가상현실 시뮬레이션을 적용한 후 비판적 사고성향에서 유의한 차이를 보고한 것과는 차이가 있다[29]. 정상 신생아간호에 대한 블렌디드 교육은 가상현실 시뮬레이션과 고충실도 시뮬레이션으로 본 연구의 중재와는 다소 차이가 있어 직접적 비교는 어렵다. 본 연구에서 비판적 사고성향이 두 그룹 간 유의한 차이를 보이지 않았던 이유는 두 그룹에게 제공된 문제중심학습 수업이 임상 시나리오 상황에서 중요한 의미를 찾고 분석하며, 간호문제 해결을 위해 접근하면서 더 학습해야 할 것(learning issue)을 찾아 자기주도학습을 하도록 촉진한 결과로 해석할 수 있다.

가상현실 시뮬레이션 교육만족도는 5점 만점에 3.64점이었다. 단일군 대상 가상현실 시뮬레이션을 적용한 실습만족도에서 교육 전 5점 만점에 4.18점에서 교육 후 4.47점으로 통계적으로 유의하게 높게 보고하였으며[30], 병원 환경에서 가상현실을 활용한 수업에 참여한 실험군의 교육만족도는 5점 만점에 4.80점, 강의식 수업에 참여한 대조군은 4.10점으로 본 연구 결과보다 높았다[12]. 단일군을 대상으로 한 연구는 가상현실 시뮬레이션을 적용하였으나 시뮬레이션 프로그램이 아닌 실습에 대한 전반적 만족도 조사로 본 연구 결과와 비교는 어렵다[30]. Kim과 Kim [12]의 연구에서 사용한 자료는 8개의 병원 공간과 물품, 기자재를 가상현실 영상으로 제작하여 시각적 이해를 돕고 한국어로 되어 있어 쉽게 이해할 수 있는 자료인 반면, 본 연구에서 사용한 가상현실 시뮬레이션은 미국에서 제작되어 영어로 구현되고 스토리를 전반적으로 이해하며 학습해야 하는 어려움이 있어 본 연구의 교육만족도가 낮게 나타난 이유라고 추측된다. 그러므로 국내 임상 상황을 기반으로 한국어로 제작된 가상현실 시뮬레이션 개발이 필요하다.

COVID-19는 교육의 대 전환을 가져왔다. 예상하지 못한 전염병의 대비뿐 아니라 사회변화 속도에 맞추어 교육 역시 변화해야 한다. 현재 간호교육에서 가상현실 시뮬레이션 교육은 실습 교과목에

주로 활용되고 있지만, 본 연구에서는 이론 교과목에서 문제중심학습법과 연계하여 학습자의 자율성을 고려하여 적용할 수 있는 하나의 방안으로 제시하였다.

본 연구에서 적용한 문제중심학습 기반 가상현실 시뮬레이션 교육의 의의는 첫째, 실습 교과목 위주로 적용하던 가상현실 시뮬레이션을 간호학 수업에 적용하고 문제해결능력과 자기효능감 효과를 검증했다는 점이다. 이는 실습과 이론 교육의 통합적 관점을 학습자에게 제공할 수 있다는 면에서 효과적일 것으로 기대한다. 둘째, 대상자와의 상호작용이 중요한 분만과정을 포함한 시뮬레이션 교육에서 학습자 중심의 융합 교육방법을 제시했다는 의의가 있다. 셋째, 본 연구 결과를 바탕으로 문제 상황에 직면하였을 때 통합적 사고가 요구되는 분만간호 교육에 융합적 교수법을 적용함으로써 학습자의 문제해결능력과 자기효능감을 고취시키는 데 도움을 줄 수 있다.

본 연구는 문제중심학습 후 시나리오 상황과 연계한 가상현실 시뮬레이션 자기주도 반복학습을 하도록 한 결과, 문제중심학습과 가상현실 시뮬레이션 융합교육이 학생들의 문제해결능력과 자기효능감 향상에 효과적인 것을 확인하였으나 몇 가지 제한점이 있다. 본 연구가 일개 교육기관의 간호대학생으로 국한되었음을 고려할 때 연구 결과를 일반화할 수 없다. 또한 실습 교과목에 주로 활용되던 가상현실 시뮬레이션 교육을 이론 교과목에 적용하기 위해 단일 주제로 2주간 진행하고 중재 효과를 1회 측정하여 시간 경과에 따른 효과를 지속적으로 확인하지는 못했다. 이러한 제한점을 바탕으로 유도분만간호 외의 범위로 확대 적용하여 반복 측정할 것을 제안하며, 여성건강간호학에서 다빈도 질환의 문제중심학습 모듈을 개발하고, 모듈과 연계된 가상현실 시뮬레이션 교육 프로그램을 개발하여 수업에 활용할 수 있는 교수법 설계가 필요함을 제안한다.

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# Challenges for future directions for artificial intelligence integrated nursing simulation education

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Artificial intelligence (AI) has tremendous potential to change the way we train future health professionals. Although AI can provide improved realism, engagement, and personalization in nursing simulations, it is also important to address any issues associated with the technology, teaching methods, and ethical considerations of AI. In nursing simulation education, AI does not replace the valuable role of nurse educators but can enhance the educational effectiveness of simulation by promoting interdisciplinary collaboration, faculty development, and learner self-direction. We should continue to explore, innovate, and adapt our teaching methods to provide nursing students with the best possible education.

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## Introduction

Artificial intelligence (AI) refers to the development of computer systems capable of performing tasks that have typically required human intelligence, such as visual perception, natural language processing, and decision-making [1]. Various applications of AI are found in healthcare, including analysis of medical imaging, clinical decision-making support systems, virtual nursing assistants, and patient monitoring [2]. Nursing simulation education uses scenarios, equipment, and techniques to replicate real-world healthcare situations and provide a safe environment for students to develop clinical skills, critical thinking, and decision-making abilities [3].

AI is currently integrated into nursing simulation education to enhance realism and interactivity and to personalize the learning experience for students. It has the potential to revolutionize the way we educate future nurses [4]. AI in nursing simulation education is the integration of AI technologies and methodologies into nursing simulations to enhance the learning experience and improve outcomes for nursing students. AI can be applied to various

aspects of nursing simulation including virtual patient models, intelligent debriefing systems, adaptive learning platforms, and clinical decision support systems [4-7].

First, AI technologies can be used to develop virtual patient models that mimic real-life clinical scenarios. These virtual patients can exhibit realistic physiological responses, such as vital sign changes, symptoms, and behaviors, based on input from the student's actions. AI algorithms enable virtual patients to adapt their responses dynamically, providing a more realistic and interactive simulation experience [8]. Another advantage is that learners can conduct simulations without having to come to the training site and can initiate self-study without the instructor directly operating the simulation. Second, AI can be utilized to create intelligent debriefing systems that provide personalized feedback and guidance to nursing students. These systems can analyze the student's actions and decisions during the simulation and offer tailored feedback, highlighting areas of strength and areas for improvement. AI algorithms can also identify patterns in student performance and provide targeted remediation strategies

## Summary statement

- **What is already known about this topic?**

Artificial intelligence (AI) has tremendous potential to change the way we train future health professionals.

- **What this paper adds**

This issue is intended to provide an opportunity for us to think about the challenges of integrating nursing simulation education and artificial intelligence.

- **Implications for practice, education, and/or policy**

In nursing simulation education, AI does not replace the valuable role of nurse educators but can enhance the educational effectiveness of simulation by promoting interdisciplinary collaboration, faculty development, and learner self-direction.

[9]. Third, AI-driven adaptive learning platforms can customize the learning experience to each student's individual needs, knowledge level, and learning style. Competition in technological development is accelerating as information technology companies such as Apple, Google, and Microsoft supply their big data-based and AI learning solutions to schools and online learning services. These platforms can analyze data on student performance, identify knowledge gaps, and deliver targeted educational content or simulation scenarios to address those gaps. Adaptive learning platforms can help optimize the learning process, ensuring that students receive the most relevant and effective educational materials [4,10,11]. Fourth, AI algorithms can be integrated into nursing simulation scenarios to provide clinical decision-making support to students. These systems can analyze patient data, simulate various treatment options, and offer recommendations based on evidence-based guidelines. Clinical decision-making support systems can help students develop critical thinking and clinical judgment skills by exposing them to complex and realistic patient-care scenarios [4,11].

The aim of this review was to understand the potential benefits, limitations, ethical considerations, and challenges of nursing simulation education with AI. In addition, the author would like to suggest an optimal direction for nursing simulation education with AI.

## The benefits of nursing simulation education with artificial intelligence

The application of AI in nursing simulation education offers several benefits [4]. However, each benefit must first be evaluated for compliance with the Healthcare Simulation Standards of Best Practice (HSSOPE™) of the International Nursing Association for Clinical Simulation and Learning (INACSL) [11]. The first

benefit is enhanced realism and fidelity. AI-driven simulations can provide realistic patient scenarios that replicate various physiological and psychological responses and create an immersive learning environment. The second benefit is improved student engagement and active learning. AI can engage students through interactive virtual patients, adaptive feedback, and gamification, all of which promote active participation and knowledge retention. This allows for the efficient use of time by students who are waiting for their turn with a simulation run directly by the professor (a problem in existing simulation education). Students can engage in preliminary learning while waiting their turn. The third benefit is personalized learning. AI algorithms can tailor simulations to each student's individual learning needs by adjusting difficulty levels, providing personalized feedback, and tracking progress. The final benefit is an efficient student evaluation and feedback mechanism. AI-based assessment tools automatically analyze student performance, provide objective feedback, and enable self-debriefing through self-reflection. In addition, AI simulations automatically generate evaluation reports on each student's nursing performance, saving instructors time in writing reports and improving evaluation accuracy [4,8-11].

These benefits met the criteria of HSSOPE™ from the INACSL. Simulation with AI was found to be adaptable because these benefits improved the modality, fidelity, and enhanced facilitation of nursing simulation design, outcomes, and objectives for nursing simulation education [12,13]. In addition, it enhanced the debriefing time with individualized feedback, and that data can be used to develop various methods of learner evaluation after simulation. Thus, it can be said to meet the criteria for debriefing, facilitation, and evaluation [11,14].

## Challenges and hurdles

There are technical challenges for nursing simulation education with AI. The first technical challenge is the integration of AI systems into existing simulation infrastructure. Adapting AI technologies to work seamlessly with current simulation equipment and software can be complex and require substantial resources [4,7,10]. The second technical challenge is data privacy and security concerns. AI simulations use sensitive patient data, raising ethical and legal considerations regarding data privacy, security, and confidentiality [5-9]. The third challenge is cost and resource allocation. Implementing AI-driven simulation education may require a significant financial investment, including acquisition of AI tools, training faculty, and maintaining technical infrastructure [4-7,9,10].

In addition to technical challenges, there are pedagogical challenges in nursing simulation education with AI. The first pedagogical challenge is designing effective AI-driven simulations. Developing high-quality AI simulations necessitates collaboration between nursing educators and AI experts to ensure clinical accuracy, realism, and alignment with learning objectives [5,8,10]. The second challenge is ensuring cultural sensitivity and inclusivity. AI algorithms and simulations should be sensitive to diverse patient populations, respecting cultural, ethnic, and socioeconomic differences to provide equitable learning experiences [4,6,7,10]. The third challenge is balancing AI reliance with critical thinking and the development of clinical judgment. While AI can provide valuable support, it is crucial to maintain a balance between AI assistance and fostering critical thinking skills, clinical reasoning, and ethical decision-making in nursing students [4-6,8-10].

## Ethical considerations in artificial intelligence-driven nursing simulation education

While the advantages and development potential of nursing simulation education with AI are infinite, risk factors such as AI hallucination are also possible. Therefore, we must set ethical principles and guidelines [4]. Ethical considerations include autonomy and patient privacy. AI simulations must prioritize patient autonomy and privacy by ensuring informed consent, protecting sensitive data, and addressing potential risks associated with the use of AI [4,8-10]. A second ethical consideration is the potential impact on the role of nursing educators. AI integration may necessitate redefining the role of nursing educators, emphasizing their

expertise in guiding students' learning, ethical decision-making, and professional development [4,8-10]. A third ethical challenge is addressing bias in AI algorithms and simulations. It is crucial to identify and mitigate biases within AI algorithms (e.g., a facial recognition algorithm may be trained to recognize white people more easily than black people because this type of data was used more frequently for training in machine learning) to ensure fair and unbiased representation of diverse patient populations in simulations [4,8-10]. Finally, transparency and accountability in AI systems is an ethical challenge. AI-driven simulations should provide transparency regarding data sources, algorithms, and decision-making processes, enabling users to understand and question the system's outputs [4-10]. In addition, all educators and students must adhere to ethical standards and confidentiality, as emphasized by the professional integrity criteria of HSSOPE™ from the INACSL [15].

## Strategies to overcome challenges

Strategies to overcome the challenges in nursing simulation with AI include (1) collaboration between nursing educators and AI developers, (2) faculty development programs for AI integration, (3) rigorous evaluation and research on AI-driven simulations, and (4) engaging students in the dialogue on AI in nursing education [4,6,8-10].

To live in the age of AI, we must remain competitive with AI as suggested by Lee [16] in the acronym PROMPT: Planning (and prospect), Reconstruction, Organize, Make a question, Persuasion, Together (and touching). By using this PROMPT method, we can apply AI-powered language models (e.g., ChatGPT) and AI to our daily lives. In addition, the PROMPT method can contribute to more effective and creative nursing education. For example, the field of women's health nursing emphasizes the need for individualized nursing care through communication with patients preparing for childbirth. By using the PROMPT method as a colleague as well as a tool in the field of women's health nursing and women's health nursing simulation education, we can contribute to more effective and creative nursing education.

## Conclusion

The future is already here, and AI can pave the way by augmenting, not replacing, the valuable role of nursing educators. Given the challenges and ethical issues in integrating AI into education, we must continue to explore, innovate, and adapt our teaching methods to provide nursing students with the best possible education.

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# Effects of anxiety, depression, social support, and physical health status on the health-related quality of life of pregnant women in post-pandemic Korea: a cross-sectional study

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**Purpose:** This study aimed to examine the effects of anxiety, depression, social support, and physical health status on the health-related quality of life of Korean pregnant women using Spilker's quality of life model.

**Methods:** This was a cross-sectional study with a correlational design. The participants included 166 pregnant women who were recruited via convenience sampling at two healthcare centers in South Korea. Questionnaires were collected from April 22 to May 29, 2023, in two cities in South Korea. The EuroQol-5D-3L, General Anxiety Disorder-7, Patient Health Questionnaire-2, Perceived Social Support through Others Scale-8, and EuroQol visual analog scale were used to assess the study variables. The t-test, Pearson correlation coefficients, and multiple regression tests were conducted using IBM SPSS ver. 26.0.

**Results:** Statistically significant correlations were identified between the health-related quality of life of pregnant women and anxiety ( $r=.29, p<.001$ ), depression ( $r=.31, p<.001$ ), social support ( $r=-.34, p<.001$ ), and physical health status ( $r=-.44, p<.001$ ). Physical health status ( $\beta=-.31, p<.001$ ) and social support ( $\beta=-.21, p=.003$ ) had the greatest effect on health-related quality of life ( $F=15.50, p<.001$ ), with an explanatory power of 26.0%.

**Conclusion:** The health-related quality of life of pregnant women was affected by social support and physical health status. This study demonstrated that physical health and social support promotion can improve the health-related quality of life of pregnant women. Healthcare providers should consider integrating physical health into social support interventions for pregnant women in the post-pandemic era.

**Keywords:** Depression; Physical health; Pregnant women; Quality of life; Social support

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## Introduction

Pregnant women tend to experience physical discomfort, including decreased mobility, due to the sharp increase in estrogen and progesterone and rapid weight gain. In addition to physical changes, they also experience developmental difficulties as they adjust

psychologically to changes in the family structure and psychological difficulties due to ambivalence [1]. Since the coronavirus disease 2019 (COVID-19) pandemic, pregnant women tend to experience more anxiety and depression than other demographic groups due to deteriorated mental health resulting from social isolation and quarantine measures [2]. Therefore, they are a vulnera-

## Summary statement

### • What is already known about this topic?

Physical, social, and psychological factors are associated with the health-related quality of life of pregnant women; however, these factors are not consistent across countries.

### • What this paper adds

The degree of social support and the physical health status of pregnant women were found to be factors that affect their health-related quality of life.

### • Implications for practice, education, and/or policy

Nurses should carefully assess the degree of social support and the physical health status of pregnant women and take proactive measures to promote their health-related quality of life.

ble population with a high risk of deteriorating mental health in the wake of the COVID-19 pandemic [3].

Pregnant women are at risk of a lower health-related quality of life due to potential physical and mental health problems that occur during pregnancy [4]. Health-related quality of life (HRQoL) can be conceptualized as an individual's level of functioning and subjective perception of their overall well-being across multiple dimensions of health, including physical, mental, and social domains [5]. A meta-analysis of the HRQoL of pregnant women identified demographic factors such as age and gestational age, social factors such as family and friends, physical factors such as nausea and pain, and psychological factors such as anxiety and depression to be the factors that most affect HRQoL [4]. Another study showed that higher HRQoL was associated with the third trimester of pregnancy compared to the second trimester, maternal age of 26 to 30 compared to other ages, and not having a job compared to having a job [6]. In a systematic review by Boutib et al. [7], the physical factors that affected the HRQoL of pregnant women included nausea, back pain, and pelvic pain; the demographic factors included advanced gestational age and multiple previous deliveries, and the psychological factors included anxiety and depression. The factors that positively affected HRQoL were social support, physical exercise, and good sleep [7]. However, the influential factors are not consistent across countries, and few studies have simultaneously examined the physical, mental, and social factors related to pregnant women in Korea. Additionally, there is a lack of research on the HRQoL of pregnant women in the post-pandemic era.

Therefore, this study aimed to examine the effects of perceived physical health status and psychological factors such as anxiety and depression on the HRQoL of pregnant women. Spilker's [8]

Quality of life (QoL) model was applied as the theoretical framework in this study. The QoL domains were organized in a pyramid model. At the bottom of the pyramid were the elements of each domain; in the middle were the broader domains of mental health, social health, and physical health; and at the top was overall well-being. In this study, we applied a conceptual framework using anxiety and depression to assess mental health, social support to assess social health, and physical health status to assess physical health as the factors that affect pregnant women's HRQoL (Figure 1). This study aimed to identify the effects of psychological health, social support, and physical health status on the HRQoL of pregnant women. The determinants of HRQoL in pregnant women identified in this study will serve as a basis for the development of nursing interventions to improve their HRQoL in the domains of mental, social, and physical health.

This study aimed to explore the impact of anxiety, depression, social support, and physical health status on the quality of life of pregnant women in the post-pandemic era. The study's specific objectives were as follows: (1) to measure the anxiety, depression, social support, physical health status, and HRQoL of pregnant women; (2) to analyze the relationships among anxiety, depression, social support, physical health status, and HRQoL in pregnant women; and (3) to identify the effects of anxiety, depression, social support, and physical health status on the HRQoL of pregnant women.

## Methods

**Ethics statement:** This study was approved by the Institutional Review Board of Hallym University (HIRB-2023-020). Informed consent was obtained from the participants.

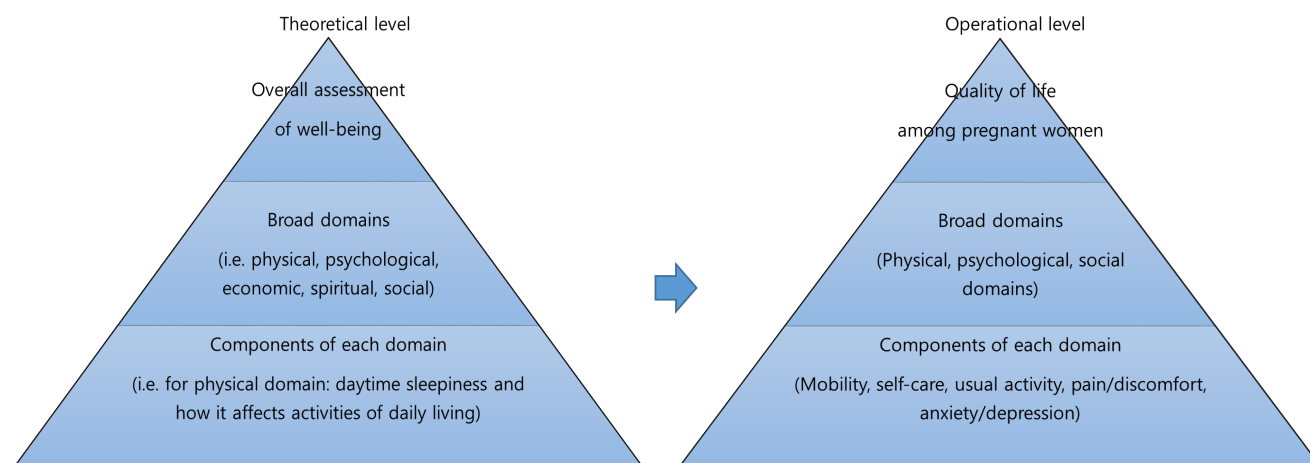


Figure 1. Conceptual framework according to Spilker's Quality of life model (1996).

### Study design

This is a correlational study that used a cross-sectional survey to analyze the factors that affect the HRQoL of pregnant women. This study was conducted according to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) reporting guidelines [9].

### Participants

The participants were selected via convenience sampling from the antenatal education programs at public health centers located in Chuncheon, Gangwon Province, and Gongju, Chungcheongnam Province in South Korea. The researcher visited the director of the public health center's maternal and child center to outline the purpose of the study, the data collection period, and the research methods and obtained permission from the director to conduct the study. After explaining the purpose and methods of the study to the women who attended the antenatal education program at the public health center, the researcher asked if they would participate in the study and obtained their written consent. Trained research assistants shared a description of the study and a written consent form, allowing the mothers enough time to understand the study objectives and procedures, and distributed questionnaires to those who voluntarily agreed to participate. The inclusion criteria were (1) those aged 20 years or older, (2) those who agreed to the purpose of the study, and (3) pregnant women who could read and write Korean. The exclusion criteria were (1) those with health problems (gestational hypertension, preterm labor, miscarriage) in a previous pregnancy, (2) those experiencing maternal health problems during their current pregnancy, and (3)

those experiencing fetal health problems during their current pregnancy. The scope of the participants' health problems was based on the diseases that affect quality of life from a meta-analysis by Li et al. [10].

The number of participants was calculated using G\*Power [11], with an effect size of 0.21, based on a range of effect sizes of 0.21 to 13.10 in a previous study on the impact of maternal health on quality of life [12], using regression analysis,  $\alpha$  of 0.05, power of 0.95, and 13 variables (age, number of children, gestational age, trimester, number of pregnancies, number of deliveries, occupation, past history, present disease, depression, anxiety, social support, and physical health status), resulting in a total of 139 participants. An additional 20% was added to the sample, making a total of 168 participants, due to possible dropout. Of the 168 questionnaires distributed, 166 were analyzed after excluding two incomplete surveys (response rate, 98.9%).

### Measurement

#### General and obstetric characteristics

All characteristics of the participants were measured using a self-reported questionnaire. Participants self-reported information on their age (year), gestational age (week), gravidity (number of pregnancies), parity (number of deliveries), and present job (occupied or not). Open-ended questions were used to elicit information on participants' past and present health problems. The researchers determined and recorded participants' trimester.

#### Anxiety

Anxiety was measured using the Korean version of the General

Anxiety Disorder-7 (GAD-7) scale originally developed by Spitzer et al. [13]. The Korean version of the instrument was available on the Patient Health Questionnaire (PHQ) website (www.phqscreeners.com) and did not require permission to use. The tool consists of seven questions, and respondents are asked to answer the question, “Over the last 2 weeks, how often have you been bothered by the following problems?” Answers are given on a 4-point scale (0, not at all; 1, several days; 2, more than half of the days; and 3, nearly every day). Higher scores indicate higher anxiety. Cronbach's alpha, which was used to determine the internal consistency, was .92 in the study by Spitzer et al. [13] and .87 in this study.

### *Depression*

Depression was measured using the Korean version of the PHQ-2 developed by Spitzer et al. [14]. The Korean version of the instrument was available from the PHQ website (www.phqscreeners.com) and did not require permission to use. The tool consists of two questions for screening major depressive disorder in primary care: “During the last 4 weeks, how often have you been troubled by feeling down, depressed, or hopeless?” and “During the last 4 weeks, how often have you been troubled by little interest or pleasure in doing things?” Each question is answered on a 5-point scale, with 1 point indicating “not at all” and 5 points indicating “very much.” A higher score indicates a higher level of depression. Cronbach's alpha was .73 in the study by Spitzer et al. [14] and .76 in this study.

### *Social support*

To measure social support, we used the Perceived Social Support through Others Scale-8 (PSO-8) developed by Park [15] and shortened to eight items by Kim et al. [16] after receiving the approval of the original authors. The PSO-8 assesses three factors, with three questions on the quality of care provided, two questions on women's personal attitudes, and three questions on the experience of stress during labor. It contains eight questions in total, and each question is answered on a 5-point Likert scale ranging from 1 point for “not at all” to 5 points for “very much.” Total possible scores range from 8 points to 40 points, with a higher score indicating a higher degree of social support. Cronbach's alpha was .91 in the study by Kim et al. [16] and .95 in this study.

### *Physical health status*

Physical health status was measured using the 1-item EuroQol visual analog scale (EuroQol VAS) developed by the European Quality of Life Group [17] and translated into Korean by the Ko-

rean Centers for Disease Control and Prevention. The tool was approved by the European Quality of Life Group. The EuroQol VAS consists of a single question answered on a self-reported basis asking the subjects to give a numerical health rating. In it, a 10-cm thermometer-like scale with graduations of 1 mm is depicted. At the bottom, 0 is labeled as the worst possible health rating, and at the top, 100 is labeled as the best possible health rating. A higher score indicates better perceived physical health according to the respondent.

### *Health-related quality of life*

HRQoL was assessed using the 5-item physical health status survey (EuroQol 5-dimensions 3-levels, EQ-5D-3L) developed by the European Quality of Life Group [18] and translated into Korean by the Korean Centers for Disease Control and Prevention [19]. The tool was approved by the European Quality of Life Group. The EQ-5D-3L consists of five questions on mobility, self-care, usual activity, pain/discomfort, and anxiety/depression. Answers are given on a 3-point Likert scale, with a score of 1 indicating no problems (level 1), a score of 2 indicating some problems (level 2), and a score of 3 indicating extreme problems (level 3). A higher score indicates a lower HRQoL. In this study, HRQoL was analyzed based on the average score of the five questions. The single item of anxiety/depression captured the constructs differently from the GAD and PHQ regarding the symptom severity for a medical diagnosis. The EQ-5D-3L was designed to focus on symptom recovery, which is distinct from measuring depression and anxiety symptoms themselves [20]. The test-retest reliability of the original instrument as indicated by Cronbach's alpha was .86 to .90, and the internal consistency reliability in this study as indicated by Cronbach's alpha was .75.

### **Data collection**

We used convenience sampling to collect data from pregnant women who visited maternity centers between April 22 and May 2, 2023, at public health centers in Chuncheon, Gangwon Province, and Gongju, Chungcheongnam Province. The participants completed the surveys on a face-to-face basis in a maternal and child health center or classroom used for antenatal care education. Researchers and trained research assistants distributed recruitment notices and instructions related to the study to explain the purpose and content of the study. They then collected self-reported questionnaires from the participants, who provided informed consent. The questionnaire took 10 to 15 minutes to complete, and the participants filled them out at individual desks separated by at least 2 meters to avoid the disclosure of personal informa-

tion. After completing the survey, participants were offered a gift worth 6,000 Korean won (approximately 5 US dollars).

### Data analysis

The collected data were analyzed using SPSS for Windows (version 26.0; IBM Corp., Armonk, NY, USA). The general and obstetric characteristics, anxiety, depression, social support, physical health status, and HRQoL of the participants were analyzed in terms of frequencies, percentages, means, and standard deviations. Differences in the degree of HRQoL were analyzed using the t-test and analysis of variance. Correlations between variables were analyzed using Pearson correlation coefficients. The factors that affected the participants' HRQoL were analyzed using multiple regression analysis. The following assumptions for regression analysis were tested: the Shapiro-Wilks test for the normality of variables, the variance inflation factor for multicollinearity, and the Durbin-Watson value for the independence of residuals, equality of variance, and linearity.

## Results

### Participants' general characteristics and differences in health-related quality of life based on their characteristics

The mean age of the participants was  $34.39 \pm 4.29$  years, and the mean gestational age was  $24.37 \pm 8.11$  weeks. A total of 56.0% of

the participants were unemployed, and 78.9% of the participants had no past health problems. The vast majority of participants (94.0%) experienced no health problems in their current pregnancy. There were no significant differences in the HRQoL total mean score based on trimester ( $F = 0.29$ ,  $p = .746$ ), gravidity ( $F = 2.28$ ,  $p = .105$ ), parity ( $F = 2.68$ ,  $p = .071$ ), job ( $t = 1.27$ ,  $p = .261$ ), past health problems ( $t = -0.46$ ,  $p = .640$ ), and present health problems ( $t = -1.53$ ,  $p = .127$ ) (Table 1).

### Degree of anxiety, depression, social support, physical health status, and health-related quality of life

The participants had mean scores of  $9.93 \pm 0.80$  for anxiety,  $2.80 \pm 0.88$  for depression,  $30.70 \pm 6.87$  for social support, and  $73.04 \pm 17.80$  for physical health status. The mean score for HRQoL was  $1.39 \pm 0.39$ , and the mean scores for the HRQoL subcategories were  $0.32 \pm 0.56$  for mobility,  $1.10 \pm 0.35$  for self-care,  $1.32 \pm 0.55$  for usual activity,  $1.66 \pm 0.64$  for pain/discomfort, and  $1.55 \pm 0.62$  for anxiety/depression (Table 2).

### Relationships among anxiety, depression, social support, physical health status, and health-related quality of life

The HRQoL of the participants showed statistically significant positive correlations to anxiety ( $r = .29$ ,  $p = .001$ ) and depression ( $r = .31$ ,  $p < .001$ ) and statistically significant negative correlations to social support ( $r = -.34$ ,  $p < .001$ ) and physical health status

**Table 1.** Characteristics of participants and differences of health-related quality of life (HRQoL) (N=166)

Variable	Categories	n (%)	Mean $\pm$ SD (variable)	Range	Mean $\pm$ SD (HRQoL)	t or F	p
Age (year)			$34.39 \pm 4.29$	23–46			
Gestational age (week)			$24.37 \pm 8.11$	3–38			
Trimester	First	14 (8.4)			$1.37 \pm 0.39$	0.29	.746
	Second	87 (52.4)			$1.37 \pm 0.41$		
	Third	65 (39.2)			$1.41 \pm 0.39$		
Gravidity	1	119 (71.7)		1–3	$1.42 \pm 0.41$	2.28	.105
	2	38 (22.9)			$1.37 \pm 0.35$		
	3	9 (5.4)			$1.13 \pm 0.22$		
Parity	0	121 (72.9)		0–2	$1.41 \pm 0.40$	2.68	.071
	1	35 (21.1)			$1.39 \pm 0.35$		
	2	10 (6.0)			$1.12 \pm 0.21$		
Job	Yes	73 (44.0)			$1.40 \pm 0.38$	1.27	.261
	No	93 (56.0)			$1.38 \pm 0.40$		
Past health problems <sup>†</sup>	Yes	35 (21.1)			$1.42 \pm 0.45$	-0.46	.640
	No	131 (78.9)			$1.38 \pm 0.37$		
Present health problems <sup>‡</sup>	Yes	10 (6.0)			$1.58 \pm 0.58$	-1.53	.127
	No	156 (94.0)			$1.38 \pm 0.38$		

<sup>†</sup>Cystitis, coronavirus disease 2019, hypothyroidism, Ménière disease, pyelonephritis, and thyroid cancer; <sup>‡</sup>Nausea, pruritis, diarrhea, constipation, hematuria, cough, hypothyroidism, and pelvic pain.

**Table 2.** Degree of anxiety, depression, social support, physical health status, and health-related quality of life (HRQoL) of participants (N=166)

Variable	Categories	Mean $\pm$ SD	Range	Possible range
Anxiety		9.93 $\pm$ 0.80	7–21	0–21
Depression		2.80 $\pm$ 0.88	2–5	2–10
Social support		30.70 $\pm$ 6.87	8–40	8–40
Physical health status		73.04 $\pm$ 17.80	10–100	0–100
HRQoL	Mobility	1.32 $\pm$ 0.56	1–3	1–3
	Self-care	1.10 $\pm$ 0.35	1–3	1–3
	Usual activity	1.32 $\pm$ 0.55	1–3	1–3
	Pain/Discomfort	1.66 $\pm$ 0.64	1–3	1–3
	Anxiety/Depression	1.55 $\pm$ 0.62	1–3	1–3
Total mean		1.39 $\pm$ 0.39	1–3	1–3

**Table 3.** Relationships among age, anxiety, depression, social support, physical health status, and health-related quality of life (HRQoL) (N=166)

Factor	r (p)					
	Age	Anxiety	Depression	Social support	Physical health status	HRQoL
Age	1					
Anxiety	-.04 (.600)	1				
Depression	.01 (.940)	.58 (<.001)	1			
Social support	-.19 (.013)	-.20 (.008)	-.14 (.059)	1		
Physical health status	-.05 (.520)	-.33 (<.001)	-.29 (<.001)	-.29 (<.001)	1	
HRQoL	.12 (.098)	.29 (<.001)	.31 (<.001)	-.34 (<.001)	-.44 (<.001)	1

**Table 4.** Factors influencing participants' health-related quality of life (N=166)

Factor	B	SE	$\beta$	t	p
Anxiety	.008	0.01	.06	0.71	.474
Depression	.070	0.03	.15	1.88	.061
Social support	-.012	0.01	-.21	-3.06	.003
Physical health status	-.007	0.01	-.31	-4.19	<.001
Adjusted R <sup>2</sup> = 26.0, df = 4, F = 15.50, p < .001					

( $r = -.44, p < .001$ ) (Table 3).

### Impact of anxiety, depression, social support, and physical health status on health-related quality of life

The linear regression analysis assumptions were analyzed to determine the factors that affected the participants' HRQoL. The diagnosis of collinearity, independence of residuals, normality, and linearity confirmed a Kolmogorov-Smirnov value of  $z = .105-.444$ , a Durbin-Watson value of 1.92, and a variance inflation factor of 1.063–2.147, and the slope of the P-P table was 45°; thus, the model was found to be appropriate. Physical health status ( $\beta = -.31, p < .001$ ) and social support ( $\beta = -.21, p = .003$ ) were

the most important factors affecting the participants' HRQoL, and the explanatory power of the model was 26.0% ( $F = 15.50, p < .001$ ) (Table 4).

## Discussion

This study found physical health status and social support to be the main factors affecting the HRQoL of pregnant women. This study adopted Spilker's [8] quality of life model as its theoretical framework. This framework was partially supported since, among the mental, social, and physical domains, the social domain, which was measured in terms of social support, and the physical domain, which was measured in terms of physical health status, affected the HRQoL of pregnant women. This discussion, therefore, focused on the effects of physical health status and social support on HRQoL. Pregnancy is a normal part of life, but it is also a time during which women's health is particularly vulnerable, and it involves major physical, mental, and social changes. This study is significant since it holistically identified the factors that most affect the HRQoL of pregnant women based on physical, mental, and social domains, mitigating the existing lack of research on the qual-

ity of life of pregnant women following the COVID-19 pandemic.

In this study, physical health status was the most significant factor affecting the HRQoL of pregnant women. Lau and Yin [21] also reported that lower physical health among pregnant women corresponded to a lower HRQoL. Among the common health problems experienced during pregnancy, nausea and back pain were the main symptoms associated with lower HRQoL [17]. A previous study found that pregnant women who participated in an aerobic exercise intervention had improved HRQoL in terms of physical function, pain, and general health domains compared to those who did not participate in the intervention [22]. However, significant differences in HRQoL were not observed among pregnant women who participated in another fitness intervention involving regular gym exercises compared to pregnant women who did not participate in the program [23]. According to a previous meta-analysis, moderately intense physical activity improves the quality of life of pregnant women [24]. Therefore, physical activity for pregnant women should be promoted. Monitoring physical fitness during pregnancy and providing tailored exercise interventions to pregnant women to prevent health problems will be a major factor in improving their HRQoL.

In this study, social support was the second major factor that affected the HRQoL of pregnant women. Previous studies have found the degree of social support to affect the HRQoL of pregnant women [24]. In addition, HRQoL tends to be lower among pregnant women with no spouse to provide social support [20]. A lack of emotional support from others can be perceived as rejection, exacerbating the psychological difficulties experienced by pregnant women in the wake of the COVID-19 pandemic. Globally, pregnant women have experienced high rates of depression, anxiety, and isolation during the COVID-19 pandemic, highlighting the importance of connecting with others socially and receiving their support [25]. Following the advent of the COVID-19 pandemic, interactive social support is urgently needed to ensure the mental health of pregnant women [26]. Social support is important in terms of both quantity and quality, and counseling from women's health professionals can be an important source of social support [27]. Therefore, counseling and support from maternal and child health care professionals in addition to family members should be provided to pregnant women to improve their HRQoL.

In this study, anxiety and depression, as mental health indicators, were not found to be statistically significant factors affecting the HRQoL of pregnant women; however, they still showed a moderate correlation. Lau and Yin [21] also reported that worse mental health in pregnant women corresponded to a lower

HRQoL. The mean score for anxiety among the pregnant women in this study was 9.93 points, with 4 points indicating mild anxiety, 10 to 14 points indicating moderate anxiety, and 15 to 21 points indicating severe anxiety [13]. The mean score for depression in this study as measured by the PHQ-2 was 2.80 points, indicating depression among the participants according to the instrument's methodology, which classifies a positive response to any two items as an indicator of depression [13]. Social functioning, vitality, and emotional role had a moderate association with depression in pregnant women, and pain, physical health, physical functioning, and the physical role had a weak association [24]. A study of women in advanced countries found that pregnant women with a high level of depression had greater physical and social dysfunction, and nondepressed pregnant women had a better HRQoL than pregnant women with depression [10]. Prenatal depression was also associated with postpartum depression, suggesting that further efforts should be taken to improve the quality of life of pregnant women with a high level of depression given depression's impact on pregnant women and their families [24].

The EQ-5D-3L is a widely used tool for assessing HRQoL, making it easy to compare scores across studies. In this study, the mean EQ-5D-3L score was 1.39, which was close to 1, indicating few problems in the respondents' HRQoL. In studies of pregnant women by Camacho et al. [28] and Boutib et al. [24], the mean scores using the same instrument were  $0.89 \pm 0.15$  and  $0.71 \pm 0.24$ , respectively, both of which were lower than the mean score in this study. A score range of 0.81–0.99 was reported in a 20-country wide-ranging survey of the general population [29]. The EuroQol VAS has been reported to range from 70.4 to 83.3 points. The EuroQol VAS score in this study was 73.04 points, which is similar. Therefore, the physical health status and HRQoL of pregnant women in this study were lower than those of women in general [30]. This finding is consistent with the finding that HRQoL is generally lower among pregnant women than among nonpregnant women and the population in general, especially in terms of the mental and physical domains of HRQoL [24].

In this study, we found that pregnant women, who are particularly vulnerable in the wake of the COVID-19 pandemic, experienced low social support, depression and anxiety, poor mental health, poor physical health status, and a decreased HRQoL. A longitudinal study of 12,007 pregnant women from 2020 to 2022 reported that increases in depression, anxiety, and stress coincided with timing of COVID-19 case surges [30]. Depression reportedly increased by 27.6% during the pandemic, while anxiety increased by 25.6%; younger people and women were more strong-

ly affected, and less human mobility was associated with worse mental health [31]. Therefore, we also identified social support and physical health status as factors that affect the HRQoL of pregnant women. Therefore, to improve the HRQoL of pregnant women, maternal and fetal health professionals should strengthen their social support through counseling and implement interventions incorporating exercise and other activities to improve their physical health status.

This study has some limitations. First, it was conducted with pregnant women in the regions of Gangwon and Chungcheongnam Province only, and the participants were from rural areas rather than urban areas; therefore, caution should be exercised when generalizing the study results. Additionally, this study used self-reported surveys, which may have skewed the results since they did not reflect the objective health status of the women determined via direct measurement. In addition, due to the nature of the survey, which required the ability to read and write in Korean, it was impossible to include women of other ethnicities and races who may not have understood Korean.

Based on the findings of this study, we recommend conducting further surveys to identify the factors that influence the HRQoL of pregnant women across various regions. In particular, we suggest conducting a study to determine the factors that influence the HRQoL of pregnant women in different areas and compare the differences in anxiety, depression, social support, physical health status, and HRQoL between the prenatal and postnatal periods.

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## Authors' contributions

Conceptualization, Formal analysis, Data curation: GHJ, HKK; Funding acquisition: HKK; Investigation: All authors; Writing-original draft: All authors; Writing-review & editing: All authors.

## Conflict of interest

Hyun Kyoung Kim has been editor of *Korean Journal of Women Health Nursing* since 2022. She was not involved in the review process of this article. Otherwise, there are no other conflicts of interest to declare.

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## Data availability

Please contact the corresponding author for data availability.

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# Instructions to Authors

Korean Journal of Women Health Nursing



*Korean Journal of Women Health Nursing*

Enacted in March 1995 and most recently revised in November 2022 and applied from Vol 28, No 4 (December 2022)

## 1. General Guidelines for Manuscript

The *Korean Journal of Women Health Nursing* is focused on women's healthy life processes or on conditions relevant to women due to greater risk or prevalence among women. It features original articles and review papers. Manuscripts for submission should be prepared according to the following instructions. The Journal follows the Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication (<http://www.icmje.org>) if not otherwise described below.

### 1-1. QUALIFICATION FOR AUTHORS AND LANGUAGE

Nurses or researchers throughout the world can submit a manuscript if the scope is appropriate for *Korean Journal of Women Health Nursing*. Manuscripts should be submitted in English or in Korean. Medical or nursing terminology should be written based on the most recent edition of Dorland's Illustrated Medical Dictionary, the most recent edition of English-Korean Korean-English Medical Terminology (<https://term.kma.org/search/list.asp>) published by the Korean Medical Association or the most recent edition of Standard Nursing Terminology published by the Korean Society of Nursing Science. Authors are required to state their affiliation and related status (job titles) upon submission, to support the reliability of the research.

### 1-2. RESEARCH AND PUBLICATION ETHICS

For the policies on research and publication ethics that are not stated in these instructions, the Good Publication Practice Guidelines for Medical Journals ([https://www.kamje.or.kr/board/view?b\\_name=bo\\_publication&bo\\_id=13&per\\_page=](https://www.kamje.or.kr/board/view?b_name=bo_publication&bo_id=13&per_page=)) or the Guidelines on Good Publication Practice (<https://publicationethics.org/guidance/Guidelines>) can be applied.

**Conflict-of-interests statement:** Authors are required to disclose commercial or similar relationships to products or companies mentioned in or related to the subject matter of the article being submitted. Sources of funding for the article should be acknowledged in a footnote on the title page. Affiliations of authors should include corporate appointments relating to or in connection with products or companies mentioned in the article, or otherwise

bearing on the subject matter thereof. Other pertinent financial relationships, such as consultancies, stock ownership or other equity interests, or patent-licensing arrangements should be disclosed to the Editor-in-Chief in the cover letter at the time of submission. Such relationships may be disclosed in the Journal at the discretion of the Editor-in-Chief in footnotes appearing on the title page. Questions about this policy should be directed to the Editor-in-Chief. If there is no conflict of interest, this should also be explicitly stated as "The author(s) declared no conflicts of interest."

**Statement of human and animal rights:** Clinical research should be done in accordance with the Ethical Principles for Medical Research Involving Human Subjects, outlined in the Declaration of Helsinki (<https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>). Clinical studies that do not meet the Declaration of Helsinki will not be considered for publication. Research participants' rights to privacy must be protected, and personal identifiable information should not be disclosed unless absolutely necessary. Human subjects should not be identifiable, i.e., patients' names, initials, hospital numbers, dates of birth, photographs, or other protected healthcare information should not be disclosed. If such personal information is needed as scientific data for publication, this should be explained to participants (or legal guardians) and written consent must be obtained. The possibility of online information sharing (not only printed publications) must also be explained. For animal subjects, research should be performed based on the National or Institutional Guide for the Care and Use of Laboratory Animals, and the ethical treatment of all experimental animals should be maintained. For studies using literature review and meta-analysis, Institutional Review Board (IRB) approval is not required. For secondary data analysis studies, the editorial committee will decide whether IRB approval is needed.

**Statement of informed consent:** Copies of written informed consents and IRB approval for clinical research should be kept. If necessary, the editor or reviewers may request copies of these documents to resolve questions about IRB approval and study conduct.

**Authorship:** All authors, including the co-authors, should be responsible for a significant part of the manuscript. All authors and co-authors should have taken part in writing the manuscript, reviewing it, and revising its intellectual and technical content. Any author whose name appears on a paper assumes responsibility and accountability for the results.

**Originality and duplicate publication:** All submitted manuscripts should be original and should not be considered by other scientific journals for publication at the same time. Manuscripts are accepted for publication with the understanding that their contents, or their essential substance, have not been published elsewhere, except in abstract form or by the express consent of the Editors. Any part of the accepted manuscript should not be duplicated in any other scientific journal without the permission of the Editorial Board. The duplication will be checked through Similarity-Check powered by iThenticate (<https://www.crossref.org/services/similarity-check/>) before review. If duplicate publication related to the papers of this journal is detected, the authors will be announced in the journal and their institutes will be informed, and there also will be penalties for the authors. Materials taken from other sources must be accompanied by written permissions for reproduction, obtained from the original publisher. Editors should follow the procedure set out in the Committee on Publication Ethics (COPE) flowcharts (<https://publicationethics.org/resources/flowcharts-new/translations>) that are designed to help editors follow COPE's Code of Conduct and implement its advice when faced with cases of suspected misconduct.

**Secondary publication:** It is possible to republish manuscripts if the manuscripts satisfy the condition of secondary publication of the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (<http://www.icmje.org>).

**Publication of master's thesis or doctoral dissertation:** When thesis or dissertation work is submitted for publication, the first author should be the thesis awardee and should declare that content is from thesis/dissertation.

### 1-3. TRIAL REGISTRATION & DATA SHARING

This journal follows the data sharing policy described in "Data Sharing Statements for Clinical Trials: A Requirement of the International Committee of Medical Journal Editors (ICMJE)" (<https://doi.org/10.3346/jkms.2017.32.7.1051>). As of July 1, 2018 manuscripts submitted to ICMJE journals that report the results of interventional clinical trials must contain a data sharing statement as described below. Clinical trials that begin enrolling par-

ticipants on or after January 1, 2019 must include a data sharing plan in the trial's registration. The ICMJE's policy regarding trial registration is explained at <http://www.icmje.org/about-icmje/faqs/clinical-trials-registration/>. Authors of interventional clinical trials are expected to submit the registration number (e.g., CRiS registration number, <https://cris.nih.go.kr/>) at submission. If the data sharing plan changes after registration this should be reflected in the statement submitted and published with the manuscript, and updated in the registry record. All of the authors of research articles that deal with interventional clinical trials must submit data sharing plan of example 1 to 4 in **Table 1**. Based on the degree of sharing plan, authors should deposit their data after de-identification and report the digital object identifier (DOI) of the data and the registered site.

### 1-4. PEER REVIEW PROCESS

All contributions (including solicited articles) are critically reviewed by the editorial board members, and/or reviewers. If the manuscript does not fit the aims and scope of the Journal or does not adhere to the Instructions to Authors, it may be returned to the author immediately after receipt and without a review. Before reviewing, all submitted manuscripts are inspected by Similarity-Check powered by iThenticate (<https://www.crossref.org/services/similarity-check/>), a plagiarism-screening tool. Reviewers' comments are usually returned to authors. The decision of the editor is final. Manuscripts are sent simultaneously to two reviewers for double blinded peer review. A third reviewer will be assigned if there is discrepancy. Authors will receive notification of the publication decision, along with copies of the reviews and instruction for revision, if appropriate, within two months after receipt of the submission.

**Final revised manuscript:** A final version of the accepted manuscript should be submitted on the web. If aspects of the research are reported elsewhere, include a copy of the publication(s). Include all main manuscript material in one file (with exception of title page). Save your file as MS Word. Failure to resubmit the revised manuscript within two weeks of the editorial decision is regarded as a withdrawal and will be treated as a new submission if submitted again later.

**Peer review process for handling submissions from editors, employees, or members of the editorial board:** All manuscripts from editors, employees, or members of the editorial board are processed same to other unsolicited manuscripts. During the review process, submitters will not engage in the selection of reviewers and decision process. Editors will not handle their own manuscripts if they are commissioned ones.

**Table 1.** Examples of data sharing statements that fulfill the requirements of the International Committee of Medical Journal Editors.

Element	Example 1	Example 2	Example 3	Example 4
Will individual participant data be available (including data dictionaries)?	Yes	Yes	Yes	Yes
What data in particular will be shared?	All individual participant data collected during the trial, after deidentification.	Individual participant data that underlie the results reported in this article, after deidentification (text, tables, figures, and appendices).	Individual participant data that underlie the results reported in this article, after deidentification (text, tables, figures, and appendices).	Not available
What other documents will be available?	Study protocol, statistical analysis plan, informed consent form, clinical study report, analytic code	Study protocol, statistical analysis plan, analytic code	Study protocol	Not available
When will data be available (start and end dates)?	Immediately following publication. No end date.	Beginning at 3 months and ending at 5 years following the article publication.	Beginning at 9 months and ending at 36 months following the article publication.	Not applicable
With whom?	Anyone who wishes to access the data.	Researchers who provide a methodologically sound proposal.	Investigators whose proposed use of the data has been approved by an independent review committee ("learned intermediary") identified for this purpose.	Not applicable
For what types of analyses?	Any purpose	To achieve aims in the approved proposal.	For individual participant data meta-analysis.	Not applicable
By what mechanism will data be made available?	Data are available indefinitely at (link to be included).	Proposals should be directed to xxx@yyy. To gain access, data requestors will need to sign a data access agreement.	Proposals may be submitted up to 36 months following article publication. After 36 months the data will be available in our University's data warehouse but without investigator support other than deposited metadata.	Not applicable
		Data are available for 5 years at a third-party website (link to be included).	Information regarding submitting proposals and accessing data may be found at (link to be provided).	

## 1-5. COPYRIGHTS AND CREATIVE COMMONS ATTRIBUTION NON-COMMERCIAL LICENSE

The author will also be asked to confirm that the material has not been published or submitted for publication elsewhere. All material published in the Journal will be copyrighted by Korean Society of Women Health Nursing. This is an Open Access journal distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## 1-6. ELECTRONIC SUBMISSION OF MANUSCRIPT

Authors are requested to submit their papers electronically through the online manuscript management system (<http://submit.kjwhn.org>). Once a manuscript has been submitted, the order and number of authors should not change. Any inquiries on the submitted manuscript should be made to the editorial office.

Please read all instructions before submitting.

Be prepared to enter:

- The full title of the article.
- The full names and institutional affiliations of all authors, and the name (with complete address, phone number, and e-mail) to whom correspondence should be directed.
- A running title of no more than 45 characters (including spaces).
- A structured abstract of no more than 250 words, stating purpose, methods, results (including the sample size), and conclusion drawn from the study.
- Up to five keywords (MeSH terms, in alphabetical order).

## 1-7. COPYRIGHT TRANSFER FORM AND FORM OF CONFLICTS OF INTEREST

Copyright Transfer Agreement form and form of Conflicts of interest should be submitted online at submission. Manuscripts cannot be published without this form.

## 1-8. ARTICLE PROCESSING CHARGES AND REPRINTS

Upon acceptance, an article processing charge (APC) of 600 USD (approximately 600,000 Korean Won) per article is requested to

the corresponding author. Further information can be found at [https://kjwhn.org/authors/processing\\_charge.php](https://kjwhn.org/authors/processing_charge.php).

## 1-9. SUBSCRIPTION

The full text is freely available from the website (<https://kjwhn.org>) according to the Creative Commons License (<https://creativecommons.org/licenses/by/4.0/>). Print copies can be dispatched to members of the Korean Society of Women Health Nursing and libraries world- wide upon the policy of the Society. Those who wish to receive copies and obtain further information should contact the office of the Society (<http://www.women-health-nursing.or.kr>).

## 1-10. CONTACT US

Any inquiries regarding suitability of manuscripts according to the aims and scope of the Journal, submission, review, publication, or journal-related issues are welcomed. Please contact the Editorial Office ([kjwhn@kjwhn.org](mailto:kjwhn@kjwhn.org)).

For manuscript submission, please visit:  
<http://submit-kjwhn.org>

## 2. Publication Type and Manuscript Preparation

### 2-1. WRITING MANUSCRIPTS

All manuscripts must be prepared in accordance with the “Uniform Requirements for Manuscripts Submitted to Biomedical Journals” available at <http://www.icmje.org>. Manuscripts are accepted for publication with the understanding that their contents, or their essential substance, have not been published elsewhere, except in abstract form or by the express consent of the Editors. Materials taken from other sources must be accompanied by written permissions for reproduction, obtained from the original publisher. Statistical methods should be identified. Priority claims are discouraged. All materials must be written in clear, appropriate English using Microsoft Word (doc or docx). Each page must be numbered at the lower central portion. Number pages consecutively.

### 2-2. TITLE PAGE

On the title page include title (only capitalize first letter of the first word); subtitle (if any); running title, first name, middle initial, and last names of each author, ORCID number (required for all authors), name of department(s) and institution(s) to which the work should be attributed. The address, phone number, and email of the person responsible for correspondence concerning the manuscripts should be listed separately and clearly labeled as

such. List keywords and present authors’ contributions. The journal does not limit first author status to only one person, in cases where equal contribution is evident. Describe contributions, such as the following:

#### *Example 1:*

Conceptualization: Piao H, Kim MH; Formal analysis: Piao H, Kim MH, Cui M, Choi G; Writing–original draft: Piao H, Kim MH; Writing–review & editing: Piao H, Choy JH.

#### *Example 2:* All work was done by Jeong GH.

Also, describe conflicts of interest, funding, data availability, and acknowledgements (acknowledge only those people and their institutions that have made significant contributions to the study). If applicable, state disclaimers, such as whether manuscript was adapted from thesis/dissertation.

The title page must be submitted separately from the manuscript. A template is available online (<https://www.kjwhn.org/authors/authors.php>).

## 2-3. MAIN MANUSCRIPT

Organize the main manuscript in the following order; title, abstract and keywords, summary statement, text, references, tables, figures, and pictures.

### Original articles

#### Abstract and Keywords

An abstract of no more than 250 words should be typed double-spaced on a separate page. It should cover the main factual points, according to the following subheadings: Purpose, Methods, Results, and Conclusion. The abstract should be accompanied by a list of up to five keywords for indexing purposes. Be very specific in your word choice. Use MeSH keywords (<https://meshb.nlm.nih.gov/>). and present keywords in alphabetical order.

#### Summary Statement

Following the abstract, describe a summary statement on a separate page according to the following subheadings, with 30 words or less under each subtitle.

- What is already known about this topic?

*Example:* The 75 years and older age group, with its complex health needs, is likely to make up an increasing proportion of the workload of accident and emergency strain the coming years.

- What this paper adds

*Example:* An alcohol-based surgical hand rub is more effective than a 6-minute surgical hand scrub using 4% chlorhexidine gluconate in terms of microbial counts immediately after scrubbing.

- Implications for practice, education and/or policy

*Example:* Parents' ability and willingness to participate in their child's care in the hospital should be thoroughly assessed and their participation needs to be supported.

### Main Text

Maximum word count should be within 5,000 words, although less is preferred, excluding tables, figures, and references. The manuscript should be written on A4 sized paper, in Times New Roman 12-point font, double-spaced and have margins of at least one inch (2.54 cm). In general, the text should be organized under the following headings: Introduction, Methods, Results, and Discussion.

**Introduction:** Clearly state the need of this study and main question or hypothesis of this study. Summarize the literature review or background in the area of the study.

**Methods:** Present an "Ethics statement" immediately after the heading "Methods" in a boxed format.

*Example 1:*

**Ethics statement:** This study was approved by the Institutional Review Board of XXXX University (IRB-201903-0002-01). Informed consent was obtained from the participants.

*Example 2:*

**Ethics statement:** Obtaining informed consent was exempted by the Institutional Review Board (IRB) of YYYY University (IRB-201903-0002-01) because there was no sensitive information and the survey was anonymously treated.

Describe the study design, setting and samples, and measurements, procedure, analysis used. Authors are encouraged to describe the study according to the reporting guidelines relevant to their specific research design, such as those outlined by the EQUATOR Network (<http://www.equator-network.org/home/>) and the United States National Institutes of Health/National Library of Medicine ([http://www.nlm.nih.gov/services/research\\_report\\_guide.html](http://www.nlm.nih.gov/services/research_report_guide.html)).

Ensure correct use of the terms sex (when reporting biological factors) and gender (identity, psychosocial or cultural factors), and, unless inappropriate, report the sex or gender of study par-

ticipants, the sex of animals or cells, and describe the methods used to determine sex or gender. If the study was done involving an exclusive population, for example in only one sex, authors should justify why, except in obvious cases (e.g., ovarian cancer). Authors should define how they determined race or ethnicity and justify their relevance.

**Results:** Describe the main results in a concise paragraph. This section should be the most descriptive. Note levels of statistical significance and confidence intervals where appropriate.

**Discussion:** Make discussions based only on the reported results. Describe conclusions and recommendations for further study needed. Do not summarize the study results.

**Abbreviations:** Use standard abbreviations and units recommended in the publication manual of the to the NLM Style Guide for Authors, Editors, and Publishers (2007), 2nd ed., National Library of Medicine, Bethesda, MD, USA (<http://www.nlm.nih.gov/citingmedicine>). Non-standard abbreviations should be defined the first time they appear in the text. At first usage, spell out terms and give abbreviations in parentheses. Thereafter, use only abbreviations. It is not necessary to spell out standard units of measure, even at first usage.

### Review article

An invited review will be published on an interesting or a new topic. Also submitted reviews are welcomed on any field according to the aims and scope, including systematic review and meta-analysis, scoping reviews, and integrative reviews. The main text is composed of introduction, methods, results, and discussion. There is no limit to the total number of references for a review article. The word count for the main text should be within 8,000 words.

### Invited paper

It is a commissioned article for specific purpose only with request base. The topics were discussed between editors and authors before submission. The main text is composed of 3 sections: introduction, text, and conclusion. The total number of references article is recommended to be equal to or less than 30. The word count for the main text should be within 8,000. An abstract is optional and is limited to 250 words.

### Issues and perspectives

Issues and Perspectives is usually an invited short article, which deals with the present hot issues in women's health nursing, al-

though not limited to this field. Authors of general interest to nursing and health care are also invited. Its format consists of introduction, main content, and conclusion. Length of the main text is limited to 2,000 words and keywords are limited to 5, preferably in MeSH terms. Number of references is limited to 20 and figures and tables are limited to 10 in total.

### Special essay

It is a commissioned publication type for the presentation of experiences in nursing or health field. Authors are invited by the editor-in-chief. Topics are discussed upon request. There is no specific format.

### Editorials

An editorial is usually invited by the Editorial Board. It provides the brief review and comments on pressing developments and events in the field of women's health nursing. It also may deal with a change in the journal's style and format and communication with an outside organization or professional. Other various topics shall be dealt by the Editorial Board as deemed appropriate. Divisions in the body of an editorial are not required. The total number of references is recommended to be equal to or less than 10. The word count of the main text should be less than 2,500 words.

### Letter to the editor

Any opinion or inquiry on a paper published can be addressed to the editor. Title, author, affiliation, main text and the references are the required sections. The total number of references is recommended to be less than 10. The word count of main text should be equal to or less than 1,000 words.

### In reply

As the reply to "Letter to the editor" its format is same to the "Letter to the editorial" and will be published simultaneously.

### 2-4. References

In the text, references should be cited with Arabic numerals in brackets (e.g. [1]), numbered in the order cited.

In the references section, the references should be numbered in order of appearance in the text and listed in English citation form.

Journal titles should be described in NLM style.

References within the past 5 years are encouraged, and unpublished PhD or master's thesis are not recommended as reference.

Other types of references not described below should follow the NLM Style Guide for Authors, Editors, and Publishers (<http://www.nlm.nih.gov/citingmedicine>). There are no limits to the number of references. However, limit supporting citations in text to 1-2 per statement. Note the DOI in URL form, if available.

#### *Journal article with up to six authors:*

Chung CW, Hwang EK, Hwang SW. Details of lymphedema, upper limb morbidity, and self- management in women after breast cancer treatment. *Korean J Women Health Nurs*. 2011;17(5):474-483. <https://doi.org/10.4069/kjwhn.2011.17.5.58>

#### *Journal article with more than six authors:*

Hong GH, Koh HJ, Kim KS, Kim SH, Kim JH, Park HS, et al. A survey on health management of during pregnancy, childbirth, and the postpartum of immigrant women in a multi-cultural family. *Korean J Women Health Nurs*. 2009;15(4):261-269. <https://doi.org/10.4069/kjwhn.2009.15.4.65>

#### *Book:*

Davidson MR, London ML, Wieland Ladewig PA. *Olds' maternal-newborn nursing and women's health across the lifespan*. 8th ed. Upper Saddle River, NJ: Pearson Prentice Hall; 2008. p. 20-25.

#### *Book Chapter:*

Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in

**Table 2.** Recommended maximums for articles submitted to the *Korean Journal of Women Health Nursing*

Publication type	Abstract (word count)	Text (word count) <sup>a)</sup>	References	Tables & figures	Invited or unsolicited
Original articles	250	5,000	No limit	6	Unsolicited
Review articles	250	8,000	No limit	6	Invited or unsolicited
Invited papers	Optional (250)	8,000	30	10	Invited
Issues and Perspectives	None	2,000	20	10	Invited
Special essays	None	3,000	20	10	Invited
Editorials	None	2,500	10	5	Invited
Letter to the editor	None	1,000	10	3	Unsolicited
In reply	None	1,000	10	3	Invited

<sup>a)</sup>Maximum number of words excludes the abstract, references, tables, and figure legends

Above limitations are negotiable. If more word count or number of figures and tables are required, authors can contact the editor-in-chief.

human solid tumors. In: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York, NY: McGraw-Hill; 2002. p. 93-113.

#### *Unpublished thesis or dissertation:*

Chang YE. The analysis of the association factors which influence on the breast and cervix cancer screening in Korean women: Based on the 2005 Korean national examination health and nutrition survey [master's thesis]. Seoul: Korea University; 2010. 55 p.

Lee SK. The effects of group coaching on emotional intelligence and self-efficacy of nurses [dissertation]. Seoul: Yonsei University; 2007. 85 p.

#### *Web reference:*

Statistics Korea. 2010 life tables for Korea [Internet]. Seoul: Author; 2011 [cited 2012 Jan 16]. Available from: [http://kostat.go.kr/portal/korea/kor\\_nw/3/index.board?bmode=read&a-Seq=252533](http://kostat.go.kr/portal/korea/kor_nw/3/index.board?bmode=read&a-Seq=252533)

## **2-5. Tables/Figures/Pictures**

Each table, figure, and picture should be placed on a separate sheet. Number tables consecutively and supply a brief title at the top for each. Footnotes to tables should be indicated by superscript symbols (†, ‡, §, ||, ¶, #, ††, ‡‡...) unless abbreviations are explained in which case superscripts are not required. All abbreviations used should be described in table footnote by writing the abbreviation followed by colon sign and definition, placed in alphabetical order.

Tables and figures are printed only when they express more than can be done by words in the same amount of space.

Do NOT indicate placement of tables of figures in the text. The editor will automatically place your tables and figures.

## **3. How The Journal Handles Complaints and Appeals**

The policy of *Korean Journal of Women Health Nursing* is primarily

aimed at protecting the authors, reviewers, editors, and the publisher of the journal. If not described below, the process of handling complaints and appeals follows the COPE guidelines available from: <https://publicationethics.org/appeals>

#### *Who complains or makes an appeal?*

Submitters, authors, reviewers, and readers may register complaints and appeals in a variety of cases as follows: Falsification, fabrication, plagiarism, duplicate publication, authorship dispute, conflicts of interest, ethical treatment of animals, informed consent, bias or unfair/inappropriate competitive acts, copyright, stolen data, defamation, and legal problem. If any individuals or institutions want to inform the cases, they can send a letter via the contact page on our website (<https://kjwhn.org/about/contact.php>). For the complaints or appeals, concrete data with answers to all factual questions (who, when, where, what, how, why) should be provided.

#### *Who is responsible for resolving and handling complaints and appeals?*

The Editor, Editorial Board, or Editorial Office is responsible for them. A legal consultant or ethics editor may be able to help with decision making.

#### *What may be the consequence of the remedy?*

It depends on the type or degree of misconduct. The consequence of resolution will follow the guidelines of COPE.

## **4. Direct Marketing**

Journal propagation has been done through the journal website and distribution of an introduction pamphlet. Invitations to submit a manuscript are usually focused on the presenters at conferences, seminars, or workshops if the topic is related to the journal's aims and scope.

# Research and Publication Ethics

Korean Journal of Women Health Nursing



For the policies on research and publication ethics that are not stated in these instructions, the Good Publication Practice Guidelines for Medical Journals ([https://www.kamje.or.kr/board/view?b\\_name=bo\\_publication&bo\\_id=13&per\\_page=](https://www.kamje.or.kr/board/view?b_name=bo_publication&bo_id=13&per_page=)) or the Guidelines on Good Publication Practice (<https://publicationethics.org/guidance/Guidelines>) can be applied.

## 1. Conflict-of-interests Statement

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## 2. Statement of Human And Animal Rights

Clinical research should be done in accordance with the Ethical Principles for Medical Research Involving Human Subjects, outlined in the Declaration of Helsinki (<https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>). Clinical studies that do not meet the Declaration of Helsinki will not be considered for publication. Research participants' rights to privacy must be protected, and personal identifiable information should not be disclosed unless absolutely necessary. Human subjects should not be identifiable, i.e., patients' names, initials, hospital numbers, dates of birth, photographs, or other protected healthcare information should not be disclosed. If such personal information is needed as scientific data for publication, this should be explained to participants (or legal guardians) and written consent must be

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- ☐ A4, 12 point font Times New Roman in MS Word file
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- ☐ 250 words or less (240-250 words are suggested)
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- ☐ 30 words or less under each subtitle

## Main Text

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## References

- ☐ References follow NLM style
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- ☐ No more than 6 figures, tables, and pictures altogether
- ☐ According to Instructions to Authors
- ☐ Abbreviations are noted under the table, in alphabetical order, and are congruent with text descriptions

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