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Special Issue on Digital Era Education for Women’s Health and Well-being
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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

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) 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-
ficity 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_stats-
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 are indexed in both databases: *Investigación y educación en enfermerías*, 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 USP* 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.

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

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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...
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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References
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. Health care 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.

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, Alfonzo 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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Data availability

Please contact the corresponding author for data availability.

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None.

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41. Hertling S, Hertling D, Loos F, Martin D, Graul I. Digitization in gynecology and obstetrics in times of COVID-19: results of
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 management, 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 acceptability, 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-
ogy-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 internet- 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-administer*) 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-
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 evaluation 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-1 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-
Table 1. Characteristics of the included studies (N=10)

<table>
<thead>
<tr>
<th>No.</th>
<th>Study</th>
<th>Year</th>
<th>Country</th>
<th>Study design</th>
<th>Sample/population</th>
<th>Sample size</th>
<th>Main intervention (program name)</th>
<th>Control group</th>
<th>Study outcomes</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Børøsund et al.</td>
<td>2014</td>
<td>Norway</td>
<td>RCT</td>
<td>167 breast cancer patients</td>
<td>I (IPPC): 45, I (Web-Choice): 64, C: 58</td>
<td>I (IPPC): internet-based patient-provider communication service, I (WebChoice): Web-based illness management system, which included IPPC</td>
<td>Usual care</td>
<td>1: primary 2: secondary</td>
<td>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.</td>
</tr>
<tr>
<td>A2</td>
<td>Hou et al.</td>
<td>2020</td>
<td>United States</td>
<td>RCT</td>
<td>112 breast cancer patients</td>
<td>I: 53, C: 59</td>
<td>Breast cancer self-management support (BCSMS)</td>
<td>Usual care</td>
<td>QoL</td>
<td>The mean total QoL summary scores were significantly higher among the experimental group versus the control group, respectively, at 3 months.</td>
</tr>
<tr>
<td>A3</td>
<td>Kim et al.</td>
<td>2018</td>
<td>South Korea</td>
<td>RCT</td>
<td>72 breast cancer patients with clinical stage IV</td>
<td>I: 36, C: 40</td>
<td>A mobile game-based intervention (ILOVE-BREAST)</td>
<td>Educational booklet</td>
<td>1) Time spent on education - Compliance with medication - Physical side effects - Anxiety - Depression - QoL</td>
<td>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.</td>
</tr>
<tr>
<td>A4</td>
<td>Lee et al.</td>
<td>2014</td>
<td>South Korea</td>
<td>RCT</td>
<td>59 breast cancer patients who had completed primary cancer treatment within 12 months</td>
<td>I: 29, C: 28</td>
<td>Web-based self-management exercise and diet intervention program (WSEDI)</td>
<td>Educational booklet</td>
<td>1) Exercise and intake of F&amp;V - Dietary quality 2) - HRQOL - Anxiety and depression - Fatigue - Stage of change - Perceived self-efficacy</td>
<td>Participants who engaged in at least moderate-intensity aerobic activity for at least 150 minutes per week, consumed five servings of F&amp;V each day, and saw general gains in nutritional quality, physical functioning and appetite loss (HRQOL), fatigue, motivational readiness, and self-efficacy.</td>
</tr>
<tr>
<td>A5</td>
<td>Fu et al.</td>
<td>2016</td>
<td>United States</td>
<td>Cross-sectional design</td>
<td>355 breast cancer survivors</td>
<td>NA</td>
<td>The-Optipal-Lymph-Flow-health IT system (TOLF)</td>
<td>NA</td>
<td>1) - Symptoms of pain, soreness, aching, tenderness - Number of lymphedema symptoms 2) Symptom distress/QoL related to pain and symptoms</td>
<td>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.</td>
</tr>
</tbody>
</table>
Table 1. Continued

<table>
<thead>
<tr>
<th>No.</th>
<th>Study</th>
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<th>Control group</th>
<th>Study outcomes 1: primary 2: secondary</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>A6</td>
<td>Mohammadmazadeh et al.</td>
<td>2022</td>
<td>Iran</td>
<td>Quasi-experimental</td>
<td>24 breast cancer patients</td>
<td>I: 24</td>
<td>Self-management mobile application (NI)</td>
<td>NA</td>
<td>- QoL (negative feelings, positive feelings, cognitive problems, pain, sexual interest, energy/fatigue, social avoidance, financial problems, benefits, distress-family, appearance, distress-recurrence)</td>
<td>The use of the application showed the most significant changes in QoL, including social avoidance, negative feelings, sexual function, sexual interest, and pain.</td>
</tr>
<tr>
<td>A7</td>
<td>Park et al.</td>
<td>2021</td>
<td>South Korea</td>
<td>Quasi-experimental</td>
<td>60 breast cancer patients who developed amenorrhea while receiving chemotherapy</td>
<td>I: 27</td>
<td>Self-management program with an integrative cognitive-behavioral intervention</td>
<td>Usual care</td>
<td>1) Menopausal symptoms 2) - Self-efficacy - QoL (physical well-being, emotional well-being, functional well-being)</td>
<td>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.</td>
</tr>
<tr>
<td>A8</td>
<td>Smith et al.</td>
<td>2019</td>
<td>United States</td>
<td>RCT</td>
<td>86 adult breast cancer survivors with chronic pain</td>
<td>I: 34</td>
<td>Reimagine</td>
<td>Usual care</td>
<td>1) - Depression - Fatigue 2) - Pain severity - Pain interference - Self-efficacy - (User satisfaction)</td>
<td>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.</td>
</tr>
<tr>
<td>A9</td>
<td>Tawfik et al.</td>
<td>2023</td>
<td>Egypt</td>
<td>RCT</td>
<td>150 breast cancer patients</td>
<td>I (ChemoFreeBot): 50</td>
<td>Self-care intervention by interacting with a chatbot</td>
<td>Usual care</td>
<td>1) - The frequency, severity, and distress of physical and psychological chemotherapy-related side effects 2) - Usability of the chatbot</td>
<td>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.</td>
</tr>
<tr>
<td>A10</td>
<td>van den Berg et al.</td>
<td>2015</td>
<td>Netherlands</td>
<td>RCT</td>
<td>135 breast cancer patients who had completed curative primary treatment 2 to 4 months</td>
<td>I: 63</td>
<td>Web-based self-management intervention (BREATHER)</td>
<td>Usual care</td>
<td>1) - Distress - Empowerment 2) - Negative adjustment (fatigue, helplessness, fear of cancer recurrence) - Positive adjustment (self-efficacy, remoralization, personal control, acceptance)</td>
<td>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.</td>
</tr>
</tbody>
</table>

C, control group; F&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)

<table>
<thead>
<tr>
<th>No.</th>
<th>Study</th>
<th>Year</th>
<th>Technology</th>
<th>Program construct/contents</th>
<th>Duration</th>
<th>Session</th>
<th>Intervention manager</th>
<th>Involvement of intervention manager</th>
</tr>
</thead>
</table>
| A1  | Børøsund et al.  | 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.       | 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.       | 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.       | 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.        | 2016 | Mobile-based (avatar simulation videos) | 1) Building self-care skills based on research-based, 12 weeks 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. | 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)
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<th>Intervention manager</th>
<th>Involvement of intervention manager</th>
</tr>
</thead>
</table>
| A7  | Park et al. [36] | 2021 | Mobile-based              | 1) Education and information module - Showing self-management techniques 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 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  
  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  
  2) Cognitive reframing  
  3) Mind-body exercises | 6 weeks | Access any time as needed | Nurse |
| A10 | van den Berg et al. [39] | 2015 | Web-based               | 1) Cognitive-behavioral therapy and including in formation  
  2) Assignment  
  3) Assessment  
  4) Video | 16 weeks | Access any time as needed | None |

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

---

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

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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Quality of life</td>
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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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An HJ et al. • Self-management interventions

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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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References


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


### Appendix 1. Search Strategy

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Appendix 2. Studies included in this review


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

Jin Hyeon Kim¹, Hyun Kyoung Kim²

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²Department of Nursing, College of Nursing and Health, Kongju National University, Gongju, Korea

**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 OR ‘social media’ 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, Papanikolaou 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

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

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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-Analysis 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 (PICO-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 Healthcare 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.

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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 ± 1.0 and low accuracy of 5.3 ± 2.8 [18]. Other studies also found that videos related to breast cancer had low average content quality scores of 26.70 ± 10.99 and low accuracy scores of 2.23 ± 0.97 [18]. Videos related to incontinence showed low understandability (57.9 ± 19.8) and low actionability (44.7 ± 35.9) [20]. Postpartum sexuality videos were deemed acceptable by 84% of healthcare professionals and 87% of patients [22]. Inconvenience-related videos had an average content quality score of 38.2 ± 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 [39], 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)

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

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

<table>
<thead>
<tr>
<th>Study</th>
<th>Outcomes</th>
<th>Measurement scales</th>
<th>Effects</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sajadi and Goldman [12]</td>
<td>Content quality</td>
<td>Usefulness</td>
<td>Information: 47.0% Commercial: 40.0%</td>
<td>Insufficient useful content</td>
</tr>
<tr>
<td>Briones et al. [13]</td>
<td>Source</td>
<td>Type of source</td>
<td>News: 36.1% Positive tone: 33.0%</td>
<td>The majority of videos had a negative tone and were disapproving regarding the HPV vaccine</td>
</tr>
<tr>
<td>Kiriya et al. [14]</td>
<td>Shares</td>
<td>Share count View count</td>
<td>Shares: 0.9%/1.1%, p = .53 Views: 5.1%/5.3%, p = .44</td>
<td>Not effective</td>
</tr>
<tr>
<td>Abdulghani et al. [18]</td>
<td>Usefulness</td>
<td>Accuracy of knowledge and demonstration</td>
<td>Highly useful: 34.9% Usefull: 47.7%</td>
<td>Various uses for medical education</td>
</tr>
<tr>
<td>Gursoy and Peker [16]</td>
<td>Content quality Reliability</td>
<td>DISCERN GQS</td>
<td>Useful: 37.9% Misleading: 62.0%</td>
<td>Misleading information</td>
</tr>
<tr>
<td>Stephenson et al. [17]</td>
<td>Clarity Accuracy</td>
<td>Developed scale NCDA</td>
<td>Clarity: 40.0% Accuracy: 3.0%</td>
<td>Low-quality and unreliable information</td>
</tr>
<tr>
<td>Yuksel and Cakmak [18]</td>
<td>Effectiveness Satisfaction</td>
<td>Contraception effectiveness Satisfaction</td>
<td>OR, 0.87; 95% CI, 0.60–1.27 OR, 0.93; 95% CI, 0.69–1.25</td>
<td>No statistically significant difference between the two groups</td>
</tr>
<tr>
<td>Baran and Yilmaz Baran [20]</td>
<td>Content quality Accuracy</td>
<td>DISCERN JAMA</td>
<td>2.9 ± 1.0 (1–5)† 5.3 ± 2.8 (1–5)†</td>
<td>Low-quality and untrustworthy</td>
</tr>
<tr>
<td>Parabhoi et al. [21]</td>
<td>Understandability Actionability</td>
<td>PEMAT VPI</td>
<td>57.9%± 19.8% 44.7 ± 35.9 (0–100)†</td>
<td>Not understandable and actionable for users</td>
</tr>
<tr>
<td>Rosen et al. [22]</td>
<td>Acceptance Penetration</td>
<td>Developed scale</td>
<td>Healthcare providers: 84% Patients: 87%</td>
<td>Acceptable and effective to disseminate evidence</td>
</tr>
<tr>
<td>Salmon and Bayar [23]</td>
<td>Content quality Reliability</td>
<td>DISCERN JAMA</td>
<td>38.2 ± 11.5 (15–75)† 1.4 ± 0.6 (0–4)†</td>
<td>Average level of quality</td>
</tr>
<tr>
<td>Brar et al. [24]</td>
<td>Usefulness</td>
<td>Developed scale</td>
<td>Very useful: 4.3% Moderate: 17.9% Somewhat: 39.5% Not useful: 38.3%</td>
<td>Necessary to create reliable and useful YouTube videos</td>
</tr>
<tr>
<td>Flinspach et al. [25]</td>
<td>Content quality</td>
<td>Developed scale</td>
<td>Aseptic technique followed: 42%–49%</td>
<td>Unsuitable for self-study due to serious errors</td>
</tr>
<tr>
<td>Güloğlu et al. [26]</td>
<td>Content quality Reliability</td>
<td>DISCERN GQS</td>
<td>Useful: 80.0% Misleading: 47.6%</td>
<td>Important to protect patients from musculoskeletal system complications</td>
</tr>
<tr>
<td>Hong [27]</td>
<td>Sexual knowledge Sexual attitudes Parent-child relationship</td>
<td>Increase of 36.67 points t = –6.66, p &lt; .01 t = –4.40, p &lt; .01</td>
<td>Effective for improving sexual perception and parent-child relationship</td>
<td></td>
</tr>
<tr>
<td>Hüsch et al. [28]</td>
<td>Usefulness Readability</td>
<td>Developed scale Alexa score</td>
<td>Useful: 73.3% Readability: 10.4</td>
<td>Valuable content but fairly difficult to read</td>
</tr>
<tr>
<td>Laforet et al. [29]</td>
<td>View Length View count Length (minute)</td>
<td>Professionals: 71, Consumers: 29 Professionals: 7.6, Consumers: 7.3</td>
<td>Professional YouTube is positive</td>
<td></td>
</tr>
<tr>
<td>Collà et al. [30]</td>
<td>Content quality Education quality Reliability</td>
<td>DISCERN PEMAT GQS</td>
<td>Professionals: 3, Consumers: 2 Professionals: 82.6%, Consumers: 66.7% Professionals: 26.2%, Consumers: 9.1%</td>
<td>Overall content quality is low</td>
</tr>
<tr>
<td>Tam et al. [31]</td>
<td>Reliability Accuracy</td>
<td>DISCERN FUSCS</td>
<td>Academic: 4, Urologist: 3 Academic: 36.8%, Urologist: 63.2%</td>
<td>Academic videos have more adequate quality and content</td>
</tr>
<tr>
<td>Sahin et al. [32]</td>
<td>Credibility Accuracy</td>
<td>DISCERN FUSCS Missinformation</td>
<td>YouTube: 5, TikTok: 3, p = .001 YouTube: 5, TikTok: 2, p &lt; .001 YouTube: 5, TikTok: 3, p = .003</td>
<td>YouTube is a valuable source</td>
</tr>
</tbody>
</table>

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. †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

**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 proactive 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
The study sample consisted of pregnancy and childbirth-related apps related to pregnancy or childbirth. This descriptive study was conducted to assess the quality of apps pertaining to pregnancy or childbirth that are available in South Korea’s mobile app market, most apps are used without any verification of their effectiveness 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
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/medication/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

![Flow sheet for the application (app) selection process.](https://doi.org/10.4069/kjwhn.2023.06.20)
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 (α = .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-
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 ± 0.45. The subdomain with the highest mean score was aesthetics, scoring 3.90 ± 0.52. This was followed by functionality (3.79 ± 0.75), and engagement (3.46 ± 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 ± 0.62. The highest mean score was for the intention to purchase, which was 3.56 ± 0.98. This was followed by the intention for continuous use (3.52 ± 0.68) and recommendation (3.35 ± 0.62).

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

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

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

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>n (%) or mean ± SD</th>
<th>Item mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Increasing happiness/well-being</td>
<td>54 (33.1)</td>
<td>3.46 ± 2.38</td>
</tr>
<tr>
<td></td>
<td>Action/change</td>
<td>34 (20.8)</td>
<td>3.79 ± 0.75</td>
</tr>
<tr>
<td></td>
<td>Game</td>
<td>19 (11.6)</td>
<td>3.90 ± 0.52</td>
</tr>
<tr>
<td></td>
<td>Goal setting</td>
<td>19 (11.6)</td>
<td>3.81 ± 0.53</td>
</tr>
<tr>
<td></td>
<td>Relationship</td>
<td>14 (8.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical health</td>
<td>13 (7.9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mindfulness/meditation/relaxation</td>
<td>5 (3.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reducing negative emotions</td>
<td>3 (1.8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depression</td>
<td>2 (1.7)</td>
<td></td>
</tr>
<tr>
<td>Objective quality</td>
<td>Engagement</td>
<td></td>
<td>3.74 ± 0.45</td>
</tr>
<tr>
<td></td>
<td>Functionality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aesthetics</td>
<td>3.90 ± 0.52</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information</td>
<td>3.81 ± 0.53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.74 ± 0.45</td>
<td></td>
</tr>
<tr>
<td>Subjective quality</td>
<td>Recommendation</td>
<td></td>
<td>3.35 ± 0.62</td>
</tr>
<tr>
<td></td>
<td>Continuous use</td>
<td></td>
<td>3.52 ± 0.68</td>
</tr>
<tr>
<td></td>
<td>Purchase</td>
<td>3.56 ± 0.98</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehensive evaluation</td>
<td>2.61 ± 0.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.35 ± 0.62</td>
<td></td>
</tr>
<tr>
<td>App-specific goals</td>
<td>Knowledge</td>
<td></td>
<td>3.66 ± 0.67</td>
</tr>
<tr>
<td></td>
<td>Help seeking</td>
<td>3.37 ± 0.71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intention to change</td>
<td>3.16 ± 0.45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attitude</td>
<td>3.14 ± 0.42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Behavior change</td>
<td>3.11 ± 0.93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awareness</td>
<td>2.91 ± 0.59</td>
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</tbody>
</table>
Among the six categories of app-specific usage purposes, knowledge (3.66 ± 0.67) received the highest score. This was followed by help seeking (3.37 ± 0.71), intention to change (3.16 ± 0.45), attitudes (3.14 ± 0.42), behavior change (3.11 ± 0.93), and awareness (2.91 ± 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 ± 0.50) and family category (4.10 ± 0.55) scored higher, while those in the information category (2.90 ± 1.55) scored the lowest. In the functionality dimension, apps in the childbirth/parenting category (4.13 ± 0.62) and role-playing/simulation category (4.10 ± 0.48) scored higher, while those in the information category (2.87 ± 0.88) scored the lowest. In the aesthetics dimension, apps in the childbirth/parenting category (4.04 ± 0.45) scored the highest, while those in the information category (3.00 ± 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 ± 1.67) and the family category (14.50 ± 1.51) demonstrated higher overall subjective assessment scores. Conversely, apps in the information category (11.50 ± 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 ± 1.67) and the family category (14.50 ± 1.51) demonstrated higher overall subjective assessment scores. Conversely, apps in the information category (11.50 ± 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...
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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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 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
Introduction


디지털 격차 문제는 단순히 디지털 이용능력 차이의 문제가 아닌 삶의 만족도와 우울 등 정서건강에 영향을 주는 문제이기에 더욱 중요하다[6]. 그로 인해 여성 노인의 디지털 정보활용 능력은 더욱 높아지며, 정보활용 능력이 높을수록 사람과의 관계가 높아지고, 정서건강에 미치는 영향이 높아진다는 연구결과가 있다[7]. 특히, 가족과 배우자의 정서적 지지를 많이 받는다는 연구결과가 보이게 되었다[8]. 이러한 상황에서 디지털 정보활용능력은 시간을 보낼 수 있는 유용한 도구가 될 수 있다. SNS나 소셜미디어를 통해 지인과 대화 나누기, 사진이나 영상 촬영, 음악 공유, 장보기 등을 할 수 있어 다양한 정보를 얻을 수 있다. 특히 가족과의 관계가 희박해질 때 더욱 한가로운 삶을 살 수 있게 된다[9].

효과가 유의미하지 않을음을 보고하기도 하였다. 본 연구에서는 선형연구를 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. 선형연구를 기반으로 [21] Figure 1과 같은 연구모형을 제시하였으며, 구체적인 연구목적은 다음과 같다.
(1) 여성 노인의 디지털 정보활용능력이 우울에 미치는 영향을 파악 한다.
(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 이번 연구 설계

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 노인으로 본 연구는 60세 이상의 노인들을 대상으로 진행되었다. 복지관 개설자에 따라 연구에 관심있는 참여자를 모집하였으며 본 연구의 목적을 이해하고 연구참여 동의서에 자발적으로 서명한 노인들만 연구에 참여하였다. 적합한 대상자 수는 G*Power 3.1.9.7 [22] 프로그램을 이용하여 산출하였다. 중간 효과크기 .15 [9,15], 점점력 .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 연구참여자가 직접 설문지에 응답하는 방식으로 이루어졌으며, 필요한 경우에는 연구보조원이 도움을 주었다.

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 분석에서는 합산 점수를 사용하였다(가능 점수 범위, 10~40점). 점수가 높을수록 우울 정도가 높은 것을 의미한다. 원 척도의 신뢰도는 .82였으며 [23], 본 연구에서 Cronbach’s α는 .81이었다.

디지털 정보활용능력

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’, ‘사람들과 정서적으로 지지를 받고 있다고 생각한다’, ‘개인사나 가정사에 대해 이야기할 사람이 있다’ 등이

Figure 1. Conceptual framework of the study.

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https://doi.org/10.4069/kjwhn.2023.08.30
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(가능 점수 범위, 1–5). 점수가 높을수록 사회적 지지 정도가 높음을 의미한다.

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 102만원으로 가장 많았고, 20만원에서 30만원이 21.2%, 30만원에서 40만원이 15.2%로 뒤를 이었다. 근로 상태는 노인일자리사업 참여자가 107명(54%)으로 가장 많았으며, 무직/은퇴가 60명(30.3%), 무급 가족종사자가 4명(2.0%), 자영업자가 3명(1.5%) 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 대상자의 우울은

### Table 1. Demographic characteristics (N=197)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD or n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>72.90 ± 4.84 (range, 60–88)</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
</tr>
<tr>
<td>≤ High school</td>
<td>145 (73.2)</td>
</tr>
<tr>
<td>College</td>
<td>44 (22.2)</td>
</tr>
<tr>
<td>≥ Graduate school</td>
<td>9 (4.5)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>104 (52.5)</td>
</tr>
<tr>
<td>Unmarried</td>
<td>94 (47.5)</td>
</tr>
<tr>
<td>Monthly household income (KRW)</td>
<td></td>
</tr>
<tr>
<td>&lt; 1 million</td>
<td>102 (51.5)</td>
</tr>
<tr>
<td>1 million–2 million</td>
<td>42 (21.2)</td>
</tr>
<tr>
<td>2 million–3 million</td>
<td>30 (15.2)</td>
</tr>
<tr>
<td>3 million–4 million</td>
<td>12 (6.1)</td>
</tr>
<tr>
<td>&gt; 4 million</td>
<td>12 (6.1)</td>
</tr>
<tr>
<td>Work status</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>9 (4.5)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>4 (2.0)</td>
</tr>
<tr>
<td>Family business (unpaid)</td>
<td>18 (9.1)</td>
</tr>
<tr>
<td>Job program for seniors</td>
<td>107 (54)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>60 (30.3)</td>
</tr>
<tr>
<td>Self-rated health</td>
<td></td>
</tr>
<tr>
<td>Very good</td>
<td>17 (8.6)</td>
</tr>
<tr>
<td>Good</td>
<td>57 (28.8)</td>
</tr>
<tr>
<td>Moderate</td>
<td>105 (53.0)</td>
</tr>
<tr>
<td>Bad</td>
<td>16 (8.1)</td>
</tr>
<tr>
<td>Very bad</td>
<td>3 (1.5)</td>
</tr>
<tr>
<td>Have taken ICT classes</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>102 (51.5)</td>
</tr>
<tr>
<td>No</td>
<td>96 (48.5)</td>
</tr>
<tr>
<td>KRW: Korean won (1 million KRW=roughly 800 US dollars); ICT: information and communication technology.</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD</th>
<th>Possible range</th>
<th>Data range</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressive symptoms</td>
<td>18.19 ± 5.29</td>
<td>10–40</td>
<td>10–34</td>
<td>0.72</td>
<td>0.47</td>
</tr>
<tr>
<td>Digital literacy</td>
<td>3.24 ± 1.09</td>
<td>1–5</td>
<td>1–5</td>
<td>-0.21</td>
<td>-0.75</td>
</tr>
<tr>
<td>Social support</td>
<td>3.32 ± 0.87</td>
<td>1–5</td>
<td>1–5</td>
<td>-0.38</td>
<td>0.08</td>
</tr>
</tbody>
</table>
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 위도와 첨도를 확인한 결과, 위도가 ±2보다 작고 첨도가 ±7보다 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 지도 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 1.14–2.16으로 다중공선성의 문제를 가지지 않는 것으로 확인하였다[30]. 구체적으로 회귀분석 결과를 살펴보면, 첫 번째 모델에서 사회적 지지 분산에 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 R²=.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%였으(adjusted R²=.33) (Table 4).

디지털 정보활용능력이 우울에 미치는 영향에서 사회적 지지의 매개 효과
부스트래핑을 이용한 Process Macro의 매개 효과 검정 결과 디지털 정보활용능력이 우울에 미치는 영향에 대한 사회적 지지의 매개 효과 모형 결과를 살펴보면, B=−.05, SE=.02, 95% CI [-.086 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).

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Depressive symptoms</th>
<th>Digital literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>r (p)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Digital literacy</td>
<td>−.38 (. &lt; .001)</td>
<td>1</td>
</tr>
<tr>
<td>Social support</td>
<td>−.41 ( &lt; .001)</td>
<td>.34 ( &lt; .001)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Social support</th>
<th>Depressive symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
</tr>
<tr>
<td>Age</td>
<td>.02</td>
<td>.01</td>
</tr>
<tr>
<td>Marital status</td>
<td>.09</td>
<td>.13</td>
</tr>
<tr>
<td>Level of education</td>
<td>−.05</td>
<td>.06</td>
</tr>
<tr>
<td>Monthly household income</td>
<td>.11</td>
<td>.05</td>
</tr>
<tr>
<td>Self-rated health</td>
<td>.05</td>
<td>.08</td>
</tr>
<tr>
<td>Work status</td>
<td>.11</td>
<td>.14</td>
</tr>
<tr>
<td>Digital literacy</td>
<td>.29</td>
<td>.06</td>
</tr>
<tr>
<td>Social support</td>
<td>−.17</td>
<td>.04</td>
</tr>
<tr>
<td>F (p)</td>
<td>4.81 ( &lt; .001)</td>
<td>11.50 ( &lt; .001)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.15</td>
<td>.33</td>
</tr>
</tbody>
</table>

†The reference groups were marital status (married) and work status (working).
연구[20]와 부분적으로 일치하는 결과이지만[20], 이에 더하여 여성 노인들의 대상으로 디지털 정보활용능력이 우울에 미치는 영향에서 사회적 지지의 매개 효과를 보여주었다는 점에서 선행연구와 차별된 다. 디지털 정보활용능력으로 기존이나 친구에게 전화를 하고 메시지를 주고받으며 기존의 관계를 강화할 뿐만 아니라 새로운 관계를 형성할 수도 있어서, 이러한 사회적 관계가 우울의 감소에 도움을 줄 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 정보활용능력을 교육할 수 있다. 많은 지자체, 도서관, 노인복지관에서 디지털 교육이 이루어지고 있지만 이러한 교육이 노인의 정신건강에 미치는 영향에 대한 효과성 평가는 아직 이루어지고 있지 않은 실정이다.


이러한 점에서 본 연구 결과를 해석해볼 수 있었다.

본 연구로 제한점은 다음과 같다. 먼저 전국적인 확률 표집이 아닌 서울시 노인복지관 이용자를 대상으로 표본을 수집하였기 때문에 해당 결과를 일반화하려는 한계가 있다. 추후 연구에서는 전국적인 표본과 노인복지관 비용을 포함한 좀 더 대표성 있는 표본을 대상으로 연구를 진행해야 할 것이다. 또한, 사회적 지지 높음수록 자녀나 손자녀들에게 디지털 기기 이용방법을 배우는 기회가 증가하는 등의 이유로 디지털 정보활용능력이 높을 수 있다. 디지털 정보활용능력과 사회적 지지의 관계에서의 두가지에 대해 연구되어야 할 것이다. 이러한 한계점에도 불구하고 본 연구는 디지털 소외계층을 탐구하는 여성 노인들을 대상으로 디지털 정보활용능력과 우울의 관계에서 사회적 지지의 매개 효과를 검증하고, 여성 노인들의 우울 예방 및 개선을 위한 개입의 단초를 제공했다는 의의가 있다.

| 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 | | | |
| -0.10 | | | | |
| Social support | | | | |
| Depressive symptoms | | | | |
| -0.17** | | | | |
| Digital literacy | | | | |
| -0.10** | | | | |

Figure 2. The mediation model of depressive symptoms. p<.05, **p<.01, ***p<.001.
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Authors’ contributions
Conceptualization: Lee A, Chung S; Formal analysis: Lee A; Writing–original draft: Lee A, Chung S; Writing–review & editing: Lee A, Chung S.

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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References
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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±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 (β=.45, \( p<.001 \)), influential others (β=.37, \( p<.001 \)), environmental support (β=−.18, \( p=.030 \)), and cyber sickness (β=−.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

**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].
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 α 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 α 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 mean 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 α 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 α 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 α 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 α 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 α of .95 was 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 α 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 α. 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 ± 0.57. The self-efficacy score was 2.49 ± 0.59 points, the innovative propensity score was 2.51 ± 0.64 points, and the total score for personal cognition factors was 2.50 ± 0.57 points. The influential others score was 3.02 ± 0.99 points, the environmental support score was 3.12 ± 1.12 points, and the total score for social factors was 3.07 ± 0.99 points. The engagement score was 3.61 ± 0.77 points, the functionality score was 3.55 ± 0.83 points, the aesthetics score was 3.55 ± 0.78 points, the presence score was 3.26 ± 0.83 points, and the total score for VR content factors was 3.49 ± 0.67 points. The total score for HMD-related factors was 2.38 ± 0.74 points, while that for cyber sickness was 2.17 ± 0.80 points and the mean physical discomfort score was 2.59 ± 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 ± 0.56, 3.07 ± 0.99, and 3.49 ± 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)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>n (%)</th>
<th>Continuous use intention of HMD-based VR content, Mean ± SD</th>
<th>F/H/t/U (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>10s</td>
<td>56 (25.8)</td>
<td>2.92 ± 0.53</td>
<td>23.43 (&lt; .001)</td>
</tr>
<tr>
<td></td>
<td>20s</td>
<td>154 (71.0)</td>
<td>2.48 ± 0.58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30s</td>
<td>7 (3.2)</td>
<td>2.28 ± 0.41</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>125 (57.6)</td>
<td>2.76 ± 0.60</td>
<td>3.86 (&lt; .001)</td>
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<td></td>
<td>Female</td>
<td>92 (42.4)</td>
<td>2.46 ± 0.55</td>
<td></td>
</tr>
<tr>
<td>Average number of times using HMD-based VR content</td>
<td>1–2</td>
<td>140 (64.5)</td>
<td>2.54 ± 0.61</td>
<td>4.33 (.115)</td>
</tr>
<tr>
<td></td>
<td>3–5</td>
<td>71 (32.7)</td>
<td>2.66 ± 0.55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 6</td>
<td>6 (2.8)</td>
<td>2.94 ± 0.56</td>
<td></td>
</tr>
<tr>
<td>Total HMD-based VR usage period (month)</td>
<td>&gt; 6</td>
<td>199 (91.7)</td>
<td>2.59 ± 0.60</td>
<td>0.20 (.907)</td>
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<tr>
<td></td>
<td>6–12</td>
<td>12 (5.5)</td>
<td>2.54 ± 0.54</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 12</td>
<td>6 (2.8)</td>
<td>2.70 ± 0.51</td>
<td></td>
</tr>
<tr>
<td>Experience using VR content for entertainment</td>
<td>Yes</td>
<td>214 (96.6)</td>
<td>2.59 ± 0.58</td>
<td>387.50 (.533)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>3 (1.4)</td>
<td>2.38 ± 1.09</td>
<td></td>
</tr>
<tr>
<td>Experience using VR content for education</td>
<td>Yes</td>
<td>14 (6.5)</td>
<td>2.53 ± 0.60</td>
<td>1,299.50 (.589)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>203 (93.5)</td>
<td>2.59 ± 0.59</td>
<td></td>
</tr>
<tr>
<td>Experience using VR content for healthcare</td>
<td>Yes</td>
<td>7 (3.2)</td>
<td>3.10 ± 0.48</td>
<td>1,113.00 (.019)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>210 (96.8)</td>
<td>2.57 ± 0.59</td>
<td></td>
</tr>
<tr>
<td>Intention to purchase HMD-based VR content</td>
<td>No</td>
<td>81 (37.3)</td>
<td>2.28 ± 0.61</td>
<td>29.05 (&lt; .001)</td>
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<tr>
<td></td>
<td>Not sure</td>
<td>80 (36.9)</td>
<td>2.64 ± 0.47</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>56 (25.8)</td>
<td>2.97 ± 0.47</td>
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</tr>
<tr>
<td>Intention to purchase HMD</td>
<td>No</td>
<td>92 (42.4)</td>
<td>2.28 ± 0.55</td>
<td>30.67 (&lt; .001)</td>
</tr>
<tr>
<td></td>
<td>Not sure</td>
<td>70 (32.3)</td>
<td>2.71 ± 0.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>55 (25.3)</td>
<td>2.95 ± 0.49</td>
<td></td>
</tr>
</tbody>
</table>

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)

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

HMD, head-mounted display; VR, virtual reality.†Possible range, 1–5.

and 2.44 ± 0.62, 3.06 ± 1.11, and 3.44 ± 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 ± 0.55, 4.07 ± 0.97, and 4.32 ± 0.50 points, respectively. Regarding HMD-related factors, those with experience using healthcare VR content had the lowest score of 1.84 ± 0.79 points. However, individuals who had used VR content for entertainment and education had higher scores, with 2.38 ± 0.73 and 2.64 ± 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
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

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

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

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

$\rho$: 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).
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>
<thead>
<tr>
<th>Model</th>
<th>Predictors</th>
<th>Categories</th>
<th>$\beta$</th>
<th>t (p)</th>
<th>$R^2$</th>
<th>Adj $R^2$</th>
<th>$\Delta Adj R^2$</th>
<th>F (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Constant)</td>
<td></td>
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<td>.59</td>
<td>.35</td>
<td>.35</td>
<td>57.96 (&lt; .001)</td>
</tr>
<tr>
<td></td>
<td>Personal cognition factors</td>
<td>Self-efficacy</td>
<td>.53</td>
<td>6.91 (&lt; .001)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Innovative propensity</td>
<td>.08</td>
<td>1.08 (.282)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2</td>
<td>(Constant)</td>
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<td></td>
<td></td>
<td>.63</td>
<td>.40</td>
<td>.044</td>
<td>34.62 (&lt; .001)</td>
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<td>Personal cognition factors</td>
<td>Self-efficacy</td>
<td>.46</td>
<td>5.64 (&lt; .001)</td>
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<td></td>
<td></td>
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<tr>
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<td>Innovative propensity</td>
<td>-.01</td>
<td>-.17 (.866)</td>
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<tr>
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<td>Social factors</td>
<td>Influential others</td>
<td>.32</td>
<td>3.54 (&lt; .001)</td>
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<tr>
<td></td>
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<td>Environmental support</td>
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<td>-.98 (.330)</td>
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<td>(Constant)</td>
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<td></td>
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<td>.71</td>
<td>.50</td>
<td>.11</td>
<td>26.19 (&lt; .001)</td>
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<td>Self-efficacy</td>
<td>.18</td>
<td>2.08 (.039)</td>
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<td>Innovative propensity</td>
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<td>Influential others</td>
<td>.30</td>
<td>3.36 (&lt; .001)</td>
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<td>Environmental support</td>
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<td>.50</td>
<td>5.71 (&lt; .001)</td>
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<td>Functionality</td>
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<td>Aesthetics</td>
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<td>.03 (.695)</td>
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<td>Influential others</td>
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<td>4.11 (&lt; .001)</td>
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<td>Environmental support</td>
<td>-.18</td>
<td>-.21 (.030)</td>
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<td>VR Content factors</td>
<td>Engagement</td>
<td>.45</td>
<td>5.18 (&lt; .001)</td>
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<td>Functionality</td>
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<td>-.10 (.922)</td>
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<td>Aesthetics</td>
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<td>.06 (.956)</td>
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<tr>
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<td>Presence</td>
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<td>-.44 (.662)</td>
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<td></td>
<td>HMD-related factors</td>
<td>Cyber sickness</td>
<td>-.21</td>
<td>-.33 (.001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical discomfort</td>
<td>.11</td>
<td>1.81 (.072)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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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None.

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9. Weech S, Kenny S, Barnett-Cowan M. Presence and cyber-
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
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 많다[2]. 이에 따라 간호대학에서는 임상에서 직접 환자에게 적용하기 어려운 습관이나 집중적인 훈련이 필요한 사례들을 중심으로 시뮬레이션 실습교육을 하고 있다[3].

분만실 실습이 어려운 상황에서[4] 고위험 임산부 관리의 집중치료실(maternal-fetal intensive care unit, MFICU)이 마련된 점은 바람직한 방향이지만, 임산부의 중증도가 높아 간호학생은 대상자를 만나는 것조차 어렵다. 고위험 임신 합병증 중 조기진통은 임신 34–36주에 중등도, 임신 34주 미만은 중증으로 분류되며, 임신 37주 미만의 조산은 고위험 분만에 해당되는데, 모자보건 의료 종사자들은 고위험 임산부를 잘 찾아내는 것이 중요하다[5].

조기진통 임부를 구별해내기 위해서는, 임신 37주 이전이면서 자궁경부의 개대와 소실을 동반하고 규칙적인 자궁 수축, 생리통 같은 통증, 절 불편감 등의 증상[6]이 있는지 평가할 필요가 있다. 또한, 자궁 수축보다 자궁경부의 변화가 먼저 일어날 수 있으나[7], 자궁경부 변화 없이 자궁 수축만 계속되는 조기진통도 있을 수 있으므로[8]. 분만실 간호사는 정상 임부의 중상과는 다른 조기진통 임부가 보이는 중상을 구별하기 위한 기술적 사항들을 학습할 필요가 있다. 그리고 산과 의사에게 즉각적인 보고가 필요한 조그램 상황이든 혹은 추가적인 검사가 이루어져야 할 상황인지에 따라 체계적으로 수행하여야 한다[9,10].


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 알러지에 대한 교육을 제공하고 이를 통합 수준의 시뮬레이션 실습교육에 적용함으로써(이하 조기진통 알고리즘 적용 실습교육이라고 함) 간호학생의 조기진통 관련 지식과 임상수행자신감에 미치는 효과를 평가하기로 하였다. 본 연구에서는 알고리즘 적용 실습교육에 대한 교육 만족도를 평가하기로 하였다.

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

연구 도구
조기진통 관련 지식
본 연구에서는 여성건강간호학 교재 [6]를 바탕으로 조기진통 산모 건호사 교육 시 필수적인 핵심지식을 평가하기 위한 정상분만과 차별되는 조기진통의 사정 및 임상응급에 관한 지식을 실습 문항으로 작성하였다. 이는 2021년 고위험 MFICU 간호사 보수교육에서 참석자들의 지식 변화를 알아보기 위해 개발된 20문항의 문항으로, 조기진통이 발생할 때 간호사의 적절한 대응 및 진료 진행에 있어 필수적인 지식과 지식성능을 평가하기 위해 개발된 문항이다. 본 연구에서는 20문양의 문항을 사용하여, 각 문항의 정답 점수는 1점, 오답 점수는 0점으로, 점수(가능 범위, 0~10)가 높음수록 지식 점수가 높은 것으로 의미하며, 본 연구에서 KR-20 신뢰도는 .78로 나타났다.

Table 1. Study design and process

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

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

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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 번안자에게 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 활동성상환, 투약시, 간호 제어를 추가하였다. 도구의 문항 수는 변경없이 원래의 도구에서 정한 바와 같이 간호과정 5문항, 간호 숙기 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 α는 .94[22]이었고, 본 연구에서도 Cronbach's α가 .94로 나타났다.

교육 만족도
본 연구에서 조기진통 알고리즘 시뮬레이션 실습교육에 대한 만족도 조사는 Song과 Hong[23]이 개발한 역할극을 통한 임상교육 만족도를 사용한 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 신흥도는 Cronbach's α.88, 본 연구에서는 Cronbach's α.96이었다.

연구 중재: 조기진통 사정 알고리즘 교육과 적용
조기진통 사정 알고리즘 교육자료는 PL AT에 포함된 조기진통 분류 알고리즘[11]을 본 연구자가 한국어로 번역·수정한 후 여성건강간호학 교과목을 20년 이상 담당해온 교수의 감수를 받았다. 양막파수를 확인할 수 있는 임상적 진단 방법 중 의료기관별로 시행 여부가 달라지는 검사인 Ferning, Amnisure와 그 외 배양검사인 B streptococcus culture, bacterial vaginosis screen 등은 제외 하였다. 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 PL AT의 내용을 이해할 수 있도록 조기진통 정의, 조산 위험성 사정의 필요성, fFN 양성의 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 구성하였다.

이 때 조산 위험성은 PL AT에 제시한 기준을 따라 일부가 호소하는 임상증상, 양막파수 여부, 자궁경부 개대 정도, fFN 검사 결과, 자궁경부 길이를 통해 임상적 판단을 하게 되는데, 다음과 같이 고 위험(high risk), 불분명(equivocal), 저위험(low risk)으로 나뉜다. 이 를 바탕으로 평가일에 대해 자료를 이용하여 32주 이내 임신 여성의 세 가지 임상 상황별로 판단할 사항과 판단하는 근거를 교육하였다.

COVID-19 범유행 상황이어서 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 18 mm
  →평가: 경관 길이가 20 mm 미만이므로 경부 개대가 3 cm 미만일지라도 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 결과를 참조(1주일 내 분만 예측의 참조)에 해당

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

(2) 알고리즘 기반 시나리오 작성
심습 학생들은 교육받은 조기진통 알고리즘 교육자료 내용 확장

조기진통 알고리즘 적용을 위한 교육과 훈련
전체적인 교육 흐름 및 시간은 Supplementary Table 1과 같이 이루어졌다.

- 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 미만일지라도 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 결과를 참조(1주일 내 분만 예측의 참조)에 해당

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

(3) 알고리즘 적용 연습
심습 학생들은 알고리즘 기반 시나리오를 바탕으로 상황별 판단을 적용하는 연습을 하였다. 알고리즘 적용에 필요한 능력으로 질 배진과 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 검사항
목과 결과를 연결해 보기 위한 목적으로 실시하였으며, 학생들이 작성한 조기진통 관리 알고리즘에 관한 조별 역할극을 간호사 1과 간호사 2의 1인 1조로, 1개 조 당 30분씩 진행하였다.

(4) 알고리즘 적용 실험(Supplementary Figure 1-4)
알고리즘 적용은 SimMom 3G, 표준화 환자, 지속적인 모니터링
이 이루어지는 분만 치료계획 환경에서 이루어졌다. 양수파막검사
을 실시하였으며, 학생들이 작성한 조기진통 관리 알고리즘에 관한 조별 역할극을 간호사 1과 2인 1조로, 1개 조 당 30분씩 진행하였습니다.

알고리즘 적용은 SimMom 3G, 표준화 환자, 지속적인 모니터링이 이뤄지는 분만 치료계획 환경에서 이루어졌다. 양수파막검사
을 실시하였으며, 학생들이 작성한 조기진통 관리 알고리즘에 관한 조별 역할극을 간호사 1과 2인 1조로, 1개 조 당 30분씩 진행하였습니다.

알고리즘 적용은 SimMom 3G, 표준화 환자, 지속적인 모니터링이 이뤄지는 분만 치료계획 환경에서 이루어졌다. 양수파막검사
을 실시하였으며, 학생들이 작성한 조기진통 관리 알고리즘에 관한 조별 역할극을 간호사 1과 2인 1조로, 1개 조 당 30분씩 진행하였습니다.

결과
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 실험 전후 조기진통 관련 지식과 임상수
행자신감의 변화, 실험 종료 후 교육 효과는 대응표본 t검정
(paired t-test), 그룹 간 비교는 분산분석(ANOVA), 알고리즘 적용 실험교육의 지속 효과는 반복 측정(repeated-measures ANOVA)로 분석하였다.

대상자의 일반적 특성
본 연구에 참여한 대상자의 평균 연령은 23.6±2.53세로 25세 이하 47명(77.0%), 26세 이상 14명(23.0%)이었다. 대상자 중 여성학생은 58명(95.1%), 남학생은 3명(4.9%)이었다. '간호과정과 비판적사
고' 교과목 성적은 평균 85.0±7.45점, 4학년 1학기 여성건강간호 1학년 성적은 평균 87.0±7.38점이었다. 1학기 동안 분만실 실
습은 33명(54.1%), 산부인과 실습은 28명(45.9%)이었다.

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

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean ± SD</th>
<th>Paired t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest (T0)</td>
<td>Posttest 1 (T1)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9.97 ± 1.80</td>
<td>12.16 ± 1.74</td>
<td>-7.17</td>
</tr>
<tr>
<td>Group 1 (n = 22)</td>
<td>9.59 ± 1.68</td>
<td>12.36 ± 2.17</td>
<td>-4.77</td>
</tr>
<tr>
<td>Group 2 (n = 20)</td>
<td>10.05 ± 1.61</td>
<td>11.85 ± 1.42</td>
<td>-4.10</td>
</tr>
<tr>
<td>Group 3 (n = 19)</td>
<td>10.32 ± 2.11</td>
<td>12.26 ± 1.52</td>
<td>-3.55</td>
</tr>
<tr>
<td>F (p)</td>
<td>0.86 (430)</td>
<td>0.49 (615)</td>
<td></td>
</tr>
</tbody>
</table>
조기진통 알고리즘 응용 실습교육의 지속 효과

조기진통 알고리즘 응용 실습교육의 지속 효과는 마지막 그룹 3의 실습 교육이 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 간각의 평균점을 대 상하지 않으며, 그룹별 실습교육 전후 차이를 살펴본 결과, 그룹 3(0.02), 그룹 1(0.002)의 평균점수와 그룹 2(0.02), 그룹 3(0.002)의 평균점수와의 차이가 유의하게 상승하였다(Table 3).

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

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean ± SD</th>
<th>Paired t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>Pretest (T0)</td>
<td>Posttest 1 (T1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>52.70 ± 6.87</td>
<td>59.77 ± 7.59</td>
<td>-5.51</td>
</tr>
<tr>
<td>Group 1 (n = 22)</td>
<td>51.36 ± 6.89</td>
<td>58.55 ± 8.05</td>
<td>-3.42</td>
</tr>
<tr>
<td>Group 2 (n = 20)</td>
<td>54.10 ± 7.57</td>
<td>59.90 ± 7.47</td>
<td>-2.32</td>
</tr>
<tr>
<td>Group 3 (n = 19)</td>
<td>52.79 ± 6.07</td>
<td>61.05 ± 7.36</td>
<td>-3.88</td>
</tr>
<tr>
<td>F (p)</td>
<td>0.83 (441)</td>
<td>0.55 (579)</td>
<td></td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Time</th>
<th>Mean ± SD</th>
<th>Sum of squares</th>
<th>F (p)</th>
<th>Bonferroni</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>T0</td>
<td>9.99 ± 0.23a</td>
<td>37.70</td>
<td>11.64 (.001)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>12.16 ± 0.23b</td>
<td></td>
<td></td>
<td>a &lt; b, a &lt; c, b &gt; c</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>11.10 ± 0.25c</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confidence</td>
<td>T0</td>
<td>52.70 ± 6.87d</td>
<td>281.87</td>
<td>19.45 (.001)</td>
<td>d &lt; e, d &lt; f, e &gt; f</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>59.77 ± 7.59e</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>55.77 ± 7.00f</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ANOVA: analysis of variance; CI: confidence interval.

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 논의하게 된다.


다음으로 조기진통 알고리즘 적용 실습교육의 효과를 평가하는 연구[24]는 알고리즘 적용 실습교육 후 8주째에서 만 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 3 (알고리즘 적용 실습교육 후 13주째)는 임상수행자신감 비교한 결과 실험군에서 우월하게 상승하였으나 통계적으로 유의한 차이가 없었다. 그러나 그룹 2, 3 모두 실습교육 전 지식 점수와 비교하여 유의한 감소가 없었다.
다. 즉 알고리즘 실습교육을 하는 것이 하지 않았을 때보다 짧게는 8주, 길게는 13주까지 지속적 교육 효과가 지속되었다고 보인다. 알고리즘 교육의 지속 효과에 관한 선행연구가 거의 없어 간호학생의 심폐소생술 교육의 지속성에 대한 연구가 필요하다. 심폐소생술 교육 후 8주까지 지속 która 지속되지 않았으며 6개월 후에 유의하게 감소하는 결과[30]에 비추어 볼 때, 교육 후 8–13주에 교육효과가 필요할 것으로 보인다. 이는 간호사의 사후출혈 시뮬레이션 교육 효과가 9개월 후에 사전 결과와 비슷한 수준으로 감소하였다는 결과[31]와 비교할 때, 교육 대상자와 학생이 간호사가격에 따라 다를 수 있다는 점, 기억여부 및 내용의 양, 해당 교육의 결과에 영향을 줄 수 있는 요인들을 더 탐색하여 재검토할 필요가 있다.


다음으로 본 연구에서 조기진통 알고리즘 심폐소생술 교육 만족도는 평균 45.3점으로 비교적 높은 점수를 보였다. 이는 조산 사의 주산기 시뮬레이션교육의 만족도 평가에서 시뮬레이션 교육 후 임상추론 및 임상적 의사결정과 관련된 항목이 가장 높았던 결과[32]와 비교할 때 임상적 의사결정을 돕는 알고리즘이 심폐소생술 만족도를 높일 수 있다고 추정된다. 또한, 본 연구에서 만족도 세부 항목 중 앞서 후배들의 심폐소생술으로 조기진통 증상들을 이용한 시뮬레이션 수업을 하는 것에 찬성하다는 4.62점으로 가장 높은 점수를 나타내어 조기진통 사정 알고리즘을 적용한 시뮬레이션 심폐소생술 교육을 계속할 필요가 있을 것으로 생각한다.

본 연구에서는 간호대학생에게 처음으로 PLAT의 조기진통 사정 알고리즘을 적용하고 이 알고리즘 실습교육의 단기 효과와 지속 효과를 객관시하였으나 다음과 같은 제한점이 있다. 첫째, 본 연구는 동성실 교육과정에 이르렀기 때문에 실습교육 적용 시기와 조사 기간을 무작위 실험설계로 진행하지 못한 간호학적 시기에 실제 조기진통 사정 알고리즘의 교육 효과를 비교할 대조군이 없는 제한점이 있다. 둘째, 본 연구에서는 3개월에 추가로 기간이 늘어난 점과 지속 효과를 평가하는 시기까지 교육 후 8주차, 13주차와 같이 일치하지 않았다. 이에 본 연구 결과는 시점별 해석에 주의를 기울일 필요가 있으며, 추후 연구에서는 이러한 제한점을 고려하여 연구설계와 반복 연구를 체계화한다. 또한 본 연구에서는 조기진통 임상의 임신 주수를 지정하였으나 조기진통 임상의 임신 주수의 변화를 부여하고 임상경부 복측술과 같은 조건을 포함한 알고리즘을 개발할 것을 제안한다. 한편 본 연구에서 효과크기 d=0.4를 채택하였으나 d=0.25[30], d=0.5[2], d=0.6[25]과 같이 다양하여 연구설계와 효과크기 측면의 검토가 필요하다.

이러한 제한점을보조하고 본 연구는 임상경부 개개 및 임상경관 간의, eFN 검사 결과를 포함한 PLAT의 조기진통 사정 알고리즘을 적용하고 이에 대한 단기 효과와 지속 효과를 확인한 국내 최초의 연구로서 앞으로 더 개발할 필요성을 보여주었다는 의의가 있음을 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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Data availability

Please contact the corresponding author for data availability.

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Supplementary materials

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References


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 $3.64±5.88$ 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
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 변화되었다. 이에 대학은 통합적 사고력을 갖춘 창의적 인재를 육성하기 위해 학습자를 고려하여 다양한 교수법을 연구하고 있다.[1]

이런 관점에서 대학은 교수와 학생의 역할을 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 교수학습방법 중 하나이다. 문제중심학습은 지식의 습득과 이해에 초점을 맞추지 않고, 지식과 관련된 문제상황을 해결하는 과정을 중시한다. 따라서 학생이 발생하는 문제해결 도출과정에 주안점을 두고 수업 절차를 구성하는 것이 특징이다.[4]. 교수가 실제 임상에서 발생하는 비구조화된 문제상황을 제시하고, 학생들은 문제를 해결하기 위해 자신의 지식을 바탕으로 고민하고 동료 학생들과 의견을 나눈다. 그 과정에서 추론과 융합을 통해 학습자의 창의성과 문제해결능력을 향상시킬 수 있다. 이와 같은 학습과정에서 학습자는 문제중심학습을 통해 문제해결능력과 창의성을 향상시킬 수 있으며, 학습자 중심의 교육활동이 강조되는 대학에서는 학습자 중심의 교육활동을 강조하고 있다.[5,6]

간호사의 역할은 복잡한 환경이라도 반복적이고 긴장된 상황에서 극단적으로 대상자의 상황에 대하여 반복적으로 사고하여 문제를 해결해야 한다. 특히 대상자의 상태가 감자가 변화하는 경우, 간호사는 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 촉진할 수 있으므로 간호교육에 적합한 교수법이라 할 수 있다.[7,8].


가상현실 시뮬레이션(virtual reality simulation)은 4차 산업 혁명으로 교육현장에 도입된 온라인 콘텐츠이다. 비구조화된 임상현장으로 구성되며, 각 상황에 대한 임상적 판단을 통해 문제해결능력의 향상에 기여한다.[11,12]. 가상현실 시뮬레이션은 학습 실험실이 있고 공간 제약은 없다는 장점 때문에, COVID-19 범유행 상황을 대비한 학습용 도구로 널리 사용되고 있다. 간호교육과도 유사한 관계를 형성할 수 있으며, 간호교육에서는 간호실습을 통한 학습을 대체할 수 있다. 이러한 점에서 가상현실 시뮬레이션은 간호학 교육을 위한 성공적인 도구로 기대되어 왔다.

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.
게 이해하기 위해 문제중심학습을 도입하다 하더라도 학습자가 적은 부분으로 스스로 반복적으로 접근할 때 학습 효과가 나타난다. 이때 가상현실 시뮬레이션을 함께 적용함으로써 문제중심학습을 보완하는 긍정적 효과를 얻을 수 있을 것이다. 두 가지 교수법의 시너지 효과를 창출하려면 가상현실 시뮬레이션이 문제해결과정 중 단계 과정, 중재 선택, 선택된 결과의 확인과 평가가 가능하다는 장점을 활용하여 수업을 구성할 수 있다. 학습자가 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 익숙한 현 세대의 특성을 생각할 때 문제중심수업 효과보다 더 높은 학습 효과를 보여줄 것이다. 이러한 점에 착안하여 다양한 지식을 통합한 사고력을 요구하는 간호교육에서 비판적 사고와 관련된 자아감을 향상할 수 있도록 가상현실 시뮬레이션 자기주도학습과 문제중심학습을 결합한 교수법을 구상하게 되었다.

우리 사회는 만환과 고령화 사회의 증가한왕실과 분만 합병증 발생률이 증가하고 이에 따라 유도분만 역시 계속 증가하고 있다. 유도분만은 산부와 태아 상태에 대한 통합적 이해와 관찰이 요구되므로 간호사의 정확한 지식, 비판적 사고와 문제해결능력이 매우 중요하다. 그러나 사생활 보호 요청과 출산을 저장으로 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 교육법을 설계하고 그 효과를 파악하고자 한다.

본 연구의 목적은 유도분만 수술 간호에서 문제중심학습 기반 가상현실 시뮬레이션 교육이 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 시뮬레이션 교육을 경험한 실험군과 일반 문제중심학습에 참여한 대조군의 비판적 사고성향, 문제해결능력, 자기효능감 차이를 검증하고, 가상현실 시뮬레이션 교육만족도를 확인하기 위한 비동등성 대조군 전후 시차설계(nonequivalent control group non-synchronized design)를 적용한 유사실험 연구이다(Figure 1).

<table>
<thead>
<tr>
<th>Control group (n=28)</th>
<th>Pretest</th>
<th>1st week - PBL</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>General characteristics</td>
<td>Critical thinking ability</td>
<td>Problem solving ability</td>
<td>Self-efficacy</td>
</tr>
<tr>
<td>Experimental group (n=24)</td>
<td>Pretest</td>
<td>1st week - PBL</td>
<td>Posttest</td>
</tr>
<tr>
<td>General characteristics</td>
<td>Critical thinking ability</td>
<td>Problem solving ability</td>
<td>Self-efficacy</td>
</tr>
<tr>
<td>Treatment</td>
<td>1st week - PBL</td>
<td>Virtual reality simulation</td>
<td>2nd week - PBL</td>
</tr>
<tr>
<td>Posttest</td>
<td>Critical thinking ability</td>
<td>Problem solving ability</td>
<td>Self-efficacy</td>
</tr>
</tbody>
</table>

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) 간호과 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-β) = .80, 유의수준(α) = .05으로 분석하였을 때 각 군에 26명씩 산출되었다. 구체적 기준은 다음과 같다.

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

실험군 중 COVID-19 감염 결석(n=2)과 개인 사정(n=2)으로 총 2주차 대면 수업에 참여하지 못하였으며, 가상현실 시뮬레이션 참여하지 않은 2명을 포함하여 총 24명이 분석에 포함되었다. 대조군은 총 28명이 분석에 포함되었다(Figure 2).

문제해결능력
문제해결능력은 한국교육개발원에서 Lee 등[18]이 개발한 문제해결능력 진단지를 사용하였다. 이 도구는 총 45문항으로 각 문항은 5점 Likert 척도로 측정되어 점수가 높을수록 임상수행능력이 높음을 의미한다. 총 2문항(8, 10)은 부정문항으로 점수의 일관성을 위해 역환산 처리하였다. 도구 개발 당시 신뢰도는 Cronbach’s α 계수는 .94이었으며, 본 연구에서 Cronbach’s α는 .88이었다.

연구 도구
비판적 사고성향
비판적 사고성향은 Yoon [17]이 개발한 비판적 사고성향 측정도구를 사용하였다. 본 도구는 총 7개의 하위영역으로 구분하여, 지적열정/호기심 5문항, 신중성 4문항, 자신감 4문항, 체계성 3문항, 지적공정성 4문항, 전반적 회의성 4문항, 객관성 3문항 등 총 27문항으로 구성되었으며, 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 α 계수는 .84이고 본 연구에서 Cronbach’s α는 .83이었다.

자기효능감

Figure 2. Flow diagram in this study.
가상현실 시뮬레이션 교육의 만족도
가상현실 시뮬레이션 교육만족도를 측정하기 위하여 Oh와 Kim [21]이 개발한 10문항을 원치를 해택을 받아 수정·보완하여 사용하였다. 프로그램 진행의 내용, 수행 시간, 구성 등의 적절성에 대하여 '매우 그렇지 않다(1점)에서 '매우 그렇다(5점)' 측정 Likert 척도로 측정하였으며, 점수가 높을수록 프로그램 교육만족도가 높음을 의미한다. Oh와 Kim [21] 연구에서 Cronbach's alpha는 .95였고, 본 연구의 Cronbach's alpha는 .96이었다.

자료 수집
본 연구는 안산시에 소재한 1개 대학에서 여성건강간호학 II 교과목을 수강하는 학생 중 자발적으로 연구 참여에 동의한 자를 대상으로 시행하였다. 해당 강의에 참여하지 않는 연구대상자가 연구 목적과 방법, 자료 처리와 폐기, 참여하지 않을 권리, 수익료에 대한 자를 대상으로 시행하였다. 해당 강의에 참여하지 않는 연구대상자는 수강하는 간호학과 3학년 학생 중 자발적으로 연구 참여에 동의한 자를 대상으로 시행하였다. 해당 강의에 참여하지 않는 연구대상자는 수강하는 간호학과 3학년 학생 중 자발적으로 연구 참여에 동의한 자를 대상으로 시행하였다. 

연구 진행절차
문제중심학습 기반 가상현실 시뮬레이션 교육 설계
대조군과 실험군 설계는 실험 처치와 측정기준에 의해 바른동성 대조군 전후 시차설계를 하였다. 이론수업을 먼저 진행하는 반(A-C반)은 대조군, 상담실습을 마치고 2주 후 이론수업에 참여하는 D-F반은 실험군으로 배정하였다. D-F반은 실험군으로 배정하였다. 실험군은 가상현실 시뮬레이션 교육만족도를 추가 조사하였다. 

자료 분석
수집된 자료 분석은 IBM SPSS ver. 23.0 (IBM Corp., Armonk, NY, USA)를 이용하여 분석하였다. 정규분포 유무를 확인하기 위하여 Kolmogorov-Smirnov test를 실시하였고. 대상자의 일반적 특성과 각 변수의 값은 빈도, 백분율, 평균과 표준편차로 분석하였으며, 가상현실 시뮬레이션 교육만족도를 측정하기 위하여 Cronbach's alpha는 .95이었다.
대상자의 일반적 특성과 사전 동질성 검정

실험군과 대조군의 일반적 특성과 종속변수에 대한 사전 동질성 검정은 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).

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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Categories</th>
<th>Experimental group (n=24)</th>
<th>Control group (n=28)</th>
<th>χ² or t or F (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21–25</td>
<td>22 (91.7)</td>
<td>24 (85.7)</td>
<td>0.45 (.674)</td>
</tr>
<tr>
<td></td>
<td>26–28</td>
<td>2 (8.3)</td>
<td>4 (14.3)</td>
<td></td>
</tr>
<tr>
<td>Sex†</td>
<td>Male</td>
<td>3 (12.5)</td>
<td>6 (21.4)</td>
<td>.720 (.480)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>21 (87.5)</td>
<td>22 (78.6)</td>
<td></td>
</tr>
<tr>
<td>Grade point average†</td>
<td>4.0–4.5</td>
<td>8 (33.3)</td>
<td>5 (17.9)</td>
<td>2.35 (.325)</td>
</tr>
<tr>
<td></td>
<td>3.0–3.9</td>
<td>9 (37.5)</td>
<td>16 (57.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.0–2.9</td>
<td>7 (29.2)</td>
<td>7 (25.0)</td>
<td></td>
</tr>
<tr>
<td>Motivation for choosing nursing major†</td>
<td>Employment</td>
<td>10 (42.3)</td>
<td>12 (42.9)</td>
<td>2.14 (.570)</td>
</tr>
<tr>
<td></td>
<td>Recommendation from others</td>
<td>4 (16.7)</td>
<td>8 (28.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aptitude</td>
<td>8 (33.3)</td>
<td>5 (17.9)</td>
<td></td>
</tr>
<tr>
<td>Preferred learning method†</td>
<td>High school grades</td>
<td>2 (8.3)</td>
<td>3 (10.7)</td>
<td>6.65 (.132)</td>
</tr>
<tr>
<td></td>
<td>Lecture</td>
<td>13 (54.2)</td>
<td>22 (78.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td>4 (16.7)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-study</td>
<td>3 (12.5)</td>
<td>2 (7.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Problem-based learning</td>
<td>3 (12.5)</td>
<td>2 (7.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical class</td>
<td>1 (4.2)</td>
<td>2 (7.1)</td>
<td></td>
</tr>
<tr>
<td>Interpersonal satisfaction†</td>
<td>Very high</td>
<td>3 (12.5)</td>
<td>3 (10.7)</td>
<td>1.63 (.734)</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>10 (41.7)</td>
<td>8 (28.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ordinary</td>
<td>9 (37.5)</td>
<td>15 (53.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>2 (8.3)</td>
<td>2 (7.1)</td>
<td></td>
</tr>
<tr>
<td>Critical thinking ability</td>
<td></td>
<td>92.21 ± 9.15</td>
<td>94.25 ± 7.02</td>
<td>−0.89 (.379)</td>
</tr>
<tr>
<td>Problem solving ability</td>
<td></td>
<td>152.50 ± 11.39</td>
<td>152.93 ± 12.42</td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td></td>
<td>97.88 ± 19.63</td>
<td>94.93 ± 25.14</td>
<td>−0.47 (.664)</td>
</tr>
</tbody>
</table>

†Fisher exact test.

Table 2. Differences in dependent variables between groups (N=52)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>Mean ± SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
<td>Difference</td>
</tr>
<tr>
<td>Critical thinking ability</td>
<td>Experimental</td>
<td>92.21 ± 9.15</td>
<td>103.75 ± 10.18</td>
<td>9.50 ± 9.33</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>94.25 ± 7.02</td>
<td>99.11 ± 12.33</td>
<td>6.89 ± 8.41</td>
</tr>
<tr>
<td>Problem solving ability</td>
<td>Experimental</td>
<td>152.50 ± 11.39</td>
<td>192.75 ± 14.85</td>
<td>40.25 ± 18.18</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>152.93 ± 12.42</td>
<td>167.96 ± 17.43</td>
<td>15.04 ± 15.97</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>Experimental</td>
<td>97.88 ± 19.63</td>
<td>142.00 ± 13.91</td>
<td>44.13 ± 23.82</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>94.93 ± 25.14</td>
<td>112.36 ± 21.10</td>
<td>17.43 ± 28.36</td>
</tr>
</tbody>
</table>
성향은 사전 94.25±7.02점에서 사후 99.11±12.33점으로 6.89±8.41점 상승하였다. 그러나 비판적 사고성향의 두 그룹 간 사전-사후 차이는 통계적으로 유의하지 않았다고(t=–1.47, p=.149) 제1가설은 지지되지 않았다.

문제해결능력은 실험군이 사전 152.50±11.39점, 사후 192.75±14.85점으로 40.25±18.18점 상승하였고, 대조군의 문제해결능력은 사전 152.93±12.42점, 사후 167.96±17.43점으로 15.04±15.97점 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±19.63점, 사후 142.00±13.91점으로 44.13±23.82점 상승하였고, 대조군은 사전 94.93±25.14점, 사후 112.36±21.10점으로 17.43±23.36점 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±5.88점이었다. 만족도가 가장 높았던 항목은 유도분만간호에 대한 관심도 상승(3.81±0.79점)이었으며, 다음으로 반복학습의 유용성(3.79±0.78점)과 가상현실 시뮬레이션 화면의 구성충실도(3.75±0.62점) 순으로 높았다. 반면 본 프로그램이 영어로 구성되기에 때문에 사용 언어(3.42±0.80점)와 이해도(3.42±0.80점)에 대한 만족도가 가장 낮았고, 가상현실 시뮬레이션 프로그램 사용에 대한 설문과 수행(3.54±0.83점)에서 만족도가 낮았다.

Discussion

유도분만은 산모와 태아 상태에 대한 동시 판단이 필요하며 약물 부작용과 제왕절개분만 산화처럼 예상치 못한 상황을 면두에 두어 야 한다. 특별한 문제가 발생하지 않는다는 하더라도 본 연구에 따라 산모의 불안과 진통이 증가하여 통합적인 간호가 필요하다. 이에 본 연구에서는 간호대학생이 유도분만간호에 대해 정확한 지식을 기반으로 본 상황 판단과 정보의 선택, 그리고 문제해결능력의 함양을 위해 학습자간 유동적으로 참여하고 상호작용할 수 있는 문제중심학습 기반 가상현실 시뮬레이션 교육을 간호대학생에게 적용한 결과를 토대로 논의하고자 한다.


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

본 연구에서 비판적 사고성향은 실험군과 대조군 간의 점수 차이가 통계적으로 유의하지 않았다. 기존 연구에서 간호학개념에서 실제성, 실생활의 상황에 적용하여 문제해결능력에 영향을 미칠 것으로 생각된다. 이러한 점을 고려하여, 가상현실 시뮬레이션 교육 후 자기효능감의 경도가 향상됨을 확인하였고, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다. 단순 술기로 암기해도 도움이 될 수 있지만, 학습자가 스스로 문제를 해결하는 데 도움이 될 수 있었다.
Data availability

Please contact the corresponding author for data availability.

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References


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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.

Keywords: Artificial intelligence; Nursing; Simulation

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.

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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Authors' contributions

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Data availability

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References


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 (β=.31, p<.001) and social support (β=.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

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-
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.
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, α 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 Korean 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-
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 ± 4.29 years, and the mean gestational age was 24.37 ± 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 ± 0.80 for anxiety, 2.80 ± 0.88 for depression, 30.70 ± 6.87 for social support, and 73.04 ± 17.80 for physical health status. The mean score for HRQoL was 1.39 ± 0.39, and the mean scores for the HRQoL subcategories were 0.32 ± 0.56 for mobility, 1.10 ± 0.35 for self-care, 1.32 ± 0.55 for usual activity, 1.66 ± 0.64 for pain/discomfort, and 1.55 ± 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 2).

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

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

†Cystitis, coronavirus disease 2019, hypothyroidism, Ménière disease, pyelonephritis, and thyroid cancer; ‡Nausea, pruritus, diarrhea, constipation, hematuria, cough, hypothyroidism, and pelvic pain.
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-

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

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

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

<table>
<thead>
<tr>
<th>Factor</th>
<th>Age</th>
<th>Anxiety</th>
<th>Depression</th>
<th>Social support</th>
<th>Physical health status</th>
<th>HRQoL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1</td>
<td>–.04 (.600)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>–.04 (.600)</td>
<td>1</td>
<td>–.58 (&lt;.001)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social support</td>
<td>–.14 (.059)</td>
<td>–.33 (&lt;.001)</td>
<td>–.29 (&lt;.001)</td>
<td>–.29 (&lt;.001)</td>
<td>–.44 (&lt;.001)</td>
<td></td>
</tr>
<tr>
<td>Physical health status</td>
<td>–.05 (.520)</td>
<td>–.32 (&lt;.001)</td>
<td>–.29 (&lt;.001)</td>
<td>–.29 (&lt;.001)</td>
<td>–.44 (&lt;.001)</td>
<td>–.44 (&lt;.001)</td>
</tr>
<tr>
<td>HRQoL</td>
<td>.12 (.098)</td>
<td>.29 (&lt;.001)</td>
<td>.31 (&lt;.001)</td>
<td>–.34 (&lt;.001)</td>
<td>.44 (&lt;.001)</td>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Factor</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>.008</td>
<td>.01</td>
<td>.06</td>
<td>.71</td>
<td>.474</td>
</tr>
<tr>
<td>Depression</td>
<td>.070</td>
<td>.03</td>
<td>.15</td>
<td>1.88</td>
<td>.061</td>
</tr>
<tr>
<td>Social support</td>
<td>–.012</td>
<td>.01</td>
<td>–.21</td>
<td>–3.06</td>
<td>.003</td>
</tr>
<tr>
<td>Physical health status</td>
<td>–.007</td>
<td>.01</td>
<td>–.31</td>
<td>–4.19</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Adjusted $R^2 = 26.0$, 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).
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 ± 0.15 and 0.71 ± 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.

**Funding**

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**Data availability**

Please contact the corresponding author for data availability.

**Acknowledgments**

None.

**References**

Instructions to Authors

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.

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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 participants 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.

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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 instructions for revision, if appropriate, within two months after receipt of the submission.

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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).

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Example 1</th>
<th>Example 2</th>
<th>Example 3</th>
<th>Example 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will individual participant data be available (including data dictionaries)?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>What data in particular will be shared?</td>
<td>All individual participant data collected during the trial, after deidentification.</td>
<td>Individual participant data that underlie the results reported in this article, after deidentification (text, tables, figures, and appendices).</td>
<td>Individual participant data that underlie the results reported in this article, after deidentification (text, tables, figures, and appendices).</td>
<td>Not available</td>
</tr>
<tr>
<td>What other documents will be available?</td>
<td>Study protocol, statistical analysis plan, informed consent form, clinical study report, analytic code</td>
<td>Study protocol, statistical analysis plan, analytic code</td>
<td>Study protocol</td>
<td>Not available</td>
</tr>
<tr>
<td>When will data be available (start and end dates)?</td>
<td>Immediately following publication. No end date.</td>
<td>Beginning at 3 months and ending at 5 years following the article publication.</td>
<td>Beginning at 9 months and ending at 36 months following the article publication.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>With whom?</td>
<td>Anyone who wishes to access the data.</td>
<td>Researchers who provide a methodologically sound proposal.</td>
<td>Investigators whose proposed use of the data has been approved by an independent review committee (&quot;learned intermediary&quot;) identified for this purpose.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>For what types of analyses?</td>
<td>Any purpose</td>
<td>To achieve aims in the approved proposal.</td>
<td>For individual participant data meta-analysis.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>By what mechanism will data be made available?</td>
<td>Data are available indefinitely at (link to be included).</td>
<td>Proposals should be directed to xxx@yyy. To gain access, data requestors will need to sign a data access agreement.</td>
<td>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.</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Data are available for 5 years at a third-party website (link to be included).</td>
<td>Information regarding submitting proposals and accessing data may be found at (link to be provided).</td>
<td></td>
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</table>

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.

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 worldwide 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).

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).

Ensure correct use of the terms sex (when reporting biological factors) and gender (identity, psychosocial or cultural factors), and, unless inappropriate, report the sex or gender of study participants, the sex of animals or cells, and describe the methods used to determine sex or gender. If the study was done involving an exclusive population, for example in only one sex, authors should justify why, except in obvious cases (e.g., 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:**


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


**Book:**


**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)a | 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               |

aMaximum 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.

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Unpublished thesis or dissertation:

Web reference:

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 primar-
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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=1) or the Guidelines on Good Publication Practice (https://publicationethics.org/guidance/Guidelines) can be applied.

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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.

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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.

4. 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.

5. Originality and Duplicate Publication

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7. 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.
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**Title page**

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☐ A4, 12 point font Times New Roman in MS Word file

☐ Line space: Double spacing / Margins of at least 1 inch (2.5 cm)

☐ Within 5,000 words (excluding figures, tables, references)

☐ Author information is removed

**Abstract**

☐ 250 words or less (240-250 words are suggested)

☐ Subheadings of Purpose, Methods, Results, and Conclusion

**Summary Statement**

☐ 30 words or less under each subtitle

**Main Text**

☐ Subheadings of Introduction, Methods, Results, and Discussion

☐ Permission to use instruments should have been obtained

☐ Specify Ethics statement under Methods subheading. Avoid redundant descriptions in the text

**References**

☐ References follow NLM style

☐ Limit supporting references to 1-2 per statement

**Table, figure, and picture**

☐ 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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