Aims and Scope

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

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

About the Journal

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

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

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This time of the year brings a sense of excitement, as various dictionaries announce the ‘Word of the Year’ that marks our preoccupations, curiosity, and reflects our ethos. Although several dictionaries announced words related to the proliferation of artificial intelligence (AI), e.g., hallucination [1], two major dictionaries selected divergent alternatives. Merriam-Webster selected authenticity [2] considering the number of lookups but also in relation to a likely “crisis of authenticity” in our era of deep-fakes and post-truths [3]. On a very different tangent, Oxford Word of the Year is rizz, taken from the word charisma and defined as ‘style, charm, or attractiveness; the ability to attract a romantic or sexual partner’ [4]. As I looked back on the milestones of the Korean Journal of Women Health Nursing (KJWHN), I couldn’t help but ponder how these words might offer a timely message for journal editors and researchers alike.

Journal accomplishments

This year KJWHN was honored and elated to be indexed in MEDLINE [5], a major feat for a regional journal in the field of nursing, as only approximately 11% of journals that apply to MEDLINE are accepted [6]. This is evermore significant as we are also one of a small cadre of nursing journals simultaneously indexed in PubMed Central (PMC) [5]. Another milestone was publishing a special issue, which was a first for KJWHN. The September 2023 issue focused on “Digital era education for women’s health and wellbeing” (https://kjwhn.org/current/index.php?vol=29&no=3) and covered expert opinion on opportunities and challenges for AI-integrated healthcare and healthcare education [7], as well as reviews and original research on quality evaluation, digital literacy, and virtual reality use in the classroom.

Journal metrics

Table 1 presents data on manuscripts submitted to KJWHN as of December 10, 2023. The increase in unsolicited manuscripts, from 63 in 2022 [8] to 80 in 2023, suggests a boost from being indexed in PMC and the Emerging Sources Citation Index (ESCI) in 2022. A notable increase in international submissions was also seen. However, compared to seven unsuitable manuscripts in 2022 [8], a substantial increase of 30 manuscripts was also observable this year. These editorial or ‘desk’ rejections were largely due to incongruency with our aims and scope or concerns with high percentages
in screening for plagiarism. Related to these increases in numbers, however, the editorial board has experienced challenges with limitations in resources and time, and subsequent fatigue in editors and reviewers. This is likely to have affected the time from submission to acceptance, which was roughly 56 days in 2022 [8] but lagged slightly to 85 days in 2023.

**Applying the Words of the Year to scholarly publishing**

Considering our accomplishments and journal metrics, you could say KJWHN has proven it has rizz enough, evidenced by becoming indexed in MEDLINE and attracting an increase in submissions, especially from overseas. However, our challenge is to stay true to our identity and mission, i.e., striving for an authentic presence as a scholarly journal committed to women’s health nursing.

In this line, a continuous challenge is to communicate more effectively with potential authors to recognize the journal’s aims and scope as well as our emphasis on international standards for scholarly work, e.g., advocating the use of reporting guidelines, clinical trial registration for human intervention studies, data sharing statements, etc. [8]. Another real challenge is to widen the pool of reviewers to facilitate the review process. A strategic plan would include preparing junior researchers as reviewers, showing respect and appreciation for their participation, while monitoring whether reviewers might show signs of reviewer fatigue. I take this opportunity to welcome inquiries about becoming a reviewer or how to improve reviewing skills.

Researchers could also apply these two Word of the Year terms to scholarly publications. Firstly, authenticity is central when writing the manuscript for dissemination. Merriam-Webster defines authentic as “not false or imitation; true to one’s own personality, spirit, or character” [9]. Thus, authentic manuscript writing can be interpreted as being true to the spirit and main message of the study findings. It may be tempting to think research rizz involves verbose writing or strictly following a ‘template-style’ flow of writing, as is often seen in early-stage researchers. It is worthwhile, however, to remember that wordy manuscripts do not necessarily showcase productivity or value; they rather run the risk of being redundant and cliché, and may subsequently end in vague, superficial implications. In other words, be true to your study’s main message and aim for succinctness and clarity. An example is to bring the main research aim and dependent variable to the forefront of the Discussion section, focusing on interpretation and implications, rather than flooding the text with what was already presented in the Results section.

**Appreciation for 2023 reviewers**

I wish to acknowledge the following dedicated reviewers who have supported KJWHN this year:

- Ahn, Suk Hee (Chungnam National University)
- Bae, Kyungeui (Dongseo University)
- Chae, Hyun Ju (Joongbu University)
- Cheon, Suk Hee (Sangji University)
- Cho, Insook (Inha University)
- Cho, Ok-Hee (Kongju National University)
- Choi, Hyunkyung (Kyungpook National University)
- Choi, Mi Jin (Chodang University)
- Choi, So Young (Gyeongsang National University)
- Chung, Chae Weon (Seoul National University)
- Chung, Mi Young (SunMoon University)
- Ha, Ju Young (Pusan National University)
- Han, Jeehee (Chung-Ang University)
- Haruna, Megumi (University of Tokyo)
- Hong, Sehoon (Chung University)

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<td>Non-accepted manuscripts (n)</td>
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<td>30 Accepted, 15 rejected</td>
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<td>Manuscripts under review or revision (n)</td>
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<td>Average time from submission to acceptance (day)</td>
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For the “Reviewer of the Year 2023,” the journal congratulates the following reviewers:

- Jeung-Im Kim (Soonchunhyang University)
- Joungyoun Kim (University of Seoul)
- Minjeong Seo (Gyeongsang National University)

And special recognition goes to our “Editor’s Pick 2021–2022,” as the most cited manuscripts in the Scopus database for the previous 2 years period.


As we look towards the future, the journal will continue to keep true to our identity and scope, committing to quality, trustworthiness, and communication with potential authors. Please join us in making an impact on women's health by becoming a reviewer and/or considering the journal for submission of quality studies on women's health nursing.

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**Authors' contributions**

All work was done by Kim S.

**Conflict of interest**

Sue Kim has been editor-in-chief of the *Korean Journal of Women Health Nursing* since January 2020. She was not involved in the review process of this editorial. Otherwise, there was no conflict of interest.

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Acknowledgments

None.

References

1. Hickman K. These are the 2023 Words of the Year, according to dictionaries [Internet]. White Plains, NY: Reader's Digest; 2023 Dec 13 [cited 2023 Dec 17]. Available from: https://www.rd.com/article/word-of-the-year/


Background

Approximately 36% of all cancer patients in Korea receive radiotherapy, a key modality of cancer treatment alongside surgery and chemotherapy. Diverse therapeutic techniques have resulted from advances in radiological technology and treatment devices, contributing to the improvement of the quality of treatment and patients’ quality of life.

According to 2022 data from the Korea Institute of Radiological Medical Sciences, 7.8% of female patients who underwent radiotherapy in 2019 received treatment for gynecologic cancer. Notably, approximately 98% of brachytherapy procedures were conducted to treat gynecologic cancer [1]. Radiotherapy for gynecologic cancer, which can involve both teletherapy and brachytherapy, plays a pivotal role in improving treatment outcomes because it targets not only the early stages of the cancer but also advanced lesions for radical, adjuvant, and palliative purposes. This article explores recent developments in radiotherapy, with a particular focus on radiotherapy for gynecologic cancer, and discusses acute and chronic adverse events that may occur during treatment, as well as interventions.

Latest trends in radiotherapy

Radiotherapy aims to maximize treatment effectiveness and minimize side effects by primarily irradiating tumor tissues and limiting radiation exposure to the surrounding normal tissues. Radiotherapy technology has advanced dramatically over the last 20 years, and the effectiveness of concomitant chemoradiotherapy treatment has been proven in a substantial number of studies as presented in a recent systematic review [2]. Radiotherapy initially involved treatment in a flat, two-dimensional (2D) plane based on 2D imaging centered around tumors. Subsequently, three-dimensional (3D) conformal radiotherapy became available; this method models tumors and the surrounding tissues in three dimensions using computed tomography and magnetic resonance imaging, enabling more precisely targeted treatment. High-precision radiotherapy procedures, such as intensity-modulated radiotherapy (IMRT), respiratory-gated radiotherapy, image-guided radiotherapy, and stereotactic radiotherapy, emerged in the 2000s. Active research is currently underway in the field of concomitant chemoradiotherapy, which combines radiotherapy with cancer immunotherapy [3]. Furthermore, particle therapies using protons and heavy ion particles, which are recognized for their higher treatment effectiveness and fewer side effects compared to traditional high-energy X-ray therapies.
listed above, have gained attention in recent years \[4,5\] (Figure 1). Both therapies utilize subatomic particles, and their utility is based on the ‘Bragg peak,’ a phenomenon where particles penetrate normal tissues in the human body and emit radiation energy only at specific depths where tumor tissues are found \[6\] (Figure 1).

However, cost-effectiveness should be carefully considered when choosing a treatment modality, since radiotherapy using X-rays has favorable treatment outcomes for gynecologic cancer, while particle therapy is currently offered only at three medical institutions in Korea and heavy ion particle therapy is not covered by insurance.

Gynecologic cancer is unlike other malignancies in that it often requires brachytherapy, which involves intravaginal insertion of devices, and the placement of isotopes close to the lesion for treatment, in combination with teletherapy. The advantages of brachytherapy include the delivery of a high dose of radiation due to the proximity of the equipment to the treatment area and the minimization of effects on normal tissues in the bladder and rectum \[7,8\] (Figure 2). Data reported in 2021, however, showed that the availability of brachytherapy decreased from 84% in 2005 to 78% in 2013 in Korea and the number of medical institutions that offer brachytherapy also declined from 65% in 2006 to 36.8% in 2014 \[9\]. Since it is impossible to maintain facilities for brachytherapy available due to low medical reimbursements and challenges in equipment management, patients are often referred to other institutions.

**Patient care by radiotherapy for gynecologic cancer**

Unlike chemotherapy, most symptoms related to radiotherapy occur locally in the treatment area and are affected by the method, area, dose, and duration of treatment, as well as the patient’s general condition. In general, radiotherapy for gynecologic cancer involves irradiating the pelvis, and the treatment area can be

![Figure 1.](https://www.mohw.go.kr/synap/doc.html?fn=2007041009432467018_1.hwp&rs=/upload/result/202312/)

![Figure 2.](https://www.aboutcancer.com/intracavitary_radiation_treatments.htm)

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expanded to the upper abdomen if the paraaortic lymph nodes are included in the treatment. Gastrointestinal symptoms, micturition, and genital disorders can occur due to the treatment. While most symptoms improve substantially within 6 months after the end of treatment, some patients suffer prolonged discomfort due to the persistence of these symptoms [10].

**Gastrointestinal complications**

Gastrointestinal symptoms caused by radiotherapy for gynecologic cancer include diarrhea, nausea, vomiting, tenesmus, and rectal bleeding. Approximately 30% of patients who undergo pelvic radiotherapy experience acute enteritis accompanied by diarrhea. In 10% of these patients, the symptom persists even after 5 years after treatment completion [10]. A study that compared existing 3D conformal radiation therapy (CRT) and IMRT reported that grade 3 or more severe diarrhea [11] occurred significantly more frequently in the 3D CRT group than in the IMRT group (30.6% vs. 5.6%) [12]. Therefore, IMRT has become the more widely used procedure. Common approaches to acute enteritis include fiber products, antidiarrheal agents, and the supply of fluids and electrolytes through intravenous hydration. For malabsorption due to chronic enteritis, the use of vitamin B12 and cholestryramine for bile salt malabsorption can be actively considered [13]. Anti-inflammatory agents, intestinal protectants, intestinal antimotility agents, and probiotics are generally used for acute radiation proctitis [14], and if rectal bleeding persists, endoscopic treatment, such as a sucralfate enema or argon-plasma coagulation, may be required [15,16].

**Genitourinary complications**

The bladder and ureter are inevitably exposed to radiation due to their close proximity to organs affected by gynecologic cancer. In the GOG-99 study, low-grade genitourinary toxicity was reported in approximately 43% of patients following radiotherapy after endometrial cancer surgery [10]. Symptoms include frequent urination, dysuria, and rarely, hematuria. When these symptoms occur, urinalysis and culture tests are conducted to determine whether the patient has an infection, and medication is then prescribed. If infection is ruled out, ibuprofen and phenazopyridine may be helpful for frequency, and anticholinergics can be helpful for urgency [10]. If oral medications are not effective, the cystoscopic injection of botulinum toxin A can be attempted [17]. For hemorrhagic cystitis, which can occur chronically, laser fulguration of ectatic vessels, intravesical alum or formalin, or hyperbaric oxygen may be considered [18]. Urethral strictures, which may occur in less than 5% of patients, can be addressed by endoscopic dilation or stent placement. While vesicovaginal fistulas are typically managed through simple fulguration and catheter drainage, they sometimes require open surgical repair [19].

**Sexual dysfunction**

The most frequent complications experienced by gynecologic cancer patients who have undergone pelvic radiotherapy are vaginal stenosis and diminished ovarian function in premenopausal women. These complications can lead to challenges in sexual relationships due to dyspareunia and reduced vaginal discharge, resulting in negative effects on women’s quality of life. The incidence of vaginal strictures due to radiotherapy varies from 1.2% to 88%, depending on the patient’s personal characteristics, treatment method, and dose. Vaginal strictures occur in 50% or more of patients within 3 years after the completion of treatment [20] (Figure 3).

In general, patients undergoing pelvic radiotherapy often experience menopause within 6 months after completing treatment. To alleviate the symptoms of menopause, oral progesterone and/or estrogen with a serotonin-specific reuptake inhibitor can be administered. Vaginal dilators are commonly employed as a treatment for vaginal strictures. Patients are advised to use these dilators for a duration of 10 to 15 minutes, 2 to 3 times per week, for a period of 3 to 12 months posttreatment (Figure 4).

In contrast to the past, there is now a rising demand to address sexual issues alongside physical symptoms, with a growing interest in maintaining functionality. Therefore, several models are being proposed to aid in sexual assessment and interventions [21] (Table 1).

**Hematologic toxicity**

High-dose radiotherapy causes chronic myelosuppression and damage to the bone marrow microenvironment, potentially affecting the effectiveness of chemotherapy. A study reported that acute grade 3 (Common Toxicity Criteria version 2.0, National Cancer Institute) or more severe leukopenia occurred in 81% of patients undergoing cisplatin-based pelvic chemoradiotherapy, which included expanded coverage of the para-aortic lymph nodes or common iliac lymph nodes [22]. Hence, it is necessary to monitor the neutrophil, platelet count, and hemoglobin levels through weekly blood tests. Active interventions should also be implemented, including assessing the risk of infection, based on
Table 1. Models for sexual assessment and intervention

<table>
<thead>
<tr>
<th>ALARM Model</th>
<th>PLISSIT</th>
<th>BETTER</th>
<th>PLEASURE</th>
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<tbody>
<tr>
<td>Activity (sexual)</td>
<td>P – Permission</td>
<td>Bring up sexuality</td>
<td>Partner</td>
</tr>
<tr>
<td>Libido/desire</td>
<td>L – Limited Information</td>
<td>Explain role of sexuality in QOL</td>
<td>Lovemaking</td>
</tr>
<tr>
<td>Arousal/orgasm</td>
<td>SS – Specific Suggestions</td>
<td>Tell about available resources</td>
<td>Emotions</td>
</tr>
<tr>
<td>Resolution/release</td>
<td>IT – Intensive Therapy</td>
<td>Timing critical</td>
<td>Attitudes</td>
</tr>
<tr>
<td>Medical data</td>
<td></td>
<td>Educate patient/partner</td>
<td>Symptoms</td>
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<tr>
<td></td>
<td></td>
<td>Record in health record</td>
<td>Understanding</td>
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<td>Reproduction</td>
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<td>Energy</td>
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</table>

QOL, quality of life.

Figure 3. Comparison of the cervix before and after radiotherapy. (A) Cervical cancer IIb, pre-radiotherapy. (B) Five months after radiotherapy (external beam radiotherapy [50.4 Gy]+high-dose-rate brachytherapy [24 Gy]).

Figure 4. Vaginal dilator.

the severity of the condition.

Dermatologic toxicity

Most skin reactions to gynecologic cancer radiotherapy are grades 1 to 2, but moderate or more severe skin reactions (grading criteria for radiodermatitis by the Radiation Therapy Oncology Group) are observed in up to 95% of patients with vulvar cancer [23]. Mild erythema may occur in the vulva, perineum, and inguinal and gluteal folds about 2 to 3 weeks after pelvic teletherapy, and this can be alleviated by using a topical moisturizer. Vulvar cancer patients often have white plaques covering their skin due to the overgrowth of Candida. Wearing loose-fitting, cotton clothing, avoiding heat, and using 1% hydrocortisone cream if pruritis is present may help alleviate this symptom. Late dermatologic effects include hyperpigmentation or hypopigmen-
ation, as well as telangiectasis and textural changes.

**Lymphatic system dysfunction**

Lower-extremity lymphedema is a chronic disease that may develop after the treatment of gynecologic cancer. This condition may occur if pelvic lymph nodes are included in the scope of radiotherapy after pelvic lymph node dissection during surgery. It is of the utmost importance to detect and address lymphedema early, as it can be irreversible depending on its severity. The initial assessment often relies on self-reports; thus, it is essential that patients receive prior education on lymphedema. This education should cover prevention strategies, measurement techniques, and methods for massaging the lymph nodes.

Radiation oncology nurses play a crucial role in addressing the side effects caused by radiotherapy in clinical practice. Hence, they should be able to predict the likelihood of treatment-related adverse events based on a fundamental understanding of radiotherapy. They should also be educated in advance on how patients and their caregivers can respond to changes and self-manage, in addition to providing direct nursing interventions for adverse events. Furthermore, they should conduct evidence-based assessments, be knowledgeable of symptom management, and share the information with their teammates as part of a multidisciplinary approach. The role of radiation oncology nurses as patients’ supporters and educators will make a significant contribution to improving treatment adherence among patients undergoing radiotherapy.

**Conclusions**

As radiotherapy techniques for gynecologic cancer become increasingly sophisticated and varied, the role of radiotherapy in cancer treatment is expanding. While the primary focus used to be on treatment outcomes, there is now a growing interest in the various issues experienced during the cancer survival period posttreatment, as well as symptom management during treatment. Despite the rising demand for care in tumor treatment, very few nursing curricula in Korea include education on radiotherapy, particularly the knowledge necessary for radiation oncology practice. Therefore, consistent efforts are needed to provide updated evidence-based practice, not only in clinical care but also in education.

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**Author’s contributions**

All work was done by Moon H.

**Conflict of interest**

The author 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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A comparison of the perceived importance and performance of midwives' roles between midwives and nurses in Korea: a cross-sectional study

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Purpose: This study aimed to identify the perceptions, importance, and performance of midwives' roles among midwives and nurses in Korea.

Methods: A descriptive correlational design was employed. Data were collected from 164 nurses and 79 midwives from April 1 to June 25, 2021. Midwives enrolled in the Korean Midwifery Association and nurses and midwives from two hospitals each Daegu and Gyeonggi Province in Korea were invited to participate. The independent t-test, chi-square test, the Welch-Aspin test, and Pearson correlation coefficient were used for analysis.

Results: The midwives' role perception score (3.47±1.46) was lower than that of nurses (3.95±0.85), and the midwives' role performance score (2.98±0.83) was also lower than that of nurses (3.34±0.89). Significant differences were observed between midwives and nurses in their perception and performance of roles related to prenatal management, childbirth management, management of psychological changes, postpartum management, and newborn care. Higher role perception and performance among midwives were linked to the management of psychological changes and women's health, indicating potential areas for future development.

Conclusion: The study results suggest directions for developing new roles for midwives. It is necessary to find a way to expand the field of midwives in public health by benchmarking the roles of midwives in various countries.

Keywords: Nurses; Nurse midwives; Role; Perception; Work performance

Introduction

Since South Korea's total fertility rate dropped below the replacement level of two children per woman in 1985, it has fluctuated between one and just under two. In 2008, the rate was 1.19, but it reached a historic low of 0.92 in 2019, followed by 0.78 in 2022. The number of births in 2022 was particularly low at 249,100, making it a challenge to sustain numbers in the 300,000 range [1]. The domestic number of births also saw a significant decline of 37% from 434,169 in 2015 to 273,292 in 2020. Meanwhile, the number of obstetrics and gynecology hospitals and maternity hospitals—key facilities for childbirth—initially increased from 13 to 20, but then dropped to 15 by 2020. Furthermore, the number of births in maternity hospitals fell from 1,676 in 2013 to just 668 in 2020 [2]. This decline has put the profession of midwives, who focus on childbirth preparation, in jeopardy.
Midwives are specialized healthcare professionals who have been instrumental in improving public health and promoting healthy lifestyles through guidance on childbirth, as well as prenatal and neonatal care [3]. Their responsibilities encompass childbirth preparation, managing the various stages of labor (stages 1 through 4), providing postpartum care for newborns, and performing resuscitation on infants who experience asphyxiation. In the realm of postpartum care, midwives oversee breastfeeding support and care for high-risk postpartum conditions. For newborns, they conduct health assessments and offer education and counseling [4], thereby extending the scope of maternal nursing. Midwives have also been at the forefront of advocating for natural childbirth methods, minimizing unnecessary medical interventions, and empowering women to take charge of their bodies during labor, which contributes to more positive childbirth experiences [5]. However, South Korea’s record-low fertility rate has led to a situation where midwives are unable to fulfill their vital roles, putting them at risk of losing their jobs and highlighting the need to reassess their professional roles.

In various countries, in anticipation of changes in childbirth environments, guidelines for midwifery practices have been developed to explore the expanded roles of midwives across multiple aspects. In Sweden, midwives have broadened their scope of responsibilities to include tasks such as dressing cesarean section incisions, as well as duties related to family planning and counseling adolescents [6]. In the United Kingdom, midwives address health issues including domestic violence, sexual assault, mental disorders, and substance abuse. They conduct home visits, monitor the health and safety of children, assess parenting skills, and provide referrals to relevant agencies when intervention is necessary [7]. Canadian midwives offer pregnancy and parenting services, facilitate information exchange among expectant mothers, and integrate these efforts into the local community [8]. These countries emphasize the importance of expanding the scope of midwives’ roles to include the responsibilities typically associated with specialized nurses, underscoring the capability of midwives as healthcare professionals who can provide primary nursing care. By standardizing midwifery practices and extending the unique responsibilities of midwives to serve all community members, these nations are establishing a healthcare system where midwives can effectively perform specialized roles.

Anticipating changes in the role of midwives in Korean society, we examined the actual tasks performed by midwives. Our study involved analyzing job experiences in maternity hospitals [5], developing guidelines for community-based midwives [9], and researching job satisfaction among midwives in both hospitals and maternity hospitals [10,11]. Additionally, we have investigated ways to expand the role of midwives through studies on strengthening the midwifery training system [12] and broadening their scope of practice [13]. Midwives are healthcare professionals capable of independently conducting medical procedures in maternity hospitals [3], and as nurse-midwives, they also fulfill a dual role in nursing and medical procedures within obstetrics and gynecology-related healthcare settings. Consequently, by examining the perceptions of nurses and midwives, we aim to compare the perceived importance and actual frequency of midwives’ roles to identify areas that may require modification and enhancement [14].

Summary statement

· What is already known about this topic?
  Midwives in Korea have traditionally been less involved in fetal and high-risk maternity health and menopausal women’s education management. Little is known about the perception and performance of midwives’ roles among nurses and midwives.

· What this paper adds
  There were differences in nurses and midwives regarding the perception and actual performance of midwives’ roles. Additionally, high levels of role perception and performance were significantly associated with midwives’ roles in managing psychological changes and women’s health.

· Implications for practice, education, and/or policy
  This study's findings can contribute to strengthening midwives' job education and continuing midwife training policies in Korea by expanding the scope of their roles to psychological management and primary health care for nonpregnant women over the lifespan.

Midwives are specialized healthcare professionals who have been instrumental in improving public health and promoting healthy lifestyles through guidance on childbirth, as well as prenatal and neonatal care [3]. Their responsibilities encompass childbirth preparation, managing the various stages of labor (stages 1 through 4), providing postpartum care for newborns, and performing resuscitation on infants who experience asphyxiation. In the realm of postpartum care, midwives oversee breastfeeding support and care for high-risk postpartum conditions. For newborns, they conduct health assessments and offer education and counseling [4], thereby extending the scope of maternal nursing. Midwives have also been at the forefront of advocating for natural childbirth methods, minimizing unnecessary medical interventions, and empowering women to take charge of their bodies during labor, which contributes to more positive childbirth experiences [5]. However, South Korea’s record-low fertility rate has led to a situation where midwives are unable to fulfill their vital roles, putting them at risk of losing their jobs and highlighting the need to reassess their professional roles.

In various countries, in anticipation of changes in childbirth environments, guidelines for midwifery practices have been developed to explore the expanded roles of midwives across multiple aspects. In Sweden, midwives have broadened their scope of responsibilities to include tasks such as dressing cesarean section incisions, as well as duties related to family planning and counseling adolescents [6]. In the United Kingdom, midwives address health issues including domestic violence, sexual assault, mental disorders, and substance abuse. They conduct home visits, monitor the health and safety of children, assess parenting skills, and provide referrals to relevant agencies when intervention is necessary [7]. Canadian midwives offer pregnancy and parenting services, facilitate information exchange among expectant mothers, and integrate these efforts into the local community [8]. These countries emphasize the importance of expanding the scope of midwives’ roles to include the responsibilities typically associated with specialized nurses, underscoring the capability of midwives as healthcare professionals who can provide primary nursing care. By standardizing midwifery practices and extending the unique responsibilities of midwives to serve all community members, these nations are establishing a healthcare system where midwives can effectively perform specialized roles.

Anticipating changes in the role of midwives in Korean society, we examined the actual tasks performed by midwives. Our study involved analyzing job experiences in maternity hospitals [5], developing guidelines for community-based midwives [9], and researching job satisfaction among midwives in both hospitals and maternity hospitals [10,11]. Additionally, we have investigated ways to expand the role of midwives through studies on strengthening the midwifery training system [12] and broadening their scope of practice [13]. Midwives are healthcare professionals capable of independently conducting medical procedures in maternity hospitals [3], and as nurse-midwives, they also fulfill a dual role in nursing and medical procedures within obstetrics and gynecology-related healthcare settings. Consequently, by examining the perceptions of nurses and midwives, we aim to compare the perceived importance and actual frequency of midwives’ roles to identify areas that may require modification and enhancement [14].
Through this research, we aim to provide foundational data by identifying the perceived differences in the roles of midwives between nurses and midwives themselves. This data will help to broaden the scope of midwives’ roles in the community, in accordance with the responsibilities outlined in medical laws for midwifery and health guidance for pregnant women and newborns [3]. Furthermore, we plan to delineate areas where the expansion of midwives’ roles is warranted.

The purpose of this study was to identify the perception and performance of midwives’ roles among midwives and nurses, with the ultimate goal of finding strategies for expanding the roles performed by midwives. The specific objectives were as follows.

1) To understand the perception and performance of midwives’ roles among midwives and nurses.
2) To compare differences in the perception and performance of midwives’ roles among midwives.
3) To explore the relationship between the perception and performance of midwives’ roles among midwives and nurses.

Methods

Ethics statement: This study was approved by the Institutional Review Board of Nam Seoul University (IRB: 202102-002). Informed consent was obtained from the participants.

Study design

This study employed a descriptive correlational research design to assess the perception and performance of midwives’ roles among midwives and nurses. The structure and content of this study are described following research reporting guidelines, adhering to the order of the STROBE checklist (https://www.strobe-statement.org/).

Participants

The study participants comprised midwives enrolled in the Korean Midwifery Association, as well as midwives and nurses (non-midwives) employed at two women’s specialty hospitals in Daegu and at two university hospitals that have introduced women’s healthcare services in the Gyeonggi region. Eligibility was determined based on understanding and acceptance of the study’s purpose.

The specific inclusion criteria were as follows.
1) Hold a license as a midwife or nurse (non-midwife).
2) Clearly understand the researcher’s explanations and agree to participate in the study.

The specific exclusion criteria were as follows.
1) Individuals with health conditions preventing them from reading and understanding the study questionnaire.
2) Individuals with self-reported diagnoses or experiences of depression or other mental health disorders, making their judgment unclear.
3) Individuals with a nursing license but no work experience.

The sample size for the study was calculated using G*Power version 3.15. Drawing from a prior investigation into the roles of hospital and maternity hospital midwives [15], the required sample size for two groups was determined based on an independent t-test. With a significance level set at 0.05, a medium effect size of 0.15, and a desired statistical power of 0.80, the minimum number of participants needed was 168. This study’s participants were drawn from two regions and four medical institutions, as well as from the 677 registered members of the Midwives Association. Given that a previous study on midwife core competency development, which included 681 midwives, yielded only 20% usable data [4], we aimed to include a comparable 20% of the registered midwives in the association for our sample. This approach resulted in a target group of 130 midwives and a total of 260 participants. Ultimately, 243 participants’ data were included in the final analysis.

Study tools

Perception of midwives’ roles

The tool designed to assess the perception of midwives’ roles included 64 items across eight sub-domains and was originally developed by Yu [15]. We obtained permission from the developer to use the tool, which we then modified and expanded to meet the specific objectives of our study. To evaluate the content validity of the tool, we conducted a comprehensive review of both domestic and international literature on the roles of midwives, analyzed the job descriptions provided by the Korean Midwives Association, and sought content validity confirmation from three professors with expertise in women’s health nursing and 10 seasoned midwives, each with over a decade of experience. Following these steps, the tool was refined to contain 60 items within seven domains: antenatal care (18 items), intrapartum care (15 items), psychological support (three items), postpartum care (five items), neonatal care (five items), women’s health care (nine items), and management (five items). These domains were selected to gauge the perceived importance of each role. The tool employed a 5-point Likert scale, ranging from “not important” (1 point) to “very important” (5 points), allowing for total scores
between 60 and 300. A higher score reflected a greater perceived importance of the role. In prior research, the tool demonstrated a Cronbach’s α value of .92 [15]. In the current study, the Cronbach’s a value reached .99, indicating excellent internal consistency. The Cronbach’s a values for the individual domains were as follows: antenatal care, .97; intrapartum care, .95; psychological support, .98; postpartum care, .98; neonatal care, .98; women’s health care, .98; and management, .95.

Role performance of midwifery
The tool for assessing the performance of midwives’ roles included the same items as the role perception tool developed by Yu [15]. Its content validity was established through a review of both domestic and international literature on midwives’ roles, as well as the job analysis table provided by the Korean Association of Midwives. This tool employs a Likert 5-point scale, with responses ranging from “always do” (5 points) to “never do at all” (1 point). The total score can range from 60 to 300, with higher scores indicating a greater frequency of role performance activities as perceived by the respondents. In previous research, the Cronbach’s a was reported as .92 [15], while in the current study, it was found to be .97. The Cronbach’s a values for each domain were as follows: antenatal care, .95; intrapartum care, .90; psychological support, .96; postpartum care, .94; neonatal care, .94; women’s health care, .87; and management, .87.

General characteristics
General characteristics included age, education level, occupation, type of workplace, workplace location, and work experience, comprising six items in total.

Data collection
Data collection occurred between April 1 and June 25, 2021. The study was advertised on the Korean Midwifery Association’s bulletin board and nurses and midwives who were attending continuing education sessions at hospitals in Gyeonggi Province and Daegu were also invited to participate. Data collection at hospitals required obtaining permission from the institutions and making in-person visits. The researcher detailed the study’s objectives to the participants, provided them with the opportunity to review the survey, and collected signed consent forms from those who chose to participate. Completing the survey took roughly 10 to 15 minutes, and participants received small gifts (hand sanitizer and masks for coronavirus disease 2019 [COVID-19] protection) upon completion. The completed surveys were immediately collected and securely stored in a location accessible only to the researcher.

Data analysis
The collected data were analyzed using IBM SPSS for Windows, ver. 20.0 (IBM Corp., Armonk, NY, USA). Differences in the perception of midwives’ roles between midwives and nurses, as well as differences in frequency of role performance, were analyzed using the independent sample t-test. Differences in the perception and performance of midwives’ roles among midwives were analyzed using the independent sample t-tests, and in cases where homogeneity of variance was not supported, Welch-Aspin test values were utilized. The relationship between the perception and performance of midwives’ roles among midwives and nurses was assessed using Pearson correlation coefficients.

Results

General characteristics of participants
Among the 243 participants, there were 79 midwives (11.7% of 677 registered midwives) and 164 nurses (non-midwives). The average age of the midwives was 46.0 years, compared to 38.2 years for the nurses. The largest age group for both the midwives and nurses was those in their 40s, representing 41.8% and 34.1% of their respective groups. Regarding educational attainment, the majority of midwives were 4-year university graduates (41.8%) and graduate school graduates (38.0%). In contrast, the nurses were predominantly 4-year university graduates (48.2%) and vocational school graduates (31.1%). The midwives were predominantly employed in general hospitals, clinics, tertiary hospitals, and private practices. The nurses most commonly worked in tertiary hospitals and general hospitals. When it came to professional experience, the largest group of midwives had 10 to less than 20 years of experience (40.5%), while the largest group of nurses had less than 10 years of experience (37.1%) (Table 1).

Perception of midwives’ roles among midwives and nurses
For the perception of midwives’ roles midwives scored 208.74 points and nurses scored slightly higher at 235.05 points. In an analysis of average scores by area, midwives had the highest role perception score for antenatal care (3.55 ± 1.45), followed in descending order by intrapartum care (3.54 ± 1.25), and postpartum care (3.54 ± 1.60). Nurses had the highest role perception score for neonatal care (4.26 ± 1.01), followed in descending order by postpartum care (4.22 ± 1.02), and psychological support for changes (3.80 ± 0.98).

In antenatal care, both midwives and nurses identified referring
Table 1. General characteristics of participants (N=243)  

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Mean (range) or n (%)</th>
<th>χ²</th>
<th>p</th>
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</tr>
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<tbody>
<tr>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>20–29</td>
<td>4 (5.1)</td>
<td></td>
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<td>29.95</td>
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<tr>
<td></td>
<td>30–39</td>
<td>18 (22.8)</td>
<td></td>
<td></td>
<td>&lt; .001</td>
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<tr>
<td></td>
<td>40–49</td>
<td>33 (41.8)</td>
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<tr>
<td></td>
<td>50–59</td>
<td>12 (15.2)</td>
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<td>≥ 60</td>
<td>12 (15.2)</td>
<td></td>
<td></td>
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<tr>
<td>Education level</td>
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<td>.007</td>
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<td>≤ Graduate school</td>
<td>30 (38.0)</td>
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<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
<td>Private workplace</td>
<td>8 (10.1)</td>
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<td></td>
<td></td>
</tr>
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<td></td>
<td>Other</td>
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<td></td>
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<td>Seoul</td>
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<td>Gyeonggi</td>
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</tr>
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<td></td>
<td>Chungcheong</td>
<td>7 (8.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gyeongsang</td>
<td>26 (32.9)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Jeju</td>
<td>4 (5.1)</td>
<td></td>
<td></td>
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<tr>
<td>Work experience (year)</td>
<td>&lt; 10</td>
<td>7 (8.9)</td>
<td></td>
<td></td>
<td>30.13</td>
</tr>
<tr>
<td></td>
<td>10-19</td>
<td>32 (40.5)</td>
<td></td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td></td>
<td>20-29</td>
<td>23 (29.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 30</td>
<td>17 (21.5)</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

high-risk pregnant women to a specialist (3.71 ± 1.72 and 4.83 ± 1.01, respectively) as the most important role of a midwife. Midwives, however, placed more emphasis on fetal heart auscultation (3.68 ± 1.74) and assessing fetal movement (3.67 ± 1.67), while nurses focused on educating about pain management during childbirth (4.31 ± 0.97) and referring to a specialist upon detecting abnormal conditions in pregnant women (4.30 ± 1.02). During intrapartum care, both groups agreed that referring to a specialist in cases of abnormal labor and dystocia (3.71 ± 1.69 and 4.43 ± 1.01, respectively) was an important role of midwives. Midwives gave higher priority to performing maternal cardiopulmonary resuscitation (3.80 ± 1.59), whereas nurses emphasized the importance of family support in implementing intrapartum pain management (4.31 ± 0.99). In providing psychological support for changes, midwives viewed offering emotional support to prevent postpartum depression (3.52 ± 1.62) as their primary role. Nurses, in contrast, saw informing and counseling about postpartum depression reactions (4.33 ± 0.99) as the most important. For postpartum care, education and counseling on postpartum care (3.58 ± 1.67) were seen as essential by both midwives and nurses. Midwives added early detection, diagnosis, and treatment of postpartum complications (3.61 ± 1.64) to their list of roles, while nurses focused on educating about prevention and self-care methods for postpartum complications (4.29 ± 1.04) and the immediate reporting of symptoms (4.27 ± 1.05). In neonatal care, assessing newborn health (3.65 ± 1.75 and 4.42 ± 1.04, respectively) and providing education and guidance on breastfeeding (3.57 ± 1.72 and 4.25 ± 1.09, respectively) were recognized as midwife roles by both midwives and nurses. Regarding women's health care, counseling and referring sexual violence victims to specialized agencies (3.28 ± 1.59 and 3.55 ± 1.28, respectively) were considered primary midwife roles by both midwives and nurses. Midwives also included education on normal adolescent menstruation and healthy lifestyle patterns (3.29 ± 1.59) as part of their role, while nurses considered counseling on premarital pregnancy and referrals to specialized agencies (3.57 ± 1.25). In management, document management (3.53 ± 1.72 and 3.81 ± 1.21, respectively) and environmental management...
(3.47 ± 1.69 and 3.80 ± 1.20, respectively) were prioritized as primary midwife roles by both midwives and nurses (Table 2).

**Frequency of midwives’ role performance as perceived by midwives and nurses**

The perceived frequency of role performance was reported to be 181.69 points by midwives and 201.10 points by nurses. When examining the average scores by area, midwives ranked their role performance frequency in the following order: neonatal care (3.29 ± 1.38), antenatal care (3.19 ± 1.05), intrapartum care (3.19 ± 0.78), and postpartum care (3.19 ± 1.25). Conversely, nurses ranked midwives’ role performance frequency as follows: neonatal care (3.74 ± 1.13), postpartum care (3.59 ± 1.15), antenatal care (3.53 ± 0.92), and intrapartum care (3.44 ± 0.93).

In antenatal care, both midwives and nurses reported frequently performing roles such as assessing fetal movement, with midwives scoring 3.74 ± 1.13 and nurses scoring 3.80 ± 1.32. Midwives also identified fetal heart auscultation (3.58 ± 1.75) and education on the importance of antenatal examinations and counseling (3.39 ± 1.50) as key roles. Nurses, on the other hand, emphasized the frequent use of intrapartum pain control (3.87 ± 1.15) and the referral of high-risk pregnant women to specialists (3.86 ± 1.22). During intrapartum care, both groups noted a high frequency of role performance in using Doppler for fetal heart rate measurement, with midwives scoring 3.65 ± 1.68 and nurses scoring 3.93 ± 1.28. Midwives added intravenous injection for vascular access in emergencies (3.53 ± 1.63) as an additional role, whereas nurses focused on supporting and encouraging mothers and families using pain control methods (3.94 ± 1.12) and providing emergency treatment and referrals to specialists for abnormal labor and dystocia prediction (3.93 ± 1.27). In the realm of psychological support for changes, midwives prioritized providing care to prevent postpartum depression (2.90 ± 1.32), while nurses placed importance on informing mothers and families about postpartum psychological changes, including depression (3.45 ± 1.23). Postpartum care engaged in education and counseling was common in both groups, with midwives scoring 3.42 ± 1.55 and nurses scoring 3.70 ± 1.25. Similarly, in neonatal care, both groups reported high role performance frequency in assessing newborn health, with midwives scoring 3.49 ± 1.75 and nurses scoring 4.02 ± 1.20. In women’s health care, midwives frequently performed roles such as early diagnosis of uterine cancer through Pap tests (2.56 ± 1.47), education and management of elderly women (2.44 ± 1.37), and participation in community programs or research (2.44 ± 1.47).

Nurses reported a high frequency of counseling and guidance on adolescent sexual education (2.69 ± 1.23) and education on normal adolescent menstruation and healthy lifestyle patterns (2.67 ± 1.22). In management tasks, both midwives and nurses indicated a high frequency of role performance in document management, with midwives scoring 3.05 ± 1.59 and nurses 3.39 ± 1.30, and in environmental management, with midwives scoring 2.87 ± 1.50 and nurses 3.40 ± 1.30 (Table 3).

**Difference in midwives’ perception and performance of midwives’ roles**

The gap between midwives’ role perception and their performance was 27.05 points, with higher role perception than role performance. When examining the average scores by domain, the greatest disparity between perception and performance was observed in women’s health care, with a difference of 0.84 points. This was followed by psychological support during changes at 0.68 points, management at 0.55 points, antenatal care at 0.36 points, intrapartum care at 0.35 points, postpartum care at 0.35 points, and neonatal care at 0.24 points, as detailed in Table 4.

**Correlation between midwives’ role perception and role performance**

There was a moderate positive correlation between midwives’ role perception and role performance (r = .617, p < .001), as well as between nurses’ role perception and role performance (r = .648, p < .001). Both midwives and nurses had higher scores.

---

**Table 2. Importance of midwives’ roles as perceived by midwives and nurses (N=243)**

<table>
<thead>
<tr>
<th>Subcategories</th>
<th>Importance of midwives’ roles, mean ± SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Midwives</td>
<td>Nurses</td>
<td></td>
</tr>
<tr>
<td>Antepartum care</td>
<td>3.55 ± 1.45</td>
<td>4.02 ± 0.86</td>
<td>-2.67</td>
</tr>
<tr>
<td>Childbirth care</td>
<td>3.54 ± 1.25</td>
<td>3.89 ± 0.91</td>
<td>-2.34</td>
</tr>
<tr>
<td>Psychological change</td>
<td>3.49 ± 1.59</td>
<td>4.22 ± 0.98</td>
<td>-3.81</td>
</tr>
<tr>
<td>Postpartum care</td>
<td>3.54 ± 1.60</td>
<td>4.22 ± 1.02</td>
<td>-3.45</td>
</tr>
<tr>
<td>Newborn care</td>
<td>3.53 ± 1.63</td>
<td>4.26 ± 1.01</td>
<td>-3.69</td>
</tr>
<tr>
<td>Women’s health care</td>
<td>3.23 ± 1.50</td>
<td>3.49 ± 1.16</td>
<td>-1.35</td>
</tr>
<tr>
<td>Management</td>
<td>3.37 ± 1.57</td>
<td>3.51 ± 1.14</td>
<td>-.71</td>
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Table 3. Midwives’ role performance frequency as perceived by midwives and nurses (N=243)

<table>
<thead>
<tr>
<th>Subcategories</th>
<th>Midwives’ role performance frequency, mean ± SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Midwives</td>
<td>Nurses</td>
<td></td>
</tr>
<tr>
<td>Antepartum care</td>
<td>3.19 ± 1.05</td>
<td>3.53 ± 0.92</td>
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<tr>
<td>Childbirth care</td>
<td>3.19 ± 0.78</td>
<td>3.41 ± 0.91</td>
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<tr>
<td>Psychological change care</td>
<td>2.81 ± 1.28</td>
<td>3.37 ± 1.22</td>
<td>-3.32</td>
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<tr>
<td>Postpartum care</td>
<td>3.19 ± 1.25</td>
<td>3.59 ± 1.15</td>
<td>-2.45</td>
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<tr>
<td>Newborn care</td>
<td>3.29 ± 1.38</td>
<td>3.74 ± 1.13</td>
<td>-2.50</td>
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<tr>
<td>Women’s health care</td>
<td>2.39 ± 1.25</td>
<td>2.64 ± 1.17</td>
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</tr>
<tr>
<td>Management</td>
<td>2.82 ± 1.06</td>
<td>3.08 ± 1.12</td>
<td>-1.80</td>
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</table>

Table 4. Differences between role perception and role performance among midwives

<table>
<thead>
<tr>
<th>Subcategories</th>
<th>Midwives (N = 79)</th>
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<th>p</th>
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<tr>
<td></td>
<td>Role perception, mean ± SD</td>
<td>Role performance, mean ± SD</td>
<td></td>
</tr>
<tr>
<td>Antepartum care</td>
<td>3.55 ± 1.45</td>
<td>3.19 ± 1.05</td>
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</tr>
<tr>
<td>Childbirth care</td>
<td>3.54 ± 1.25</td>
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<tr>
<td>Psychological change care</td>
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<tr>
<td>Postpartum care</td>
<td>3.54 ± 1.60</td>
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<td>3.26</td>
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<tr>
<td>Newborn care</td>
<td>3.53 ± 1.63</td>
<td>3.29 ± 1.38</td>
<td>2.24</td>
</tr>
<tr>
<td>Women’s health care</td>
<td>3.23 ± 1.50</td>
<td>2.39 ± 1.25</td>
<td>3.40</td>
</tr>
<tr>
<td>Business management</td>
<td>3.37 ± 1.57</td>
<td>2.82 ± 1.06</td>
<td>3.27</td>
</tr>
<tr>
<td>Total</td>
<td>3.47 ± 1.46</td>
<td>2.98 ± 0.83</td>
<td>3.73</td>
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</table>

Discussion

In terms of the importance of the seven areas of midwives’ roles, midwives prioritized antenatal care as the most crucial role, followed by intrapartum care and postpartum care. In contrast, nurses perceived neonatal care as the most important role of midwives, followed by psychological support for changes and postpartum care. There were differences in the ranking of the importance of midwives’ roles between midwives and nurses. However, regarding the frequency of role performance, both midwives and nurses reported high frequencies for neonatal care and postpartum care.

In antenatal care, nurses recognized the importance of educating expectant mothers on various topics, including antenatal examinations, breast care, nutrition, personal hygiene, and the significance of prenatal education. They also provided counseling on methods for pain control during childbirth, discussed the roles of family members, and assessed the emotional well-being and potential high-risk states of pregnant women, reporting any concerns to a specialist. This underscores the educational responsibilities of midwives, aligning with research that confirms their active engagement in these antenatal educational activities [16]. In Sweden, midwives play a comprehensive role in antenatal care, which extends to conducting ultrasounds, health assessments, and providing guidance on exercise and nutrition. They also offer parenting education, thereby enhancing women’s nursing competencies through the promotion of education, information, and overall health [6]. This broad scope of practice highlights the critical educational function of midwives in antenatal care and corroborates the findings of this study [17].

In managing labor, nurses acknowledged the significant role of midwives in various tasks, including administering intravenous injections, utilizing labor-inducing agents and uterine contraction stimulants, providing pain relief medication, monitoring fetal heart rates, promoting and facilitating intrapartum pain control, educating patients about antibiotic use, and consulting with specialists in cases of abnormal childbirth and dystocia. Apart from intravenous injections, midwives are also recognized for performing house calls to adjust episiotomies for childbirth. These responsibilities, with the exception of administering analgesics, are typically included in midwifery care for natural childbirth at maternity centers [9]. Midwives advocate for hospital
births to provide multidimensional care. In instances of abnormal childbirth and dystocia, they collaborate with specialists to transfer patients to the hospital, ensuring the safety of natural childbirth [16]. Although labor management is closely associated with midwifery as defined by medical laws, the ability to perform these roles is hindered by declining birth rates [1] and an increase in hospital deliveries [2]. Consequently, there is a pressing need to evaluate the role of Korean midwives in labor management and consider ways to expand their responsibilities.

Regarding psychological change support, nurses perceived midwives as playing a more crucial role than how midwives perceived it themselves in educating mothers and families about postpartum depression, as well as in counseling, care, early detection, and referral to specialists. This perception is reinforced by the fact that, in Sweden, midwives are tasked with responsibilities related to postpartum depression [6], and in the United Kingdom, they address health issues associated with mental disorders [7]. The awareness of healthcare professionals regarding the management of psychological changes could provide a foundation for broadening the scope of midwives’ roles in Korea.

In postpartum care, healthcare professionals recognize that midwives play a multifaceted role. This included family planning, providing education on postpartum care, preventing and managing postpartum complications, educating patients about the symptoms of complications, and facilitating the early detection, diagnosis, and treatment of these complications. Furthermore, midwives were also recognized as being responsible for offering family planning counseling and educating new mothers on recognizing complication symptoms and the importance of reporting them.

In neonatal care, healthcare professionals recognized midwives’ roles in assessing newborn health, educating parents on breastfeeding, providing guidance on formula feeding, advising on neonatal infection management, and counseling on infant safety. It is understood that midwives fulfill these responsibilities, with the exception of breastfeeding education and guidance. The areas of postpartum and neonatal care are encompassed within the broader scope of maternal health and well-being as defined by medical law [3]. This is true not only for midwives in Korea but also for their international counterparts who have long been engaged in these practices. For instance, in Sweden, midwives carry out these duties in maternity centers, whereas in the United Kingdom, they make home visits to assess parenting skills and offer support. In Canada, midwives play a pivotal role in fostering communication among expectant mothers within the community, and in Turkey, they leverage expertise and scientific platforms to implement these services, demonstrating a diversity of methods even within similar roles [18]. The fact that different countries adopt various strategies to enhance the effectiveness of comparable roles underscores the importance of continuous professional development for Korean midwives. This need is particularly pressing in light of the recent COVID-19 crisis and the advent of the “new normal,” as well as the challenges presented by a declining birth rate.

In the realm of women’s health care, nurses viewed midwives as pivotal in educating and guiding adolescents about normal menstrual cycles and healthy lifestyles. They are also seen as key providers of counseling and guidance on adolescent sexual education and as first responders in offering support to victims of sexual violence, including making referrals to specialized institutions. When it comes to management, healthcare nurses noted that midwives play a more significant role in environmental management than the midwives perceive themselves to have. Women’s health care is an integral part of primary healthcare. This is consistent with the duties of Swedish midwives, who provide sexual education to elementary students and adolescents, offer guidance on contraception, counsel on mental health disorders, and assist with issues of maladjustment in school life [6]. Furthermore, the roles of United Kingdom midwives in managing health issues related to domestic violence, sexual violence, mental disorders, and substance abuse are in line with the findings of this study [7,19].

Environmental management refers to healthcare professionals taking into account the hospital setting when considering patient care. Park et al. [18] suggested that the choice of expectant Korean mothers to deliver in hospitals is influenced by factors such as access to modern medical equipment and rigorous infection control, rather than the childbirth expertise of midwives. Despite this preference, satisfaction with hospital medical services remains low. Women are increasingly opting for maternity centers over hospitals to avoid issues like meconium-stained amniotic fluid, trauma, infection, and other health complications associated with hospital births. Additionally, maternity centers are favored for their more humane approach and fewer unnecessary interventions, allowing women to play a more active role in their childbirth experience [20]. This trend underscores the effective environmental management by midwives and showcases their professional expertise. Kim and Kang [21] corroborated these observations, noting that midwives place great trust in their professional organizations and public services. They value autonomy and self-regulation and have a strong sense of purpose, which contributes to higher job satisfaction compared to hospital nurses.

Midwives exhibited discrepancies between their perceived
roles and their actual practices across the seven domains, with the most pronounced gaps noted in the management of women's health and the care for psychological changes. The scope of women's health care encompassed a range of services, including adolescent health education, sexual education, counseling for premarital pregnancy, support for single mothers, assistance for victims of sexual violence, menopause education, uterine cancer screening, management of elderly women’s health, and involvement in community programs. In the realm of psychological change care, midwives were expected to offer emotional support, counsel for postpartum depression, and facilitate the early detection and referral of postpartum depression symptoms. The management of women's health was deemed the least important and least frequently performed task, suggesting a scarcity of opportunities, which aligns with Yu's findings [15]. However, this contrasts with the situation in Sweden and the United Kingdom, where midwives actively engage in both women’s health management and psychological change care [6,7]. Benchmarking against these countries suggests that it is necessary to expand the roles of Korean midwives in women’s health management and psychological change care.

Lastly, the analysis of the correlations between the scores for role perception and role importance indicated that for both nurses and midwives, a higher perception of the importance of midwives’ roles was associated with higher scores for role performance. This suggests that the more midwives recognize the significance of their roles, the more frequently they perform those roles, effectively defining the scope of their responsibilities. Furthermore, since nurses perceived the roles of midwives as more important than the midwives did themselves, it is recommended that future initiatives to broaden the scope of midwives’ roles should build upon this recognition of their importance.

This study confirmed the perceived importance and performance levels of midwives’ roles as evaluated by both nurses and midwives. The higher scores assigned to midwives’ role perception and performance by nurses, as opposed to midwives themselves, suggest a need to explore new roles for midwives. This need arises particularly as they face challenges in role performance due to declining birth rates. By acknowledging the differences in role perception and performance, midwives have the opportunity to broaden their scope beyond the traditional focus on pregnant women and newborns. They can extend their services to include families and community residents, offering comprehensive health management, education, counseling, health assessments, health promotion, disease prevention, treatment, and rehabilitation within primary healthcare. Additionally, they can support psychological change management and women’s healthcare. By capitalizing on the strengths of nurse-midwives, they are well-positioned to assume diverse roles in the post-COVID-19 era in Korea.

Despite the global shortage of midwives and the clear need for midwifery training, Korea is facing challenges due to having only four institutions that offer midwife training [22]. Consequently, the training of midwives is a difficult endeavor, and even those who are trained struggle with a decreasing number of job opportunities. Although there is a general overlap between the roles of midwives and nurses worldwide, Korean midwives have traditionally concentrated exclusively on childbirth and providing health and care guidance to pregnant women and newborns. This specialization has highlighted the necessity for an evolution in the midwife's role. Furthermore, given the significance of broadening the midwife's role in women's health care—especially against the backdrop of falling birth rates—there is an imperative for programs that enhance the recognition and importance of the midwife’s role.

To reinforce the essential role of midwives and broaden their responsibilities, our findings support benchmarking the roles of midwives across different countries globally. Future research that investigates the specific duties of midwives in each nation could also aid in enhancing the scope of midwifery in Korea.

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Conceptualization: All authors; Formal analysis, Funding acquisition: Park J; Writing–original draft: All authors; Writing–review & editing: Kim K.

**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


Prevalence and associated factors of prenatal depression in pregnant Korean women during the COVID-19 pandemic: a cross-sectional study

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**Purpose:** This study investigated the effects of prenatal education characteristics, pandemic-related pregnancy stress, and health behaviors during pregnancy on prenatal depression in pregnant women during the coronavirus disease 2019 (COVID-19) pandemic.

**Methods:** The participants were 180 pregnant Korean women, recruited from internet communities for pregnancy preparation, childbirth, and childcare, from July 5 to 15, 2022. The collected data were analyzed using the t-test, analysis of variance, the Mann-Whitney U-test, the Kruskal-Wallis test, and multiple regression analysis.

**Results:** The scores for pandemic-related pregnancy stress (24.50±6.37) and health behaviors during pregnancy (67.07±9.20) were high. Nearly half of the participants (n=89, 49.4%) presented with prenatal depression, with scores of 10 or greater. Prenatal depression had a positive correlation with gestational age (r=.18, p=.019) and pandemic-related pregnancy stress (r=.27, p<.001), and a negative correlation with health behaviors during pregnancy (r=–.42, p<.001). The factors associated with prenatal depression were pandemic-related pregnancy stress (t=4.70, p<.001), marital satisfaction (dissatisfied) (t=3.66, p<.001), pregnancy healthcare practice behaviors (t=–3.31, p=.001), family type (weekend couple) (t=2.84, p=.005), and gestational age (t=2.32, p=.022). The explanatory power of these variables was 38.2%.

**Conclusion:** Since participants had a high level of prenatal depression during the pandemic, and infectious diseases such as COVID-19 may recur, strategies should be developed to improve pregnant women’s mental health with consideration of the unique variables that are relevant in a pandemic. It is also necessary to develop efficient online prenatal education programs that can be implemented even in special circumstances such as social distancing, and to evaluate their effectiveness.

**Keywords:** COVID-19; Depression; Pregnancy; Prenatal education

**Introduction**

During pregnancy, women undergo unique physiological, psychological, and social changes. They are exposed to a considerable amount of visible and potential stress, which can make them more susceptible to depression and anxiety [1]. Before the outbreak of the coronavirus disease 2019 (COVID-19), prenatal stress, encompassing general worries and fears about pregnancy, was reported as being more prevalent among pregnant women with a history of mental illness, those who were younger, or those with lower incomes and educational levels [2]. However, during the COVID-19 pandemic, even pregnant women without these
risk factors appeared to have experienced high levels of prenatal stress, and some exhibited symptoms of dissociative disorder and posttraumatic stress disorder (PTSD) [2]. There was also a significant increase in depression and anxiety disorders during the pandemic, which indicates that the psychological impact of the pandemic appeared to have been a threat to all pregnant women, not just those with vulnerable characteristics [2]. The decline in mental health among women during pregnancy can be attributed to several factors, such as the unknown effects of COVID-19 on the health of both the mother and fetus, changes and restrictions in prenatal checkup routines and service facilities, and isolation from social support networks due to social distancing measures [3].

Recent research suggests that increased stress during pregnancy and prenatal depression, particularly during a pandemic, can disrupt the maternal-fetal bond [4]. This heightened stress can trigger an overactive response in the fetus, leading to an excessive release of stress hormones in the mother. This, in turn, activates the immune system, potentially causing issues with inflammation and immune regulation [5]. Consequently, this can result in adverse birth outcomes, such as preterm birth or the delivery of babies that are small or of low birthweight for their gestational age [3].

During the pandemic, pregnant women reported significantly elevated stress levels compared to the period before. Their depression was intensified by the fear of infection and a lack of adequate support during childbirth [6]. Prior research has identified marital satisfaction as a significant determinant of prenatal depression [7]. Lower marital satisfaction has been linked to heightened prenatal depression and a reduction in healthcare practices during pregnancy [8]. Prenatal depression is also affected by gestational age, with physical and mental stress escalating in the third trimester. This demonstrates the need for meticulous management of prenatal depression, taking into account the gestational week.

Improving behaviors related to pregnancy healthcare can serve as an effective strategy for reducing prenatal depression. The frequency of breakfast consumption, sleep duration, and drinking habits all have an impact on prenatal depression; thus, a diet rich in vitamins and increased physical activity are recommended during pregnancy [9]. Even amidst a pandemic, participating in online fitness classes can increase physical activity levels, thereby bolstering pregnant women’s resilience against prenatal depression. Moreover, factors associated with physical activity and sleep during pregnancy play a significant role in managing pandemic-related stress, underscoring the importance of reinforcing healthcare practices among pregnant women [10].

Prenatal education can improve the healthcare practices of pregnant women, instilling a sense of preparedness for pregnancy and parenthood. This not only boosts their confidence in childbirth but also mitigates prenatal depression and wards off postpartum depression [11-13]. Prenatal education must evolve to meet the times and the specific needs of pregnant women. However, traditional approaches often overlook the individual circumstances of pregnant women and tend to generalize their experiences [14].

COVID-19 has been linked to significant changes in the mental health, quality of life, attitudes, and lifestyle of pregnant wom-
en. There has been a notable increase in stress and depression during this period. Social distancing measures have curtailed their physical activities during leisure time, leading to an increase in time spent at home. Furthermore, there has been a heightened interest in the complications, epidemiology, and treatment of infectious diseases such as COVID-19 [15]. Consequently, this study aims to assess the current state of prenatal education and the impact of pandemic-related pregnancy stress and healthcare practices on prenatal depression. The goal is to provide foundational data and evidence to develop intervention strategies for prenatal education that can enhance mental health and healthcare practices among pregnant women.

The specific aims of this study were as follows:
1) To examine the general and obstetric characteristics of pregnant women and their prenatal education during the COVID-19 pandemic
2) To assess the levels of pandemic-related pregnancy stress, healthcare practices, and prenatal depression during the COVID-19 pandemic
3) To analyze the differences in these factors among pregnant women based on their general, obstetric, and prenatal education characteristics
4) To investigate the correlation between these characteristics, pandemic-related stress, healthcare practices, and prenatal depression
5) To determine the factors associated with prenatal depression among pregnant women during the COVID-19 pandemic

Methods

**Ethics statement:** This study was approved by the Institutional Review Board of Jeonju University (No. jjiRB-220728-HR-2022-0511). Obtaining written informed consent was exempted due to the complete anonymity inherent to the design of the online survey. The study was conducted in line with the Declaration of Helsinki.

**Research design**
This cross-sectional, correlational study aimed to investigate the impact of prenatal education characteristics, pandemic-related pregnancy stress, and pregnancy healthcare practice behaviors on prenatal depression during the COVID-19 pandemic. This study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines (https://www.strobe-statement.org).

**Participants**
Women aged 18 years or older, who were pregnant during the COVID-19 pandemic were recruited via online community posts through convenience sampling. The third trimester (28 weeks or more) was selected for participant selection, based on prior research [16] that indicated a higher prevalence of prenatal depression during this stage of pregnancy. The decision to concentrate on this group was further substantiated by the results of the Ministry of Health and Welfare’s National Mental Health Survey for the second quarter of 2022. This survey showed a significant surge in depression rates during the COVID-19 outbreak in December 2021, with rates ranging from 18.1 to 22.8%, representing a more than fivefold increase from 2019 [17]. Therefore, it was deemed necessary to investigate depression in pregnant women during this critical period. Women who had difficulty with Korean language literacy or were under 28 weeks of pregnancy were excluded. The sample size was determined using the G power 3.1.9.2 program, with a significance level of 0.05, a medium effect size of 0.15, a power of 0.85, and 15 predictors related to prenatal depression, general, obstetric, and prenatal education characteristics and the minimum sample size was determined to be 153 participants. The target was set at 180 participants to account for a potential 15% dropout rate [18]. As there were no incomplete or insufficient responses, the final analysis was conducted with a sample size of 180 (100%).

**Instruments**

**Prenatal depression**
The investigators obtained permission to utilize the Korean version [19] of the Edinburgh Postnatal Depression Scale (EPDS) [20]. Although the EPDS tool was initially created to evaluate postnatal depression, it has been validated for use in measuring depression during pregnancy [21]. The tool is comprised of 10 items, each rated on a 4-point Likert scale. It evaluates symptoms such as depression, anxiety, and suicidal ideation experienced in the past week. Responses range from “not at all” (0 points) to “very much” (3 points). With the exception of items 1, 2, and 4, all items are scored in reverse. Higher scores (possible range: 0–30) indicate more severe prenatal depression and the cutoff for depression in Korean women was scores of 10 or higher [21]. The reliability was confirmed by a Cronbach’s α value of .85 in a prior study with Korean women [19] and .86 in the present study.

**Pandemic-related pregnancy stress**
The Pandemic-related Pregnancy Stress Scale (PREPS) utilized in this study was adapted from the scale originally developed by
Preis et al. [22] and subsequently translated into Korean by Kim and Heo [23], with the developer’s permission. The scale comprises two subdomains: “perinatal infection stress (3 items)” and “preparedness stress (4 items).” Each item is rated on a 5-point scale (1 not at all, to 5 very much) and higher scores (possible range: 7–35) indicate greater pandemic-related pregnancy stress. Cronbach’s a values for the original scale ranged from .68 to .86 [22]. The overall reliability of the seven items in the Korean version Cronbach’s a of .87, with subdomain values ranging from .81 to .85 [23]. Cronbach’s a was .92 for this study, with subdomain values between .85 and .91.

Pregnancy healthcare practice behavior

The 20-item Prenatal Healthcare Behavior Scale, originally developed by Wang et al. [24] and later revised and supplemented by Wang and Kim [25], was adapted with the developers’ permission. The adapted version comprises 17 items in the following six subdomains: medication management (3 items), physical care/hygiene (4 items), prenatal care/education (2 items), activity/rest (3 items), nutrition management (3 items), and mental health (2 items). Each item is scored on a 5-point scale (1 not at all, to 5 very well) and higher scores (possible range: 17–85) indicate a higher level of pregnancy healthcare practice behavior. In previous research [25], Cronbach’s a was .72, while in the current study Cronbach’s a was .83.

General, obstetric, and prenatal education characteristics

General characteristics encompassed age, marital status, family structure, marital satisfaction, job loss, and income changes resulting from the COVID-19 pandemic. Obstetric characteristics included gestational age, prenatal checkups, parity, planned pregnancy, smoking and drinking habits during pregnancy, method of conception, high-risk pregnancy status, preferred sex of the fetus, desired childbirth method, alterations in childbirth plans due to the COVID-19 pandemic, self-quarantine experiences during pregnancy, changes in prenatal checkups, and COVID-19 diagnoses during pregnancy. Finally, prenatal education characteristics centered on the need for and interest in prenatal education, methods of acquiring prenatal information during pregnancy, preferred prenatal education methods and modes, changes in prenatal education participation due to the COVID-19 pandemic (including reasons for these changes), and the receipt of prenatal education during the pandemic. This last category also included reasons for not receiving education (if applicable), satisfaction with the received prenatal education, the number of prenatal education classes attended, and whether the participant was accompanied by a husband or guardian, if any.

Data collection

The data were collected via an online survey from July 5 to 15, 2022. The survey was disseminated through internet communities in Korea focused on pregnancy preparation, childbirth, and childcare. Emails were dispatched to the coordinators of these online communities, soliciting their help in data collection. An announcement about the survey, along with a link to the online questionnaire, was posted on the community boards. Access was granted only to those who agreed to participate in the study. Both the community boards and the online questionnaire clearly stated that participants could withdraw from the study at any time. Agreement to participate voluntarily, after reading the relevant information in the online questionnaire, was a prerequisite for participation in the study. The survey took approximately 15 minutes to complete. As a token of appreciation, participants who completed the survey received a mobile beverage voucher (worth approximately 5 US dollars) via text message within 14 days of completion.

Data analysis

SPSS for Windows ver. 27.0 (IBM Corp., Armonk, NY, USA) was used to analyze the data. Pregnant women’s general and obstetric characteristics, prenatal education characteristics, pandemic-related pregnancy stress, pregnancy healthcare practice behaviors, and prenatal depression during the COVID-19 pandemic were analyzed using frequency analysis and descriptive statistics. The differences in these factors among pregnant women based on their general, obstetric, and prenatal education characteristics were analyzed using the t-test, analysis of variance, the Mann-Whitney U-test, and the Kruskal-Wallis test, with post-hoc tests conducted using the Scheffé test. The correlations among these characteristics, pandemic-related stress, healthcare practices, and prenatal depression among pregnant women were analyzed using Pearson correlation coefficients. The factors that influenced prenatal depression among pregnant women during the COVID-19 pandemic were identified using multiple regression analysis.

Results

General, obstetric, and prenatal education characteristics of participants

Table 1 presents the general, obstetric, and prenatal education characteristics of the 180 participants. The average age of the
Table 1. General, obstetric, and prenatal education characteristics of the participants (N=180)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age (year)</strong></td>
<td>Mean ± SD 32.22 ± 2.86 (Min 26, Max 41)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18–29</td>
<td>27 (15.0)</td>
</tr>
<tr>
<td></td>
<td>30–34</td>
<td>119 (66.1)</td>
</tr>
<tr>
<td></td>
<td>≥ 35</td>
<td>34 (18.9)</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td>Married</td>
<td>176 (97.8)</td>
</tr>
<tr>
<td></td>
<td>Common-law marriage</td>
<td>4 (2.2)</td>
</tr>
<tr>
<td><strong>Family type</strong></td>
<td>Couple with child(ren)</td>
<td>164 (91.1)</td>
</tr>
<tr>
<td></td>
<td>Couple with parent(s)</td>
<td>9 (5.0)</td>
</tr>
<tr>
<td></td>
<td>Weekend couple</td>
<td>7 (3.9)</td>
</tr>
<tr>
<td><strong>Marital satisfaction</strong></td>
<td>Satisfied</td>
<td>165 (91.7)</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>11 (6.1)</td>
</tr>
<tr>
<td></td>
<td>Dissatisfied</td>
<td>4 (2.2)</td>
</tr>
<tr>
<td><strong>Job loss due to the COVID-19 pandemic</strong></td>
<td>Yes</td>
<td>24 (13.3)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>156 (86.7)</td>
</tr>
<tr>
<td><strong>Changes in income due to the COVID-19 pandemic</strong></td>
<td>No</td>
<td>127 (70.6)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>53 (29.4)</td>
</tr>
<tr>
<td><strong>Obstetric characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gestational age (week)</strong></td>
<td>Median 31 weeks+6 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28–31+6 days</td>
<td>112 (62.2)</td>
</tr>
<tr>
<td></td>
<td>32–35+6 days</td>
<td>39 (21.7)</td>
</tr>
<tr>
<td></td>
<td>≥ 36</td>
<td>29 (16.1)</td>
</tr>
<tr>
<td><strong>Prenatal checkup</strong></td>
<td>Regular</td>
<td>162 (90.0)</td>
</tr>
<tr>
<td></td>
<td>Irregular</td>
<td>18 (10.0)</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td>Nullipara</td>
<td>159 (88.3)</td>
</tr>
<tr>
<td></td>
<td>Multipara</td>
<td>21 (11.7)</td>
</tr>
<tr>
<td><strong>Planned pregnancy</strong></td>
<td>Yes</td>
<td>144 (80.0)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>36 (20.0)</td>
</tr>
<tr>
<td><strong>Smoking during pregnancy</strong></td>
<td>Yes</td>
<td>8 (4.4)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>172 (95.6)</td>
</tr>
<tr>
<td><strong>Drinking during pregnancy</strong></td>
<td>Yes</td>
<td>11 (6.1)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>169 (93.9)</td>
</tr>
<tr>
<td><strong>Pregnancy method</strong></td>
<td>Natural</td>
<td>174 (96.7)</td>
</tr>
<tr>
<td></td>
<td>Infertility treatment</td>
<td>6 (3.3)</td>
</tr>
<tr>
<td><strong>High-risk pregnancy</strong></td>
<td>Yes</td>
<td>21 (11.7)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>159 (88.3)</td>
</tr>
<tr>
<td><strong>Desired sex of fetus</strong></td>
<td>Yes</td>
<td>144 (80.0)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>36 (20.0)</td>
</tr>
<tr>
<td><strong>Preferred childbirth method</strong></td>
<td>Natural delivery</td>
<td>136 (75.6)</td>
</tr>
<tr>
<td></td>
<td>Cesarean section</td>
<td>42 (23.3)</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>2 (1.1)</td>
</tr>
<tr>
<td><strong>Change in childbirth plan due to the COVID-19 pandemic</strong></td>
<td>Yes</td>
<td>24 (13.3)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>156 (86.7)</td>
</tr>
<tr>
<td><strong>Experience of self-quarantine during pregnancy</strong></td>
<td>Yes</td>
<td>61 (33.9)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>119 (66.1)</td>
</tr>
<tr>
<td><strong>Changes in prenatal checkups due to the COVID-19 pandemic</strong></td>
<td>Yes</td>
<td>46 (25.6)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>134 (74.4)</td>
</tr>
<tr>
<td><strong>COVID-19 diagnosis during pregnancy</strong></td>
<td>Yes</td>
<td>27 (15.0)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>153 (85.0)</td>
</tr>
</tbody>
</table>

(Continued to the next page)
Table 1. Continued

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of prenatal education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need for prenatal education</td>
<td>Much needed</td>
<td>102 (56.7)</td>
</tr>
<tr>
<td></td>
<td>Needed</td>
<td>55 (30.5)</td>
</tr>
<tr>
<td></td>
<td>Somewhat needed</td>
<td>23 (12.8)</td>
</tr>
<tr>
<td>Interest in prenatal education</td>
<td>Mean ± SD 7.90 ± 1.79 (Min 2, Max 10)</td>
<td></td>
</tr>
<tr>
<td>How prenatal information was obtained during pregnancy</td>
<td>Internet (blogs, online communities, YouTube)</td>
<td>152 (84.4)</td>
</tr>
<tr>
<td></td>
<td>Healthcare providers (nurses, doctors, midwives)</td>
<td>93 (51.7)</td>
</tr>
<tr>
<td></td>
<td>Acquaintances</td>
<td>63 (35.0)</td>
</tr>
<tr>
<td></td>
<td>Prenatal classes at hospitals, public health centers, etc. (including online)</td>
<td>58 (32.2)</td>
</tr>
<tr>
<td></td>
<td>Books</td>
<td>53 (29.4)</td>
</tr>
<tr>
<td>Desired prenatal education method</td>
<td>Knowledge transfer education</td>
<td>20 (11.1)</td>
</tr>
<tr>
<td></td>
<td>Knowledge transfer education and practice</td>
<td>140 (77.8)</td>
</tr>
<tr>
<td></td>
<td>Practice education</td>
<td>20 (11.1)</td>
</tr>
<tr>
<td>Desired prenatal education mode</td>
<td>Digital/electronic media (online)</td>
<td>98 (54.4)</td>
</tr>
<tr>
<td></td>
<td>Face-to-face</td>
<td>72 (40.0)</td>
</tr>
<tr>
<td></td>
<td>Virtual reality, augmented reality</td>
<td>10 (5.6)</td>
</tr>
<tr>
<td>Changes in prenatal education participation due to the COVID-19 pandemic</td>
<td>Yes</td>
<td>46 (25.6)</td>
</tr>
<tr>
<td></td>
<td>Reasons for changes in prenatal education†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Schedule change or cancellation of classes by institutions offering prenatal education</td>
<td>29 (63.0)</td>
</tr>
<tr>
<td></td>
<td>Cancelled due to fear of COVID-19 infection</td>
<td>24 (52.2)</td>
</tr>
<tr>
<td></td>
<td>Self-quarantine due to COVID-19 infection</td>
<td>16 (34.8)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>63 (35.0)</td>
</tr>
<tr>
<td></td>
<td>Did not apply for prenatal education</td>
<td>71 (39.4)</td>
</tr>
<tr>
<td>Received prenatal education during the COVID-19 pandemic</td>
<td>Yes</td>
<td>96 (53.3)</td>
</tr>
<tr>
<td></td>
<td>Satisfaction with the prenatal education Mean ± SD 8.39 ± 1.34 (Min 2, Max 10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>84 (46.7)</td>
</tr>
<tr>
<td></td>
<td>Reasons for not receiving prenatal education†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restrictions on gatherings due to social distancing</td>
<td>45 (53.6)</td>
</tr>
<tr>
<td></td>
<td>Did not know when and where classes on prenatal education would be held</td>
<td>39 (46.4)</td>
</tr>
<tr>
<td></td>
<td>Schedule constraints</td>
<td>22 (26.2)</td>
</tr>
<tr>
<td></td>
<td>Not interested</td>
<td>17 (20.2)</td>
</tr>
<tr>
<td></td>
<td>Lack of equipment or difficulty accessing it online</td>
<td>16 (19.1)</td>
</tr>
<tr>
<td></td>
<td>Thought it would not be helpful</td>
<td>9 (10.7)</td>
</tr>
<tr>
<td>Number of prenatal education classes attended</td>
<td>Mean ± SD 3.33 ± 2.76 (Min 1, Max 12)</td>
<td></td>
</tr>
<tr>
<td>Accompanied by husband (or a guardian)</td>
<td>Yes</td>
<td>62 (64.6)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>34 (35.4)</td>
</tr>
</tbody>
</table>

†Multiple responses.

participants was 32.22 ± 2.86 years. A significant majority, 156 participants (86.7%), reported no job loss, while 127 participants (70.6%) indicated no change in their income due to the COVID-19 pandemic.

The median gestational age of the participants was 31 weeks and 6 days. Most participants (n = 156, 86.7%) did not alter their childbirth plans due to the pandemic and 119 participants (66.1%) did not undergo self-quarantine during their pregnancy. Furthermore, 134 participants (74.4%) reported no changes to their prenatal checkups, and 153 participants (85.0%) were not diagnosed with COVID-19 during their pregnancy.

The most popular method of obtaining prenatal information
was through the internet (blogs, online communities, YouTube), reported by 152 participants (84.4%) through multiple responses. Knowledge transfer and practice education were identified as the most preferred types of prenatal education by 140 participants (77.8%). Of the 46 participants (25.6%) who experienced changes in their prenatal education due to the pandemic, 29 (63%) stated that these changes were due to schedule alterations or cancellations by educational institutions, based on multiple responses. Among all participants, 96 (53.3%) received prenatal education during this period. Of the remaining 84 participants (46.7%) who did not receive education, the most frequently cited reason was “restrictions on gatherings due to social distancing,” reported by 45 participants (53.6%) through multiple responses.

Pandemic-related pregnancy stress, pregnancy healthcare practice behavior, and prenatal depression

The participants’ pandemic-related pregnancy stress was 24.50 ± 6.37 (3.50 ± 0.91 out of 5 points), which indicates a high level of stress. The mean score for preparedness stress (14.22 ± 3.88; point average, 2.03 ± 0.55) was slightly higher than for perinatal infection (10.29 ± 3.09; point average, 1.47 ± 0.40) (Table 2).

The overall mean score for pregnancy healthcare practice behavior was also high, at 67.07 ± 9.20 (3.95 ± 0.54 out of 5 points). The average score for prenatal depression was 8.85 ± 5.31 and 91 participants (50.6%) fell within the normal range (0–9; mean, 4.51 ± 3.12) whereas 89 participants (49.4%) were categorized as having depression (score of 10 or greater; mean, 13.28 ± 2.86) (Table 2).

Differences in pandemic-related pregnancy stress, pregnancy healthcare practice behavior, and prenatal depression according to the participants’ characteristics

The method of pregnancy (natural or not; Z = –2.01, p = .045) and changes in the childbirth plan due to the COVID-19 pandemic (Z = –2.62, p = .009) were identified as statistically significant factors influencing pandemic-related pregnancy stress, based on the obstetric characteristics. Regarding prenatal education characteristics, the need for prenatal education (χ² = 22.51, p < .001), the preferred method of prenatal education (χ² = 9.41, p = .009), modifications in prenatal education participation due to the COVID-19 pandemic (F = 5.54, p = .005), and receiving prenatal education during the COVID-19 pandemic (t = 3.49, p = .001) were also found to have statistically significant associations with pandemic-related pregnancy stress. Post-hoc analysis revealed that those who experienced changes in prenatal education due to the COVID-19 pandemic exhibited higher levels of pandemic-related pregnancy stress than those who did not (Table 3).

Based on the general and obstetric characteristics of the participants, several factors were found to significantly influence pregnancy healthcare practice behaviors. These factors include marital status (Z = –3.07, p = .002), family type (χ² = 7.17, p = .028), marital satisfaction (χ² = 18.94, p < .001), and changes in income due to the COVID-19 pandemic (t = 2.13, p = .035). Other influential factors included prenatal checkup (Z = –4.28, p < .001), planned pregnancy (t = 2.94, p = .004), smoking during pregnancy (Z = –2.62, p = .009), drinking during pregnancy (Z = –3.54, p < .001), high-risk pregnancy (Z = –2.46, p = .014), and experience of self-quarantine during pregnancy (t = –2.59, p = .010). In terms of prenatal education characteristics, the desired method of prenatal education (χ² = 16.38, p < .001), the preferred mode of prenatal education (χ² = 13.21, p = .001), changes in prenatal education participation due to the COVID-19 pandemic (F = 3.41, p = .035), and receiving prenatal education during the COVID-19 pandemic (t = 2.67, p = .008) were also found to have a significant impact on pregnancy healthcare practice behaviors. Post-hoc analysis revealed that participants who did not experience changes in prenatal education demonstrated higher levels of pregnancy healthcare practice behaviors than those who did (Table 3).

Statistical analysis revealed the following characteristics that

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Possible score range</th>
<th>Data range</th>
<th>Mean ± SD (point average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pandemic-related pregnancy stress</td>
<td>Total</td>
<td>7–35</td>
<td>7–35</td>
<td>24.50 ± 6.37 (3.50 ± 0.91)</td>
</tr>
<tr>
<td></td>
<td>Preparedness</td>
<td>4–20</td>
<td>4–20</td>
<td>14.22 ± 3.88 (2.03 ± 0.55)</td>
</tr>
<tr>
<td></td>
<td>Perinatal infection</td>
<td>3–15</td>
<td>3–15</td>
<td>10.29 ± 3.09 (1.47 ± 0.40)</td>
</tr>
<tr>
<td>Pregnancy healthcare practice behavior</td>
<td>Total</td>
<td>17–85</td>
<td>38–85</td>
<td>67.07 ± 9.20 (3.95 ± 0.54)</td>
</tr>
<tr>
<td>Prenatal depression</td>
<td>0–30</td>
<td></td>
<td>0–27</td>
<td>8.85 ± 5.31</td>
</tr>
<tr>
<td></td>
<td>No (0–9) (n = 91, 50.6%)</td>
<td></td>
<td>0–9</td>
<td>4.51 ± 3.12</td>
</tr>
<tr>
<td></td>
<td>Yes (≥ 10) (n = 89, 49.4%)</td>
<td></td>
<td>10–27</td>
<td>13.28 ± 2.86</td>
</tr>
</tbody>
</table>

†On a scale of 1–5 points.
Table 3. Differences in pandemic-related pregnancy stress, pregnancy healthcare practice behavior, and prenatal depression according to the participants’ general, obstetric, and prenatal education characteristics (N=180)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Pandemic-related pregnancy stress</th>
<th>Pregnancy healthcare practice behavior</th>
<th>Prenatal depression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD</td>
<td>t/F/Z/χ² (p)</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>General characteristics</td>
<td></td>
<td>Mean ± SD</td>
<td>t/F/Z/χ² (p)</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Age (year)†</td>
<td>18–29</td>
<td>23.07 ± 4.38</td>
<td>3.73 (.155)</td>
<td>65.37 ± 9.27</td>
</tr>
<tr>
<td></td>
<td>30–34</td>
<td>24.76 ± 6.55</td>
<td>6.74 (.841)</td>
<td>66.06 ± 11.57</td>
</tr>
<tr>
<td></td>
<td>≥ 35</td>
<td>24.76 ± 7.04</td>
<td>6.74 (.841)</td>
<td>10.12 ± 5.46</td>
</tr>
<tr>
<td>Marital status‡</td>
<td>Married</td>
<td>24.57 ± 6.39</td>
<td>−1.18 (.236)</td>
<td>67.47 ± 8.84</td>
</tr>
<tr>
<td></td>
<td>Common-law marriage</td>
<td>21.50 ± 5.52</td>
<td>49.25 (.096)</td>
<td>8.71 ± 5.17</td>
</tr>
<tr>
<td>Family type‡</td>
<td>Couple+child(ren)</td>
<td>24.44 ± 6.54</td>
<td>0.13 (.939)</td>
<td>66.55 ± 9.12</td>
</tr>
<tr>
<td></td>
<td>Couple+parent(s)</td>
<td>25.78 ± 1.71</td>
<td>75.00 (.774)</td>
<td>3.44 ± 3.78</td>
</tr>
<tr>
<td></td>
<td>Weekend couple</td>
<td>24.28 ± 6.63</td>
<td>68.86 (.901)</td>
<td>13.43 ± 3.91</td>
</tr>
<tr>
<td>Marital satisfaction‡</td>
<td>Satisfied</td>
<td>24.73 ± 6.43</td>
<td>5.73 (.057)</td>
<td>68.05 ± 8.60</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>20.82 ± 4.24</td>
<td>55.64 ± 10.03</td>
<td>12.18 ± 3.63</td>
</tr>
<tr>
<td></td>
<td>Dissatisfied</td>
<td>25.50 ± 6.81</td>
<td>58.00 ± 5.60</td>
<td>20.50 ± 5.07</td>
</tr>
<tr>
<td>Job loss due to the COVID-19 pandemic†</td>
<td>Yes</td>
<td>26.33 ± 5.78</td>
<td>−1.53 (.126)</td>
<td>64.96 ± 10.08</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.22 ± 6.43</td>
<td>67.39 ± 9.05</td>
<td>10.83 ± 5.05</td>
</tr>
<tr>
<td>Changes in income due to the COVID-19 pandemic†</td>
<td>No</td>
<td>24.32 ± 6.27</td>
<td>−0.59 (.553)</td>
<td>68.00 ± 8.95</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>24.94 ± 6.64</td>
<td>68.43 ± 9.51</td>
<td>8.01 ± 5.00</td>
</tr>
<tr>
<td>Obstetric characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational age‡</td>
<td>28–31+6 days</td>
<td>24.87 ± 6.59</td>
<td>1.65 (.439)</td>
<td>67.68 ± 8.65</td>
</tr>
<tr>
<td></td>
<td>32–35+6 days</td>
<td>24.05 ± 5.08</td>
<td>68.31 ± 9.01</td>
<td>10.08 ± 4.22</td>
</tr>
<tr>
<td></td>
<td>≥ 36</td>
<td>23.69 ± 7.13</td>
<td>63.03 ± 10.69</td>
<td>9.55 ± 4.48</td>
</tr>
<tr>
<td>Prenatal checkup‡</td>
<td>Regular</td>
<td>24.72 ± 6.47</td>
<td>−1.73 (.084)</td>
<td>68.21 ± 8.47</td>
</tr>
<tr>
<td></td>
<td>Irregular</td>
<td>22.61 ± 5.11</td>
<td>56.78 ± 9.40</td>
<td>8.52 ± 5.35</td>
</tr>
<tr>
<td>Parity‡</td>
<td>Nullipara</td>
<td>24.36 ± 6.35</td>
<td>−0.75 (.453)</td>
<td>67.40 ± 8.99</td>
</tr>
<tr>
<td></td>
<td>Multipara</td>
<td>25.57 ± 6.57</td>
<td>64.52 ± 10.60</td>
<td>8.72 ± 5.19</td>
</tr>
<tr>
<td>Planned pregnancy‡</td>
<td>Yes</td>
<td>24.67 ± 6.35</td>
<td>0.68 (.499)</td>
<td>68.05 ± 8.79</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>23.86 ± 6.51</td>
<td>63.11 ± 9.87</td>
<td>8.41 ± 4.99</td>
</tr>
<tr>
<td>Smoking during pregnancy‡</td>
<td>Yes</td>
<td>28.37 ± 5.83</td>
<td>−1.88 (.060)</td>
<td>57.62 ± 10.13</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.32 ± 6.35</td>
<td>67.50 ± 8.95</td>
<td>11.00 ± 4.00</td>
</tr>
<tr>
<td>Drinking during pregnancy‡</td>
<td>Yes</td>
<td>25.64 ± 7.14</td>
<td>−0.65 (.518)</td>
<td>56.18 ± 9.73</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.43 ± 6.33</td>
<td>67.77 ± 8.74</td>
<td>12.27 ± 3.63</td>
</tr>
<tr>
<td>Pregnancy method‡</td>
<td>Natural</td>
<td>24.36 ± 6.40</td>
<td>67.19 ± 9.21</td>
<td>8.86 ± 5.32</td>
</tr>
<tr>
<td></td>
<td>Infertility treatment</td>
<td>28.67 ± 3.93</td>
<td>63.33 ± 8.80</td>
<td>8.50 ± 5.45</td>
</tr>
<tr>
<td>High-risk pregnancy‡</td>
<td>Yes</td>
<td>26.38 ± 7.05</td>
<td>−1.70 (.089)</td>
<td>61.67 ± 11.57</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.26 ± 6.26</td>
<td>67.78 ± 8.64</td>
<td>10.81 ± 4.86</td>
</tr>
<tr>
<td>Desired sex of fetus</td>
<td>Yes</td>
<td>24.58 ± 6.25</td>
<td>0.30 (.766)</td>
<td>67.10 ± 9.03</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.22 ± 6.94</td>
<td>66.92 ± 10.00</td>
<td>8.35 ± 5.12</td>
</tr>
<tr>
<td>Preferred childbirth method‡</td>
<td>Normal delivery</td>
<td>24.80 ± 6.31</td>
<td>1.49 (.475)</td>
<td>67.95 ± 8.82</td>
</tr>
<tr>
<td></td>
<td>Cesarean section</td>
<td>23.40 ± 6.63</td>
<td>64.36 ± 10.03</td>
<td>10.43 ± 4.61</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>27.50 ± 7.01</td>
<td>63.50 ± 9.19</td>
<td>7.00 ± 1.41</td>
</tr>
<tr>
<td>Change in childbirth plan due to the COVID-19 pandemic‡</td>
<td>Yes</td>
<td>28.58 ± 4.35</td>
<td>−3.62 (&lt;.001)</td>
<td>66.46 ± 10.26</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>23.88 ± 6.41</td>
<td>67.16 ± 9.06</td>
<td>9.33 ± 4.64</td>
</tr>
<tr>
<td>Experience of self-quarantine during pregnancy‡</td>
<td>Yes</td>
<td>25.33 ± 5.54</td>
<td>1.24 (.216)</td>
<td>64.62 ± 9.54</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.08 ± 6.74</td>
<td>68.32 ± 8.80</td>
<td>10.61 ± 4.93</td>
</tr>
<tr>
<td>Changes in prenatal checkups due to the COVID-19 pandemic‡</td>
<td>Yes</td>
<td>25.93 ± 6.16</td>
<td>1.77 (.078)</td>
<td>66.43 ± 8.05</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.01 ± 6.39</td>
<td>67.28 ± 9.59</td>
<td>10.37 ± 4.88</td>
</tr>
</tbody>
</table>

(Continued to the next page)
were likely to significantly impact prenatal depression: family type ($\chi^2 = 11.84, p = .003$), marital satisfaction ($\chi^2 = 11.79, p = .003$), job loss due to the COVID-19 pandemic ($Z = -2.21, p = .027$), and changes in income as a result of the pandemic ($t = -3.35, p = .001$). Other influential factors were prenatal checkups ($Z = -2.73, p = .006$), whether the pregnancy was planned ($t = -2.25, p = .026$), alcohol consumption during pregnancy ($Z = -2.48, p = .013$), the desired sex of the fetus ($t = -2.54, p = .012$), and the preferred method of childbirth ($\chi^2 = 6.37, p = .041$). The experience of self-quarantine during pregnancy ($t = 3.26, p = .001$) and changes in prenatal checkups due to the pandemic ($t = 2.27, p = .024$) also showed a high likelihood of affecting prenatal depression. In terms of prenatal education characteristics, the preferred mode of prenatal education ($\chi^2 = 6.79, p = .034$) had a statistically significant association with prenatal depression (Table 3).

Correlations among the participants’ characteristics and main variables
Prenatal depression in pregnant women showed a slight positive correlation with both gestational age ($r = .18, p = .019$) and stress related to the pandemic ($r = .27, p < .001$). Conversely, it demonstrated a moderately strong negative correlation with behaviors related to pregnancy healthcare practices ($r = -.42, p < .001$) (Table 4).

Factors associated with prenatal depression during the COVID-19 pandemic
To identify factors influencing prenatal depression, we dummy-coded general and obstetric characteristics that demonstrated significant impacts. These included family type, marital satisfaction, job loss, changes in income, prenatal checkups, planned pregnancy, alcohol consumption during pregnancy, desired sex of the fetus, preferred childbirth method, self-quarantine experience during pregnancy, and changes in prenatal checkups. Additionally, the preferred mode of prenatal education, which fell un-

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Pandemic-related pregnancy stress</th>
<th>Pregnancy healthcare practice behavior</th>
<th>Prenatal depression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD t/F/Z/χ² (p)</td>
<td>Mean ± SD t/F/Z/χ² (p)</td>
<td>Mean ± SD t/F/Z/χ² (p)</td>
</tr>
<tr>
<td>COVID-19 diagnosis during pregnancy‡</td>
<td>Yes</td>
<td>25.55 ± 5.34  -0.65 (5.17)</td>
<td>64.89 ± 11.18  -1.20 (2.21)</td>
<td>10.30 ± 4.90  -1.65 (1.00)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.32 ± 6.53  -0.26 (7.41)</td>
<td>67.45 ± 8.80  -1.80 (3.31)</td>
<td>8.59 ± 5.36  -0.15 (2.21)</td>
</tr>
<tr>
<td>Characteristics of prenatal education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need for prenatal education†</td>
<td>Much needed</td>
<td>25.68 ± 7.05  22.51 (&lt;.001)</td>
<td>68.19 ± 9.14  5.06 (.080)</td>
<td>8.70 ± 5.58  0.87 (6.46)</td>
</tr>
<tr>
<td></td>
<td>Needed</td>
<td>24.09 ± 5.13  0.65 (.517)</td>
<td>66.69 ± 8.38  6.00 (.010)</td>
<td>9.31 ± 4.88  8.39 (5.24)</td>
</tr>
<tr>
<td></td>
<td>Somewhat needed</td>
<td>20.30 ± 3.51  0.05 (1.00)</td>
<td>63.00 ± 10.40 6.00 (.010)</td>
<td>8.39 ± 5.24  8.39 (5.24)</td>
</tr>
<tr>
<td>Desired prenatal education method†</td>
<td>Knowledge transfer education</td>
<td>26.55 ± 7.29  9.41 (.009)</td>
<td>72.25 ± 7.62  16.38 (&lt;.001)</td>
<td>10.40 ± 5.02  3.73 (.155)</td>
</tr>
<tr>
<td>Desired prenatal education mode†</td>
<td>Digital/electronic media (online)</td>
<td>24.19 ± 6.86  0.621 (.733)</td>
<td>69.19 ± 8.94  13.21 (.001)</td>
<td>7.85 ± 5.32  6.79 (.034)</td>
</tr>
<tr>
<td></td>
<td>Face-to-face</td>
<td>24.72 ± 5.83  6.14 ± 5.35</td>
<td>64.17 ± 9.01  10.26 (.521)</td>
<td>8.50 ± 3.81  8.35 (5.24)</td>
</tr>
<tr>
<td></td>
<td>VR, AR</td>
<td>26.00 ± 5.35  5.54 (.005)</td>
<td>65.78 ± 9.58  9.89 ± 5.51</td>
<td>1.24 (.291)  1.24 (.291)</td>
</tr>
<tr>
<td>Changes in prenatal education participation due to the COVID-19 pandemic</td>
<td>Yes</td>
<td>26.59 ± 5.75  5.54 (.005)</td>
<td>65.78 ± 9.58  9.89 ± 5.51</td>
<td>1.24 (.291)  1.24 (.291)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24.95 ± 7.52  4.14 (.035)</td>
<td>68.49 ± 7.80  8.65 ± 4.90</td>
<td>6.85 (4.90)  6.85 (4.90)</td>
</tr>
<tr>
<td></td>
<td>Did not apply for prenatal education†</td>
<td>22.76 ± 5.14  6.76 ± 5.78</td>
<td>65.76 ± 9.78  8.35 ± 5.51</td>
<td></td>
</tr>
<tr>
<td>Receipt of prenatal education during the COVID-19 pandemic</td>
<td>Yes</td>
<td>26.01 ± 6.85  3.49 (.001)</td>
<td>68.75 ± 8.47  2.67 (.008)</td>
<td>8.85 ± 5.42  0.01 (.991)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>22.78 ± 5.30  6.54 ± 5.30</td>
<td>65.14 ± 9.67  8.84 ± 5.22</td>
<td></td>
</tr>
</tbody>
</table>

†Kruskal-Wallis test, ‡Mann-Whitney U-test.
under pre-natal education characteristics, was also included. Alongside these, we included gestational age and key variables such as pandemic-related pregnancy stress and pregnancy healthcare practice behaviors, both of which showed a correlation with pre-natal depression. As a result, a total of 15 independent variables were analyzed in the multiple regression analysis using the enter method. Moreover, the dummy variable for the preferred childbirth method (cesarean section) demonstrated multicollinearity with a tolerance limit value of 0.06 and a variance inflation factor (VIF) value of 18.04. This was also the case for the variable for the preferred childbirth method (natural delivery), which had a tolerance limit value of 0.06 and a VIF value of 17.93. Consequently, the dummy variable with the higher VIF value — specifically, the preferred childbirth method (cesarean section) — was removed prior to conducting the multiple regression analysis (Table 5).

The tolerance limit values for the independent variables fell within a range of 0.52 to 0.91, while the VIF values varied between 1.10 and 1.91. This suggests that multicollinearity was not an issue. The Durbin-Watson statistic registered at 1.81, nearing the standard of 2, but not approaching 0 or 4, thereby affirming the independence of errors. The resulting multiple regression model proved to be significant (F = 7.14, p < .001), with the 15 independent variables accounting for 38.2% of the variance.

Multiple regression analysis indicated that pandemic-related pregnancy stress (t = 4.70, p < .001), marital dissatisfaction (t = 3.66, p < .001), pregnancy healthcare practice behavior (t = −3.31, p = .001), being part of a weekend couple (t = 2.84, p = .005), and advanced gestational age (t = 2.32, p = .022) were all significant predictors of prenatal depression. This suggests that pregnant women who experienced higher levels of pandemic-related stress, marital dissatisfaction, and lower engagement in pregnancy healthcare practices, those who were part of a weekend couple, and those with a higher gestational age were more likely to experience prenatal depression. During the COVID-19 pandemic, it was found that among the variables influencing prenatal depression, pandemic-related pregnancy stress (β = .29) had the most significant impact.

**Discussion**

The present study found that 49.4% of pregnant women experienced prenatal depression, as determined by a score of 10 or higher on the K-EPDS. This rate aligns with a previous study [26] conducted during the COVID-19 pandemic, which reported a high prevalence of 56.3% using the same tool and criteria. This high prevalence sharply contrasts with a 21.1% rate found in a pre-pandemic study [27] in Korea, suggesting a significant increase in prenatal depression during the pandemic. The current study identified various risk factors for prenatal depression, each with a distinct impact. These factors include family type, marital satisfaction, prenatal checkups, planned pregnancy, alcohol consumption during pregnancy, desired sex of the fetus, and preferred childbirth method. These findings align with previous research [28,29] on Korean pregnant women. Additionally, this study incorporated COVID-19-related variables such as job loss, changes in income, self-quarantine experience, and alterations in prenatal checkups, all of which were found to influence prenatal depression. Prior research [30] has underscored that prolonged self-quarantine and disrupted prenatal care due to the pandemic can exacerbate prenatal depression. The severity of depression significantly increased in both pregnant and nonpregnant women when self-quarantine exceeded 50 days. This highlights the need for policy discussions about suitable self-quarantine durations for pregnant women and the importance of monitoring their mental health during repeated outbreaks. Consequently, follow-up studies on prenatal depression based on the duration of self-quarantine are crucial. Moreover, 25.6% of participants experienced changes in their prenatal checkups due to the COVID-19 pandemic, and these women reported higher levels of depression.
of prenatal depression than those who did not experience changes. However, another study [31] found that 37.1% of pregnant women were unable to receive regular checkups due to the pandemic, a rate higher than that observed in this study. Unplanned changes or cancellations in prenatal checkups can leave pregnant women feeling unprepared for childbirth, which can negatively impact their mental health and potentially lead to anxiety, stress, and both prenatal and postnatal depression [32]. Therefore, it is crucial to emphasize the importance of consistent prenatal checkups during infectious disease outbreaks to help pregnant women maintain their mental health.

This study also discovered that pregnant women reported increased levels of prenatal depression during the COVID-19 period when they encountered heightened pandemic-related pregnancy stress, diminished marital satisfaction, insufficient pregnancy healthcare practices, were part of a weekend couple, and were at a more advanced gestational age. These variables accounted for 38.2% of the variation in prenatal depression. Drawing on these findings, this study examined the influence of each factor on prenatal depression, proposed policy implications to tackle these issues, and suggested practical solutions for pregnant women.

Pandemic-related stress during pregnancy was identified as the most significant factor contributing to an increase in prenatal depression, a finding that aligns with previous research [6,33]. This specific type of stress, distinct from typical pregnancy stress, emerged as a major predictor of prenatal depression during the pandemic in this study. Notably, the incidence of prenatal depression was found to be twice as high during the pandemic as compared to pre-pandemic levels, suggesting that the pandemic itself has intensified depression symptoms. Moreover, both objective stressors, such as changes in prenatal checkups, financial difficulties, and unemployment, and subjective stressors, such as fear of COVID-19 infection and limited support during childbirth, have

### Table 5. Factors affecting prenatal depression (N=180)

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>T (p)</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>1.48</td>
<td>5.29</td>
<td>0.28</td>
<td>0.28 (.780)</td>
<td>1.35</td>
</tr>
<tr>
<td>Family type*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Couple+child(ren)</td>
<td>2.65</td>
<td>1.51</td>
<td>0.14</td>
<td>1.75 (.081)</td>
<td>1.91</td>
</tr>
<tr>
<td>Weekend couple</td>
<td>6.26</td>
<td>2.21</td>
<td>0.23</td>
<td>2.84 (.005)</td>
<td>1.88</td>
</tr>
<tr>
<td>Marital satisfaction*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>2.02</td>
<td>1.51</td>
<td>0.09</td>
<td>1.33 (.185)</td>
<td>1.35</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>9.24</td>
<td>2.52</td>
<td>0.26</td>
<td>3.66 (&lt;.001)</td>
<td>1.42</td>
</tr>
<tr>
<td>Job loss due to the COVID-19 pandemic (yes)*</td>
<td>−0.35</td>
<td>1.15</td>
<td>−0.02</td>
<td>−0.30 (.763)</td>
<td>1.56</td>
</tr>
<tr>
<td>Changes in income due to the COVID-19 pandemic (yes)*</td>
<td>1.02</td>
<td>0.84</td>
<td>0.09</td>
<td>1.21 (.227)</td>
<td>1.52</td>
</tr>
<tr>
<td>Prenatal checkup (irregular)*</td>
<td>1.12</td>
<td>1.23</td>
<td>0.06</td>
<td>0.91 (.364)</td>
<td>1.41</td>
</tr>
<tr>
<td>Planned pregnancy (no)*</td>
<td>−0.60</td>
<td>0.88</td>
<td>−0.05</td>
<td>−0.68 (0.498)</td>
<td>1.27</td>
</tr>
<tr>
<td>Drinking during pregnancy (yes)*</td>
<td>−0.16</td>
<td>1.51</td>
<td>−0.01</td>
<td>−0.11 (.915)</td>
<td>1.34</td>
</tr>
<tr>
<td>Desired sex of fetus (yes)*</td>
<td>1.25</td>
<td>0.85</td>
<td>0.10</td>
<td>1.46 (.145)</td>
<td>1.20</td>
</tr>
<tr>
<td>Preferred childbirth method (normal delivery)*</td>
<td>−1.23</td>
<td>0.77</td>
<td>−0.10</td>
<td>−1.59 (.114)</td>
<td>1.14</td>
</tr>
<tr>
<td>Experience of self-quarantine during pregnancy (yes)*</td>
<td>0.53</td>
<td>0.74</td>
<td>0.05</td>
<td>0.71 (.477)</td>
<td>1.28</td>
</tr>
<tr>
<td>Changes in prenatal checkups due to the COVID-19 pandemic (yes)*</td>
<td>1.13</td>
<td>0.83</td>
<td>0.09</td>
<td>1.37 (.174)</td>
<td>1.35</td>
</tr>
<tr>
<td>Desired prenatal education mode (digital/electronic media [online])</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face-to-face</td>
<td>0.37</td>
<td>0.70</td>
<td>0.03</td>
<td>0.52 (.605)</td>
<td>1.22</td>
</tr>
<tr>
<td>VR, AR</td>
<td>0.33</td>
<td>1.44</td>
<td>0.01</td>
<td>0.23 (.818)</td>
<td>1.12</td>
</tr>
<tr>
<td>Gestational age</td>
<td>0.04</td>
<td>0.02</td>
<td>0.15</td>
<td>2.32 (.022)</td>
<td>1.25</td>
</tr>
<tr>
<td>Pandemic-related pregnancy stress</td>
<td>0.24</td>
<td>0.05</td>
<td>0.29</td>
<td>4.70 (&lt;.001)</td>
<td>1.10</td>
</tr>
<tr>
<td>Pregnancy healthcare practice behavior</td>
<td>−0.14</td>
<td>0.04</td>
<td>−0.25</td>
<td>−3.31 (.001)</td>
<td>1.60</td>
</tr>
</tbody>
</table>

R² = .444, adjusted R² = .382, F = 7.14, p < .001

AR, augmented reality; B, unstandardized coefficients; β, standardized coefficients; VIF, variance inflation factor; VR, virtual reality.

*References: family type (couple+parent[s]); marital satisfaction (satisfied); job loss due to the COVID-19 pandemic (no); changes in income due to the COVID-19 pandemic (no); prenatal checkup (regular); planned pregnancy (yes); drinking during pregnancy (no); desired sex of fetus (yes); preferred childbirth method (undecided); experience of self-quarantine during pregnancy (no); changes in prenatal checkup due to the COVID-19 pandemic (no); desired prenatal education mode (digital/electronic media [online]).
contributed to the heightened depression among pregnant women. In particular, higher levels of subjective stress were closely associated with more severe depression symptoms [6]. Additionally, variations in pandemic-related pregnancy stress were observed in relation to changes in childbirth plans due to the pandemic and pregnancies resulting from infertility treatments. This observation aligns with previous studies that employed similar methodologies [22,34]. Pregnant women infected with COVID-19 faced limited childbirth options, which escalated their fear and stress, potentially leading to PTSD [35]. Therefore, it is crucial to ensure that pregnant women have the right to make choices during childbirth in order to reduce stress during such crises.

Women who became pregnant through infertility treatments experienced intense stress from the onset of their pregnancy. Concerns about treatment interruptions and delays during the pandemic [36], as well as the potential for decreased fertility due to infection [37], further exacerbated their depression and stress [36]. In response, policy discussions are needed to ensure the continuity of infertility treatments through medical insurance [36] and to incorporate prenatal care into emergency medical systems during pandemics. Previous research has shown that stress associated with childbirth and postpartum care significantly impacts prenatal depression during a pandemic [33]. Therefore, it is imperative to expand support and resources in prenatal care systems and to enhance pregnant women’s capabilities through prenatal education [33]. In addition, mindfulness interventions, particularly those delivered via mobile apps, have proven effective in reducing stress and alleviating prenatal depression during prolonged periods of infectious disease outbreaks. These interventions also provide high accessibility to mental health information and are well-accepted by pregnant women [38]. Therefore, developing digital health stress management programs that are readily available to pregnant women at any time and place, would be helpful in preparation for recurring infectious diseases.

In the current study, the second most influential factor on prenatal depression during the pandemic was identified as pregnancy healthcare practice behavior, aligning with previous research [10,39]. The extent of these behaviors appears to be influenced by factors such as marital status, family structure, marital satisfaction, self-quarantine experience during pregnancy, and income changes due to the COVID-19 pandemic. These factors are also linked to the social support provided by family members, suggesting that their emotional and material assistance significantly impacts how pregnant women manage their healthcare practices during the pandemic. Typically, pregnant women receive more social support from family and relatives than from friends. Adequate family support has been shown to positively influence health-promoting behaviors [40,41], a finding supported by prior research. This study also discovered that pandemic-related income changes affected pregnancy healthcare practice behaviors. This aligns with another study [40] that found insufficient income negatively impacts women’s health-promoting behaviors. Moreover, a household trend survey in Korea [42] confirmed that the pandemic has led to a decrease in income and an increase in unemployment, which in turn influences changes in household income. Therefore, identifying the material, emotional, and economic support available to pregnant women from family and friends during a pandemic situation and establishing measures to ensure that pregnant women can avoid deficiencies during self-quarantine and maintain their healthcare practices, can be helpful preventive measures against prenatal depression. In this context, promoting healthcare practices among pregnant women during the pandemic is of particular importance. For instance, providing virtual reality-based prenatal group exercise programs tailored to their altered lifestyles can positively impact their bonding with other pregnant women [43].

Prenatal depression was significantly influenced by marital satisfaction, which aligns with previous research [7]. Lower marital satisfaction, which often results in less support from husbands, has been reported as associated with an increase in prenatal depression [7]. This study also found that being a weekend couple, as opposed to living in a large or nuclear family, seemed to result in less support from husbands, which in turn influenced prenatal depression. However, a pre-COVID-19 study [7] found that prenatal depression was twice as prevalent in large families living with parents compared to nuclear families. This suggests the need for further research on family size and weekend couples, especially during pandemic situations. Given that an increase in domestic conflicts and violence were attributed to factors such as unemployment, school closures, and social isolation during the pandemic [44], such factors may likely influence pregnant women’s marital satisfaction and should be considered for future research.

Finally, this study identified a correlation between advanced gestational age and prenatal depression, a finding that aligns with prior research [16]. All participants in this study were in their third trimester and exhibited an increase in prenatal depression as their gestational age progressed. Given that the third trimester is a crucial phase for the onset of prenatal depression, largely due to heightened physical and psychological stress [16], greater attention is required as pregnancy progresses, to facilitate early identification and efficient treatment of prenatal depression.
The current study revealed a relatively high level of pandemic-related pregnancy stress, and subscores of 2.03 for stress related to preparedness and 1.47 for perinatal infection. Using the same measurement, higher average scores were reported in prior studies: a US study [22] reported an average score of 3.36 for both subcategories, while an Italian study [45] reported scores of 2.75 and 2.59 for preparedness and perinatal infection stress, respectively. Interestingly, participants in our study experienced less pandemic-related pregnancy stress. This discrepancy may be due to the timing of the study. The US study [22] was conducted during a period of rapidly increasing COVID-19-related deaths [46], and the Italian study [45] took place during a second wave of the pandemic. In contrast, our study in Korea was carried out during a phase of relaxed social distancing measures [17] and COVID-19 transitioning to an endemic phase. This context may account for the lower stress levels observed among our Korean participants compared to those in the previous studies. This also suggests that as time passed, the level of stress experienced during the pandemic gradually decreased, indicating that people have been adapting to the new normal [47]. However, it is important to note that the various traumas experienced during the pandemic could potentially lead to depression or post-pandemic stress disorder even after the pandemic has ended [48]. Therefore, despite the lower levels of pandemic-related pregnancy stress observed among pregnant women in Korea, it is premature to be complacent, monitoring the trends of pregnancy stress as the pandemic concludes and in the subsequent periods would be beneficial.

The high level of pregnancy healthcare practice behaviors in this study (67.07 points) is comparable to the level reported in a pre-COVID-19 study in Korea [25], which recorded an average score of 63.47 to 65.32 using the same evaluation tool. Contrary to expectations that social distancing and isolation would decrease pregnancy healthcare practice behaviors, no such reduction was observed. Interestingly, pregnant women who did not experience social distancing exhibited higher healthcare practice behaviors than those who did. Moreover, women who received prenatal education during the COVID-19 pandemic demonstrated superior healthcare practices compared to those who did not. However, considering that only 33.9% of participants experienced social distancing and 53.3% received prenatal education during the pandemic, these factors did not significantly impact the overall level of the behaviors. Pregnant women who receive professional prenatal education, equipped with accurate prenatal knowledge, can enhance their self-care abilities and healthcare practice behaviors. While face-to-face education was previously the standard, recent advancements in digital technology and the proliferation of infectious diseases have led to the introduction of web- or mobile-based prenatal education programs [25,49]. In light of this, the aim of this study was to investigate the evolving needs and current status of prenatal education for pregnant women during the pandemic. Despite social distancing, self-quarantine, and public facility closures, 53.3% of participants had attended at least one prenatal education session. This is similar to the 53.7% reported in a pre-pandemic study [50]. Regardless of the outcome, a significant 87.2% of participants expressed a need for prenatal education, a figure that substantially exceeds the participation rate. The average interest in prenatal education was around 8 out of 10 points, indicating a significant surge in demand during this period. The primary reasons for not receiving prenatal education were “social distancing” and a “lack of information about when and where the education was available,” suggesting that pandemic-related restrictions were the main obstacles to receiving education.

The internet emerged as the primary source of prenatal information for pregnant women during the COVID-19 pandemic, accounting for 84.4% of all information sources, compared to 30.0% before the pandemic [51] and 82.4% just prior to the pandemic [52]. This indicates an increased dependence on the internet for information. During the pandemic’s peak in Korea, there was a significant decrease in the number of patients and visits to hospitals or clinics compared to the period before the outbreak. This led to a potential decrease in health services provided by primary healthcare facilities [53], and pregnant women may not have received sufficient prenatal information from health professionals, leading to a natural increase in their reliance on the internet. However, the reliability of internet information can be questionable [54], and the information available may not always cater to the specific needs of pregnant women [55]. Therefore, it is crucial to devise policy-level strategies to improve the digital health literacy of pregnant women. This will enable them to effectively search for, understand, and assess the reliability of online prenatal information [56]. Given the recurring nature of infectious diseases, it is imperative for clinical experts to focus on developing strategies that can positively influence pregnant women’s reliance on the internet for prenatal information.

This study also found that the level of prenatal depression was associated with the desired prenatal education mode. Pregnant women who favored face-to-face prenatal education exhibited higher instances of prenatal depression. This can be attributed to the fact that these women seek more than just information from their education; they also crave empathy and emotional support,
which they find through bonding with other expectant mothers in similar circumstances [55]. However, online prenatal education may not provide the same opportunities for forming these emotional connections, potentially leading to feelings of isolation [57]. Before the pandemic, prenatal education in Korea was primarily conducted in person at public health centers. While online prenatal education can serve as an effective intervention for prenatal depression during a pandemic, it may not fully address the psychological and emotional needs that are met through social interactions. Consequently, further research is needed to develop effective online prenatal education programs that can be utilized during pandemic conditions.

Based on the findings of this study, the factors that significantly impacted prenatal depression included pandemic-related pregnancy stress, marital satisfaction (or lack thereof), pregnancy healthcare practices, family type (specifically, weekend couples), and gestational age. However, as this study focused solely on women in their third trimester, the results may not be directly applicable to those in their first or second trimesters. Additionally, the survey used to assess prenatal education was conducted in a straightforward question-and-answer format, which limited the ability to provide a comprehensive overview of prenatal education practices during the pandemic. The factors associated with prenatal depression also had a relatively low explanatory power of 38.2%. This could be due to the fact that unlike previous research conducted in Korea during the pandemic [16], this study did not specifically analyze pregnant women with a history of depression or those currently experiencing depression during pregnancy. Despite these limitations, the study’s significance lies in its examination of the changing phenomena by analyzing each variable of pandemic-related pregnancy stress and pregnancy healthcare practices in relation to the characteristics of pregnant women and their prenatal education. The study also provides foundational data for the development of various prenatal education programs aimed at promoting mental health in pregnant women in preparation for future infectious diseases. It further underscores the need for strategies to reduce pregnancy stress and improve pregnancy healthcare behaviors.

In conclusion, prenatal depression among pregnant women during pandemics like COVID-19 is a serious issue that necessitates immediate evaluation and treatment. Because prenatal depression often intensifies in the later stages of pregnancy, interventions that are both timely and tailored to the pregnancy stage are essential. It is critical to acknowledge stress and healthcare practice behaviors as significant influences on prenatal depression during the COVID-19 pandemic. Therefore, monitoring and managing these factors among pregnant women is crucial, particularly in the face of recurring infectious diseases. Consequently, national and healthcare policies, as well as active interventions, are required to address these issues.

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**Authors’ contributions**

Conceptualization, Methodology, Formal analysis, Investigation, Supervision: Kim ME; Data curation, Software: Kim ME, Jung HN; Writing–original draft: Kim ME, Jung HN; Writing–review & editing: Kim ME.

**Conflict of interest**

The authors declare no conflict of interest.

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**Data availability**

Please contact the corresponding author for data availability.

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None.

**References**

13925
23. Kim ME, Heo ML. Evaluating the reliability and validity of


Influence of folic acid knowledge on effective folic acid intake in Chinese pregnant women: a cross-sectional study

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Purpose: This study aimed to investigate the current status of effective folic acid intake and the level of folic acid knowledge of Chinese pregnant women and to analyze the relationship between effective folic acid intake and folic acid knowledge.

Methods: From November 2021 to May 2022, 140 pregnant women at Yantai Yuhuangding Hospital in the Chinese province of Shandong, answered questions about their general characteristics, folic acid intake, and folic acid knowledge. The data were analyzed using the t-test, chi-square test, and logistic regression analysis, and were presented with frequency with percentage or mean±standard deviation.

Results: Only 16.4% of the pregnant women (n=23) took folic acid effectively, using the following four criteria. Of all pregnant women who took folic acid, 72.2% took folic acid starting 1 month before pregnancy, 70.8% took folic acid up to 3 months after pregnancy, 36.8% took 400 μg every time, and 78.6% took folic acid more than 24 days every month. The score for folic acid knowledge was relatively high (5.61±2.18 on a scale of 0–9). A higher folic acid knowledge score correlated with more effective folic acid intake (t=4.10, p<.001).

Conclusions: Our study shows that the current recommendations to prevent neural tube defects through effective folic acid intake supplementation are not being fully implemented in China. Furthermore, folic acid knowledge was positively correlated with the effectiveness of its intake. Future education related to effective folic acid intake should emphasize the four methods of effective folic acid intake, especially regarding the recommended dose of 400 μg every time.

Keywords: Folic acid; Knowledge; Neural tube defects; Pregnant women; Women's health

Introduction

According to guidelines from the Centers for Disease Control and Prevention (CDC), all women with the potential to bear children should consume 400 μg of folic acid daily, starting at least 1 month before pregnancy and continuing until 3 months into pregnancy. This is to prevent fetal neural tube defects, including spondyloschisis, anencephaly, and cephalocele [1]. The prevalence of neural tube defects varies across regions as defined by the World Health Organization. A systematic review conducted in 2016 reported incidences of 21.9 per 10,000 people in the East Mediterranean region, 15.8 in Southeast Asia, 11.7 in Africa, 11.5 in the Americas, 9.0 in Europe, and 6.9 in the West Pacific region [2]. With its vast size, China exhibits varying incidences of neural tube defects across different regions. Higher rates are observed in the northern and western parts, while lower rates are...
Summary statement

· What is already known about this topic?
   Efforts to prevent neural tube defects by effectively using folic acid are underway worldwide. In China, many pregnant women take folic acid. However, the proportion of those consistently consuming folic acid from before pregnancy through the entire gestational period was found to be low.

· What this paper adds
   A substantial proportion (36.8%) of pregnant Chinese women surveyed in the East region, did not take the correct dose of folic acid, one of the four criteria for effective folic acid consumption.

· Implications for practice, education, and/or policy
   Considering that all four guidelines for folic acid in pregnancy have not yet been fully implemented in China, healthcare professionals should emphasize the need to take folic acid at least 1 month before pregnancy and consume 400 µg of folic acid daily.

seen in the southern and eastern regions. Although the average incidence in Mainland China is 6.18 per 10,000, a closer look at each region reveals the following: in North China, the Inner Mongolia Autonomous Region has an incidence of 20.1 per 10,000, and Shanxi Province has 16.07 per 10,000. In East China, Anhui Province has 10.65 per 10,000. Northwest China has an average incidence of 20 per 10,000, with Gansu Province showing an incidence of 39.51 per 10,000. These findings can be attributed to factors such as the ecological environment, economic development, and the standard of the healthcare system [3]. There appears to be a need for studies that identify the factors influencing the reduction of neural tube defect incidence, with the aim of mitigating their negative effects.

While the exact cause of neural tube defects remains unknown, a deficiency in folic acid during pregnancy is considered a significant factor. Research indicates that consuming folic acid during pregnancy can prevent between 50% and 70% of fetal neural tube defects [4]. Despite global initiatives promoting the prevention of neural tube defects through adequate folic acid intake, a study by Chitayat et al. [5] suggests that the rate of effective folic acid consumption is low, resulting in insufficient prevention of these defects. Effective folic acid intake is defined as the prevention of neural tube defects in women of childbearing age by consuming 400 µg of folic acid, starting at least 1 month before pregnancy and continuing until 3 months after pregnancy [1]. In this study, effective folic acid intake was specified as follows: (1) a daily intake of 400 µg of folic acid, (2) beginning 1 month prior to pregnancy, (3) continuing until 3 months post-pregnancy, and (4) when the correct intake of folic acid occurs on 80% or more of the total number of days [1,6].

Most previous studies on the four criteria for effective folic acid consumption in various countries did not clearly define the exact period of intake. In studies carried out in China, it was found that between 7.9% and 32.7% of women began taking folic acid prior to pregnancy [7,8], 55.7% started 2 months post-pregnancy [7], and 14.3% took it from 3 months pre-pregnancy until 3 months post-pregnancy [9]. In terms of folic acid intake prior to pregnancy in other countries, 20.5% of Japanese women began 1 month before pregnancy [10], and 11.7% of Italian women did the same [11]. In Korea, 24.6% of women started taking folic acid before pregnancy, regardless of the specific period [12], while 24.7% of Irish women [13] and 30% of American women [14] followed suit. In contrast, between 54.9% and 74.9% of Italian women began their folic acid intake after pregnancy [11,15], and 47.2% of Italian women took a daily dose of 400 µg [15]. These findings illustrate the patterns of folic acid consumption among pregnant women in China and other parts of the world. Few studies, whether in China or elsewhere, have specified the exact period of intake. The rate of intake before pregnancy was relatively low, with most participants beginning their folic acid regimen after becoming pregnant. While previous studies have reported the rate of folic acid intake at various stages before and after pregnancy, few have addressed the overall effective intake rate. Therefore, this study aimed to investigate the extent to which the criteria for effective intake are being met by pregnant women in China. Furthermore, it is crucial to provide Chinese women with education on proper folic acid consumption to improve their understanding of effective folic acid intake and encourage its use.

Folic acid knowledge refers to the awareness that folic acid be-
longs to the vitamin B complex, and that an adequate amount of folic acid in the body can help prevent significant congenital defects in the fetal brain and spine. It also involves knowing that a daily dose of 400 µg of folic acid is necessary from 1 month before pregnancy until 3 months after pregnancy [1]. Existing research on folic acid knowledge reveals that 58.3% of pregnant women in China were aware that folic acid intake is necessary to prevent neural tube defects. However, only 15.6% knew the correct intake period for folic acid, and 36.7% knew the accurate dosage [16]. Studies have shown that 56.4% of pregnant women in Korea and 85.4% in Ireland were aware that folic acid helps prevent neural tube defects [12,17]. Additionally, 32.2% of pregnant women in Japan knew the exact dosage of folic acid [10].

In summary, the level of folic acid knowledge among pregnant women in China appears to be similar to that of pregnant women in Korea, particularly regarding folic acid’s role in preventing neural tube defects. It is also comparable to the knowledge level among pregnant women in Japan concerning the dosage of folic acid. Although there was no comparison group for the intake period of folic acid, it was found that few women had accurate knowledge of this aspect.

An analysis was conducted to determine the correlation between knowledge of folic acid and its intake. The results revealed that pregnant women who understood the role of folic acid in preventing neural tube defects were 2.64 times more likely to consume folic acid compared to those who were unaware of its benefits [10]. This suggests that simply being aware of the need for folic acid can influence its actual consumption. Given that accurate knowledge about folic acid can potentially enhance its effective intake, this study aimed to further investigate this correlation.

Upon investigating other factors that influence folic acid intake, it was observed that in both China and other countries, certain factors were associated with a higher rate of folic acid consumption. These factors included being aged 30 years and above [10,13,18], having a higher level of education [18-20], earning a higher income [20,21], residing in cities [19], suffering from chronic diseases [11,22], planning pregnancies [19,22], being a married woman [11,21], having given birth [11,13,21], and having undergone infertility treatment.

A review of the above references shows that most existing studies have only incorporated certain criteria when defining effective folic acid intake. These studies have investigated the current state of folic acid consumption and analyzed its alignment with the understanding of folic acid. Therefore, this study aimed to evaluate the status of effective folic acid intake among pregnant women in China, in line with the four guidelines issued by the CDC. Furthermore, the study investigated women’s understanding of folic acid and the impact that this knowledge has on effective folic acid consumption. Ultimately, the findings are hoped to contribute to improving effective folic acid intake rates through these investigations.

Methods

Ethics statement: Obtaining informed consent was exempted by the Institutional Review Board of Seoul National University (No. 2109/001-014) because there was no sensitive information and the survey was anonymously treated.

Study design

This cross-sectional survey study sought to examine the intake of folic acid and knowledge about folic acid among pregnant women in China and explore the influence of folic acid knowledge on effective folic acid intake.

Participants

This study included women who were at least 12 weeks pregnant and were patients at Yantai Yuhuangding Hospital in Shandong, China. The participants were selected through convenience sampling. The study was based on previous research, which found that 42% of participants had taken folic acid prior to pregnancy [23]. An odds ratio (OR) of 2.64 was established, with a confidence level of 0.05 and a test power of 0.8, using G*power 3.1. The minimum sample size was calculated to be 134, but we anticipated a dropout rate of 20%, so the final sample size was set at 161. After data collection, it was found that a total of 154 women had completed the survey. However, after excluding 10 participants who did not complete the survey faithfully and four who had not taken folic acid, the total number of participants used in the survey analysis was 140.

Instruments

After preparing the questionnaire and consent form in Korean, the researchers enlisted the help of a specialized agency for translation and reverse translation. This resulted in the final version of the tool, which was written in Chinese. The validity of this final questionnaire was subsequently assessed by two nursing educators who were proficient in both Chinese and Korean. Furthermore, a preliminary survey was carried out with three pregnant women living in China and no difficulties in understanding or completing the survey were found. Thus, items were deemed sat-
isfactory for the main survey.

**Effective folic acid intake**

Effective folic acid intake was assessed based on the following criteria: (a) whether the daily intake of folic acid was 400 µg (yes/no), (b) whether folic acid was consumed starting from 1 month prior to pregnancy (yes/no), (c) whether folic acid was consumed during the first 3 months of pregnancy (yes/no), and (d) whether folic acid was consumed at least 24 days in a month (yes/no). A total score of 4 points indicated effective intake, while a score ranging from 0 to 3 points was considered indicative of ineffective intake.

**Folic acid knowledge**

We utilized nine items from the CDC’s 10-item questionnaire related to folic acid knowledge (https://www.cdc.gov/ncbddd/folicacid/quiz.html), after making necessary revisions. Each item was answered with either a “yes” or “no,” with correct responses earning 1 point and incorrect responses earning 0 points. The total score, which could range from 0 to 9, served as an indicator of the respondent’s knowledge of folic acid; a higher score signified greater knowledge. The Cronbach’s α for this knowledge tool is .65.

**Folic acid intake**

A questionnaire was developed based on Bai et al.’s study [24]. It comprised 18 items, which included questions about whether the respondent had taken folic acid, the first and last instances of folic acid intake, the total daily amount of folic acid consumed, and the specific content of the folic acid taken.

**General characteristics**

The general characteristics of the participants were collected using eight items: age, ethnicity, city residency, education level, spouse’s education level, occupation, spouse’s occupation, and monthly family income. The obstetric characteristics of the participants were as follows: the date of their last menstrual period, history of miscarriage, history of abortion, history of infertility, and whether the pregnancy was planned.

**Data collection**

Data were collected from November 2021 to May 2022. A research assistant, who had previously worked as a nurse in China and had undergone training with the researchers, was responsible for data collection at Yantai Yuhungding Hospital in Shandong, China. Participants were recruited by scanning a QR code on a flyer posted in the hospital, which led them to the study’s information sheet. If a participant agreed to take part in the study, she proceeded to complete the online questionnaire. The information sheet outlined the study’s content, purpose, and data anonymity, and it also stated that participants could withdraw at any point during the study if they chose not to continue. If a participant clicked “do not agree,” the survey automatically ended. Completing the online questionnaire took approximately 10 minutes. As a token of appreciation, each participant received a mobile coffee coupon worth 3 US dollars.

**Data analysis**

Data were analyzed as follows using IBM SPSS for Windows ver. 24.0 (IBM Corp., Armonk, NY, USA). The general and obstetric characteristics of the pregnant women were analyzed using frequency, percentages, mean, and standard deviation. Differences in effective folic acid intake according to folic acid knowledge were analyzed using the t-test and the chi-square test. Finally, logistic regression analysis was conducted to identify factors influencing folic acid intake.

**Results**

**Characteristics of participants**

The mean age of the 140 participants was 31.56 ± 3.88 years (range, 21–41 years). In terms of education, 67.9% of the participants held university degrees, and 89.3% were employed. Among the participants’ spouses, 67.1% held university degrees, and 97.9% were employed.

Sixty percent of the participants were experiencing their first pregnancy. A smaller portion (8.6%) had previously experienced a miscarriage. Additionally, 30.7% had undergone an abortion. Notably, 82.9% of all participants had planned their pregnancies (Table 1).

**Status of effective folic acid intake**

Of the total participants, 16.4% (23 individuals) met all four criteria for effective folic acid intake, while the remaining 83.6% (117 individuals) did not. When we analyzed the intake outcomes based on these four criteria, we found that (1) 72.2% (104 individuals) began taking folic acid prior to pregnancy, (2) 70.8% (102 individuals) continued taking folic acid up to 3 months post-pregnancy, (3) only 36.8% (53 individuals) consumed the recommended daily dose of 400 µg of folic acid, and (4) 78.6% (110 individuals) took the supplement for at least 24 days in a month, which equates to 80% of the month. As these figures indicate, the criterion with the lowest adherence was the correct
Table 1. Sociodemographic and obstetric characteristics and differences in effective folic acid intake according to general and obstetric characteristics (N=140)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Total (N = 140), n (%)</th>
<th>Folic acid intake, n (%)</th>
<th>χ² (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective† (n = 23)</td>
<td>Ineffective (n = 117)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sociodemographic characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>Mean ± SD (range), 31.56 ± 3.88 (24–41)</td>
<td></td>
<td></td>
<td>20.34 (.257)</td>
</tr>
<tr>
<td>24–29</td>
<td>42 (30.0)</td>
<td>5 (21.7)</td>
<td>37 (31.6)</td>
<td></td>
</tr>
<tr>
<td>30–34</td>
<td>69 (49.3)</td>
<td>11 (47.9)</td>
<td>58 (49.6)</td>
<td></td>
</tr>
<tr>
<td>35–41</td>
<td>29 (20.7)</td>
<td>7 (30.4)</td>
<td>22 (18.8)</td>
<td></td>
</tr>
<tr>
<td>Nationality</td>
<td>Han nationality</td>
<td>122 (87.1)</td>
<td>21 (91.3)</td>
<td>0.43 (.514)</td>
</tr>
<tr>
<td>Minority nationality</td>
<td>18 (12.9)</td>
<td>2 (8.7)</td>
<td>16 (13.7)</td>
<td></td>
</tr>
<tr>
<td>Location of residence</td>
<td>Town</td>
<td>128 (91.4)</td>
<td>21 (91.3)</td>
<td>0.00 (.981)</td>
</tr>
<tr>
<td></td>
<td>Countryside</td>
<td>12 (8.6)</td>
<td>2 (8.7)</td>
<td>10 (8.5)</td>
</tr>
<tr>
<td>Education</td>
<td>≤ High school</td>
<td>45 (32.1)</td>
<td>6 (26.1)</td>
<td>39 (33.3)</td>
</tr>
<tr>
<td></td>
<td>≥ College</td>
<td>95 (67.9)</td>
<td>17 (73.9)</td>
<td>78 (66.7)</td>
</tr>
<tr>
<td>Husband’s education</td>
<td>≤ High school</td>
<td>46 (32.9)</td>
<td>7 (30.4)</td>
<td>39 (33.3)</td>
</tr>
<tr>
<td></td>
<td>≥ College</td>
<td>94 (67.1)</td>
<td>16 (69.6)</td>
<td>78 (66.7)</td>
</tr>
<tr>
<td>Employment</td>
<td>Employed</td>
<td>125 (88.3)</td>
<td>21 (91.3)</td>
<td>104 (88.9)</td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>15 (10.7)</td>
<td>2 (8.7)</td>
<td>13 (11.1)</td>
</tr>
<tr>
<td>Husband’s employment</td>
<td>Employed</td>
<td>137 (97.9)</td>
<td>23 (100)</td>
<td>114 (97.4)</td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>3 (2.1)</td>
<td>0 (0)</td>
<td>3 (2.6)</td>
</tr>
<tr>
<td>Monthly income (Chinese yuan‡)</td>
<td>≤ 10,000</td>
<td>76 (54.3)</td>
<td>15 (65.2)</td>
<td>61 (52.1)</td>
</tr>
<tr>
<td></td>
<td>&gt; 10,000</td>
<td>64 (45.7)</td>
<td>8 (34.8)</td>
<td>56 (47.9)</td>
</tr>
<tr>
<td>Obstetric characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td>Primiparous</td>
<td>84 (60.0)</td>
<td>17 (73.9)</td>
<td>67 (57.3)</td>
</tr>
<tr>
<td></td>
<td>Multiparous</td>
<td>56 (40.0)</td>
<td>6 (26.1)</td>
<td>50 (42.7)</td>
</tr>
<tr>
<td>History of miscarriage</td>
<td>Yes</td>
<td>12 (8.6)</td>
<td>3 (13.0)</td>
<td>9 (7.7)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>128 (91.4)</td>
<td>20 (87.0)</td>
<td>108 (92.3)</td>
</tr>
<tr>
<td>History of abortion</td>
<td>Yes</td>
<td>43 (30.7)</td>
<td>15 (65.2)</td>
<td>82 (70.1)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>97 (69.3)</td>
<td>8 (34.8)</td>
<td>35 (29.9)</td>
</tr>
<tr>
<td>History of infertility</td>
<td>Yes</td>
<td>10 (7.1)</td>
<td>3 (13.0)</td>
<td>7 (6.0)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>130 (92.9)</td>
<td>20 (87.0)</td>
<td>110 (94.0)</td>
</tr>
<tr>
<td>Planned pregnancy</td>
<td>Yes</td>
<td>116 (82.9)</td>
<td>22 (95.7)</td>
<td>94 (80.3)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24 (17.1)</td>
<td>1 (4.3)</td>
<td>23 (19.7)</td>
</tr>
</tbody>
</table>

†Effective folic acid intake is 400 µg of folic acid taken more than 24 days every month from 1 month preconception until 3 months after pregnancy.
‡10,000 Chinese yuan is roughly 1,380 US dollars.

daily dosage of folic acid (Figure 1).

Among the participants who did not meet the criteria for effective folic acid intake, 25.8% (36 individuals) consumed folic acid from 1 month prior to pregnancy until 3 months post-pregnancy, for at least 24 days each month. This group represented the majority. They were followed by 12.9% (18 individuals) who consumed folic acid from before pregnancy for at least 24 days each month, 12.2% (17 individuals) who consumed folic acid until 3 months post-pregnancy for at least 24 days each month, and 6.5% (nine individuals) who consumed 400 µg of folic acid daily from before pregnancy until 3 months post-pregnancy. Among the participants with ineffective intake who underwent surgery, 2.1% (three individuals) did not meet any of the four criteria for effective folic acid intake.

Differences in folic acid knowledge according to effective folic acid intake

The mean score for participants’ knowledge of folic acid was relatively high, at 5.61 ± 2.18 out of a possible 9 points. The statement that received the highest rate of correct responses was “the easiest way to get the right amount of folic acid every day is to take 400 µg of synthetic folic acid,” with 79.3% (111 individuals) of partici-
pants responding “yes.” Conversely, the statement with the lowest rate of correct responses was “folic acid is a B vitamin,” with only 50.7% (71 individuals) of participants responding “yes.”

Upon analyzing the variance in folic acid knowledge based on effective folic acid intake, it was found that the group with effective folic acid intake scored higher in folic acid knowledge compared to the group with ineffective folic acid intake ($t = 4.10, p < .001$). Among the items related to folic acid knowledge, participants who were aware that “women of childbearing age should consume 400 µg of folic acid every day” ($\chi^2 = 10.95, p < .001$), understood “ways to be sure that you are getting enough folic acid every day” ($\chi^2 = 10.71, p < .001$), knew “what are spina bifida and anencephaly” ($\chi^2 = 3.98, p < .005$), and recognized that “the easiest way to get the right amount of folic acid every day is to take 400 µg of synthetic folic acid” ($\chi^2 = 4.49, p < .005$), were more likely to exhibit effective folic acid intake (Table 2).

### Influencing factors on effective folic acid intake

To identify the factors that influence the effective intake of folic acid among pregnant women, we conducted a binomial logistic regression analysis. This analysis used significant variables derived from a cross-tabulation analysis, which examined potential differences based on general and obstetrical characteristics. However, our analysis revealed that these characteristics did not significantly impact the effective intake of folic acid among pregnant women (Table 1). We found that a higher score in folic acid knowledge (OR, 1.74; 95% confidence interval [CI], 1.29–2.35) was associated with effective folic acid intake. Notably, participants who understood that “women of childbearing age should consume 400 µg of folic acid daily” (OR, 14.77; 95% CI, 1.93–113.35) and knew “ways to be sure that you are getting enough folic acid every day” (OR, 5.74; 95% CI, 1.84–17.90) were more likely to effectively consume folic acid. However, when we adjusted the ORs using the characteristics found to be significant in effective folic acid intake, we did not identify any significant determinants (Table 3).

### Discussion

This study is the first, to our knowledge, to examine the status of effective folic acid intake and investigate its relationship with...
Table 2. Differences in effective folic acid intake according to correct folic acid knowledge (N=140)

<table>
<thead>
<tr>
<th>Question</th>
<th>Total (N = 140), n (%)</th>
<th>Folic acid intake, n (%)</th>
<th>χ² or t (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Folic acid is a B vitamin</td>
<td>71 (50.7)</td>
<td>15 (65.2)</td>
<td>2.32 (.128)</td>
</tr>
<tr>
<td>2. Folic acid reduces the risk for spina bifida and anencephaly</td>
<td>100 (71.4)</td>
<td>20 (87.0)</td>
<td>3.25 (.071)</td>
</tr>
<tr>
<td>3. Women of childbearing age should consume 400 µg of folic acid every day</td>
<td>92 (65.7)</td>
<td>22 (95.7)</td>
<td>10.95 (&lt;.001)</td>
</tr>
<tr>
<td>4. Ways to be sure that you are getting enough folic acid every day</td>
<td>72 (51.4)</td>
<td>19 (82.6)</td>
<td>10.71 (&lt;.001)</td>
</tr>
<tr>
<td>5. What are spina bifida and anencephaly</td>
<td>77 (55.0)</td>
<td>17 (73.9)</td>
<td>3.98 (.046)</td>
</tr>
<tr>
<td>6. In order to help prevent neural tube defects, folic acid must be taken before and during the first few months of pregnancy</td>
<td>93 (66.4)</td>
<td>17 (73.9)</td>
<td>0.69 (.406)</td>
</tr>
<tr>
<td>7. While it's important to eat a healthy diet, the easiest way to get the right amount of folic acid every day is to take 400 µg of synthetic folic acid</td>
<td>111 (79.3)</td>
<td>22 (95.7)</td>
<td>4.49 (.034)</td>
</tr>
<tr>
<td>8. A woman should be talking folic acid if she is planning a pregnancy, is capable of becoming pregnant, even if she is not planning a pregnancy, or thinks she might become pregnant sometime in the future</td>
<td>72 (51.4)</td>
<td>16 (69.6)</td>
<td>3.62 (.057)</td>
</tr>
<tr>
<td>9. Now that you are an expert on folic acid, you should make sure to take a multivitamin containing folic acid every day, eat foods rich in folate, and foods fortified with synthetic folic acid, tell a friend about the importance of folic acid</td>
<td>97 (69.3)</td>
<td>18 (78.2)</td>
<td>1.04 (.307)</td>
</tr>
</tbody>
</table>

Total score (possible range, 0–9), mean ± SD: 5.61 ± 2.18, 7.22 ± 1.65, 5.29 ± 2.13, 4.10 (<.001)

†Effective folic acid intake is 400 µg of folic acid taken more than 24 days every month from 1 month preconception until 3 months after pregnancy.

Folic acid knowledge, in line with the four criteria set by the CDC's folic acid intake guidelines. Our findings indicate that the rate of effective folic acid intake, based on these four guidelines, was 16.4%. This is significantly higher than the 4.82% rate of effective folic acid intake among pregnant women in Northwest China, as reported in a 2011 study. In that study, women consumed 400 µg of folic acid at least 5 days a week, starting 1 month before pregnancy and continuing until 2 months after conception [24]. This increase may be attributed to an actual rise in folic acid intake among pregnant women in China, a result of a policy that provided folic acid free of charge to boost intake rates [25]. However, the rate of effective intake remains relatively low.

This study can be compared to others that only adopted some of the criteria for effective folic acid intake. In 2017, the rate of effective folic acid intake, defined as consumption from 3 months before pregnancy until 3 months after pregnancy, was examined in Tianjin City. The rates of folic acid intake were found to be 14.4%, respectively [26]. In 2014, the rate of effective folic acid intake, defined as consumption from 3 months before pregnancy for at least 24 days a month, was analyzed in Shanxi Province. The rate of folic acid intake was found to be 14% [6], a figure similar to the intake rate in this study. All participants had taken folic acid at some point, but only a small proportion continued to take it from before conception through pregnancy. This finding is consistent with a study conducted overseas [27] and suggests that the participants' lack of knowledge about the precise period for folic acid intake contributes to the low rate of effective folic acid intake.

In this study, 72.2% of participants reported taking folic acid for at least 1 month prior to pregnancy. This is significantly higher than the 24.7% rate reported in Cawley et al's study [13] involving pregnant women. To determine if there is a correlation between a participant's level of education and the rate of folic acid intake, further studies are needed. This aligns with a previous study suggesting that a participant's education level influences the rate of folic acid intake before pregnancy [28]. In this study, it was observed that 70.8% of participants continued taking folic acid up to 3 months post-pregnancy. This rate is compa-
Table 3. Effect of folic acid knowledge on effective folic acid intake (N=140)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories (%)</th>
<th>Effective folic acid intake†</th>
<th>Unadjusted OR (95% CI)</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly income (Chinese yuan)</td>
<td>≤ 10,000 (53.5)</td>
<td>0.58 (0.23–1.48)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 10,000 (46.5)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>College (68.1)</td>
<td>1.42 (0.58–3.88)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High school (31.9)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Employed (88.9)</td>
<td>1.31 (0.28–6.25)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unemployed (11.1)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td>Multiparous (40.3)</td>
<td>0.47 (0.17–1.29)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primiparous (59.7)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Abortion</td>
<td>Yes (29.9)</td>
<td>1.25 (0.49–3.22)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (70.1)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Planned pregnancy</td>
<td>Yes (81.9)</td>
<td>0.19 (0.02–1.45)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (18.1)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Knowledge score (0–9)</td>
<td>Yes (65.7)</td>
<td>1.74† (1.29–2.35)</td>
<td>1.74 (0.51–1.88)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (34.3)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3. Women of childbearing age should consume 400 µg of folic acid every day</td>
<td>Yes (65.7)</td>
<td>14.77† (1.93–113.35)</td>
<td>1.76 (0.79–1.27)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (34.3)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>4. Ways to be sure that you are getting enough folic acid every day</td>
<td>Yes (61.4)</td>
<td>5.74† (1.84–17.90)</td>
<td>1.04 (0.60–1.66)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (48.6)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5. What are spina bifida and anencephaly</td>
<td>Yes (55.0)</td>
<td>2.69 (0.99–7.31)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (45.0)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>7. While it’s important to eat healthy diet, the easiest way to get the right amount of folic acid every day is to take 400 µg of synthetic folic acid</td>
<td>Yes (79.3)</td>
<td>6.92 (0.89–53.69)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (20.7)</td>
<td>Reference</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

CI, confidence interval; OR, odds ratio.
†Effective folic acid intake is 400 µg of folic acid taken more than 24 days every month from 1 month preconception until 3 months after pregnancy.
‡10,000 Chinese yuan is roughly 1,380 US dollars.
§p<.05.

rable to the 66.1% reported in a study conducted with pregnant women in China [16]. This suggests that the “Health Guidelines for Preconception and during Pregnancy,” a public initiative launched in China in 2011 [28], has successfully raised awareness about the importance of folic acid intake among women. Consequently, most women now understand the need to take folic acid during pregnancy. Approximately 36.8% of the women in this study reported taking a daily dose of 400 µg of folic acid, a rate similar to the 47.2% reported in a study conducted with women in Italy [15]. This suggests that over half of the participants are unaware of the recommended daily dose of folic acid. According to a study by Maraschini et al. [15], only 8.0% of all participants received education on the correct dosage of folic acid prior to pregnancy, and 13.7% received such education during pregnancy. This underscores the fact that the importance of the correct dosage is not sufficiently emphasized in education about folic acid intake. Among the participants in this study, 78.6% reported taking folic acid for at least 24 days each month. This rate is similar to the 81.6% reported in a previous study conducted in China [23]. This suggests that the majority of women consistently take folic acid daily once they start.

In summary, while pregnant women in China were cognizant of the need to take folic acid up to 3 months post-pregnancy, and understood the frequency of its intake, they did not meet the recommended daily intake of 400 µg, starting at least 1 month prior to pregnancy. For effective folic acid consumption, individuals must strive to meet all these criteria in their daily routines. To boost the prevalence of effective folic acid consumption, several countries, including the United States, have instituted and enforced folic acid fortification policies. These policies promote the consumption of grain products fortified with folic acid. However, according to a meta-analysis by Toivonen et al. [29], there is no discernible difference in the incidence of neural tube defects between countries that have implemented folic acid fortification policies and those that have not. While county-level policies are necessary to increase the rate of effective folic acid intake, it appears that individual awareness of the importance of folic acid consumption, and the personal initiative to include it in one's
diet, are even more critical.

Turning to knowledge, the mean score for folic acid knowledge among the pregnant women participating in the study was 5.61 out of a possible 9 points. Two items had a correct response rate of 70% or higher, three items had a rate of 60% or higher, and four items had a rate of 50% or higher. This indicates that the overall understanding of folic acid is relatively high among the participants. However, further education is necessary on the items that scored lower to ensure accurate comprehension. These items included: “folic acid is a B vitamin,” “ways to be sure that you are getting enough folic acid every day,” “what are spina bifida and anencephaly,” and “a woman should be taking folic acid if she is planning a pregnancy, is capable of becoming pregnant, even if she is not planning a pregnancy, or thinks she might become pregnant sometime in the future.” Additionally, the statement “women of childbearing age should consume 400 µg of folic acid daily” did not receive a high rate of correct responses. Given that this item also had the lowest adherence rate in the folic acid intake survey conducted as part of this study, there is a clear need for increased awareness and emphasis on this point.

The binomial logistic analysis revealed that participants with a more comprehensive understanding of folic acid were more likely to exhibit effective folic acid intake. This finding aligns with a survey conducted among pregnant women and those who had recently given birth in China. In this survey, women who understood the importance of folic acid during pregnancy and its role in preventing neural tube defects showed better adherence to folic acid intake [30]. Consequently, it is crucial to enhance folic acid knowledge to increase the rate of effective folic acid intake. The role of nurses, who are often the primary source of this knowledge, is also of paramount importance. Research indicates that the rate of folic acid intake among pregnant women and women of childbearing age increases when clinical staff provide brief, 30 to 60-second explanations about folic acid [31]. Therefore, nurses, who are tasked with educating these women, should emphasize the correct method of folic acid intake and instruct on how to effectively incorporate it into their routine.

In this study, factors such as the participant’s monthly income, education level, employment status, multiparity, miscarriage history, and whether the pregnancy was planned did not significantly influence effective folic acid intake. This finding contrasts with the study by Kim et al. [12] in Korea, which found that higher income, higher education level, and employment were associated with increased folic acid intake. It also differs from the study by Nilsen et al. [11] in Italy, which reported that primiparous women had a higher rate of effective folic acid intake. Specifically, our study found that whether a pregnancy was planned did not impact effective folic acid intake. This is in contrast to findings from Ireland, where women with planned pregnancies had a higher rate of folic acid intake [13]. The discrepancy may be due to the small sample size of our study and the fact that the majority of respondents reported having planned pregnancies, leading to oversampling. Furthermore, our study applied strict criteria for measuring effective intake, as opposed to the simple confirmation of intake used in previous studies. This could also account for the observed differences. In conclusion, the significant correlation between demographic and obstetrical characteristics and folic acid intake reported in previous studies was not observed in our study. This may be due to our smaller sample size, uneven distribution of demographic and obstetrical characteristics, and different method of measuring effective folic acid intake. Therefore, the relationship between demographic and obstetrical characteristics, including planned pregnancies, and effective folic acid intake should be re-evaluated in future studies with larger sample sizes.

The limitations of this study include the absence of a nationwide sample because it focused only on one specific area in China. In addition, it considered all four criteria of effective intake, making it difficult to compare the study directly with existing studies.

Nonetheless, this study provides meaningful results because it analyzed all four criteria of effective folic acid intake, pinpointing the specific reasons for unsuccessful implementation. Moreover, the study illustrates that to enhance the rate of effective folic acid intake, women of childbearing age need to cultivate an interest in folic acid consumption, a preventive strategy against neural tube defects. It underscores the necessity for comprehensive education on the precise dosage and duration of folic acid intake. We anticipate that this survey will offer participants the chance to proactively adopt effective folic acid intake practices in the future.

Based on the findings of this survey, future education on effective folic acid intake should take into account the following considerations. While most pregnant women are aware of the need to take folic acid, they may not be fully informed about the necessity of adhering to all four guidelines for effective intake, including its role in preventing neural tube defects. It is particularly important to emphasize that folic acid should be taken at least 1 month prior to pregnancy and that the recommended daily dosage for nonpregnant women is 400 µg.

There is an urgent need to educate women about folic acid, including its benefits and effective usage, for the betterment of women’s health. This education should be delivered in a clear and easily comprehensible manner. Future research should aim...
to validate the impact of this education on the understanding and effective consumption of folic acid. It should also reexamine the relationship between effective intake and demographic characteristics not previously investigated in this study. Furthermore, it appears necessary to monitor compliance with specific criteria for folic acid consumption through a mobile application.

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**Authors' contributions**

Conceptualization: Jin YJ, Kim HW; Data collection: Jin YJ; Formal analysis: Jin YJ, Kim HW; Funding acquisition: Kim HW; Writing–original draft: Jin YJ; Writing–review & editing: Kim HW.

**Conflict of interest**

The authors declared no conflict of interest.

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**Data availability**

Please contact the corresponding author for data availability.

**Acknowledgments**

We thank the pregnant women for participating in this study.

**References**


An explanatory model of quality of life in high-risk pregnant women in Korea: a structural equation model

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**Purpose:** This study aimed to develop and validate a structural model for the quality of life (QoL) among high-risk pregnant women, based on Roy’s adaptation model.

**Methods:** This cross-sectional study collected data from 333 first-time mothers diagnosed with a high-risk pregnancy in two obstetrics and gynecology clinics in Cheonan, Korea, or participating in an online community, between October 20, 2021 and February 20, 2022. Structured questionnaires measured QoL, contextual stimuli (uncertainty), coping (adaptive or maladaptive), and adaptation mode (fatigue, state anxiety, antenatal depression, maternal identity, and marital adjustment).

**Results:** The mean age of the respondents was 35.29±3.72 years, ranging from 26 to 45 years. The most common high-risk pregnancy diagnosis was gestational diabetes (26.1%), followed by preterm labor (21.6%). QoL was higher than average (18.63±3.80). Above-moderate mean scores were obtained for all domains (psychological/baby, 19.03; socioeconomic, 19.00; relational/spouse-partner, 20.99; relational/family-friends, 19.18; and health and functioning, 16.18). The final model explained 51% of variance in QoL in high-risk pregnant women, with acceptable overall model fit. Adaptation mode (β=–.81, p=.034) and maladaptive coping (β=.46, p=.043) directly affected QoL, and uncertainty (β=–.21, p=.004), adaptive coping (β=.36, p=.026), and maladaptive coping (β=–.56, p=.023) indirectly affected QoL.

**Conclusion:** It is essential to develop nursing interventions aimed at enhancing appropriate coping strategies to improve QoL in high-risk pregnant women. By reinforcing adaptive coping strategies and mitigating maladaptive coping, these interventions can contribute to better maternal and fetal outcomes and improve the overall well-being of high-risk pregnant women.

Keywords: High-risk pregnancy; Nursing; Psychological adaptation; Quality of life; Uncertainty

Introduction

In South Korea (hereafter, Korea), there is a trend towards delayed marriages, resulting in an average age of 33.4 years for first-time mothers in 2021. Furthermore, the percentage of mothers of advanced maternal age, defined as 35 years or older, is 33.8% [1]. A report from the World Health Organization indicates that mothers aged 35 years and above are at a higher risk of developing gestational diabetes mellitus, pregnancy-induced hypertension, and experiencing premature birth, stillbirth, neonatal death, and congenital malformations compared to women aged 20 to 34 years [2]. Alongside the increase in advanced maternal age, there has been a significant rise in the number of pregnancies classified as high-risk over the past decade. Specifically, the number has surged nearly sevenfold, from 27,223 cases in 2009 to 145,868 cases in 2018 [3]. High-risk pregnancies, which pose a threat to the health and life of pregnant women, fetuses, and newborns during pregnancy and childbirth, include factors such...
Summary statement

- What is already known about this topic?
  Few studies have been conducted to explain the factors influencing quality of life (QoL) due to adaptation and maladaptation during pregnancy in high-risk pregnant women.

- What this paper adds
  Development of a QoL model for high-risk pregnant women based on Roy’s adaptation theory revealed that adaptive coping played a vital role in helping these women adjust to pregnancy.

- Implications for practice, education, and/or policy
  This model of QoL in high-risk pregnant women is a useful framework for developing coping strategies and programs to enhance their QoL.

as chronic preexisting conditions, advanced maternal age, complications from the current pregnancy, as well as socioeconomic levels, mental health issues, and other considerations [4].

In high-risk pregnancies, 92.2% of women diagnosed with preterm labor require hospitalization for the sake of the fetus’s well-being [5]. Even those who receive outpatient care find it challenging to maintain a stable pregnancy, requiring drug therapy and frequent monitoring. This situation can potentially lead both the woman and her partner to experience maladaptive responses to pregnancy [6]. The often-ambiguous etiology of high-risk pregnancies makes predicting outcomes difficult, and the clarity of treatment results may be compromised [7]. As a result, high-risk pregnant women face heightened uncertainty as their psychological stability is threatened and stress persists due to concerns about the fetus, anxiety over maintaining the unstable pregnancy, fear of miscarriage, and a lack of information [7]. However, specialized education and counseling services for these women are limited. Consequently, they may resort to maladaptive coping behaviors, such as self-blame, rumination, and catastrophizing, in response to negative emotional states and uncertain situations [8].

From a cognitive perspective, coping is recognized as a strategy for regulating emotions, and it is divided into two categories: adaptive coping and maladaptive coping [9]. Adaptive coping aims to decrease uncertainty and psychological distress in pregnant women, thereby improving their mental health and quality of life (QoL). In contrast, maladaptive coping can lead to increased depression and anxiety, which negatively affects QoL [10]. Therefore, it is expected that the selection and implementation of appropriate coping strategies will influence the QoL for high-risk pregnant women by maintaining psychological well-being or managing negative emotions [9]. The factors that influence the QoL for high-risk pregnant women are varied and can have either positive or negative effects. Notable factors that have been reported to significantly impact the QoL for high-risk pregnant women include maternal identity [11], spousal support [12], physical symptoms [13], and depression, anxiety, and fatigue [14]. These factors represent the physical, mental, and social adaptation levels of the pregnant woman. They can be viewed as the emotional and behavioral characteristics of high-risk pregnant women and are suitable for measurement as an adaptation mode that evaluates individual behavior. However, a review of the literature reveals a gap in research on the QoL and influencing factors for high-risk pregnant women diagnosed with various conditions, as most studies tend to focus on pregnant women with no or minimal health issues [15,16]. Current research on the QoL for high-risk pregnant women has often been limited to specific conditions, neglecting the process-oriented and multifaceted aspects of adaptation while emphasizing physical health and emotional states [12]. Therefore, from a nursing perspective, it is crucial to gain a comprehensive understanding of the adaptation and QoL of high-risk pregnant women. Identifying relevant factors will provide evidence for nursing interventions aimed at improving their QoL.

Research on high-risk pregnancies, guided by Roy’s adaptation theory [17], has been reported in two international studies. Amanak et al. [18] examined the influence of this theory on maternal adaptation among women with pregnancy-induced hypertension. Similarly, Widiasih et al. [19] applied nursing plans and interventions based on the adaptation theory to women experiencing premature rupture of membranes and assessed their impact on these women’s physical and psychological well-being. As
pregnancy has been suggested to be a series of responses to individual changes and environmental stimuli. Roy’s adaptation model \[17\], was identified as a suitable theoretical foundation for understanding the QoL of high-risk pregnant women during pregnancy. This theory comprises stimuli, coping mechanisms, adaptation modes, and adaptation. Thus, our model focused on uncertainty, adaptive coping, maladaptive coping, and adaptation modes and the goal of our research was to identify the factors that influence the QoL in high-risk pregnant women. We also aimed to understand the demands related to their QoL. Ultimately, we hope to provide evidence-based data that will help establish intervention strategies to improve the QoL for these women.

**Purpose**

The purpose of this study was to construct a hypothetical model explaining QoL in high-risk pregnant women through a literature review of previous studies based on Roy’s adaptation theory \[17\], to validate the fit between actual data and the model, and to elucidate the direct and indirect relationships among factors. The specific objectives were as follows:

1) To construct a hypothetical model of QoL in high-risk pregnant women.
2) To validate the fit between the hypothetical model and actual data, presenting a model that explains QoL in high-risk pregnant women.
3) To identify the direct and indirect effects, as well as the total effects, among variables influencing QoL in high-risk pregnant women, thereby confirming the causal relationships among variables.

**Conceptual framework and hypothetical model of the study**

The conceptual framework of this study was constructed based on Roy’s adaptation model \[17\] and a review of the relevant literature. Roy’s adaptation model posits that humans, as psychosocial beings with physical, emotional, and social dimensions, are at the heart of the adaptation system. Individuals utilize this system to respond and adapt to changes in their environment. Roy and Andrews \[17\] define health as the process of becoming an integrated human being. The ultimate goal of nursing, according to this model, is to promote adaptive processes that enhance the interaction between the human system and the environment. This interaction positively impacts health and QoL. In Roy’s adaptation model \[17\], stimuli can be internal or external. The outcomes, based on the stimuli input into the individual’s adaptation system and the level of adaptation, are regulated through behavioral responses via cognator and regulator coping processes. The model identifies four modes of adaptation: the physiological mode, self-concept mode, role function mode, and interdependence mode. These four modes are highly interconnected and act as mediators between the stimuli input into the human system, the coping mechanisms, and adaptation \[21\]. The experiences of uncertainty, coping, adaptation mode, and adaptation as perceived by high-risk pregnant women can be understood within the context of Roy’s adaptation theory. In other words, this study views pregnancy as an open adaptive system that is constantly interacting with a changing internal and external environment. High-risk pregnancy, characterized by uncertainty, is seen as stimuli input into this system. The study aims to explain the phenomenon of adaptation to pregnancy through the four modes of adaptation—physiological, self-concept, role function, and interdependence—which are altered through coping. The conceptual framework of this study, based on Roy’s adaptation model, is shown in Figure 1.

In this study, high-risk pregnancy is considered as a source of contextual stimuli, as women experience uncertain emotions about maintaining pregnancy and fetal well-being due to the diagnosis of complications related to high-risk pregnancy and a lack of specialized information. This uncertainty is input into our framework. We perceive coping mechanisms as cognitive emo-
tion regulation strategies, where regulatory processes help manage emotions and feelings, thereby influencing psychological well-being. Coping during pregnancy is seen as a combination of adaptive and maladaptive coping. This is viewed as a mechanism that influences the cognitive regulatory processes that high-risk pregnant women use to adapt during pregnancy. This adaptation involves physiological factors, emotional factors, and cognitive regulation processes related to roles and interactions with partners. Adaptation involves four modes. In the physiological mode, the primary demand is physiological integration, taking into account the physical and mental fatigue of high-risk pregnant women [22]. The self-concept mode is defined as the integration of beliefs about oneself and psychological symptoms at a given point in time [20]. High-risk pregnant women, compared to low-risk pregnant women, tend to exhibit higher levels of antenatal depression and anxiety related to concerns about maintaining pregnancy and the fetus [23]. Based on the concept definition of high-risk childbirth adaptation [20], emotional factors such as antenatal depression and state anxiety are posited to comprise the self-concept mode. The role function mode focuses on the role individuals occupy in society. High-risk pregnant women, diagnosed with high-risk pregnancy, may experience negative impacts on the process of integrating their identity as mothers, affecting maternal identity acquisition [24]. Therefore, in this study, we consider the performance of the maternal role and the formation of identity by high-risk pregnant women as factors influencing QoL. The interdependence mode, based on previous research [17], involves behavioral classifications related to interdependent relationships. In this mode, individuals focus on interactions related to affection, respect, and values. High-risk pregnant women, influenced by spousal support and the quality of marital relationships during pregnancy, are expected to impact their QoL. Therefore, we conceptualize marital adjustment as the interdependence mode. Considering the interrelated nature of these five concepts based on the literature review, we incorporate them into the concept of adaptation used in the model. We define the adaptation level as the QoL to which high-risk pregnant women adapt during pregnancy.

Thus, this research model, focuses on the QoL in high-risk pregnant women. Uncertainty in high-risk pregnant women is established as an exogenous variable, while adaptive coping, maladaptive coping, adaptation mode, and QoL are designated as endogenous variables. The hypothetical model that considers the relationships between these concepts is presented in Figure 2.

### Methods

#### Ethics statement:
This study was approved by the Institutional Review Board of Chungnam National University (No. 202107-SB-125-01). Written informed consent was obtained from the participants.

#### Study design

This study used structural equation modeling to construct a hypothetical model explaining QoL in high-risk pregnant women based on Roy’s adaptation model [17] and previous research. The study is described according to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) reporting guidelines (http://www.strobe-statement.org).

#### Participants

The selection criteria for this study were primiparous women who were at least 35 years old (advanced maternal age), living with their spouse, had a gestational age between 20 weeks and 37 weeks, and were diagnosed with a high-risk pregnancy by a specialist. The high-risk pregnancy conditions included 19 specific diseases [25]: preterm labor, postpartum hemorrhage, preeclampsia, premature rupture of membranes, placental abruption, placenta previa, threatened abortion, polyhydramnios, oligohydramnios, antepartum hemorrhage, incompetent internal os of the cervix, pregnancy-induced hypertension, multiple pregnancies, gestational diabetes mellitus, hyperemesis gravidarum, renal disease, heart failure, intrauterine growth restriction, and diseases of the uterus and its appendages. Participants were excluded if they had been diagnosed with cancer or heart disease prior to pregnancy or were currently taking medication for depression. The sample size for this study was determined based on the requirement that 10 to 20 times the number of observed variables is needed for model validation [26]. Given that there were

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**Figure 2.** Theoretical model of quality of life in high-risk pregnant women.
20 observed variables in this case, a sample size of at least 300 participants was required. To account for a potential 20% dropout rate, a total of 370 participants were recruited [27]. After excluding 37 cases (10%) due to unreliable responses, the final study population consisted of 333 participants (100 recruited in person and 233 recruited online), thereby meeting the aforementioned sample size requirements.

**Study tools**

Permission to use the measurement tool was obtained through email communication with the tool developers and the authors of the Korean translation before data collection.

**Adaptation level: Quality of life**

The Maternal Postpartum Quality of Life Questionnaire (MAPP-QOL), originally developed by Hill and Aldag [28], and later translated into Korean by Choi et al. [29], was adapted by our research team to better suit the characteristics of pregnant women. Despite its initial design for postpartum mothers, the questionnaire’s items were found to be relevant to pregnant women, making it an appropriate tool for assessing their QoL. The original 40-item MAPP-QOL comprises five domains: psychological/baby (eight items), socioeconomic (nine items), relational/spouse-partner (five items), relational/family-friends (10 items), and health and functioning (eight items). Modification involved excluding four items specific to postpartum mothers’ experiences: “in the care of the cesarean section or episiotomy site,” “in the assistance with caring for newborns or other children,” “in the time spent with children,” and “in your ability to breastfeed your child.” This modified version underwent a content validity evaluation by three nursing professors and one obstetric nurse. Using a 4-point scale (4, very valid to 1, not valid at all), all items, except one related to “economic ability” with a content validity index below 0.8, were confirmed to have a validity index of 1.0. Subsequently, the modified MAPP-QOL consisted of 35 items across five domains: psychological/baby (eight items), socioeconomic (eight items), relational/spouse-partner (five items), relational/family-friends (seven items), and health and functioning (seven items). The MAPP-QOL assesses the satisfaction and importance of each item on a scale from 1 to 6. According to the scoring method, the total score and subdomain score ranges are calculated, with scores ranging from a minimum of 0 to a maximum of 30 points. A higher score indicates a higher QoL in pregnant women. During its development, the tool demonstrated reliability with a Cronbach’s α of .95. The Cronbach’s α values for each subfactor were as follows: psychological/baby, .86; socioeconomic, .87; relational/spouse-partner, .88; relational/family-friends, .85; and health & functioning, .86.

**Contextual stimuli: Uncertainty**

Mishel’s Uncertainty in Illness Scale [30], which was translated into Korean by Chung et al. [31], was used. This 33-item instrument has four subdomains: ambiguity (13 items), complexity (seven items), inconsistency (seven items), and unpredictability (five items); and an additional item that does not fall within these four subdomains. The scale uses a self-report 5-point Likert scale (1, not at all to 5, very much) and higher scores (possible range, 33–160) indicate a greater level of uncertainty. Cronbach’s α, as a measure of the tool’s reliability, was .91 at the time of its development [30], and .84 in this study.

**Coping mechanisms: Coping**

The Korean version [32] of the Cognitive Emotion Regulation Questionnaire (CERQ), a cognitive emotion regulation strategy tool developed by Garnefski et al. [9], was used to measure coping. The CERQ categorizes cognitive coping into nine factors, which are further divided into adaptive coping subfactors, which include putting into perspective, refocusing on planning, acceptance, positive refocusing, and positive reappraisal, and maladaptive coping subfactors, which include self-blame, blaming others, rumination, and catastrophizing. The CERQ consists of 36 items, rated on a 5-point Likert scale (1, almost never, to 5, almost always). Adaptive coping has a possible range of 20 to 100 points, maladaptive coping has a possible range of 16 to 80 points, and each subfactor has a possible range of 4 to 20 points. Higher subfactor scores indicate a higher usage of cognitive strategies. The reliability of the tool, as measured by Cronbach’s α, was .80 at the time of its development [33] and .86 in this study. The reliability of the subfactors was as follows: putting into perspective, .72; refocusing on planning, .82; acceptance, .62; positive refocusing, .83; positive reappraisal, .78; self-blame, .80; blaming others, .84; rumination, .72; and catastrophizing, .71.

**Adaptation modes**

**Fatigue**

This study utilized a score derived from a simplified 10-item fatigue scale. This scale, originally developed by Milligan et al. [34], was later translated into Korean, modified, and revised by Song [35]. The tool consists of physical and mental dimensions, each rated on a 4-point Likert scale (1, not at all, to 4, very much). A higher score (possible range, 10–40) signifies a higher level of fa-
tigue. In Song’s study [35], the Cronbach’s a value was .88, while in this study, it was .86.

State anxiety
State anxiety was assessed using the State-Trait Anxiety Inventory [36], which was translated and validated in Korean [37]. The inventory comprises 20 items, each rated on a 4-point Likert scale (1, not at all, to 4, very much). A higher score (possible range, 20–80) indicates a greater level of state anxiety. The reliability of the inventory was good during its initial development, i.e., Cronbach’s a value of .92 [36], as well as in this study .92.

Antenatal depression
The Korean version [38] of the Edinburgh Postnatal Depression Scale (EPDS) [39] was utilized to assess antenatal depression which has been confirmed as reliable and valid for antenatal depression as well. The 10-item EPDS assesses depression, anxiety, fear, guilt, and suicidal thoughts. The total score ranges from 0 to 30 points and a cutoff score of 9/10 is used for Korean women, with scores above 10 indicating a higher degree of antenatal depression [38]. The reliability of the Korean version was good, i.e., Cronbach’s a value of .87 in a prior study [38], and .81 in this study.

Maternal identity
Maternal identity scores were derived using a 40-item instrument developed by Kim and Hong [40]. Twenty items each assess behavioral factors and emotional factors. Each item is rated on a 4-point Likert scale (1, not at all, to 4, very much) and higher scores (possible range, 40–160) suggest a more effective performance of the anticipated maternal role, enhanced interaction between the expectant mother and the fetus, and a positive emotional state [40]. The tool’s reliability was good, i.e., Cronbach’s a of .92 at development [40], and .92 in this study.

Marital adjustment
The Korean adaptation [41] of the Dyadic Adjustment Scale (DAS) [42], specifically the abbreviated DAS-10 item version, was used to assess discrepancies between spouses, marital satisfaction, and spousal cohesion [41]. Of the total score (possible range, 1–51), a cutoff of 32 points is applied, with higher scores signifying greater marital adjustment. In the study conducted by Cho et al. [41], Cronbach’s a was reported as .83, while in this study, it was found to be .88.

General and obstetric characteristics
The general characteristics of the participants, such as age, education level, employment status, economic status, and length of marriage, were measured. Obstetric characteristics included gestation period, experience with hospitalization, prenatal education, diagnosis of a high-risk pregnancy, and subjective health status.

Data collection
Data were collected from October 20, 2021 to February 20, 2022, using both in-person and online methods. The in-person data collection was carried out after explaining the research objectives and securing approval from the directors and nursing staff of two obstetrics and gynecology departments. Posters were displayed in outpatient departments, and the survey took approximately 20 to 30 minutes to complete. Upon completion, each participant placed their questionnaire in a sealed envelope. The collected data were then coded, inputted, and stored in password-protected files. For online data collection, cooperation was obtained from the administrators of a large online community for pregnant women in Korea, known as ‘MomsHolic.’ The researcher posted recruitment posters on the site, and participants who were interested could express their willingness to participate by clicking on a link provided in the research description, as specified by the research administrator. Individual survey links were then sent to these participants for data collection. All participants in the study received a mobile coupon (worth roughly 4 US dollars) as a token of appreciation.

Data analysis
The data analysis was carried out using IBM SPSS ver. 26.0 and AMOS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including difference tests, correlations, and reliability were done, for the participants’ general characteristics and the variables measured. Cronbach’s a was used to assess the reliability of the research instruments. To validate construct validity, model fit, total effects among variables, direct effects, indirect effects, and explanatory power as a structural equation model, we performed exploratory factor analysis and confirmatory factor analysis using the AMOS program. We assessed the normality of the sample through skewness and kurtosis. To check for multicollinearity among the measurement variables, we examined tolerance, variance inflation factor, and Pearson correlation coefficients. The estimation for the structural model assumed multivariate normality and utilized maximum likelihood estimation. We assessed the fit of the hypothesis model using $\chi^2$, $\chi^2/df$, goodness of fit index (GFI), standardized root mean square re-
Results

Differences in quality of life according to participants’ characteristics

The mean age of the study participants was 35.29 (± 3.72) years, ranging from 26 to 45 years, and the majority (51.1%) were under 35 years old (n = 170). Most participants had a college degree (n = 299, 89.8%), 58.6% (n = 195) reported not having a job, and 39.0% (n = 130) had an income of over 6 million Korean won. The mean duration of marriage was 40.33 (± 28.01) months, ranging from 3 to 180 months. The participants’ gestational period averaged 28.75 (± 4.74) weeks, with 50.5% (n = 168) between 20 and 28 weeks and 49.5% (n = 165) between 29 and 37 weeks. Among the participants, 35.4% (n = 118) reported a history of hospitalization, and 38.1% (n = 127) received antenatal education. Regarding high-risk pregnancy diagnoses, 48.6% (n = 162) were first-time mothers over 35 years old, followed by 26.1% (n = 87) with gestational diabetes mellitus and 21.6% (n = 72) with preterm labor. Self-reported health status was perceived as poor by 18.3% (n = 61) and average by 46.3% (n = 154) (Table 1).

Significant differences were observed in the QoL scores based on participant characteristics such as education level, employment status, gestational period, and self-reported health status. Participants who held a college degree demonstrated significantly higher QoL scores (t = –2.53, p = .012). Similarly, those who were employed also had significantly higher scores compared to those who were not (t = 2.92, p = .004). Participants at 20 to 28 weeks of gestation had higher QoL scores (t = 2.50, p = .013). Furthermore, participants who reported a good subjective health status had significantly higher QoL scores (F = 16.89, p < .001) (Table 1).

Descriptive statistics and verification of the study variables’ validity

The mean total score for QoL was 18.63 (± 3.80), indicating an above-average level. The subscale scores were as follows: psychological/baby, 19.03 (± 4.48); socioeconomic; 19.00 (± 4.60); relational/spouse-partner, 20.99 (± 4.58); relational/family-friends, 19.18 (± 4.78); and health & functioning, 16.18 (± 4.19). Among these, the relational/spouse-partner subscale had the highest score, while health & functioning had the lowest.

Uncertainty had a mean score of 91.60 (± 14.29), indicating an above-average level. Adaptive coping had a mean score of 79.39 (± 10.31), with the following sub-scores: perspective scoring, 15.70 (± 2.73); refocus on planning, 16.73 (± 2.34); acceptance, 15.88 (± 2.22); positive refocusing, 14.94 (± 3.06); and positive reappraisal, 16.14 (± 2.52). Maladaptive coping had a mean score of 47.32 (± 9.63), with the following sub-scores: self-blame, 12.68 (± 2.74); blaming others, 9.72 (± 3.38); rumination, 13.23 (± 3.20); and catastrophizing, 11.69 (± 3.31). Fatigue had a mean score of 27.67 (± 5.73), state anxiety had a mean score of 44.65 (± 10.49), and antenatal depression had a mean score of 10.54 (± 5.11), with 57.6% (n = 192) scoring 10 or higher. Maternal identity had a mean score of 126.51 (± 16.35), and marital adjustment had a mean score of 38.19 (± 6.10), both indicating above-average levels (Supplementary Table 1).

The correlation coefficient values between the measured variables ranged from r = –.01 to .75, suggesting no issues with multicollinearity (r > ±.90). The variance inflation factors varied from 405.07, χ² = .004). Participants at 20 to 28 weeks of gestation had higher QoL scores (t = 2.50, p = .013). Furthermore, participants who reported a good subjective health status had significantly higher QoL scores (F = 16.89, p < .001) (Table 1).

Verification of the fit of the hypothetical model

Results of the testing and modification of the hypothetical model

The test results of the hypothetical model revealed that the absolute fit indices (χ² = 405.07, χ²/df = 3.94, GFI = .90, SRMR = .11, RMSEA = .09), the incremental fit indices (CFI = .92 and TLI = .90), and the parsimonious fit index (PNFI = .90), did not fully satisfy the recommended criteria for absolute fit indices—specifically, this was the case for χ², χ²/df, SRMR, and RMSEA. To improve the model fit, we conducted explorations of the relationships between variables and their theoretical foundations. Drawing on previous research that suggests a direct impact of
Table 1. Differences in quality of life according to participants’ characteristics (N=333)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Categories</th>
<th>n (%)</th>
<th>Quality of life</th>
<th>t/F(p)</th>
<th>Scheffé</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>Mean ± SD, 35.29 ± 3.72 (range, 26–45)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤ 35</td>
<td>170 (51.1)</td>
<td>18.90 ± 3.55</td>
<td>1.01 (.364)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36–39</td>
<td>118 (35.4)</td>
<td>18.43 ± 3.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 40</td>
<td>45 (13.5)</td>
<td>18.12 ± 4.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>High school</td>
<td>34 (10.2)</td>
<td>17.07 ± 2.88</td>
<td>–2.53 (.012)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>College</td>
<td>299 (89.8)</td>
<td>18.80 ± 3.86</td>
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<td></td>
</tr>
<tr>
<td>Occupation</td>
<td>Yes</td>
<td>138 (41.4)</td>
<td>19.34 ± 3.90</td>
<td>2.92 (.004)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>195 (58.6)</td>
<td>18.12 ± 3.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly compensation (million KRW)</td>
<td>&lt; 2</td>
<td>5 (1.5)</td>
<td>18.13 ± 0.94</td>
<td>0.11 (.956)</td>
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<tr>
<td></td>
<td>2–3.9</td>
<td>82 (24.6)</td>
<td>18.55 ± 3.68</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>4–5.9</td>
<td>116 (34.9)</td>
<td>18.77 ± 4.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 6</td>
<td>130 (39.0)</td>
<td>18.57 ± 3.77</td>
<td></td>
<td></td>
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<tr>
<td>Marital duration (month)</td>
<td>3–36</td>
<td>192 (57.7)</td>
<td>18.76 ± 4.05</td>
<td>1.29 (.280)</td>
<td></td>
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<tr>
<td></td>
<td>37–60</td>
<td>79 (23.7)</td>
<td>18.09 ± 3.33</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>61–180</td>
<td>62 (18.6)</td>
<td>18.90 ± 3.57</td>
<td></td>
<td></td>
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<tr>
<td>Gestational period (week)</td>
<td>20–28</td>
<td>168 (50.5)</td>
<td>19.14 ± 4.05</td>
<td>2.50 (.013)</td>
<td></td>
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<tr>
<td></td>
<td>29–37</td>
<td>165 (49.5)</td>
<td>18.10 ± 3.47</td>
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<tr>
<td>Hospitalization experience</td>
<td>Yes</td>
<td>118 (35.4)</td>
<td>18.66 ± 3.82</td>
<td>0.11 (.917)</td>
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</tr>
<tr>
<td></td>
<td>No</td>
<td>215 (64.6)</td>
<td>18.61 ± 3.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prenatal education</td>
<td>Yes</td>
<td>127 (38.1)</td>
<td>18.25 ± 3.35</td>
<td>–1.42 (.158)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>206 (61.9)</td>
<td>18.86 ± 4.05</td>
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<td></td>
</tr>
<tr>
<td>Classification of high-risk pregnancies †</td>
<td>Advanced maternal age ‡</td>
<td>162 (48.6)</td>
<td>18.30 ± 4.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gestational diabetes mellitus</td>
<td>87 (26.1)</td>
<td>18.42 ± 3.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preterm labor</td>
<td>72 (21.6)</td>
<td>19.17 ± 3.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incompetent internal os of cervix</td>
<td>29 (8.7)</td>
<td>17.54 ± 4.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pregnancy-induced hypertension</td>
<td>29 (8.7)</td>
<td>20.80 ± 2.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple pregnancies</td>
<td>29 (8.7)</td>
<td>19.90 ± 4.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antepartum hemorrhage</td>
<td>21 (6.3)</td>
<td>18.93 ± 2.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Placenta previa</td>
<td>18 (5.4)</td>
<td>19.54 ± 2.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preeclampsia</td>
<td>16 (4.8)</td>
<td>17.63 ± 3.88</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Hyperemesis gravidarum</td>
<td>13 (3.9)</td>
<td>17.13 ± 2.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Premature rupture of membrane</td>
<td>8 (2.4)</td>
<td>15.39 ± 1.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oligohydramnios</td>
<td>8 (2.4)</td>
<td>15.50 ± 2.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived health status</td>
<td>Poor *</td>
<td>61 (18.3)</td>
<td>17.26 ± 3.62</td>
<td>16.89 (&lt;.001) (a,b &lt; c)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate ‡</td>
<td>154 (46.3)</td>
<td>18.00 ± 3.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good ‡</td>
<td>118 (35.4)</td>
<td>20.15 ± 3.53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

KRW: Korean won (1 million KRW is approximately 800 US dollars).

† Multiple responses. ‡ ≥35 years.

Coping on QoL [43], we added two paths to the hypothetical model: one from adaptive coping to QoL, and another from maladaptive coping to QoL. The final modified model showed adequate absolute fit indices ($\chi^2 = 261.11 \ [<.001]$, $\chi^2/df = 2.69$, GFI = .93, SRMR = .05, and RMSEA = .07), incremental fit indices (CFI = .95 and TLI = .91), and parsimonious fit index (PNFI = .47). These results met the adequacy criteria for both the absolute fit indices and the incremental fit indices (Table 2).

Results of the effect analysis in the modified model
In the modified model’s estimated paths, six out of seven total paths were found to be statistically significant. The coping model revealed significant paths from uncertainty to both adaptive coping ($\beta = –.26$, $p = .006$) and maladaptive coping ($\beta = .68$, $p = .014$). Similarly, in the adaptation mode model, both adaptive coping ($\beta = –.44$, $p = .018$) and maladaptive coping ($\beta = .69$, $p = .012$) demonstrated significant paths. Lastly, in the final QoL model, the adaptation mode ($\beta = –.81$, $p = .034$) and maladaptive coping ($\beta = .46$, $p = .043$) were identified as significant paths.
The variable that most significantly influenced the QoL in high-risk pregnant women was the adaptation mode. Both direct and indirect effects were significantly demonstrated by maladaptive coping, while uncertainty showed a significant indirect effect. These factors had an explanatory power of 51%. The variable that had the most profound impact on the adaptation mode in high-risk pregnant women was maladaptive coping. Maladaptive coping displayed a significant direct effect, whereas uncertainty showed a significant indirect effect. These factors exhibited an explanatory power of 79%. Uncertainty in high-risk pregnant women significantly directly affected both adaptive and maladaptive coping. Adaptive coping had an explanatory power of 7%, while that of maladaptive coping was 47% (Figure 3, Table 3).

Discussion

This study constructed a hypothetical model based on Roy’s adaptation theory [17] and informed by concepts from literature reviews, to elucidate the QoL in high-risk pregnant women. We then tested the model’s adequacy and the significance of its pathways using a sample of 333 high-risk pregnant women. Factors that explained the QoL demonstrated direct effects for adaptation mode and maladaptive coping, and indirect effects for uncertainty, adaptive coping, and maladaptive coping. The results of this study prompt a discussion on variables associated with the QoL in high-risk pregnant women and the implications for their nursing care.

Of the primiparous women diagnosed with high-risk pregnancies, approximately half of these high-risk pregnant women were over 35 years old, which is considered advanced maternal age. In 2018, the rate of advanced maternal age pregnancies in Korea was reported to be 31.8% [3]. The higher rate in this study may be due to the deliberate self-selection of high-risk pregnant women of advanced maternal age. Preterm labor is often reported as a common health issue in high-risk pregnancies [4]. The high incidence of gestational diabetes mellitus in this study is likely due to the fact that the participants were recruited from outpatient obstetrics and gynecology clinics. Among the participants, 118 (35.4%) had a history of hospitalization, which reflects the efforts of high-risk pregnant women to prevent adverse outcomes related to preterm labor [6]. However, this could also contribute to an increased burden of pregnancy and uncertainty about the prognosis compared to women with low-risk pregnancies. The percentage of participants who reported poor subjective health status was 18.3%, which is slightly higher than the 16.8% reported for hospitalized high-risk pregnant women [44] and similar to the 18.4% reported for high-risk pregnant women receiving outpatient care [45]. When compared to the 15.4% re-
reported in a study on women with low-risk pregnancies [46], it is clear that women diagnosed with high-risk pregnancies tend to perceive their health status more negatively, regardless of whether they are receiving outpatient or inpatient treatment. The results of this study revealed that the QoL score for high-risk pregnant women averaged 18.63 out of 30 points. This score is comparable to the 18.94 average score of participants who were hospitalized due to preterm labor [14]. Although it was difficult to find studies using the same tool for direct comparison with low-risk pregnant women, the score was lower than that of mothers without prenatal complications, who averaged 19.64 points [47]. This suggests that the QoL for high-risk pregnant women may be lower than that for low-risk pregnant women. This conclusion aligns with the findings of systematic literature review studies [48], which indicate that the QoL for high-risk pregnant women is indeed lower compared to their low-risk counterparts. These results underscore the necessity for medical care and intervention strategies that are specifically designed for the unique circumstances of high-risk pregnant women, going beyond standard therapeutic interventions and health maintenance.

Although the initial hypothetical model did not meet the recommended standards, modifications were made to confirm the final model. This revised model achieved the recommended levels with a chi-square to degrees of freedom ratio of 2.69, and both SRMR and RMSEA were below 0.08. GFI, CFI, and TLI values all exceeded 0.90, indicating a good fit [26]. The modified model demonstrated that factors such as uncertainty, adaptive coping, maladaptive coping, and adaptation mode in high-risk pregnant women accounted for their QoL. Conversely, a structural model study on the health-related QoL in low-risk pregnant women [49] identified sleep quality, physical activity, and perceived health status as explanatory factors. This highlights the differences in factors that explain the QoL in pregnant women, depending on their risk status.

The uncertainty score for participants in this study (91.60 points) was comparable to the score of 97.31 observed in pregnant women hospitalized due to high-risk pregnancies [50]. Given that the participants in this study were diagnosed with high-risk pregnancies and were receiving both outpatient and inpatient care, the heightened uncertainty can likely be attributed to their high-risk pregnancy diagnosis. This study reinforces the idea that uncertainty influences coping strategies, leading to a de-
crease in adaptive coping and an increase in maladaptive coping [7]. However, it was observed in this study that high-risk pregnant women tended to rely more on maladaptive coping than adaptive coping to manage the negative emotions triggered by the high-stress situation of a high-risk pregnancy. This observation is consistent with research that suggests an increase in uncertainty leads to a decrease in adaptive coping and an increase in maladaptive coping [51]. Moreover, high-risk pregnant women perceived uncertainty as contextual stimuli, which negatively affected their QoL. This finding is in line with research that proposes high levels of uncertainty can cause high-risk pregnant women to harbor negative thoughts about their lives, making it challenging for them to actively cope, and potentially leading to maladaptive outcomes during pregnancy [22].

The adaptation mode of the participants in this study was analyzed in terms of fatigue, state anxiety, antenatal depression, maternal identity, and marital adjustment. The fatigue score (27.67 points) was comparable to the score of 27.78 points observed in low-risk pregnant women during the later stages of pregnancy [52]. However, the state anxiety score for high-risk pregnant women (44.62 points) was 1.5 times higher than the score of 29.20 points seen in low-risk pregnant women [53]. Moreover, the antenatal depression score was 10.54 points, 1.7 times higher than the score of 6.12 points for low-risk pregnant women [54], suggesting the presence of mild depressive symptoms. The maternal identity score was 126.51 points, lower than the score of 131.15 points for low-risk pregnant women [55] and comparable to the score of 127.80 points for pregnant women with gestational diabetes mellitus [56]. This implies that high-risk pregnant women may face challenges in attachment behavior and transitioning to motherhood compared to their low-risk counterparts. The marital adjustment score (38.19 points) was lower than the score of 41.06 points for low-risk pregnant women [54], suggesting less stability and satisfaction in the marital lives of high-risk pregnant women. If marital relationships are unsatisfactory, it may lead to negative emotions in pregnant women and adversely affect their QoL. Therefore, it is important to understand and consider the aspect of marital adjustment in high-risk pregnant women.

Upon examining the factors in the model, it was observed that uncertainty in high-risk pregnant women indirectly impacted their QoL. A study on breast cancer patients reported a significant indirect effect [57], but additional repetitive research is required to confirm the indirect factors of uncertainty that affect the QoL in high-risk pregnant women. Adaptive coping demonstrated a significant indirect effect, while maladaptive coping was found to have significant direct and indirect effects on the QoL. Considering that adaptive coping is employed to effectively manage physical and emotional well-being, providing information on stress management techniques and high-risk pregnancy could assist in promoting adaptive coping strategies [7]. Maladaptive coping, a strategy often used by high-risk pregnant women [51], can intensify negative psychological issues such as anxiety and depression, and hinder the transition to motherhood. Therefore, it is vital to help these women reduce their reliance on such strategies. The adaptation mode was found to have a significant direct effect on the QoL. In this study, the adaptation mode, which includes physiological indicators like fatigue and self-concept indicators such as anxiety and depression, showed a negative correlation with the QoL. Role function indicators like maternal identity and interdependence indicators such as marital adjustment also exhibited a static correlation with the QoL. These findings suggest that the adaptation mode of high-risk pregnant women operates in a mutually related manner, exerting a negative direct effect on the QoL and thus reducing it. This highlights the necessity for a comprehensive perspective on how individuals adapt to various stimuli in their lives.

Although the participants experienced high levels of uncertainty, fatigue, anxiety, and depression, their QoL remained above average. This can be attributed to the positive indirect effect of adaptive coping strategies, which were mediated by the adaptation mode. Additionally, the direct effect of maladaptive coping strategies also influenced QoL. This finding is consistent with previous research suggesting that the QoL in high-risk pregnant women is significantly influenced by their coping strategies [12]. Consequently, it is recommended that nursing interventions be planned to enhance adaptive coping and reduce maladaptive coping strategies, as this could improve QoL for high-risk pregnant women.

This study has several limitations, including the use of both in-person and non-in-person data collection methods. The in-person data collection was restricted to outpatient women in a single region, who were recruited through convenience sampling. As such, care should be taken when extrapolating the results of this study to all high-risk pregnant women. The QoL was found to be lower in participants who were high school graduates, unemployed, between 29 and 37 weeks of gestation, and those who reported poor subjective health. However, these factors were not included in the model, so caution is necessary when interpreting the research results. High-risk pregnant women have varying risk factors depending on the type of complication and gestational period. Therefore, it is crucial to analyze changes and causal rela-
tionships over time among the various factors that affect QoL. We recommend conducting follow-up studies using longitudinal research to verify the model’s effectiveness in determining the time series effects on QoL throughout pregnancy.

In conclusion, this study provided foundational data for the development of nursing interventions aimed at enhancing the QoL for high-risk pregnant women, drawing on Roy’s adaptation theory. It takes into account a range of factors—physical, psychological, social, and environmental—that could potentially impact the QoL of these women. The study identifies significant direct and indirect pathways among factors related to QoL, underscoring the crucial role of uncertainty management in nursing interventions. It also highlights the importance of encouraging adaptive coping strategies and minimizing the use of maladaptive ones, to help high-risk pregnant women adapt and improve their QoL.

As findings established the influence of coping mechanisms on QoL in high-risk pregnant women, ongoing education and counseling are essential in clinical environments to help these women adjust to pregnancy and employ adaptive coping strategies, rather than resorting to maladaptive ones. For those high-risk pregnant women who exhibit a low capacity for adaptive coping or a propensity to over-rely on maladaptive coping, the implementation of cognitive-behavioral interventions could enhance their QoL and facilitate their adjustment to pregnancy.

**Data availability**

Please contact the corresponding author for data availability.

**Acknowledgments**

None.

**Supplementary materials**

Further details on supplementary materials are presented online (available at https://doi.org/10.4069/kjwhn.2023.11.13.1).

**References**


56. Lee SM, Park HJ. Relationship among emotional clarity, ma-

Factors influencing the intention to engage in cervical cancer preventive behavior in human papillomavirus-infected women: a cross-sectional survey

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Purpose: This study investigated the influence of cervical cancer knowledge, human papillomavirus (HPV) knowledge, self-efficacy, and uncertainty on the intention to engage in cervical cancer preventive behavior in HPV-infected women.

Methods: This descriptive correlational study was conducted among 129 adult women aged 20 to 65 years who received positive HPV results at a general hospital in Changwon, Korea. The dataset was analyzed using descriptive statistics, the independent t-test, analysis of variance, the Pearson correlation coefficient, and multiple regression.

Results: The mean score for the intention to engage in cervical cancer preventive behavior was high (4.43±0.65). This intention was significantly different according to age at first sexual intercourse (F=7.38, p=.001), HPV type (F=4.79, p=.010), vaccination (t=3.19, p=.002), and condom use (t=3.03, p=.003). The intention to engage in cervical cancer preventive behavior showed significant, weak-to-moderate positive correlations with HPV knowledge (r=.22, p=.012) and self-efficacy (r=.42, p<.001). Self-efficacy (β=.46, p<.001), first sexual intercourse at <20 years (β=.45, p<.001), first sexual intercourse at 20-24 years (β=.29, p=.018), HPV high- and low-risk group infection (β=.26, p=.019), HPV high-risk group infection (β=.26, p=.026), and vaccination (β=.21, p=.007) significantly influenced the intention to engage in cervical cancer preventive behavior. These variables explained 34.6% of variance in intention.

Conclusion: Study findings support the need to develop a program that effectively conveys accurate information about cervical cancer prevention to HPV-infected women and helps them enhance self-efficacy to boost the intention to engage in cervical cancer preventive behavior.

Keywords: Human papillomavirus; Prevention; Self efficacy; Uncertainty; Uterine cervical neoplasms

Introduction

The human papillomavirus (HPV), which is primarily transmitted through sexual contact, has been recognized as a significant cause of cervical cancer [1]. To date, more than 200 types of HPV have been identified [2], with high-risk strains such as HPV-16 and HPV-18 being strongly linked to genital cancers, especially cervical cancer [3]. According to data from the Korea Central Cancer Registry in 2022 [4], cervical cancer constituted 1.2% of all cancer cases in Korea in 2020, ranking as the 10th most common cancer among women. The 2021 Cancer Trends Report from the National Cancer Center [5] indicates that each
Cervical cancer preventive behavior among HPV-infected women.

HPV vaccination and regular screening are essential preventive measures against cervical cancer [9]. The vaccine is effective in preventing new HPV infections, even after initial exposure, but it cannot cure existing infections or related diseases [6]. It is also important to avoid smoking, which is a known risk factor, and to be cautious with long-term use of oral contraceptives, as they can increase the risk of cervical cancer by 1.2 to 1.5 times [9]. Additionally, limiting the number of sexual partners and consistently using condoms during intercourse are recommended [1]. Research has indicated that various factors, including perceived benefits and the severity of health beliefs related to vaccination, contraceptive use, and HPV testing experience, enhance cervical cancer prevention behaviors among nurses [10]. A study focusing on nursing students found that those with a higher intention to engage in cervical cancer preventive behavior were more likely to participate in cervical cancer screening [11]. Furthermore, research involving Korean women in their 20s revealed that more conservative sexual attitudes were associated with increased preventive behavior [12]. In a study on female university students, higher levels of self-efficacy and fear were associated with a stronger intention to engage in preventive behavior [13].

Providing information about cancer to foster positive attitude changes has been shown to be an effective strategy for promoting the practice of cervical cancer prevention behaviors [14]. Research indicates that greater knowledge about cervical cancer is associated with more consistent engagement in preventive behavior [15]. However, despite the importance of intending to engage in such behaviors, adult Korean women generally possess limited knowledge about the disease. For instance, only 41.7% are aware of the connection between HPV infection and cervical cancer [16], and even nurses’ understanding of HPV is notably deficient [10].

Women who test positive for HPV often experience significant anxiety and uncertainty due to the associated risk of developing cervical cancer [17]. This anxiety extends to concerns about the potential effects on pregnancy and childbirth [18]. Studies involving gastric cancer and hemodialysis patients have demonstrated that uncertainty can influence the intention to engage in preventive behavior, with greater uncertainty correlating with a reduction in health-promoting actions [19]. Additionally, dialysis patients tend to show lower adherence to prescribed sick role behaviors when they face greater uncertainty and have a more serious perception of their illness [20]. However, research has yet to explore the impact of uncertainty on the intentions of HPV-infected women to engage in preventive behavior.

Self-efficacy is a critical factor in increasing the intention to engage in preventive behavior [21]. It influences not only health-promoting actions but also acts as an essential bridge between knowledge and behavior [22]. Elevated self-efficacy is associated with improved health behaviors, and interventions designed to boost self-efficacy can lead to positive behavioral modifications,
ultimately enhancing health outcomes [23]. Moreover, height-
ened self-efficacy correlates with more regular participation in
cervical cancer prevention behaviors [24] and has been rec-
nized as a mediator in developing the intention to prevent cervi-
cal cancer [13].

Therefore, this study aimed to assess the levels of cervical can-
cer and HPV knowledge, self-efficacy, and uncertainty in HPV-infected women, as well as their effects on the intention to
engage in cervical cancer preventive behavior. The goal was to
provide foundational data that could inform the development of
programs to improve the intention of HPV-infected women to
engage in cervical cancer preventive behavior.

The purpose of this study was to identify factors influencing
HPV-infected women’s intention to engage in cervical cancer preventive behavior. These behaviors are defined as voluntary
and diligent actions aimed at cancer prevention. The study had
the following specific aims: first, to investigate how participants’
characteristics influence their intention to engage in cervical can-
cer preventive behavior; second, to assess levels of intention, cer-
vical cancer knowledge, HPV knowledge, self-efficacy, and un-
certainty among participants; third, to identify correlations be-
tween these variables and preventive behavior intention; and
fourth, to determine the factors that influenced participants’ in-
tentions to engage in such behaviors.

Methods

Research design
This descriptive correlational study was conducted to identify
factors influencing the intention to engage in cervical cancer pre-
ventive behavior among women infected with HPV. This study
adhered to the STROBE reporting guidelines (https://www.
strobe-statement.org/).

Participants
This study enrolled adult women between the ages of 20 and 65
years who tested positive for HPV at the obstetrics and gynecol-
yogy department of a general hospital in Changwon, Korea. Par-
ticipants were invited to participate through convenience sam-
pling and included those who could communicate in Korean,
understood and consented to the study’s objectives, and were
reachable within one week of receiving their HPV test results.
Women diagnosed with carcinoma in situ or cervical cancer were
excluded from the study. The required sample size was calculated
using G*Power 3.1.9.2, based on a previous study [25]. The pa-
rameters set for the calculation included a significance level of
.05, a medium effect size of .15, a power of 80%, and nine predic-
tors: cervical cancer knowledge, HPV knowledge, uncertainty,
self-efficacy, smoking, age at first sexual intercourse, number of
sexual partners, condom use, and HPV vaccination. The calcula-
tion indicated that a sample size of 114 would be sufficient for
multiple regression analysis. To account for a potential 20%
dropout rate, the study aimed to enroll 143 participants. Ulti-
mately, the final analysis was conducted on 129 cases after ex-
cluding 14 responses deemed inadequate.

Instruments
All tools in this study were used after receiving approval via
e-mail from the corresponding developer and translator. A struc-
tured questionnaire with 99 items was used, covering topics such
as the intention to engage in cervical cancer preventive behavior,
cervical cancer knowledge, HPV knowledge, uncertainty, self-
efficacy, and both general and HPV-related characteristics.

Intention to engage in cervical cancer preventive behavior
The intention to engage in cervical cancer preventive behavior
was assessed using a tool developed by Ko [26], drawing on the
study of Yoo et al. [27] on the intention to prevent novel flu and
Han’s research [28] on early cancer screening promotion messag-
es targeting Korean and Japanese women aged 30 to 59 years.
This instrument consists of six items, each addressing a distinct
aspect of cervical cancer prevention: seeking information about
prevention, consulting with a physician, undergoing regular
screenings, recommending screenings to others, getting vaccinat-
ed, and advocating for HPV vaccination for others. Responses are
measured on a 5-point Likert scale, ranging from 1 (“strongly dis-
agree”) to 5 (“strongly agree”), where higher scores reflect a stron-
ger intention to engage in preventive behavior. For this study, the
mean scores were calculated, with possible values ranging from 1
to 5. The tool demonstrated high reliability, with Cronbach’s α of
.88 in the initial study [10] and .81 in the current study.

Cervical cancer knowledge
Cervical cancer knowledge was assessed using a tool modified
and expanded by Kim and Park [29], based on the study of Lee
and Lee [30]. This instrument comprises eight items: four ad-
dressing the risk factors for cervical cancer, one regarding its incidence, one concerning symptoms, one related to diagnosis, and one about prognosis. Responses were categorized as “true,” “false,” or “do not know.” Correct responses were awarded 1 point, while incorrect or “do not know” answers received no points. A higher aggregate score, ranging from 0 to 8, reflected a more comprehensive understanding of cervical cancer. At the time of its development, the tool demonstrated a Cronbach’s α of .83 [29], and in this study, the Kuder-Richardson Formula 20 (KR-20) reliability coefficient was .61.

**Human papillomavirus knowledge**

HPV knowledge was assessed using a 20-item tool developed by Kim and An [31]. This tool encompasses a range of topics, including the association between HPV and cervical cancer, symptoms of HPV, the distinction between low-risk and high-risk types, correlations with latency periods, prognosis, and immunity, the ages at which HPV is most prevalent, modes of transmission, methods of examination and diagnosis, strategies for prevention and treatment, and the risk of congenital infections. The scoring approach mirrored that of the cervical cancer knowledge assessment, with scores ranging from 0 to 20, where higher scores indicated a more comprehensive understanding of HPV. The reliability of the instrument at the time of its development [31] was reflected by a Cronbach’s α of .87, and in the current study, the KR-20 reliability coefficient was .84.

**Uncertainty**

The Mishel Uncertainty in Illness Scale Community Form (MUIS-C) [32], as translated by Chung et al. [33], was utilized to measure uncertainty. This instrument comprises 23 items categorized into four subdomains: ambiguity, complexity, inconsistency, and unpredictability. Respondents rate each item using a 5-point Likert scale, where 1 signifies “not at all” and 5 indicates “very much.” Higher scores denote increased uncertainty. In the analysis, average scores were calculated, with possible values ranging from 1 to 5. The MUIS-C’s original reliability was reported with Cronbach’s α values ranging from .91 to .93 [32]; Cronbach’s α was .85 in the study by Chung et al. [33], and it was .82 in the current study.

**Self-efficacy**

Self-efficacy was measured using a Korean version of a 24-item health management self-efficacy scale, which was translated and subjected to factor analysis by Lee et al. [34]. This adapted version originated from the 28-item scale developed by Becker et al. [35]. The scale encompasses six subdomains: exercise management (eight items), disease management (four items), emotional management (three items), nutrition management (three items), stress management (three items), and health behavior management (three items). Responses are scored on a 5-point Likert scale, ranging from 1 (“strongly disagree”) to 5 (“strongly agree”), with higher scores denoting increased self-efficacy. For this study, the mean scores were calculated, which could vary from 1 to 5. The reliability of the instrument was confirmed with a Cronbach’s α of .91 in the study by Lee et al. [34] and .92 in the current study.

**General and human papillomavirus-related characteristics**

The general characteristics of the participants included seven items: age, marital status, educational level, job, average monthly household income, drinking, and smoking. HPV-related characteristics included 11 items: menopause status, age at first sexual intercourse, number of sexual partners during lifetime, current condom use, frequency of sexual intercourse, frequency of Pap tests, HPV vaccination status, induced abortion, childbirth, cervical cancer test results, and HPV types.

**Data collection**

Women who visited the obstetrics and gynecology outpatient clinic and tested positive for HPV were recruited for the study between February and April 2023. The researcher explained the purpose of the study and the survey details over the phone to potential participants. After participants agreed to take part in the study, an online survey link was sent to them. The online survey began with a description of the study, and clicking “agree” was considered to indicate consent. Participants who completed the survey received a mobile beverage coupon worth 4 US dollars as a token of appreciation.

**Data analysis**

IBM SPSS for Windows ver. 27.0 (IBM Corp., Armonk, NY, USA) was used to analyze the data. The general and HPV-related characteristics of participants were analyzed using frequency, percentage, and mean with standard deviation. We examined differences in knowledge of cervical cancer and HPV, levels of uncertainty, self-efficacy, and the intention to engage in cervical cancer preventive behavior according to these characteristics. This examination was conducted using the t-test and analysis of variance, with subsequent post-hoc analysis performed using the Scheffé test. To analyze the levels of knowledge about cervical cancer and HPV, uncertainty,
self-efficacy, and the intention to engage in cervical cancer preventive behavior, we employed the mean and standard deviation. Pearson’s correlation coefficients were utilized to explore the relationships between knowledge of cervical cancer and HPV, uncertainty, self-efficacy, and the intention to engage in cervical cancer preventive behavior. Finally, multiple regression analysis was applied to identify factors that influenced the intention to engage in cervical cancer preventive behavior.

**Results**

**Differences in cervical cancer preventive behavior intentions based on general and human papillomavirus-related characteristics**

The average age of the participants was 37.96 ± 9.31 years. Among them, 84 individuals (65.1%) were married, with the most common level of education being a bachelor’s degree or higher, as reported by 58 participants (45.0%). A significant majority, 97 participants (75.2%), were employed. The average monthly household income was 4.84 ± 2.94 million Korean won, which is approximately 3,657.05 ± 2,224.10 US dollars. Alcohol consumption was reported by 78 participants (60.5%), while 115 (89.1%) indicated that they were nonsmokers (Table 1).

In terms of HPV-related characteristics, 118 of the participants (91.5%) were premenopausal. The average age of first sexual intercourse was 20.80 ± 3.09 years, with 39 participants (30.2%) reporting their first sexual encounter before the age of 20 years. The average number of lifetime sexual partners was 4.74 ± 4.20, with the most common response being one partner, as reported by 24 participants (18.6%). A majority, 95 (73.6%), did not use condoms, and the most frequently reported frequency of sexual intercourse was less than once a month, at 48.1%. Regarding preventive health measures, 45 (34.9%) of the participants underwent annual Pap tests, and 66 (51.2%) had received HPV vaccinations. A total of 90 participants (69.8%) reported no history of induced abortion, and high-risk HPV types were detected in 66 participants (51.2%) (Table 1).

The intention to engage in cervical cancer preventive behavior showed significant relationships with the following factors: age at first sexual intercourse (F = 7.38, p = .001), HPV type (F = 4.79, p = .010), vaccination status (t = 3.19, p = .002), and condom use (t = 3.03, p = .003). According to the Scheffe post-hoc test, participants who first engaged in sexual intercourse before the age of 20 years or between the ages of 20 and 24 years had a higher intention for such behavior than those who were 25 years or older at the time of first sexual intercourse. Participants with high-risk HPV types or a combination of high- and low-risk types exhibited higher intentions than those with only low-risk types. Furthermore, those who had been vaccinated or used condoms showed a greater intention to engage in cervical cancer preventive behavior (Table 1).

**Levels of intention to engage in cervical cancer preventive behavior, cervical cancer knowledge, human papillomavirus knowledge, uncertainty, and self-efficacy**

Participants exhibited a high intention to engage in cervical cancer preventive behavior, with an average score of 4.43 ± 0.65 on a 1 to 5 scale. Knowledge of cervical cancer was somewhat above average, scoring 4.87 ± 1.86 on a 0 to 8 scale. HPV knowledge was moderate, with an average score of 10.04 ± 4.36 on a 0 to 20 scale. The level of uncertainty was slightly below average at 2.42 ± 0.52 on a 1 to 5 scale, while self-efficacy exceeded the average, registering at 3.90 ± 0.70 on a 1 to 5 scale (Table 2).

**Correlations between intention to engage in cervical cancer preventive behavior, cervical cancer and human papillomavirus knowledge, uncertainty, and self-efficacy**

The intention to engage in cervical cancer preventive behavior was positively associated with both HPV knowledge (r = .22, p = .012) and self-efficacy (r = .42, p < .001). Knowledge about cervical cancer was positively correlated with HPV knowledge (r = .63, p < .001) and inversely correlated with uncertainty (r = –.21, p = .016). Furthermore, HPV knowledge was negatively correlated with uncertainty (r = –.21, p = .015), and uncertainty was inversely related to self-efficacy (r = –.33, p < .001) (Table 3).

**Factors influencing the intention to engage in cervical cancer preventive behavior**

Multiple regression analysis was used to identify factors that influence the intention to engage in cervical cancer prevention behaviors. The independent variables considered were age at first sexual intercourse, HPV type, vaccination status, condom use, and knowledge of cervical cancer and HPV, as well as levels of uncertainty and self-efficacy. Categorical variables such as age at first sexual intercourse (with ≥ 25 years as the reference), HPV type (with low-risk as the reference), vaccination status (with unvaccinated as the reference), and condom use (with non-use as the reference) were dummy-coded for analysis. The Durbin-Watson statistic was 1.643, suggesting the absence of autocorrelation in the residuals. Furthermore, the standardized residuals fell within the range of 3, indicating a normal distribution of errors. Multicollinearity was not a concern, as indicated by tolerance.
Table 1. Differences in the intention of cervical cancer preventive behavior according to participants’ characteristics (N=129)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Mean ± SD or n (%)</th>
<th>Intention to engage in cervical cancer preventive behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD</td>
<td>t or F</td>
</tr>
<tr>
<td>Age (year)</td>
<td>20–29</td>
<td>24 (18.6)</td>
<td>27.58 ± 3.32</td>
</tr>
<tr>
<td></td>
<td>30–39</td>
<td>51 (39.5)</td>
<td>27.06 ± 3.66</td>
</tr>
<tr>
<td></td>
<td>40–49</td>
<td>37 (28.7)</td>
<td>25.40 ± 4.59</td>
</tr>
<tr>
<td></td>
<td>≥ 50</td>
<td>17 (13.2)</td>
<td>26.70 ± 3.49</td>
</tr>
<tr>
<td>Marital status</td>
<td>No</td>
<td>45 (34.9)</td>
<td>27.38 ± 3.55</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>84 (65.1)</td>
<td>26.24 ± 4.07</td>
</tr>
<tr>
<td>Educational level</td>
<td>High school</td>
<td>27 (20.9)</td>
<td>25.26 ± 4.36</td>
</tr>
<tr>
<td></td>
<td>College</td>
<td>44 (34.1)</td>
<td>27.07 ± 3.65</td>
</tr>
<tr>
<td></td>
<td>≥ University</td>
<td>58 (45.0)</td>
<td>26.95 ± 3.82</td>
</tr>
<tr>
<td>Job</td>
<td>Yes</td>
<td>97 (75.2)</td>
<td>26.66 ± 3.90</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>32 (24.8)</td>
<td>26.56 ± 4.04</td>
</tr>
<tr>
<td>Monthly income (KRW)</td>
<td>3 million</td>
<td>38 (29.5)</td>
<td>27.18 ± 3.56</td>
</tr>
<tr>
<td></td>
<td>3 million–3.9 million</td>
<td>29 (22.5)</td>
<td>26.93 ± 3.86</td>
</tr>
<tr>
<td></td>
<td>4 million–4.9 million</td>
<td>47 (36.4)</td>
<td>25.62 ± 4.38</td>
</tr>
<tr>
<td></td>
<td>&gt; 5 million</td>
<td>15 (11.6)</td>
<td>27.87 ± 2.82</td>
</tr>
<tr>
<td>Current drinking</td>
<td>Yes</td>
<td>78 (60.5)</td>
<td>26.95 ± 3.79</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>51 (39.5)</td>
<td>26.15 ± 4.10</td>
</tr>
<tr>
<td>Current smoking</td>
<td>Yes</td>
<td>14 (10.9)</td>
<td>25.78 ± 3.81</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>115 (89.1)</td>
<td>26.74 ± 3.94</td>
</tr>
<tr>
<td>Menopause</td>
<td>Yes</td>
<td>11 (8.5)</td>
<td>26.74 ± 3.88</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>118 (91.5)</td>
<td>25.45 ± 4.27</td>
</tr>
<tr>
<td>Age at first sexual intercourse (year)</td>
<td>&lt; 20(^a)</td>
<td>39 (30.2)</td>
<td>27.67 ± 3.47</td>
</tr>
<tr>
<td></td>
<td>20–24(^b)</td>
<td>76 (58.9)</td>
<td>26.74 ± 3.80</td>
</tr>
<tr>
<td></td>
<td>≥ 25(^c)</td>
<td>14 (10.9)</td>
<td>23.21 ± 4.10</td>
</tr>
<tr>
<td>No. of sexual partners during lifetime</td>
<td>1</td>
<td>24 (18.6)</td>
<td>26.04 ± 3.95</td>
</tr>
<tr>
<td></td>
<td>2–4</td>
<td>53 (41.1)</td>
<td>26.32 ± 4.07</td>
</tr>
<tr>
<td></td>
<td>≥ 5</td>
<td>52 (40.3)</td>
<td>27.23 ± 3.73</td>
</tr>
<tr>
<td>Current condom use</td>
<td>Yes</td>
<td>34 (26.4)</td>
<td>28.09 ± 2.88</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>95 (73.6)</td>
<td>26.11 ± 4.12</td>
</tr>
<tr>
<td>Frequency of sexual intercourse</td>
<td>Less than once a month</td>
<td>62 (48.1)</td>
<td>26.68 ± 3.74</td>
</tr>
<tr>
<td></td>
<td>Once a week</td>
<td>55 (42.6)</td>
<td>26.33 ± 4.14</td>
</tr>
<tr>
<td></td>
<td>2–3 times a week</td>
<td>11 (8.5)</td>
<td>27.64 ± 3.98</td>
</tr>
<tr>
<td></td>
<td>4 or more times a week</td>
<td>1 (0.8)</td>
<td>30.00</td>
</tr>
<tr>
<td>Pap test</td>
<td>Every 6 months</td>
<td>35 (27.1)</td>
<td>26.77 ± 4.06</td>
</tr>
<tr>
<td></td>
<td>Every 1 year</td>
<td>45 (34.9)</td>
<td>27.38 ± 3.53</td>
</tr>
<tr>
<td></td>
<td>Every 2 years</td>
<td>40 (31.0)</td>
<td>25.80 ± 4.14</td>
</tr>
<tr>
<td></td>
<td>More than 3 years</td>
<td>9 (7.0)</td>
<td>26.11 ± 4.07</td>
</tr>
<tr>
<td>HPV vaccination</td>
<td>Yes</td>
<td>66 (51.2)</td>
<td>27.68 ± 3.04</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>63 (48.8)</td>
<td>25.54 ± 4.43</td>
</tr>
<tr>
<td>Induced abortion</td>
<td>Yes</td>
<td>39 (30.2)</td>
<td>26.79 ± 3.73</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>90 (69.8)</td>
<td>26.57 ± 4.02</td>
</tr>
<tr>
<td>History of childbirth</td>
<td>Yes</td>
<td>72 (55.8)</td>
<td>26.24 ± 4.09</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>57 (44.2)</td>
<td>27.14 ± 3.66</td>
</tr>
<tr>
<td>HPV type</td>
<td>Low risk(^a)</td>
<td>21 (16.3)</td>
<td>24.33 ± 4.95</td>
</tr>
<tr>
<td></td>
<td>High risk(^b)</td>
<td>66 (51.2)</td>
<td>26.89 ± 3.77</td>
</tr>
<tr>
<td></td>
<td>Both(^c)</td>
<td>42 (32.6)</td>
<td>27.38 ± 3.16</td>
</tr>
</tbody>
</table>

HPV: human papillomavirus; KRW: Korean won (1 million KRW=roughly 800 US dollars).
\(^a\)Scheffé test.
Table 2. Summary of cervical cancer knowledge, HPV knowledge, uncertainty, self-efficacy, intention to engage in cervical cancer preventive behavior (N=129)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Possible range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to engage in cervical cancer</td>
<td>1–5</td>
<td>3</td>
<td>5</td>
<td>4.43 ± 0.65</td>
</tr>
<tr>
<td>preventive behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervical cancer knowledge</td>
<td>0–8</td>
<td>0</td>
<td>8</td>
<td>4.87 ± 1.86</td>
</tr>
<tr>
<td>HPV knowledge</td>
<td>0–20</td>
<td>0</td>
<td>18</td>
<td>10.04 ± 4.36</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>1–5</td>
<td>1.26</td>
<td>3.91</td>
<td>2.42 ± 0.52</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>1–5</td>
<td>1.79</td>
<td>5</td>
<td>3.90 ± 0.70</td>
</tr>
</tbody>
</table>

HPV: human papillomavirus.

Table 3. Relationships among cervical cancer knowledge, HPV knowledge, uncertainty, self-efficacy and intention to engage in cervical cancer preventive behavior (N=129)

<table>
<thead>
<tr>
<th>Variable</th>
<th>r (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intention to engage in cervical cancer preventive behavior</td>
</tr>
<tr>
<td>Intention to engage in cervical cancer</td>
<td>1</td>
</tr>
<tr>
<td>preventive behavior</td>
<td></td>
</tr>
<tr>
<td>Cervical cancer knowledge</td>
<td>.13 (.138)</td>
</tr>
<tr>
<td>HPV knowledge</td>
<td>.22 (.012)</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>−.09 (.321)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.42 (&lt; .001)</td>
</tr>
</tbody>
</table>

HPV: human papillomavirus.

values between .346 and .873 and variance inflation factors ranging from 1.146 to 2.893. The analysis identified several significant factors that influence the intention to engage in cervical cancer preventive behavior for cervical cancer. These factors, in order of significance, included self-efficacy (β = .46, p < .001), first engaging in sexual intercourse before the age of 20 years (β = .45, p < .001) or between the ages of 20 and 24 years (β = .29, p = .018), infection with both high- and low-risk HPV types (β = .26, p = .019), infection with high-risk HPV types alone (β = .26, p = .026), and vaccination (β = .21, p = .007). Consequently, higher self-efficacy, earlier age at first sexual intercourse, and infection with high-risk HPV types or both high- and low-risk types, as opposed to only low-risk types, along with being vaccinated, significantly increased the intention to engage in cervical cancer preventive behavior. Collectively, these factors accounted for 34.6% of the variance in the intention to engage in cervical cancer preventive behavior (Table 4).

Discussion

This study aimed to assess the levels of cervical cancer and HPV-related knowledge, self-efficacy, and uncertainty among women infected with HPV, as well as the factors influencing their intention to engage in cervical cancer preventive behavior, with the goal of developing programs to increase such intentions in HPV-infected women. The results indicated that self-efficacy, age at first sexual intercourse, HPV infection type, and vaccination status were all significant determinants of their preventive behavior intention.

In this study, participants demonstrated higher cervical cancer knowledge scores than those reported in similar studies using the same assessment tool. For instance, a study involving nursing students [11] reported scores of 4.83 for those who had undergone a Pap test and 3.98 for those who had not. In contrast, female university students scored 3.74 in another study [36]. Likewise, the HPV knowledge scores of participants in this study exceeded those found in other research: 2.74 for married immigrant women [37], 5.33 for female university students [36], and 7.98 for nurses [10]. The elevated level of knowledge among HPV-infected women in this study may be attributed to their heightened interest in HPV and cervical cancer, which likely motivates them to actively seek information from various sources, including medical professionals. However, given the potential risk of cervical cancer in HPV-infected women, their knowledge level, while
comparatively high, is still not sufficient. Therefore, systematic education focused on HPV management and cervical cancer prevention for HPV-infected women is necessary.

This study found that participants had an average uncertainty score of 2.42 out of a possible 5 points, reflecting a moderate degree of uncertainty. This finding aligns with results from previous research using the same measurement tool, which reported scores of 2.47 in gastrectomy patients with gastric cancer [19], 2.67 in patients undergoing hemodialysis [20], and 2.52 in female thyroid cancer patients [38]. However, there is a scarcity of research on uncertainty in women infected with HPV. Given the unpredictable nature of treatment outcomes and the potential progression to cervical cancer, it is crucial to alleviate uncertainty in these women. Providing education about HPV and cervical cancer can play a significant role in this effort by offering accurate knowledge and information.

The average score for the intention to engage in cervical cancer preventive behavior among the study participants was 4.43. Although there are no directly comparable prior studies focusing on HPV-infected women, similar research utilizing the same measurement tool has yielded varying results. In Ko’s study [26], women between the ages of 20 and 50 years had an average score of 3.62. A separate study involving nurses reported an average score of 3.55 [10], and female university students scored an average of 4.25 in research conducted by Nguyen and Lee [13]. Compared to these outcomes, the intention of HPV-infected women in the current study to participate in preventive behavior seems to be relatively high.

The factors influencing the intention to engage in cervical cancer preventive behavior were self-efficacy, age at first sexual intercourse, HPV type, and vaccination status, listed in order of impact. Previous research [39] has shown that self-efficacy exerts a stronger influence on health-promoting behaviors, preventive behavior, and sick role behaviors than other variables. It also affects university students’ intentions to adopt preventive behavior for emerging infectious diseases [40]. In a study with female university students, Nguyen and Lee [13] identified self-efficacy as a mediating factor for the intention to practice cervical cancer prevention. Similarly, Ma et al. [24] found self-efficacy to be a highly influential factor among Chinese individuals in their twenties. This study corroborates these findings, highlighting self-efficacy as the most significant factor, in line with numerous previous studies. These results indicate that confidence in one’s ability to take appropriate action in specific situations can significantly affect the willingness to engage in health-promoting behaviors. Consequently, it is essential to develop strategies that enhance self-efficacy to increase women’s intention to engage in cervical cancer preventive behavior, particularly among those infected with HPV.

Regarding the HPV-related characteristics of the participants, initiating sexual intercourse between the ages of 20 and 24 years, or before the age of 20 years, being infected with high-risk HPV or both high- and low-risk types, and receiving the HPV vaccine were all identified as factors influencing the intention to engage in cervical cancer preventive behavior. However, the limited

### Table 4. Linear regression on factors associated with the intention to engage in cervical cancer preventive behavior (N=129)

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>10.47</td>
<td>2.83</td>
<td>3.71</td>
<td>&lt; .001</td>
<td></td>
</tr>
<tr>
<td>Cervical cancer knowledge</td>
<td>0.07</td>
<td>0.20</td>
<td>0.04</td>
<td>0.33</td>
<td>.74</td>
</tr>
<tr>
<td>HPV knowledge</td>
<td>-0.02</td>
<td>0.09</td>
<td>-0.02</td>
<td>-0.22</td>
<td>.83</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>0.01</td>
<td>0.03</td>
<td>-0.02</td>
<td>-0.02</td>
<td>.60</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.11</td>
<td>0.02</td>
<td>0.46</td>
<td>5.80</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Age at first sexual intercourse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>3.82</td>
<td>1.02</td>
<td>0.45</td>
<td>3.74</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>20–24</td>
<td>2.32</td>
<td>0.97</td>
<td>0.29</td>
<td>2.41</td>
<td>.018</td>
</tr>
<tr>
<td>HPV type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-risk</td>
<td>2.00</td>
<td>0.88</td>
<td>0.26</td>
<td>2.26</td>
<td>.026</td>
</tr>
<tr>
<td>Both high- and low-risk</td>
<td>2.14</td>
<td>0.90</td>
<td>0.26</td>
<td>2.37</td>
<td>.019</td>
</tr>
<tr>
<td>HPV vaccination</td>
<td>1.63</td>
<td>0.60</td>
<td>0.21</td>
<td>2.72</td>
<td>.007</td>
</tr>
<tr>
<td>Current condom use</td>
<td>0.57</td>
<td>0.71</td>
<td>0.06</td>
<td>0.80</td>
<td>.427</td>
</tr>
</tbody>
</table>

Adjusted $R^2 = .35, F = 7.76, p < .001$

HPV: human papillomavirus.

The reference groups were age at first sexual intercourse (≥25), HPV type (low-risk), HPV vaccination (no), and current condom use (no).
amount of prior research on HPV-infected women makes direct comparisons with these findings challenging. Since 2016, Korea has implemented the Healthy Women’s First Step Clinic Program since 2016, providing free HPV vaccinations to 12-year-old female adolescents [41]. In general, receiving the complete vaccine series before becoming sexually active is the most effective method for preventing cervical cancer. Nevertheless, vaccination remains beneficial for those who are sexually active, already infected with HPV, or older, as it can prevent new HPV infections and reinfection with existing HPV strains, thereby reducing the risk of cancer [6]. Therefore, it is imperative to provide HPV-infected women with accurate information about cervical cancer prevention, educate them on specific preventive actions, and emphasize the importance and benefits of HPV vaccination.

HPV infection is the most direct and significant cause of cervical cancer among its various causes. Women who test positive for HPV often face psychological and social challenges, including shock, confusion, anxiety, and fear of the disease [41]. However, cervical cancer can be prevented through regular screenings, HPV vaccination, and adherence to sexual health preventive behavior. Early detection and treatment are key to reducing mortality rates [9]. Therefore, it is vital to promote the intention to engage in cervical cancer preventive behavior among women with HPV. This study highlights the importance of boosting self-efficacy and developing effective educational programs for prevention. Furthermore, because HPV is a sexually transmitted infection, it is particularly important to address infected women's negative emotions and the societal stigma associated with HPV. Such efforts will contribute to the creation of a supportive environment, encouraging these women to actively engage in cervical cancer preventive behavior.

Interestingly, this study found that knowledge of cervical cancer and HPV did not significantly influence participants’ intention to engage in cervical cancer preventive behavior. This finding aligns with previous research [12,26] indicating that knowledge alone is not sufficient to motivate preventive behavior. Additionally, these findings suggest that, while knowledge is a necessary component for increasing cervical cancer preventive behavior, knowledge alone is insufficient to induce the intention to engage in such behavior. While the KR-20 reliability score for the cervical cancer knowledge tool in this study was low (.61), it was still identified as influential. Consequently, there is a need for further development of a more reliable cervical cancer knowledge tool for future research.

This study included a wide range of participants, ranging from women newly diagnosed with HPV or those with a relatively brief infection duration, to women with a history of HPV infection who were undergoing regular follow-up over a prolonged period. However, a limitation of this study is the lack of consideration for the duration of the participants’ HPV infection. Research on diabetes patients [42] has shown that the length of time since diagnosis is associated with statistically significant differences in self-care behaviors. Specifically, patients who had been diagnosed with diabetes for over 10 years exhibited better self-care practices than those diagnosed for less than five years. Consequently, future studies should take the time since diagnosis into account.

Another limitation of the study is the difficulty of generalizing the findings to all women affected by HPV, as the sample consisted solely of HPV-infected women from a single general hospital in a specific region. Therefore, further research is needed to investigate the timing and duration of HPV infection across a broader demographic. Additionally, follow-up studies are essential to create and validate effective cervical cancer prevention programs tailored to women with HPV infection.

Most HPV research in Korea has centered on specific groups such as nurses, university students, and unmarried women. However, there has been a notable lack of investigation into the lived experiences of women who have contracted HPV. This study holds significance as it sheds light on the motivations behind cervical cancer preventive behavior in women with HPV. These insights provide crucial foundational data that will inform the creation of effective cervical cancer prevention programs.

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Authors’ contributions

Conceptualization: Song B, Choi SY; Data collection: Song B; Formal analysis: Song B; Writing–original draft: Song B; Writing–review & editing: Choi SY.

Conflict of interest

The authors declared no conflict of interest.

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Data availability

The dataset files are available from Harvard Dataverse at https://doi.org/10.7910/DVN/7WYAFA.

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Factors influencing health-related quality of life in older adult women with sarcopenia: analysis of the Korean National Health and Nutrition Examination Survey 2019

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Purpose: This study aimed to identify factors influencing the health-related quality of life (HRQoL) of older adult women with sarcopenia.

Methods: The study was secondary data analysis using data from the 2019 Korea National Health and Nutrition Examination Survey. The final sample consisted of 142 women aged 60 years and older with sarcopenia and were selected from 8,110 women. The participants was analyzed using complex descriptive statistics, independent t-test, and regression.

Results: In terms of HRQoL, three general characteristics were found to be influential, with an explanatory power of 56.0%: difficulty climbing stairs, difficulty working, and perceived health status. Having no or mild difficulty when climbing stairs (B=.20, p=.001; B=.21, p<.001) and no or mild difficulty when working (B=.25, p=.002; B=.208, p=.013) had a significant effect on HRQoL compared to severe difficulty. Having good or ordinary perceived health status had a significant effect on the HRQoL (B=.11, p<.001; B=.09, p<.001).

Conclusion: Based on study findings that the HRQoL of older adult women with sarcopenia were influenced by difficulty climbing stairs and working, as well as good perceived health status, healthcare providers should assist elderly women to maintain physical activities in their daily lives.

Keywords: Aged; Quality of life; Sarcopenia; Women

Introduction

Sarcopenia is one of the diseases that degrade the health-related quality of life (HRQoL) of older adult women and the decrease in muscle mass due to aging is one of the representative changes [1]. Sarcopenia causes musculoskeletal diseases (e.g. falls and fractures), depression, or cognitive decline. In addition, chronic diseases such as heart failure and chronic obstructive pulmonary disease accelerate muscle loss, resulting in a vicious cycle. This not only has a great impact on the HRQoL but also has become an important public health problem [2].

The decrease in muscle strength and muscle mass begins at the age of about 40 years, and women in particular lose muscle mass at the same time they experience an increase in abdominal fat due to energy loss caused by aging and hormonal changes caused by menopause [3]. In an 8-year follow-up of a longitudinal study of aging with a sample of 3,404 people in the United Kingdom, women were at 20% higher risk of developing sarcopenia than men [4]. In particular, in Asians, women had a higher risk of sarcopenia due to higher body fat ratios than other ethnic groups.
Summary statement

· What is already known about this topic?
  Sarcopenia is one of the diseases that influence the health-related quality of life (HRQoL) of older adult women.

· What this paper adds
  This secondary analysis of national data using hand grip strength as a measure for sarcopenia found that the HRQoL of older adult women was influenced by difficulty in climbing stairs, difficulty working, and perceived health status.

· Implications for practice, education, and/or policy
  Strategies to enhance climbing stairs, working without difficulty, and maintaining good perceived health status are needed for older adult women with sarcopenia.

and increased abdominal obesity [5]. Therefore, the management and prevention of sarcopenia for older Asian women diagnosed with sarcopenia is an important health problem.

Older adult women with sarcopenia have been reported as feeling lonely and depressed due to difficulties and social constraints in daily life related to aging and having suicidal thoughts, which can negatively affect their HRQoL [6]. In addition, a longitudinal study of 40–44 years-old participants reported that having sarcopenia at baseline was associated with worse scores of HRQoL at follow-up, compared to those without sarcopenia at baseline [7]. Another study of 4,937 Korean seniors aged 60 years or older found that HRQoL scores were significantly lower for sarcopenic women compared to their nonsarcopenic counterparts [8]. Moreover, as older adult women have a higher muscle reduction rate than older adult men and a longer life expectancy [9], they are a vulnerable group that is likely to be in a vicious cycle caused by sarcopenia. The quality of life (QoL) of older people with sarcopenia is also related to mental health, i.e., having sarcopenia was associated with a higher level of depression or anxiety, lower subjective health perception and nutritional status, and poorer QoL [10]. Moreover, because older people have many diseases, HRQoL was found to be related to the type of health insurance currently subscribed to and whether private medical insurance is available [11].

A useful model for identifying factors affecting HRQoL was modified by Ferrans et al. [12] from Wilson and Cleary’s HRQoL model [13]. This modified HRQoL model offers a framework that integrates the biomedical paradigm focused on the cause of disease and the social science paradigm focused on function and overall well-being. The model explains how HRQoL can be examined in terms of dynamic and multifaceted aspects while explaining the influence on the HRQoL through the following characteristics: individual characteristics, biological factors, symptoms, functional status, general health perceptions, and environmental characteristics [12]. Therefore, this study aimed to use the model to explore the factors influencing HRQoL in older women with sarcopenia.

Previous studies on sarcopenia in elderly women conducted in South Korea (hereafter, Korea) have focused on the effect of sarcopenic obesity on psychological health and QoL [6], the prevalence and factors related to sarcopenic obesity [14], and the prevalence of sarcopenia in association with activities of daily living, nutrition, and depression [14]. However, there are few studies that comprehensively sought to identify factors affecting the HRQoL based on Ferran’s HRQoL model [12] in older adult women with sarcopenia. Therefore, the current study was conducted to identify factors affecting HRQoL in older women with sarcopenia, to ultimately provide nursing evidence for improving their HRQoL.

This study aimed to identify factors influencing HRQoL of older adult women with sarcopenia based on Ferran’s HRQoL model [12], and the specific purposes are as follows.

(1) To identify the general characteristics of older adult women with sarcopenia
(2) To investigate the difference in HRQoL according to their general characteristics
(3) To determine the factors influencing their HRQoL

Methods

Ethics statement: Obtaining informed consent was exempted by the Institutional Review Board of Jeonbuk National University (No. IRB-2022-08-021) because there was no sensitive information and the survey was anonymously treated.
Research design
This study is a descriptive correlational study conducted to identify factors influencing HRQoL in older adult women with sarcopenia in Korea, analyzing the 8th Korea National Health and Nutrition Examination Survey (KNHANES) 2019 data. This study was described in accordance with the STROBE guidelines (https://www.strobe-statement.org/index.php?id=strobe-home).

Data sources
The 8th KNHANES was conducted in 2019 when the Korea Centers for Disease Control and Prevention conducted a survey of the annual National Health and Nutrition Survey with the approval of the Research Ethics Review Committee. Stratified sampling was done for all Koreans and from the 4,381 women out of 8,110 respondents of the KNHANES, 1,347 women aged 60 years or older were extracted. Subsequently, 290 elderly women with sarcopenia were again extracted. Excluding 148 persons with any missing information on even one of the variables considered in the study, the final analysis was done on a total of 142 elderly women with sarcopenia (Figure 1).

Measurement
Sarcopenia
According to the Asian Working Group for Sarcopenia, sarcopenia is diagnosed based on handgrip strength (HGS), physical performance, and skeletal muscle mass, and a condition in which all three are reduced is classified as severe sarcopenia [2]. In the current study, sarcopenia is defined as HGS of less than 18 kg in women [2]. The maximum value of HGS of both hands or one hand measured three times was used.

Health-related quality of life
The HRQoL was analyzed using the EuroQol-5 Dimension (EQ-5D) instrument developed by the EuroQol Group [15]. The EQ-5D measures overall health and consists of five dimensions: mobility, self-care, usual activity, pain/discomfort, and anxiety/depression. Items are evaluated in three levels: ‘no problem,’ ‘moderate problem,’ and ‘serious problem’ and analyzed by the EQ-5D index, which is calculated from the prediction formula presented by the Korea Disease Control and Prevention Agency. A weight-adjusted value was calculated as 0 to 1 point and scores closer to 1 indicate better HRQoL.

Independent variables
Individual characteristics include age, marital status, education level, income level, employment, drinking status, and total sleep duration. Biological function includes disease and comorbidity. Symptoms include subjective perceptions and experiences, such as depression symptoms, suicidal ideation, and subjective stress. Functional status comprises physical, social, and role, such as climbing stairs and working. General health perceptions consist of subjective health evaluation, such as perceived health status. Environmental characteristics include health insurance, and interpersonal relationships, such as health insurance, private insurance, living area, and living type [12].

Individual characteristics
Age, marital status, education level, income level, employment,
drinking, and sleep duration were included as the individual characteristics. Age was classified into early older adults aged 60 to 74 years and late older adults aged 75 years or older [16]. Marital status was classified into married or others, and education level was classified as elementary school or less, middle school, and high school or higher. Household income was classified into three groups according to the instructions for using KNHANES, lower (≤ 1 million Korean won [KRW]), middle (1–3 million KRW), and upper (> 3 million KRW). Employment was classified into yes and no; drinking was classified into drinking and nondrinking; and total sleep duration was classified as 7 hours or more and less than 7 hours.

**Biological function**

Biological function includes osteoporosis, diabetes mellitus, body mass index (BMI), and waist circumference. Osteoporosis and diabetes were classified into yes and no, depending on whether they were diagnosed by a doctor. BMI was classified into < 18.5 kg/m$^2$ (underweight), 18.5–22.9 kg/m$^2$ (normal), 23–24.9 kg/m$^2$ (overweight), and ≥ 25 kg/m$^2$ (obese). Waist circumference was classified by self-report as less than 85 cm (normal) and 85 cm or greater (obesity) [17].

**Symptoms**

Symptoms included depressive symptoms, suicidal ideation, and perceived stress. Depressive symptom was classified as yes and no for “depression for more than two consecutive weeks,” and suicide ideation were classified as yes and no for “serious suicide ideation over the past year.” Perceived stress was reclassified as “a lot (feeling a lot, feeling very much)” and “a little (feeling a little, feeling little)” about stress when asked about how much stress they felt in daily life.

**Functional status**

Functional status included difficulty climbing stairs and difficulty working during the past week. Difficulty of climbing stairs was classified as ‘no difficulty climbing stairs (no),’ ‘some difficulty climbing stairs (mild),’ ‘a lot of difficulty climbing stairs (severe),’ and ‘couldn’t climb stairs (very severe).’ Difficulty of working was classified as ‘no difficulty working (no),’ ‘some difficulty working (mild),’ ‘a lot of difficulty working (severe),’ and ‘couldn’t work (very severe).’

**General health perceptions**

General health perceptions were classified into good (very good, good), ordinary (normal), and poor (very bad, bad) based on the question, “How do you feel about your health in general?”

**Environmental characteristics**

Environmental characteristics included health insurance, private insurance, living area, and living type. Health insurance was classified into self-employed, employee, and dependent. The private insurance was classified into yes and no according to membership. The living area was classified into urban and rural, and the living type was classified into alone and together.

**Statistical analysis**

The complex sample design was performed in consideration of the sample weight according to the sample design. Stratification variables and colony variables provided by the Korea Centers for Disease Control and Prevention were designated and analyzed. The data was analyzed using IBM SPSS ver. 26.0 (IBM Corp., Armonk, NY, USA), and significance set at $p < .05$. For participants’ characteristics, frequency and weighted percentage, estimated mean, and standard error (SE) were computed using complex sample frequency analysis. For the difference in HRQoL according to the general characteristics, independent t-tests were performed. Multiple regression analysis was performed for factors influencing HRQoL.

**Results**

**Participants’ general characteristics**

The mean age of the 142 participants was 72.77 years (SE, 0.57), and 51.3% were over 75 years of age. Overall, 72.3% of participants were unemployed and 54.2% were in the lower household income group. Regarding biological function, the most prevalent disease was osteoporosis (38.0%), followed by diabetes mellitus (27.5%). In terms of BMI, most respondents were normal (37.3%), followed by overweight (30.5%), and obesity (29.3%), and 55.7% were obese in waist circumference. Regarding symptoms, 16.1% of participants suffered from depression, 10.0% had experienced suicidal ideation, and 29.6% of participants reported a lot of stress in their daily lives. Regarding functional status, 47.9% and 42.2% of participants experienced mild difficulty climbing stairs and working, respectively, and 51.4% perceived their health status as ordinary. Regarding environmental characteristics, 62.9% of the employed and 58.3% of all participants did not have private insurance, 69.2% lived in urban areas, and 68.5% lived with someone (Table 1).
Health-related quality of life according to the general characteristics of older adult women with sarcopenia

Married participants had significantly higher HRQoL than those whose status was otherwise (t = 10.05, p = .002). In terms of symptoms, those who did not report depression symptoms and suicidal ideation had a higher HRQoL score than those who did (t = 5.02, p = .029; t = 6.87, p = .011, respectively). Regarding functional status, those who had no or mild difficulty climbing stairs nor working had a higher HRQoL than their counterparts who had severe difficulty climbing stairs and working (F = 8.72, p < .001; F = 6.27, p = .001, respectively). In general, those with good or normal health perception showed a higher HRQoL than those with poor perception (F = 14.32, p < .001). Regarding environmental characteristics, HRQoL was higher for those with private insurance (t = 4.07, p = .048), and those living with someone (t = –3.65, p = .001) (Table 2).

Factors influencing health-related quality of life of older adult women with sarcopenia

No and mild difficulty in climbing stairs were significantly associated with a higher HRQoL (B = .203, p = .001; B = .209, p < .001, respectively). In working, no and mild difficulty were also significantly associated with a higher HRQoL (B = .254, p = .002; B = .208, p = .013, respectively). Good or normal perceived health perceptions were significantly associated with a higher HRQoL (B = .111, p < .001; B = .087, p < .001, respectively). The explanatory power of these variables’ ability to explain HRQoL in older adult women with sarcopenia was approximately 56% (Table 3).

Table 1. General characteristics of participants (N=142)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>n' or Estimated mean ± SE</th>
<th>Weighted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual characteristics</td>
<td>Age (year)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>60–74</td>
<td>74</td>
<td>48.7</td>
</tr>
<tr>
<td></td>
<td>≥ 75</td>
<td>68</td>
<td>51.3</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>65</td>
<td>44.5</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>77</td>
<td>55.5</td>
</tr>
<tr>
<td>Education level</td>
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</tr>
<tr>
<td></td>
<td>Middle school</td>
<td>50</td>
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</tr>
<tr>
<td></td>
<td>≥ High school</td>
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<td>Middle</td>
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<tr>
<td>Employment</td>
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<tr>
<td></td>
<td>No</td>
<td>105</td>
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<tr>
<td>Drinking</td>
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</tr>
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<td>Total sleep duration (hour)</td>
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<td>Biological function</td>
<td>Osteoporosis</td>
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<td></td>
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<td></td>
<td>No</td>
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<td>72.5</td>
</tr>
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<td>Body mass index (kg/m²)</td>
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<tr>
<td></td>
<td>18.5–22.9</td>
<td>51</td>
<td>37.3</td>
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<tr>
<td></td>
<td>23–24.9</td>
<td>43</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td>≥ 25</td>
<td>43</td>
<td>29.3</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>≥ 85</td>
<td>80</td>
<td>55.7</td>
</tr>
<tr>
<td></td>
<td>&lt; 85</td>
<td>62</td>
<td>44.3</td>
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Table 1. Continued

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<thead>
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<tr>
<td>Symptoms</td>
<td>Depressive symptom</td>
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</tr>
<tr>
<td></td>
<td>No</td>
<td>116</td>
<td>83.9</td>
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<td>14</td>
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<td></td>
<td>No</td>
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<td>90.0</td>
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<td>102</td>
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<td>69</td>
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<tr>
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<td>Very severe</td>
<td>9</td>
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<td></td>
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<td></td>
<td>Good</td>
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<td></td>
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<td>Dependent</td>
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<td>79</td>
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<td>Living type</td>
<td>Alone</td>
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</tr>
<tr>
<td></td>
<td>Together</td>
<td>93</td>
<td>68.5</td>
</tr>
</tbody>
</table>

*Unweighted count (frequency).
Discussion

Regarding functional status, difficulty working had the greatest impact on the HRQoL of older adult women with sarcopenia. Working not only improves economic status but also self-esteem and QoL for older adult women with sarcopenia [18]. This may be because self-esteem increases through social ties and role performance; and through working people can feel less lonely or alienated, which may have a positive effect on subjective health awareness [19]. As the working-age population (15–64 years old) in Korea continues to decline and the older adult population rapidly increases, the possibility for older adult women to work may improve individual QoL and further contribute to sustainable growth in Korean society [20]. Therefore, community support systems that offer various social entry programs can help to create jobs for older adult women with sarcopenia. Follow-up studies that identify other related factors that affect the HRQoL of older adult women with sarcopenia, and intervention directions are also needed.

This study’s finding that HRQoL was higher with no difficulty climbing stairs is supported by a prior study that reported a statistically significant positive correlation between physical fitness variables, including stair climbing, with QoL in Korean low-income elders 65 years or older [21]. Another study [22] found that older people participating in a physical activity program including climbing stairs had more muscle strength. In addition to seeking to prevent and manage muscular dystrophy through exercise from middle age, when muscle mass begins to decrease [23] efforts to guide and educate older adult women with sarcopenia are needed, so that they can continue to practice climbing stairs in their daily lives.

Regarding general health perception, high HRQoL was associ-

### Table 2. Quality of life according to general characteristics (N=142)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Mean ± SE</th>
<th>F or t (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual characteristics</td>
<td></td>
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</tr>
<tr>
<td>Age (yr)</td>
<td>60–74</td>
<td>0.89 ± 0.02</td>
<td>0.09 (.756)</td>
</tr>
<tr>
<td></td>
<td>≥ 75</td>
<td>0.87 ± 0.03</td>
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</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>0.93 ± 0.02</td>
<td>10.05 (.002)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>0.83 ± 0.02</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>≤ Elementary school</td>
<td>0.87 ± 0.02</td>
<td>0.01 (.379)</td>
</tr>
<tr>
<td></td>
<td>Middle school</td>
<td>0.86 ± 0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ High school</td>
<td>0.90 ± 0.02</td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td>Lower</td>
<td>0.80 ± 0.02</td>
<td>1.45 (.228)</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>0.90 ± 0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upper</td>
<td>0.88 ± 0.05</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Yes</td>
<td>0.90 ± 0.02</td>
<td>2.64 (.109)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0.86 ± 0.02</td>
<td></td>
</tr>
<tr>
<td>Drinking</td>
<td>Yes</td>
<td>0.88 ± 0.02</td>
<td>0.04 (.838)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0.88 ± 0.03</td>
<td></td>
</tr>
<tr>
<td>Total sleep duration (hour)</td>
<td>≥ 7</td>
<td>0.89 ± 0.02</td>
<td>0.36 (.550)</td>
</tr>
<tr>
<td></td>
<td>&lt; 7</td>
<td>0.87 ± 0.02</td>
<td></td>
</tr>
<tr>
<td>Biological function</td>
<td>Yes</td>
<td>0.81 ± 0.02</td>
<td>0.09 (.760)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0.82 ± 0.03</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>Yes</td>
<td>0.77 ± 0.04</td>
<td>3.43 (.069)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0.86 ± 0.01</td>
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<tr>
<td>Body mass index (kg/m²)</td>
<td>&lt; 18.5</td>
<td>0.80 ± 0.04</td>
<td>0.61 (.593)</td>
</tr>
<tr>
<td></td>
<td>18.5–22.9</td>
<td>0.85 ± 0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23–24.9</td>
<td>0.82 ± 0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 25</td>
<td>0.80 ± 0.04</td>
<td></td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>≥ 85</td>
<td>0.81 ± 0.02</td>
<td>0.07 (.785)</td>
</tr>
<tr>
<td></td>
<td>&lt; 85</td>
<td>0.82 ± 0.03</td>
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</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Mean ± SE</th>
<th>F or t (p)</th>
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<tbody>
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<td>Symptoms</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Depressive symptom</td>
<td>Yes</td>
<td>0.74 ± 0.04</td>
<td>5.02 (.029)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0.83 ± 0.02</td>
<td></td>
</tr>
<tr>
<td>Suicidal ideation</td>
<td>Yes</td>
<td>0.72 ± 0.01</td>
<td>6.87 (.011)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0.85 ± 0.01</td>
<td></td>
</tr>
<tr>
<td>Perceived stress</td>
<td>A lot</td>
<td>0.81 ± 0.03</td>
<td>1.39 (.242)</td>
</tr>
<tr>
<td></td>
<td>A little</td>
<td>0.86 ± 0.02</td>
<td></td>
</tr>
<tr>
<td>Functional status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty climbing stairs</td>
<td>No</td>
<td>0.87 ± 0.03</td>
<td>8.72 (.&lt; .001)</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
<td>0.87 ± 0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>0.72 ± 0.03</td>
<td>(a,b &gt; d)</td>
</tr>
<tr>
<td></td>
<td>Very severe</td>
<td>0.64 ± 0.06</td>
<td></td>
</tr>
<tr>
<td>Difficulty working</td>
<td>No</td>
<td>0.89 ± 0.02</td>
<td>6.27 (.001)</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
<td>0.83 ± 0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>0.79 ± 0.03</td>
<td>(a,b &gt; d)</td>
</tr>
<tr>
<td></td>
<td>Very severe</td>
<td>0.60 ± 0.07</td>
<td></td>
</tr>
<tr>
<td>General health perceptions</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Perceived health status</td>
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<td>0.65 ± 0.04</td>
<td>14.32 (c &gt; b &gt; a)</td>
</tr>
<tr>
<td></td>
<td>Ordinary</td>
<td>0.83 ± 0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>0.87 ± 0.03</td>
<td></td>
</tr>
<tr>
<td>Environmental characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Self-employed</td>
<td>0.90 ± 0.03</td>
<td>0.32 (.724)</td>
</tr>
<tr>
<td></td>
<td>Employee</td>
<td>0.89 ± 0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dependent</td>
<td>0.85 ± 0.06</td>
<td></td>
</tr>
<tr>
<td>Private insurance</td>
<td>Yes</td>
<td>0.91 ± 0.03</td>
<td>4.07 (.048)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0.85 ± 0.03</td>
<td></td>
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<td>0.59 (.446)</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
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<td></td>
</tr>
<tr>
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<td>0.74 ± 0.03</td>
<td>3.65 (.001)</td>
</tr>
<tr>
<td></td>
<td>Together</td>
<td>0.89 ± 0.01</td>
<td></td>
</tr>
</tbody>
</table>

**Holm-Bonferroni method.**
ated with perceiving one’s health condition as good, which is consistent with other studies [4,24]. Perceived health perception is a comprehensive evaluation of one’s health in terms of physical, mental, social, and psychological aspects, and is reported to be closely related to depression and physical activity [25]. Given that health-promoting programs for older adults resulted in improving perceived health awareness and QoL [26], active management programs for older adult women with sarcopenia are needed.

A limitation of this study was that while sarcopenia should be studied in consideration of time changes to identify causal relationships, because cross-sectional KNHANES data that included HGS measurement were used, it was only possible to identify associated factors. Therefore, it would be beneficial to incorporate sarcopenia measures in future KNHANES data, e.g., physical performance or skeletal muscle mass, especially for high-risk groups. Also, while the revised QoL model describes the effect of individual and environmental characteristics on biological function and the interactions between an individual and their environment, this study did not list the results of these effects and interactions. Despite these limitations, this study is meaningful in that it applied Ferran’s QoL model [12] to identify the factors influencing the HRQoL of older adult women with sarcopenia.

In conclusion, this study’s findings show that it is necessary to actively implement supportive interventions that can reduce difficulties in daily life, such as working and climbing stairs for elderly women with sarcopenia. Findings can be applied by encouraging women to exercise from middle age, when sarcopenia can begin, and assisting older adult women to continue their physical activities. Finally, continuing and expanding sarcopenia measurement in national surveys and the development of interventions and health policies to improve the HRQoL of older adult women with sarcopenia are also needed.

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Authors’ contributions

Conceptualization: Lee SH, Nho JH; Formal analysis: Lee SH;
Conflict of interest

Ju-Hee Nho has been an associate editor of the Korean Journal of Women Health Nursing since January 2021. 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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How do mothers with young children perceive endocrine-disrupting chemicals?: an exploratory qualitative study

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¹Wonju College of Nursing, Yonsei University, Wonju, Korea
²College of Nursing, Research Institute of Nursing Science, Seoul National University, Seoul, Korea

Purpose: Despite the health impacts of endocrine-disrupting chemicals (EDCs) beginning in the early stages of life, there is little research on the perception of EDCs among Korean mothers, who are primarily responsible for protecting children. This study aimed to explore how mothers with young children perceived EDCs for their concerns, the issues they faced, and the way they dealt with them.

Methods: An exploratory qualitative design was utilized. Twelve mothers who were recruited from snowball sampling participated in voluntary interviews. Individual in-depth interviews lasting approximately 47 to 60 minutes were recorded and transcribed verbatim. The data were analyzed using qualitative content analysis as suggested by Graneheim and Lundman.

Results: Four categories, 10 subcategories, and 25 condensed meaning units were identified by interpreting mothers’ underlying meanings. The four categories were ‘Knowledgeable yet contrasting ideas regarding EDCs,’ ‘Negative health impact, but more so for children,’ ‘Inaction or trying to minimize exposure,’ and ‘Need for early, reliable resources and social change.’ Mothers were knowledgeable about EDCs and actively needed further education and support. While they tended to focus more on the health impact of EDCs on their children and were optimistic about their health risks, paying less attention to their preventive behaviors.

Conclusion: Healthcare professionals must consider mothers’ perceptions of EDCs in future education and interventions regarding EDCs impact on women’s life stages such as puberty, pregnancy, and childrearing. Also preventive strategies that can be applied to their daily lives are needed.

Keywords: Endocrine disruptors; Mothers; Perception; Qualitative research

Introduction

Endocrine-disrupting chemicals (EDCs) are compounds that interfere with normal hormone function. They are primarily synthesized for industrial solvents, electronics, personal care products, plastics, and pesticides, and they include polychlorinated biphenyls, bisphenol A, phthalates, dioxins, DDT (dichlorodiphenyltrichloroethane), and others [1,2]. Since EDCs are ubiquitous in our living environment, their effects can be seen at all stages of life, including in developing fetuses, and persistent exposure to EDCs and the accumulation of EDCs in the human body can lead to health problems in children and adults [1,3]. Particularly, exposure to bisphenol A and polybrominated diphenyl ethers during pregnancy is associated with intrauterine growth restriction [4], higher levels of anxiety, depression, aggression, hyperactivity, and behavioral problems in children [5], and persistent lower cognitive abilities from the ages of 2 to 8 years [6], as well as lower attention levels and executive function-
ing at the ages of 9 to 12 years [7]. More importantly, constant exposure to EDCs in the environment can lead to the early onset of puberty and breast cancer [8], obesity, diabetes, thyroid dysfunction, and infertility [3,9]. Thus, it is critical to be aware of environmental hazards and the life-long health impacts of EDCs beginning in the early stages of life.

In this regard, parents are primarily responsible for protecting children from exposure to EDCs [10]. As children grow up, parents play multiple roles in the formation of their health behaviors by educating their children, acting as role models, and influencing their cognitive and behavioral characteristics [11]. Many studies have shown that parenting practices, particularly mothers’ parenting styles, influence their child(ren)’s body weight, diet, physical activity, and eating behaviors [12,13]. Due to the important role of mothers in families and social environments for protecting children from various harmful conditions, mothers should be engaged to and supported to guide children’s health practices. Nevertheless, there is little research on the perception of EDCs among mothers, who tend to be children’s primary caregivers. Mothers are known, however, to share information about EDCs through social networking services [14]. It is important to understand mothers’ real experiences; what and how they are concerned about EDCs, what kind of matters they come across, and how they take care of it during childrearing. Therefore, a qualitative approach was considered appropriate for addressing the aims of this study exploring perspectives and ideas about EDCs among Korean mothers with young children, particularly as primary caregivers. This study aimed to explore the perceptions of EDCs among mothers with young children to provide a basis for parental education to enhance parents’ awareness concerning the risks of EDCs, particularly in a way that meets parents’ needs and expectations concerning childcare.

Methods

Design
This study used an exploratory qualitative design to explore the perception of mothers with young children about EDCs for their concerns, the issues they faced, and the way they dealt with them. This study adhered to the COREQ (Consolidated Criteria for Reporting Qualitative Research) guidelines (https://www.equator-network.org/reporting-guidelines/coreq/).

Participants
The participants were recruited from three locations in the Kangwon-do area selected through snowball sampling. A director of a local kindergarten was approached by the research team, and then the director as a key person introduced mothers to the study. Considering the distribution of children’s age, two additional childcare centers were introduced by the key person, then each director of the center allowed the research team to recruit potential participants.

The mothers were included in the study if they (1) were their child’s primary caregiver, (2) had at least one or more infants, toddlers, or preschoolers, and (3) provided written consent after agreeing to the purpose and processes of the study. There was no specific exclusion criterion for the mothers. Since mothers’ expe-

Summary statement

- **What is already known about this topic?**
  Endocrine-disrupting chemicals (EDCs) are ubiquitous in our living environment, and their harmful effects are known to lead to health problems in children and adults.

- **What this paper adds**
  Mothers were knowledgeable about EDCs and actively needed further education and support, however, they tended to focus more on the health impact of EDCs on their children while being optimistic about their health risks.

- **Implications for practice, education, and/or policy**
  Healthcare professionals must consider mothers’ perceptions of EDCs in future education programs and interventions to ensure that mothers receive accurate information about EDCs with preventive strategies for their everyday lives.

**Ethics statement:** This study was approved by the institutional review board of Yonsei University Wonju Severance Christian Hospital (No. CR319012). Informed consent was obtained from the participants.
riences could be influenced by the developmental processes of their children, we decided to explore various experiences of mothers so as not to be biased to a certain gender or age within the age criteria during the recruitment process.

The number of study participants in a qualitative study is considered sufficient once the threshold of reliable information is met, and the appropriate number of participants is generally assumed to be 1 to 30 [15]. A total of 12 mothers were interviewed and included in the final analysis as the data were saturated.

**Data collection procedure**

For data collection, initial meetings with possible participants and the research assistant were arranged by the director of the kindergarten and childcare centers.

For mothers who agreed to participate, interviews were conducted by the principal investigator on a scheduled date and time in a private room in each institution. A research assistant with a master’s degree was also present in the room to record field notes about the interview environment and the non-verbal behaviors of the participants. Each participant was interviewed once and the interview proceeded in a comfortable environment where the mothers could share their experiences in as much detail as possible. At the end of the interview, the mothers shared any questions or comments they had. A small gift (worth 25 US dollars) was given to the mothers to express gratitude for their time and cooperation.

All interviews were recorded, and the files were transcribed by the research assistant, using identification numbers to anonymize participants. Field notes were also utilized for the data analyses. Each interview lasted for approximately 47 to 60 minutes, with an average of 54 minutes.

**Interview questions**

The four main questions were provided as follows; “Would you tell us what you know about EDCs?”; “What do you think about the impact of EDCs on you and your child(ren)?”; “What actions do you take to reduce the health impact of EDCs?”; and “What do you think are the most effective ways to reduce exposure to EDCs?”

**Data analysis**

A total of 730 minutes of interviews was transcribed and analyzed according to Graneheim and Lundman’s [16] qualitative content analysis process method, which proceeded as follows: The researchers initially read the transcribed materials including field notes to get a sense of the whole, then started to mark meaningful phrases and sentences as units of analysis during the second reading. Then we selected meaning units separately and compared the outcomes to confirm the significant meaning units. Next, the selected meaning units responding to the study aim were reviewed and agreed upon regarding their core contents between the authors. Then condensed meaning units were composed and abstracted into subcategories and categories. During the analysis, we continuously discussed interpretations in all steps.

**Trustworthiness**

To achieve trustworthiness, we tried to meet the credibility, confirmability, authenticity, dependability, and transferability criteria for qualitative studies [16]; to ensure credibility, we recruited mothers with young children of infants, toddlers, or preschoolers who were willing to share their experiences according to the aims of the study. In addition, recruitment was continued to include 12 mothers to obtain the richness and saturation of data. For confirmability and authenticity, the analyzed outcomes were verified by three mothers (each one from three age groups: an infant, a toddler, and a preschooler). They confirmed if the reports reflected mothers’ feelings, tones, expressions, and words of their experiences in richer and more vigorous ways. For dependability, we had more than five team meetings to ensure that no errors were made during the analysis, particularly, codes and supporting quotes from the original text were selected to be differentiated among subcategories and categories. In addition, we attempted to avoid any preconceptions and listened to the mothers’ experiences with a nonjudgmental attitude so that the participants would be able to openly express what they wanted to share. To ensure transferability, the selection criteria and characteristics of the mothers were described in the report to provide the content from which the findings could be transferred to other groups of mothers.

**Results**

The general characteristics of the 12 mothers are presented in Table 1.

The average age was 34.3 years (range: 23–41 years), and the average number of children was 1.6 (range: 1–3). In terms of financial status, 11 mothers (91.7%) considered themselves middle-class, and six mothers (41.7%) were employed. Two mothers reported having thyroid disease and asthma, and there were two reported cases of children diagnosed with precocious puberty and atopic dermatitis, respectively.

A total of 288 major statements were identified in the inter-
views and after repeated reading of transcripts, 87 meaning units were found to be significant. A total of 25 condensed meaning units were then generated based on the interpretation of underlying meanings, which were further categorized into 10 subcategories and four categories. The mothers’ experiences of EDCs defined in the analysis were ‘Knowledgeable yet contrasting ideas regarding EDCs,’ ‘Negative health impact, but more so for children,’ ‘Inaction or trying to minimize exposure,’ and ‘Need for early, reliable resources and social change’ as shown in Table 2.

### Knowledgeable yet contrasting ideas regarding endocrine-disrupting chemicals

The mothers said that they knew EDCs as substances entering our body through various routes, in addition, some mothers expressed that EDCs were toxins accumulated in the bodies while others perceived EDCs as being harmless as they would decompose in the body.

**Multiple routes of endocrine-disrupting chemicals entering the body**

Five condensed meaning units were included in this subcategory. The mothers recognized that EDCs were substances that entered the body through various methods, such as using plastic containers or toys, heating food in disposable containers in the microwave, breathing in fumes from burning substances, and absorbing them through the skin from shampoo and cosmetics in daily life. In addition, they perceived EDCs as something that affected the fetus through the umbilical cord during pregnancy.

“It’s in a lot of plastics… the biggest inflow would be through the mouth. Particularly, babies, they take everything to their mouth and suck their toys. I realize it strongly when I hear the news on TV about the detection of EDCs from toys.” (participant 1)

“I have heard from SNS postings. When we pour hot water in the white Styrofoam of cup noodles and when we put vinyl in the microwave… disposable containers for delivery food… those are all EDCs.” (participant 5)

“The smoky smell from something burned… that’s the EDCs. It also exists in the air and enters our body when we breathe.” (participant 7)

“It is also in the shampoos and cosmetics we use every day. It can infiltrate through our skin and eyes [laugh].” (participant 8)

#### Contrasting ideas about endocrine-disrupting chemicals

In this subcategory, two condensed meaning units were explored. The mothers understood EDCs in a contrasting manner, with some viewing them as something accumulated in the body without being discharged and others believing that they are decomposed in the body.
“Since EDCs are chemically generated, detrimental substances will be accumulated in our body if it is heated and transformed into EDCs. Because of environmental pollution, fruits grow deformed, so it is scary if the same thing could happen if EDCs are not eliminated from our body.” (participant 9)

“I’ve heard from my husband, a chemistry researcher that all those things accrue in women’s wombs. He always insists not to buy canned products, bleached toilet papers, etc.” (participant 6)

“I think we can be immune to EDCs as it is deformed like a virus… Maybe it could also be decomposed in our body if we follow a vegetarian diet.” (participant 1)

“How long are we going to live (laugh)… do people live forever if not eating fast foods, if not using cotton sanitary pads? A person who says EDCs are noxious seems to be picky. Eventually, we all die later. I don’t care much about that.” (participant 11)

Negative health impact, but more so for children
EDCs were believed to induce health problems in mothers and children were seen as more vulnerable to the effects of EDCs. However, some mothers were not concerned about the effects of EDCs on them or their children. They expressed different opinions on the influences of EDCs on health.

Causes of health problems for oneself
Three condensed meaning units were identified in this subcategory. Eating a large amount of instant food was a trigger for men-

| Table 2. Experiences of endocrine-disrupting chemicals (EDCs) among mothers with young children |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Condensed meaning unit | Subcategory | Category |
| Chemicals that can enter through the mouth when using products made of plastics | Multiple routes of EDCs entering the body | Knowledgeable yet contrasting ideas regarding EDCs |
| Chemicals that can be delivered from the mother to the fetus through the umbilical cord | | |
| Chemicals produced when using disposable food containers in the microwave | | |
| Chemicals that can be breathed in from something burning | | |
| Chemicals that can be absorbed through the skin from products | | |
| Toxins that accumulate in the body | | |
| Substances that are not harmful and are decomposed in the body | Contrasting ideas about EDCs | |
| Menstrual pain triggered via the consumption of instant foods | Causes of health problems for oneself | Negative health impact, but more so for children |
| Allergy, asthma, or skin rash via contact with EDCs | | |
| Greater susceptibility to infertility in women because ova are already inside the body unlike sperm | Higher vulnerability of children to the impact of EDCs | |
| Children living in a developed society with ubiquitous sources of EDC exposure | | |
| EDC exposure as dangerous for children due to longer-term and more frequent exposure | | |
| Not a pressing issue to me | Optimism about one's health problems due to EDCs | |
| No sense of active harm to myself from EDCs | | |
| No need for action because of the absence of current health issues | Maintaining the easy ways of living | Inaction or trying to minimize exposure |
| Continuing to use convenient products despite the harms of EDCs | Taking actions to reduce EDC exposure based on experiences | |
| Minimizing my exposure to EDCs after my children experienced health problems | | |
| Trying to avoid exposure to EDCs throughout pregnancy and childbirth | | |
| Early education for children for better effects | Early education in children and its ability to spread | Need for early, reliable resources and social change |
| Parental changes via the influence of children | Social and systemic changes to reduce EDCs | |
| Establishment of policies and regulations to reduce EDCs | | |
| Continuous public awareness through social media | | |
| Environment for adopting eco-friendly products | | |
| Understandable information backed by evidence | Reliable information applicable to daily life | |
| Practical information applicable to daily life | | |
strual pain, and contact with EDCs caused allergies, asthma, and skin rashes. In addition, women felt the risk of infertility since they were born with a limited number of eggs, which could be affected by EDCs. The mothers acknowledged the relationship between EDCs and women's reproductive health issues based on their experiences and allergic diseases associated with the environment.

“I ate a lot of cup noodles and instant food when I was in high school and had worse cramping, which I never had before.” (participant 6)

“Unlike the first and the second pregnancy, I had trouble having a baby after… I think women would be more vulnerable to infertility than men because ovum is in women's bodies from birth while sperm is constantly produced, isn’t it?” [nodding and looking at the interviewer] (participant 2)

“My asthma gets worse, too, when the air quality is bad, and wouldn’t it make the skin more sensitive?… and it won’t be good for those with weak bronchial tubes…” (participant 4)

Higher vulnerability of children to the impact of endocrine-disrupting chemicals
Two condensed meaning units reflected the higher vulnerability of children rather than adults. The mothers expressed that their children had a higher chance of being exposed to EDCs as they are going to live in a developed, modern society for a longer time than we adults will live.

“Kids are living in an environment with polluted air, vehicle smoke, and manufactured goods… so I think ADHD is increasing now… one of my friend’s kid was also diagnosed with it, kind of bad substances causing issues to the brain….” (participant 12)

“I see the difference clearly in my boy. Whenever he eats a lot of snacks, atopy symptoms are spreading under the genital area.” (participant 7)

“My daughter (8 years-old) is under treatment for precocious puberty, I found her breast budding one day. I blame myself; she might have had the disease because I gave her instant foods, cup noodles too much.” (participant 3)

Optimism about one's health problems due to endocrine-disrupting chemicals
In contrast, the mothers perceived that, since they did not currently have any particular health problems, any health issues from EDCs would be experienced in the distant future, if at all. In addition, they did not believe that adults would experience health issues from EDCs and felt they were far removed from such health problems.

“I feel like I won’t have any problem due to EDCs in the short term. If it does, it will be about 20 to 30 years later… around menopause?” (participant 9)

“There is nothing I can directly feel. It’s invisible so it seems okay. To be honest, I don’t care…” (participant 8)

Inaction or trying to minimize exposure
For the question of what the mothers do to protect their health from EDCs, two opposing subcategories were identified. One position indicated keeping the same way of living because of the absence of disease and preference for a more convenient life. The other took actions to avoid exposure to EDCs based on the health problems of their children as well as their own health concerns.

Maintaining the easy ways of living
Two condensed meaning units were identified under this subcategory. Some felt no need for action since they were not currently experiencing any health problems, while others kept using convenient products despite the harms of EDCs. The mothers were aware of the destructiveness of EDCs, but they did not make any changes in their behavior for various reasons, such as a lack of current health issues, time management, and parenting convenience.

“I think I’ll follow the advice only when I start feeling sick [laugh]. I have a habit of not doing something unless it is at hand.” (participant 4)

“It is hard to give up or to reduce the use of the microwave or an air fryer. I need those for timesaving when cooking for my baby or family [shamefaced smile].” (participant 11)

Taking actions to reduce endocrine-disrupting chemicals exposure based on experiences
In this subcategory, two condensed meaning units were identified. The mothers tried to minimize their exposure to EDCs after their children experienced health problems and throughout pregnancy and childbirth. The mothers stated that they acknowledged the health problems of their children due to EDCs and that they took extra care to avoid EDCs that could harm the fetus during pregnancy.

“My child has heavy atopic dermatitis, so I try to give as little instant food as possible and to give more homemade foods. It is hard to
see him having a hard time because of itching, so I try to do my best as a mother.” (participant 3)

“I started to be concerned when I got pregnant... so I was especially careful not to use the microwave and plastic containers. Now I wonder about the world our children will live in.” (participant 10)

Need for early, reliable resources and social change
The mothers expressed three subcategories related to their ideas for reducing their exposure to EDCs’ harms. The younger the child, the better the effects of education, so early education is essential. The mothers perceived that EDCs are associated with environmental pollution, which requires social agreement to establish policies. Finally, the mothers requested practical information for reducing EDC exposure.

Early education in children and its ability to spread
Two condensed meaning units were identified in this subcategory. The mothers believed early education about EDCs for children would be more effective for spreading information about EDCs and encouraging positive life habits. In addition, they believed that children could motivate their parents to change their behaviors by sharing what they learned.

“I’m not interested in learning more about EDCs [quietly] but I think it will be beneficial to teach kids in the school curriculum because learning at a young age is most effective.” (participant 4)

“Once they learn, they will point out their moms’ faulty behavior. It will lead the parents to change their behavior… so I think it will be effective to educate the kids.” (participant 6)

Social and systemic changes to reduce endocrine-disrupting chemicals
Under this subcategory, three condensed meaning units were identified. The mothers believed that government policy and regulation are needed due to the lack of awareness on reducing the consumption of products containing EDCs. In addition, they suggested continuous promotion through social media to raise awareness about EDCs. They also pointed out that environments where people can sell and buy eco-friendly products should be fostered.

“People don’t seem to be urgent about EDCs’ risks and say ‘why now?’ That’s why I feel the need for some kind of governmental regulation.” (participant 7)

“I think societal awareness is important. Campaigns or social movements are what we need. Since social media is powerful today, information could spread through mom’s cafes or civic groups…” (participant 11)

“I hope prices are lowered with more movements for eco-friendly product consumption and with more production of them.” (participant 10)

Reliable information applicable to daily life
Two condensed meaning units were identified related to this subcategory. The mothers wanted tangible information with scientific evidence to curtail the harms of EDCs, which are invisible toxic substances. Moreover, they wanted practical information that could be applied to their daily lives to reduce exposure to EDCs. They called for specific and realistic alternatives to motivate action.

“No notable results of experiments on the impact of EDCs can be effective, like lung cancer photos on cigarette packs. That will be easier to understand, then we would be more careful, wouldn’t we?” (participant 5)

“When a person that I know gave me information about avoiding EDCs for cooking, it was useful for me to follow what I had heard.” (participant 11)

“Eradicating EDCs would be very unrealistic, so experts could recommend alternatives that are practical…” (participant 1)

Discussion
The study explored the perceptions about EDCs from the perspectives of mothers with young children using qualitative content analysis. Exposure to EDCs is known to occur through food, water, dermal contact, and inhalation [17], and the mothers in this study accurately recognized the transmission routes of EDCs. The mothers in this study, possibly due to their recent experiences of pregnancy and childrearing, were able to identify most of the possible routes of transmission, including the umbilical cord from the mother to the fetus. However, four of the mothers did not believe EDCs caused any bad consequences and decomposed gradually in the body. As suggested in prior literature [18] perceived EDCs as low risk since they are invisible and ubiquitous in daily life. As most of the mothers correctly perceived, EDCs accumulate and persist in organisms and the environment, and they may cause clinically observable and, when possible, measurable effects [19]. Thus, the long-term consequence of EDCs must be accurately shared with the public over time. Labeling consumer products with information would be a good way to increase risk perception, which has been observed to be effective in women of childbearing age [20]. As indicated...
in a previous study of 406 Korean adults [21], better knowledge about the environment would influence people to purchase more pro-environmental products.

The second distinct perception was about the relationship between EDCs and health problems. The mothers assumed that the vulnerability of children was much higher due to a higher chance of extended exposure to EDCs, which could potentially engage mothers to have more interest in preventive behaviors through future education and intervention. Therefore, it is important to provide information to reproductive aged women concerning the timing of exposure to EDCs, since developing fetuses and neonates are most vulnerable to endocrine disruption [22]. Indeed, many diseases and disorders are now considered to be related to prenatal exposure to EDCs, such as premature birth [23], autism [24], allergies [25], and congenital abnormalities [26]. While the mothers acknowledged various health problems due to EDCs, seven of the participants were optimistic that health problems due to EDCs would only happen to them in the distant future. Although EDCs have a very long half-life in the body and their adverse effects manifest at later ages [17], it is still important for parents to maintain a healthy lifestyle to prevent diseases and to be role models for their children. Above all, optimism hinders people from engaging in preventive health behaviors [27,28]. Thus, strategies need to be devised to minimize inaccurately optimistic views and increase awareness about the potential health consequences of EDC exposure.

The extent to which the mothers in this study understood the health impacts of EDCs appeared to correspond to their proactive behaviors to avoid the harms of EDCs. The mothers’ actions to avoid exposure to EDCs mostly related to their children’s health problems, even at the time of pregnancy and childbirth, rather than their own health issues. However, the mothers tended to maintain their lifestyles due to the convenience of using products with EDCs, which was similar to the findings of a study about the attitudes of young adult women in Korea concerning EDCs [29]. Mothers of young children are generationally accustomed to a high-convenience lifestyle and tend to consume more fast foods or processed foods and disposable products. Unconscious exposure to EDCs occurs through various routes of transmission. In particular, dietary intake accounts for more than 90% of total exposure to EDCs [30]. Therefore, mothers must understand their own vulnerability and health risks related to EDCs and ultimately make sustainable behavioral changes, especially as the primary caregiver of their child(ren) [31].

One of the main categories from the interviews with the mothers was that they required various ways to reduce their exposure to EDCs, such as actions based on the precautionary principle, regulatory actions, scientific evidence, and changes in the awareness of the general population about EDCs on social media. These varied demands indicate that detailed and concrete strategies that are applicable at the individual, public, and government levels are needed. Media, which comprise a major source of information, are an important determinant of risk perception [18,32]. Media is noteworthy, not only to ensure that the public maintains a positive attitude toward precautionary measures [33] but also as an easy and effective way to guide the public to improve their knowledge, perception, and behaviors [34,35]. Therefore, media strategies are needed to disseminate how EDCs evoke negative hormonal mechanisms in the human body and how behavioral changes could lead to positive changes to protect people from the harms of EDCs.

Our study also found a strong need for early education about EDCs for children to establish positive life habits to prevent EDC exposure. The mothers anticipated more significant educational effects in their children rather than in themselves and expected their children to influence themselves. Life habits developed in early childhood affect the way individuals observe and respond to others’ health habits and can influence that individual’s family members to acquire knowledge, skills, and attitudes to improve their health [36]. A previous study found that children aged 4 to 5 years who had learned about passive smoking prevention insisted that their family members quit smoking [37]. Thus, environmental education during early childhood would be an effective strategy for influencing children to grow up with good health habits and also inspire behavioral changes in their parents. Information technology such as virtual reality would be a suitable mode to raise awareness of EDCs as well as to reduce exposure to EDCs.

It is possible that mothers with more interest in EDCs could have possibly participated in the study due to their own or their children’s health problems such as asthma, atopic dermatitis, or precocious puberty. Thus, it could be a possible bias and future studies should explore a wider range of perceptions of mothers.

In conclusion, mothers in this study were knowledgeable about EDCs and actively needed further education and support. While they tended to focus more on the health impact of EDCs on their children and were optimistic about their health risks, paying less attention to their preventive behaviors.

As strategies to prevent exposure to EDCs are urgently needed, prenatal education programs could include the topic of EDC exposure and its health impacts, particularly the routes of exposure not only to the mother but to the fetus. Also, parents and teach-
ers need to be prepared in advance with accurate information and preventive strategies, to enable them to guide their young children to apply awareness, knowledge, and preventive behavioral habits in their daily lives. Overall, education programs to improve the publics general understanding of EDCs and the consequences of EDC exposure for students, health professionals (especially in endocrinology, pediatric, and maternity clinics) and laypersons are needed. Healthcare professionals should also provide the public with practical guidelines for health behaviors related to EDCs. It is also important to keep in mind that this requires political will to limit the use of these chemicals and develop and implement remediation technologies.

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References


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Authors' contributions

Conceptualization, Funding acquisition, Project administration, Supervision: Park SM; Data curation, Formal analysis, Investigation, Validation, Visualization: Park SM, Chung CW; Writing—original draft and Writing—review & editing: Park SM, Chung CW.

Conflict of interest

The authors declared no conflict of interest.

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Data availability

Please contact the corresponding author for data availability.


Analysis of suicide statistics and trends between 2011 and 2021 among Korean women

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Purpose: This study aims to analyze the number of suicide deaths in women, trends in suicide mortality, characteristics of suicide by age, and outcomes of suicide means over the past decade (2011–2021) in South Korea.

Methods: Using cause of death data from Statistics Korea, an in-depth analysis of Korean women’s suicide trends was conducted for the period of 2011–2021.

Results: In 2021, women’s suicide death in Korea was 4,159, a rate of 16.2 per 100,000 population. The rate increased by 1.4% from the previous year. Since 2011, women’s suicide rate has been on a steady downward trend, but since 2018, it has been on the rise again. Suicide rates among women in their 20s and 30s have increased, especially since the coronavirus disease 2019 pandemic, and suicide rates among women over 70 years remain high. As compared to 2011, pesticide poisoning and hanging among the means of suicide have decreased significantly, while drug and carbon monoxide continue to increase.

Conclusion: Suicide rates for Korean women in their 20s and 30s have increased significantly in recent years, and those for women over 70 years remain high. Therefore, it is necessary to investigate the causes and establish national policies for targeted management of these age groups, which contributes significantly to the rising suicide rate among Korean women.

Keywords: Mortality; Suicide; Women

Introduction

In 2021, the number of deaths in South Korea (hereafter, Korea) reached 317,680, a 4.2% increase from the previous year, reaching its highest level in the past decade [1]. The suicide rate was 26.0 (the number of deaths per 100,000 population), up 1.2% from the previous year [1]. Moreover, Korea recorded the highest level, 2.1 times higher than the Organization for Economic Co-operation and Development (OECD) average of 11.1 (the number of deaths per 100,000 standard population) [1]. In particular, it was reported that the suicide rate of women has been continuously increasing since 2017 [2]. To reduce suicide, Korea has been establishing the National Suicide Prevention Master Plan every 5 years since 2004 as a national suicide prevention strategy [3], but it has been ranked first since 2018 among OECD countries [4].

Statistics Korea reports the results of cause of death statistics every year, but it analyzes and describes suicide as one of several causes of death. According to the 2023 Suicide Prevention White Paper published annually by the Ministry of Health and Welfare...
Summary statement

· **What is already known about this topic?**
  Suicide is a social problem, rather than an individual issue. Korea’s suicide rate ranks first among Organization for Economic Co-operation and Development member countries.

· **What this paper adds**
  Suicide rates among Korean women in their 20s and 30s have increased in recent years, including during the coronavirus disease 2019 pandemic. Suicide rates for women over 70 years are decreasing but still remain high. As a means of suicide for women, drugs and carbon monoxide continue to rise.

· **Implications for practice, education, and/or policy**
  Gender, age, and means of suicide must be considered when developing suicide prevention measures. To reduce the female suicide rate, enhancing accessibility to mental health services and bolstering economic and social support are needed.

and the Korea Foundation for Suicide Prevention, the number of suicide attempts by women is 1.4 times higher than that by men [5]. Women are reported to be more vulnerable to suicide because they have lower socioeconomic levels than men [6], such as income, education, and employment, and a higher prevalence of mood and anxiety disorders, including depression [7]. Therefore, a detailed approach that considers the changing trends in suicide rates and differences in suicide rates by gender and age is needed to develop policies to effectively reduce suicide rates.

Thus, this study aims to update Korean women’s suicide death statistics, suicide rate trends, gender- and age-specific suicide characteristics, and suicide means over the past 10 years from 2011 to 2021. The trends identified can provide basic data for policy establishment for suicide prevention at the present time when women face increasing vulnerable factors.

Methods

**Ethics statement:** This study was a secondary analysis of existing mortality data and did not require Institutional Review Board approval or informed consent.

**Data sources**
This study used cause-of-death statistics from Statistics Korea to analyze trends in suicide deaths among Korean women. The cause-of-death statistics were compiled based on death certificates collected by Statistics Korea. In this study, microdata on cause of death statistics from 2011 to 2021 were analyzed through the MicroData Integrated Service of Statistics Korea [8]. This data includes demographic characteristics of the deceased and detailed causes of death, including external factors (accidents, etc.). To increase the accuracy of causes of death, Statistics Korea reflects administrative records from institutions such as the National Cancer Center, Health Insurance Review and Assessment Service, and the National Institute of Scientific Investigation.

**Study variables**
The variables used in this study were total deaths, suicide deaths, suicide death rates, female mortality rates, and means of suicide.

**Definition of terms**
**Suicide deaths**
This refers to the act in which an individual, with the intention of causing their own death, deliberately ends their own life using any means or method (in cases where parents commit suicide with young children, the death of young children is classified as homicide rather than suicide) [1].

**Age-standardized suicide death rate**
The death rate was adjusted to account for the impact of age structure on mortality levels, allowing for mortality comparisons between populations with different age distributions [1].

**Suicide means**
Among the classification codes according to the Korean Standard Classification of Diseases, the codes of suicide means are further subdivided (X60–X84). They are as follows: hanging (X70); fall (X80); carbon monoxide (X67.0–X67.4); pesticides (X68); drowning (X71); other and unspecified gases (X67.8–
X67.9); drugs (X60–X64); and others (X65, X66, X72–X79, X81–X84) [1].

Statistical methods
Data on all deaths were used as the statistical data and analyzed using descriptive statistics and calculations according to the formula based on the definition of terms.

Results
In 2021, the number of suicide deaths in Korean men and women reached 13,352, an increase of 157 (1.2%) compared with the previous year, with a suicide rate of 26.0 per 100,000 population (Table 1). The suicide rate peaked at 31.7 per 100,000 population in 2011 and then showed a declining trend for 6 years. However, in 2018, the suicide rate increased again to 26.6 per 100,000 population, temporarily dropping to 25.7 in 2020, but rebounding to 26.0 in 2021.

Trends in suicide rates by gender
Examining the trend in suicide rates by gender, in 2021, the number of suicide deaths among women reached 4,159, with a suicide rate of 16.2 per 100,000 population, a 1.4% increase from the previous year (Table 1). In the "age-standardized suicide death rate," which eliminates differences in age structures among nations, women’s suicide rate increased by 2.1% compared with the previous year, indicating a larger increase in suicides in women. The gender-specific suicide rate difference, which was 23.2 per 100,000 population in 2011, decreased to 19.7 in 2021, signifying a gradual increase of suicide among women and a narrowing gender gap in suicide rates.

Trends in suicide rates by age
Over the past 10 years (2011–2021), the suicide rate for all women has shown an overall downward trend (Figure 1). Compared with 2011, the age-specific suicide rate in 2021 decreased in all age groups over 20 years, with the largest decreases in the 70–79 and over 80 years age groups at 50.5% and 60.0%, respectively. However, compared with 2020, the age-specific suicide rates in 2021 increased to 8.4%, 1.2%, and 7.0% for the under 20, 20–29 years, and 30–39 years age groups, respectively. Since 2018, suicide rates have increased significantly in the 20–29 and 30–39 years age groups. Suicide rates among young women in their 20s and 30s increased markedly in 2020 and 2021, during the coronavirus disease 2019 (COVID-19) pandemic (Table 2).

Trends in suicide rates by means
In the recent 3-year period (2019–2021), the most common means of suicide for women were hanging (46.9%), falling (24.5%), and carbon monoxide (8.0%) (Figure 2). Drugs (sedative-hypnotic drugs, psychotropic drugs, etc.) and carbon monoxide poisoning are two of the means of women’s suicide that have steadily increased from 2011 to 2021. Specifically, drug use increased 220.5% and carbon monoxide increased 134.3%, whereas pesticide poisoning and hanging decreased significantly to 75.0% and 28.8%, respectively (Table 3).

Table 1. The number of suicide death, suicide death rate, and age-standardized suicide death rate (South Korea, 2011–2021)

<table>
<thead>
<tr>
<th>Year</th>
<th>Suicide deaths (person)</th>
<th>Suicide death rate (per 100,000 population)</th>
<th>Age-standardized suicide death rate (per 100,000 standard population)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>2011</td>
<td>15,906</td>
<td>5,040</td>
<td>10,866</td>
</tr>
<tr>
<td>2012</td>
<td>14,160</td>
<td>4,538</td>
<td>9,622</td>
</tr>
<tr>
<td>2013</td>
<td>14,427</td>
<td>4,367</td>
<td>10,060</td>
</tr>
<tr>
<td>2014</td>
<td>13,836</td>
<td>4,100</td>
<td>9,736</td>
</tr>
<tr>
<td>2015</td>
<td>13,513</td>
<td>3,954</td>
<td>9,559</td>
</tr>
<tr>
<td>2016</td>
<td>13,092</td>
<td>3,849</td>
<td>9,243</td>
</tr>
<tr>
<td>2017</td>
<td>12,463</td>
<td>3,541</td>
<td>8,922</td>
</tr>
<tr>
<td>2018</td>
<td>13,670</td>
<td>3,808</td>
<td>9,862</td>
</tr>
<tr>
<td>2019</td>
<td>13,799</td>
<td>4,069</td>
<td>9,730</td>
</tr>
<tr>
<td>2020</td>
<td>13,195</td>
<td>4,102</td>
<td>9,093</td>
</tr>
<tr>
<td>2021</td>
<td>13,352</td>
<td>4,159</td>
<td>9,193</td>
</tr>
<tr>
<td>2021 compared to 2011 (%)</td>
<td>-16.1</td>
<td>-17.5</td>
<td>-15.4</td>
</tr>
<tr>
<td>2021 compared to 2020 (%)</td>
<td>1.2</td>
<td>1.4</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Discussion

The gender ratio of suicide rates has decreased, indicating a relatively higher increase of suicide deaths in Korean women compared with men [1]. Furthermore, in 2021, the women’s suicide death rate reached 16.2 per 100,000 population, a significant increase of 1.4% from the previous year [1].

The foreign press concluded that the high suicide rate of young Korean women influenced this trend, noting that Korea’s suicide rate, which had been on the decline over the past decade, began to increase again in 2018, and was the highest among OECD member countries [9]. In Korean society, women are expected to take on the dual roles of household chores and childcare, while also participating in the workforce. This contradictory situation,
Figure 2. Composition of means of suicide (South Korea, 2019–2021).

*Others: X65 (alcohol, organic), X66 (solvents, halogenated hydrocarbons, their vapors), X69 (other and unspecified chemicals and noxious), X72–X79 (handgun; rifle, shotgun, larger firearm; other and unspecified firearm; explosive material; smoke, fire, flames; steam, hot vapors, hot objects; sharp object; blunt object), X81–X84 (jumping or lying before moving object; crashing of motor vehicle; other specified means; unspecified means).

Table 3. Women’s suicide rate by means (South Korea, 2011–2021; per 100,000 population)

<table>
<thead>
<tr>
<th>Year</th>
<th>Drugs</th>
<th>Carbon monoxide</th>
<th>Other and unspecified gases</th>
<th>Pesticides</th>
<th>Hanging</th>
<th>Drowning</th>
<th>Fall</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0.3</td>
<td>0.6</td>
<td>0.1</td>
<td>3.3</td>
<td>10.0</td>
<td>0.5</td>
<td>4.2</td>
<td>1.2</td>
</tr>
<tr>
<td>2012</td>
<td>0.3</td>
<td>0.6</td>
<td>0.2</td>
<td>2.7</td>
<td>8.4</td>
<td>0.6</td>
<td>4.2</td>
<td>1.1</td>
</tr>
<tr>
<td>2013</td>
<td>0.3</td>
<td>0.9</td>
<td>0.2</td>
<td>1.8</td>
<td>8.4</td>
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<td>3.0</td>
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<td>0.6</td>
<td>3.8</td>
<td>0.7</td>
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<td>1.2</td>
<td>0.2</td>
<td>0.9</td>
<td>7.7</td>
<td>0.6</td>
<td>3.7</td>
<td>0.9</td>
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<td>3.7</td>
<td>0.8</td>
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<tr>
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<td>0.2</td>
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<td>7.1</td>
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<td>4.3</td>
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<td>220.5</td>
<td>134.3</td>
<td>57.1</td>
<td>–75.0</td>
<td>–28.8</td>
<td>46.9</td>
<td>0.7</td>
<td>–36.1</td>
</tr>
<tr>
<td>2021 compared to 2020 (%)</td>
<td>20.6</td>
<td>28.3</td>
<td>–30.0</td>
<td>–1.9</td>
<td>–8.1</td>
<td>–1.9</td>
<td>14.2</td>
<td>–5.9</td>
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coupled with discrimination in the workplace, contributes to an increase in suicide among Korean women [9]. Analyzing the proportion of non-regular workers in 2022, women accounted for 55.2%, which is 10.4% higher than men, and the proportion of non-regular men and women workers by age group was highest in those 60 years or older (31.3%), followed by 50–59 years (21.1%) and 20–29 years (17.3%) [10]. During the COVID-19 pandemic, the service industry was particularly devastated, and naturally, young women were inevitably affected [10]. Even before the pandemic, however, Korean women have been a vulnerable group regarding employment and self-reliance, compared to their male counterparts. During the 2008 financial crisis in Korea, non-regular workers were converted to part-time workers, and women occupied more of the lower-income portion of the workforce; women became assistants and worked mainly in the service sector [11]. Women are significantly impacted when so-
cioeconomic crises worsen. Pervasive gender discrimination, the instability of female employment, violence against women, the burden of balancing work and family life, and the feminization of poverty have been pointed out as preexisting factors that deteriorate the quality of life for women in Korea [12]. Specifically, the degradation of the quality of life among young Korean women is attributed to factors such as a lack of career advancement opportunities, gender discrimination, biases, relative deprivation compared to men, economic weakening owing to job disparities or lack of promotions, and domestic violence [10]. As a countermeasure, suicide prevention policy should focus on changing the overall social atmosphere, gender-discriminatory appearance standards, and the culture that tolerates sexual abuse using hidden cameras. Violence against women in the labor market, such as sexual violence, dating violence, sexual contempt, and bullying should not be condoned [13]. Enforcing workplace policies that eliminate discrimination can foster women's independence and hope. Additionally, policies that allow for career breaks during marriage or childcare will enable women to be equal members of society and participants in the labor market, as individuals who work together for social development.

Since 2011, the suicide rate for Korean women aged 70 years and older has continued to decline, and the decline is significant. While this is a positive phenomenon, there is still a high rate of suicide among this age group compared with women in other age groups. In this regard, greater attention should be given to older women living alone, especially as Korea has the largest number of poor seniors among OECD countries [14], and economic differences owing to insufficient income and gender wage gaps have emerged as social problems [14]. The suicide rate owing to physical disease problems is higher than that of other age groups [6] and the subsequent economic burden is also a major cause of the high suicide rate [6]. Despair, loneliness, and the death of a meaningful person or spouse can increase suicide rates among older adults [5,15]. This means that as women's lifespan increases [16], the number of older people living alone increases, and the proportion of older women at risk of suicide also increases.

In 2020, 35.1% of households with a head of household age 65 years or older were single-elderly households. Of these, 44.1% were in their 70s, and 71.9% were women [17]. These older adults living alone rated their subjective health negatively, had poorer overall healthcare practices than all older adults, and 44.6% were self-supporting [17], indicating both economic poverty and healthcare vulnerability. Korean women experience a 1.5 to 2 times higher prevalence of depression than men [7], a systematic review of suicide among older Koreans living alone reported a high proportion of women aged 70 years and older living alone and found that higher levels of depression and lower levels of social support were associated with a higher risk of suicide [18].

According to a previous study [18], depression had the strongest effect on suicidal ideation in older adults, and higher levels of depression were associated with higher levels of suicidal ideation. However, social support from the family had a moderating effect on the relationship between depression and suicidal ideation. This indicates that older people living alone and with limited family support are more likely to be depressed and suicidal. Therefore, there is a need to screen older women for depression and provide them with community-based social support. Currently, Korea is conducting various types of projects for vulnerable populations through integrated health promotion programs. Nurses can promote mental health and counteract the vulnerability among older women living alone, especially through the effective implementation of home-visiting health care programs [19].

There are multiple factors to consider in the recent increase in suicide rates found among young women in their 20s and 30s, e.g., a steep increase starting in 2018 and a 7.0% increase from 2020 to 2021 in women in their 30s. The relationship between individual unhealthy behaviors, such as smoking and drinking, and suicide risk; and with environmental vulnerability during the COVID-19 pandemic are worth examining. Current smoking prevalence is the percentage of people who smoked five or more packs of cigarettes in their lifetime and are currently smoking. Among Korean men, the current smoking prevalence has continued to decline from 47.3% in 2011 to 31.3% in 2021, whereas it remained similar among women, from 6.8% in 2011 to 6.9% in 2021 [20]. In particular, Korean women in the 20–40 years age group showed an increasing trend in smoking rates compared with other age groups [21].

Meanwhile, monthly drinking rates (drinking at least once a month in the past year) for Korean women in 2021 were 60.6% for 19 to 29-year-olds and 56.9% for 30 to 39-year-olds, with more than half of the women reporting daily drinking [22]. In the 2021 data, women aged 30–39 years reported the highest rate of high-risk drinking, at 13.2%, followed by those aged 19–29 and 40–49 years at 10.7% [23]. A previous study [24] that analyzed data from the Korean National Health and Nutrition Examination Survey found that suicidal ideation was 1.56 times higher among alcohol abusers than among moderate drinkers, and 1.34 times higher among current smokers than among non-smokers. Furthermore, compared with nonsmokers and moderate drinkers, current smokers and alcohol abusers had a 2.13 times higher risk of suicidal ideation and a 3.81 times higher risk
of suicide attempts [23]. Given that smoking and drinking in women have been reported to be significantly associated with the risk of suicide death [25], the increasing prevalence of smoking and risky drinking in young women may be related to the increasing suicide rate. Therefore, efforts should be made to increase health-promoting behaviors in women.

After the COVID-19 pandemic, the issues have been managed through “COVID-19 Women’s Employment Crisis Recovery Measures” [26], “Elderly Welfare Policy” [27], but support has been concentrated on women in their 30s and 50s, women who are responsible for caring, and older women. Notably, the large increase in suicide rates among women in their 20s in 2020 and 2021 may reflect the impact of the COVID-19 pandemic in this context, the lack of support for young women aged 20–30 years. The pandemic appears to have negatively impacted women more than men, with women experiencing mental health issues such as loneliness, depression, anxiety, and posttraumatic stress disorder symptoms, as well as an increased risk of violence against women at home and in the workplace [28]. Loneliness has been reported to be a significant predictor of suicidal thoughts and behavior [29]. A study on deaths before and after the COVID-19 outbreak in Korea [30] reported that the actual number of suicides among women and those under the age of 34 in 2020 significantly exceeded the predictions of suicide rates based on pre-COVID-19 data. This supports the notion that the negative impact of the pandemic on women is associated with increased suicide rates among younger women. Furthermore, the number of Korean women in their 20s and 30s who received medical care for depression in the first half of 2020 increased significantly compared to that in 2019 [31]. Social isolation and loneliness due to social distancing [32] during a pandemic, such as COVID-19, can have a huge impact on mental health, especially for young women, and efforts should be made to ameliorate this.

Drug and carbon monoxide poisoning as a means of suicide among Korean women has steadily increased over the past decade, whereas suicide deaths by pesticide poisoning have decreased significantly. Regulations on the means of suicide, such as the 2012 ban on highly toxic pesticides in Korea [33], appear to have led to a decrease in actual suicide deaths due to pesticide poisoning. Indeed, the restriction of lethal means of suicide is an important component of suicide prevention strategies, as seen in Denmark [34] and Switzerland [35]. The increase in women’s suicide deaths due to drug and carbon monoxide poisoning suggests that women are more likely to choose nondramatic means of suicide as compared to men [36], especially given the ease with which sedatives and sleeping pills can be purchased online as well as charcoal burning that causes carbon monoxide emission. Korea’s Fifth Basic Plan for Suicide Prevention, established in 2023 [33], specifies aims to strengthen the management of risk factors in relation to the means of suicide, including places with a high frequency of suicide, suicide-related media reporting, and restricting dangerous and/or lethal means of suicide. Additionally, gender-specific patterns of suicide means should also be considered.

This study updates Korean women’s suicide death statistics, suicide rate trends, gender- and age-specific suicide characteristics, and suicide means outcomes for the past decade from 2011 to 2021. The results showed that women in their 20s and 30s and women aged 70 years or older were more at risk of suicide deaths in Korea. In addition, there has been a recent increase in drugs and carbon monoxide as the preferred means of suicide for women. Therefore, more sensitive and responsive policies are needed and the following measures should be considered to reduce the suicide rate among women: improve employment; expand mental health promotion programs to mitigate depression; encourage health-promoting behaviors to reduce alcohol consumption and smoking in women; manage women’s preferred means of suicide, and increase sociocultural intolerance of sexual and dating violence.

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Authors’ contributions

Conceptualization: Choi H, Jang H; Formal analysis: Kang B, Lee S, Park S; Writing–original draft: Choi H, Jang H, Kang B; Writing–review & editing: Choi H, Jang H.

Conflict of interest

Hyunkyung Choi has been an editorial board member of the Korean Journal of Women Health Nursing since January 2022. She was not involved in the review process of this manuscript. Otherwise, there is no conflict of interest to declare.

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Korean Society of Women Health Nursing. However, the opinions are the authors’ alone.

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.

1-1. QUALIFICATION FOR AUTHORS AND LANGUAGE

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

1-2. RESEARCH AND PUBLICATION ETHICS

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

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

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

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

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

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

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

1-3. TRIAL REGISTRATION & DATA SHARING
This journal follows the data sharing policy described in “Data Sharing Statements for Clinical Trials: A Requirement of the International Committee of Medical Journal Editors (ICMJE)” (https://doi.org/10.3346/jkms.2017.32.7.1051). As of July 1, 2018 manuscripts submitted to ICMJE journals that report the results of interventional clinical trials must contain a data sharing statement as described below. Clinical trials that begin enrolling 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.

1-4. PEER REVIEW PROCESS
All contributions (including solicited articles) are critically reviewed by the editorial board members, and/or reviewers. If the manuscript does not fit the aims and scope of the Journal or does not adhere to the Instructions to Authors, it may be returned to the author immediately after receipt and without a review. Before reviewing, all submitted manuscripts are inspected by Similarity-Check powered by iThenticate (https://www.crossref.org/services/similarity-check/), a plagiarism-screening tool. Reviewers’ comments are usually returned to authors. The decision of the editor is final. Manuscripts are sent simultaneously to two reviewers for double blinded peer review. A third reviewer will be assigned if there is discrepancy. Authors will receive notification of the publication decision, along with copies of the reviews and instruction for revision, if appropriate, within two months after receipt of the submission.

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

Peer review process for handling submissions from editors, employees, or members of the editorial board: All manuscripts from editors, employees, or members of the editorial board are processed same to other unsolicited manuscripts. During the review process, submitters will not engage in the selection of reviewers and decision process. Editors will not handle their own manuscripts if they are commissioned ones.
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The author will also be asked to confirm that the material has not been published or submitted for publication elsewhere. All material published in the Journal will be copyrighted by Korean Society of Women Health Nursing. This is an Open Access journal distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

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

Please read all instructions before submitting.

Be prepared to enter:

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

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

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

1-8. ARTICLE PROCESSING CHARGES AND REPRINTS

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

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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? Any purpose</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>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>
</tr>
</tbody>
</table>
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).

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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 un-published 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

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

Maximum number of words excludes the abstract, references, tables, and figure legends.

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

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

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

**Who is responsible for resolving and handling complaints and appeals?**
The Editor, Editorial Board, or Editorial Office is responsible for them. A legal consultant or ethics editor may be able to help with decision making.

**What may be the consequence of the remedy?**
It depends on the type or degree of misconduct. The consequence of resolution will follow the guidelines of COPE.

4. Direct Marketing
Journal propagation has been done through the journal website and distribution of an introduction pamphlet. Invitations to submit a manuscript are usually focused on the presenters at conferences, seminars, or workshops if the topic is related to the journal's aims and scope.
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=) or the Guidelines on Good Publication Practice (https://publicationethics.org/guidance/Guidelines) can be applied.

1. Conflict-of-interests Statement

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2. Statement of Human And Animal Rights

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

3. Statement of Informed Consent

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

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

All submitted manuscripts should be original and should not be considered by other scientific journals for publication at the same time. Manuscripts are accepted for publication with the understanding that their contents, or their essential substance, have not been published elsewhere, except in abstract form or by the express consent of the Editors. Any part of the accepted manuscript should not be duplicated in any other scientific journal without the permission of the Editorial Board. The duplication will be checked through SimilarityCheck powered by iThenticate (https://www.crossref.org/services/similarity-check/) before review. If duplicate publication related to the papers of this journal is detected, the authors will be announced in the journal and their institutes will be informed, and there also will be penalties for the authors. Materials taken from other sources must be accompanied by writ-
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Author’s Checklist

☐ This manuscript has not been submitted for publication elsewhere and follows the Publication and Research Ethics of the Korean Journal of Women Health Nursing.

Title page
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Manuscript preparation
☐ 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
Title: ____________________________________________________________

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