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Korean Society of Women Health Nursing

Aims and Scope

The *Korean Journal of Women Health Nursing* is the primary source of information for meeting the challenges of providing optimum healthcare for women. This authoritative peer-reviewed journal publishes the latest clinical and research papers on health issues that affect women throughout their lifespan. The Journal aims to be the core resource for cutting-edge advancements and clinical applications of new nursing practice, therapeutic protocols for the management of health problems in women, and innovative research in gender-based issues that impacts treatment and nursing care.

The emphasis of the journal is on clinical nursing practice and education on the social science components relevant to women's health issues. Topics covered include nursing care, education and research methodology for ante-, intra-, and post-partal women, for middle aged and elderly women's health, and for socio-cultural issues and therapies.

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, 1995 - Vol. 6, no. 1, 2000, pISSN: 1225-9543), and the *Journal of Korean Academy of Women's Health Nursing* (Vol. 6 No. 2, 2000 - Vol. 7. No. 2, 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, 2012- 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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***Korean Journal of Women Health Nursing* is indexed in Scopus and stepping closer to international connectivity**

Sue Kim

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I am delighted to announce that the *Korean Journal of Women Health Nursing* (KJWHN) received notice from the Scopus Content Selection and Advisory Board (CSAB) on April 13, 2021, that the journal will be included in the Scopus database.

This recognition from Scopus builds on the dedication and tireless work of prior editors-in-chief and editorial board members and signals the continuous work needed for KJWHN to continue its growth while striving for international connectivity.

The journal was launched in March 1995 under its previous title, the *Journal of Korean Women's Health Nursing Academic Society*, publishing eight articles in the first issue. Till June 2012 the journal has been published under the current title. Throughout the past 25 years, KJWHN has been "The" scholarly platform for sharing among Korean nurses in maternal and women's health for nurses in clinical practice, nurse researchers, and students alike. KJWHN was an early pioneer among Korean nursing journals in terms of offering open access since 2008 and being included in CINAHL in 2009, as well as the Directory of Open Access Journals (DOAJ) in 2013.

The following timeline illustrates our path of seeking and achieving Scopus status, which may help other journals: In 2013, the first application to Scopus was submitted. A few months later, the editorial office received notice of rejection with the following comments: "Citedness is below expectations. There is no international diversity among authors. Some part of reference listing is inconsistent with the author instructions."

Acting on these comments, the editorial board was expanded and editors' efforts to advertise the journal and encourage international authors resulted in a manuscript submission from Turkey, which was eventually published.

In August 2015, the second application was submitted, and another letter was received in November 2016, citing the following rejection reasons: "Some part of reference listing is inconsistent with the author instructions. There is no international diversity among editors and low citation activity on editorial board level."

In response, the editorial board worked over the past 4 years to overcome the shortcomings before reapplying in January 2021. It adopted an internal system to screen for inconsistencies with author instructions, including the reference list and conducted regular training of editorial board members. Furthermore, since 2020, KJWHN has invited a professional manuscript editor to ensure consistency with author instructions. Regarding the second limitation, the editorial board and international advisory board were restructured and expanded. While KJWHN had six international advisory board members from three countries in 2016, this was expanded to nine international mem-

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bers from five countries across three continents as of January 2021. These international members are active professionals in their field, and are contributing to the journal via peer-review as well as writing invited papers for the journal. Finally, for citation activity, editorial board members' academic activity was made available on our website via Scopus Author ID and ORCID links. In addition to addressing the specific comments, editors have worked diligently to improve the journal according to international standards. The journal went through three rounds of revising author guidelines for clarity since 2020, created a statement on *Principles of Transparency and Best Practice in Scholarly Publishing* version 3 [1], updated the publication ethics content to reflect international academic publishing recommendations, such as the Committee on Publication Ethics (COPE), and formally enlisted the expertise of an Ethics Editor. The journal moved to a new English-based online submission system that facilitates journal management for authors and reviewers from Korea and abroad (<https://submit.kjwhn.org>). Our new English-based website continues to support full open access (<https://kjwhn.org>), in addition to translations powered by Google in 80 languages and metrics information. Information on funding sources was made available from 2020.

After implementing these changes, in January 2021, the third application to Scopus was submitted. The acceptance letter from CSAB, received on April 13, 2021, included the following comments: "The previous and current editorial teams are to be commended on the development which has led to extended citations in international research journals. Many papers have been cited.

The development of the ethical standards throughout is very clear and in keeping with both COPE and Scopus guidance. The use of the COPE et al.'s 2018 Principles of Transparency guidance was especially of value and demonstrates an ongoing attention to publishing practice and ethical content of the journal."

While I am delighted the journal is now accepted into the Scopus database, I realize this is a timely opportunity and significant time of reflection for KJWHN to consider how to potentiate its value for authors and reach a wider international readership in the coming future. In this line, I want to add a few notes on how the journal seeks to further improve itself over the next few months.

Citations are a constant challenge for all journals. While the adage for academia is 'publish or perish,' for journals this seems to have become what I shall term 'be cited to survive and thrive.' The total cites in the Scopus database have increased annually as follows: 71 in 2017, 96 in 2018, 123 in 2019, and 125 in 2020. The majority of citations, however, are from Korean journals in Scopus, both nursing and others (Figure 1). Also, most citations are from Korea (330 documents), followed by the United States (51 documents) and Iran (Figure 2). Now that references of the journal will be added to the Scopus database, I look forward to journal metrics improving and greater opportunities to increase international connectivity.

I will continue to examine our policies to be up-to-date with international scholarly publishing trends and directions. From the June issue, several changes were implemented: Firstly, data sharing is now possible through Harvard Dataverse (<https://dat>

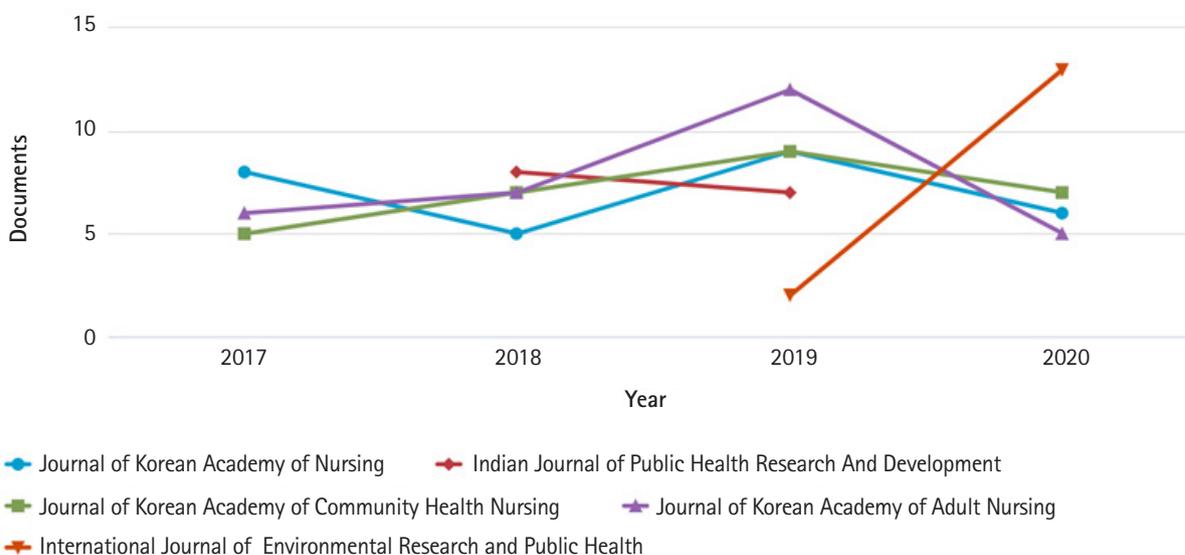


Figure 1. Documents per year by cited source for the *Korean Journal of Women Health Nursing* per Scopus database.

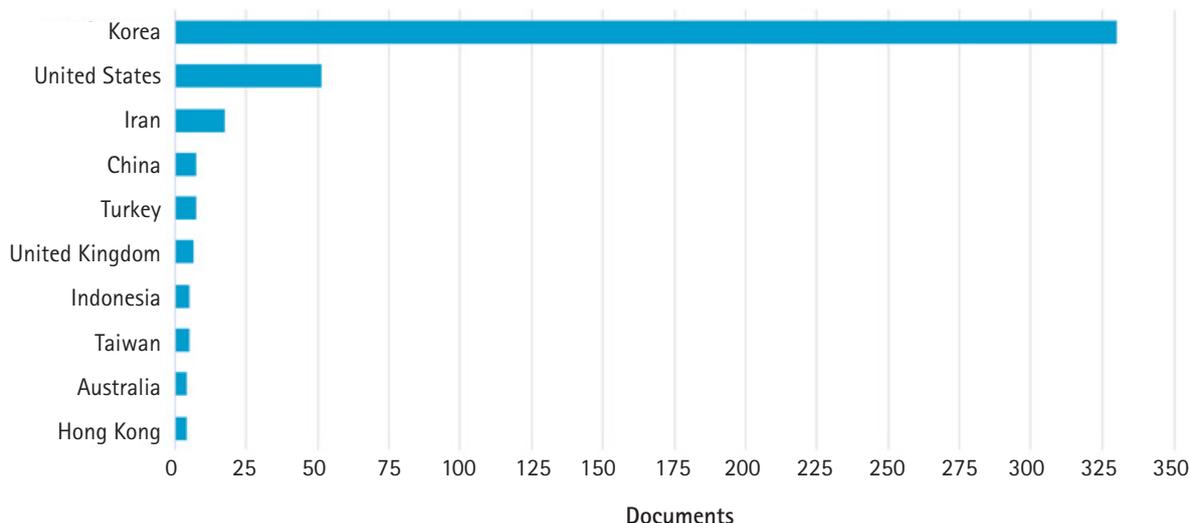


Figure 2. Citing documents by country or territory for the *Korean Journal of Women Health Nursing* per Scopus database.

Table 1. Recommended maximums for articles submitted to the *Korean Journal of Women Health Nursing*

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

^{a)}Maximum number of words excludes the abstract, references, tables, and figure legends.

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

averse.harvard.edu) for authors who wish to share data for transparency and replicability. Also, ascribing to internationally accepted reporting guidelines, e.g., those suggested by the Equator network (<https://www.equator-network.org/>), is being applied. In addition to these updates to the author guidelines, the following will be applied from the 2021 September issue: Manuscript types for submission have been expanded and requirements for each type have been clarified (Table 1).

Readers may notice that the majority of articles are in English in this issue. Some Korean journals have chosen to switch to publishing fully in English, such as the *Archives of Plastic Surgery* (APS) and more recently, *Child Health Nursing Research*, a domestic nursing journal. In the case of APS, since switching to English-only manuscripts in 2012, publication metrics improved and it was accepted for the Scopus database in 2013 and included in the Web of Science Core Collection in 2016 [2,3]. Indeed, the exponential growth over a short period of roughly 4 years follow-

ing the English-only policy, appears to suggest an exemplary pathway for other Korean journals. Considering the criticism about structural bias towards Western, English-based research among global databases such as Web of Science and Scopus [4], and the inherent bias of impact factors against non-English language and culture-bound health fields [5], perhaps this is indeed a tested, recommendable strategy. However, not all journals can immediately focus on becoming international-based journals publishing only in English, nor should this be the automatic ‘gold standard’ for all. Publishing in the native language is justified and necessary, especially in cases when local applications of the research or domestic impact of the articles are more relevant and important for the national and/or regional community [6]. An example is the series of method papers on measurement tool reliability and validity, that are purposively being published in the Korean language since our 2021 March issue [7,8], as a means of clarifying Korean terminology and conceptual understanding for

our Korean readers.

Nevertheless, an analysis of natural science journals from several countries publishing in English or other languages, reported that English publications had a higher number of citations than those published in other languages, even when controlling for the effect of the journal, year of publication, and paper length [6]. It is worthy to consider the authors' interpretations that English articles have the advantage of reaching a larger audience, may avoid limitations in scientific perspective, and can be conducive for potential scientific collaboration. As such, journals often have to weigh serving the needs of domestic readers and scholars through native language publications, while expanding English publications for the sake of increasing international interest and citations. KJWHN will continue to value Korean-language submissions in order to serve the Korean scholarly community, while it will simultaneously focus on offering quality English articles, both from within and abroad. This is in line with KJWHN's mission to ultimately become a top-tier journal for women's health nursing in Asia.

The success of our efforts will largely depend on a solid number of submissions. I invite authors to submit their work, especially systematic review and meta-analysis papers, experimental design studies, exploratory qualitative research, and methodology manuscripts. For descriptive and correlational research design manuscripts, I encourage authors to include a description of the theoretical or conceptual framework used to ground their quantitative research, which has been emphasized as good practice [9].

The present achievements of KJWHN have been possible through the support and cooperation of society members and readers worldwide. I truly appreciate all of them for their contribution. To promote the journal to an internationally top-ranking one, the continuous attention of nursing scholars in Korea and worldwide are essential. The journal will continue to promote maternal and women's health nursing by following international publishing standards and thoroughly editing and publishing manuscripts.

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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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Practical issues and research trends of oncofertility in gynecologic cancer

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Introduction

Cervical, endometrial, and ovarian cancer are the most common gynecologic cancers in Korea (hereafter, Korea) [1]. Cervical cancer is the most common, followed by endometrial and ovarian cancer [1]. In a major change in the epidemiology of gynecologic cancer in Korea, the incidence of cervical cancer is rapidly decreasing and the incidence of endometrial cancer and ovarian cancer is rapidly increasing [2]. Notably, although the incidence of cervical cancer is decreasing overall, the incidence of cervical cancer and endometrial cancer is increasing among young women [2]. In addition, as the birth rate falls and the average age at which women first give birth gradually increases, the incidence of gynecologic cancer among young women who have not yet undergone childbirth is also increasing [3]. Therefore, there has been a greater impetus in recent years on preserving fertility in young women with gynecologic cancer. For young women who have not undergone childbirth, the preservation of fertility after treatment for gynecologic cancer has a significant impact on their quality of life. For early-stage gynecologic cancers, fertility-sparing treatment makes future pregnancy possible by treating the cancer and leaving parts of the uterus and ovaries intact. For advanced gynecologic cancers, treatments that leave the uterus and ovaries intact are not always possible, and radiation therapy or chemotherapy, which can lead to infertility, are often required. Therefore, assisted reproductive technology is required to preserve fertility. This article describes methods for preserving fertility in young women with gynecologic cancer and examines practical issues and research trends related to oncofertility in gynecologic cancer.

Fertility-sparing treatment for young women with early-stage gynecologic cancer

The cure rate for stage I gynecologic cancers is very high, underscoring the need to focus on improving patients' quality of life. Fertility preservation after gynecologic cancer treatment in young women who have not yet given birth to children is one of the major quality of life problems for this

population. Guidelines for safe fertility-sparing management in women who want to become pregnant after treatment for gynecologic cancer have been established to some extent based on the results of numerous studies.

Fertility-sparing treatment for young women with early-stage cervical cancer

Radical trachelectomy is a fertility-sparing surgical treatment for young women with early-stage cervical cancer who want to preserve fertility [4]. In this surgical procedure, the cervix, paracervical tissue, and upper vagina are removed, and the thin rim of the cervix and the uterine body are left to connect to the vagina [5]. The widely accepted criteria for considering radical trachelectomy are as follows: (1) the patient is a young woman who eagerly wants to preserve fertility; (2) the patient has stage I cervical cancer that is confined to the uterine cervix; (3) the tumor size is < 2 cm; (4) squamous cell carcinoma, adenocarcinoma, or adenosquamous carcinoma is present, and (5) the patient shows no evidence of prior infertility [6]. Radical trachelectomy can be performed through vaginal, abdominal, laparoscopic, and robotic surgical approaches. The first procedure of this type that was performed was vaginal radical trachelectomy [5,7]. However, the procedure for the vaginal approach is difficult to learn, and the radicality of the operation is limited. To compensate for these shortcomings, an abdominal approach was developed [8]. Considering the advantages of minimally invasive surgery compared to open surgery, this procedure is now often performed using laparoscopic surgery or robotic surgery [9,10]. It was reported that the results of radical trachelectomy tend to be similar to those of radical hysterectomy when the indications for potential patients were adhered to properly [11,12].

According to a recent meta-analysis, there is no substantial difference between vaginal, abdominal, laparoscopic, and robotic radical trachelectomies in terms of oncological treatment outcomes and posttreatment pregnancy outcomes [13-15]. In cases of cervical cancer with tumors larger than 2 cm, research has been undertaken to determine if radical trachelectomy can be performed after the tumor decreases in size as a result of neoadjuvant chemotherapy [16].

In addition, other studies have examined the effectiveness of less radical surgical procedures such as conization or simple trachelectomy for cervical cancer cases where the tumor is small [17]. Research has also been performed to compare the abdominal approach and the minimally invasive approach for radical trachelectomy [18].

Fertility-sparing treatment for young women with early-stage endometrial cancer

For endometrial cancer, fertility-sparing treatment primarily consists of hormone therapy [19,20]. Among the various types of hormone therapies, the most widely used and researched is treatment using progestin [19,20]. High-dose oral progestin such as medroxyprogesterone acetate and megestrol acetate or a progestin-releasing intrauterine device are the most common methods for administering progestin [19,20]. The widely accepted criteria for potential patients of fertility-sparing treatment in endometrial cancer are as follows: (1) the patient is a young woman who eagerly wants to preserve fertility; (2) the patient has stage I endometrial cancer confined to the endometrium; (3) endometrioid adenocarcinoma is present; and (4) the patient shows no prior evidence of infertility [21]. It is known that complete remission occurs in approximately 76% of cases treated with progestin therapy [22,23]. The remaining 24% of patients do not respond to progestin therapy and hysterectomy should be performed instead [22,23]. For patients with complete remission due to progestin therapy, attempting pregnancy immediately is recommended. Since the recurrence rate of endometrial cancer is very high, hysterectomy is recommended after patients in remission complete family planning [22,23]. The pregnancy outcomes after fertility-sparing treatment using progestin are promising [24]. Recent studies have examined a treatment strategy in which all endometrial cancer tissues are removed via hysteroscopic surgery and adjuvant hormone therapy is administered [19,25]. In addition, studies have examined the therapeutic effects of metformin, aromatase inhibitors, gonadotropin-releasing hormone agonists, and several drug combinations [26].

Fertility-sparing treatment for young women with early-stage epithelial ovarian cancer

Epithelial ovarian cancer is the most common histological type of ovarian cancer. Fertility-sparing treatment for women with epithelial ovarian cancer involves preserving the uterus and part of the normal ovarian tissue during surgery to enable pregnancy after treatment [27]. The widely accepted criteria for potential patients with epithelial ovarian cancer to receive fertility-sparing surgery are as follows: (1) the patient is a young woman who eagerly wants to preserve fertility; (2) the patient has stage I epithelial ovarian cancer confined to one ovary; and (3) the patient shows no prior evidence of infertility [28]. In recent large studies, the survival outcomes after fertility-sparing surgery for stage I epithelial ovarian cancer patients were reported to be similar to those of patients who underwent standard surgical treatment

[29,30]. Pregnancy outcomes were also reported to be good [27].

Options to preserve fertility for young women with advanced-stage gynecologic cancer

Surgical treatment for advanced gynecologic cancer can lead to situations in which the uterus and/or ovaries cannot be preserved. In addition, infertility can occur after radiation therapy or gonadotoxic chemotherapy. In this situation, thorough consultation before treatment is required for patients who wish to preserve fertility, and assisted reproductive technology is required.

If the ovaries should be removed surgically or pelvic radiation therapy or gonadotoxic chemotherapy is planned, a strategy to collect and store the patient's eggs is needed before treatment. These methods include embryo cryopreservation, oocyte cryopreservation, and ovarian tissue cryopreservation. Ovarian transposition can also be an option before pelvic radiation therapy. If the patient has a spouse, embryo cryopreservation is the most effective method [31]. However, it takes over 2 weeks for ovarian hyperstimulation, transvaginal ovum pick-up, and fertilization before cryopreservation of an embryo is possible [31]. In the absence of a spouse, oocyte cryopreservation can be performed [31]. Immediately after transvaginal ovum pick-up, the patient's oocytes are frozen, but this process also takes over 2 weeks [31]. As of recently, ovarian tissue cryopreservation can also be performed [32]. One advantage of ovarian tissue cryopreservation is that no additional time is required to induce ovarian hyperstimulation, so there is no need to postpone anti-cancer treatment [32]. If these processes cannot be performed before treatment, ovum donation should be selected as the method for inducing pregnancy.

If the uterus has been removed, a surrogate mother can be used in family planning. The development of artificial uteruses and research in the field of uterine transplantation are in the beginning stages, and no conclusions can be drawn yet.

Conclusion

For women with gynecologic cancers, there are several ways to preserve fertility and perform childbirth after treatment. For women with early-stage gynecologic cancers, one method of doing so is to preserve parts of the uterus and ovaries. If the uterus and ovaries cannot be preserved, or radiation therapy and gonadotoxic chemotherapy are required, assisted reproductive technology can be used as a method to preserve fertility. If a

woman diagnosed with gynecologic cancer wishes to preserve fertility in order to give birth after treatment, it is necessary to discuss these treatment options in detail before treatment.

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Conflict of interest

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측정도구의 심리계량적 속성 2: 구조타당도, 내적일관성 및 교차문화타당도/측정동일성

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Psychometric properties of an instrument 2: structural validity, internal consistency, and cross-cultural validity/measurement invariance

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Structural validity, internal consistency, and cross-cultural validity/measurement invariance are psychometric properties of the internal structure of an instrument. In psychometric studies published in Korean nursing journals, structural validity has mainly been assessed using confirmatory factor analysis. Cross-cultural validity/measurement invariance has rarely been evaluated. It is recommended for Korean nursing researchers to evaluate the internal structure of instruments using a greater variety of methods, such as item response theory, Rasch analysis, multi-group confirmatory factor analysis, and differential item functioning.

Keywords: Cultural validity; Internal consistency; Instrument; Psychometrics; Structural validity

주요어: 문화타당도; 측정도구; 내적일관성; 심리계량적 속성; 구조타당도

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서론

측정도구 개발과정에서 내용타당도 다음으로 실시되어야 할 것은 도출된 예비문항들이 어떻게 척도(하부척도)로 결합되는지를 결정하는 일이다. 다시 말해서, 측정도구의 내적구조(internal structure)를 결정하는 것이다. 심리계량적 속성(psychometric properties) 중에서 도구의 내적구조를 파악하기 위해 실시되는 것은 구조타당도(structural validity), 내적일관성(internal consistency) 및 교차문화타당도/측정동일성(cross-cultural validity/measurement invari-

ance)이다[1].

구조타당도

구조타당도는 개발하려는 도구가 측정하고자 하는 구성개념의 차원(dimension)을 적절히 반영하는가에 관한 것으로, 주로 사용되는 검증방법에는 확인적 요인분석(confirmatory factor analysis, CFA)과 문항반응이론(item response theory, IRT)/라쉬 분석(Rasch analysis)이 있다[2]. 여기서는 통상적으로 많이 사용되는 CFA에 대

해 살펴볼 것이다.

측정도구의 구조타당도 평가를 위한 CFA 사용은 이론 또는 실증적 근거에 입각해서 잠재변수(요인)와 관찰변수(문항)의 관계 및 잠재변수들의 관계에 대해 가설적 측정모형을 만들고, 실제로 수집한 자료와 얼마나 일치하는지를 검증하기 위함이다. 측정모형은 차원에 따라 단일차원(unidimensional)과 다차원(multidimensional) 모델로 구분될 수 있다. 다차원 모델은 일차(first-order)와 고차(higher-order) 수준의 모델로 나눌 수 있고, 이외에도 이중요인(bi-factor) 모델이 있다. 모델의 선택은 구성개념에 대한 이론 및 실증적 근거에 의해 정해진다. 따라서 연구자는 CFA를 적용하기 전에, 관심 있는 구성개념의 이론적 배경이나 실증적 근거에 대해 충분히 파악하는 것이 중요하다.

만약 도구개발에서 측정하고자 하는 구성개념과 관련된 어떤 이론이 사용되었다면, 이를 바탕으로 이미 내용타당도 단계에서 개념적 차원과 각 차원에 속하는 문항들이 정해진 상태일 것이다. 따라서 가설로 세워진 측정모형에 대해 CFA를 실시한다. 하지만 어떤 경우에는 내용타당도에서 구성개념과 관련된 문항들을 도출하였지만, 개념적 차원의 수를 모르거나 도출된 문항들이 어떤 차원에 어떻게 군집되는지에 대한 정보가 없을 수 있다. 이런 경우에는 먼저 탐색적 요인분석(exploratory factor analysis, EFA)을 실시하여 요인의 수와 어떤 문항이 어떤 특정 요인에 의미 있게 연관이 있는지를 확인한다. 이렇게 확보된 실증적 근거를 바탕으로 CFA를 실시한다[3].

사례로 Lee 등[4]이 개발한 당뇨병 환자의 헬스 리터러시 측정도구(diabetes health literacy scale, DHLS)를 살펴보자. 최근 의료보건 분야에서 헬스 리터러시 개념의 중요성이 부각되고 있지만, 상대적으로 이에 대한 이론은 초기단계에 있다. 따라서 측정모형에 사용할 이론적 기틀을 찾기 힘든 상황이라고 할 수 있다. 연구자들은 구성개념이 몇 개의 요인으로 이루어지며 어떤 개념적 속성들이 어떤 요인에 속하는지에 대한 실증적 근거를 만들고, 이 근거를 기틀로 측정모형을 구성해서 CFA를 수행하였다. 즉, 462명의 당뇨병 환자를 모집하고 이를 무작위로 두 개의 표본으로 나누어서, 첫 번째 표본에는 EFA를 실시하여 3개의 요인으로 구성되었다는 것과 각 문항들이 어떤 요인에 속하게 되는지에 대한 실증적 정보를 얻었다. 이렇게 얻은 실증적 정보를 바탕으로, 두 번째 표본으로 CFA를 실시하여 DHLS 구조타당도를 검증하였다. 즉, 각각의 표본에 EFA와 CFA를 적용하여 구조타당도를 교차확인(cross-validation)하는 방법을 사용하였다.

CFA를 수행하기 위해 고려해야 할 사항 중에 하나는 표본크기이다. 일반적으로 많이 사용되는 기준(rule of thumb)은 추정되는 모수의 10배 이상이며, 최소 200 케이스가 사용된다[3]. 예를 들어 측정모형에 두 개의 요인이 있는데, 첫 번째 요인에는 7개의 문항이 있고 두 번째 요인에는 2개의 문항이 있으며 두 개의 요인은 상호관련이 있다고 하자(first-order two-factor model with a total of

nine items). 이 측정모형에서 추정되어야 할 모수는 19로, 필요한 표본크기는 최소 190 (19×10)이 된다. 하지만 최소 200케이스 기준을 고려한다면, 200 이상이 필요하다. 표본크기는 이 외에도 자료의 정규성, 요인의 개수 및 복잡성 등을 고려해서 정해야 한다.

측정모형에 대한 가설이 만들어졌으면, 사용할 통계 프로그램을 결정하고 수집된 자료를 가지고 CFA를 실시한다. CFA를 위한 모수 추정 방법으로 가장 흔히 사용되는 것은 최대우도법(maximum likelihood)으로 대부분의 프로그램에서 초기 설정되어 있다[5]. 최대우도법을 사용하기 위해서는 다변량 정규성(multivariate normality) 가정을 만족해야 한다. 하지만 문항의 점수가 Likert 척도 유형(예를 들어 1, 매우 동의함; 2, 동의함; 3, 동의하지 않음; 4, 전혀 동의하지 않음)의 서열 척도이면, 특히 문항반응의 범주수준의 개수가 2-4일 경우 다변량 정규성을 만족하기 어려워져 편중된 모수 추정이 이루어진다. 다변량 정규성은 Mardia's normalized estimate로 검증할 수 있다[6]. 검증 결과 다변량 정규성의 가정이 위배되면, 다른 추정방법을 고려하거나(예를 들어 weighted least squares, asymptotically distribution-free, 또는 Bayesian estimation 등) bootstrap 방법을 사용한다.

다음 단계는 가설적 측정모형이 수집된 데이터에 적합한지를 결정하는 것이다. 모델적합도를 나타내는 지수는 다양하고 그 평가기준도 전문가마다 조금씩 차이가 있다: $\chi^2/\text{degree of freedom}$, root mean square error of approximation, standardized root mean square residual, comparative fit index, normed fit index, goodness of fit index [7,8]. 간호연구에서는 연구자가 사용한 모델적합지수의 평가기준과 연구자가 인용한 문헌에서 제시된 평가기준이 일치하지 않는 오류가 많이 발생한다.

측정모형 적합도가 만족되지 않으면, 연구자는 모델설정오류(model misspecification)의 가능성을 탐지하게 되며, 가설모형의 적합을 높이기 위해 주로 modification indices (MI)를 사용한다. Lee 등[9]은 당뇨병 관리에 대한 자기효능감 측정도구(Diabetes Management Self-Efficacy Scale, DMSES)의 구조타당도를 검증하기 위해 CFA를 사용하였다. 첫 번째 CFA 수행 결과, 모델적합지수가 기준보다 조금씩 부족하였다. 따라서 MI를 확인해 지수가 가장 높았던 문항 14와 16의 측정오차에 공분산을 설정하고 CFA를 다시 시행한 결과 모델이 유의하게 향상되었다. 이 후, DMSES 문항 16과 17, 그리고 문항 9와 10의 측정오차에 공분산을 차례로 설정하고 두 번의 CFA를 다시 실시하였다. 여기서 중요한 것은 여러 개의 모델수정을 한꺼번에 실시하는 것이 아니라, 하나의 모델수정이 실시될 때마다 기존 모델에 비해 유의하게 향상되었는지를 비교해야 한다는 것이다. DMSES 연구에서는 기존모델과 수정모델의 $\Delta\chi^2$ 가 통계적으로 유의하게 감소했는지를 판단의 근거로 사용하였다. 그리고 연구자는 수정과 관련된 문항들 모두는 당뇨병 식이에 관한 것으로 문항 내용의 중복가능성을 제시하였다.

위의 예제와 같이 모델수정은 한 번에 하나씩 수행되어야 하며,

수정모형이 기존 모형보다 향상되었음을 근거에 입각해서 판단해야 한다. 또한 연구자는 수정된 현상에 대한 설명을 제시해야 한다. 하지만 국내 간호학술지에 게재된 도구개발 논문을 살펴보면, 거의 대부분의 연구에서 여러 개의 수정을 한번의 CFA를 통해 실시하고, 그 결과 사용된 다양한 모델적합도 지수 중 어떤 지수라도 조금 향상되지만 하면 이를 최종모델로 제시하고 있다. 또한 모델수정이 왜 발생했는지 또는 수정의 의미가 무엇인지에 대한 설명은 거의 찾아보기 힘들다.

모델이 전반적으로 적합하다면(overall model fit), 문항이 지정된 요인에 유의하게 적재되었는지(critical ratio value of > 1.96)와 표준화된 요인적재 값이 .50 이상인지, 요인(잠재변수) 간의 관계가 너무 높지 않은지 살펴봐야 한다[10]. Lee 등[11]에 의한 Depression Anxiety Stress Scale (DASS)-12 구조타당도 검증을 사례로 살펴보자. DASS-12는 우울, 불안 및 스트레스 3개의 차원으로 구성된 도구다. CFA 결과 모든 문항이 지정된 요인에 유의하게 적재되었으며, 표준화 요인적재 값은 .655에서 .850로 높았다. 하지만 DASS-12의 우울과 불안 요인의 관계($\phi = .887$), 불안과 스트레스 요인의 관계($\phi = .910$), 그리고 스트레스와 우울 요인의 관계($\phi = .910$)가 모두 높게 나타났다. 이와 같이 요인들 간의 관계가 매우 높게 나타나면, 요인들을 합치거나 고차(higher-order) 모델의 가능성을 고려해야 한다. DASS-12의 경우 단일 요인을 가진 측정 모델은 적합하지 않고 3개 요인으로 구성된 이차수준의 모델이 적합한 것으로 나타났으나, 3개 요인으로 구성된 기존의 일차수준의 CFA 모델과 비교해서 모델 향상이 통계적으로 유의하지 않았다. 따라서 최종적으로 DASS-12는 일차수준의 3개 요인으로 구성된 것으로 결론 내렸다.

간호학술지에 게재된 측정도구 논문을 살펴보면, CFA 결과에서 문항의 표준화된 요인적재 값이나 요인들 간의 관계에 문제가 있음에도 불구하고 연구자가 이에 대한 언급을 하지 않거나 또는 문제가 있음을 진술하고도 어떤 수정이나 해결 없이 타당도 검증을 끝내는 경우가 대부분이다. 2020년 간호학술지에 게재된 측정도구를 살펴보자[12]. 연구자는 CFA 결과 모형적합지수가 만족되었고, 요인적재 값이 .60 이상이므로 3개의 요인으로 구성된 구조타당도가 충족되었다고 하였다. 하지만 문항의 측정오차 6쌍에 대한 모델수정이 있었음에도 불구하고, 수정 과정 및 의미에 대한 언급이 전혀 없었다. 또한 잠재변수(요인)들 간의 높은 상관관계(.74-.85)가 나타났다는데, 다시 말해서 요인들이 독립되지 않았다는 것을 의미하는데도 불구하고 이에 대한 어떤 언급이나 추후 조치가 없었다.

때로는 문항의 표준화된 요인적재 값이나 요인들 간의 관계에 대한 이슈를 언급하기 위해 보조방법을 사용한다. 대표적인 것으로 경제학자인 Fornell과 Larcker [13]가 제안한 평균분산추출(average variance extracted, AVE)을 들 수 있다. 이들이 제시한 AVE 계산은 요인에 포함된 문항들의 표준화된 요인적재 값을 제곱한 합(Σ 요인적재값²)을 표준화된 요인적재 값의 제곱합과 측정오차의 합을 합

한 값(Σ 요인적재값²+측정오차의 합)으로 나누는 것이다. Hair 등 [10]은 Σ 요인적재값²을 요인에 있는 문항의 수로 나누어 산출하는 간단한 방법을 제안하였다. 계산된 AVE가 .50보다 크면, 지정된 요인에서 문항들의 수렴타당성이 충족되었다고 하였다. 두 요인의 AVE 값들 모두가 요인 간에 공유된 분산(shared variance)보다 크면, (요인들 간의) 판별타당성이 만족된다고 볼 수 있다.

다시 위에서 언급한 연구[12]의 사례로 돌아가 보자. 이 연구에서 요인 1, 2, 3의 AVE를 각각 계산하면, .56, .65, .65가 된다. 따라서 각 요인의 문항들의 수렴타당성이 만족되었다고 할 수 있다. 하지만 요인들 간의 판별성에는 문제가 있다. 특히 요인 1과 2의 공유된 분산(요인들 간의 상관계수의 제곱)은 .72 (.85 × .85)로 요인 1과 2의 AVE .56이나 .65보다 높아서 요인 1은 2로부터(또는 요인 2는 1로부터) 분리하기 어렵다고 해석할 수 있다.

Lee 등[14]은 구조타당도에서 AVE 해석에 주의를 기울일 필요가 있다고 강조하였다. AVE를 이용한 문항의 수렴타당성 및 요인들 간의 판별타당성에 대한 해석은 모두 개발하고자 하는 도구의 내적구조(internal structure)를 확인하기 위한 보조방법이다. 그럼에도 불구하고 국내 일부 간호학자들은 개발하고자 하는 도구로 측정된 점수와 연구자가 가설에 의해 선택한 비교개념(comparator)을 측정하는 도구를 사용해서 수집한 점수가 어느 정도로 관련 있는가를 검증하는 외적 수렴타당도 및 판별타당도와 혼동해서 해석하는 경우가 있다고 하였다.

2021년 한 간호학술지에 게재된 Humanistic Practice Ability of Nursing (HPAN) 척도 개발 연구를 살펴보자[15]. 임상간호사 406명을 대상으로 자료를 수집해서 200명의 자료는 EFA 분석에, 나머지 116명의 자료는 CFA 분석에 사용하였다. 연구자는 HPAN 능력모델을 기틀로 사용하여 HPAN 척도를 개발하였다고 했다. 그렇다면 이미 가설로 제시한 측정모델이 있기 때문에 EFA 분석 없이 CFA를 수행할 수도 있었다. 더군다나 CFA에 사용할 표본크기가 116명으로 부족한 상황인데도 불구하고, 왜 직접 CFA를 수행하지 않았을까? 또한 도구개발을 위해 사용한 개념적 기틀에서 구성 개념이 위계적 구조를 가지고 있다는 설명은 없었다(인용된 참고문헌은 중국어로 확인이 불가능하였음). 그럼에도 불구하고 가설로 제시된 측정모델은 왜 이차수준의 위계적 모델이었을까? 이차수준의 모델이 맞다면, 5개의 요인으로 구성된 일차수준의 CFA로 분석한 이유는 무엇이었을까? 만약 연구자가 제시한 측정모형이 맞다면(원문에 제시된 Figure 2), 문항들은 일차수준의 5개의 요인들과 이차수준의 요인 “humanistic practice ability of nursing”에 의해 설명되고, 각 문항은 지정된 일차요인에는 0이 아닌 값으로 적재되며(non-zero), 지정되지 않은 다른 4개의 일차수준의 요인에는 0으로 적재된다는 것을 의미한다. 또한 5개의 일차수준 요인들의 공변이는 전부 이차수준 요인 “humanistic practice ability of nursing”에 의해 설명된다는 것을 말하는 것이다. 이 연구의 측정모델에는 일차수준의 5개 요인들 간의 상관관계에 관한 것은 없음에도

불구하고, 연구자는 일차수준의 5개 요인의 AVE와 요인들 간의 공유된 분산 값을 사용하여 요인들의 판별타당성을 해석하였다. 다시 말해, 도구개발을 위해 사용한 개념적 기틀, 가설로 제시된 측정모델, 그리고 구조타당도를 검증한 방법의 연계성이 부족하다고 할 수 있다.

내적일관성

내적일관성(internal consistency)은 척도(하부척도)에 있는 문항들 모두가 자신들이 속한 그 잠재변수(요인)를 어느 정도로 측정하는지를 말한다[3]. 내적일관성 측정으로 가장 많이 사용되는 것은 Cronbach's alpha이고, 도구개발 연구에서 측정속성으로 가장 많이 검증되는 것이기도 하다[14]. 하지만 측정도구가 다차원인 경우에 문항 전체에 대한 값만 제시하고 하부척도에 대한 α 값을 제시하지 않는 경우들이 종종 있다. α 값은 문항이 많을수록 증가하는 경향이 있다. 그러므로 측정도구가 다차원인 경우에는 전체문항 α 값을 제시할 필요는 없으며, 각 하부척도 α 를 제시해야 한다. 이와 관련하여 연구자들이 종종 범하는 오류는, 내적일관성 검증을 구조타당도 검증 전에 실시하는 것이다. 구조타당도 검증에서 측정도구의 차원(dimension)이 확정되어야 문항 전체에 대한 α 값을 구할 것인지 아니면 하부척도 각각의 α 값을 구할 것인지가 결정되기 때문이다. 최근에는 CFA를 통해 얻은 추정 값들을 이용한 omega index (ω)를 사용하기도 한다[16]. ω 는 Cronbach's alpha보다 조금 더 엄격한 방법으로, 보통 α 값보다 약간 낮게 나타난다. 측정도구 문항 반응이 이분형일 경우에 내적일관성 평가는 보통 Kuder-Richardson Formula 20을 사용한다[17]. 하지만 이분형 응답이 0과 1로 코딩되었다면, Cronbach's alpha로 계산해도 상관없다[3].

위의 고전검사이론에 입각한 내적일관성 평가방법 이외에도 문항반응이론/라쉬 분석에서는 문항/피험자 분리신뢰도(item/person separation reliability or item/person reliability)와 문항/피험자 분리지수(person separation index)를 사용한다. 분리신뢰도는 0에서 1 사이의 값을 가지며 Cronbach's alpha와 거의 유사한 값을 산출하고, 평가기준은 $> .70$ 이다. 분리지수는 0부터 무한대의 값을 가질 수 있는데, > 1.50 이면 수용할 만하다고 할 수 있다[18].

교차문화타당도/측정동일성

교차문화타당도/측정동일성(cross-cultural validity/measurement invariance)은 번역된 측정도구의 문항 또는 척도가 원래 측정도구에서의 문항/척도의 수행 정도를 얼마나 반영하는지에 관한 것이다[1]. 교차문화타당도/측정동일성을 검증하기 위해서는 연구 설계에 비교 집단이 포함되어야 한다. 예를 들어, 어떤 측정도구가 영어와 한국어 버전에서 척도/문항이 동일하게 작용하는지를 알아보기 위함이라면, 언어라는 비교 집단이 있어야 한다.

고전검사이론에서는 교차문화타당도/측정동일성 검증방법으로 다집단 확인적 요인분석(multi-group confirmatory factor analysis, MGCFAs)을 많이 사용한다. 문항반응이론/라쉬 분석에서는 차별 문항기능(differential item functioning, DIFF)이 사용된다[2].

만성질환자의 자가간호에 대한 자기효능감 측정도구(Self-care Self-efficacy Scale, SCSES)에 대한 교차문화타당도 검증 연구에 대해 살펴보자[19]. 미국, 중국(홍콩), 이탈리아 및 브라질의 만성질환자 957명으로부터 SCSES를 사용해서 자료를 수집하고, 교차문화타당도를 검증하기 위해 MGCFAs를 사용해서 분석하였다. 그 결과 SCSES는 4개국 문화에 따라 측정의 동일성이 부분적으로 만족한 것으로 나타났다. 어떤 측정도구는 문화나 언어 이외에 성별, 나이 및 급만성질환 등과 같이 대상자의 특성이나 조건에 따라 민감할 수 있다. 이 같은 도구의 속성을 파악하기 위해 측정동일성을 검증한다. Gomez 등[20]은 성별에 걸쳐서 DASS-21이 측정동일한지를 평가하기 위해서 687명의 성인(남자 227명, 여자 460명)을 대상으로 자료를 수집하고 MGCFAs를 사용하여 분석하였다. 그 결과, DASS-21은 형태동일성(configural invariance) 및 요인계수동일성(metric invariance)을 만족하였다. 즉, 성별에 걸쳐 측정도구의 전반적인 요인구조가 같았고 문항-요인적재(item factor loading)의 강도가 동일하게 나타났다.

이번에는 문항반응이론의 견지에서 실시된 측정동일성 검증에 대해 살펴보자. Lindkvist 등[21]은 제1형 당뇨병을 진단받은 청소년을 대상으로 당뇨병 관리에 대한 자기효능감 도구(Self-efficacy in Diabetes Management, SEDM)를 검증하였다. SEDM은 총 10개의 문항으로 두 개의 하부척도로 구성되어 있다(요인 1: 문항 1-4번은 실제적 관리에 대한 자기효능감, 요인 2: 문항 5-10번은 정서적 자기효능감). 연구자는 SEDM의 문항이 성별집단에 관계없이 동일하게 기능하고 있는지를 확인하기 위해 라쉬 모델을 적용해서 DIFF를 실시하였다. 그 결과 요인 1에서는 성별에 따라 차별적으로 기능하는 문항이 없었으나, 요인 2의 문항 5, 9번은 차별적으로 기능하는 것으로 나타났다. 즉, 성별은 대상자들이 두 문항에 대해 어떻게 반응하는지에 영향을 준다는 것이다. 따라서 SEDS 점수계산은 성별에 따라 보정되어야 할 필요성이 있다는 것을 암시한다.

위와 같은 교차문화타당도/측정동일성에 관한 심리계량적 연구는 국내 간호학술지에서는 찾아보기 힘든 실정이다. 이에 대해 Lee 등[14]은 국내 간호학술지에 게재된 측정도구 연구는 고전적 검사이론에 입각한 구조타당도와 내적일관성 위주로 이루어지고 있다고 비평하였다. 따라서 앞으로 측정도구에 대한 심리계량적 연구를 할 때는, 다양한 측정 속성들에 대해 다양한 분석방법을 적용해서 평가해 볼 것을 권유한다.

요약

측정도구의 구조타당도는 내용타당도 이후 가장 먼저 수행되어야

할 측정 속성이다. 이를 위해 국내 간호학에서는 주로 CFA를 사용하는데, CFA로 얻을 수 없는 정보들을 제시하는 IRT/라쉬 분석도 같이 적용해 볼 것을 추천한다. 구조타당도 이외에 내적일관성 및 교차문화타당도/측정동일성 또한 측정도구의 내적구조를 확인하기 위한 것이다. 국내 간호학 측정도구 연구에서 교차문화타당도/측정동일성에 대한 검증은 거의 찾아볼 수 없는 상황이다. 따라서 앞으로는 이에 대한 평가도 시행되기를 바란다.

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Authors' contributions

All work was done by Lee EH.

Conflict of interest

The author declared no conflict of interest.

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Data availability

Not applicable.

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Psychosocial support interventions for women with gestational diabetes mellitus: a systematic review

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Purpose: This study aimed to analyze the content and effectiveness of psychosocial support interventions for women with gestational diabetes mellitus (GDM).

Methods: The following databases were searched with no limitation of the time period: Ovid-MEDLINE, Cochrane Library, Ovid-Embase, CINAHL, PsycINFO, NDSL, KoreaMed, RISS, and KISS. Two investigators independently reviewed and selected articles according to the predefined inclusion/exclusion criteria. ROB 2.0 and the RoBANS 2.0 checklist were used to evaluate study quality.

Results: Based on the 14 selected studies, psychosocial support interventions were provided for the purpose of (1) informational support (including GDM and diabetes mellitus information; how to manage diet, exercise, stress, blood glucose, and weight; postpartum management; and prevention of type 2 diabetes mellitus); (2) self-management motivation (setting goals for diet and exercise management, glucose monitoring, and enhancing positive health behaviors); (3) relaxation (practicing breathing and/or meditation); and (4) emotional support (sharing opinions and support). Psychosocial supportive interventions to women with GDM lead to behavioral change, mostly in the form of self-care behavior; they also reduce depression, anxiety and stress, and have an impact on improving self-efficacy. These interventions contribute to lowering physiological parameters such as fasting plasma glucose, glycated hemoglobin, and 2-hour postprandial glucose levels.

Conclusion: Psychosocial supportive interventions can indeed positively affect self-care behaviors, lifestyle changes, and physiological parameters in women with GDM. Nurses can play a pivotal role in integrative management and can streamline the care for women with GDM during pregnancy and following birth, especially through psychosocial support interventions.

Keywords: Gestational diabetes; Psychosocial support systems; Social support; Systematic review

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Introduction

Gestational diabetes mellitus (GDM) is the most common medical complication during pregnancy and is defined as diabetes mellitus (DM) or impaired glucose tolerance first detected during pregnancy with the secretion of placental hormones nec-

essary for the fetus to grow [1]. Changes in hormone metabolism, such as estrogen, progesterone, prolactin, and placental hormones [2], as well as increased weight due to increased food intake and reduced levels of physical activity, can result from increased insulin resistance [3].

The prevalence of GDM is reported to be 3% to 14% of preg-

Summary statement

• What is already known about this topic?

Gestational diabetes mellitus (GDM) can negatively affect the mother and fetus during pregnancy, and postpartum development of type 2 diabetes mellitus is also possible. However, the modalities and impact of various psychosocial support interventions have not been clearly identified.

• What this paper adds

This systematic review found that informational support and motivational encouragement were frequently used, whereas relaxation and emotional support were underused. Psychosocial support interventions induced changes in self-care behaviors, depression, anxiety, self-efficacy, stress, and fasting plasma glucose, glycated hemoglobin, and 2-hour postprandial glucose levels.

• Implications for practice, education, and/or policy

For positive maternal-fetal outcomes, more relaxation and emotional support measures are needed for women with GDM. Nurses should ensure that integrated psychosocial supportive interventions are offered in both internal medicine and obstetrics; in particular, such interventions should be provided not only during pregnancy but also after childbirth.

nant women worldwide and has been steadily increasing [4]. GDM can have a significant impact on obstetric complications and perinatal fetal mortality, and various health problems such as neonatal hypoglycemia, respiratory distress syndrome, obesity, DM, and a decline in brain development after childbirth [5]. A history of GDM increases women's probability of being diagnosed with GDM in the next pregnancy by 30% to 50% [6], and progression to type 2 diabetes mellitus (T2DM) occurs in 35% to 60% of women [7]. Therefore, strategies to promote self-management are required to prevent complications during pregnancy and childbirth [1].

According to the literature, the effectiveness of intervention programs for women with GDM has been confirmed to a certain extent, especially with regard to physical and dietary interventions. Consuming a low-glycemic index diet and increasing activity levels lowered blood glucose levels, helped reduce insulin requirements during pregnancy, and had a positive effect on appropriate maternal weight gain and reduction in macrosomia rates [8]. In addition, regular moderate-intensity exercise helped control postprandial blood glucose levels in women with GDM [9]. Pregnant women with GDM, however, are confronted with a complex situation where they must acquire knowledge about GDM and practice a healthy lifestyle at the same time as they are diagnosed [10]. Pregnant women diagnosed with GDM are under stress due to the psychosocial changes that pregnancy brings, and concerns that GDM can negatively affect the health of the mother and the fetus can prompt them to feel more stress and depression than women with normal pregnancies, making it difficult to control their blood glucose levels [11]. These concerns can cause women to feel pressured to do well with treatment,

which may lead to further stress and anxiety [12]. Postpartum women with GDM need regular self-management such as weight management, diet management, exercise, breastfeeding, and blood glucose testing [13]. However, due to the lack of evidence-based information on the necessity of postpartum care and health beliefs about how these efforts affect health promotion in the future, self-management for GDM has not been found to be effective in most studies [14]. Of particular note, it is difficult for women with GDM to practice self-management due to lack of time and childcare [15].

As such, women with GDM experience various psychological changes and find it difficult to practice self-management due to a lack of social support. Therefore, it is necessary to provide psychosocial support interventions to facilitate regular self-management among women with GDM. Nursing interventions that reflect the needs of pregnant women with GDM and include psychosocial support, taking into account the complex situation of pregnancy and GDM management, have a positive effect on the health of pregnant women and fetuses, as well as prevention of type 2 DM (T2DM). However, intervention studies for women with GDM have mainly focused on diet and exercise, and as such, systematic reviews have been mostly conducted on these topics. Few systematic investigations have focused on the psychological aspects of women with GDM, such as stress, anxiety, or social support. Therefore, this study aimed to analyze the content and impact of psychosocial interventions for women with GDM, and to evaluate their effectiveness. This research is ultimately expected to provide basic data for the development of interventions for GDM education programs.

Methods

Ethics statement: This study is a systematic review of previously published studies and therefore received an exemption from the Institutional Review Board of Yonsei University Health Systems (Y-2020-0130).

Study design

The study was conducted and described in accordance with the guidelines for systematic literature review reporting of (Preferred Reporting Items for Systematic Reviews and Meta-Analyses, PRISMA 2020) [16]. The study protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) at the National Institute for Health Research (registration number: CRD42020221764).

Following a search of the literature, processes of literature selection, literature quality evaluation, and data extraction were conducted. In order to ensure consistency when selecting literature and evaluating the quality of the literature, two researchers (the main researcher and an assistant researcher with systematic review expertise) independently conducted assessments, and in instances of disagreement, a decision was made through discussion together.

Search of the literature

Nine online databases were used to search for literature published in domestic and international journals. The following international databases were searched based on the COSI (core, standard, ideal) model [17]: Ovid-MEDLINE, Cochrane Library, Ovid-Embase, Cumulative Index for Nursing Allied Health Literature (CINAHL), and PsycINFO. The domestic databases searched were the National Discovery for Science Leaders (NDSL), KoreaMed, Research Information Sharing Service (RISS), and Korean Studies Information Service System (KISS). Keywords such as “diabetes, gestational,” “psychosocial support systems,” “psychosocial support,” “psychological support,” “social support,” “stress,” “anxiety,” and “depression” were used. A manual search was also conducted to review the references of the selected literature. The databases were searched with no limitation of the time period, and the final search for literature selection was conducted on September 22, 2020 (Supplementary Material).

Criteria for selection and exclusion of literature

Criteria for inclusion of literature

In this study, using the participant, intervention, comparison,

outcome, study design (PICO-SD) framework, the following criteria were applied: studies of women with GDM, studies of interventions and programs including psychosocial support, studies in which the effectiveness of an intervention was reported, studies published in English or Korean, and peer-reviewed studies.

- **Participants:** The participants were pregnant women diagnosed with GDM or women with a GDM history within 5 years of childbirth, who had not been diagnosed with T2DM. GDM is diagnosed in the second or third trimester of pregnancy, by a 75-g oral glucose tolerance test (OGTT) with a one-step approach [18], a 100-g OGTT with a two-step approach [19], or according to the guidelines of the Australian Diabetes in Pregnancy Society (ADIPS) [20] (Appendix 1).
- **International Association of Diabetes and Pregnancy Study Group criteria (one-step approach):** A 75-g OGTT is performed in a fasting state, and if at least one marker of plasma glucose is abnormal, GDM is diagnosed (fasting plasma glucose [FPG] ≥ 92 mg/dL, 1-hour plasma glucose ≥ 180 mg/dL, and 2-hour plasma glucose ≥ 153 mg/dL).
- **Carpenter criteria (two-step approach):** Regardless of fasting, a screening test of 50-g OGTT is performed, and if the result is higher than 140 mg/dL, it is determined as positive. If two or more plasma glucose levels are abnormal, GDM is diagnosed (FPG ≥ 95 mg/dL, 1-hour plasma glucose ≥ 180 mg/dL, 2-hour plasma glucose ≥ 155 mg/dL, and 3-hour plasma glucose ≥ 140 mg/dL).
- **ADIPS guidelines:** FPG ≥ 5.5 mmol/L or 2-hour plasma glucose ≥ 8.0 mmol/L on a 75-g OGTT.
- **Intervention:** intervention and education programs, including psychosocial support (informational support, motivational encouragement for self-management, relaxation, emotional support) at least two times or more than 30 minutes.
- **Comparisons:** usual care or nonintervention that did not provide psychosocial support interventions.
- **Outcomes:** A classification of the dependent variables of randomized controlled trials (RCTs) and non-RCTs that included psychosocial support interventions for women with GDM through a literature review.
- **Behavioral variables:** self-management (self-care behavior), practicing healthy eating habits (energy from total fat, fiber intake), and practicing healthy physical activities.
- **Psychosocial variables:** self-efficacy, prenatal attachment, maternal identity, psychological distress, stress, depression, anxiety, emotional adjustment to diabetes, positive mental health, motivation to change, cues to action, barriers for physical activity and diet, health-related quality of life, social support, perceived susceptibility, perceived severity, perceived benefit,

- perceived barriers, and risk perception of T2DM.
- Physiological variables: FPG, 1-hour postprandial glucose (PP1hr), 2-hour postprandial glucose (PP2hrs), glycated hemoglobin (HbA1c), 75-g OGTT, glycated albumin, insulin resistance, systolic blood pressure, diastolic blood pressure, triglyceride, low-density lipoprotein, high-density lipoprotein, total cholesterol, body weight after childbirth, body mass index (BMI) after childbirth, waist circumference, and weight loss after childbirth.
 - Study design: RCT and non-RCTs were included.

Criteria for exclusion of literature

The following studies were excluded from the selection of literature: non-original articles (editorials, reviews, letters and opinion pieces, etc.), gray literature (theses, congress presentation, conference material, abstracts, etc.), studies not focused on women with GDM, studies that did not present an intervention or pro-

gram that included psychosocial support, qualitative studies, those not reporting the effectiveness of the intervention, and those not published in English or Korean.

Process of literature selection

In total, 1,801 studies were identified through the aforementioned databases and two more were added through a manual search of the references, finally confirming 1,803 studies. Duplicate literature was eliminated (n= 872) through the EndNote X9 program (Clarivate Analytics, Philadelphia, PA, USA) and by hand. Finally, studies were excluded according to the exclusion criteria (n= 869).

In the first selection process, the title and abstract were checked to determine whether to select or exclude the document, and for the 60 studies remaining, the secondselection process involved reviewing the full text to determine whether to include or exclude it. After excluding 48 studies, 14 studies were

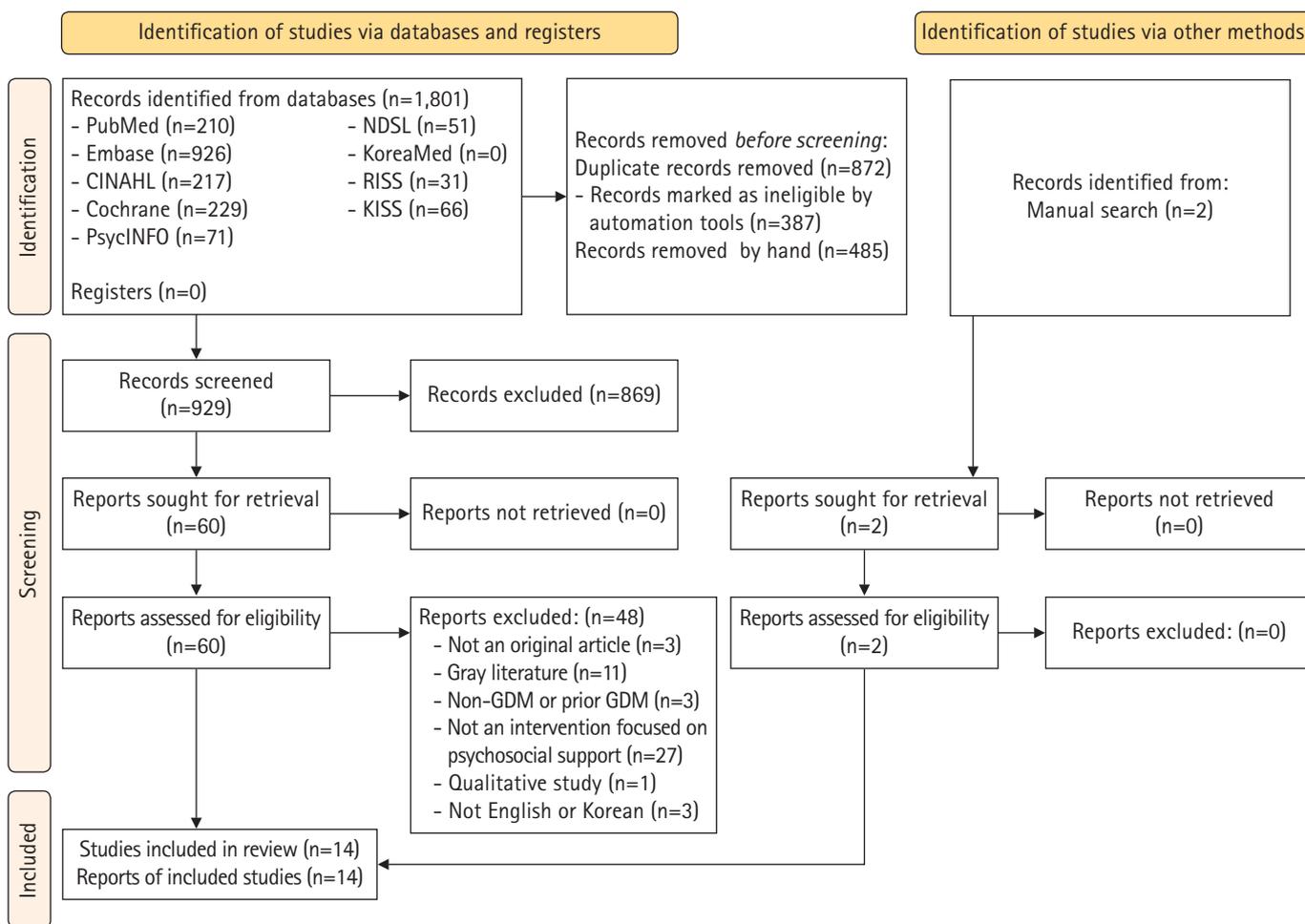


Figure 1. PRISMA 2020 flow chart for the literature search. GDM, Gestational diabetes mellitus.

selected (Figure 1).

Literature quality evaluation

The quality of the final selected articles was evaluated using the Cochrane Risk of Bias (RoB) 2.0 for RCTs [21], and the Health Insurance Review & Assessment Service (HIRA) Study Design Algorithm for Medical Literature of Intervention (DAMI) and the Risk of Bias assessment tool for Non-Randomized Studies (RoBANS) 2.0 for non-RCTs [22].

The RoB 2.0 was used to assess the quality of RCTs in six areas: bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of the outcome, bias in selection of the reported results, and overall bias. RoBANS 2.0 was applied to non-RCTs to evaluate quality in eight areas: comparability of participants, selection of participants, confounding variables, intervention measurement, blinding of the outcome assessment, outcome evaluation, incomplete outcome data, and selective outcome reporting. In each area of the RoB 2.0 and RoBANS 2.0 tools, the risk of bias was judged as low, high, or unclear. In order to ensure the consistency of the literature quality evaluation, two researchers (the first and second authors) independently conducted it, and in cases of disagreement, consensus was reached through a reevaluation after discussing together.

Data extraction and synthesis

Data were extracted using a predefined format that included the author's name, publication year, country of the study, study design, sample, content of the intervention, intervention methods, interventions sessions, measurement time, and outcomes of the intervention (behavioral, psychosocial, and physiological variables). We did not perform a meta-analysis because of heterogeneity in the population and intervention characteristics. We synthesized the results quantitatively.

Results

General characteristics of the selected studies

Among the 14 articles selected for the evaluation of the psychosocial intervention program, studies conducted prior to 2013 could not be identified. Eight studies (57.1%) [23-30] were published before 2018, and six studies (42.9%) [31-36] were published after 2018. In the past 3 years, psychosocial support interventions for women with GDM have been actively studied, and it can be confirmed that various intervention methods such as smartphone- or web-based interventions are being used. There were nine international studies and five domestic studies done in Korea ($n = 5$,

35.7%) [28-30,34,36], which was the country with the most studies included in this analysis, followed by Iran ($n = 4$, 28.6%) [24,25,33,35], while one study (7.1%) each was included from Turkey [31], Netherlands [32], United Kingdom [23], Australia [26], and Ireland [27]. The total number of study participants was 1,331, with eight studies (57.1%) [24,25,28,30-33,36] having more than 50 but fewer than 100 participants, three studies (21.4%) [23,26,35] having more than 100 participants, and three studies (21.4%) [27,29,34] having fewer than 50 participants. Ten studies (71.4%) [23-25,28-31,33-35] were conducted among women with GDM during pregnancy and four (28.6%) [26,27,32,36] focused on women with a GDM history within 5 years of childbirth, who had not been diagnosed with T2DM. The studies comprised seven RCTs (50.0%) [23-27,31,32] and seven non-RCTs (50.0%) [28-30,33-36] (Table 1).

Literature quality evaluation results

The quality evaluation of the literature showed that five of the seven RCTs (71.4%) [23,24,26,31,32] were well randomized; although the remaining two studies (28.6%) [25,27] were described as involving random assignment, the method was not reported. Six studies (85.6%) [23-25,27,31,32] did not clearly state whether either the participants or researchers were aware of the intervention received by study participants, and only one study (14.3%) [26] was found to be well-blinded for both. As such, bias due to deviations from intended interventions was of some concern. Three studies (42.9%) [23,26,32] used an intent-to-treat (ITT) analysis to correct for bias due to missing outcome data. Although all studies used appropriate methods of measuring the outcome, only two studies (28.6%) [24,26] reported that the outcome assessors were not aware of the intervention received by study participants. This suggests the possibility that outcome assessment may have been influenced by knowledge of the intervention received. All studies (100%) [23-27,31,32] reported outcome data according to a predefined analysis plan. No studies were excluded as a result of the quality assessment. However, the selected literature was assessed overall as being somewhat risky in terms of bias, so the results should be interpreted carefully (Figure 2).

Six of the seven non-RCTs (85.6%) [28-30,33,34,36] confirmed the homogeneity of the experimental group and the control group. All studies (100%) [28-30,33-36] were prospective studies, and three studies (42.9%) [33,34,36] reported a sufficient follow-up period to correct for variables may have been disturbed by the learning effects, and the overall selection bias was evaluated to be low. In four studies (57.1%) [28,30,34,35], the measurements were obtained from reliable sources such as medi-

Table 1. Comparison of studies' characteristics (N=14)

Variable	Categories	n (%)	References	
Publication year	< 2018	8 (57.1)	[23-30]	
	≥ 2018	6 (42.9)	[31-36]	
Publication country	Domestic	Korea	5 (35.7)	[28-30,34,36]
	International	Iran	4 (28.6)	[24,25,33,35]
		Turkey	1 (7.1)	[31]
		Netherlands	1 (7.1)	[32]
		United Kingdom	1 (7.1)	[23]
		Australia	1 (7.1)	[26]
		Ireland	1 (7.1)	[27]
Participants	< 50	3 (21.4)	[27,29,34]	
	50-99	8 (57.1)	[24,25,28,30-33,36]	
	≥ 100	3 (21.4)	[23,25,36]	
Population	Women with GDM in pregnancy	10 (71.4)	[23-25,28-31,33-35]	
	Women with a GDM history within 5 years of childbirth (not diagnosed with T2DM)	4 (28.6)	[26,27,32,36]	
Study design	RCT	7 (50.0)	[23-27,31,32]	
	Non-RCT	7 (50.0)	[28-30,33-36]	
Intervention level	Individual	12 (85.7)	[23,25-34,36]	
	Group	6 (42.9)	[24,26-28,30,35]	
	Both	4 (28.6)	[26-28,30]	
Intervention methods	Face-to-face	6 (42.9)	[25-27,29,31,32]	
	Phone	6 (42.9)	[26,28-30,32,36]	
	Pamphlets	3 (21.4)	[30,31,36]	
	Video	2 (14.3)	[23,36]	
	Smartphone-based	1 (7.1)	[33]	
	Web-based	1 (7.1)	[34]	
	Text and postcards	1 (7.1)	[32]	
	Two or more methods	8 (57.1)	[26-32,36]	
Total number of sessions	< 10 times	7 (50.0)	[23,24,26,29,30,35,36]	
	10-20 times	6 (42.9)	[25,27,28,32-34]	
	30 times	1 (7.1)	[31]	
Intervention duration	30 minutes-2 hours	3 (21.4)	[23,25,36]	
	2-4 hours	4 (28.6)	[30-32,35]	
	> 4 hours	4 (28.6)	[24,27,28,34]	
	Not reported	3 (21.4)	[26,29,33]	
Psychosocial support interventions	Informational support	12 (85.7)	[23,24,26-30,32-36]	
	Self-management motivation	11 (78.6)	[23,24,26-30,32-36]	
	Relaxation	4 (28.6)	[25,28,30,31]	
	Emotional support	4 (28.6)	[23,28-30]	

GDM: Gestational diabetes mellitus; RCT: randomized controlled trial; T2DM, type 2 diabetes mellitus.

cal records and measured at least two times, so the performance bias was low. One study (14.3%) [35] stated that the evaluator was well-blinded for the outcome assessments. In the outcome evaluation, the results were evaluated well by using tools with proven reliability and validity in six studies (85.6%) [28-30,33-35]. There were two studies (28.6%) [34,35] for which it was difficult to confirm whether incomplete results were presented,

and overall the probability of attrition bias was low. One study (14.3%) [34] reported outcome variables such as HbA1c, FPG, and PP1hr, which are expected to be mainly reported in GDM studies, and for six studies (85.6%) [28-30,33,35,36], it was difficult to determine whether selective results were reported. Thus, a possibility of reporting bias was found overall (Figure 2).

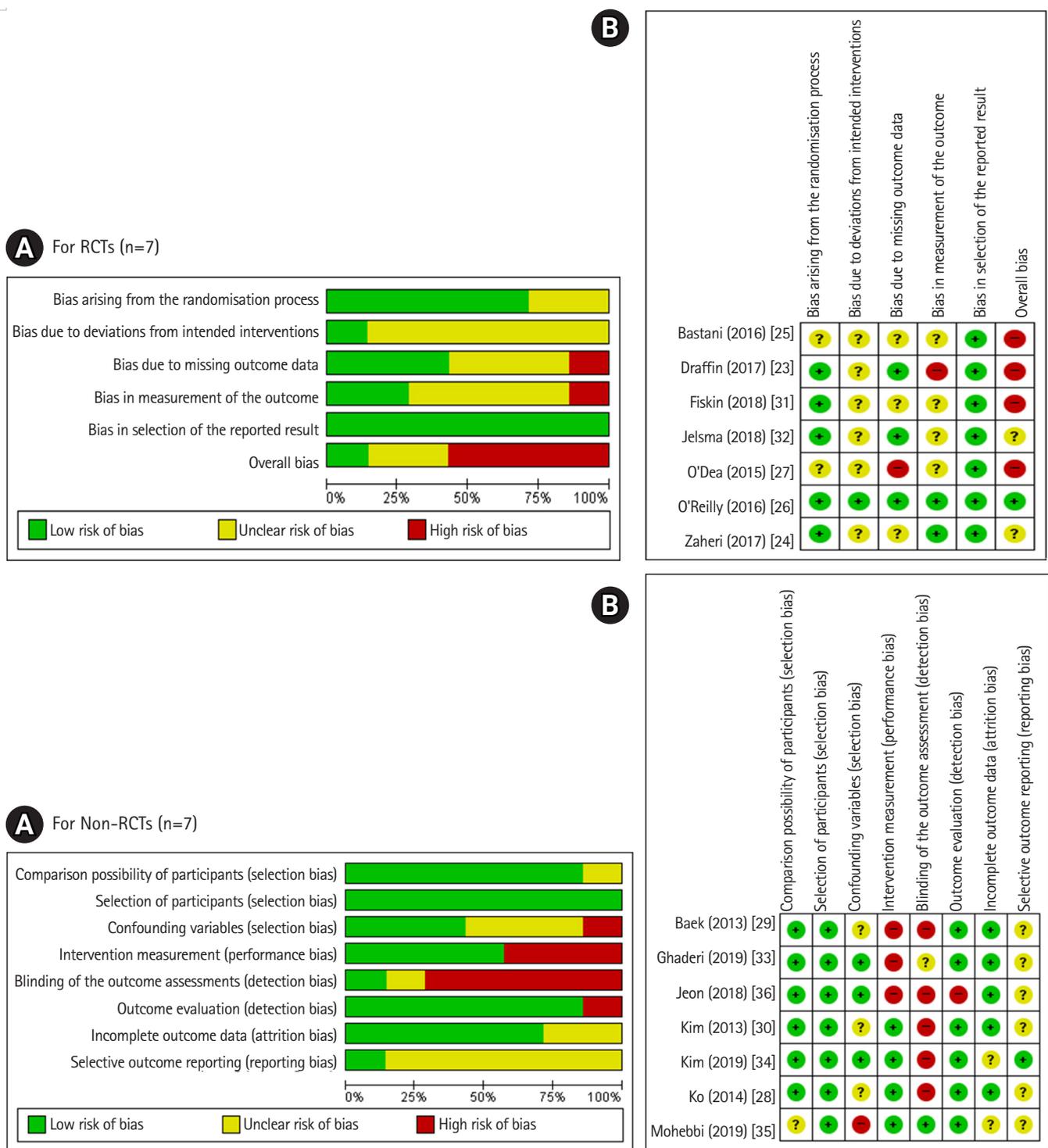


Figure 2. Risk of bias graphs. (A) Risk of bias summary. (B) Risk of bias for selected studies. RCT, randomized controlled trial.

Content of psychosocial support interventions for women with GDM

Among the 10 studies conducted on pregnant women diagnosed with GDM, seven programs [23,28-30,33-35] focused on promoting lifestyle changes (management of diet, exercise, stress,

and blood glucose), and other psychological support interventions involved diaphragmatic breathing exercises [31], a stress reduction intervention applying cognitive-behavioral stress management training [24], and an anxiety reduction intervention through acupuncture [25] (Table 2).

Four studies were conducted on women with a history of GDM, most of which were diabetes prevention programs [26,27,32,36]. The lifestyle interventions were for women with a history of GDM and BMI more than 25 kg/m² [32], women diagnosed with GDM within the last 1 year [26], women with a history of GDM who had been diagnosed with prediabetes [27], and women who give birth after being diagnosed with GDM [36] (Table 2).

Of the selected articles, 12 used individual interventions (85.7%) [23,25-34,36], six used group interventions (42.9%) [24,26-28,30,35], and four used both types of interventions (28.6%) [26-28,30]. The intervention methods were face-to-face in six studies (42.9%) [25-27,29,31,32], phone-based in six studies (42.9%) [26,28-30,32,36], pamphlet-based in three studies (21.4%) [30,31,36], and video-based in two studies (14.3%) [23,36], while one study each (7.1%) used smartphone-based [33], web-based [34], and short message service and postcard-based interventions [32]. Eight studies (57.1%) [26-32,36] used two or more methods (Table 1).

The total number of sessions was up to 10 in seven studies (50.0%) [23,24,26,29,30,35,36], 10 to 20 in six studies (42.9%) [25,27,28,32-34], and 30 times in one study (7.1%) [31]. The total duration of the interventions was 2 to 4 hours in four studies (28.6%) [30-32,35], more than 4 hours in four studies (28.6%) [24,27,28,34], and 30 minutes to 2 hours in three studies (21.4%) [23,25,36], while three studies (21.4%) [26,29,33] did not specify the total intervention duration (Table 1).

Psychosocial support interventions were found to provide (1) informational support, (2) self-management motivation, (3) relaxation, and (4) emotional support. Among them, informational support was the most common, as it was addressed in 12 studies (85.7%) [23,24,26-30,32-36], followed by 11 studies (78.6%) [23,24,26-30,32-36] that promoted motivation for self-management, and four studies each (28.6%) that used relaxation [25,28,30,31] or emotional support [23,28-30] (Table 3).

In a detailed analysis of the 12 interventions providing informational support, diet management was the most common (n = 8, 57.1%) [23,26-28,30,32-34]. Six studies each dealt with GDM information (42.9%) [23,28-30,33,35] and T2DM prevention (42.9%) [23,26,28,30,33,36]. Among the 11 interventions provided for the purpose of self-management motivation, strengthening health behavior practices was the most common (n = 11, 78.6%) [23,24,26-30,32,34-36]. Among the four interventions provided to promote relaxation, deep breathing was the most common (n = 3, 21.4%) [28,30,31]. Other measures used were acupressure [25], yoga [28], and encouraging *taekyo* (Korean traditional prenatal bonding and interacting with the fetus)

[30]. Finally, from the four interventions provided for the purpose of emotional support, sharing opinions and supporting each other in small groups was the most common (n = 2, 14.3%) [28,30], while other measures included encouraging expression of positive feelings toward maternal and fetal outcomes [23], willingness to self-manage [28], and emotional status [29] (Table 3).

Effectiveness of psychosocial support interventions for women with GDM

The effectiveness of the psychosocial support interventions for women with GDM was evaluated by categorizing the outcomes of the interventions conducted in the literature into (1) behavioral variables, (2) psychosocial variables, and (3) physiological variables.

Half of the selected studies (n = 7) reported behavioral variables. Of the five studies [28,30,34-36] that analyzed behavioral change, four studies [28,30,34,35] noted increased self-care behavior with statistical significance. Changes in psychosocial variables after psychosocial support intervention were reported in all studies, and depression, anxiety, self-efficacy, and stress were the major variables. Out of the studies dealing with depression (n = 7 [24,26-29,31,34]), anxiety (n = 7 [23-25,27,29,31,34]), and stress (n = 4 [23,24,27,31]), statistically significant improvements were found in four studies [24,28,29,31], five studies [24,25,29,31,34], and three studies [24,27,31], respectively. Of the six studies [23,27,29,32,35,36] dealing with self-efficacy, four studies [29,32,35,36] demonstrated statistically significant increases after the intervention. Finally, for physiological parameters, out of the 14 selected studies, nine studies [23,24,26-28,30,34-36] measured FPG, HbA1c, and PP2hrs as main variables. Out of the studies measuring FPG (n = 5 [24,26-28,34]), HbA1c (n = 4 [28,30,34,35]), and PP2hrs (n = 3 [26,27,30]), statistically significant improvements were reported in three studies [24,26,28], three studies [28,34,35], and two studies [27,30], respectively (Table 4).

Discussion

This study was conducted to analyze the content and effectiveness of psychosocial interventions for women with GDM. Most of the 14 selected studies were conducted in Korea (35.7%) or Iran (28.6%). Since sociocultural factors are very important factors in the management of GDM [37], psychosocial support interventions should be utilized with active consideration of the sociocultural background of various countries.

The reviewed studies mostly had 50 to 99 participants

Table 2. Characteristics of the selected studies (N=14)

First author (year) [reference]	Country	Study design	Sample	Experimental group	Control group	Measurement time
Fiskin (2018) [31]	Turkey	RCT	Pregnant women with GDM (IUP 24–28 wk)	n = 30 ·Diaphragmatic breathing exercises ·5 minutes every morning (face-to-face, pamphlets) ·30 days	n = 30 Usual care	Pretest, at 15 days, post-test (3 times)
Jelma (2018) [32]	Netherlands	RCT	Women with GDM history (6–48 months after delivery) and BMI $\geq 25 \text{ kg/m}^2$	n = 29 ·Behavioral LSM education ·Counseling: 1 hour (2 face-to-face), 5 telephone, follow-up (5 via text messaging, 4 postcard) ·5 months	n = 30 Usual care	Pretest and post-test (2 times)
Draffin (2017) [23]	United Kingdom (multi-center)	RCT	Pregnant women with GDM	n = 75 ·Educational DVD (46 minutes) on GDM and GDM management (individual): encouraging positive health behaviors and promoting positive feelings	n = 67 Usual care	Pretest, 2 weeks after intervention, 6–8 weeks post-delivery (3 times)
Zaheri (2017) [24]	Iran (two health centers)	RCT	Pregnant women with GDM, stress score > 15	n = 40 ·Relaxation and cognitive-behavioral techniques: 2 hours x 6 times (group) ·3 weeks	n = 40 Usual care	Pretest, 2 weeks after the last session (2 times)
Bastani (2016) [25]	Iran	RCT	Pregnant women with GDM	n = 28 ·Nurse-provided acupuncture at the true point on the forearm: 3 minutes x 3 times x 2 (individual) ·2 days	n = 29 Acupressure at false point	Pretest and post-test (2 times)
O'Reilly (2016) [26]	Australia (multi-center)	RCT	Women with a history of GDM within their first postnatal year	n = 206 ·Individual education on DPP (1 time), group reviewing and longer-term goal setting (5 times), telephone reviewing and longer-term goal setting (2 times) ·3 months	n = 228 Usual care	Pretest, 3 months/12 months after pretest (3 times)
O'Dea (2015) [27]	Ireland	Mixed methods RCT	Women with a history of GDM in the past 1–3 years and abnormal glucose tolerance	n = 16 ·Individualized assessment, 1-hour group exercise, group education seminar, one-to-one motivational interview and individual goal setting with specialist nurse, physio-therapist, or dietician ·2.5 hours x 12 times (face-to-face and group) ·12 weeks	n = 20 Usual care (educational pamphlets and routine follow-up)	Pretest, post-test, 1-year follow-up (3 times)
Ghaderi (2019) [33]	Iran	Non-RCT	Pregnant women with GDM (IUP 22–32 weeks)	n = 44 ·Smartphone-based individual education on GDM and management, postpartum management, T2DM prevention ·Monitored the number of log-ins and duration of using the application	n = 43 Usual care	Pretest, 6 weeks after the intervention (2 times)
Kim (2019) [34]	Korea	Non-RCT	Pregnant women with GDM (IUP 24–28 weeks)	n = 22 ·Web-based individual program+nutrition session ·Online health diary once a week, logging daily FPG and number of steps taken ·20–30 minutes x 12 times every week	n = 22 Usual care	Pretest and post-test (2 times)

(Continued to the next page)

Table 2. Continued

First author (year) [reference]	Country	Study design	Sample	Experimental group	Control group	Measurement time
Mohebbi (2019) [35]	Iran (multi-center)	Non-RCT	Pregnant women with GDM	n = 55 ·Education on self-management ·35–40 minutes x 4 times (group) ·1 month	n = 55 Usual care	Pretest, 3 months/6 months after intervention (3 times)
Jeon (2018) [36]	Korea	Non-RCT	Postpartum women with GDM	n = 30 ·Education on postpartum GDM and management: 20 minutes x 1 time (pamphlets and video) ·Telephone follow-up (5 minutes x 3 times) ·6 weeks	n = 32 Provide video after the follow-up measurement	Pretest, 12 weeks post-delivery (2 times)
Ko (2014) [28]	Korea	Non-RCT	Pregnant women with GDM (IUP 24 weeks)	n = 34 ·LSM coaching: 30 minutes x 4 times (education), 30 minutes x 4 times (small group) ·Individual telephone coaching: 20 minutes x 4 times ·4 weeks	n = 34 Usual care	Pretest and post-test (2 times)
Baek (2013) [29]	Korea	Non-RCT	Pregnant women with GDM (IUP 24–28 weeks)	n = 19 ·Case management program ·National standards for DM self-management education and Bandura's self-efficacy resources (1 face-to-face interview and 5 telephone calls) ·2 weeks	n = 18 Usual care	Pretest and post-test (2 times)
Kim (2013) [30]	Korea	Non-RCT	Pregnant women with GDM (IUP 24–30 weeks)	n = 28 ·Integrated self-management program combining GDM education and pregnancy care (emotional support, <i>taekyo</i> , self-management, abdominal breathing, postpartum prevention of T2DM) ·1 hour x 3 times (small group and pamphlets) ·Checking self-management, abdominal breathing, SMBG: 10–15 minutes x 2 times (telephone and pamphlets) ·5 weeks	n = 27 Usual care (provide booklet)	Pretest and post-test (2 times)

DM: Diabetes mellitus; DPP: diabetes prevention program; DVD: digital video disc; FPG: fasting plasma glucose; GDM: gestational diabetes mellitus; IUP: intrauterine pregnancy; LSM: lifestyle modification; RCT: randomized controlled trial; SMBG: self-monitoring blood glucose; T2DM: type 2 diabetes mellitus.

Table 3. Content of selected studies (N=14)

Purpose of intervention	Contents	Randomized controlled trial						Non-randomized controlled trial							
		Fiskin (2018) [31] [†]	Jelsma (2018) [32] [†]	Draffin (2017) [23]	Zaheri (2017) [24]	Bastani (2016) [25]	O'Reilly (2016) [26] [†]	O'Dea (2015) [27] [†]	Ghadri (2019) [33]	Kim (2019) [34]	Mohebbi (2019) [35] [†]	Jeon (2018) [36] [†]	Ko (2014) [28] [†]	Baek (2013) [29] [†]	Kim (2013) [30] [†]
Informational support (85.7%)	Give information about GDM (42.9%)			✓			✓		✓	✓		✓	✓	✓	✓
	Give information about DM (21.4%)						✓				✓				
	Diet management (57.1%)		✓	✓			✓	✓	✓			✓			✓
	Exercise management (21.4%)						✓								✓
	Stress management (35.7%)				✓		✓	✓	✓		✓				✓
	Blood glucose management (21.4%)			✓				✓							✓
	Weight management (21.4%)			✓				✓							✓
	Good sleep hygiene (7.1%)						✓								✓
	Insulin therapy (14.3%)			✓											
	Postpartum period management (diet, exercise, stress, weight management after delivery, breastfeeding) (35.7%)						✓		✓		✓		✓		✓
Motivational encouragement (78.6%)	Prevention of type 2 diabetes (42.9%)			✓				✓				✓			✓
	Explain how to use educational application (14.3%)											✓			
	Set a goal for management (50.0%)		✓				✓		✓	✓		✓		✓	✓
	Checking diet management (28.6%)								✓	✓		✓			✓
	Checking exercise management (28.6%)								✓	✓		✓			✓
	Checking glucose monitoring (35.7%)								✓	✓		✓			✓
	Checking weight management (7.1%)									✓		✓			✓
	Checking postpartum GDM management (7.1%)										✓				
	Checking stress management (7.1%)														✓
	Enhancing positive health behaviors (78.6%)		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Relaxation (28.6%)	Practicing breathing (21.4%)		✓												✓
	Taekyo (7.1%)														✓
	Practicing yoga (7.1%)												✓		
Emotional support (28.6%)	Nurse-provided acupuncture (7.1%)												✓		
	Sharing opinions and support for each other (14.3%)												✓		✓
	Encouragement to express willingness to self-manage (7.1%)												✓		✓
	Encouragement to express emotions (7.1%)														✓
Promoting positive feelings toward outcomes for woman and baby (7.1%)			✓												

DM: Diabetes mellitus; GDM: gestational diabetes mellitus.

[†]Two or more intervention methods used, e.g.: Jelsma (2018) used face-to-face, telephone, short message service (SMS), postcards.

Table 4. Outcomes of selected studies (N=14)

First author (year) [reference]	Behavioral	Psychosocial	Variable	Physiological
Fiskin (2018) [31]		Prenatal attachment ↑ ⁺ , depression ↓ ⁺ , anxiety ↓ ⁺ , stress ↓ ⁺		
Jelsma (2018) [32]		Barriers for PA and diet ↓ ⁺ Social support for PA and diet ↑ ⁺ Self-efficacy for PA and diet ↑ ⁺		
Draffin (2017) [23]		1°: anxiety, 2°: prenatal stress, emotional adjustment to diabetes, self-efficacy, GDM knowledge, risk perception		1°: glycemic control (PP1hrs breakfast glucose ↓ ⁺)
Zaheri (2017) [24]		1°: psychological stress (depression, anxiety, stress) ↓ ⁺		2°: glycemic control (FPG ↓ ⁺)
Bastani (2016) [25]		Maternal anxiety ↓ ⁺		
O'Reilly (2016) [26]	2°: energy from total fat, fiber intake, moderate-intensity PA	2°: depressive symptoms		1°: [3 months] diabetes risk factor (Wt ↓ ⁺ , WC ↓ ⁺ , FPG ↓ ⁺): [12 months] diabetes risk factor (Wt, WC ↓ ⁺ , FPG ↓ ⁺) 2°: reduction in body weight, PP2hrs, SBP, DBP, T.chol ↓ ⁺ , TG, LDL ↓ ⁺ , HDL ↓ ⁺
O'Dea (2015) [27]	2°: PA and diet	2°: mood (positive mental health, psychological distress, depression, anxiety, stress ↓ ⁺), cognition (perceived social support, motivation to change, exercise self-efficacy, diet self-efficacy ↑ ⁺), wellbeing (QOL ↑ ⁺)		1°: glycemic control (FPG) 2°: glycemic control (PP2hrs ↓ ⁺ , IR), lipid profile (TG, HDL, LDL, T.chol), Wt & WC (Wt, BMI, WC)
Ghaderi (2019) [33]		1°: T2DM risk perception ↑ ⁺ 2°: T2DM risk perception ↑ ⁺		
Kim (2019) [34]	Self-care behavior ↑ ⁺	Anxiety ↓ ⁺ , depression		Glycemic control (HbA1c ↓ ⁺ , glycated albumin, FPG, PP1hr)
Mohebbi (2019) [35]	Self-management ↑ ⁺ [3 months] Self-management ↑ ⁺ [6 months]	[3 months] Perceived severity ↑ ⁺ [6 months] Perceived susceptibility ↑ ⁺ , severity ↑ ⁺ , barriers ↓ ⁺ , benefits ↑ ⁺ , self-efficacy ↑ ⁺ , cues to action ↑ ⁺		[6 months] Glycemic control (HbA1c ↓ ⁺)
Jeon (2018) [36]	Self-management	Self-efficacy ↑ ⁺		Glycemic control (75-g OGTT)
Ko (2014) [28]	Self-care behavior ↑ ⁺	Depression ↓ ⁺		Glycemic control (FPG ↓ ⁺ , HbA1c ↓ ⁺)
Baek (2013) [29]		Self-efficacy ↑ ⁺ , depression ↓ ⁺ , anxiety ↓ ⁺		
Kim (2013) [30]	Self-management ↑ ⁺	Maternal identity ↑ ⁺		Glycemic control (PP2hrs ↓ ⁺ , HbA1c)

1°: Primary outcome; 2°: secondary outcome; BMI: body mass index; DBP: diastolic blood pressure; FPG: fasting plasma glucose; GDM: gestational diabetes mellitus; HbA1c: glycated hemoglobin; HDL: high-density lipoprotein; IR: insulin resistance; LDL: low-density lipoprotein; OGTT: oral glucose tolerance test; PA: physical activity; PP1hr: 1-hour postprandial glucose; PP2hrs: 2-hour postprandial glucose; QOL: quality of life; SBP: systolic blood pressure; T2DM: type 2 diabetes mellitus; TG: triglycerides; T.chol: total cholesterol; Wt: weight.
⁺Statistically significant.

[24,25,28,30-33,36] and half were of RCT design [23-27,31,32], while there were only four multi-center intervention studies [23,24,26,35]. There is a need for more well designed RCTs in the future, expanding to a greater number of participants, and a need to actively conduct multi-center and multi-national studies.

In terms of study quality, seven RCTs [23-27,31,32] were evaluated as having a low overall level of bias in the randomization process and selection of the reported results, while there was a likely overall risk of bias in the areas of deviations from intended interventions, missing outcome data, and measurement of the outcomes. Only three studies [23,26,32] used an ITT analysis, underscoring the need for more ITT analysis studies to correct for bias due to missing outcome data. In the seven non-RCTs [28-30,33-36], selection bias, performance bias, and attrition bias were evaluated to be low overall, but there was a possibility of detection bias because the evaluators' blinding was not mentioned [33] or impossible, as researchers provided interventions for participants directly, making it difficult to blind the outcome evaluators. For example, researchers reviewed the participants' health diaries [34], provided a postnatal care program for GDM postpartum women [36], and helped participants change their health behavior [28]. In two studies involving questionnaires, the researcher conducted a consultation on self-management after questionnaire administration [29] or collected the questionnaire immediately [30]. Furthermore, six studies [28-30,33,35,36] were found to have possible reporting bias. In the future, it is necessary to ensure that the evaluators are well-blinded to minimize the risk of detection bias.

Most of the selected studies ($n = 10$, 71.4%) were aimed at pregnant women diagnosed with GDM, of which the most common focus was on promoting lifestyle changes, whereas only four dealt with women with GDM after childbirth. Because pregnant women diagnosed with GDM are seven times more likely to develop T2DM than pregnant women who maintain normal blood glucose [38], GDM interventions are not only needed for pregnancy, but should be continued after childbirth. It is possible that the lack of GDM intervention studies continuing beyond pregnancy is related to the fact women diagnosed with GDM are often referred to a separate clinician for diabetes management [30], which may result in women with GDM feeling confusion and disconnection in care, as well as decreased collaborative follow-up. Therefore, nurses can play a pivotal role, especially linking clinical departments (internal medicine and obstetrics), and helping women with GDM to continue practicing self-care beyond childbirth.

Individual interventions were performed in most of the studies, and group interventions were used in six studies (42.9%). In

addition, various methods such as face-to-face interventions, telephone interventions, pamphlets, and videos were used. One-to-one coaching provides effective knowledge acquisition by enabling participants to receive advice tailored to individual needs and levels [39]. It is effective to organize small-group meetings with 5 to 10 people. If there are more than 10 people, it is difficult to meet individual learning needs [40]. Other studies provided video that stimulated learners' curiosity and enhanced their understanding and satisfaction [41] or informational support using smartphones, which have advantages such as accessibility and economics [33]. It is necessary to find additional interventions that can provide relaxation and emotional support.

Although half of the studies had fewer than 10 sessions, of the four studies [28,30,34,35] that presented statistically significant results on changes in self-care behavior, it is notable that the frequency of intervention was 4 to 12 times, the total intervention duration was 20 to 60 minutes per session, and the total duration was 2.3 to 6 hours. In GDM management, it is important to provide regular and consistent interventions to facilitate changes in self-care behavior; these four studies appear to suggest that at least four sessions, with more than 20 minutes per session, for a total of 2.3 hours or more is recommendable to promote changes in self-care behavior.

While this review found that informational support and motivational encouragement for self-management were frequently used, relaxation and emotional support were underused. Failure to recognize the seriousness of GDM due to poor education and poor knowledge of health can make it difficult to practice self-management for GDM [42]. On the contrary, regular motivation allows women to adapt well to self-management of GDM [43]. Therefore, informational support for women lacking GDM knowledge, along with strategies for strengthening women's motivation, is needed and should be continued. In addition, psychosocial support interventions should actively incorporate emotional support and relaxation, especially considering the fear often associated with GDM diagnosis, concerns about the health of the fetus, and anxiety of developing T2DM [44].

The main behavioral variable affected by psychosocial support interventions was change in self-care behaviors. Diagnosis of GDM can be a motivator for healthy behavioral changes and subsequent lifestyle changes [45], so nurses should actively support women with GDM at the time of diagnosis. In addition, because spousal or family support can promote self-management in women with GDM [46], intervention studies based on family support and actively including family members should be conducted.

Depression, anxiety, self-efficacy, and stress were major psy-

psychosocial variables found to improve with intervention. Pregnant women with GDM were found to have depressive symptoms that were 3.78 times as severe as those of women with normal pregnancies, and are known to have higher depression and anxiety due to the possibility of complications of GDM [47]. Furthermore, anxiety symptoms significantly increase the risk of DM [48]. In addition, high psychological stress experienced by pregnant women can negatively affect their emotional changes, maternal role, and fetal attachment [49]. Therefore, GDM should be recognized as a high-risk condition and coordinated psychosocial supportive interventions should be offered to reduce depression, anxiety, and stress.

Self-efficacy is an important determinant for self-management and self-control in GDM. As a perception of confidence or a judgment of one's ability to perform the actions necessary to achieve the desired outcome [50], it plays an important role in adherence to treatment and control of blood glucose [51]. Therefore, psychosocial supportive interventions should also be offered to increase self-efficacy.

The goal of glycemic control during pregnancy is to maintain an FPG of < 95 mg/dL, a PP1hr of < 140 mg/dL, and a PP2hrs of < 120 mg/dL in both pre-GDM and GDM states [52]. The goal of HbA1c control is less than 6.0% to 6.5% in the first trimester of pregnancy and less than 6.0% in the second trimester, but individualized targets must be set with consideration of the risk of hypoglycemia [53]. Fasting hyperglycemia at more than 105 mg/dL in pregnant women with GDM is a risk factor for serious perinatal complications such as intrauterine fetal death, macrosomia, neonatal hypoglycemia, trauma, jaundice, maternal hypertension, preeclampsia, cesarean delivery, and induced delivery [54]. Since postprandial blood glucose during pregnancy has a very strong correlation with the neonatal outcomes of macrosomia [5], it is appropriate to use physiological variables such as FPG, HbA1c, and PP2hrs as the main outcomes. Since 35% to 60% of women diagnosed with GDM develop T2DM [7], it is necessary to determine whether prediabetes or T2DM develops through a 75-g OGTT 6 to 12 weeks after childbirth. If the test results are normal, the woman should have an annual diabetes screening test [4]. Therefore, when designing an intervention program for postpartum women, the 75-g OGTT 6 to 12 weeks after childbirth should be considered as a physiological variable.

Since it is difficult to change self-care behaviors through one-time diabetes education, which is conducted in internal medicine, it is necessary to ensure that integrated psychosocial supportive interventions between internal medicine and obstetrics can be provided on a regular basis, even after childbirth. At a hospital, internal medicine and obstetrics should work together for

women with GDM who complain of anxiety about the negative effects of GDM on the fetus (such as macrosomia, hypoglycemia, and respiratory distress syndrome), fear of childbirth, and awareness of the risk of T2DM. Furthermore, the role of professional nurses who systematically manage pregnant women with GDM and promote collaboration between both departments should be emphasized.

The main limitation of this study is that only studies published in Korean or English were selected. Furthermore, since most studies were determined to have a high potential for performance bias, detection bias, and reporting bias, it is necessary to be careful about generalizing the effectiveness of interventions.

Nevertheless, this study is meaningful in that it is the first systematic review study conducted in Korea focusing on psychosocial support interventions for women with GDM; therefore, it can provide basic data for the development of programs for GDM management and T2DM prevention that actively incorporate psychosocial support components.

Based on the results of this study, psychosocial support interventions for GDM should continue to provide informational support and strengthen the motivation to engage in self-care behaviors, and greater use of relaxation and emotional support is needed for women with GDM to maintain positive health behaviors. Psychosocial supportive interventions positively affect self-care behaviors, depression, anxiety, self-efficacy, and stress, as well as improving FPG, HbA1c, and PP2hrs in women with GDM. Therefore, in addition to diet and exercise therapy, which are the main therapeutics for GDM, integrated and comprehensive interventions that include psychosocial dimensions are needed. GDM control and T2DM prevention are needed by continuing to provide GDM interventions including psychosocial support after childbirth. Nurses can bridge the divided care of women with GDM and advanced practice nurses specializing in diabetes care are well poised to provide integrated management starting at pregnancy and extending beyond birth.

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Conflict of interest

Sue Kim has been the editor-in-chief of the *Korean Journal of Women Health Nursing* since January 2020. She was not involved in the review process of this manuscript. Otherwise, there was 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/EFHSOY>.

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Supplementary materials

Further details on supplementary materials are presented online (available at <https://doi.org/10.4069/kjwhn.2021.05.13>).

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Appendices

Appendix 1. Details of selected studies (N = 14)

First author (year) [reference]	Diagnostic criteria	Theoretical framework
Baek (2013) [29]	Carpenter criteria 100-g glucose tolerance test	Bandura's (1977) self-efficacy
Bastani (2016) [25] [†]	Not described (personal communications 3 times, but no answer)	Not described
Draffin (2017) [23]	IADPSG criteria 75-g glucose tolerance test	Not described
Fiskin (2018) [31] [†]	Carpenter criteria 100-g glucose tolerance test	Not described
Ghaderi (2019) [33] [†]	Carpenter/IADPSG criteria* (diagnosis reported in patient file)	Not described
Jelsma (2018) [32]	ADIPS criteria 75-g glucose tolerance test	Rosal's (2001) patient-centered counseling model
Jeon (2018) [36] [†]	Carpenter criteria 100-g glucose tolerance test	Health belief model
Kim (2013) [30]	Carpenter criteria 100-g glucose tolerance test	Cox's (1982) interaction model of client health behavior
Kim (2019) [34] [†]	Carpenter criteria 100-g glucose tolerance test	Not described
Ko (2014) [28]	IADPSG criteria 75-g glucose tolerance test	Whitemore's (2009) goal-reality-options-will (GROW) coaching model
Mohebbi (2019) [35]	No concerns about clinical diagnostic criteria (diagnosed GDM by physicians)	Health belief model
O'Dea (2015) [27]	IADPSG criteria 75-g glucose tolerance test	Not described
O'Reilly (2016) [26]	ADIPS criteria 75-g glucose tolerance test	Not described
Zaheri (2017) [24] [†]	IADPSG criteria 75-g glucose tolerance test	Antoni's (2007) cognitive-behavioral stress management

ADIPS: Australian Diabetes in Pregnancy Society; GDM: gestational diabetes mellitus; IADPSG: International Association of Diabetes and Pregnancy Study Group.

[†]The author was contacted to determine the diagnostic criteria.

Factors affecting unmet healthcare needs of low-income overweight and obese women in Korea: analysis of the Korean National Health and Nutrition Examination Survey 2017

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Purpose: The purpose of this study was to explore unmet healthcare needs among low-income overweight and obese women and to identify the factors affecting unmet healthcare needs.

Methods: The study was a secondary analysis of data from the 2017 Korea National Health and Nutrition Examination Survey. A final sample of 388 out of 8,127 participants was analyzed using complex descriptive statistics, the chi-square test, the independent t-test, and logistic regression.

Results: The mean age of the participants was 66.51 ± 1.05 years. Unmet healthcare needs were experienced by 19.4% of low-income overweight and obese women. Women with depression, stress, and poor self-reported health status were significantly more likely than their counterparts to experience unmet healthcare needs. Poor self-reported health status was confirmed to be related to unmet health needs in low-income overweight and obese women (odds ratio, 2.65; $p=.011$).

Conclusion: The study provides the novel insight that the unmet healthcare needs of low-income overweight and obese women were influenced by self-reported health status. Healthcare providers should make efforts to develop strategies to reduce unmet healthcare needs among low-income overweight and obese women, who constitute a vulnerable population.

Keywords: Health services needs and demand; Income; Obesity; Overweight; Women

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Introduction

The prevalence of obesity among adults over the age of 19 in Korea (hereafter, Korea) increased by 2.5% points from 31.9% in 2009 to 33.4% in 2015 and further increased to 34.4% in 2019. Classified by income level, the prevalence of obesity among middle and upper-income earners was 33.7%, whereas it was 34.5% among middle and lower-income earners and 35.6% among lower-income earners. Disparities were also seen according to the residential area, as the prevalence of obesity was 33.6% among those living in urban areas and 38.3% for residents of rural areas, which have lower income levels; overall, the prevalence of obesity was higher among those living in rural settings [1]. Among

women in particular, an interaction was observed between the effects of income and residential area. The overall obesity rate of higher-income women was 7% points higher than that of lower-income women, but this disparity was wider (9.3% points) among those living in rural areas. Furthermore, the obesity rate among women with a low level of education was 6.3% points higher than that among women with a high level of education [1]. These observations indicate that obesity in Korean women is associated with low socioeconomic status, as has also been observed in other developed countries.

As expressed by the saying that “obesity is a disease” [2], obesity is associated with endometrial cancer and breast cancer in addition to chronic diseases commonly encountered in adulthood,

Summary statement

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

Low-income overweight and obese women are a physically, psychologically, and socially vulnerable population.

- **What this paper adds**

Need factors were significant in predicting unmet healthcare needs in contrast to predisposing or enabling factors. The unmet healthcare needs of low-income overweight and obese women are influenced by self-reported health status.

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

Strategies to enhance self-reported health status can be used by healthcare providers in probing for unmet healthcare needs among low-income overweight and obese women.

such as diabetes and hypertension [3]. Furthermore, 25% of obese women experienced depression [4]. Obesity increases the risk of anovulation, menstrual irregularities, polycystic ovarian syndrome, and impaired endometrial receptivity and implantation, and obese women were found to be more than three times more likely to become infertile than normal-weight women [3]. Of particular note, it has been reported that low-income women ate larger quantities of food with a high glycemic index and lipid content [5]. Compounded by a lack of conditions for exercise and high treatment costs making medical access less accessible, low-income women are more likely to become obese [6]. It has been found that among low-income women, those with obesity had a lower quality of life than normal-weight women, and their health status was perceived somewhat negatively [7]. Attention is needed to alleviate the health inequalities caused by income and gender gaps.

Unmet healthcare needs refer to a situation where adequate prevention, alleviation, and treatment of a disease or disability cannot be provided due to a lack of medical services [8]. The presence of unmet healthcare needs increases disease severity and increases the likelihood of complications and mortality [9]. In particular, unmet healthcare needs due to socioeconomic problems have a negative effect on psychological factors; for example, they increase social isolation and depression by causing relative deprivation [10]. Social isolation and depression, in turn, cause suicidal thoughts [11] and significantly lower individuals' quality of life. Unmet healthcare needs were found to be associated with low income, low education level, chronic illness, living alone, and limited activities [12,13]. Low income has also been found to be related to poor health status as well as unmet healthcare needs [14,15]. In a study of Korean adults based on data from the Korean Health Panel, it was reported that economic reasons had a mediating effect of 14.7% to 32.9% of unmet healthcare needs [16]. Of note, income had a stronger effect on

unmet healthcare needs among women than among men [17]. As described above, overweight and obese women in low-income groups have specific health care needs, so it is necessary to understand the status of their unmet healthcare needs and the factors affecting them. With increasing interest in unmet healthcare needs, factors related to unsatisfactory medical care for adults, married migrant women, the elderly, and single-person households have been studied [12-18]. However, research has yet to explore the status of unmet healthcare needs and related factors among low-income women who are overweight and obese in Korea, underscoring the need for efforts to improve health by identifying and improving the factors associated with the health inequalities that these women experience.

Anderson's behavioral model was developed for the identification and evaluation of factors related to medical service use, and it is a useful model for identifying social and personal determinants of medical service use [19]. Anderson's behavioral model has been used not only to analyze medical service use behavior but also to identify systematic factors influencing unmet healthcare needs in research aiming to achieve equitable access to medical service use [18,20]. Therefore, in this study, the classification in Anderson's behavioral model (predisposing, enabling, and need factors) was used to explore the factors influencing unmet healthcare needs. Predisposing factors are characteristics that an individual already has before the occurrence of medical needs, and include demographic factors such as age, sex, and education. Enabling factors include economic and sociological factors such as income level, employment, family resources, and insurance as factors that enable medical services to be used, and need factors are related to the level of an individual's disability or disease, including overall health status and symptoms [19].

As previously discussed, low-income women who are overweight and obese experience a variety of health problems. Therefore, this study identified aspects of their individual, demograph-

ic, social, and economic vulnerabilities and unmet healthcare needs. In light of the need to determine the factors that affect unmet healthcare needs, the present study, based on Anderson's behavioral model, aimed to identify the factors influencing unmet healthcare needs among low-income women who are overweight and obese. It is expected that these findings will inform a personal and socioeconomic approach to improve the health of these women in the future.

Objectives

The purpose of this study was to obtain insights into the unmet healthcare needs of low-income women who are overweight and obese in Korea, and to identify the factors influencing unmet healthcare needs based on Anderson's behavioral model of medical care. The specific aims were as follows:

First, to investigate the status of unmet healthcare needs for low-income women who are overweight and obese.

Second, to identify differences in unmet healthcare needs according to predisposing factors, enabling factors, and need factors of low-income women who are overweight and obese.

Third, to analyze factors influencing unmet healthcare needs of low-income women who are overweight and obese.

Methods

Ethics statement: This study was exempted by the Institutional Review Board (IRB) of Jeonbuk National University (2020-08-018), as this was secondary analysis of existing data and the data were handled anonymously.

Study design

This study was conducted to obtain insights into the characteristics of unmet healthcare needs and factors influencing those needs among overweight and obese low-income women. This secondary analysis used health survey data from the seventh Korea National Health and Nutrition Examination Survey (KNHANES) (2017) and analyzed the data based on Anderson's behavioral model of medical care. This study was described in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (<https://www.strobe-statement.org/index.php?id=strobe-home>).

Data sources

This study used data from the seventh wave of the KNHANES, which is conducted annually, with the approval of the Research Ethics Review Committee from the Korea Centers for Disease

Control and Prevention. Only the 2017 KNHANES contained a survey on whether participants had experienced "depression for 2 weeks in a row"; therefore, this study used data from 2017. From the total number of participants in the 2017 data from the 7th KNHANES, 6,518 adult women aged 19 years or older were extracted. Using a body mass index of 23 kg/m² as the cutoff [21], there were 456 overweight or obese women whose household income was in the lowest quartile. Sixty-eight participants were excluded if there was no information or answers of "don't know" for relevant variables (marital status, 1; education, 38; economic activity, 38; type of health insurance, 18; whether they subscribed to private insurance, 5; diabetes diagnosis, 1; tuberculosis diagnosis, 32; cancer diagnosis, 32; aerobic physical activity, 41; whether they have felt depressed for at least 2 weeks, 14; perceived stress, 14; and subjective health status, 31). In total, data from 388 respondents were extracted and analyzed (Figure 1).

Study variables

Unmet healthcare needs

Medical use data from the KNHANES were used to assess unmet healthcare needs, which were defined as an answer of "yes" to the item asking, "did you ever need treatment (examination or

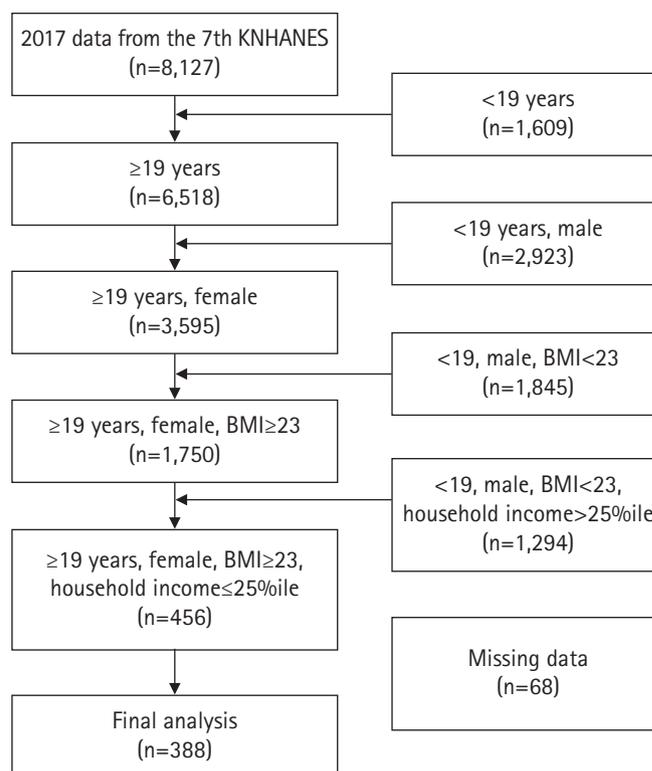


Figure 1. Flowchart of the study population. BMI: Body mass index (kg/m²); KNHANES: Korea National Health and Nutrition Examination Survey.

treatment) in a hospital (excluding dentistry) in the last year?”

Low income

Low-income status was defined based on the household income quartile, which is a basic variable in the KNHANES. Household income was classified into lower, middle-low, middle-high, and upper quartiles, and those who fell into the lower quartile were defined as low income.

Predisposing factors

The predisposing factors included age, marital status, education level, and the number of family members living together. Age was classified into under 60 years, 60 to 79 years, and 70 years or older, and marital status was divided into married, bereaved, divorced, and single. Education level was classified as elementary school or lower, middle school, high school, and college or higher. In addition, the number of family members living together was reclassified to divide respondents into those who lived alone and those who lived with at least one other family member.

Enabling factors

Enabling factors were classified into employment, health insurance type, and private insurance coverage. Employment status was classified in terms of presence or absence, and the types of health insurance were classified as self-employed, employee, and dependent. Private insurance coverage was classified as “yes” or “no.”

Need factors

Need factors included hypertension, diabetes, and cancer, which are representative chronic diseases suggested by the Centers for Disease Control and Prevention [22], as well as tuberculosis, which has been identified as a relevant factor among socioeconomically vulnerable groups [23]. Aerobic physical activity, depression, stress, and perceived health status were analyzed. The presence of chronic diseases (hypertension, diabetes, tuberculosis, and cancer) was confirmed by doctors. Participants were classified as engaging or not engaging in aerobic physical activity, based on whether they took part in 2 hours and 30 minutes of moderate-intensity physical activity or 1 hour and 15 minutes of high-intensity physical activity per week, or a mixture of moderate and high-intensity physical activities (high-intensity of 1 minute = moderate-intensity of 2 minutes). Depression was classified as present or absent based on answers of “yes” and “no,” respectively, for the item asking whether participants had experienced feeling depressed for 2 weeks or more. According to previous studies [13,18], responses on perceived stress were dichotomized as “no” (responses of feeling less stress, feeling a little stress, or barely feeling stress in everyday life) or “yes” (feeling a lot of stress or feeling very much stress in everyday life). Perceived health status was classified as “very bad,” “bad,” “average,” “good,” or “very good”; these responses were merged into “poor” (very bad or bad), “moderate,” and “good” (good or very good).

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Data collection

This study was based on 2017 data from the seventh KNHANES. The KNHANES gathers information on the health level, health behavior, and food and nutrition intake of the Korean people, and involves a household member survey, a health survey, a medical examination, and a nutrition survey. The household member survey identifies the current status of households in a selected area and selects households to participate in the KNHANES. The health survey is divided into a household survey, a health interview survey, and a health behavior survey, and is conducted through an interview and a self-response survey. In addition, the medical examination includes physical measurements, blood pressure and pulse measurements, and blood and urine tests, and the nutritional survey gathers information on dietary behavior and food intake. The data are collected following a protocol developed by the Korea Centers for Disease Control and Prevention (now known as the Korea Disease Control and Prevention Agency) and analyzed according to the guidelines for use.

Data analysis

Data analysis was conducted using IBM SPSS ver. 26.0 (IBM Corp., Armonk, NY, USA). According to the analysis guideline, the complex-sample design elements were reflected and analyzed with appropriate consideration of the sample.

- 1) The general characteristics of the respondents and the status of unmet healthcare needs were analyzed by a composite sample frequency analysis.
- 2) The differences in unmet healthcare needs according to the characteristics of the respondents were analyzed by the complex-sample t-test and the complex-sample Rao-Scott chi-square test.
- 3) Complex-sample multiple logistic regression analysis was performed for the factors influencing unmet healthcare needs.

Results

General characteristics of the respondents

There were a total of 388 respondents in this study, with an average age of 66.51 ± 1.05 years. The majority (51.9%) were over 70 years of age. The most common marital status was married

Table 1. General characteristics of respondents (N=388)

Factor	Variable	Categories	n [†]	% [†] (SE)	
Predisposing factors	Age (year)		Mean ± SE, 66.51 ± 1.05		
		< 60	68	23.5 (3.2)	
		60–69	106	24.7 (2.7)	
		≥ 70	214	51.9 (2.9)	
	Marital status	Married	182	47.7 (3.0)	
		Bereaved	160	38.6 (2.8)	
		Divorced	35	9.4 (1.6)	
		Single	11	4.4 (1.5)	
	Education level	≤ Elementary school	282	67.8 (3.2)	
		Middle school	39	10.3 (1.6)	
		High school	50	17.1 (2.8)	
≥ College		17	4.8 (1.2)		
Family members in the residence (n)		Mean ± SE, 2.04 ± 0.07			
	Alone	160	33.5 (2.9)		
	≥ 2	228	66.5 (2.9)		
Enabling factors	Employment	Yes	120	32.3 (3.0)	
		No	268	67.7 (3.0)	
	Health insurance	Self-employed	117	33.2 (3.0)	
		Employee	193	49.4 (3.1)	
		Dependent	78	17.4 (2.7)	
	Private insurance	Yes	145	40.9 (2.8)	
No		243	59.1 (2.8)		
Need factors	Chronic disease	Hypertension	Yes	229	52.2 (2.9)
			No	159	47.8 (2.9)
	Diabetes mellitus	Yes	89	21.5 (2.4)	
		No	299	78.5 (2.4)	
	Tuberculosis	Yes	15	3.5 (0.9)	
		No	373	96.5 (0.9)	
	Cancer	Yes	33	8.3 (1.6)	
		No	355	91.7 (1.6)	
	Aerobic physical activity	Yes	87	24.4 (2.7)	
		No	301	75.6 (2.7)	
	Depression	Yes	119	30.4 (2.9)	
		No	269	69.6 (2.9)	
	Stress	Yes	127	34.3 (2.5)	
		No	261	65.7 (2.5)	
	Perceived health status	Poor	180	42.9 (3.1)	
Moderate		176	49.2 (3.1)		
Good		32	7.9 (1.5)		

[†]Unweighted count (frequency), weighted %.

(47.7%), the most common education level was an elementary school (67.8%), and the average number of family members living together was 2.04 ± 0.07, while 33.5% of participants lived alone. Slightly more than two-thirds of the respondents (67.7%) were not employed, while 49.4% had employee-based national health insurance coverage and 59.1% of them did not have private insurance.

Table 2. Unmet healthcare needs in respondents (N=388)

Variable	Categories	n [†]	% [†] (SE)
Unmet medical needs	Yes	74	19.4 (2.6)
	No	314	80.6 (2.6)

[†]Unweighted count (frequency), weighted %.

Table 3. Unmet healthcare needs according to general characteristics (N=388)

Factor	Variable	Categories	Unmet healthcare needs		F [†] or t (p)	
			n [‡] /% (SE)			
			Yes	No		
Predisposing factors	Age (year)		Mean ± SE, 68.29 ± 1.33	Mean ± SE, 66.08 ± 1.25	-1.20 (.232)	
		< 60	14/17.6 (5.1)	54/82.4 (5.1)	0.96 (.385)	
		60–69	26/25.8(6.3)	80/74.2 (6.3)		
	Marital status	≥ 70	34/17.2 (3.2)	180/82.8 (3.2)		
		Married	38/21.4 (3.9)	144/78.6(3.9)	1.17 (.319)	
		Bereaved	30/20.7 (4.2)	130/79.3 (4.2)		
		Divorced	4/8.7 (4.9)	31/91.3 (4.9)		
	Education level	Single	2/9.5 (7.3)	9/90.5 (7.3)		
		≤ Elementary school	57/22.5 (3.1)	225/77.5 (3.1)	1.94 (.131)	
		Middle school	6/14.8 (6.1)	33/85.2 (6.1)		
High school		9/13.4 (4.6)	41/86.6 (4.6)			
Number of family members in the residence	≥ College	2/6.9 (4.9)	15/93.1 (6.9)			
		Mean ± SE, 2.33 ± 0.23	Mean ± SE, 1.97 ± 0.07	-1.47 (.144)		
	Alone	30/18.7 (3.7)	130/81.3 (3.7)	0.05 (.824)		
	≥ 2	44/19.8 (3.4)	184/80.2 (3.4)			
Enabling factors	Employment	Yes	21/18.2 (4.1)	99/81.8 (4.1)	0.16 (.687)	
		No	53/20.0 (3.0)	215/80.0 (3.0)		
	Health insurance	Self-employed	22/21.2 (4.6)	95/78.8 (4.6)	0.21 (.811)	
		Employee	34/18.3 (3.0)	159/81.7 (3.0)		
		Dependents	18/19.4 (4.7)	60/80.6 (4.7)		
	Private insurance	Yes	28/20.6 (4.5)	117/79.4 (4.5)	0.15 (.701)	
No		46/18.6 (3.0)	197/81.4 (3.0)			
Need factors	Chronic disease	Hypertension	Yes	43/20.1 (3.1)	186/79.9 (3.1)	0.09 (.760)
			No	31/18.7 (3.7)	128/81.3 (3.7)	
	Diabetes mellitus	Yes	12/11.9 (3.6)	77/88.1 (3.6)	3.44 (.066)	
		No	62/21.5 (3.2)	237/78.5 (3.2)		
	Tuberculosis	Yes	6/34.4 (12.3)	9/65.6 (12.3)	2.06 (.155)	
		No	68/18.9 (2.7)	305/81.1 (2.7)		
	Cancer	Yes	5/13.3 (5.9)	28/86.7 (5.9)	0.83 (.344)	
		No	69/20.0 (2.8)	286/80.0 (2.8)		
	Aerobic physical activity	Yes	18/18.5 (4.6)	69/81.5 (4.6)	0.06 (.803)	
		No	56/19.7 (2.9)	245/80.3 (2.9)		
	Depression	Yes	33/26.3 (4.8)	86/73.7 (4.8)	4.27 (.041)	
		No	41/16.4 (2.8)	228/83.6 (2.8)		
	Stress	Yes	34/26.0 (4.4)	93/74.0 (4.4)	5.93 (.017)	
		No	40/16.0 (2.6)	221/84.0 (2.6)		
	Perceived health status	Poor	49/28.7 (3.9)	131/71.3 (3.9)	6.92 (.001)	
		Moderate	21/12.6 (3.2)	155/87.4 (3.2)		
Good		4/11.4 (5.6)	28/88.6 (5.6)			

[†]Unweighted count (frequency), weighted %; [‡]Rao-Scott composite sample chi-square tests.

Hypertension was the most common chronic disease (52.2%), followed in order by diabetes (21.5%), cancer (8.3%), and tuberculosis (3.5%). Slightly more than three-quarters of respondents (75.6%) did not engage in aerobic physical activity, 30.4% had

depression, and 34.3% perceived stress in their daily lives. The most common perceived health status was moderate (49.2%), followed by poor (42.9%) and good (7.9%) (Table 1).

Table 4. Factors related to unmet healthcare needs (N=388)

Factor	Variable	Categories	OR (95% CI)	<i>p</i>
Need factor	Depression	Yes	1.17 (0.50–2.72)	.718
		No	Reference	
	Stress	Yes	1.40 (0.66–3.01)	.379
		No	Reference	
	Self-related health status	Good	0.37 (0.11–1.27)	.114
		Moderate	0.40 (0.20–0.78)	.007
Poor		Reference		
			$\chi^2 = 15.47, p = .003$	

CI: Confidence interval; OR: odds ratio.

Unmet healthcare needs

Among the respondents of this study, 74 (19.4%) had unmet healthcare needs, while 314 (80.6%) had not experienced unmet healthcare needs (Table 2).

Unmet healthcare needs according to respondents' characteristics

Table 3 shows the differences in unmet healthcare needs according to the general characteristics of the respondents of this study. No significant differences were found in predisposing factors or enabling factors according to unmet healthcare needs. Among the need factors, the presence of depression was significantly associated with unmet healthcare needs ($F = 4.27, p = .041$), as was perceived stress ($F = 5.93, p = .017$). Unmet healthcare needs were also more common in respondents with poor perceived health ($F = 6.92, p = .001$).

Factors influencing unmet healthcare needs in low-income women who are overweight and obese

Among the need factors, perceived health status was identified as a factor affecting unmet healthcare needs among the respondents of this study. The odds of having unmet healthcare needs were approximately 60% lower in those with moderate self-reported health than in those with poor self-reported health (odds ratio, 0.40; 95% confidence interval, 0.20–0.78; $p = .007$) (Table 4).

Discussion

This study investigated the status of unmet healthcare needs and identified factors influencing unmet healthcare needs among low-income women who were overweight and obese based on 2017 data from the seventh KNHANES. The factors influencing unmet healthcare needs were categorized into predisposing factors, enabling factors, and need factors according to Anderson's model of medical use behavior. It is expected that the results will

be used as basic data for the preparation of alternative strategies to reduce unmet healthcare needs and the development of health promotion programs for this population.

It was found that 75.6% of low-income women who were overweight and obese did not engage in aerobic physical activity, 30.4% had depression, and 34.3% perceived stress in their everyday lives. Only 7.9% of respondents reported good perceived health. In the 2018 KNHANES results, it was reported that 47.6% of adults over 19 years old in Korea engaged in aerobic physical activity, including 38.9% of women [24]. The corresponding proportion in this study was much lower. Exercise and lifestyle intervention programs have been shown to be effective in promoting physical activity in overweight and obese women [25,26]. Interventions should be considered to promote physical activity for low-income women. In addition, the proportions of respondents reporting depression and perceived stress were higher than those of Korean adult women overall (13.7% and 28.6%, respectively) [27]. Likewise, the proportion of respondents with good perceived health was lower than that (23.2%) among adult women over 20 years of age based on 2020 data from Statistics Korea [28]. These results show that low-income women who are overweight and obese have relatively poor physical and psychological health, underscoring the need to pursue personal and social structural strategies to improve their physical and psychological health.

The frequency of unmet healthcare needs among low-income women who were overweight and obese was 19.4%. This is higher than the result of a survey of 134,072 people based on the results of the Canadian community health survey, which showed that the frequency of unmet healthcare needs among adult women was 12.6% [20], and a corresponding rate of only 1.6% was reported in Thailand [29]. Country-specific differences may result from differences in medical service systems and insurance systems from country to country; nonetheless, the proportion of women with unmet healthcare needs observed in the present study can be

seen as quite high. For instance, the frequency of unmet healthcare needs found in the present study is higher than that (17.3%) reported in a previous study of women in single households using 2017 KNHANES data [13] and the rate (15.75%) reported among adults in Korea using panel data [30]. In addition, the majority of respondents in this study were in their 70s or older, had a low education level, and were not engaged in economic activities, and 33.5% of them lived alone. Among all overweight and obese adult women in the KNHANES data, 25% were low income (in the lowest income quartile), and many did not have private insurance. These results show the need for an approach to resolve health inequality among adults older than 60 who live alone. In particular, women had a 3.8% points higher likelihood of having unmet healthcare needs than men who lived alone [13]. Low-income women were found to experience frequent difficulties accessing medical services and communicating with medical staff [31]. To develop measures to reduce unmet healthcare needs, there is a need to develop a policy that takes into account these women's characteristics (i.e., a gender-sensitive policy). In addition, a more systematic approach and efforts to provide sufficient medical services based on a detailed assessment of these women's needs and problems are necessary.

This study found that depression, perceived stress, and poor perceived health status were associated with a significantly higher likelihood of unmet healthcare needs. This is consistent with the results of previous studies [32,33], indicating that unmet healthcare needs are more common in adults over 19 years of age, including the elderly, who have depression, stress, and poor perceived health status. It has been reported that stress reduces or eliminates individuals' will to use medical services, causing frustration and resulting in unmet healthcare needs [34]. In addition, depressed individuals pay less attention to the positives and focus on the negatives [35,36], meaning that even if their needs for treatment are satisfied, they may not perceive the situation accordingly; their continuing perception of being "unsatisfied" may itself act as a risk factor for avoiding treatment [37-39], resulting in unmet healthcare needs. Therefore, it is necessary to develop strategies to reduce unmet healthcare needs through interventions and approaches that can assess mental health status and reduce depression and stress.

In this study, the differences in unmet healthcare needs and factors influencing unmet healthcare needs were examined according to predisposing, enabling, and need factors based on Anderson's model of medical use behavior. Perceived health status was investigated as a need factor, and it was found that moderate perceived health status was associated with a 60.4% lower chance of having unmet healthcare needs. This is similar to the results of

previous studies [40-42], which found that the subjective health status of moderate or poor was associated with unmet healthcare needs. Based on these results, it was suggested that efforts to reduce unmet healthcare needs should focus on individuals who perceive their health status as poor [13]. In this study, health status perceived at moderate level was associated with a lower likelihood of unmet healthcare needs. A study of 11,378 adults in Korea found that the risk of unmet healthcare needs was 1.46 times higher for those with moderate perceived health status than in those who perceived their health status as good [39], showing the need to pay attention to those with moderate perceived health status. One's perceived health status is closely related to not only one's comprehensive health status, but also to quality of life, and is a tool that can predict medical use or mortality by reflecting health coping ability and social resources [43]. Therefore, in order to reduce unmet healthcare needs, it is necessary to identify individuals' perceived health status and to establish a system and policy that enables medical services to be used when necessary.

In this study, predisposing factors and enabling factors were not identified as significant variables. This is contrary to previous studies showing that predisposing and enabling factors such as age, education, occupation, and type of medical coverage influenced unmet healthcare needs [18,20]. The number of samples in this study was 388, which is relatively small compared to studies of 10,000 or more, and the number of variables identified for each factor was relatively small. Although the weighting was considered, the number of respondents was small; hence, further research on the factors influencing unmet healthcare needs considering various variables should include an expanded number of low-income women who are overweight and obese.

This study data may have been affected by various biases due to the fact that self-reported data were analyzed, not data from medical records. Written responses on respondents' experiences over the past year may have also been affected by recall bias. Despite these limitations, this study makes a significant contribution by confirming the degree of unmet healthcare needs among low-income women who are overweight and obese, identifying the factors that affect the likelihood of unmet healthcare needs, and obtaining basic data for improving satisfaction with healthcare and promoting health in this population. Based on this study, it will be necessary to increase health equity by promoting personal and socioeconomic health policies that especially consider need factors.

This study investigated the characteristics of low-income women who were overweight and obese and their degree of unmet healthcare needs and analyzed differences in unmet health-

care needs according to respondents' characteristics and the factors influencing unmet healthcare needs using Anderson's model of medical use behavior. It was found that 19.4% of low-income women who were overweight and obese experienced unmet healthcare needs and perceived health status had an effect on unmet healthcare needs. Healthcare providers need strategies to develop policies that focusing on the physical and psychological health status of low-income overweight or obese women to reduce unmet healthcare needs.

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Authors' contributions

Conceptualization: Nho JH, Park SK; Formal analysis: Nho JH; Writing-review & editing: Nho JH, Park SK.

Conflict of interest

Ju-Hee Nho has been 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

The dataset file is available from Harvard Dataverse at <https://doi.org/10.7910/DVN/LCVFYB>.

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Does family support mediate the effect of anxiety and depression on maternal-fetal attachment in high-risk pregnant women admitted to the maternal-fetal intensive care unit?

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Purpose: This study investigated the mediating effect of family support in the relationships of anxiety and depression with maternal-fetal attachment among pregnant women admitted to the maternal-fetal intensive care unit (MFICU) in Korea.

Methods: The participants were high-risk pregnant women with a gestational age of at least 20 weeks who were admitted to MFICUs in Busan and Yangsan. The Korean versions of four measurement tools were used for the self-report questionnaire: Spielberger's State-Trait Anxiety Inventory, the Edinburgh Postnatal Depression Scale, Cobb's family support measurement, and Cranley's maternal-fetal attachment scale. Data were collected from June 22 to September 20, 2020. Out of 124 participants, data from 123 respondents were analyzed. Descriptive statistics and regression analysis were done.

Results: The average age of participants was 34.1 years. Their anxiety level was moderate (43.57±11.65 points out of 80) and 53.6% were identified as having moderate depression (average 10.13±5.48 points out of 30). Family support was somewhat high (average 43.30±5.03 points out of 55). The average score of maternal-fetal attachment was also somewhat high (73.37±12.14 points out of 96). Family support had a partial mediating effect in the relationships of anxiety and depression with maternal-fetal attachment among high-risk pregnant women admitted to the MFICU.

Conclusion: Maintaining family support is challenging due to the nature of the MFICU. Considering the mediating effect of family support, establishing an intervention plan to strengthen family support can be helpful as a way to improve maternal-fetal attachment for high-risk pregnant women admitted to the MFICU.

Keywords: Anxiety; Depression; Hospitals; Pregnancy; Self-report

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Introduction

Due to the recent increase in women's social status and activity in the workforce, the proportion of older and high-risk pregnant women over 35 is also increasing. The number of pregnant women who received hospitalization or outpatient care for high-risk pregnancies in Korea increased from 27,223 in 2009 to 142,565

in 2019, corresponding to approximately six-fold growth over 10 years [1]. High-risk pregnancies cause high-risk deliveries of high-risk newborn babies [2], and constitute a social problem that increases medical costs, reduces population health [3], and increases individual and national economic losses [4]. Against this background, the Korean government established a policy to support the establishment of maternal neonatal intensive care

Summary statement

• What is already known about this topic?

Several studies have compared the relationships of anxiety and depression with fetal attachment among high-risk and normal pregnant women. However, the mediating effects of family support in this relationship have not been examined among high-risk pregnant women in the maternal-fetal intensive care unit (MFICU).

• What this paper adds

Family support was found to have a partial mediating effect in the relationships of anxiety and depression with maternal-fetal attachment among high-risk pregnant women admitted to the MFICU.

• Implications for practice, education, and/or policy

The development and application of nursing mediation programs and counseling that can increase family support, reduce anxiety and depression, and promote maternal-fetal attachment would benefit high-risk pregnant women in the MFICU.

centers as a public health policy project. This policy provides systematic therapeutic management and nursing for high-risk pregnant women in the maternal-fetal intensive care unit (MFICU), and as of 2021, 19 hospitals are operating MFICUs. MFICUs provide intensive management, including fetal monitoring for pregnant women with gestational hypertension, gestational diabetes, heart disease, and complications such as postpartum bleeding and sepsis [5]. Fetal attachment refers to the development of emotional bonds with the fetus, prompting women to participate in interactive behaviors with and show affection for the fetus [6]. It is an important factor in helping pregnant women develop and adapt during pregnancy and influences healthy fetal development [7].

Pregnant women can experience depression due to changes in hormone levels and emotions related to pregnancy [8]. Depression has negative consequences for childbirth, such as preterm delivery, low birth weight, and difficulty forming bonds with the baby after childbirth [9]. Pregnant women admitted to the MFICU often experience panic and frustration due to the sudden diagnosis of a high-risk pregnancy, uncertain prognosis, and hospitalization [4]; thus, they often experience higher anxiety than women with normal pregnancies [10]. Depressed pregnant women have less interest in the fetus and interact less with the fetus, making it challenging to form maternal-fetal attachment [9]. Previous studies of maternal-fetal attachment have shown that the higher anxiety and depression of hospitalized high-risk pregnant women negatively affect fetal attachment, whereas family support reduces these adverse effects [2,9,11].

With the recent increase in MFICUs across Korea and the restrictive nature of the MFICU setting, multiple issues are foreseeable for high-risk pregnant women. However, insufficient research has explored factors associated with fetal attachment and

the mediating effects of family support, both in domestic and international contexts. No studies have been conducted on the effects of anxiety and depression on fetal attachment and the mediating effects of family support in that relationship among high-risk pregnant women admitted to the MFICU.

This study aimed to identify factors affecting maternal-fetal attachment and the mediating effect of family support among high-risk pregnant women admitted to MFICU in Korea. The specific aims were (1) to identify the factors affecting the participants' maternal-fetal attachment, and (2) to identify the mediating effect of family support on maternal-fetal attachment.

Methods

Ethics statement: This study was approved by the Institutional Review Board of Inje University (2020-04-022-003). Informed consent was obtained from the participants.

This is a self-report-based study using a correlational survey design. This manuscript was written in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (<https://www.strobe-statement.org/index.php?id=strobe-home>).

Sample and sampling

The participants of this study were women who were diagnosed with high-risk pregnancy and admitted to the MFICU of Inje University Busan Paik Hospital in Busan and Pusan National University Yangsan Hospital in Yangsan. Pregnant women who fulfilled the following four criteria were included via convenience sampling: (1) admission after being diagnosed with premature

labor, early amniotic membrane rupture, cervical incompetence, placenta previa, premature rupture of amniotic membrane, pre-eclampsia, oligohydramnios, abruptio placentae, uterine malformation, multiple pregnancies, polyhydramnios, fetal abnormalities (fetal growth delay, fetal malformation, or fetal lyrics), and relevant medical conditions (high blood pressure, diabetes, autoimmune diseases, blood clotting disorders, etc.); (2) at least 20 weeks of pregnancy; (3) a hospital stay of more than 3 days; and (4) comprehension of the purpose of the study and voluntary agreement to participate. The following two exclusion criteria were applied: (1) diagnosis of psychiatric diseases such as depression and cognitive dysfunction; and (2) unstable conditions that could affect the mother or fetus, such as delivery in progress or active bleeding. There was no identifiable bias in the selection or exclusion process.

The sample size required for this study was calculated using G*Power version 3.1.9.4. Based on previous studies [12], the following conditions were entered: effect size, .15 (medium size); significance level, .05; power, .80; and seven predictor variables (age, religion, high-risk pregnancy experience, planned pregnancy, anxiety, depression, and family support). The minimum number of samples required for multiple regression analysis was calculated as 103 participants, and a dropout rate of 20% was anticipated based on a previous study [12]. All eligible women were invited to take part in the study; out of a total of 124 participants, all responded to the questionnaire. Excluding one inadequate response, 123 participants were included in the analysis (Figure 1).

Instruments

The original developers and Korean translators gave permission to use all the measurement tools used in this study. Measurement

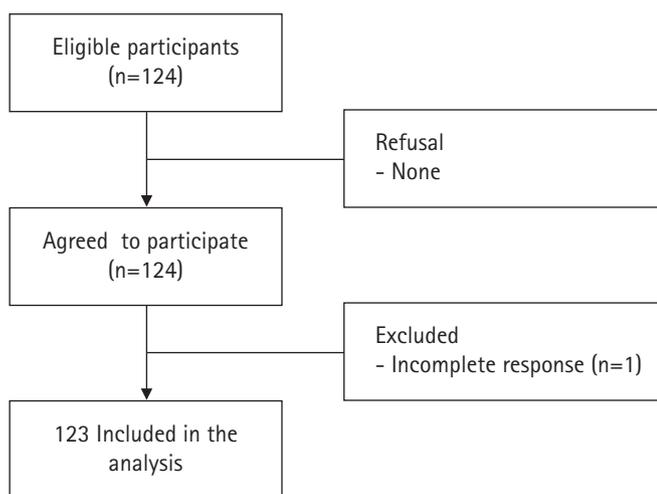


Figure 1. Flow diagram of recruitment.

tools for anxiety, depression, family support, and maternal-fetal attachment were used. The time to complete the paper questionnaire was about 10 minutes.

Maternal-fetal attachment

Cranley's maternal-fetal attachment scale (MFAS) was developed for pregnant women [6], and the Korean version was developed by Kim [13]. This tool consists of a total of 24 items; three items that distinguish oneself from the fetus, six items that speculate on the characteristics and intentions of the fetus, four items related to role acceptance, five items that ask about interaction with the fetus and the woman herself, and six items related to commitment. The responses are given on a 4-point Likert scale (1, definitely no; 4, definitely yes). The scores range from 24 to 96 points, and higher scores indicate a greater degree of maternal-fetal attachment. At the time of development, Cronbach's α of the original tool was .85 [6]. Internal reliability was good for the translated tool (Cronbach's $\alpha = .92$) [13] and in the present study (Cronbach's $\alpha = .92$).

Family support

Cobb's family support measurement tool was developed for patients with various pathologies [14] and translated into Korean by Kang [15]. This 11-item tool measures the degree of family support perceived by the patient with a 5-point Likert scale (1, not at all; 5, very much). The total score ranges from 11 to 55 points, and higher scores indicate a higher degree of family support. The Cronbach's α value of the tool at the time of development was .89 [14], and it was .86 for the translated tool [15]. Internal reliability was good in the present study (Cronbach's $\alpha = .87$).

Anxiety

The Korean version of Spielberger's State-Trait Anxiety Inventory [16], translated by Kim and Shin [17], was developed for measuring anxiety in normal adults without mental disorders. In this study, the 20 items on present state anxiety were included to measure anxiety levels in hospitalization. The summed scores using the 4-point Likert scale (1, not at all; 4, always) yielded a possible range from 20 to 80 points, with higher scores corresponding to a higher degree of anxiety. Cronbach's α was .84 at the time of development [16], .87 for the Korean translation [17], and .94 in the present study.

Depression

The Edinburgh Postnatal Depression Scale (EPDS) was initially developed to screen for postpartum depression [18] and has also

been used in pregnancy [19]. The Korean translation by Han et al. [20] was used. It measures respondents' mood for the last week with 10 items on a 4-point Likert scale (0, no, never; 3, yes, most of the time; or variable descriptions), and positive items are handled by inverse conversion. The total score ranged from 0 to 30, and a higher score indicates more severe depression. Those with a score of 10 or higher are classified as requiring psychiatric evaluation in Korea [20], with scores of 10 to 12 points classified as mild depression and a score of more than 12 requiring careful attention for major depressive disorder. Cronbach's α was .87 for the original tool [18], .85 for the translated tool [20], and .84 in the present study.

General characteristics and obstetric characteristics

The general characteristics consisted of eight items, including current age, marital status, marital period, education, occupation, monthly income, religion, and the number of family members. The obstetric characteristics consisted of 15 items, including the number of days of hospitalization, diagnosis, and whether the pregnancy was planned. These items were designed by the authors according to the literature.

Procedures

The survey data were collected from June 22 to September 20, 2020. Questionnaires were distributed by the research team and collected after completion on the same day. A gift for the newborn (worth 2 US dollars [USD]) was provided as a token of appreciation.

Statistical methods

Skewness and kurtosis were tested to confirm whether the data had a normal distribution. The general characteristics, obstetric characteristics, anxiety, depression, and degree of maternal-fetal attachment were analyzed using descriptive statistics, and factors affecting maternal-fetal attachment were analyzed using hierarchical multiple regression. The procedure proposed by Baron and Kenny [21] was used to confirm the mediating effect of family support, and the Sobel test was performed to verify the effectiveness of the mediating effect path. The independent variables were anxiety and depression, which showed significant correlations with fetal attachment. Family support was introduced as a mediator. In the first step, it was checked whether the independent variables (anxiety and depression) affected the mediator (family support). In the second step, it was checked whether the independent variables (anxiety and depression) had a significant effect on the dependent variable (fetal attachment). In the final step, it was checked whether the independent variables (anxiety

and depression) and the mediator (family support) had a significant effect on the dependent variable (fetal attachment). The mediating effect was confirmed by comparing the regression coefficient in step 2 with the regression coefficient in step 3. The analytical process is presented in Figure 2. The collected data were analyzed using IBM SPSS ver. 25.0 (IBM Corp., Armonk, NY, USA).

Results

General and obstetric characteristics of the participants

The average age of the participants was 34.1 years old, and 53.7% were under 35 years old. The average length of marriage was 46.63 months, and 39.1% of participants had been married for less than 24 months. The proportion of participants with a spouse was 96.7%, and 78.9% of the participants had a terminal education level of college graduation. Furthermore, 51.2% of participants were employed. The average monthly household income was 5.22 million Korean won (USD 4,626), and 49.6% of the group had monthly household incomes between 3 million Korean won (USD 2,659) and 6 million Korean won (USD 5,318). The majority of the participants (69.1%) were not religious, and 61.8% lived with their husbands (Table 1).

The average gestational age was 32.08 weeks, and 39.8% of the participants' gestational age was between 28 weeks and 37 weeks. Fewer than half of the women (38.2%) were pregnant for the first time, while 31.7% previously had a natural abortion, and 7.3% previously had an artificial abortion. In addition, 13.8% of the participants had a history of preterm birth, and 28.5% of the participants had a previous full-term delivery. The proportion of the participants who had previously experienced a high-risk pregnancy was 30.1%. Most of the participants (61.0%) had spontaneous natural pregnancies and planned pregnancies (65.0%). The average length of hospitalization was 5.02 days, and 72.4% were hospitalized for 3 days. Multiple diseases were diagnosed in 56.3% of

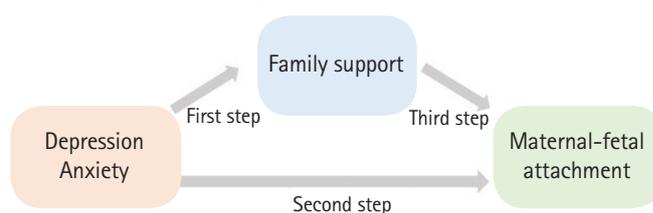


Figure 2. Relationships among the two independent variables (depression and anxiety), the mediator (family support), and dependent variable (maternal-fetal attachment) and the analysis steps.

Table 1. General characteristics of participants (N=123)

Characteristic	Categories	n (%)	Mean \pm SD	t/F	p
Age (year)	< 35	66 (53.7)	76.46 \pm 10.94	3.15	.002
	\geq 35	57 (46.3)	69.78 \pm 12.56		
Spouse	Yes	119 (96.7)	73.61 \pm 11.62	0.59	.595
	No	4 (3.3)	66.20 \pm 24.77		
Length of marriage (month)	\leq 24	48 (39.0)	75.81 \pm 13.07	2.84	.062
	25–72	59 (48.0)	70.69 \pm 10.78		
	\geq 73	16 (13.0)	75.93 \pm 12.66		
Education	\leq High school	15 (12.2)	71.73 \pm 9.17	2.66	.073
	University (college)	97 (78.9)	72.73 \pm 12.15		
	\geq Graduate school	11 (8.9)	81.27 \pm 13.68		
Job	Yes	63 (51.2)	72.82 \pm 13.34	-0.51	.610
	No	60 (48.8)	73.95 \pm 10.83		
Monthly household income (KRW)	\leq 3 million	30 (24.4)	71.13 \pm 12.85	0.81	.444
	3.01–6 million	61 (49.6)	73.60 \pm 11.60		
	\geq 6.01 million	32 (26.0)	75.01 \pm 12.55		
Religion	Yes	38 (30.9)	72.94 \pm 11.25	-0.25	.796
	No	85 (69.1)	73.56 \pm 12.58		
Cohabiting family	Living without spouse	6 (4.9)	68.00 \pm 20.48	0.77	.462
	Living with spouse only	76 (61.8)	74.11 \pm 11.91		
	Living with spouse & others	41 (33.3)	72.78 \pm 11.20		

KRW: Korean won (1 million KRW is approximately 900 US dollars).

the participants. The proportion of participants with medical illnesses was 40.7%, while 35.8% of participants had preterm labor and 26.8% had fetal abnormalities. The other obstetric conditions were as follows; cervical incompetence (21.1%), multiple pregnancies (19.5%), placenta previa (13.8%), premature rupture of amniotic membrane (11.4%), preeclampsia (9.8%), uterine malformation (8.9%), oligohydramnios (4.9%), abruptio placentae (1.6%), and polyhydramnios (0.8%) (Table 2).

Participants' anxiety, depression, family support, and fetal attachment

The participants' anxiety score was medium (43.57 \pm 11.65 points out of a maximum of 80). For depression, the average was 10.13 \pm 5.48 points out of a maximum of 30, with 66 (53.6%) identified as likely depressed (score of 10 or more) and 42 women (34.1%) having levels highly suspicious for depression (score of 13 or greater). The average score of family support was somewhat high (43.30 \pm 5.03 points out of a maximum of 55). The average score of maternal-fetal attachment was also somewhat high (73.37 \pm 12.14 points out of a maximum of 96) (Table 3).

Mediating effects of family support in the relationships of anxiety and depression with maternal-fetal attachment

We examined the autocorrelation of the dependent variable and

the multicollinearity between the independent variables before verifying the mediating effect. The Durbin-Watson statistic yielded results of 2.10 to 2.45, which were close to 2. Therefore, the assumption of the independence of the residuals could be accepted. Tolerance ranged from .74 to .95, all above .10, and the variance inflation factor (VIF) ranged from 1.04 to 1.33, all below 10, indicating no multicollinearity.

Controlling for age, which was a significant factor, in the first step, it was found that anxiety, an independent variable, had a significant effect on the mediator (family support) ($\beta = -.50$, $p < .001$). In the second step, anxiety was found to have a significant effect on maternal-fetal attachment (dependent variable) ($\beta = -.55$, $p < .001$). In the third step, anxiety (independent variable) and family support (mediator) had significant effects on maternal-fetal attachment (dependent variable) (anxiety: $\beta = -.42$, $p < .001$; family support: $\beta = .25$, $p = .002$). In the third step, the explanatory power of anxiety and family support was 41.9%. The β value of anxiety in the third step was $-.42$, the absolute value of which was less than that in the second stage, $-.55$, indicating a mediating effect of family support. Since both the independent variable and the mediator significantly affected the dependent variable, it was found that family support partially mediated the effect of anxiety on maternal-fetal attachment. Furthermore, the Sobel test showed the significance of the mediating effect ($z = -2.87$,

Table 2. Obstetric characteristics of participants (N=123)

Characteristic	Categories	n (%)	Mean \pm SD	t/F	p
Gestational period (week)	≤ 27	35 (28.5)	71.94 \pm 10.22	1.37	.256
	28-36	49 (39.8)	72.28 \pm 13.19		
	≥ 37	39 (31.7)	76.02 \pm 12.23		
Experience of spontaneous abortion	Yes	39 (31.7)	71.41 \pm 10.88	-1.22	.223
	No	84 (68.3)	74.28 \pm 12.64		
Number of pregnancies	1	47 (38.2)	74.89 \pm 13.62	0.60	.550
	2	42 (34.1)	72.26 \pm 10.61		
	≥ 3	34 (27.6)	72.64 \pm 11.89		
Experience of induced abortion	Yes	9 (7.3)	75.66 \pm 8.58	0.58	.559
	No	114 (92.7)	73.19 \pm 12.39		
Experience of preterm delivery	Yes	17 (13.8)	68.52 \pm 12.28	-1.78	.076
	No	106 (86.2)	74.15 \pm 11.99		
Experience of full-term delivery	Yes	35 (28.5)	74.17 \pm 11.04	0.45	.648
	No	88 (71.5)	73.05 \pm 12.60		
Experience of high-risk pregnancy	Yes	37 (30.1)	70.89 \pm 12.36	-1.49	.138
	No	86 (69.9)	74.44 \pm 11.96		
Pregnancy method	Natural pregnancy	75 (61.0)	73.52 \pm 12.16	0.02	.995
	Ovulation induction	5 (4.1)	74.20 \pm 16.78		
	Intrauterine insemination	6 (4.9)	72.66 \pm 11.44		
	<i>In vitro</i> fertilization	37 (30.1)	73.08 \pm 12.07		
Planned pregnancy	Yes	80 (65.0)	73.70 \pm 11.88	0.40	.686
	No	43 (35.0)	72.76 \pm 12.74		
Hospitalization days	3	89 (72.4)	73.97 \pm 12.54	1.01	.365
	4-5	15 (12.2)	74.40 \pm 10.86		
	≥ 6	19 (15.4)	69.73 \pm 11.02		
Number of diagnosed diseases	1	54 (43.9)	72.70 \pm 11.78	0.79	.454
	2	39 (31.7)	72.43 \pm 11.88		
	≥ 3	30 (24.4)	75.80 \pm 13.17		
Disease	Preterm labor	44 (35.8)			
	Premature rupture of membrane	14 (11.4)			
	Incompetent internal os of cervix	26 (21.1)			
	Placenta previa	17 (13.8)			
	Placenta abruptio	2 (1.6)			
	Preeclampsia	12 (9.8)			
	Polyhydramnios	1 (0.8)			
	Oligohydramnios	6 (4.9)			
	Uterus anomaly	11 (8.9)			
	Multifetal gestation	24 (19.5)			
	Fetal abnormality	33 (26.8)			
	Maternal disease	50 (40.7)			

$p = .003$).

Controlling for age, which was a significant factor, depression, an independent variable, had a significant effect on the mediator (family support) in the first step ($\beta = -.45, p < .001$). In the second step, depression was found to have a significant effect on maternal-fetal attachment (dependent variable) ($\beta = -.56, p < .001$). In the third step, depression ($\beta = -.44, p < .001$) and family support ($\beta = .26, p = .001$) were found to have statistically significant ef-

fects, and the explanatory power of depression and family support was 43.5%. The β value of depression in the third step was $-.44$, the absolute value of which was lower than the β -value in the second step, $-.56$. Therefore, it can be concluded that family support mediated the effect of depression on maternal-fetal attachment. Since both the independent variable and the mediator significantly affected the dependent variable, it can be concluded that family support partially mediated the effect of depression on fetal

Table 3. Degree of anxiety, depression, family support, and maternal-fetal attachment (N=123)

Variable	n (%)	Score		
		Possible range	Mean ± SD	Range
Anxiety		20–80	43.57 ± 11.65	21–79
Depression		0–30	10.13 ± 5.48	0–22
Normal	57 (46.3)	0–9		
Likely depressed	24 (19.5)	10–12		
Major depression	42 (34.1)	13–30		
Family support		11–55	43.30 ± 5.03	30–50
Maternal-fetal attachment		24–96	73.37 ± 12.14	36–96

Table 4. The mediating effect of family support on the relationships of anxiety and depression with maternal-fetal attachment (N=123)

Variable	B	SE	β	t	p	Adjusted R ²	F
1 Anxiety → Family support	-0.21	.03	-.50	-6.39	<.001	.246	40.82
2 Anxiety → Maternal-fetal attachment	-0.57	.07	-.55	-7.68	<.001	.376	37.79
3 Anxiety → Maternal-fetal attachment	-0.44	.08	-.42	-5.35	<.001	.419	30.38
Family support → Maternal-fetal attachment	0.60	.19	.25	3.15	.002		
Sobel test: Z = -2.95, p = .003							
1 Depression → Family support	-0.41	.07	-.45	-5.58	<.001	.198	31.17
2 Depression → Maternal-fetal attachment	-1.25	.16	-.56	-7.77	<.001	.381	38.70
3 Depression → Maternal-fetal attachment	-0.09	.17	-.44	-5.72	<.001	.435	32.34
Family support → Maternal-fetal attachment	0.64	.18	.26	3.52	.001		
Sobel test: Z = -3.07, p = .002							

Age is adjusted.

attachment. Furthermore, according to the Sobel test, the mediating effect ($z = -3.03, p = .002$) was significant (Table 4).

Discussion

The factors influencing maternal-fetal attachment in high-risk pregnant women admitted to MFICU were depression, anxiety, and family support, of which depression was the most influential factor. Conducting screening for prenatal depression using an available tool would make it possible to effectively screen and manage patients with significant depression within a short time at a low cost. Systematic and ongoing management of prenatal depression may help not only reduce patients’ depression but also improve maternal-fetal attachment. According to a prior study [22], support through collective counseling helps reduce depression and enhances hope and optimism. Thus, it may be helpful to provide supportive counseling for high-risk women admitted to MFICU. Other influencing factors were anxiety and family support. This result is similar to the findings of a previous study in high-risk pregnant women [2] that reported that anxiety and marital adaptation influenced maternal-fetal attachment. Another study of women who experienced miscarriage noted that

spousal support was a factor associated with maternal-fetal attachment [12].

The partial mediating effect of family support was confirmed in the relationships of anxiety and depression with maternal-fetal attachment in high-risk pregnant women admitted to MFICU. High anxiety and depression levels may reduce family support, which can negatively affect maternal-fetal attachment. Family support acts as a mediator to reduce the decline in maternal-fetal attachment caused by anxiety and depression. Although family members should be encouraged to visit the hospital during permitted hours to support high-risk pregnant women, their ability to do is very limited in the MFICU due to the nature of this setting and the constant surveillance required. Although the data collection period was during the COVID-19 pandemic, the limited opportunity for in-person support from family is inherent to the MFICU. Family support via smartphones is an alternative, but more structured “visiting” modes that encourage engagement and supportive interactions are needed.

The participants in this study reported relatively high maternal-fetal attachment scores, with an average of 73.37 out of 96 points, which is similar to the result of 74.25 points in a study of high-risk pregnant women [10] using the same tool. However, it

is lower than the average of 81.36 points in a study of women with normal pregnancies women [7]. These results imply that high-risk pregnant women admitted to the MFICU have a lower degree of maternal-fetal attachment than women with normal pregnancies (i.e., without pregnancy complications or other diseases).

In this study, the average anxiety score was 43.57 out of a total of 80. This is higher than previously reported scores of 39.02 points in high-risk pregnancies [2] and 39.3 points in normal pregnancies [9] using the same tool. As state anxiety ranged from 21 to 79 points, reflecting significant variation among individuals, nursing interventions for pregnant women in the MFICU should carefully note differences in individual characteristics and the degree of anxiety.

The average depression score (10.13 out of a total of 30) was also higher than previously reported among pregnant women (7.8 points) [23]. In this study, 53.6% of participants required a psychiatric evaluation (score ≥ 10). Furthermore, 34.1% were found to be at risk for severe depression (score ≥ 13), which is higher than the proportion of 20.6% reported for generally healthy pregnant women [23]. Underlying diseases, early labor pains, and fetal abnormalities were present in a large proportion of participants in this study, which is believed to have affected depression among pregnant women.

Although it is difficult to compare the findings directly due to insufficient research using the same tool among high-risk pregnant women, the degree of family support in this study (43.3 out of 55) appears to be similar to that reported for women with normal pregnancies (17.84 out of 20) using the multidimensional scale of perceived social support tool [24]. There is a need for further research on family support among high-risk pregnant women admitted to the MFICU.

Since the participants of the study were selected through convenience sampling from two hospitals in one region, caution is needed when generalizing the results to other institutions in other regions or countries. Nonetheless, this study is meaningful in that it examined high-risk women in the MFICU; as such, future studies would be beneficial to expand the target participants through nationwide sampling. It is also necessary to conduct further studies to develop nursing intervention programs that can strengthen family support and engagement with high-risk pregnant women during their stay in the MFICU to improve maternal-fetal attachment.

In conclusion, this study found that lower levels of anxiety and depression, as well as higher levels of family support, were associated with higher maternal-fetal attachment. Depression was identified as the most influential factor, and the mediating effect of family support in the relationships of depression and anxiety

with maternal-fetal attachment was verified. Therefore, it is necessary to reduce negative emotions such as anxiety and depression, and active family support is necessary to overcome those negative emotions. Developing a nursing intervention program to reduce anxiety would also support pregnant women and their family members. It is necessary to diagnose depression early through a prenatal depression screening system to enable early interventions. It would also be worth considering preparing an educational program to cultivate professional counselors for high-risk pregnant women with formal certificates for those who complete the course.

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Conflict of interest

The authors declared no conflict of interest.

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Data availability

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Do depression and its associated factors differ in women daytime and shift workers?: an analysis of the Korea National Health and Nutrition Examination Survey 2018

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Purpose: This study examined health behaviors, use of health services, and depression among women who perform daytime and shift work in Korea, as well as factors related to depression.

Methods: We conducted a secondary analysis using data from the 2018 data of the 7th Korea National Health and Nutrition Examination Survey. Data on women, 1,493 regular daytime workers and 322 shift workers, were analyzed.

Results: Women shift workers ($\chi^2=43.97, p<.001$), had a lower education level ($\chi^2=45.56, p<.001$), and lower personal income ($\chi^2=16.85, p=.030$) than their daytime counterparts. A higher proportion of shift workers were unmarried ($\chi^2=37.47, p<.001$) and they typically worked fewer than 40 hours per week ($\chi^2=69.94, p<.001$). The depression score of shift workers was higher than that of daytime workers ($t=2.85, p=.005$). A higher proportion of shift workers also drank alcohol ($\chi^2=6.49, p=.032$) and smoked ($\chi^2=30.79, p<.001$). Over 8% of shift workers typically slept fewer than 5 hours per night ($\chi^2=14.17, p=.024$). It was confirmed that depression in women shift workers was affected by age, personal income, marital status, health status, and smoking status, in addition to cancer screening participation, unmet medical care needs, and unmet dental care needs.

Conclusion: More attention should be given to the health needs of women working shifts. Health promotion programs specific for women shift workers are needed to improve their physical and mental health, encourage use of medical care services, and improve public health policies and systems.

Keywords: Depression; Health behavior; Health services; Shift work schedule; Working women

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Introduction

As the desire for higher education and self-actualization has increased among women in Korea, their participation in the economy has also increased, with the rate of employment for women rising from 54.9% in 2011 to 60.0% in 2019 [1,2]. However, this remarkable increase in women's employment rate does not mean that women's self-actualization and quality of life have necessarily improved. This is because a high proportion of women undertake non-regular shift work and part-time work compared to

men, and inequality has been identified as a new problem related to the different employment rates and employment patterns of men and women [3]. Married women in the workforce in particular, must participate in economic activities on a par with men, while also performing additional household roles such as house-keeping and childcare; these coexisting demands can be considered hazardous to their health [1,4].

Shift work refers to a type of work in which people are divided into two or more groups, and the daily work is divided into two or more shifts [5,6]. With the growing emphasis on convenience

Summary statement

• What is already known about this topic?

Regular shift work may be harmful to workers' health. The negative effects of shift work on mental health have been repeatedly verified.

• What this paper adds

This study focused on the health of women shift workers. Compared to their counterparts working daytime, shift working women were more depressed, reported worse health behaviors, and had more unmet health care needs.

• Implications for practice, education, and/or policy

Women shift workers were younger, had lower education levels, and lower incomes than daytime workers. Considering that shift working women were more depressed, more frequently consumed alcohol and smoked, and had a more vulnerable health status than daytime workers, health promotion programs specific to their general characteristics and needs are in demand to protect and promote their health.

in everyday life, shift work has been increasing in popularity in recent years [5], and there has been a growing interest in the impact of shift work on workers' physical, mental, and social health.

Compared to regular daytime workers, shift workers are more likely to experience disruptions in their daily routines and lives due to irregular working hours, and thus have more difficulty maintaining positive everyday health behaviors [7,8]. It is well-known that shift work interferes with workers' normal sleep-wake cycles, especially night shift workers, for whom the risk of safety accidents is high due to decreased concentration. Thus, a high proportion of shift workers in general tend to engage in unhealthy behaviors such as not getting enough sleep, smoking, and drinking alcohol [8,9]. As a result, shift work can lead to difficulties maintaining good health in daily life and increase workers' vulnerability to diseases. Shift workers frequently experience digestive, musculoskeletal, metabolic, and cerebrovascular diseases [8-10], and women shift workers have been reported to have an elevated risk of breast cancer [9,10] and premature birth [10] or miscarriage [10].

Studies on the mental health of shift workers have found that shift workers tend to experience a variety of mental health problems such as high stress [11], depression, and anxiety [7]. Serious depression among women shift workers was also found in preceding studies [11,12]. According to the Korean National Health and Nutrition Examination Survey (KNHANES), women shift workers were 2.94 times more likely to develop depression than their male counterparts [12], and the degree of depression experienced by women shift workers was 1.73 times higher than men according to a meta-analysis of research on shift workers [11]. However, previous studies have not provided sufficient evidence regarding why women shift workers experience more

serious depression than men shift workers. Some studies have suggested that women generally have a higher risk of depression than men [11], while others have suggested that hormonal reactions can cause women to be more stressed about rotated or shift work, making them more vulnerable to depression than men [12]. One explanation for the high levels of depression among women shift workers may be that childcare or housework duties increase their fatigue and stress levels in addition to the negative physical and mental effects of shift work [1,3]. In order to identify the causes and factors that influence depression among women shift workers, studies that are designed to exclude the effects of exogenous variables should be conducted.

Unmet medical care needs, which occur when people are unable to use medical services despite experiencing illness or health problems that require medical attention, is an important direct indicator of medical inequality [13,14]. These variables are meaningful indicators of the health of women who perform shift work. According to an analysis of adult women in Korea, the extent to which women received insufficient medical care was at least 1.2 times and up to 1.5 times higher for employed women than for unemployed women, and the reasons for insufficient medical care among women were costs, long wait times at doctor's offices, difficulties obtaining health services during working hours, and childcare responsibilities [15]. For employed women, analysis of unmet medical conditions of daytime workers and shift workers with modified working schedules is sorely lacking and more in-depth research is needed.

Prior studies have found that shift work and depression are related. Although women shift workers reported more serious depression than men shift workers, most studies on depression that included women shift workers classified all participants simply as

shift workers, not accounting for gender differences in their analyses [11,12], or examined health behaviors, depression, and quality of life among all women workers regardless of work type [1,15]. In many studies, women shift workers were not distinguished from other women workers according to their working patterns. In addition, studies of depression among shift workers have typically compared workers by sex, and many of the interpretations resulting from these studies have been fragmented [11,12].

Among women workers, those who perform shift work tend to face many health vulnerabilities. Studies that examine women workers should further classify them as daytime or shift-based workers, according to the type of work performed, in order to more accurately identify differences in health status and depression. Furthermore, in order to better understand women shift workers' health, identifying their unmet medical needs, which tend to be indicators of general characteristics, health behaviors, and medical inequality, is also of value. Depression among women shift workers has already been shown to be at a serious level [11,12]. Thus, it is important and urgent to identify the factors affecting depression among women shift workers as a next step.

This study was therefore conducted to examine shift working women's health behaviors, health care use, and depression according to their type of work, and analyze factors related to depression. This would improve the existing understanding of women shift workers' mental health, and enable suggestions for future health promotion programs targeted to women shift workers, and provide basic data to support policies that address their needs.

Purpose of the study

This study was conducted to examine health behaviors, the use of medical services, and depression among women daytime workers and shift workers, and to identify factors related to depression using the 2018 data of the 7th KNHANES. The specific objectives of this study were as follows.

- To identify and compare the general characteristics, health-related behaviors, use of medical services, and the prevalence of depression among women daytime and shift workers
- To analyze differences in the prevalence and degree of depression according to the general characteristics, health-related behaviors, and use of medical services of female daytime and shift workers
- To analyze factors related to depression among female daytime and shift workers

Methods

Ethics statement: This study was exempted by the Institutional Review Board (IRB) of Hannam University (IRB-2020-E-03-01). This study was a secondary analysis of data and data were received anonymously.

Design

This secondary analysis study used 2018 data from the 7th KNHANES (2016-2018), with a correlational research design, to compare differences in health-related behaviors, medical service usage, and depression among working women and to identify factors related to depression among working women. This study was described in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (<https://www.strobe-statement.org/index.php?id=strobe-home>).

Participants

Participants were working women aged 19 years or older who participated in the 7th KNHANES, during the period of January to December 2018, conducted by the Korea Centers for Disease Control and Prevention. Women were considered employed if they answered "yes" to the following question: "Have you worked for more than 1 hour for income in the last week, or in an unpaid role as a family member for more than 18 hours?" Of the total 7,992 people who participated in the survey, 4,352 were women and 1,815 of whom were women aged 19 years or older (Figure 1).

In this study, women were considered daytime workers if they answered "yes" to the following question: "Do you usually work between 6 AM and 6 PM?" Women were considered shift workers if they worked any of the following: evening shifts (2 AM to midnight), night shifts (9 PM to 8 AM the next day), regular or irregular day and night shifts, 24-hour shifts, and other alternatives to a standard daytime work schedule. Of the 1,815 working women aged 19 years or older, 1,493 were daytime workers and 322 were shift workers.

Variables

Depression

Depression in the 7th KNHANES was measured using the Patient Health Questionnaire-9 (PHQ-9) [16]. The PHQ-9 consists of nine questions for determining if respondents have suffered from depression-related symptoms over the previous 2

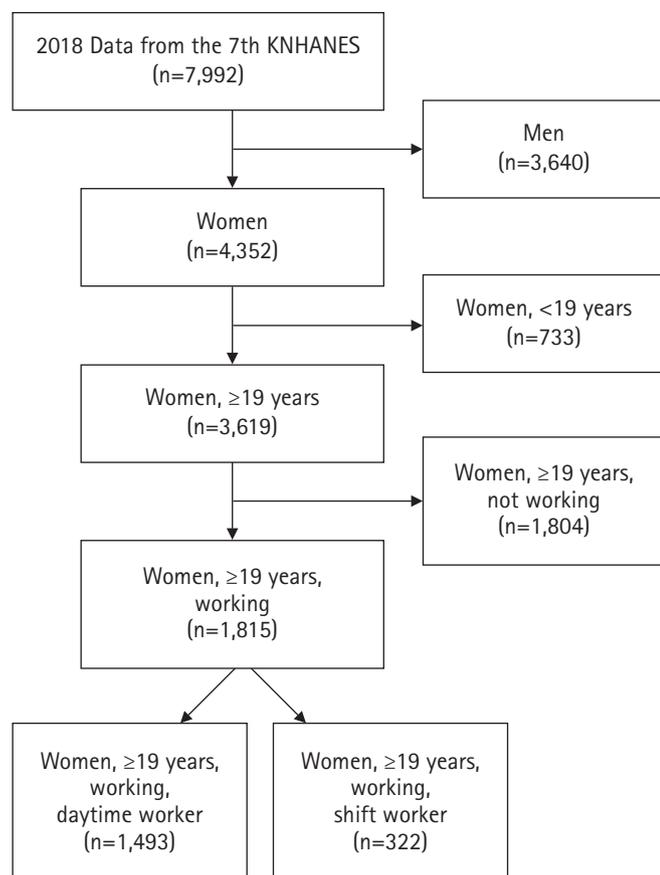


Figure 1. Flowchart of the study population. KNHANES: Korea National Health and Nutritional Examination Survey.

weeks, for which there are four possible responses: ‘not at all,’ ‘several days,’ ‘more than half the days,’ or ‘nearly every day.’ The PHQ-9 results are calculated by summing scores for each question (0 not at all, to 3 nearly every day). Higher scores indicate a greater degree of depression. A score of 0–4 points indicates minimal depression, 5–9 points indicates mild depression, 10–14 points indicates moderate depression, 15–19 points indicates moderately severe depression, and 20–27 points indicates severe depression. For analysis, 10 points was treated as the cutoff, with summed scores of 10 or greater indicating depression.

Health-related behaviors

Health-related behaviors were drinking status, smoking status, frequency of aerobic physical activity, and average nightly sleeping hours for both weeknights and weekend nights.

Participants were considered non-drinkers if they had not consumed alcohol in the past month, and drinkers if they had. They were considered non-smokers if they did not smoke or had quit

smoking, and smokers if they smoked daily or occasionally. Respondents were considered physically inactive if they participated in aerobic physical activity rarely or never; physically active meant they participated in aerobic physical activity daily or often. Average hours slept for both weeknights and weekend nights were classified in four categories: 4 hours or less, 5–6 hours, 7–8 hours, or 9 hours or more [17,18].

Use of medical services

To determine respondents’ use of medical services, KNHANES collected data on the following: Participants answered ‘yes’ or ‘no’ to questions asking whether they had received a medical check-up and cancer screening within the previous 2 years and a flu vaccination within the previous year. Unmet medical needs and unmet dental needs were also determined.

General characteristics

General characteristics included age, education level, personal income, marital status, household type, relationship with other household members, occupation, average weekly working hours, and subjective health status.

Age was classified according to the following five groups: 19–29, 30–39, 40–49, 50–59, or 60 years and older. Education level was classified as a middle school level or less, high school level, or college level and above. Income was divided into five classifications according to the quintile classification criteria of the KNHANES: high, upper middle, middle, lower middle, and low. Marital status was either married or unmarried, and household types were divided into single-person and multi-person. Job type was classified as managers/professionals, office/service/sales, or other. The number of working hours per week was classified as less than 40 hours, 40 hours, between 40 and 52 hours, and more than 52 hours, based on labor law. Subjectively perceived health status was classified as good, moderate, or poor.

Data collection

The data used for this study were downloaded from the KNHANES website. The KNHANES consists of a self-reported health survey, check-up survey, and nutrition survey at household level, taking place over a 3-year period. Tests were conducted at mobile screening centers, and nutritional surveys were conducted by visiting target households in person. The Korea Centers for Disease Control and Prevention publishes the results of the survey with the disclosure of raw data on the KNHANES website, which only provides anonymous data so that individuals cannot be identified from the survey data in compliance with the Personal Information Protection Act and Statistics Act.

Data analysis

Data analysis in this study was conducted using IBM SPSS ver. 20.0 (IBM Corp., Armonk, NY, USA) and complex-sample analysis, considering the complex-sample elements, strata, cluster, and weight. The specific data analysis methods were as follows.

- (1) The general characteristics, health-related behaviors, and use of medical services among women daytime and shift workers were analyzed using complex-sample statistics. Depression was quantified using the mean and standard error with complex-sample descriptive analysis.
- (2) A comparison of the general characteristics, health-related behaviors, and use of medical services between women daytime and shift workers was conducted using the complex-sample t-test and cross-tab analysis.
- (3) Differences in the prevalence and intensity of depression between women daytime workers and shift workers were analyzed using a complex-sample general linear model.
- (4) The general characteristics, health-related behaviors, and differences in the prevalence and intensity of depression according to the use of medical services were analyzed using a complex-sample general linear model.
- (5) The depression-related factors of women daytime workers and shift workers were analyzed using a complex-sample general linear model.

Results

Differences in general characteristics between women daytime and shift workers

Women daytime and shift workers differed in terms of age, education level, personal income, marital status, and average hours worked per week. Among the age ranges, the smallest proportion of daytime workers was 19 to 29 years old (16.2%), as opposed to shift workers, for whom women aged 19 to 29 years made up the largest proportion (30.6%), showing a statistically significant difference ($\chi^2 = 43.97, p < .001$). There was also a difference in education level, with 46.8% of daytime workers reporting college education or higher, whereas 50.3% of shift workers reporting having graduated from high school ($\chi^2 = 45.56, p < .001$). For personal income, the highest proportion of daytime workers reported having upper middle (21.6%) or high (22.1%) personal income levels, while the highest proportion of shift workers reported having low (21.3%) and lower middle (25.8%) personal income levels ($\chi^2 = 16.85, p = .030$). There were also more unmarried shift workers (35.6%) than their daytime working counterparts (20.1%) ($\chi^2 = 45.56, p < .001$). In terms of average hours worked per week, a higher proportion of daytime workers re-

ported working 40 hours per week or between 40 and 52 hours per week than shift workers, who mostly worked fewer than 40 hours per week ($\chi^2 = 69.94, p < .001$) (Table 1).

Differences in health-related behaviors, use of health care services, and depression between women daytime and shift workers

Daytime and shift working women differed in terms of drinking status, smoking status, physical activity, average hours slept per night on weeknights, medical check-ups, and cancer screening. Shift workers had a higher proportion of drinkers (58.3%) than daytime workers (50.6%) ($\chi^2 = 6.49, p = .032$). In addition, shift workers had a higher proportion of smokers (15.0%) than daytime workers (6.1%) ($\chi^2 = 30.79, p < .001$). Shift workers also engaged in physical activity (48.5%) less often than daytime workers (40.1%) ($\chi^2 = 7.87, p = .025$). Daytime workers averaged 7-8 hours of sleep on weeknights (54.3%) more often than shift workers (49.8%), and more shift workers reported sleeping fewer than 5 hours per weeknight (8.3%) than daytime workers (3.9%) ($\chi^2 = 14.17, p = .024$). A lower proportion of shift workers received a medical check-up within the previous 2 years (60.9%) than daytime workers (73.6%) ($\chi^2 = 21.85, p < .001$). Fewer shift workers received cancer screening (54.3%) than daytime workers (64.5%) ($\chi^2 = 12.38, p < .001$).

The average scores for depression were higher among shift workers (3.19 points) than among daytime workers (2.42 points) ($t = 2.85, p = .005$). A higher proportion of shift workers also scored more than 10 points (indicating moderate depression) on the PHQ-9 (8.6%) than daytime workers ($\chi^2 = 14.22, p = .001$) (Table 2).

Differences in depression according to general characteristics, health-related behaviors, and use of healthcare services among daytime workers

Daytime workers showed different results for depression according to age, personal income, marital status, household type, health status, drinking status, smoking status, physical activity, average hours slept per night on weeknights, average hours slept per night on weekend nights, medical check-up status, cancer screening status, unmet health care needs, and unmet dental care needs.

Depression was higher in women aged 19 to 29 years than in women aged 60 years and over ($F = 6.88, p < .001$), and women with a high level of personal income showed the lowest level of depression ($F = 6.95, p < .001$). Single women more frequently had depression than married women ($F = 18.66, p < .001$), and women from single-person households had higher levels of de-

Table 1. General characteristics of daytime and shift working women (N=1,815)

Characteristics	Categories	Daytime workers (n = 1,493)		Shift workers (n = 322)		χ^2 (p)
		n [†]	% [†] (SE)	n [†]	% [†] (SE)	
Age (year)	19–29	173	16.2 (1.3)	75	30.6 (3.2)	43.97 (<.001)
	30–39	246	18.9 (1.5)	40	12.8 (1.9)	
	40–49	349	23.0 (1.4)	77	23.2 (3.0)	
	50–59	368	24.3 (1.5)	80	22.3 (2.8)	
	≥ 60	357	17.6 (1.4)	50	11.1 (1.8)	
Education level	≤ Middle school	405	22.3 (1.7)	61	16.1 (2.2)	45.56 (<.001)
	High school	458	31.0 (1.5)	148	50.3 (3.2)	
	≥ College	630	46.8 (1.8)	113	33.6 (3.1)	
Personal income	Low	238	17.9 (1.2)	59	21.3 (3.2)	16.85 (.030)
	Lower middle	284	17.9 (1.3)	79	25.8 (3.2)	
	Middle	300	20.5 (1.3)	57	16.7 (2.4)	
	Upper middle	328	21.6 (1.4)	66	19.4 (2.8)	
	High	340	22.1 (1.4)	60	16.8 (2.4)	
Marital status	Married	1,259	79.9 (1.5)	230	64.4 (3.2)	37.47 (<.001)
	Unmarried	234	20.1 (1.5)	92	35.6 (3.2)	
Household type	Single-person	165	10.6 (1.2)	49	13.5 (2.1)	2.47 (.165)
	Multi-person	1,328	89.4 (1.2)	273	86.5 (2.1)	
Household head	Self	554	35.8 (1.8)	129	36.8 (2.9)	0.12 (.746)
	Other	939	64.2 (1.8)	193	63.2 (2.9)	
Occupation type	Manager/professional	342	25.6 (1.4)	96	26.5 (2.8)	4.77 (.236)
	Office/service/sales	713	49.5 (1.5)	159	54.0 (3.5)	
	Others	438	25.0 (1.6)	67	19.4 (2.4)	
Paid worker	Yes	1,147	79.0 (1.3)	229	75.2 (2.9)	2.35 (.210)
	No	346	21.0 (1.3)	93	24.8 (2.9)	
Time spent working (hour/week)	≤ 39	650	41.8 (1.7)	213	66.3 (2.9)	69.94 (<.001)
	40	321	22.0 (1.3)	25	9.4 (1.9)	
	41–51	331	23.9 (1.4)	53	15.2 (2.1)	
	≥ 52	191	12.4 (1.0)	31	9.2 (1.7)	
Perceived health status	Poor	245	16.0 (1.2)	52	16.4 (2.3)	0.65 (.800)
	Moderate	798	52.7 (1.5)	179	54.5 (3.2)	
	Good	450	31.3 (1.3)	91	29.1 (3.0)	

[†]Unweighted and valid frequency, [†]valid percentage.

pression than women from multi-person households ($F = 6.24$, $p = .013$). Compared to women who perceived their health as being good, women who perceived having moderate or poor normal or bad health had higher levels of depression ($F = 48.24$, $p < .001$). Women who drank alcohol also had higher scores for depression than women who did not drink ($F = 10.11$, $p = .002$), and women who smoked had higher depression levels than non-smoking women ($F = 14.24$, $p < .001$).

Women who were physically active were more depressed than women who were inactive ($F = 6.10$, $p = .015$). In addition, women who slept fewer than 5 hours on average during the week had higher levels of depression ($F = 6.80$, $p < .001$), as were women who slept fewer than 5 hours on average during the weekend

($F = 4.07$, $p = .008$). Women who had not received a medical check-up ($F = 7.74$, $p = .009$) or cancer screening ($F = 6.18$, $p = .014$) within the previous 2 years were more depressed on average. Women daytime workers with unmet medical needs ($F = 28.18$, $p < .001$) and unmet dental care needs ($F = 11.46$, $p = .001$) also showed higher levels of depression (Table 3).

Differences in depression according to general characteristics, health-related behaviors, and use of healthcare services among shift workers

Depression among women shift workers varied depending on age, personal income, marital status, health status, smoking status, cancer screening status, unmet health care needs, and unmet

Table 2. Health behaviors and use of health services of women daytime and shift workers (N=1,815)

Characteristics	Categories	Daytime workers (n = 1,493)		Shift workers (n = 322)		χ^2 (p) or t (p)
		n [†] or range	%* (SE) or mean \pm SE	n [†] or range	%* (SE) or mean \pm SE	
Health behavior						
Drinking	Yes	703	50.6 (1.6)	175	58.3 (3.1)	6.49 (.032)
	No	788	49.4 (1.6)	146	41.7 (3.1)	
Smoking	Yes	74	6.1 (0.9)	43	15.0 (2.4)	30.79 (<.001)
	No	1,416	93.9 (0.9)	279	85.0 (2.4)	
Physical activity	Yes	583	40.1 (1.5)	147	48.5 (3.3)	7.87 (.025)
	No	909	59.9 (1.5)	174	51.5 (3.3)	
Time spent sleeping (hour/weeknight)	≤ 4	52	3.9 (0.6)	28	8.3 (1.8)	14.17 (.024)
	5–6	512	35.2 (1.5)	110	33.4 (2.8)	
	7–8	817	54.3 (1.5)	159	49.8 (3.3)	
	≥ 9	109	6.7 (0.8)	25	8.4 (2.0)	
Time spent sleeping (hour/weekend night)	≤ 4	24	1.6 (0.4)	12	3.2 (1.0)	3.63 (.477)
	5–6	273	17.4 (1.1)	67	17.0 (2.2)	
	7–8	806	52.7 (1.4)	165	51.4 (3.3)	
	≥ 9	387	28.3 (1.5)	78	28.5 (3.4)	
Health service use						
Medical check-up	No	377	26.4 (1.3)	121	39.1 (3.4)	21.85 (<.001)
	Yes	1,115	73.6 (1.3)	201	60.9 (3.4)	
Cancer screening	No	490	35.5 (1.6)	136	45.7 (3.6)	12.38 (<.001)
	Yes	1,002	64.5 (1.6)	186	54.3 (3.6)	
Influenza vaccination	No	890	61.6 (1.6)	202	66.9 (3.0)	3.32 (.113)
	Yes	601	38.4 (1.6)	120	33.1 (3.0)	
Unmet medical needs	No	1331	89.2 (1.0)	293	90.8 (1.7)	0.71 (.448)
	Yes	162	10.8 (1.0)	29	9.2 (1.7)	
Unmet dental needs	No	1,048	71.5 (1.4)	228	71.0 (3.0)	0.04 (.879)
	Yes	443	28.5 (1.4)	94	29.0 (3.0)	
Depression	Total	0–27	2.42 \pm 0.10	0–23	3.19 \pm 0.27	2.85 (.005)
	Yes (≥ 10)	56	3.8 (0.6)	29	8.6 (1.8)	14.22 (.001)
	No (< 10)	1,430	96.2 (0.6)	293	91.4 (1.8)	

[†]Unweighted and valid frequency, ^{*}valid percentage.

dental care needs.

Depression was higher in women aged 19 to 29 and 30 to 39 compared to the other age ranges ($F = 4.12$, $p = .003$). Women with a high level of personal income had the lowest level of depression ($F = 6.17$, $p < .001$). Single women had higher levels of depression than married women ($F = 6.68$, $p = .011$). Women who smoked showed higher levels of depression than women who did not smoke ($F = 11.31$, $p = .001$). Compared to women who perceived their health as being good, women who perceived their health as normal or bad had higher levels of depression ($F = 14.62$, $p < .001$). Shift work women who had not received a cancer screening ($F = 4.06$, $p = .046$) were more depressed, and depression was high among women with unmet health care needs ($F = 5.59$, $p = .019$) and unmet dental care needs ($F = 6.01$,

$p = .015$) (Table 3).

Factors related to depression in women workers

Depression-related factors for women daytime workers were age, personal income, health status, drinking status, smoking status, average hours slept per night, and unmet medical care needs, with 26% model explanation. Depression was higher in women aged 19 to 29 years than in women aged 60 years or older. Lower personal income and poor perceived health status also corresponded to higher levels of depression. Women who drank alcohol and smoked had higher levels of depression than non-drinking and non-smoking women. Depression was higher among women who slept on average fewer than 5 hours per night on weeknights compared to women who averaged between 7 and 9

Table 3. Depression according to general characteristics, health behaviors, and use of health services (N=1,815)

Characteristics	Categories	Daytime workers (n = 1,493)		Shift workers (n = 322)	
		Mean (SE)	F (p)	Mean (SE)	F (p)
Age (year)	19–29	3.72 (0.29)	6.88 (<.001)	3.68 (0.56)	4.12 (.003)
	30–39	2.20 (0.22)		4.95 (0.78)	
	40–49	2.14 (0.16)		2.93 (0.52)	
	50–59	2.15 (0.21)		2.42 (0.39)	
	≥ 60	2.21 (0.20)		1.89 (0.47)	
Education level	≤ Middle school	2.55 (0.21)	0.43 (.649)	2.96 (0.65)	0.22 (.805)
	High school	2.31 (0.16)		3.35 (0.39)	
	≥ College	2.43 (0.14)		3.05 (0.38)	
Personal income	Low	2.83 (0.24)	6.95 (<.001)	3.54 (0.68)	6.17 (<.001)
	Lower middle	2.94 (0.27)		4.46 (0.64)	
	Middle	2.58 (0.19)		2.90 (0.53)	
	Upper middle	2.16 (0.16)		2.86 (0.47)	
	High	1.76 (0.15)		1.58 (0.29)	
Marital status	Married	2.17 (0.10)	18.66 (<.001)	2.61 (0.30)	6.68 (.011)
	Unmarried	3.42 (0.27)		4.24 (0.53)	
Household type	Single-person	3.25 (0.35)	6.24 (.013)	3.79 (0.52)	1.44 (.233)
	Multi-person	2.32 (0.10)		3.10 (0.29)	
Household head	Self	2.66 (0.16)	3.35 (.069)	3.54 (0.39)	1.17 (.282)
	Other	2.83 (0.12)		2.99 (0.35)	
Occupation type	Manager/professional	2.39 (0.19)	0.34 (.714)	2.95 (0.46)	0.25 (.781)
	Office/service/sales	2.49 (0.14)		3.37 (0.40)	
	Others	2.30 (0.19)		3.04 (0.59)	
Paid worker	Yes	2.38 (0.10)	0.72 (.396)	3.11 (0.30)	0.31 (.582)
	No	2.56 (0.19)		3.43 (0.51)	
Time spent working (hour/week)	≤ 39	2.31 (0.14)	0.92 (.432)	3.04 (0.31)	0.55 (.652)
	40	2.31 (0.19)		2.82 (1.06)	
	41–51	2.73 (0.23)		3.35 (0.49)	
	≥ 52	2.37 (0.25)		4.41 (1.14)	
Perceived health status	Bad	4.81 (0.34)	48.24 (<.001)	6.01 (0.76)	14.62 (<.001)
	Normal	2.28 (0.13)		3.07 (0.37)	
	Good	1.45 (0.12)		1.82 (0.30)	
Drinking status	Yes	2.70 (0.14)	10.11 (.002)	3.59 (0.40)	3.12 (.079)
	No	2.14 (0.12)		2.63 (3.34)	
Smoking status	Yes	4.83 (0.67)	14.24 (<.001)	6.06 (0.96)	11.31 (.001)
	No	2.27 (0.09)		2.68 (0.24)	
Physical activity	Yes	2.69 (0.15)	6.10 (.015)	3.38 (0.39)	0.55 (.461)
	No	2.24 (0.12)		3.01 (0.34)	
Time spent sleeping (hour/weeknight)	< 5	6.03 (0.82)	6.80 (<.001)	4.34 (1.24)	2.27 (.082)
	5–6	2.20 (0.16)		3.41 (0.45)	
	7–8	2.28 (0.11)		2.63 (0.28)	
	≥ 9	2.51 (0.30)		4.54 (0.81)	
Time spent sleeping (hour/weekend night)	< 5	6.28 (1.29)	4.07 (.008)	4.57 (1.56)	0.50 (.686)
	5–6	2.25 (0.22)		3.28 (0.68)	
	7–8	2.22 (0.12)		2.94 (0.39)	
	≥ 9	2.66 (0.19)		3.43 (0.47)	
Medical check-up	No	2.84 (0.19)	7.74 (.009)	3.86 (0.49)	3.76 (.054)
	Yes	2.27 (0.11)		2.76 (0.29)	
Cancer screening	No	2.72 (0.17)	6.18 (.014)	3.76 (0.43)	4.06 (.046)
	Yes	2.23 (0.11)		2.71 (0.30)	

(Continued to the next page)

Table 3. Continued

Characteristics	Categories	Daytime workers (n = 1,493)		Shift workers (n = 322)	
		Mean (SE)	F (p)	Mean (SE)	F (p)
Influenza vaccination	No	2.49 (0.12)	0.87 (.351)	3.42 (0.35)	2.08 (.152)
	Yes	2.31 (0.15)		2.72 (0.35)	
Unmet medical needs	No	2.18 (0.09)	28.18 (<.001)	2.94 (0.25)	5.59 (.019)
	Yes	4.37 (0.41)		5.69 (1.14)	
Unmet dental needs	No	2.20 (0.10)	11.46 (.001)	2.76 (0.28)	6.01 (.015)
	Yes	2.97 (0.21)		4.25 (0.56)	

Table 4. Factors related to depression among women daytime workers (N=1,493)

Characteristics	Categories	B (SE)	95% CI		t	p
			Lower	Upper		
Constant		0.02 (0.26)	-0.50	0.54	0.08	.937
Age (year) [†]	19-29	1.42 (0.40)	0.63	2.21	3.57	<.001
	30-39	0.52 (0.30)	-0.06	1.1	1.76	.081
	40-49	0.33 (0.23)	-0.12	0.78	1.47	.145
	50-59	0.22 (0.22)	-0.22	0.66	0.97	.334
Personal income [†]	Low	0.57 (0.26)	0.06	1.08	2.2	.029
	Lower middle	0.60 (0.27)	0.08	1.13	2.27	.025
	Middle	0.48 (0.22)	0.05	0.91	2.19	.030
	Upper middle	0.12 (0.22)	-0.24	0.61	0.88	.380
Marital status [†]	Unmarried	0.54 (0.33)	-0.12	1.19	1.62	.108
Household type [†]	One-person	0.46 (0.32)	-0.18	1.09	1.41	.160
Perceived health status [†]	Bad	2.99 (0.33)	2.35	3.63	9.19	<.001
	Normal	0.67 (0.15)	0.38	0.96	4.56	<.001
Drinking status [†]	Yes	0.33 (0.16)	0.02	0.63	2.1	.037
Smoking status [†]	Yes	1.59 (0.59)	0.42	2.75	2.69	.008
Physical activity [†]	Yes	0.25 (0.14)	-0.04	0.53	1.72	.087
Time spent sleeping [†] (hour/weeknight)	< 5	2.47 (0.88)	0.74	4.2	2.82	.005
	5-6	-0.06 (0.17)	-0.40	0.28	-0.34	.735
	≥ 9	-0.13 (0.32)	-0.77	0.5	-0.41	.679
Time spent sleeping [†] (hour/weekend night)	< 5	0.73 (1.20)	-1.64	3.1	0.61	.543
	5-6	0.07 (0.24)	-0.40	0.54	0.31	.760
	≥ 9	0.08 (0.20)	-0.32	0.48	0.4	.691
Medical check-up [†]	No	0.18 (0.27)	-0.35	0.71	0.66	.508
Cancer screening [†]	No	-0.34 (0.22)	-0.77	0.09	-1.55	.122
Unmet medical needs [†]	Yes	1.33 (0.36)	0.63	2.03	3.75	<.001
Unmet dental needs [†]	Yes	0.17 (0.18)	-0.20	0.53	0.91	.367

R² = .26, F = 11.40, p < .001

CI: Confidence interval.

[†]The reference groups for dummy variables were as follows: age (≥60 years), personal income (high), marital status (married), household type (multi-person), perceived health status (good), drinking status (no), smoking status (no), physical activity (no), time spent sleeping (7-8 hours), medical check-up (yes), cancer screening (yes), unmet medical needs (no), and unmet dental needs (no).

hours of sleep on weeknights. Depression was also higher among women with unmet medical care needs (Table 4).

As for women shift workers, depression-related factors included age, personal income, health status, smoking status, unmet health care needs, and unmet dental care needs; the model including

these factors explained 31% of variance. Compared to women aged 60 years or older, depression was higher among women aged 30 to 39 years. Lower personal income and poor perceived health status corresponded to higher levels of depression. Women who smoked experienced higher levels of depression than non-smok-

Table 5. Factors related to depression among women shift workers (N=322)

Characteristics	Categories	B (SE)	95% CI		t	p
			Lower	Upper		
Constant		-1.26 (0.71)	-2.66	0.13	-1.79	.076
Age (year) [†]	19–29	1.26 (1.13)	-0.98	3.49	1.11	.268
	30–39	1.94 (0.83)	0.29	3.58	2.33	.021
	40–49	0.77 (0.59)	-0.40	1.94	1.3	.196
	50–59	0.06 (0.64)	-1.21	1.32	0.09	.927
Personal income [†]	Low	1.15 (0.58)	0.01	2.29	1.99	.049
	Lower middle	2.24 (0.61)	1.05	3.44	3.7	<.001
	Middle	1.29 (0.56)	0.18	2.4	2.3	.023
	Upper middle	1.10 (0.52)	0.07	2.14	2.1	.037
Marital status [†]	Unmarried	0.90 (0.85)	-0.78	2.58	1.06	.29
Perceived health status [†]	Bad	3.08 (0.67)	1.77	4.4	4.63	<.001
	Normal	1.19 (0.43)	0.35	2.04	2.81	.006
Smoking status [†]	Yes	2.07 (0.86)	0.37	3.76	2.4	.017
Cancer screening [†]	No	0.07 (0.45)	-0.82	0.97	0.16	.870
Unmet medical needs [†]	Yes	2.90 (0.92)	1.09	4.7	3.17	.002
Unmet dental needs [†]	Yes	1.11 (0.52)	0.08	2.14	2.13	.035
$R^2 = .31, F = 4.66, p < .001$						

CI: Confidence interval.

[†]The reference groups for dummy variables were as follows: age (≥ 60 years), personal income (high), marital status (married), perceived health status (good), smoking status (no), cancer screening (yes), unmet medical needs (no), and unmet dental needs (no).

ing women, and depression was also higher among women with unmet medical and dental care needs (Table 5).

Discussion

In this study, depression was higher among women shift workers than among their daytime working counterparts. This is consistent with the results of a study of employed women showing a higher rate of depression among women who performed shift work than among women who were daytime workers [19] and a study of male and female workers that also showed a higher rate of depression among shift workers than among daytime workers [8,20]. Considering that the rate of depression is higher among women workers than men [20,21], these results indicate that women who perform shift work experience the most depression among various categories of workers. Because shift work is different from the 24-hour biological rhythm [22], it interferes with workers' biological rhythm, leading to a variety of physical health problems as well as various mental health problems such as anxiety and depression [23,24]. However, shift work is inevitably performed due to industrial development and flexible working hours [8]. Therefore, efficient and practical interventions for depression prevention and management are needed for women shift workers, and to do so, it is necessary to accumulate evidence

through repeated studies that seek to identify the factors related to their experience of depression. In addition, the prevalence of shift work has continued to increase and is expected to further increase in the future [25,26]. This requires community-level and national attention and flexible measures such as adjusting shift work cycles, reducing shift work hours, and ensuring sufficient rest during shift work [8].

This study identified common influential factors on depression for women workers: age, personal income, perceived health status, smoking status, and unmet medical needs. For daytime working women drinking status and average hours slept per weeknight were additional factors; whereas unmet dental needs were an extra factor for shift working women.

Age affected depression differently, however, between daytime and shift workers, with daytime workers experiencing higher levels of depression in the 19–29 years age range than in the 60 years and older range, while shift workers experienced higher levels of depression in the 30–39 years range than in the 60 years and older range. This is somewhat consistent with the results of a study on paid workers that showed higher rates of depression among younger workers, especially those between 19 and 39 years old [27]. The high level of depression among workers aged 19 to 39 years compared to other age ranges reflects the socio-economic environment of Korea, where there has been an in-

crease in youth unemployment, nontraditional employment, and job insecurity [27]. In addition, people in their 30s often experience a new family environment due to getting married and having children, which can lead to conflicts between work and home roles, and possibly deepen depression [21]. This suggests that depression intervention and prevention programs for women workers need to focus more on those in their 20s and 30s. In addition, differences were observed between daytime and shift working women in terms of which age groups experienced the most depression, so further research is needed.

The analysis of personal income related to depression showed that lower personal income for both daytime and shift workers corresponded to higher levels of depression. This is consistent with previous studies which have found that lower income groups experience higher levels of depression [27-29]. In addition, this study found differences in depression levels according to personal income were greater among shift workers than among daytime workers. These findings support the need for depression prevention and management programs for women workers to target low-income workers, with a particular focus on shift workers with low income.

The analysis of smoking status found that women who smoked showed higher rates of depression than non-smokers among both daytime workers and shift workers, while women who drank alcohol showed a higher rate of depression than non-drinking women only among daytime workers. Prior studies have shown that women who smoked and drank alcohol had higher levels of depression than non-smoking women and non-drinking women [28,30]. However, some studies have found no link between smoking or drinking and depression, reflecting the difficulty of determining the factors that influence the decision to smoke or drink as they relate to depression [28]. In this study, drinking had an influence on depression only among daytime work women, unlike previous studies. Therefore, greater evidence should be accumulated through additional research on the influence of smoking and drinking on depression among women workers. In addition, age at first exposure to smoking or drinking, the degree of exposure, and the effects of smoking or drinking, as well as current smoking and drinking status, can affect depression [30]. Therefore, more in-depth understanding of issues related to smoking and drinking is required, such as how long women have been regular smokers/drinkers, their regular amount of smoking/drinking, and the frequency with which they smoke/drink.

Among women with unmet medical needs, the rate of depression was high for both daytime workers and shift workers, while for women with unmet dental needs, the rate of depression was high only for shift workers. Unmet health care needs lead to a

higher likelihood of negative health-related consequences [31], and if one has unmet health care needs, there is also a strong possibility of having unmet dental care needs [32]. The relationship between mental health and unmet health care needs is strong [31], and the high rate of depression among female daytime and shift workers with unmet medical needs in this study can be understood in this context. In addition, if the demand for health services is high, even if people are provided consistent health services, they might not perceive those services as having been sufficient [32]. It has been found that one reason for the high rate of unmet dental care needs is that those with high income feel that dental care is a low priority compared to other problems, while those with low income cannot always afford dental care [33]. Given the high proportion of female shift workers with a low income in this study, unmet dental needs were likely related to depression only for shift workers because of their inability to afford sufficient dental care or lack of desire to obtain dental care due to economic strain. However, this study did not identify the reasons for unmet dental needs, so it is necessary to identify both the presence of unmet dental needs and the reasons for unmet dental needs in future studies.

The number of average hours slept on weeknights was related to depression only among female daytime workers, and depression was high among women who slept fewer than 5 hours on average per night. This can be understood in the same context as prior studies finding that workers who slept for fewer than 7 hours per night on average had a 2.16 times higher incidence of depression [20], and that fewer hours of sleep resulted in a higher degree of depression [27]. Sleep and depression are closely related [25], and sleep disorders can lead to depression [19]. Therefore, it is important to provide interventions for the prevention and management of depression among women workers that consider time spent sleeping and factors related to sleep disorders. In addition, the relationship between time spent sleeping and depression was significant only among daytime workers, which could be understood in relation to the results of a study [25] finding that shift nurses had adapted to irregular sleep patterns, while daytime nurses were accustomed to regular sleep. However, for shift workers, the risk of sleep disorders is higher than that of daytime workers, so it is necessary to conduct further studies on the relationship between sleep and depression according to type of work. In addition, it is necessary to identify sleep-related characteristics such as sleep quality and time spent sleeping, to determine their relationship with depression.

In this study, women daytime and shift workers differed in age, education, personal income, marital status, and time spent working. The lowest proportion of daytime workers were ages 19-29

years, while the highest proportion of shift workers were ages 19–29 years, indicating that the typical age of women shift workers was lower than that of daytime workers. This can be understood in the context of the results of prior studies [8,26] that showed that shift workers tended to be younger than daytime workers. A prior study on nurses found that most new (younger) nurses are assigned to perform shift work, while experienced nurses are assigned to daytime work [26]. In general, workers prefer daytime work over shift work and is likely that the phenomenon of assigning shift work to new employees is also true of other professions besides nursing, potentially explaining the lower average age of women shift workers than daytime workers.

There was a difference in education level, as the largest share of women daytime workers were college graduates, while the largest share of shift workers were high school graduates. This is consistent with prior studies [8,20] that reported that daytime workers tended to have a higher education level than shift workers. Considering previous studies that found that a high percentage of non-regular workers performed shift work [34] and that shift workers had a low average education level [8], this study's results can also be understood in this context. While this difference may be due to the characteristics of daytime and shift work, our analysis did not take that possibility into account and may be an area for future research to clarify.

Personal income was lower and lower education levels were found for women shift workers than for daytime workers. A prior study reported that daytime workers tended to have a higher economic status than shift workers, but there was no statistical significance [20], which differed from this study. Education levels are related to income levels, and low education levels tend to correspond to low income levels [18,28]. In addition, this study found that the average weekly time spent working tended to be lower for shift workers than for daytime workers, which is also related to low income levels.

There was a higher proportion of unmarried women among shift workers than among daytime workers. This is consistent with previous studies [20,23] that found that there were more single women among shift workers than among daytime workers. This is likely because married women often have to balance work and family, which can lead to many problems if they perform shift work. Thus, married women likely tend to avoid shift work more than unmarried women. In addition, shift work tends to be assigned to new employees, and experienced employees are assigned daytime work [19]. Therefore, considering that women tend to get married after being employed rather than getting married and then seeking employment, new employees are more likely to be unmarried and are thus also more likely to be as-

signed shift work.

Drinking and smoking were more prevalent among shift workers than daytime workers. This is inconsistent with a preceding study that found no difference in the prevalence of drinking and smoking between daytime and shift workers [8]. This finding can likely be attributed to the younger age of women shift workers compared to daytime workers in this study. Prior studies on workers' drinking and smoking habits have analyzed differences according to occupation type, such as manufacturing jobs, office jobs, and service jobs, and found differences in the drinking and smoking habits of workers across different occupations [35,36]. However, differences in drinking and smoking habits between daytime workers and shift workers are measured differently depending on the study, so further studies are needed. In addition, Korean culture emphasizes drinking as an important activity for social relationships and as an opportunity to exchange information with co-workers and bosses, so it is necessary to analyze both the prevalence of drinking and the reasons for drinking. It has also been found that the risk of smoking is high among night shift workers [29], meaning that it is also necessary to consider the type of shift when analyzing the smoking rate among shift workers.

On average, women daytime workers often slept for the recommended number of hours per weeknight, while shift workers often slept on average for fewer than 5 hours per weeknight. Prior studies, however, have found that there was no difference in average time spent sleeping between daytime workers and shift workers [8] or that the total time spent sleeping by shift workers was higher than daytime workers [25]. Thus, it is necessary to conduct further studies on the average time spent sleeping by women daytime workers and shift workers. In addition, shift work disrupts biorhythm, causing irregular sleep patterns and reducing sleep quality [24,25], and a prior study reported that shift workers experienced irregular sleep times, took more sleeping pills, and experienced a lower quality of sleep than daytime workers [25]. Therefore, identifying the qualitative characteristics of sleep as well as quantitative characteristics (e.g., time spent sleeping) may help improve sleep issues according to daytime and shift work in women.

In this study, the use of health services between women daytime workers and shift workers differed for medical check-ups and cancer screening, and the percentage of shift workers who received a medical check-up and cancer screening within the previous 2 years was lower than that of daytime workers. This is partly consistent with a previous study [29] that reported that the rate of medical check-ups was lower among women who worked at night compared to women who worked during the

day, but that there was no difference in cancer screening rates. Considering that the proportion of non-regular workers is high for shift work and the health insurance subscription rate is low for non-regular workers [29], this result can likely be attributed to the high possibility that women who perform shift work are less likely to receive health insurance benefits than women who perform daytime work. In addition, this study's finding that women shift workers were younger, have less education, and have a lower income than daytime workers likely also relates to differences in health insurance benefits and thus the rate at which shift workers attend medical check-ups and cancer screenings. Since shift work interference with biological rhythm can lead to a variety of health problems [22,24], the need for early detection and treatment of health problems through medical check-ups and cancer screenings is greater for shift working women than for daytime workers. Closely examining the reasons why women shift workers are less likely to have medical check-ups and cancer screenings may be helpful for policies to narrow this gap.

This study has the following limitations. All types of work other than daytime work were classified as shift work, and thus, the various contexts of shift work could not be considered. In addition, job-related characteristics, which can affect depression among working women, were not available. Future studies should examine different types of shift work to identify differences according to type of work, with appropriate consideration of a wider range of variables that may also affect depression among working women.

In summary, depression was found to be higher among women who performed shift work than among women who performed daytime work. The factors related to depression among women daytime workers were age, personal income, perceived health status, smoking status, drinking status, average hours of sleep per weeknight, and unmet medical needs, while those related to depression among women shift workers were age, personal income, perceived health status, smoking status, unmet medical needs, and unmet dental needs. Therefore, it is necessary to provide practical and efficient evidence-based interventions for depression prevention and management among women who perform shift work, taking into account depression-related factors. In addition, national support and various policies that specifically support women performing shift work is needed to improve their health and well-being.

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Authors' contributions

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

Conflict of interest

The authors declared no conflict of interest.

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Data availability

The dataset file is available from Harvard Dataverse at <https://doi.org/10.7910/DVN/FVEQHE>.

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Development and application of a self-transcendence enhancement program for the well-being of elderly women living alone in Korea

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Purpose: The purpose of this study was to develop a self-transcendence enhancement program and examine its effect on self-transcendence, spiritual well-being, and psychological well-being in elderly women who live alone.

Methods: A self-transcendence enhancement program was developed through theory, literature review, and in-depth interviews. The theoretical framework came from the Psychoeducational Approach to Transcendence and Health intervention model based on Reed's middle-range theory of self-transcendence. The program consisted of multiple modalities in a structured, theory-based program lasting for eight weekly sessions. Using a single-group pretest-posttest design, the program was tested on a group of 40 elderly women aged 75 to 84 years living alone in Daejeon, Korea. Participants completed self-reported study questionnaires before and after the program at the elderly welfare center. Data were analyzed using SPSS version 24.0, with significance level set at .05. Paired t-test was used to compare mean differences before and after the program.

Results: The mean age of the study participants was 79.1 years. After completing the program, the participants showed higher levels of self-transcendence ($t=8.78, p<.001$), overall spiritual well-being ($t=8.30, p=.002$), religious spiritual well-being ($t=1.79, p=.040$), existential spiritual well-being ($t=6.75, p=.002$), and positive affect ($t=3.77, p=.001$) than they did before the program. They also reported lower levels of depression ($t=-7.59, p<.001$) and negative affect ($t=-6.15, p<.001$).

Conclusion: The self-transcendence enhancement program developed in this study may be effective for improving the level of self-transcendence in elderly women living alone and helping them to attain spiritual and psychological well-being.

Keywords: Aged; Depression; Female; Personal satisfaction; Psychological adaptation

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Introduction

Background/rationale

In terms of well-being, elderly women who live alone appear to be a more vulnerable group than other demographic groups in Korea (hereafter, Korea) [1,2]. According to studies of the well-being of elderly women who lived alone, 61.7% belonged to

the depressed group [1], with subjective well-being also showing poor results for life satisfaction and positive emotions in addition to above-average negative emotions [3]. In addition, while the spiritual well-being of elderly women living alone was found to be slightly above average, it was lower than that of elderly people who lived alone overall [2,4]. The psychological and spiritual well-being of elderly women living alone is relatively poor due to

Summary statement

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

Elderly women who live alone are more likely to be poor and face social isolation and loneliness, which may affect their health outcomes. Self-transcendence is important for the psychological and spiritual well-being of elderly people.

- **What this paper adds**

The self-transcendence enhancement program proposed in this study showed a positive effect on the self-transcendence, psychological well-being, and spiritual well-being of elderly women living alone. This theory-driven self-transcendence enhancement program contributes to the cumulative body of nursing knowledge.

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

Nurses can conduct this program for elderly women at elder care facilities. A tailored intervention along with an interprofessional team approach would be possible.

interactions between various circumstances making them vulnerable. As such, elderly women living alone are often in a state of crisis [5,6], with vulnerable living conditions and limited support. The healing of resentment and depression felt by elderly women living alone is deeply related to the psychological and spiritual concepts of gratitude and forgiveness [7,8]. Thus, the need to pursue well-being beyond one’s current vulnerable situation is higher for elderly women living alone than for other age groups. It may be possible to reach a state of well-being through self-transcendence by changing one’s own inner life and perspective. Therefore, interventions for psychological and spiritual well-being are needed for elderly women in a position of vulnerability [9].

Self-transcendence is the core concept of self-transcendence theory, which was developed by the nursing theorist Reed [9]. It refers to the process of expanding one’s boundaries to deeper and higher dimensions to overcome a personal crisis using the following four components; a deep understanding of oneself, expansion of one’s interpersonal relationships through interactions with others, connection with a dimension beyond the typically perceived world, and integration of the past and the future into the present [9]. Programs using the concept of self-transcendence improved psychological well-being by reducing depression among elderly people in a nursing home in one study [10] and, in another study, improved the subjective well-being of community-dwelling elderly women [11]. Self-transcendence programs have also helped to promote the psychological and spiritual well-being of elderly women and breast cancer patients living alone in times of crisis [12,13]. Interventions to improve the well-being of elderly women living alone have usually focused on the physical, psychological, and social problems caused by the vulnerability of this population. Some interventions to deal with physical and psychological health issues among this population

have included urinary incontinence prevention exercises, art therapy, and group play therapy [14-16]; subjective well-being and depression reduction [3]; depression and physical health improvement [17]; and self-esteem and interpersonal relations [18]. However, despite the many difficult life events and health experiences had by elderly women living alone, it is difficult to find programs that promote their psychological and spiritual well-being, including self-transcendence.

Objectives

This study was based on Reed’s self-transcendence theory [9], which directly addresses the life experiences and the demand for self-transcendence of elderly women living alone. A conceptual framework for this study was created to help develop a self-transcendence enhancement program and evaluate its applicability (Figure 1). The program in this study can be implemented in

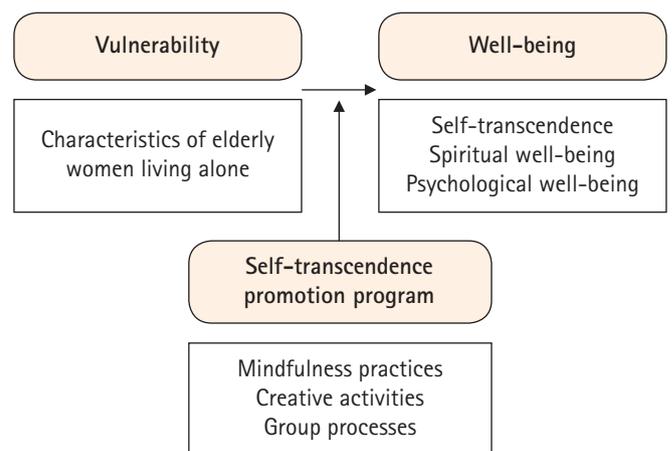


Figure 1. Conceptual framework of the study.

practice to improve the psychological and spiritual well-being of elderly women living alone. There were two specific objectives when designing the program: first, to develop a self-transcendence enhancement program based on self-transcendence theory by identifying attributes related to well-being experienced by elderly women living alone; and second, to examine the effects of the program on self-transcendence, spiritual well-being, and psychological well-being (depression, life satisfaction, positive affect, negative affect) of elderly women living alone. Three hypotheses were set: *first*, elderly women living alone who participated in the self-transcendence enhancement program would have a stronger sense of self-transcendence than they did before participating in the program; *second*, elderly women living alone who participated in the self-transcendence enhancement program would have greater spiritual well-being than before; and *third*, elderly women living alone who participated in the self-transcendence enhancement program would have greater psychological well-being than before. Specifically, decreased depression and increased life satisfaction, positive affect, and negative affect were anticipated.

Methods

Ethics statement: This study was approved by the Institutional Review Board of Chungnam National University (201907-SB-106-01). Informed consent was obtained from the participants.

Study design

This study is a single-group pretest-posttest experimental study.

Participants

The participants of this study were elderly Korean women living alone. The researcher (first author) selected two senior citizens centers using convenience sampling based on a report on the current status of elderly women living alone, issued by the Ministry of Health and Welfare [19]. Participants were chosen from those who voluntarily agreed to participate in the study. The inclusion criteria were Korean women living alone, who were between 75 to 84 years of age, and understood the purpose of the study. They also had to be able to read, write, listen, comprehend, and express themselves. The participants were further limited to those who had not experienced a similar self-transcendence program consisting of training, meditation, self-reflection, creative activities, and group discussions, and who could attend more than 75% of the eight sessions. Women aged 75 to 84 years old specifically were chosen as participants since this was the age

range with the highest proportion of women living alone [2,20]. Furthermore, elderly women above the age of 85 years tend to consider changes in well-being as a natural phenomenon due to advanced age and accept their present lives more positively [21]. The exclusion criteria were those with expected difficulty participating in the program and survey due to severe chronic diseases (grade 2 or higher), mental illness, cognitive impairment, visual impairment, or hearing impairment.

Study size

The effect size of the self-transcendence variable ($d = .70$) and the effect size of the depression variable ($d = .45$) suggested by Kim and Kim's [22] self-transcendence program were considered, and the lower of the two values was selected for this study. Thus, the effect size was set to $d = .45$, and with a significance level of $\alpha = .05$ and power of $.80$, the minimum sample size required for a one-sided paired t-test was found to be 32 participants. A total of 40 people were recruited for the final sample size, in estimation of a potential 20% dropout rate in the course of the 8-week program. By the end of the program, there were 34 participants (85% retention rate) (Figure 2).

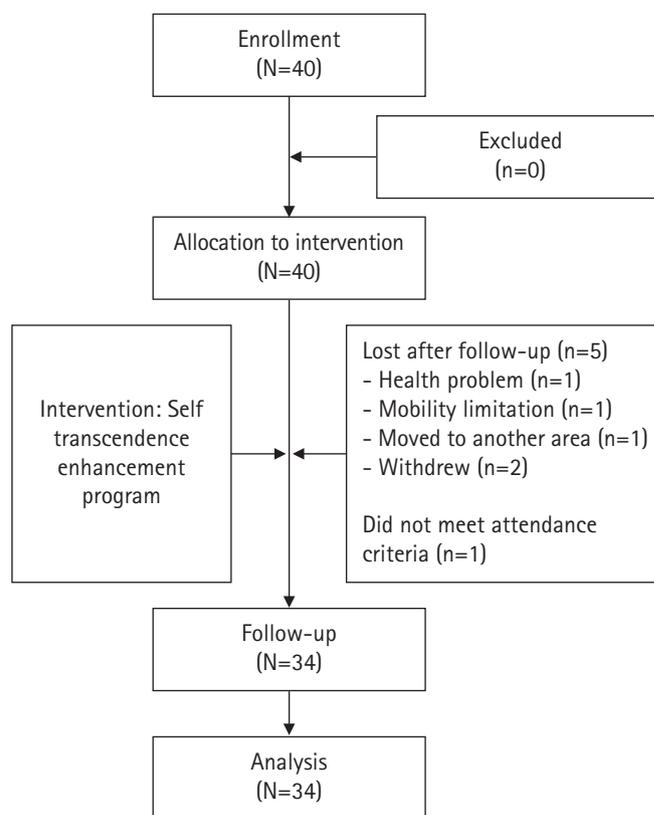


Figure 2. Flow chart of the study.

Development of the self-transcendence enhancement program

Analysis of the literature and content of in-depth interviews

Interventional studies that applied Reed’s concept of self-transcendence [9] were selected by searching literature databases including KoreaMed, Korea Citation Index, PubMed, and CINAHL. A study that reported improved self-transcendence of community-dwelling elderly women [11] provided a basis for organizing the eight topics included in this study’s program across eight 1-hour sessions over a total of eight weeks. That study’s framework served as a starting point for the introductions, development, conclusions, and family activities included in our program. In addition, single sessions in our program were designed to include 10 minutes for introductions, 40 minutes for development, and 10 minutes for conclusions, based on the time breakdown of a self-transcendence enhancement program for drug addicts [22]. Based on another study that conducted a social support activity program for the elderly [10], the class size for the program was small (limited to 6–7 people) to encourage active communication, support, and reassurance.

In-depth interviews and qualitative content analysis were conducted to select a program theme that reflected the specific aspects related to self-transcendence among elderly women. In-depth interviews were conducted with nine women who voluntarily participated, using the same inclusion criteria. These women were independent of the larger study and interviewed twice (over 2 weeks) from November 2 to 16, 2019. The questionnaire items included in the in-depth interviews focused on the four di-

mensions of self-transcendence (individual, interpersonal, individual, and temporal) for elderly women living alone (Supplementary data). One-on-one interviews were conducted and lasted about 1 hour per session.

The qualitative analysis involved applying the three stages of inductive content analysis devised by Elo and Kyngäs [23]—open coding, categorization, and abstraction—to understand the perspectives on life of elderly women living alone and the implicit categories related to their self-transcendence. The categorizations included ambivalence toward oneself, the limits of interpersonal relationships, negative self-awareness toward aging, negative emotions toward life, the desire to pursue spirituality, awareness of a better life, and the disharmony between one’s desires for the rest of life and the reality. These formed eight meaning clusters at the final level of abstraction: self-expression and respect, overcoming feelings of regret, caring, forgiving, building relationships, living an altruistic life, having a good death, and finding purpose and meaning in life.

Program composition

Based on the eight meaning clusters, intervention activities were devised and concrete activities were created. The themes of the program were based on the eight meaning clusters related to the self-transcendence needs of elderly women living alone, with a focus on the expansion of temporal boundaries (Table 1). The intervention activities in this study were based on the five self-transcendence domains and three intervention activities suggested in the model of the Psychoeducational Approach to Transcendence and Health intervention method [24], which was developed by

Table 1. Design of the self-transcendence enhancement program for elderly women living alone

Week	Theme/[dimension]	Activities and contents	Duration (minute)	Homework
1	Respecting and expressing oneself [Intrapersonal]	· Making group names and self-introduction	10	Praising each other’s appearance
		· Body scan meditation	40	
		· Expressing positive statements about one’s appearance · Decorating one’s name tag to express oneself · Activities summary, sharing thoughts, feedback	10	
2	Escaping from negative feelings of past regret and focusing positively on life in the present [Intrapersonal Transpersonal]	· Sharing weekly homework and home activities	10	Writing about hobbies I want to do
		· Body scan meditation	40	
		· Drawing my life trajectory, talking about joys and sorrows · Exploring negative feelings about past regrets · Talking about the influence of negative feelings on daily life, the possibility of changing circumstances and actions in one’s past life, and something one wants to do to live a life without regrets		
		· Activities summary, sharing thoughts, feedback	10	

(Continued to the next page)

Table 1. Continued

Week	Theme/[dimension]	Activities and contents	Duration (minute)	Homework
3	Taking care of one's inner self [Intrapersonal Transpersonal]	· Sharing weekly homework and home activities	10	Practicing inner-care activities
		· Body scan meditation	40	
		· Expressing gratitude to oneself using life trajectories · Exploring ways to take care of one's inner self · Talking about the impact on one's life and changes in perspectives on life when doing inner-care activities · Activities summary, sharing thoughts, feedback	10	
4	Forgiving people from one's past [Transpersonal Temporal]	· Sharing weekly homework and home activities	10	Writing a letter of forgiveness
		· Body scan meditation	40	
		· Expressing one's negative feelings about hurtful experiences using life curves and talking about the influence of those feelings on daily life · Facilitator's education: importance and methods of forgiveness · Writing a forgiveness resolution to a person to forgive him or her · Activities summary, sharing thoughts, feedback	10	
5	Maintaining close relationships with people [Intrapersonal Interpersonal]	· Sharing weekly homework and home activities	10	Delivering a gift box to someone
		· Body scan meditation	40	
		· Drawing and introducing a map of one's social network · Talking about positive experiences within social networks and how to restore estranged relationships · Making a gift box for someone I would like to be close to again · Activities summary, sharing thoughts, feedback	10	
6	Living an altruistic life by helping others [Interpersonal Transpersonal]	· Sharing weekly homework and home activities	10	Practicing group volunteer activities
		· Body scan meditation	40	
		· Watching videos of senior citizens doing volunteer work · Facilitator's education: the meaning and value of volunteering and positive benefits to life · Sharing volunteer work experiences (feelings, motivation) · Presentation after discussion of practical group volunteer activities · Activities summary, sharing thoughts, feedback	10	
7	Greeting a good death [Transpersonal Temporal]	· Sharing weekly homework and home activities	10	Writing my daily life list in preparation for a good death
		· Body scan meditation	40	
		· Watching videos: older people living meaningfully to greet a good death · Facilitator's education: recognizing death as a part of life, preparation for a good death, living meaningfully for the rest of life · Sharing one's death anxiety, what to do to prepare for a good death · Making a will or writing a will for family · Activities summary, sharing thoughts, feedback	10	
8	Seeking purpose and meaning in life [Transpersonal Temporal]	· Sharing weekly homework and home activities · Introducing session theme and activities	10	Practicing Lessons from the 8-week program in daily life
		· Drawing my own tree of hope: future plans and goals, one's life purpose and meaning	40	
		· Presentation of life plans, goals, and meaning using the hope tree · Sharing thoughts on completing the 8-week program	10	

modifying the concept of self-transcendence. The five transcendental areas were spirituality, contemplation, introspection, creativity, and relationships. The three intervention activities were mindfulness practice, creative activities, and group processes

(Figure 3). The specific activities included in the final program were introduction, development, conclusion, and family activities. Body scan meditation (a mindfulness activity that includes deep breathing, relaxation, and meditation) was conducted

during each session to foster mindfulness and improve spirituality, contemplation, and self-reflection. The family activities that were practiced during the week following each session consisted of activities to practice mindfulness [11] to improve spirituality, contemplation, and self-reflection.

Validity of the program

To ensure the validity of the program, this study was revised once and supplemented after receiving advice from a nursing professor and geriatric and psychiatric advanced practice nurses. A preliminary survey was conducted during an 11-day period with six elderly women who lived alone in a senior citizen center in Daejeon, Korea, regarding the program’s procedures to verify the completeness of its content and composition and to identify any unexpected problems. As a result of this preliminary survey, only body scan meditation in the sitting position was included in the final program due to the survey respondents’ opinion that the basic yoga movement included as a mindfulness activity could cause strain on the joints of program participants (Table 1).

Operation of the self-transcendence enhancement program for elderly women living alone

The self-transcendence enhancement program for the well-being

of elderly women living alone was conducted across eight sessions (total of eight weeks). In the first session, participants were divided into small groups of 6 or 7 people, with each group given a name, and an introduction was provided to foster a comfortable and intimate group atmosphere. From the second session onward, the participants shared their impressions and encouragement about homework and weekly home activities, which were designed to introduce topics and activities from the next session to capture participants’ interest. First, body scan meditation was performed for 5 minutes, followed by specific activities for 35 minutes. The theme of the first session was “expressing and respecting oneself.” The second session’s theme was “focusing positively on life in the present free from negative feelings about regrets from the past.” The theme of the third session was “caring for oneself,” followed by “forgiving people in the past to focus on life in the present” in the fourth session. The theme of the fifth session was “maintaining intimate relationships with people with a heart full of gratitude for others,” and the theme of the sixth session was “living an unselfish life of helping others.” The seventh session’s theme was “having a good death” and the eighth session’s theme was “having purpose and meaning in life.” Activities were carried out individually or through interaction and participants’ experiences were shared. At the conclusion, the facilitator

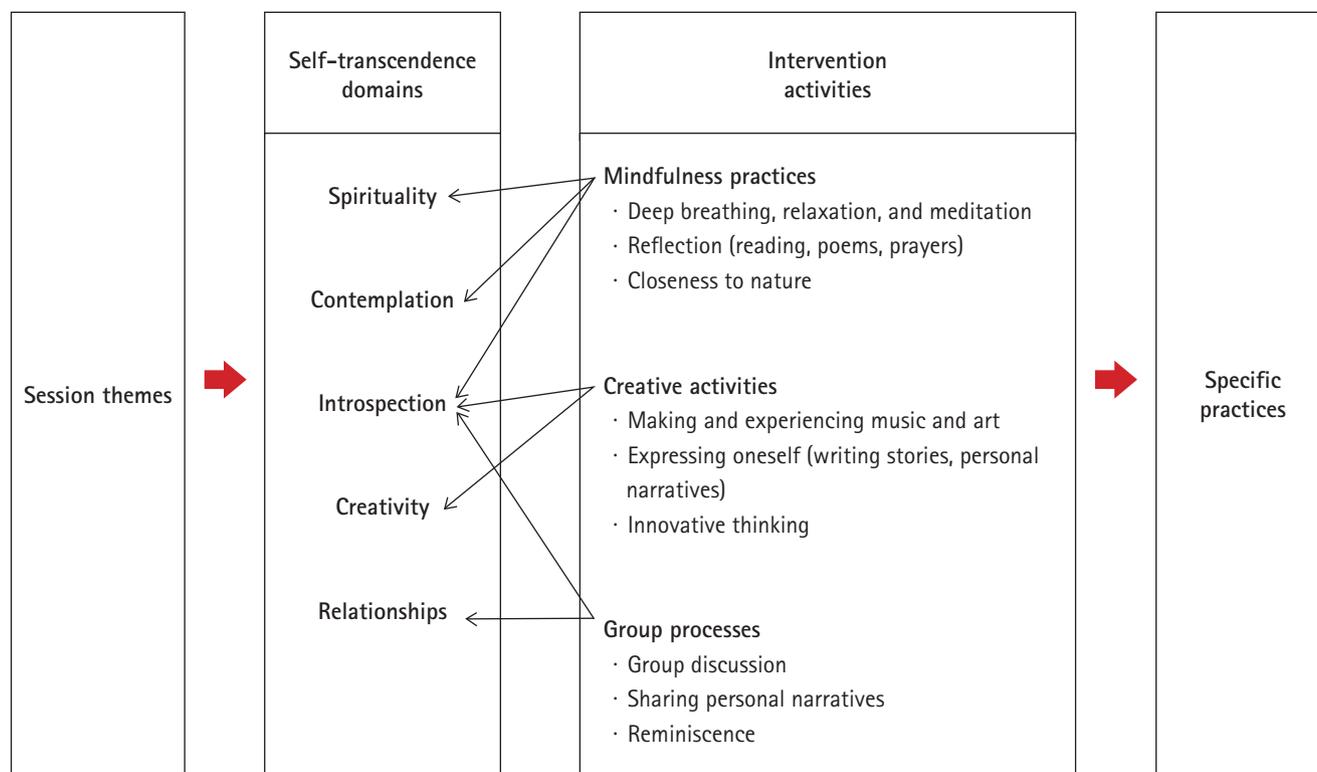


Figure 3. Framework of the self-transcendence enhancement program in the study.

summarized the topics and activities of each session, and the participants shared their feelings about the activities. At this time, participants were given assignments to review concepts and themes related to the activities. For family activities, one theme was chosen among the following activities; reading, observing, religious activities, encountering nature, and meditation. The selected activity was to be practiced by participants to maintain self-transcendence activities during the week (Table 1).

Instruments

The measurement tools used for data collection in this study were approved for use by the original authors.

Self-transcendence

The Korean version of the self-transcendence scale by Reed [25], of which the reliability and validity were verified by Kim et al. [26], was used. This tool inverted one item (item 15) and had a total of 15 items that were completed using a 4-point Likert scale (1 not at all, 4 strongly agree). The possible score range is 15–60 points, with a higher score indicating a higher degree of self-transcendence. Cronbach's α was .80 at the original development of the tool [25], .85 in the Korean version developed by Kim et al. [26], and .93 in this study.

Spiritual well-being

The modified Korean version of the spiritual well-being scale [27] by Lee [28] was used in this study. This scale is composed of two subscales: religious spiritual well-being (10 items) which measures one's relationship with God and satisfaction with human life; and existential spiritual well-being (10 items) which focuses on the meaning and purpose of life. The subscales are completed using a 6-point Likert scale (1, not at all; 6, strongly agree) with nine items being scored inversely. In this study, the 6-point Likert scale was converted to a 4-point Likert scale (1, not at all; 4, strongly agree) to make it easier for the participants to give their responses. The possible summed score range was 20–80 points, with a higher score indicating a higher degree of spiritual well-being. The original tool [27], had good internal consistency, i.e., Cronbach's α overall, .96 for the religious spiritual well-being subscale, and .86 for the existential spiritual well-being subscale. In Lee's study [28], Cronbach's α was .93 overall, .95 for the religious spiritual well-being subscale, and .86 for the existential spiritual well-being subscale. In this study, Cronbach's α was .87 overall, .79 for the religious spiritual well-being subscale, .82 for the existential spiritual well-being subscale.

Psychological well-being is a subjective psychological state of health, which includes one's ability to experience subjective satis-

faction, euphoria, or general emotions and emotions when responding to environmental stimuli in daily life [29]. Therefore, in this study, depression, life satisfaction, and positive and negative emotions were measured as factors related to psychological well-being using the below tools.

Depression

Kee's Korean version [30] of the geriatric depression scale (short version) developed by Yesavage and Sheikh [31] was used. This is a binomial response tool (0 no, 1 yes) and 6 out of 15 items (items 1, 5, 7, 11, 13, 15) are inverted. Out of a possible score of 0–15, the screening cutoff for elderly is 5 points [30]. For the original tool [31], Cronbach's α was .94. It was .88 in the study of Kee [30] and .81 in this study.

Satisfaction with life

Kwak's Korean version [32] of the satisfaction with life scale developed by Diener et al. [33] was adopted for this study. The five items are rated on a 5-point Likert scale (1, not at all; 5, strongly agree) with a possible score range of 5–25. A higher score indicates a higher level of life satisfaction. Cronbach's α was .87 in the original tool [33], .80 in Kwak's study [32], and .90 in this study.

Positive and negative affect

Jeon's Korean version [34] of the positive and negative affect scale based on the original scale by Watson et al. [35] was used. It includes 20 items in total—nine on positive emotions and 11 on negative emotions—rated on a 5-point Likert scale (1, not at all; 5, strongly agree). Higher scores indicate higher levels of positive affect (possible score range, 9–45) or negative affect (possible score range, 11–55). The reliability of the original tool [35] was shown by Cronbach's α of .86 for positive affect and .87 for negative affect. In the study by Jeon [34], it was .84 for positive affect and .79 for negative affect, and in this study, it was .96 for positive affect and .97 for negative affect.

Procedures

This study was conducted from December 31, 2019 to February 23, 2020. The procedures and methods are described below.

Research assistant training and safety activities for research sites

The research assistants included two nursing students. They received education about the purpose of this study, the design and content of the program, research procedures and precautions, and the roles of research assistants. To keep the participants comfortable and safe, a welcoming indoor environment with sitting desks that could accommodate 20 people was prepared, risk fac-

tors related to falls (pointed objects, furniture with sharp corners) were rearranged, and regular safety checks were conducted. Protocols to protect study participants from coronavirus disease 2019 (COVID-19) were designed and followed. Researchers and assistants wore masks that covered their mouths and noses, remained at least 1 meter apart from others, washed their hands often with soap and water, and avoided crowds and poorly ventilated indoor spaces.

Pretest

A pretest survey was conducted after the researcher explained the purpose and method of the study to the 40 initial participants. The preliminary investigation period was from December 31, 2019 to January 2, 2020. The study participants gathered at the same time and filled out questionnaires for about 1 hour. The selection criteria required participants to be able to read, write, hear, comprehend, and express themselves in words, so there were no difficulties completing the questionnaires themselves; however, the participants had difficulties comprehending the response method. One researcher and two research assistants helped them with explanations.

Experimental intervention

The eight-session program was conducted across 8 weeks from January 3, to February 21, 2020, at two senior citizen centers with 40 participants. This period was prior to COVID-19 outbreaks in the area and infection protocols were not as rigid. Safety protocols were maintained as sessions were conducted, once per week for 1 hour each.

Posttest

A posttest survey was conducted from February 22, 23, 2020, after the completion of the 8-week program. The same measurement tools used in the pretest survey were used except for general characteristics, which were not collected in the posttest survey. This study followed the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement [36] to improve the reporting quality of nonrandomized evaluations of behavioral interventions.

Statistical analysis methods

The general characteristics of the participants were analyzed by frequency and percentage, mean, and standard deviation. To analyze the effect of the self-transcendence enhancement program, the paired t-test was conducted to analyze pre- and postintervention values. Statistical analysis was performed using IBM SPSS Statistics ver. 25.0 (IBM Corp., Armonk, NY, USA).

Results

General characteristics of the participants

The average age of the 34 participants was 79.10 years, 23 (67.6%) did not graduate from elementary school, and the average period for which they had lived alone was 10.08 years. The average monthly income of the participants was 497,400 Korean won (439 US dollars), and 25 people (73.5%) answered “poor” or “very poor” for their perceived health condition. Twenty-eight participants (82.3%) said their children were their guardians, while 4 (11.8%) listed relatives and 2 (5.9%) listed neighbors as their guardians. Fourteen participants (41.2%) were contacted by their guardians once per month, and 15 (44.1%) were visited by their guardians once per month. For leisure activities, 22 participants (64.7%) reported not having hobbies or participating in leisure activities, and 23 participants (67.6%) reported not being religious (Table 2).

Evaluation of the applicability of the self-transcendence enhancement program

Effectiveness of the program

Participants’ self-transcendence, spiritual well-being, and psychological well-being increased after the intervention program (Table 3). The self-transcendence scores of elderly women living alone increased significantly from 43.26 points before participation in the program to 48.91 points after the program ($t = 8.78, p < .001$). The participants’ overall spiritual well-being after the program increased significantly, from 56.52 points to 64.29 points ($t = 8.30, p = .002$), and both the religious and existential spiritual well-being subareas also improved. The average religious spiritual well-being score increased from 27.76 points to 29.70 points after the program ($t = 1.79, p = .040$), and the average existential spiritual well-being score increased from 29.55 points to 34.58 points ($t = 6.75, p = .002$). Thus, the first and second hypotheses were accepted.

Positive affect increased, and depression and negative affect decreased. The participants’ average score for depression decreased from 8.73 points to 7.00 points after the program ($t = -7.59, p < .001$), and the average negative affect score decreased from 34.11 points before the program to 30.26 points after the program ($t = -6.15, p < .001$). In addition, the mean positive affect score rose from 30.41 points to 32.00 points ($t = 3.77, p = .001$). The average life satisfaction score also increased from 14.14 points to 14.97 points, but it was not statistically significant ($t = 1.72, p = .470$). Therefore, three out of the four components of the third hypothesis—decreased depression, increased posi-

Table 2. General characteristics of participants (N=34)

Characteristics	Categories	n (%)	Mean ± SD
Age (year)	75–80	19 (55.9)	79.10 ± 2.8
	81–84	15 (44.1)	
Education level	< Elementary school	23 (67.6)	
	≥ Elementary school	11 (32.4)	
Time spent living alone (year)	≤ 5	4 (11.8)	10.08 ± 3.74
	6–10	19 (55.8)	
	11–15	7 (20.6)	
	≥ 16	4 (11.8)	
Monthly income (KRW)	≤ 3 million	10 (29.4)	49.74 ± 15.39
	3.1–5.9 million	16 (47.1)	
	≥ 6 million	8 (23.5)	
Perceived economic status	Adequate	5 (14.7)	
	Insufficient	15 (44.1)	
	Very bad	14 (41.2)	
Perceived health status	Good	9 (26.6)	
	Poor	23 (67.6)	
	Very poor	2 (5.9)	
Guardian type	Children	28 (82.3)	
	Relatives	4 (11.8)	
	Neighbors	2 (5.9)	
Frequency of contact with guardian	Once a week	13 (38.2)	
	Once a month	14 (41.2)	
	More than once a month	7 (20.6)	
Frequency of visits by guardian	Once a week	6 (17.7)	
	Once a month	15 (44.1)	
	More than once a month	13 (38.2)	
Hobbies	Singing classes	3 (8.8)	
	Religious activities	5 (14.7)	
	Exercise and walking	4 (11.8)	
	None	22 (64.7)	
Religion	Yes	11 (32.4)	
	No	23 (67.6)	

KRW: Korean won (1 million KRW is approximately 900 US dollars)

Table 3. The effect of the self-transcendence enhancement program on study outcomes (N=34)

Variable	Possible score range	Mean ± SD		t	p (one-tailed)
		Pretest	Posttest		
Self-transcendence	15–60	43.26 ± 7.47	48.91 ± 7.82	8.78	< .001
Spiritual well-being	20–80	56.52 ± 8.09	64.29 ± 7.82	8.30	.002
Religious spiritual well-being	10–40	27.76 ± 7.76	29.70 ± 7.52	1.79	.040
Existential spiritual well-being	10–40	29.55 ± 5.95	34.58 ± 4.95	6.75	.002
Psychological well-being					
Depression	0–15	8.73 ± 1.83	7.00 ± 1.49	–7.59	< .001
Life satisfaction	5–25	14.14 ± 4.66	14.97 ± 4.87	1.72	.470
Positive affect	9–45	30.41 ± 7.42	32.00 ± 6.91	3.77	.001
Negative affect	11–55	34.11 ± 4.86	30.26 ± 4.47	–6.15	< .001

tive affect, and decreased negative affect after the program—were accepted. However, the hypothesis that life satisfaction

would increase was not accepted.

Adherence and acceptability

The attendance rate was 85%, with 34 people completing the program, and the attendance rate increased as the sessions proceeded after the first half, with a more than 90% attendance rate for the fourth session. Participants showed high satisfaction in the process of actively exchanging opinions during small-group activities, proactively exchanging their thoughts about their own experiences and feelings. During the program, there were no incidents such as damaged relationships or inappropriate disclosure of confidential information due to group activities across the 8 weeks. The main reasons that six people discontinued participation in the program were health problems ($n=2$), moving to another city ($n=1$), and not meeting the attendance criteria ($n=1$). In addition, there were no incidents related to the participants' health or safety such as hypoglycemia, dehydration, or falls.

Discussion

The improvement of the average self-transcendence score after the program is consistent with the results of another study [11] in which the self-transcendence score increased after a self-transcendence program for elderly women in the United States. This is likely due to the effect of the program on changing participants' inner perspectives and worldviews as well as participants' desires for a better life by achieving self-transcendence.

The average scores for the spiritual well-being of elderly women living alone were similar to those of underprivileged older women living alone [2] and higher than those of elderly people living alone in rural areas [37]. After participation in the program, participants experienced improvements in both existential and religious spiritual well-being. In particular, scores for existential spiritual well-being increased two times more than religious spiritual well-being. The reason for this is that other activities not related to religion were performed during the program, such as activities to help others, activities to face death, and activities to search for the purpose and meaning of the rest of their lives, to help participants live a harmonious life. Another study found that a self-transcendence program [4] reduced community-dwelling elderly people's death anxiety and encouraged them to pursue lives led by meaning and purpose. Thus, these programs have been shown to improve participants' sense of religious and existential spiritual well-being.

The average depression score reported by elderly women living alone in this study was higher than that found in another study of elderly women living alone [1,38], and more than twice that of community-dwelling elderly people [39]. The results of the present study support previous finding [4] that depression

was influenced by economic status, education level, marriage status, health status, and social life. Participant's depression levels were found to have decreased after participating in the program.

The average positive and negative affect scores after the program were 3.37 points and 3.10 points (out of 5 points), respectively. The average positive and negative affect scores were lower in this study than in a study of community-dwelling elderly people [40]. The program was effective at improving the affect of elderly women living alone. In particular, the average negative affect score decreased significantly. Therefore, ways to improve positive affect should be explored by devising a positive psychology program suitable for elderly women living alone, with a particular focus on low-income families [3].

However, the intervention program did not significantly affect participants' life satisfaction. This is contrary to another study [11], which found that life satisfaction among home-dwelling elderly women who participated in a self-transcendence enhancement program significantly increased. The reason for this discrepancy may be that life satisfaction among the elderly is affected by monthly average income, education level, subjective health level, and other related factors [41], and there is a limit to how much life satisfaction could be improved through a single 2-month program.

There is a limitation to generalizing the present results to other regions and countries since we recruited elderly women living alone in a particular region. However, their physical, economic, and social demographic characteristics can be generalized. In addition, this study used a single-group pretest-posttest experimental design to evaluate the applicability of the program. The ability to evaluate the effectiveness of the program was also limited by the inability to control for confounding variables maturation issues. Lastly, the researcher and two research assistants conducted and analyzed the program simultaneously. Therefore, the validity of the study is limited. In future studies, single-blind randomization should be used to generate more credible results by establishing both a control group and an experimental group.

The self-transcendence enhancement program for the well-being of elderly Korean women living alone developed in this study had a positive effect on spiritual (religious and existential) well-being and psychological well-being (depression, positive affect, and negative affect), and also enhanced participants' sense of self-transcendence. Through this study, it was confirmed that this program could be safely conducted with other groups of elderly people. In addition, this study contributed to the body of evidence-based nursing knowledge related to promoting self-transcendence in elderly women living alone through the application of an intervention program based on nursing theory. The safety of this program was confirmed, and the attendance rate of the participants was

satisfactory. Therefore, it is highly recommended that this program be conducted for small groups of people in the same age group at other institutions. Furthermore, nurses working in local communities should utilize connections between senior citizen centers and public health centers to implement this program for elderly women living alone.

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Authors' contributions

Conceptualization: Kim SM, Ahn S; Writing—original draft: Kim SM; Writing—review & editing: Kim SM, Ahn S.

Conflict of interest

The authors declared no conflict of interest.

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None.

Data availability

Please contact the corresponding author for data availability.

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Supplementary materials

Further details on supplementary materials are presented online (available at <https://doi.org/10.4069/kjwhn.2021.06.07>).

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Development and application of a couple-centered antenatal education program in Korea

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Purpose: This study was conducted to develop a couple-centered antenatal education program and to test the program's feasibility.

Methods: With a preliminary-experimental study design, 33 pregnant couples who were expecting their first child participated in this study. The program consisted of four sessions (1 hour/session/week) of education and counseling. Data were collected before and after the intervention from September 2018 to April 2019 at a women's hospital in Daejeon, Korea, with demographic data forms, the Edinburgh Postnatal Depression Scale, Perceived Stress Scale, Maternal-Fetal Attachment Scale, Korean Newborn Care Confidence Scale, Wijma Delivery Expectancy/Experience Questionnaire, and Dyadic Adjustment Scale-10.

Results: The pregnant women and their husbands were on average 32.30 ± 3.10 and 33.21 ± 6.25 years old, respectively. The mean marriage duration was 2.34 ± 1.63 years, the gestational age was 31.30 ± 2.66 weeks, and 78.8% of the couples had a planned pregnancy. After the program, both the pregnant women and their husbands showed significant improvements in attachment to the fetus and confidence in providing infant care. Prenatal depression, prenatal stress, and fear of childbirth in pregnant women significantly decreased after completing the program. However, the dyadic adjustment score did not change significantly either in the pregnant women or their husbands.

Conclusion: A couple-centered antenatal education program seems to be effective for couples adjusting to parenthood, but further studies should explore ways to have a positive impact on couples' relationships.

Keywords: Marriage; Parents; Pregnant woman; Prenatal education; Spouses

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Introduction

Parenthood begins with having the first child; pregnancy is a time of preparation, and the postpartum period is a time of change in the marital relationship due to the new parental role [1]. Anxiety, depression, and changes in marital relationships during pregnancy are associated with the fear of childbirth [2] and an increased risk of preterm birth and low birthweight [3]. The needs and challenges, birth experiences, and changes in roles and relationships of

pregnant women cause maternal stress [4]. In their husbands, negative emotions and fears related to the father identity and father role lead to stress [5], and mothers and fathers adapt differently to parenthood due to their different experiences of pregnancy and childbirth [6]. Therefore, prenatal education programs need to provide information for both prospective fathers and mothers [7].

Worsening of the marital relationship has a negative effect on attachment to the fetus, as well as the process of adapting to

Summary statement

• What is already known about this topic?

Couple-centered prenatal education is more effective if it combines elements dealing with the parental role and the marital relationship, such as communication and mutual support. However, the effects of such interventions need to be confirmed.

• What this paper adds

This study developed a couple-centered antenatal education program incorporating a model of becoming parents and showed its effectiveness and feasibility.

• Implications for practice, education, and/or policy

The couple-centered antenatal education program presented herein was effective for couples adjusting to parenthood; therefore, this comprehensive program can be implemented in maternity practice.

changes in the marital relationship during the transition period [8]. Conversely, higher satisfaction in the marital relationship during pregnancy and maintenance of a good relationship improve adaptation to the parental role in the postpartum period [9]. Preparing for the parental role together and maintaining the marital relationship facilitate the parental transition process [10]. In a gender-equal society, there is little difference in the roles of mothers and fathers as parents; therefore, gender-equal prenatal education should be provided when fathers participate in pregnancy and childrearing [11,12].

Mercer [13] theorized that during the process of becoming a mother, the family is a dynamic system that includes mother-father, maternal-fetal, and paternal-fetal interactions, and that the role of the mother is affected by the interactions of the mother with the father and baby. However, this framework leaves the father as a supporter to help his partner become a mother, overlooking the process of becoming a father; this has led to a tendency for husbands to be alienated from prenatal education [13]. The process of parental change is an experience shared by couples [14] and an inter-couple process [15], meaning that a comprehensive approach is needed in the process of becoming parents for both pregnant women and their husbands. Therefore, the theory of becoming a mother by Mercer [13] needs to be expanded to an approach to becoming parents that includes both spouses. In addition, prenatal education that includes communication and mutual support is effective in promoting adaptation in the marital relationship during the transition period [16]. A recent meta-analysis of the effects of psychoeducation for couples combining the parental aspect and couple-relationship education also reported that such interventions reduce negative effects, such as postpartum depression, on the maternal and paternal side, and improve couple-relationship satisfaction [17]. The authors argued that couple-centered prenatal education is more effective if it

combines elements of the parental role and marital relationship [16].

Most prenatal education in Korea (hereafter, Korea) is provided for only pregnant women (64.4%), with a focus on delivery, breastfeeding, and infant care; meanwhile, very few studies have explored interventions dealing with mother-father interactions or couple relationships [18], leaving a gap in the literature that needs to be addressed. Interventions for pregnant couples who are transitioning to parenthood are needed to help couples adapt to becoming parents and to address the couple relationship. The purpose of this study was to develop a couple-centered antenatal education program to help couples better adapt to becoming parents and to address aspects of the couple relationship, and then to confirm its effectiveness and applicability based on Mercer's theory of becoming a mother [13] (Figure 1).

The hypotheses of this study were as follows.

- 1) Pregnant couples who participate in the couple-centered antenatal education program will have a better adaptation to becoming parents, as shown by measures including prenatal depression, prenatal stress, fetal attachment, newborn-care confidence, and mother's fear of childbirth.
- 2) Pregnant couples who participate in the couple-centered antenatal education program will improve their adaptation to the couple relationship, as measured by the couple's dyadic adjustment.

Methods

Ethics statement: This study approved was by the Institutional Review Board of Chungnam National University (201806-SB-063-01). Informed consent was obtained from the participants.

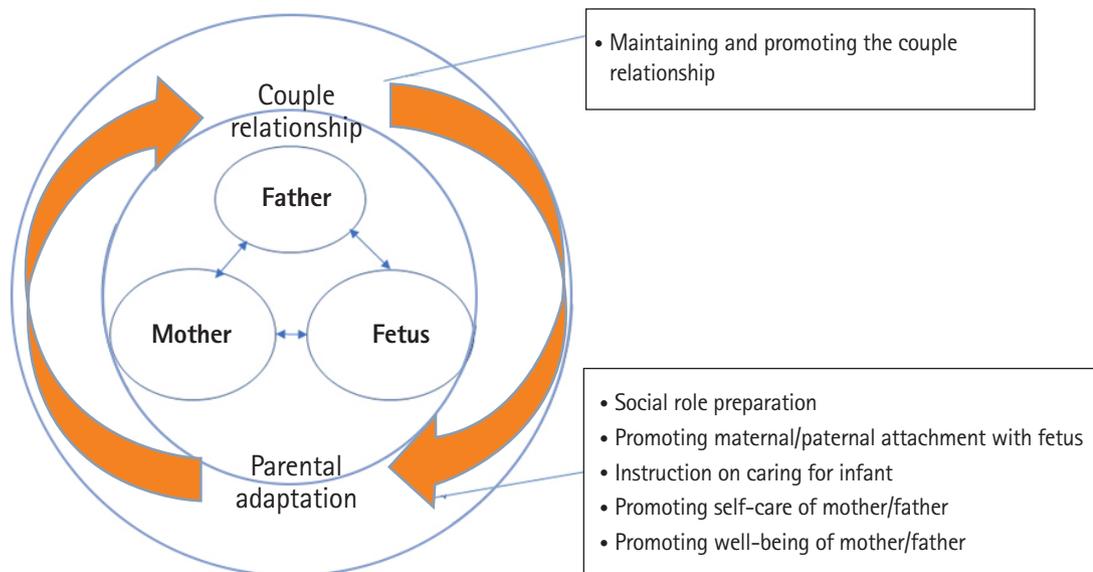


Figure 1. Conceptual framework of pregnant couple's becoming parents.

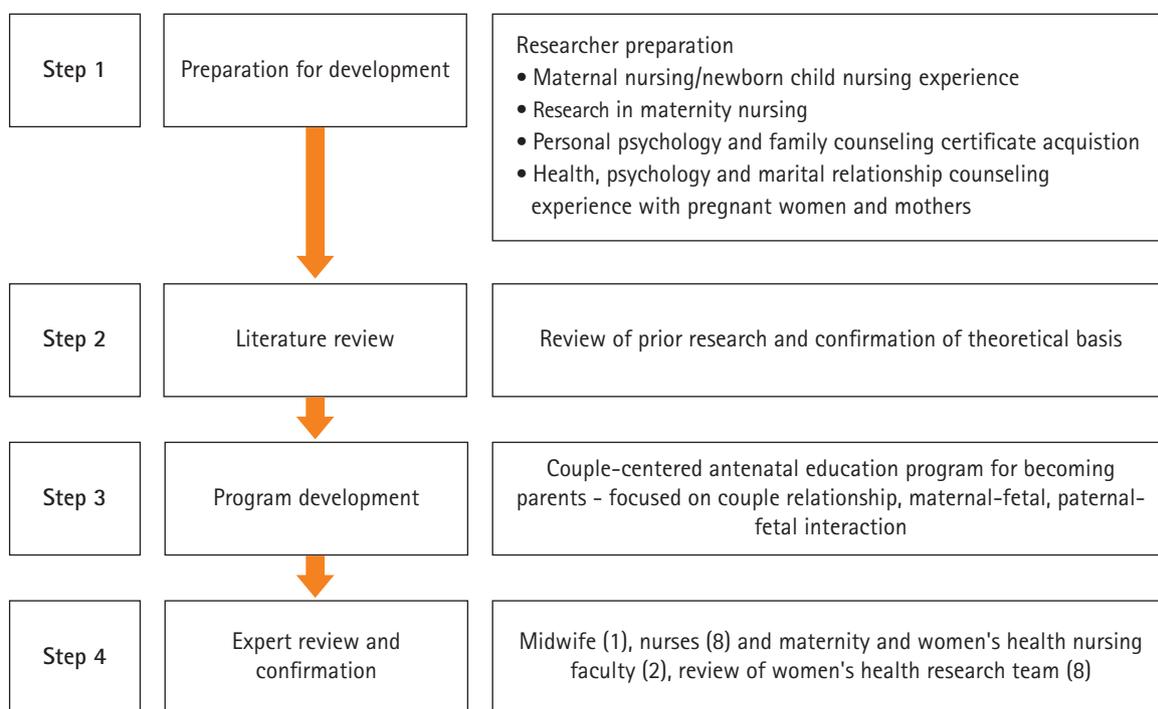


Figure 2. Development process of the couple-centered antenatal education program.

Study design and setting

The couple-centered antenatal program was developed by the first author through multiple stages of program development, as shown in Figure 2. This program was delivered by the first author and a midwife at a women's hospital in Daejeon, Korea, with a single-group pretest-posttest study design from September 2018

to April 2019. A member of the research team explained the study and the possibility of participation to couples in the outpatient waiting room. If they voluntarily agreed to participate, they received information about the program schedule, a preliminary survey was conducted, and a follow-up investigation was conducted immediately after they finished the fourth session of the

program (1 hour/session/week).

Participants

The study participants were married couples, including women who were pregnant with their first child at 28–34 weeks of gestation, because couples who answered that they were well prepared in the third trimester were found to adapt well in the postpartum period [19]. Since this prenatal educational program targeted low-risk segments of the general population, pregnant women who had complications (such as gestational diabetes, hypertension, or placental and cervical problems) or multiple pregnancies were excluded; additionally, couples were excluded if either the pregnant woman or the husband had any other health problems.

The required sample size was calculated based on effect sizes (d) of 1.71 and 0.47 for a childbirth education pilot study aimed at preventing fear of childbirth and depression, respectively, among pregnant women [20]. For the effect size (d) of 0.47 for depression, a significance level of 0.05 (one-tailed), and a statistical power of 0.80, a sample of at least 30 people was required. This study therefore recruited 48 couples, of which 11 couples either withdrew from the study or did not present to a scheduled appointment) and four couples gave birth during the intervention period, meaning that 33 couples participated in the pretest, the intervention program, and the posttest (Figure 3). This study followed the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement [21] to improve the reporting quality of nonrandomized evaluations of behavioral interventions.

Intervention program

Program development

A couple-centered antenatal education program was developed to help couples’ adaptation to become parents and their relationship. The environmental interaction model [22] of the process of becoming a mother was used as a theoretical basis for the educational program. A couple-centered psychoeducation method was selected according to the results of a previous study [23]. Through a critical evaluation of various studies [16-18,20,24-29] of effective nursing interventions to help parental adaptation and couple relationships, the content and methods of the program were specifically constructed. In order to confirm the validity of the content of the educational program, the initially developed program was reviewed by experts, including nurses and midwives in women’s hospitals, maternity and women’s health nursing professors, and women’s health researchers. In addition, after listening to the opinions of women who had experienced pregnancy and childbirth within the past 3 years, content related to the husband’s pregnancy experience and massage was added to the intervention program (Figure 2).

Program content

The couple-centered antenatal education program applied in this study (Table 1) had two main content areas: adaptation of the couple relationship [16-17,23] and becoming parents for couples [13,22]. The content on couple-relationship adaptation included emotional intimacy, support, respect, empathy, gratitude, and emotional exchange between couples from pregnancy to the

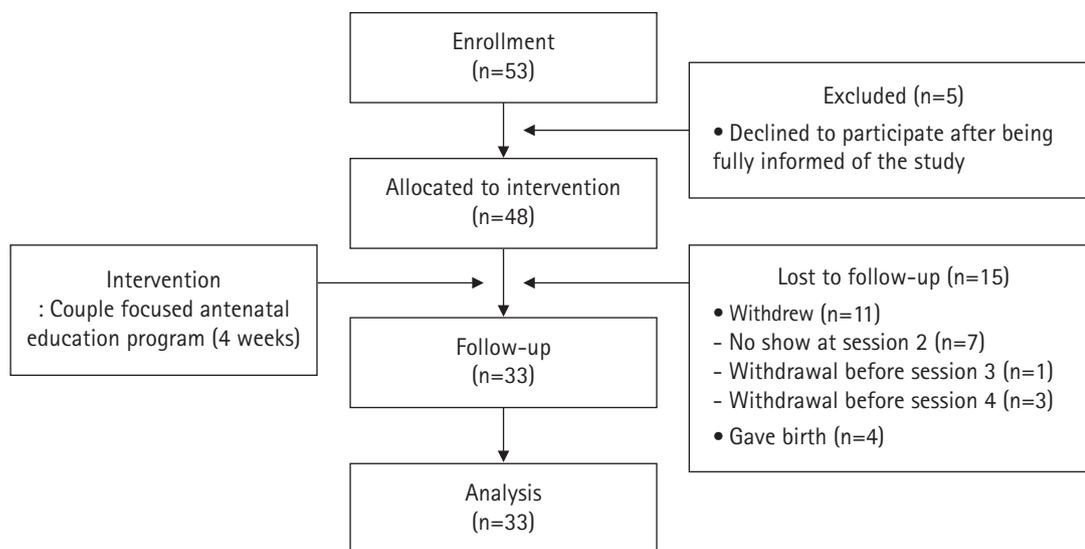


Figure 3. Flow diagram of the study.

Table 1. The couple-centered antenatal education program

Goal based on the ecological interaction model	Methods	Content
Session 1: Becoming happy parents (1 hour by a midwife)		
Social-role preparation	Education, information, practice, Q&A	Happy environment, relieving stress, and participation of the husband
Attachment promotion: parental-fetal attachment		Talking and singing with finger movement for the fetus
Self-care promotion: preparation for a normal delivery	Education, information, practice, Q&A	Normal delivery process and husband roles Method of how to breathe, relax, and massage to relieve the pain
Session 2: Becoming competent parents (1 hour by a midwife)		
Social-role preparation	Education, information, Q&A	Newborn care in growth and development, normal reflex reactions, and getting used to baby signals, father-child care
Infant-caregiving instruction	Education, information, Q&A	Advantages of breastfeeding (for mother and baby), and breastfeeding method, baby's signals, and deep breastfeeding (latch and positioning)
	Practice, Q&A	Breast massage and breastfeeding, holding a baby, feeding and burping, soothing a crying baby, changing diapers, bathing, and managing the umbilical cord
Session 3: Becoming a happy couple and family (1 hour by a women's health nurse)		
Well-being promotion	Education, information, conversation, Q&A	1. Physical and mental changes in the pregnant woman and her husband 2. Check the mother's and father's situations during the perinatal period and talk about each other's difficulties and how to help, and how to maintain the marital relationship
	Experience	1. Husbands wear pregnancy simulator vest
	Conversation practice	1. Identify usual communication patterns, and practice positive self-assertive communication
Self-care promotion	Education, information, Conversation, Q&A	1. Physical changes, and discomfort of pregnant women, and caution and self-care methods, importance of spousal support during the third trimester 2. Prenatal and postpartum depression, stress related to the parental transition in couples, the importance of mutual support for couples, and self-care for couples, express their feelings with each other on parental transition
Session 4: Becoming a happier couple (1 hour by a women's health nurse)		
Well-being promotion	Education, information, conversation practice, Q&A	1. Understanding and empathy between spouses, and the effects of the virtuous cycle of expressing gratitude and empathy 2. Identifying common marital problems in parents and discuss current marital problems or difficulties 3. Characteristics of well-adapting parents, the positive effects of hugging, and consideration for each other
	Conversation practice	1. Thank-you messages (conversations and letter-writing) 2. Talk about what they want from others
Social-role preparation	Education, information, conversation Q&A	1. Importance of accepting and adapting to parenthood in a positive manner 2. Talking about the difficulties, burdens, and fears of childbirth

postpartum period as ways to deal with marital problems and difficulties. The content dealing with becoming parents included promoting well-being in response to physical and mental changes, discomfort, depression, and stress, self-care, parental-fetal attachment, preparation for normal delivery, and preparation for the parenting role (e.g., newborn baby care and breastfeeding). Each session set 2 to 3 specific goals for couples, such as social-role preparation, instructions on infant caregiving, and the

promotion of fetal attachment, self-care, and well-being.

Application of the program

Two nurses (a women's health nurse and a midwife/breastfeeding expert) provided the educational program in four sessions, each of which lasted for 1 hour in the childbirth education room of the hospital. The size of each intervention group was decided based on couples' needs, with the education provided to one to

three couples at a time. The teaching method consisted of face-to-face education and counseling. Throughout the session, we provided education and information to help the couples discuss these topics, allocated time to practice skills such as expressing one's own emotions and effective conversation techniques, and provided time for questions and answers. In addition, a small gift was presented to encourage participants to continue participating in the program, and periodic text messages were sent as reminders before scheduled appointments and to express appreciation for the participants' participation.

Measurements

The study variables were measured before and after the educational program to test the program's effectiveness. The researcher explained to the couple how to answer each questionnaire and asked them to respond separately to prevent couple-related dynamics from affecting the responses. The measures for adaptation to becoming parents were prenatal depression and stress for the parents themselves, parental-fetal attachment for the parental-fetal relationship, newborn-care confidence for becoming parents, and fear of childbirth for mother's childbirth preparation, while dyadic adjustment was used to measure adaptation of the couple relationship.

Prenatal depression

Depression in pregnant couples was measured using the Korean version of the Edinburgh Postnatal Depression Scale [30], which was translated by Kim et al. [31] and is one of the most widely used tools for assessing perinatal depression in both women and men [32]. The scale contains 10 items. Each item is scored on a 4-point Likert scale (0, no; 3, most of the time), and the total score thus ranges from 0 to 30. Scores above 10 are considered to indicate depression in Korea [31]. The reliability of the original instrument was indicated by a Cronbach's α of 0.87 [30]; in the present study, Cronbach's α was 0.77–0.78 in the pregnant women and 0.56–0.63 in their husbands.

Stress

Stress in pregnant couples was measured using the Korean version of the Perceived Stress Scale [33], which was translated by Park and Seo [34]. The scale contains 10 items. Each item is scored on a 5-point Likert scale (0, never; 4, very often); thus, the total score ranges from 0 to 40. The reliability of the original instrument was indicated by a Cronbach's α of 0.84–0.86 [33]; in the present study, Cronbach's α was 0.78–0.83 in the pregnant women and 0.79–0.82 in their husbands.

Parental-fetal attachment

Parental-fetal attachment was measured using the Korean version of the Maternal-Fetal Attachment Scale [35], which was translated by Kim [36]. The scale contains 25 items. Each item is scored on a 4-point Likert scale (1, never; 4, always) and the total score therefore ranges from 25 to 100. A higher score indicates a higher degree of fetal attachment [36]. Since this is a tool for measuring maternal-fetal attachment, paternal attachment was measured by reframing questions 22, 23, and 24 for a husband as dealing with pride and concern about his pregnant wife [36]. The reliability of the original tool was indicated by a Cronbach's α of .84 [35]; in the present study, Cronbach's α was 0.94–0.95 for maternal-fetal attachment and 0.93–0.94 for paternal-fetal attachment in the present study.

Newborn-care confidence

Confidence in caring for newborns was measured using a self-report questionnaire [37]. The 22-item scale is scored on a 5-point Likert scale (0, very uncertain; 5, very confident), and the total score thus ranges from 22 to 110. A higher score indicates higher confidence in raising newborns. The reliability of the original instrument was indicated by a Cronbach's α of 0.84 [37]; in the present, Cronbach's α was 0.94–0.96 in the pregnant women and 0.95–0.97 in their husbands.

Maternal fear of childbirth

Childbirth fear in pregnant women was measured using the Korean version of the Wijma Delivery Expectancy Questionnaire (version A) [38] before delivery, which was translated by Park et al. [39]. The scale contains 33 items, each of which is scored on a 5-point Likert scale (1, not at all; 5, extremely); therefore, the total score ranges from 33 to 165. Higher scores indicate greater fear. The reliability of the original instrument was indicated by a Cronbach's α of 0.87 [38]; in the present study, Cronbach's α was 0.91–0.93.

Couple's dyadic adjustment

Marital adaptability was measured using the Dyadic Adjustment Scale (DAS)-10 [40], which is a shortened Korean form of the DAS reported by Cho, Choi, Oh, and Kwon [41] that has demonstrated reliability and validity. The scale contains 10 items. Items are scored from 0 to 5 or 6 on a 5- or 6-point Likert (0: not at all; 5: always; and/or 6: perfectly), and the total score thus ranges from 0 to 51. Higher scores indicate higher marital satisfaction, and a cut-off point is 32 or higher is used as a categorical measure of marital satisfaction [40]. The reliability of the DAS-10 was indicated by a Cronbach's α of 0.83 [41]; in the present study, Cron-

bach's α was 0.77–0.83 in the pregnant women and 0.68–0.83 in their husbands.

General characteristics

Information was gathered on participants' age, educational background, occupation, marriage duration, family income, whether the pregnancy was planned, gestational age, and lactation plan.

Program satisfaction survey

Participants were asked about their satisfaction with the overall program content, the topic that they most enjoyed among the four sessions of the program, any material that they thought was missing or could have been supplemented, perceptions regarding any other educational content that would be needed in pregnancy and childbirth education, and the educational content that they desired in postnatal education programs.

Statistical analysis

The effect of the intervention in a single group was analyzed using the one-tailed paired t-test using IBM SPSS ver. 25.0 (IBM Corp., Armonk, NY, USA).

Results

General characteristics

The pregnant women were 32.30 ± 3.10 years of age (mean \pm standard deviation), and their husbands were 33.21 ± 6.25 years of age. Almost all of the pregnant women (97.0%) and all of their husbands had at least a college education, 72.7% of the pregnant women and all of their husbands were employed, and 42.4% of the families had a monthly family income of 4–5 million Korean won (approximately 3,500–4,400 US dollars). The average marriage duration was 2.34 ± 1.63 years, the average gestational age at the time of recruitment was 31.30 ± 2.66 weeks, and 78.8% of the participants had a planned pregnancy (Table 2).

Changes in parental adaptation and dyadic adjustment of couples

Prenatal depression and stress

The score for prenatal depression of the pregnant women decreased significantly from 6.12 ± 3.67 before the intervention to 5.18 ± 3.62 after the intervention ($t = -1.89, p = .034$). The score of the husbands decreased from 3.73 ± 2.52 to 3.67 ± 2.88 , but this change was not significant ($t = -0.10, p = .460$). The stress score of the pregnant women decreased significantly from 15.30 ± 5.48 to 13.33 ± 5.75 ($t = -2.18, p = .018$), while their hus-

bands showed a non-significant decrease from 12.70 ± 4.66 to 12.27 ± 5.05 ($t = -0.53, p = .300$).

Parental-fetal attachment

The score for maternal-fetal attachment increased significantly from 73.30 ± 13.37 to 77.67 ± 12.86 ($t = 3.28, p = .001$), as did that for paternal-fetal attachment, from 79.85 ± 12.18 to 84.30 ± 10.02 ($t = 3.06, p = .002$).

Newborn-care confidence

The score for confidence in providing newborn care increased significantly from 73.27 ± 12.42 to 78.58 ± 12.51 in the pregnant women ($t = 4.02, p < .001$) and from 79.88 ± 17.83 to 83.39 ± 12.78 in their husbands ($t = 1.85, p = .037$).

Maternal fear of childbirth

Pregnant women's score for fear of childbirth decreased significantly from 68.97 ± 19.76 before the intervention to 63.45 ± 20.01 after the intervention ($t = -2.12, p = .021$).

Couples' dyadic adjustment

The score for marital adaptability increased from 41.06 ± 5.28

Table 2. Demographic characteristics of the pregnant couples (N=33)

Variable	Categories	n (%)	Mean	SD
Pregnant woman				
Age (years)			32.30	3.10
Education	High school	1 (3.0)		
	University	26 (78.7)		
	Graduate school	6 (18.3)		
Employed	Yes	24 (72.7)		
	No	9 (27.3)		
Monthly family income (KRW)	< 2 million	2 (6.1)		
	2–3.99 million	12 (36.4)		
	4–5.99 million	14 (42.4)		
	≥ 6 million	5 (15.2)		
Marriage (years)			2.34	1.63
Gestation (weeks)			31.30	2.66
Planned pregnancy	Yes	26 (78.8)		
	No	7 (21.2)		
Husband				
Age (years)			33.21	6.25
Education	University	26 (78.8)		
	Graduate school	7 (21.2)		
Employed	Yes	33 (100)		
	No	0 (0)		

KRW: Korean won (1 million KRW is approximately 900 US dollars).

before the intervention to 41.86 ± 4.12 after the intervention among pregnant women, but this change was not statistically significant ($t = 1.30$, $p = .101$). Their husbands' scores decreased by 0.67 ± 3.81 , from 43.88 ± 3.28 before the intervention to 43.21 ± 4.64 after the intervention, but this change was likewise not statistically significant ($t = -1.01$, $p = .161$) (Table 3).

Program adherence and applicability

Over the four sessions, two of the 33 couples were absent once, due to the difficulty of moving to another city and the poor condition of the pregnant woman on the day of the session. Educational videos were provided to the couples who were absent, and after watching they gave their impressions as well as their answers to questions. The program completion rate was 100% when evaluated based on the pregnant couples participating in three of the four sessions, corresponding to a 78% attendance criterion.

After completing the prenatal education program, 50.0% of the participants were very satisfied, and 41.4% were satisfied. Satisfaction with the educational topics was highest for newborn care (54.8%), followed by preparation for childbirth (25.0%), communication within couples (12.4%), and adaptation to the pregnancy and postpartum periods (7.8%).

Discussion

Development of the couple-centered antenatal education program

This study is the first in Korea to apply couple-centered education in mainstream prenatal education to help adaptation to parenthood in terms of both the marital relationship and the paren-

tal role. A unique aspect of the program is that the educational content was well-balanced in terms of adaptation to the parental role and interactions between spouses. In addition, the present study contributes to the expansion of nursing theory and the formation of a body of knowledge in nursing science by constructing a theoretical model of becoming parents for pregnant couples based on the theory of becoming a mother and the intervention effects [22].

The content related to parental adaptation dealt with physical, emotional, and relational changes during pregnancy and postpartum, childbirth preparation, and newborn care. Content related to maintaining the couple relationship was also included, since the couple relationship serves as an important psychological basis for the couple to perform the parental role together [42]. This enabled the pregnant women and their husbands to prepare for becoming parents during pregnancy, while meeting the demands of pregnancy, childbirth, and the postpartum period. This approach reflects the fact that fathers are also active in preparing for parental change and have increased expectations [10,12]. Accordingly, the beneficiaries of education were both mothers and fathers, and the program was designed to help them maintain a mutually supportive relationship through dialogue and sympathy for understanding each other and physically and mentally preparing for parenthood.

The education on couple-relationship adaptation included emotional intimacy, support, respect, empathy, and emotional exchange between partners after pregnancy and childbirth. This program was offered at an appropriate time for couples to participate together. On-site participation was chosen based on evidence that this setting is effective and that participants prefer to

Table 3. Effectiveness of the couple-centered antenatal education intervention (N=33)

Variable	Pretest		Posttest		Difference		95% confidence interval	t	p (one-tailed)
	Mean	SD	Mean	SD	Mean	SD			
Pregnant women									
Prenatal depression	6.12	3.67	5.18	3.62	-0.94	2.86	-0.10 to -1.78	-1.89	.034
Prenatal stress	15.30	5.48	13.33	5.75	-1.97	5.19	-0.13 to -3.81	-2.18	.018
Newborn-care confidence	73.27	12.42	78.58	12.51	5.30	7.58	2.61 to 7.99	4.02	<.001
Maternal-fetal attachment	73.30	13.37	77.67	12.86	4.36	7.64	1.65 to 7.07	3.28	.001
Fear of childbirth	68.97	19.76	63.45	20.01	-5.52	14.94	-0.22 to -10.81	-2.12	.021
Couple's dyadic adjustment	41.06	5.28	41.85	4.12	0.79	3.47	-0.44 to 2.02	1.30	.101
Husbands									
Prenatal depression	3.73	2.52	3.67	2.88	-0.06	3.44	-1.28 to 1.16	-0.10	.460
Prenatal stress	12.70	4.66	12.27	5.05	-0.42	4.60	-2.05 to 1.21	-0.53	.300
Newborn-care confidence	79.88	17.83	83.39	12.78	3.52	10.93	0.32 to 6.72	1.85	.037
Paternal-fetal attachment	79.85	12.18	84.30	10.02	4.45	8.35	1.49 to 7.42	3.06	.002
Couple's dyadic adjustment	43.88	3.28	43.21	4.64	-0.67	3.81	-2.02 to 0.68	-1.01	.161

interact with educators, have vivid experiences, and get answers to questions immediately [21,43]. The prenatal education program was administered to small groups of at most three couples per session, which satisfied their individual needs, facilitated active counseling and conversation techniques, and allowed sufficient interactions with the participants [43,44].

Effects of the couple-centered antenatal education program

The effects of this couple-centered antenatal education program were analyzed in terms of variables for confirming parental adaptation: prenatal depression, prenatal transition stress, parental-fetal attachment, newborn-care confidence, and fear of childbirth. Pregnant women who participated in the program showed reductions in prenatal depression, stress, and fear of childbirth, as well as improvements in maternal-fetal attachment and confidence in providing newborn care. Their husbands showed improvements in attachment with the fetus and confidence in providing newborn care. This is consistent with previous reports that pregnant couples who participated in antenatal education showed increased confidence in parental adaptation (e.g., childbirth and parenting), and increased communication and cooperation with their husbands to overcome anxiety and stress [45,46]. In the present study, only the pregnant women (i.e., not their husbands) showed reduced depression and stress. This contrasts with a report of improved mental health among couples who participated in a marital-relationship program during pregnancy, a time of transitioning to parenthood [47]. This discrepancy is attributable to the levels of depression and stress being very low in the husbands, indicating a floor effect. This is similar to the report of Petch and Halford [29], who explained that among couples who received parental-role education and marital-relationship education, there was no effect of education when parental-role stress was low. The finding of a significant reduction in maternal fear of childbirth is consistent with previous findings [48]. In light of the result that marital adaptation is a predictor of fear of childbirth [2], this program included not only childbirth-preparation education in order to reduce fear of childbirth but also education to increase marital adaptation. It is believed that confidence in childbirth will increase and the fear of childbirth will decrease in couples who receive education that prepares them for childbirth and helps them to maintain a good couple relationship.

However, there was no effect on marital adaptation. The score of marital adaptation was 43 and 41 for the pregnant women and their husbands, respectively, in this study, compared with a threshold score of 32 reported by Cho et al. [41]. A recent meta-analysis reported a small improvement in marital-relationship satisfaction [17], but the marital adaptation score after the edu-

cational intervention remained similar to that before the intervention, perhaps because the marital-relationship education helped couples to feel satisfied with their current marital relationship in terms of having positive feelings and preventing future marital problems [49]. In the pre- and postexamination of this study, both the pregnant women and their husbands had a marital adaptation score of more than 80% of the total score of 50 points, and there was no significant difference between the pre-test and postscores, so it seems that satisfaction in marital adaptation was maintained. The lack of an observed improvement in the marital relationship underscores the need to reexamine the effectiveness of this aspect of the program through a follow-up investigation.

This study only confirmed the prenatal effects of couple-centered education aiming to help participants become parents in a single group, but a recent meta-analysis showed that couple psychoeducation reduces maternal postpartum depression and ameliorates paternal negative affect, as well as leading to overall improvements in couples' relationship satisfaction [17]. Therefore, future studies will need to confirm the effect of the intervention by expanding it to the postpartum period with a control group. In addition, a single-group pre-post experimental study was conducted to evaluate the applicability of the program; therefore, the degree to which the effectiveness of the program is limited because it was not possible to control for confounding variables and maturity issues. In subsequent studies, single-blind randomization is required for more reliable results by establishing both a control group and an experimental group. Another limitation of this study is that the confidence intervals were relatively wide due to the small sample size. As a general rule, as a sample size increases, the confidence interval should become narrower. Therefore, the effectiveness of this intervention should be examined with a larger sample. Further, the participants in this study consisted of highly educated couples with a good marital relationship in their first pregnancies, limiting the generalizability of the results to couples with other demographic characteristics.

Future studies should consider combining online and offline education in order to reduce the discontinuation of participation related to temporal and spatial restrictions. In the present prenatal education program, scores of higher than 90% were found for both parental adaptation in caring for newborns and preparation for childbirth, and also the satisfaction of the couples with their adaptation during pregnancy. Therefore, this prenatal education program is applicable to pregnant couples in obstetric clinics or local community practice. This couple-centered antenatal education program based on the model of becoming parents seems to be effective and feasible as a way to promote the adjustment of

pregnant couples to parenthood. Antenatal education programs should be implemented with both couple-relationship and parental adaptation elements to help pregnant couples adjust to parenthood. Future studies should address the need for programs to reflect educational demands related to fathers' preparations for becoming parents and caring for newborns.

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Conceptualization, Data collection, Formal analysis: all authors;
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Conflict of interest

The authors declared no conflict of interest.

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Data availability

Please contact the corresponding author for data availability.

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Development and validation of women's environmental health scales in Korea: severity, susceptibility, response efficacy, self-efficacy, benefit, barrier, personal health behavior, and community health behavior scales

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Purpose: This study aimed to develop the following scales on women's environmental health and to examine their validity and reliability: severity, susceptibility, response efficacy, self-efficacy, benefit, barrier, personal health behavior, and community health behavior scales.

Methods: The item pool was generated based on related scales, a wide literature review, and in-depth interviews on women's environmental health according to the revised Rogers' protection motivation theory model. Content validity was verified by three nursing professionals. Exploratory factor analysis, convergent validity, and internal consistency reliability were examined.

Results: The scales included 10 items on severity, 11 on susceptibility, 10 on response efficacy, 14 on self-efficacy, 8 on benefits, 10 on barriers, 17 on personal health behavior, and 16 on community health behavior. Convergent validity with the environmental behavior scale for female adolescents was supported. The Cronbach's α values for internal consistency were good for all scales: severity, .84; susceptibility, .92; response efficacy, .88; self-efficacy, .90; benefits, .91; barriers, .85; personal health behavior, .90; and community health behavior, .91.

Conclusion: The evaluation of the psychometric properties shows that these scales are valid and reliable measures of women's environmental health awareness and behaviors. These scales may be helpful for assessing women's environmental health behaviors, thereby contributing to efforts to promote environmental health.

Keywords: Environmental health; Health behavior; Psychometrics; Women's health

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Introduction

Although evidence is accumulating that women's environmental health problems are caused by environmental pollution [1-5], few studies have investigated health behaviors that promote women's environmental health [6]. Liu et al. [5] measured levels of exposure to environmental pollutants but did not address lifestyle changes, which is a limitation of that study. Therefore, it is necessary to investigate various aspects of health behavior. Wom-

en's environmental health problems may affect the reproductive organs from birth to old age, reflecting the need to protect women's health in advance from contaminants to which women are repeatedly exposed during the course of their life [7]. A useful tool to measure environmental health behavior is required to inform efforts to improve women's reproductive health. However, the existing tools for measuring women's environmental health behavior have limitations, such as being restricted to specific behaviors (i.e., not including awareness) [8], having adolescent participants [9],

Summary statement

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

According to the revised protection motivation theory, environmental fear stimulates internal cognitive processes including an assessment of severity, vulnerability, response efficacy, self-efficacy, the rewards of maladaptive responses, and the costs of adaptive responses for health behavior.

- **What this paper adds**

Severity, susceptibility, response efficacy, self-efficacy, benefit, barrier, personal health behavior, and community health behavior scales were developed and showed valid psychometric properties; these scales will help measure not only threat appraisal and coping appraisal but also women's environmental health behavior in light of personal and communal aspects.

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

Women's environmental health research and education may improve by utilizing the developed scales to test factors affecting environmental behavior and improving environmental health.

and dealing with unrelated health behaviors [10].

This study developed a tool based on Rogers' [11] revised protection motivation theory to explain the mechanism of environmental health awareness, which affects environmental health behavior. When humans have fears regarding environmental health, they adopt protective behavior through threat appraisal and coping appraisal. Threat appraisal involves subtracting perceived severity and perceived vulnerability from the rewards of maladaptive responses, and coping appraisal involves subtracting the costs of adaptive responses from response efficacy and self-efficacy [11]. Severity is defined as one's evaluation of fear of a severe negative outcome, vulnerability as perceptions regarding the mortality or morbidity of the disease, response efficacy as the effect that behavior would have on disease prevention, and self-efficacy as an evaluation of the individual's ability to engage in certain behavior [12]. Rogers [11] extended this theoretical framework to emphasize the rewards of maladaptive responses and adaptive responses. The rewards of maladaptive responses are defined as the benefits of continuing a risky behavior and the

costs of adaptive responses as the losses induced by maintaining a protective behavior [12]. Fear of environmental risks stimulates women's awareness of the severity of environmental harm, their susceptibility to environmental diseases, the response efficacy of preventive behavior, their self-efficacy, the rewards of continuing environmental behavior, and the costs of maladaptive behaviors that are dismissive of environmental health. Rogers' revised theory has been verified in various fields such as chronic pediatric diseases [13] and sexually transmitted infections [14]. Rogers' theory can also be adopted in environmental health-related fields because it provides insights into the inner decision-making mechanism for coping with threats [12]. Therefore, the revised protection motivation theory was applied in this study to measure women's internal perceptions and actions regarding environmental threats (Figure 1).

This study aimed to develop eight scales to measure environmental health awareness and health behavior (severity, susceptibility, response efficacy, self-efficacy, benefits, barriers, personal health behavior, and community health behavior) by applying

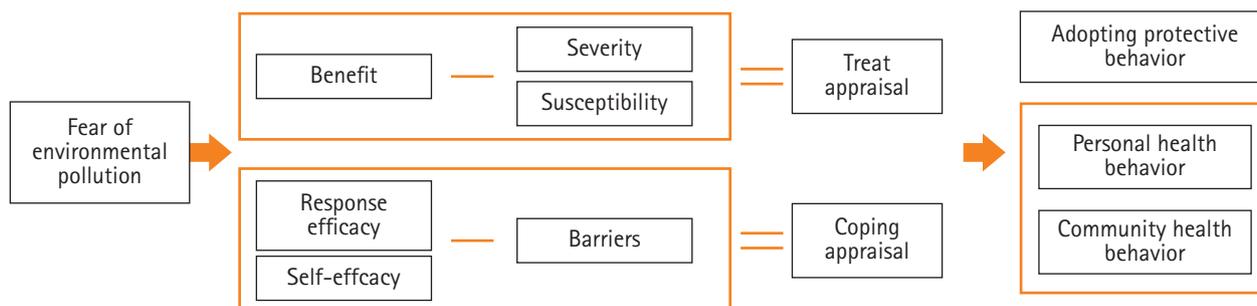


Figure 1. Conceptual framework of environmental health awareness and behavior scales for women.

the method developed by DeVellis [15] for women residing in local communities according to Rogers' revised protection motivation theory [11]. It is hoped that these scales will be used to measure the effectiveness of interventions for women's environmental health awareness and health behavior. The specific purposes were as follows: (1) to develop severity, susceptibility, response efficacy, self-efficacy, benefit, barrier, personal health behavior, and community health behavior scales for women's environmental health; and (2) to confirm the validity and reliability of the measurement tools.

Methods

Ethics statement: This study was reviewed by the Institutional Review Board of Kongju National University (KNU-IRB-2020-34) and adhered to the Declaration of Helsinki. Informed consent was obtained from participants.

Study design

This is a methodological study to develop and validate the following eight scales for women's environmental health in Korea: severity, susceptibility, response efficacy, self-efficacy, benefit, barrier, personal health behavior, and community health behavior scales.

Participants

The inclusion criteria were Korean women over the age of 19 years who lived in local communities. The criteria for selection were women who could speak, write, and read Korean and those who agreed with the purpose and process of the study. The exclusion criteria were women currently hospitalized for health problems, and those who had difficulty understanding the purpose and content of the study.

Development of the preliminary items

To develop the preliminary items, existing tools, a related literature review, and interview data from 10 women in the local community were analyzed. The literature review was done from September 9 to 13, 2020 using PubMed, CINAHL, Education Resources Information Center (ERIC), and the Research Information Sharing Service of Korea. For each database, an advanced search — (“Environment”[Mesh] AND (“Health Behavior”[Mesh] AND (“Wom*”[Mesh] OR “Female”[Mesh])) AND “Psychometrics”[Mesh]), “Environmental health”[Mesh] AND “severity” AND (“Women”[Mesh] OR “Female”[Mesh])) AND “Psychometrics”[Mesh], “Environmental health”[Mesh] AND “vulnerability OR susceptibility” AND (“Women”[Mesh] OR

“Female”[Mesh]) AND “Psychometrics”[Mesh], “Environmental health”[Mesh] AND “self-efficacy” AND (“Women”[Mesh] OR “Female”[Mesh]) AND “Psychometrics”[Mesh], “Environmental health”[Mesh] AND “self-efficacy” AND (“Women”[Mesh] OR “Female”[Mesh]) AND “Psychometrics”[Mesh], “Environmental health”[Mesh] AND “benefit OR reward” AND (“Women”[Mesh] OR “Female”[Mesh]) AND “Psychometrics”[Mesh], “Environmental health”[Mesh] AND “cost OR barrier” AND (“Women”[Mesh] OR “Female”[Mesh]) AND “Psychometrics”[Mesh], “Environmental health”[Mesh] AND “behavior” AND (“Women”[Mesh] OR “Female”[Mesh]) AND “Psychometrics”[Mesh]—and a keyword search for (‘Environment,’ ‘Health Behavior,’ ‘Female,’ ‘Measurement,’ and ‘Tools’) were done. The search of the four databases yielded 27, 10, one, and three results, respectively. Four articles were also retrieved through a manual search. Finally, three tools were used [8-10]. The interviews were held from September 26 to October 29, 2020. The researcher interviewed two women face-to-face and eight women by phone. The interviews took an average of 40 minutes per person, and two interviews were conducted for each participant. Participants were recruited through convenience sampling, and the face-to-face interviews were conducted at the office of the health center. The women's age ranged from 23 to 43 years, with an average of 37.4 years. The interviewees comprised four housekeepers, two freelancers, one bank clerk, one researcher, and two educators. Nine of the women had no health problems, while one had diabetes. The questionnaire was guided through a semi-structured questionnaire, with prompts such as “Please tell me about environmental pollutants that pose a threat to health.” The final 106 meaningful statements were derived, listed, and allocated to the scales. In total, 101 items of the preceding tools [8-10] were modified according to Rogers' revised protection motivation theory [16]. The conceptual framework of the tool was modified into eight scales: severity, susceptibility (adapted from vulnerability), response efficacy, self-efficacy, benefits (adapted from rewards of maladaptive responses), barriers (adapted from costs of adaptive responses), personal health behavior, and community health behavior (Figure 1). A Likert scale was used, with responses from 1 (not at all) to 5 (very much). In the item extraction process, the researchers independently extracted and then decided whether to include inconsistent items through a meeting. Items with disagreements were included in the request for expert review of content validity. Fifty overlapping items were removed from the interview data, and the final 157 preliminary items were developed.

The content validity of the preliminary items was verified by one head of a women's hospital, one professor of women's health

nursing, and one maternal and child health expert at a public health center. Their average age was 52.2 years, and their average professional experience was 26.7 years. A request was made via e-mail for them to review content validity using a 5-point Likert scale from 1 (not very valid) to 5 (very valid). The item-level content validity index (I-CVI) and the average scale-level content validity index (S-CVI/Ave) were tested. For the I-CVI, the ratio of 'valid' and 'very valid' for each item was set as .78 or more, and for the S-CVI/Ave, the average of I-CVI for the item was set as .90 or more [16].

Preliminary survey

The preliminary survey was done from November 19 to 23, 2020. Two women who met the inclusion criteria (22 years old and 61 years old) read the questions one by one to verify whether they understood the meaning and to confirm their understanding. The degree of comprehension was evaluated from 1 point ('I do not understand at all') to 5 points ('I understand very well'). The average score of comprehension was 4.5 points, and no item was rated as difficult to understand. The average time required to respond was 15 minutes.

Measurement tools for convergent validity

The 43-item Environmental Health Perception for Female Adolescents (EHP-FA) tool, developed to evaluate the environmental health awareness of female adolescents aged 18 to 22 years [9], was used for convergent validity. This tool is comprised of four subscales: sensitivity (17 items), vulnerability (8), response efficacy (9), and self-efficacy (9) according to Rogers' original theory [17]. At the time of development, Cronbach's α was .94, .95, .88, and .90 for each subscale; and in this study, the corresponding values were .85, .76, .87, and .86, respectively. The 32-item Environmental Health Behavior for Female Adolescents (EHB-FA) [9] tool was also used. The EHB-BA was developed to evaluate the environmental health behaviors of female adolescents aged 18 to 22 years and has two subscales: personal health behavior (19 items) and community health behavior (13). Permission for use was obtained. At the time of development, Cronbach's α was .94 and .88 for each subscale, respectively; and in this study, it was .92 and .89, respectively. The intention-related measurement used for the validity test was rated on a 7-point Likert scale, with responses ranging from 1 point ('I am not familiar with environmental health behavior') to 7 points ('I regularly practice environmental health behavior') [8].

Data collection

From November 27 to December 3, 2020, survey data were col-

lected by two researchers and three research assistants at schools, welfare centers, academies, libraries, public health centers, and homes in Daejeon, Gongju, and Sejong in Korea. The research assistants met with potential participants, explained the research purpose, and received signed informed consent forms.

According to the sample size of 200 to 400 persons proposed in exploratory factor analysis to verify construct validity [18], the required number of participants was 200. Considering a possible drop-out rate of 10%, the questionnaire was distributed to 220 women. After excluding 10 inappropriate responses, data from 210 (95.5%) women were analyzed.

Data analysis

The collected data were analyzed using SPSS ver. 25.0 (IBM Corp., Armonk, NY, USA). Exploratory factor analysis and promax rotation in principal axis factor analysis were used due to the correlations between factors. To confirm the appropriateness of the sample, the Kaiser-Meyer-Olkin (KMO) and Bartlett sphericity tests were performed. The criterion for item selection for factor extraction was that the eigenvalue was greater than 1 and the commonality of each item was .40 or more [19]. Subscale intercorrelations and the item total correlation (ITC) were examined [20]. Pearson's correlation coefficients with the EHP-FA and EHB-FA were used for convergent validity analysis. A Cronbach's α of .70 or higher was considered to indicate reliability [21].

Results

Demographic characteristics of the participants

The average age of the participants was 36.14 (standard deviation, ± 13.76) years (range, 19–70 years), and 54.3% of the participants had a spouse. The proportion of high school graduates was 46.7%, and 51.0% did not have a job. The most common range of monthly household income was between 4.5 million Korean won (approximately 4,000 US dollars) and 6 million Korean won (5,300 US dollars), which accounted for 30.5% of the participants. Some of the participants had previous experiences of disease treatment (35.7%), and 22.9% of the participants had a disease at the time of the survey (Table 1).

Content validity

The content validity of each item was .80–1.00 for 152 of the 157 items, and five items had an I-CVI less than .78. As the researchers reviewed the items, the five items with an I-CVI content validity less than .78 based on the expert group review were deleted. The deleted items were 'Ask for health information,' 'I have a habit of exercising,' 'I decide on my own health behavior,' 'Move

Table 1. Demographic characteristics of the participants (N=210)

Variable	Categories	n (%)	Mean \pm SD
Age (year)	19	4 (1.9)	36.14 \pm 13.76
	20-29	81 (38.6)	
	30-39	39 (18.6)	
	40-49	52 (24.8)	
	50-59	21 (10.0)	
	\geq 60	13 (6.1)	
Spouse	Yes	114 (54.3)	
	No	96 (45.7)	
Education	Elementary school	2 (1.0)	
	Middle school	4 (1.9)	
	High school	98 (46.7)	
	Associate or bachelor's	79 (37.6)	
	Master's or doctoral	27 (12.9)	
Job	Yes	103 (49.0)	
	No	107 (51.0)	
Monthly household income (KRW)	\leq 1.5 million	31 (14.8)	
	1.5-3 million	39 (18.6)	
	3.01-4.5 million	39 (18.6)	
	4.51-6 million	64 (30.5)	
	\geq 6.01 million	37 (17.6)	
Medical history [†]	Yes	75 (35.7)	
	No	135 (64.3)	
Present disease [†]	Yes	48 (22.9)	
	No	162 (77.1)	

KRW: Korean won (1 million = KRW is approximately 900 US dollars).

[†]Immune disease (11), uterine myoma (10), cancer (8), arthritis (7), indigestion (7), ovarian disease (6), pneumonia (4), thyroid disease (3), others (19); [†]Arthritis (9), hypertension (7), immune disease (6), thyroid disease (6), ovarian disease (4), others (16).

to a place with less pollution,' and 'Endometriosis may occur.' The S-CVI/Ave of the final 152 questions was .92. The researchers held a meeting to ensure that the final items conveyed the intended meaning. The final 152 preliminary items included 24 on severity, 12 on susceptibility, 13 on response efficacy, 14 on self-efficacy, 10 on benefits, 18 on barriers, 33 on personal behavior, and 18 on community behavior.

Factor analysis

Exploratory factor analysis was performed by applying principal axis factor analysis and promax rotation for each of the eight conceptual scales of the 152 preliminary items selected according to their content validity.

Severity of environmental health risks

The KMO value was .83, exceeding the standard value of .80, and Bartlett's sphericity test showed that the approximate chi-square value was 743.82 (degree of freedom [df] = 45, $p < .001$). After factor analysis, items with the following values were extracted: an eigenvalue of 1 or more, a commonality of .40 or more, a subscale intercorrelation coefficient between factors of .30-.80,

an ITC of .40 or more, and items that met the criteria, in which one factor includes three or more items. Four items were eliminated on the severity scale. As a result, this subscale consisted of four items for the first factor ('chemicals'), three items for the second factor ('electromagnetic waves'), and three items for the third factor ('harmful food'). The correlations between all three factors ranged from .43 to .48 ($p < .001$) and the correlations between the scale and subscales were .88, .79, and .76, respectively ($p < .001$). The ITCs ranged from .58 to .74 ($p < .001$), and the explained variance was 65.4% (Table 2, Supplementary Table 1).

Susceptibility to environmental health problems

The KMO value of the susceptibility scale was .87, and Bartlett's chi-square value was 991.91 (df = 55, $p < .001$); these values were suitable. After factor analysis of 12 items, seven items were included in the first factor ('reproductive health problems') and three items for the second factor ('general health problems'). One item ('ovarian problems') was eliminated due to low commonality. The correlation between the final factors was .60 ($p < .001$), and the correlations between the scale and subscales were .95 and .86, respectively ($p < .001$). The ITCs ranged from .56 to .85 ($p < .001$),

Table 2. Exploratory factor analysis of severity, susceptibility, response efficacy, self-efficacy, benefit, barrier, personal behavior, and community behavior for women's environmental health (N=210)

Scales	Items	Factor 1	Factor 2	Factor 3
		Chemicals	Electromagnetic waves	Harmful food
Severity	12. Nail polish	.87	.28	.35
	9. Plastic products	.83	.45	.40
	10. New furniture	.81	.41	.41
	11. Perfume	.62	.58	.28
	8. Night lighting	.44	.86	.38
	7. Cell phone	.23	.77	.25
	23. Microwave heating	.55	.75	.51
	18. Microplastics	.35	.30	.84
	19. Food additives	.41	.31	.78
	22. Instant food	.30	.41	.73
Eigenvalue		4.26	1.17	1.11

Total variance explained = 65.4%

Kaiser-Meyer-Olkin = .83, Bartlett's test of sphericity = 743.82, degrees of freedom = 45, $p < .001$

Scales	Items	Factor 1	Factor 2
		Reproductive health problems	General health problems
Susceptibility	3. Gynecologic cancer	.91	.46
	2. Infertility	.90	.55
	4. Menstrual problems	.88	.45
	1. Uterine disease	.87	.52
	6. Fetal anomaly	.80	.54
	7. Abortion	.79	.57
	8. Precocious puberty	.75	.54
	9. Atopic dermatitis	.55	.83
	10. Respiratory disease	.30	.76
	12. Immunosuppression	.65	.75
		11. Obesity	.62
Eigenvalue		6.53	1.15

Total variance explained = 69.8%

Kaiser-Meyer-Olkin = .87, Bartlett's test of sphericity = 991.91, degrees of freedom = 55, $p < .001$

Scales	Items	Factor 1	Factor 2
		Avoid toxicant	Pursuit of health
Response efficacy	1. Avoid electromagnetic waves	.81	.38
	12. Avoid micro-dust	.80	.40
	6. Avoid chemicals	.79	.41
	7. Avoid instant food	.70	.63
	8. Avoid night lights	.69	.58
	11. Home cooking	.68	.66
	5. Personal hygiene	.66	.55
	2. Attention to environmental issues	.45	.83
	3. Environmental information seeking	.38	.80
	4. Try to drink clean water	.48	.77
Eigenvalue		4.93	1.10

Total variance explained = 60.3%

Kaiser-Meyer-Olkin = .88, Bartlett's test of sphericity = 896.72, degrees of freedom = 45, $p < .001$

Scales	Items (I can prevent...)	Factor 1	Factor 2	Factor 3
		Preventive efficacy	Judgement efficacy	Control efficacy
Self-efficacy	9. toxicants via the air	.89	.42	.30
	6. toxicants through my skin	.84	.38	.09
	7. toxicants via soil	.82	.47	.37
	8. toxicants via food	.81	.43	.46

(Continued to the next page)

Table 2. Continued

Scales	Items (I can prevent...)	Factor 1	Factor 2	Factor 3
		Preventive efficacy	Judgement efficacy	Control efficacy
	5 hazardous environment	.70	.35	.64
	10. I scrutinize consumer information.	.38	.85	.40
	11. I search for internet information.	.37	.82	.44
	14. I can judge environmental news.	.32	.80	.55
	12. I learn about environmental toxicant.	.55	.78	.29
	13. I look for food hazards.	.52	.76	.37
	3. I choose useful health behavior	.22	.44	.82
	2. I manage my health	.26	.42	.81
	1. I identify harmful environment	.44	.43	.76
	4. I avoid temptations of convenience	.24	.28	.70
Eigenvalue		6.21	1.85	1.34

Total variance explained = 67.2%

Kaiser-Meyer-Olkin = .87, Bartlett's test of sphericity = 874.90, degrees of freedom = 91, $p < .001$

Scales	Items	Factor 1	Factor 2
		Psychological benefits	Physical benefits
Benefits	10. I feel comforted that environmental health is beneficial to my health.	.91	.38
	9. I feel satisfied that I did not harm the environment.	.90	.39
	8. I feel psychological stability about the environment.	.84	.47
	7. The guilt of environmental pollution is relieved.	.84	.41
	6. Environmental protection is a social phenomenon.	.78	.54
	5. Digestion functions well.	.46	.90
	3. Weight is lost.	.33	.88
	4. Skin improves.	.57	.84
Eigenvalue		4.70	1.36

Total variance explained = 75.8%

Kaiser-Meyer-Olkin = .88, Bartlett's test of sphericity = 1074.58, degrees of freedom = 595, $p < .001$

Scales	Items	Factor 1	Factor 2
		Negative atmosphere	Burden
Barriers	17. Difficulty speaking openly	.81	.35
	12. Doctors' offices do not give information	.80	.39
	16. Difficulty obtaining information	.79	.41
	8. Distrust of health effects	.76	.19
	18. Negative reactions from people around you	.68	.46
	13. Attention-consuming	.33	.79
	5. High cost	.39	.76
	6. Time consuming	.45	.74
	4. Invisible effects	.30	.73
	3. Discomfort to reduce disposables	.23	.72
Eigenvalue		4.26	1.57

Total variance explained = 58.5%

Kaiser-Meyer-Olkin = .85, Bartlett's test of sphericity = 764.68, degrees of freedom = 45, $p < .001$

Scales	Items	Factor 1	Factor 2	Factor 3	Factor 4
		Lifestyle	Personal goods	Food	Dust
Personal health behavior	3. I reduced the use of chemicals.	.85	.43	.57	.33
	4. I avoid exposure to heavy metals.	.84	.49	.49	.29
	5. I use bisphenol-free products.	.81	.34	.49	.30
	1. I reduced antiseptic use.	.77	.36	.32	.29
	2. I avoid exposure to radiation.	.73	.28	.40	.35
	7. I keep away from cell phones.	.73	.49	.64	.27
	6. I avoid exposure to light at night.	.72	.35	.62	.20

(Continued to the next page)

Table 2. Continued

Scales	Items	Factor 1	Factor 2	Factor 3	Factor 4
		Lifestyle	Personal goods	Food	Dust
	15. I avoid nail polish.	.42	.88	.45	.22
	13. I avoid air fresheners.	.34	.87	.34	.36
	14. I avoid antiseptic cosmetics.	.40	.81	.34	.34
	12. I avoid perfume.	.52	.67	.43	.19
	10. I reduce meat-eating.	.51	.34	.88	.31
	9. I eat a low-fat diet.	.45	.41	.87	.34
	11. I reduce food additives.	.55	.48	.73	.22
	18. I avoid micro-dust.	.30	.37	.30	.88
	17. I avoid car exhaust.	.38	.29	.39	.83
	16. I avoid cigarette smoke.	.33	.24	.20	.82
Eigenvalue		7.68	1.74	1.59	1.17

Total variance explained = 67.7%

Kaiser-Meyer-Olkin = .88, Bartlett's test of sphericity = 2154.69, degrees of freedom = 153, $p < .001$

Scales	Items	Factor 1	Factor 2	Factor 3	Factor 4
		Reduction	Involvement	Recycling	Reuse
Community health behavior	1. I reduce plastic use.	.89	.53	.35	.51
	2. I reduce waste.	.84	.42	.28	.34
	3. I reduce detergent use.	.82	.33	.38	.39
	4. I reduce disposables.	.81	.53	.34	.54
	5. I minimize personal use.	.78	.56	.40	.67
	16. I try to convince others to reduce disposables.	.53	.83	.25	.46
	13. I have an interest in environmental issues.	.49	.76	.17	.29
	17. I encourage others to separate garbage.	.35	.75	.44	.31
	18. I talk about ways to solve environmental problems.	.31	.74	.26	.37
	12. I participate in environmental activities.	.42	.73	.44	.50
	10. I separate waste collection.	.30	.30	.90	.35
	11. I separate battery waste.	.38	.26	.80	.42
	9. I separate drug waste.	.33	.43	.75	.21
	6. I reuse products.	.36	.36	.30	.88
8. I conserve electricity.	.55	.46	.35	.87	
7. I conserve water.	.46	.55	.56	.62	
Eigenvalue		6.89	1.56	1.45	1.09

Total variance explained = 68.8%

Kaiser-Meyer-Olkin = .87, Bartlett's test of sphericity = 1788.85, degrees of freedom = 120, $p < .001$

and the explained variance was 69.8% (Table 2, Supplementary Table 1).

Response efficacy related to environmental health behaviors

Suitable values were found for the KMO test (.88) and Bartlett's chi-square value (896.72; $df = 45, p < .001$). After factor analysis of 13 items, seven items for the first factor ('avoiding toxicants'), and three items for the second factor ('pursuit of health') were selected. Three items related to 'vegetable consumption,' 'migrating to a low-pollution area,' and 'inquiry to medical staff' were eliminated because they had ITCs of less than .40. The correlation between

the final factors was .59 ($p < .001$), and the correlations between the scale and subscales were .97 and .86, respectively ($p < .001$). The ITCs ranged from .50 to .73 ($p < .001$), and the explained variance was 60.3% (Table 2, Supplementary Table 1).

Self-efficacy related to environmental health behaviors

The KMO value was .87, and Bartlett's chi-square value was found to be 874.90 ($df = 91, p < .001$). After the factor analysis of 14 questions, all questions were selected. There were five items for the first factor ('preventive efficacy'), five items for the second factor ('judgment efficacy'), and four items for the third fac-

tor ('control efficacy'). The correlations between the factors ranged from .40 to .48 ($p < .001$), and the correlations between the scale and subscales were .84, .86, and .73, respectively ($p < .001$). The ITCs ranged from .48 to .72 ($p < .001$), and the explained variance was 67.2% (Table 2, Supplementary Table 1).

Benefits of environmental health behaviors

This scale was found to be suitable, with a KMO value of .88 and a Bartlett's chi-square value of 1,074.58 ($df = 595$, $p < .001$). After the factor analysis of 10 items, eight items were selected: five items for the first factor ('psychological benefits'), and three items for the second factor ('physical benefits'). The correlation between the final factors was .50 ($p < .001$), and the correlations between the scale and subscales were .82 and .92, respectively ($p < .001$). The ITCs ranged from .47 to .80 ($p < .001$), and the explained variance was 75.8% (Table 2, Supplementary Table 1).

Barriers to environmental health behaviors

The scale on barriers was found to be suitable, with a KMO value of .85 and Bartlett's chi-square value of 764.68 ($df = 45$, $p < .001$). After the factor analysis of 18 items, five items for the first factor ('negative atmosphere') and five items for the second factor ('burden') were selected. The correlation between the factors was .45 ($p < .001$), and the correlations between the scale and subscales were .87 and .84, respectively ($p < .001$). The ITCs ranged from .40 to .70 ($p < .001$), and the explained variance was 58.5% (Table 2, Supplementary Table 1).

Personal health behavior

Suitable results were found for the KMO value (.88) and Bartlett's chi-square value (2154.69; $df = 153$, $p < .001$). After the factor analysis of 33 items, 17 items were selected: seven items for the first factor ('lifestyle'), four items for the second factor ('personal goods'), three items for the third factor ('food'), and three items for the fourth factor ('dust'). The correlations between the factors ranged from .40 to .48 ($p < .001$), and the correlations between the scale and subscales were .87, .77, .82, and .61, respectively ($p < .001$). The ITCs ranged from .48 to .76 ($p < .001$), and the explained variance was 67.7% [20] (Table 2, Supplementary Table 1).

Community health behavior

For the community health behavior scale, the KMO value was .87 and Bartlett's chi-square value was 1,788.85 ($df = 120$, $p < .001$). After the factor analysis of 18 items, 16 items were selected: five items for the first factor ('reduction'), five items for the second factor ('involvement'), three items for the third factor ('recy-

cling'), and three items for the fourth factor ('reuse'). The correlations between the factors were .40 to .55 ($p < .001$) and the correlations between the scale and subscales were .85, .84, .68, and .77, respectively ($p < .001$). The ITCs ranged from .55 to .77 ($p < .001$), and the explained variance was 68.8% (Table 2, Supplementary Table 1).

The finally developed eight scales included 10 items on severity, 11 on susceptibility, 10 on response efficacy, 14 on self-efficacy, 8 on benefits, 10 on barriers, 17 on personal health behavior, and 16 on community health behavior (Table 2).

Reliability

Cronbach's α (95% confidence interval [CI]), as a measure of internal consistency, was good for all scales and subscales (Supplementary Table 1):

- Severity: .84 (95% CI = .82-.95; chemicals = .80; electromagnetic waves = .74; harmful food = .70)
- Susceptibility: .92 (95% CI = .90-.94; reproductive health problems = .94; general health problems = .78)
- Response efficacy: .88 (95% CI = .86-.91; avoiding toxicants = .87; pursuit of health = .76)
- Self-efficacy: .90 (95% CI = .88-.91; preventive efficacy = .88; judgment efficacy = .86; control efficacy = .80)
- Benefits: .91 (95% CI = .89-.93; psychological benefits = .91; physical benefits = .85)
- Barriers: .85 (95% CI = .82-.88; negative atmosphere = .83; burden = .81)
- Personal health behavior: .90 (95% CI = .88-.92; lifestyle = .90; personal goods = .84; food = .82; dust = .81)
- Community health behavior: .91 (95% CI = .89-.93; reduction = .89; involvement = .83; recycling = .77; reuse = .77)

Convergent validity

The developed tool showed statistically significant positive correlations with EHP-FA and EHB-FA, demonstrating convergent validity. All of the scales showed a significant positive correlation with the EHP-FA: severity ($r = .62$, $p < .001$), susceptibility ($r = .65$, $p < .001$), response efficacy ($r = .78$, $p < .001$), self-efficacy ($r = .66$, $p < .001$), benefits ($r = .29$, $p < .001$), barriers ($r = .21$, $p = .002$), personal behavior ($r = .40$, $p < .001$), and community behavior for women's environmental health ($r = .39$, $p < .001$). A significant positive correlation with the EHB-FA was also found: severity ($r = .23$, $p = .001$), susceptibility ($r = .55$, $p < .001$), response efficacy ($r = .26$, $p < .001$), self-efficacy ($r = .51$, $p < .001$), benefits ($r = .18$, $p = .001$), barriers ($r = .10$, $p = .013$), personal behavior ($r = .92$, $p < .001$), and community behavior for women's environmental health ($r = .90$, $p < .001$) (Table 3).

Table 3. Correlations among the eight women's environmental health scales, Environmental Health Perception for Female Adolescents, and Environmental Health Behavior for Female Adolescents (N=210)

Scales	Scales, r (ρ)								
	1	2	3	4	5	6	7	8	9
2	.33 ($<.001$)	1							
3	.42 ($<.001$)	.56 ($<.001$)	1						
4	.11 (.110)	.07 (.350)	.28 ($<.001$)	1					
5	.06 (.389)	.17 (.016)	.17 (.017)	.32 ($<.001$)	1				
6	.16 (.018)	.12 (.088)	.13 (.069)	.16 (.024)	.17 (.017)	1			
7	.26 ($<.001$)	.40 ($<.001$)	.25 ($<.001$)	.44 ($<.001$)	.40 ($<.001$)	.10 (.151)	1		
8	.15 ($<.001$)	.06 (.393)	.78 ($<.001$)	.66 ($<.001$)	.29 ($<.001$)	.21 ($<.001$)	.40 ($<.001$)	1	
9	.62 ($<.001$)	.65 ($<.001$)	.78 ($<.001$)	.66 ($<.001$)	.29 ($<.001$)	.21 (.002)	.40 ($<.001$)	.39 ($<.001$)	1
10	.23 (.001)	.55 ($<.001$)	.26 ($<.001$)	.51 ($<.001$)	.18 (.001)	.10 (.013)	.92 ($<.001$)	.90 ($<.001$)	.44 ($<.001$)

1=Severity; 2=susceptibility, 3=response efficacy; 4=self-efficacy; 5=benefit; 6=barrier; 7=personal behavior; 8=community behavior for women's environmental health; 9=Environmental Health Perception for Female Adolescents; 10=Environmental Health Behavior for Female Adolescents.

Discussion

The scales developed in this study were based on the revised protection motivation theory [11]. This theory explains changes in health behavior by adding the concepts of self-efficacy, rewards of maladaptive responses, and costs of adaptive responses to its original theoretical form [17]. When a person feels that the action's reward exceeds its cost based on threat appraisal and coping appraisal, he or she can intend to take action and change the behavior [11]. In this study, all concepts of the revised protection motivation theory were substituted with corresponding environmental health concepts, and psychological evidence for the composition of the tool was confirmed [15].

As a result of reviewing existing environmental health behavior measurement tools [11,12,15], a literature review, interviews, and expert content validity test, it was found that the I-CVI and S-CVI/Ave values were above the corresponding standards, thereby establishing content validity [16]. Construct validity was confirmed through empirical tests of the pattern matrix, the structural matrix, the correlation coefficients between all items and each factor, and the correlation coefficients between factors [19].

This study attempted to grasp the meaning of the factors for the concepts underlying each scale. The severity scale comprised three subscales ('chemicals,' 'electromagnetic waves,' and 'harmful food'). A difference between this scale and existing tools is

that the severity of electromagnetic waves was derived as one factor. The items related to microplastics and light pollution reflect the recent problem of environmental pollution. Severity is an important concept related to environmental health in the United States, as a previous study assessed whether people had been exposed to environmental toxicity in the clinic [22]. Furthermore, this tool can be easily used as a more straightforward question.

The susceptibility scale included two subscales ('reproductive health problems' and 'general health problems'). It can be seen that women were aware of their reproductive health problems and the health problems of the fetus and their children. As the relationship between female reproductive health problems and environmental pollutants has recently been established [2,23], it can be seen that this scale reflects the environmental health perceptions of women residing in local communities.

Response efficacy contained two subscales ('avoiding toxicants' and 'pursuit of health'). The fact that the actions to avoid environmental pollutants had a higher explanatory power than actions taken to pursue health is consistent with the principle of precautionary care used in environmental health [7,24].

Self-efficacy contained three subscales ('preventive efficacy,' 'judgment efficacy,' and 'control efficacy'). This classification does not exist in existing tools. Since self-efficacy is a strongly influential variable within the theory of health behavior changes [25], the developed scale will be valuable as a measurement tool.

Benefits consisted of two subscales ('psychological benefits' and 'physical benefits'). It semantically coincided with the concept of compensation for actions, which has recently been proposed in the revised motivational theory [11]. In addition, the concept of benefits includes the possibility of measuring rewards for actions that existing tools cannot measure.

Barriers had two subscales ('negative atmosphere' and 'burden'). The classification of items was appropriate in terms of content and semantically coincided with the concept of the cost of action, which has recently been proposed in the revised motivational theory [11]. According to the theory of change in health behavior, people are more sensitive to the barriers of health behavior than to the benefits of behavior [12]. Therefore, the scale dealing with barriers should be included in studies using the measurement tool developed in this study.

Personal health behavior consisted of four subscales ('lifestyle,' 'personal goods,' 'food,' and 'dust'). Compared to other tools [8], the personal behavior scale contains health behaviors that are easy for women to practice in daily life; therefore, it is straightforward to measure health behaviors using this tool, which is advantageous.

Community health behavior consisted of four subscales ('reduction,' 'involvement,' 'recycling,' and 'reuse'). This subscale reflects the community's commitment to creating an environment that is not harmful to health by preventing environmental pollution [26].

The measurement tool developed in this study utilized all the constituent factors of the revised protection motivation theory model. Furthermore, validity and reliability testing was done. The tool reflects a comprehensive array of information on the environmental awareness and behavior of women residing in local communities in Korea through interviews and surveys. Therefore, it is distinctive from existing tools. It can be used to measure women's environmental health awareness and strengthen environmental health behavior.

A limitation of this study limitation is the difficulty of generalizing the results to women in Korea as a whole or in other countries because data were collected from a local community setting in Korea. The convergent validity may have been high because of the lack of a gold-standard tool and because it was developed by applying a revised theory based on existing tools. Additionally, confirmatory factor analysis was not conducted.

We suggest conducting confirmatory factor analysis in further research to test the fitness of the theoretical framework. In the exploratory factor analysis, the variance explained by each subscale was found to be from 58.5% to 75.8%. Further efforts to find the remaining sources of variance are needed. Additional

analyses of women from a wider variety of regions are required to address the limitation of generalizability. It is also necessary to investigate whether women with environmental health problems have high scores on these scales.

This study developed the following scales for measuring women's environmental health: severity, susceptibility, response efficacy, self-efficacy, benefit, barrier, personal behavior, and community behavior for women residing in local communities in Korea. Research on environmental health in women has attracted increasing attention not only in Korea but also worldwide. As the scales' validity and reliability were verified from various angles, their suitability for use in future research on women's environmental health can be confirmed.

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Conflict of interest

The authors declared no conflict of interest.

Data availability

Please contact the corresponding author for data availability.

Supplementary material

Further details on supplementary materials are presented online (available at <https://doi.org/10.4069/kjwhn.2021.06.21>).

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Instructions to Authors

Korean Journal of Women Health Nursing

Enacted in March 1995 and most recently revised in November 2020 and applied from Vol. 26, No. 4 (December 2020).

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.

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

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

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

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

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

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

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

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

1-3. DATA SHARING

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

ticipants on or after January 1, 2019 must include a data sharing plan in the trial's registration. The ICMJE's policy regarding trial registration is explained at <http://www.icmje.org/about-icmje/faqs/clinical-trials-registration/>. 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. All manuscripts from editors, employees, or members of the editorial board are processed the same way as other unsolicited manuscripts. During the review process, they will not engage in the selection of reviewers and decision process. Editors will not handle their own manuscripts even if they are commissioned ones. 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. 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.

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

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

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

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

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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.

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- The full title of the article.
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- 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 400 USD (approximately 400,000 Korean Won) per article is requested to

the corresponding author. Further information can be found at https://kjwhn.org/authors/processing_charge.php.

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

1-10. CONTACT US

Any inquiries regarding suitability of manuscripts according to the aims and scope of the Journal, submission, review, publication, or journal-related issues are welcomed. Please contact the Editorial Office (<https://kjwhn.org/about/contact.php>).

For manuscript submission, please visit:

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2. Specific Guidelines for 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.

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 (<http://www.nlm.nih.gov/mesh/meshhome.html>). 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.

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.

References

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

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

Journal titles should be described in NLM style.

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

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

Journal article with up to six authors:

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

Journal article with more than six authors:

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

Book:

Davidson MR, London ML, Wieland Ladewig PA. *Olds' mater-*

nal-newborn nursing and women's health across the lifespan. 8th ed. Upper Saddle River, NJ: Pearson Prentice Hall; 2008. p. 20- 25.

Book Chapter:

Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. In: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York, NY: McGraw-Hill; 2002. p. 93-113.

Unpublished thesis or dissertation:

Chang YE. The analysis of the association factors which influence on the breast and cervix cancer screening in Korean women: Based on the 2005 Korean national examination health and nutrition survey [master's thesis]. Seoul: Korea University; 2010. 55 p.
Lee SK. The effects of group coaching on emotional intelligence and self-efficacy of nurses [dissertation]. Seoul: Yonsei University; 2007. 85 p.

Web reference:

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

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.

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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.

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

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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.

1. Conflict-of-interests Statement

Authors are required to disclose commercial or similar relationships to products or companies mentioned in or related to the subject matter of the article being submitted. Sources of funding for the article should be acknowledged in a footnote on the title page. Affiliations of authors should include corporate appointments relating to or in connection with products or companies mentioned in the article, or otherwise bearing on the subject matter thereof. Other pertinent financial relationships, such as consultancies, stock ownership or other equity interests, or patent-licensing arrangements should be disclosed to the Editor-in-Chief in the cover letter at the time of submission. Such relationships may be disclosed in the Journal at the discretion of the Editor-in-Chief in footnotes appearing on the title page. Questions about this policy should be directed to the Editor-in-Chief. If there is no conflict of interest, this should also be explicitly stated as “The author(s) declared no conflicts of interest.”

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.

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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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6. Secondary Publication

It is possible to republish manuscripts if the manuscripts satisfy

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When thesis or dissertation work is submitted for publication, the first author should be the thesis awardee and should declare that content is from thesis/dissertation.

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- 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
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- Abbreviations are noted under the table, in alphabetical order, and are congruent with text descriptions

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