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ISSN(Print) 2287-9110
ISSN(Online) 2287-9129

CHNR

Child Health Nursing Research

Vol.30, No.2, April 2024

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Korean Academy of Child Health Nursing

CHNR
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pISSN 2287-9110
eISSN 2287-9129

About the Journal

Child Health Nursing Research (CHNR) is the official peer-reviewed research journal of the Korean Academy of Child Health Nursing. CHNR is a multidisciplinary, double-blind peer-reviewed, open-access journal that publishes original research, theory, and review papers on health care and nursing from the beginning of life to young adulthood, including both children and their families. It is devoted to all fields of child health, including global and cultural issues, aimed at both domestic and international healthcare professionals. The journal is published quarterly (Jan 31, Apr 30, July 31, and Oct 31) in English. The journal welcomes submissions from healthcare professionals around the world, and encourages the submission of papers dealing with cultural issues and those studied by international research teams.

- Indexed in major databases: PubMed Central, PubMed, Scopus, CINAHL, DOAJ, Crossref Metadata, Google Scholar, ScienceCentral, KCI (Korea Citation Index), RISS, KoreaMed, and KoMCI.
- Its abbreviated title is Child Health Nurs Res.
- Open access: All articles published in the journal are freely available with an open access license for everyone to read and download from the CHNR website (http://www.e-chnr.org/) immediately and permanently after publication.

Aims and Scope

Child Health Nursing Research aims to promote the health, development, and well-being of children and their families in Korea and all over the world by providing research on evidence-based practices.
Its scope includes the most recent clinically and academically relevant topics in health care and nursing from the beginning of life to young adulthood, including both children and their families. The journal deals with articles that address research, theory, and practice in a wide range of child health nursing areas and relevant cultural issues. Its regional scope is mainly Korea, but it welcomes submissions from researchers and nurses worldwide.
The primary readers of this journal are healthcare professionals, administrators and scientists serving newborns, infants, children, adolescents, young adults, and their families, including nurses, midwives, physicians, developmental specialists, public health workers, scientists, educators, epidemiologists, and other health caregivers.
The ultimate goal of *Child Health Nursing Research* is to develop a body of knowledge on the health of newborns, infants, children, adolescents, young adults, and their families while improving the clinical field and community with evidence-based practices to promote the health of children and families all over the world.

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Printed April 30, 2024 Published April 30, 2024

Published by the Korean Academy of Child Health Nursing

College of Nursing, Daegu Catholic University, Korea
Tel: +82-53-650-4829, Fax: +82-53-650-4392, e-mail: hykoo@cu.ac.kr

Printed by M2PI

#805, 26 Sangwon 1-gil, Seongdong-gu, Seoul 04779, Korea
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CHNR
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Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):75-76
https://doi.org/10.4094/chnr.2024.019

pISSN 2287-9110
eISSN 2287-9129

CHNR

As a good companion in *Child Health Nursing Research*: a peer reviewer

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Editor-in-Chief, *Child Health Nursing Research*
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The peer-review process is a crucial aspect of manuscript evaluation, offering an objective assessment of the research to enhance the manuscript's quality and ensure its suitability for publication. In *Child Health Nursing Research* (CHNR), the editorial board will discuss the role of the peer reviewer in the 2024 editorial, with a particular focus on the value of peer reviewers as companions in the field of publishing.

1. Who is the Peer Reviewer in CHNR?

The peer reviewers for CHNR are members of the Korean Academy of Nursing Science and Korean Academy of Child Health Nursing. The majority of them are experts in child nursing, teaching child nursing at universities, possessing specialized knowledge in nursing and health for children and their families. They have also published research papers in CHNR. Presently, CHNR has 71 peer reviewers, and additional judges may be appointed depending on the area of expertise. These peer reviewers are volunteers who are dedicated to serving the mission of CHNR. They provide constructive feedback on manuscript submitted by authors, encouraging them to have academic and scientific value. When appointing a peer reviewer for a journal, the editorial board thoroughly checks the background of the chosen reviewer. This includes their main research field, such as clinical field or research methodology, to ensure that the manuscript receives a scientific and rational review. The ultimate goal is to ensure that the resulting publication is of high quality.

In the field of CHNR, it is crucial for peer reviewers to showcase their expertise and familiarity with scientific methods to provide feedback that is both valuable and applicable. This requires a profound comprehension of the latest literature, emerging technologies and historical studies that are relevant to children's health. By demonstrating such proficiency, peer reviewers can help shape the future of children's health and pave the way for better scientific research and advancements in the field.

2. The Process of Peer Review for CHNR

All papers submitted to CHNR undergo a peer-review process. The principles of CHNR's peer-review process are presented on the journal's homepage (https://www.e-chnr.org/authors/reviewers.php). Once an author submits a manuscript to an academic journal, the editorial department appoints experts who are qualified to review the manuscript based on their expertise and the topic and type of the article. All manuscripts submitted to CHNR are reviewed by at least two peer reviewers. CHNR adheres to a double-blind policy, whereby the author's name and affiliation are concealed from the reviewer and the reviewer's identity is concealed from the author. For manuscripts that have undergone review, a decision of 'Accept,' 'Minor revision,' 'Major revi-

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Received: April 25, 2024 **Accepted:** April 26, 2024

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sion,' or 'Reject' is conveyed to the author. CHNR is an open access journal, and it implements a policy where authors do not pay for review and peer reviewers are also not paid for their reviews.

3. The Virtues of the Peer Reviewer

It is recommended that peer reviewers adhere to the ethical standards of peer review when conducting reviews. Matters related to ethical compliance that require peer review are presented by ICMJE (International Committee of Medical Journal Editors, https://www.icmje.org/recommendations/browse/roles-and-responsibilities/responsibilities-in-the-submission-and-peer-peview-process.html), COPE (Committee on Publication Ethics, https://publicationethics.org/resources/guidelines/cope-ethical-guidelines-peer-reviewers), and numerous other publishers and academic organizations. Additionally, CHNR provides guidelines for peer-review ethics compliance.

When invited to serve as a peer reviewer, the first step is to assess whether the manuscript to be reviewed is related to their area of expertise and whether there is a conflict of interest. If the reviewer finds that the manuscript falls outside their area of expertise or there is a conflict of interest, they should decline the request to review the article.

It's important for peer reviewers to respond promptly to review requests upon agreeing to review for a journal. This helps to avoid delays in the review process, which can be challenging for editors when selecting new reviewers for rejected articles. It's also crucial for reviewers to decline review requests without delay if they are unable to do so for any reason. Peer reviewers should strive to accept all requests within their scope of practice and promptly communicate a decline if significant time constraints prevent a review. This approach can help ensure a smooth and efficient review process for all parties involved.

CHNR has been engaged in the delivery of training programs for peer reviewers. In the future, there will be a need for ongoing programs to train new peer reviewers and conduct programs for existing ones. Anyone who is an author, peer reviewer, or editor can become a peer reviewer for CHNR. The dedication of these peer reviewers has played a significant role in the current success of CHNR. Thus, it is reasonable to expect that the future of CHNR will be bright, thanks to their hard work. We would like to express our gratitude to all the peer reviewers who have demonstrated their commitment to CHNR and have been valuable partners.

ARTICLE INFORMATION

Authors' contribution

All the work was done by Yunsoo Kim.

Conflict of interest

Yunsoo Kim has been the editor-in-chief of *Child Health Nursing Research* since 2022. She was not involved in the review process of this editorial. No existing or potential conflict of interest relevant to this article was reported.

Funding

None.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):77-86
https://doi.org/10.4094/chnr.2023.057

pISSN 2287-9110
eISSN 2287-9129

CHNR

Combined effects of sugar-sweetened beverage consumption, screen-based sedentary behavior, and sleep duration on South Korean adolescent obesity: a cross-sectional study

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Received: November 22, 2023
Revised: December 30, 2023
Accepted: January 9, 2024

Purpose: This study examined the combined effects of sugar-sweetened beverage (SSB) consumption, screen-based sedentary behaviors, and sleep duration on adolescent obesity. **Methods:** It followed a cross-sectional study design and conducted secondary analysis on data from 20,497 high school students who participated in the 17th (2021) Korea Youth Risk Behavior Web-based Survey. This study underwent logistic regression analysis in complex sampling analysis. **Results:** The combinations of low and medium consumption of SSBs, excessive screen-based sedentary behaviors, and short sleep durations were associated with a 1.18 and 1.12 fold increased likelihood of obesity (95% confidence interval [CI]=1.03–1.35) and (95% CI=1.02–1.22), respectively. The combination of high SSB consumption, appropriate screen-based sedentary behaviors, and short sleep duration (adjusted odds ratio [aOR]=1.15, 95% CI=1.01–1.31) and high SSB consumption, excessive screen-based sedentary behaviors, and short sleep duration (aOR=1.40, 95% CI=1.16–1.69) were associated with obesity. **Conclusion:** Integrated and tailored programs considering combination patterns of SSB consumption, screen-based sedentary behaviors, and short sleep duration need to be developed for preventing adolescent obesity.

Keywords: Adolescent; Obesity; Sugar-sweetened beverages; Screen time; Sleep duration

INTRODUCTION

Childhood and adolescent obesity have become a significant public health issue in the 21st century, having reached epidemic proportions [1]. The World Obesity Federation has predicted that by 2025, 206 million individuals aged 5 to 19 will be affected by obesity, a number projected to increase to 254 million by 2030 [2]. In Korea, the prevalence of obesity among adolescents surged from 5.1% in 2009 to 11.1% in 2019, reflecting an average annual increase of 0.47% [3].

Overweight and obesity negatively affect adolescents' physical (e.g., type 2 diabetes) and psychosocial health (e.g., low self-esteem and social isolation) [4]. Additionally, obesity during adolescence is a strong predictor of complications associated with obesity in adulthood [1]. Early prevention and management of obesity with modifiable factors are important for promoting health during childhood, adolescence, and later life. Adolescence, marked by significant psychological and biological changes, represents a critical period where individuals can make autonomous decisions regarding lifestyle factors [5]. Thus, adolescents may have self-determined unhealthy lifestyle behaviors, including dietary habits, such as consuming sugar-sweetened beverages (SSBs), sedentary behaviors (prolonged screen time), and poor sleep patterns (short sleep durations) [6].

In terms of dietary behaviors, adolescents tend to consume

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more SSBs (including sodas and sports drinks) and less milk than younger children. According to Southerland et al. [7], approximately 63% of adolescents in the United States consume SSBs more than once a day. Similarly, approximately 96% of Korean high school students regularly consume SSB [8], of which, 40% consume them more than once a day. Thus, its frequent intake of SSBs has been significantly linked to elevated energy intake, contributing to the prevalence of adolescent obesity.

Screen-based sedentary behaviors are a common adolescent leisure activity, owing to increased availability of screen-based electronic devices, including televisions, computers, tablets, and mobile phones [9]. Adolescents in the United States, spent an average of 8.6 hours a day on screen-based sedentary behaviors in 2021, though the country's recommended limit for children and adolescents was <2 hours per day [10]. A Korean national study also showed that 66.5% of adolescents spent at least 2 hours a day on screen-based sedentary behaviors [11]. As sedentary behaviors involve low energy expenditure (<5 metabolic equivalents), excessive screen-based sedentary behaviors increase adolescents' risk of obesity [9]. In the same vein, ≥2 or 3 hours a day of screen time was linked to a likelihood of obesity in adolescents [9].

Additionally, short sleep owing to short durations is a widespread issue among adolescents. According to Wheaton and Claussen [12], 31.2% of adolescents in the United States are impacted by short sleep durations. Korean high school students, on average, slept for 6.2 hours a day on weekdays, with 63% of Korean adolescents getting less than the recommended 8 to 10 hours of sleep per day for individuals in their age group [13]. Previous studies have consistently highlighted the effects of short sleep duration on an increased likelihood of obesity among adolescents [13,14]. Thus, frequent SSB consumption, excessive screen-based sedentary behaviors, and/or short sleep durations may be associated with an increased risk of adolescent obesity.

Furthermore, frequent consumption of SSB, excessive sedentary time, and short sleep durations may be related to lifestyle behaviors [15]. Previous studies reported that increased sedentary behaviors were linked to shorter sleep durations and higher SSB consumption [15]. Additionally, higher SSB consumption and screen-based sedentary behaviors have been associated with shorter sleep durations [16]. Hence, they might be clustered behaviors, that could result in neutralized or synergetic combination effects, which differ from their independent effects. However, most of the previous studies focused on isolating the individual effects of SSB consumption, screen-based sedentary behaviors, and sleep duration on obesity in adolescents [9,14,17]. Hence, this study investigates the combined effects of SSB consumption, screen-based sedentary behaviors, and sleep duration on obesity in Korean high school students.

Childhood obesity develops through a complex pathway, and involves several underlying factors. Thus, while considering the effects of various multi-level covariates, the effects of SSBs, screen-based sedentary behaviors, and sleep duration on adolescent obesity need to be identified. According to Williams et al. [18], individuals' obesity development is shaped by biological factors (age and sex), social factors (educational levels and socioeconomic status), and psychological elements (mood and health-related behaviors). Similarly, Hoffman and Driscoll [19] proposed that a biopsychosocial model may provide a framework for a comprehensive understanding of multivariate factors associated with metabolic health, including obesity. A literature review revealed, that the biological factor—sex; social factors—grades [1,20] and families' socioeconomic status [1,20,21]; and psychosocial factors—depressive symptoms [1,22], daily stress [23], perceived body shape [24], skipping breakfast [25], fast-food consumption [1,26], lack of physical activity [1,20], and current consumption of cigarettes and alcohol [27], were associated with increased adolescent obesity.

In particular, to understand national trends of SSB consumption, screen-based sedentary behaviors related to screen use and duration of sleep, and their correlations with Korean high school students' obesity, secondary analysis of nationally representative survey data using systemic sampling methods might be helpful. Thus, through a secondary analysis of data obtained from the Korea Youth Risk Behavior Web-based Survey (KYRBS), this study aimed to identify the combined effects of SSB consumption, screen-based sedentary behaviors, and sleep durations on adolescent Korean high school students' obesity, by controlling for relevant covariates.

METHODS

Ethical statements: This study obtained an exemption from the Institutional Review Board (IRB) at Chungnam National University (No. 202307-SB-107-01) as it involves the utilization of secondary data with anonymity.

1. Study Design

This study adopted a cross-sectional design for secondary data analysis, using data collected from the 17th (2021) KYRBS— an anonymous and online based self-reported survey. The reporting of this study followed the guidelines outlined in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [28].

2. Data Source

The data set was obtained through a free download from the Korea Disease Control and Prevention Agency's website, after seeking permission from the Agency for using the raw data. KYRBS is an annually conducted national survey to collect data on the physical and mental health status, health-related behaviors, and environmental factors. The 17th KYRBS was conducted among 96.3% (30,015 out of 31,181) middle school students and 89.1% (24,833 out of 27,885) high school students, representing 800 schools spanning 17 provinces in South Korea. This study analyzed data of 24,833 high school students, but finally used 20,497 (10,563 males and 9,934 females) students' data, as it excluded data of 30,015 middle school and 4,336 high school students, having missing information on items to assess SSB consumption, screen-based sedentary behaviors, sleep duration, and covariates (Figure 1).

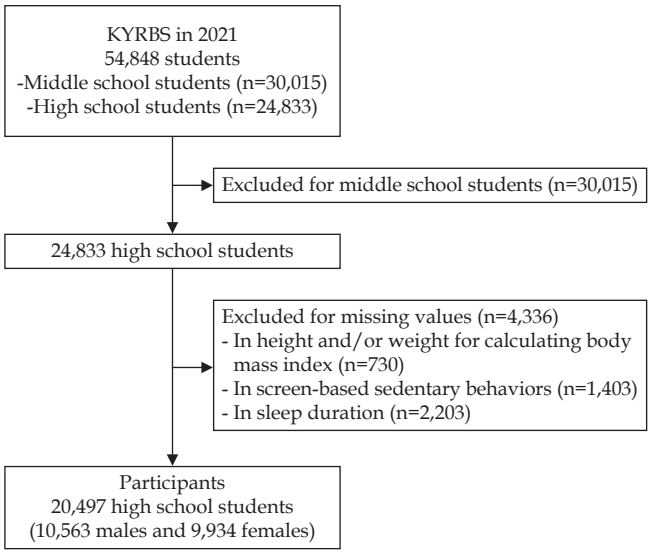

Figure 1. Sampling process for a study of the combined effects of sugar-sweetened beverage consumption, screen-based sedentary behavior, and sleep duration on South Korean adolescent obesity. KYRBS, Korea Youth Risk Behavior Web-based Survey.

3. Study Variables

1) Outcome variable

(1) Adiposity

To evaluate adiposity (obesity/non-obesity), body mass index (BMI) was computed using adolescents' self-reported height and weight. For considering age (months) and sex of adolescents, BMI percentile was evaluated with BMI using the 2017 Korean national growth charts for children and adolescents, and classified as: underweight (<5th percentile), normal weight (≥5th and <85th percentile), overweight (≥85th and <95th percentile), and obese (≥95th percentile) according to the screening criteria for growth abnormalities in the 2017 Korean national growth charts [29]. For the statistical analysis, adiposity was categorized into two groups: non-obese (underweight and normal weight) and obese (overweight and obese).

2) Independent variables

(1) SSB consumption

Consumption of SSBs was assessed using two questions about the experience (frequency) of SSB consumption (sodas and other sugar-containing beverages) within the last seven days. The responses to these questions were then converted to represent the number of consumptions per week (e.g., once a day=7 times a week). Thereafter, the weekly SSB consumption for each item was summed. Following Ra [30], quartile values were calculated based on the sum of weekly SSB consumption, and the frequency of SSB consumption was divided into three quartiles: Q1 (low, ≤3 times a week), Q2 (medium, >3 times and <7 times a week), and Q3 (high, ≥once a day).

(2) Screen-based sedentary behaviors

Screen-based sedentary behaviors were evaluated by asking two questions about average hours and/or minutes per day spent in such activities for leisure, including smartphone and computer use, on both weekdays and weekends. The average daily duration of sedentary behaviors was then categorized as either ≥2 hours a day (excessive) or <2 hours a day (appropriate), following the American Academy of Pediatrics Committee on Public Education's guidelines [10].

(3) Sleep duration

Sleep duration was evaluated through four questions related to bedtime and wake-up time on both weekdays and weekends. The average duration of sleep (hours) per day was computed based on the provided bedtime and wake-up time and categorized into <8 hours a day (short) and ≥8 hours a day (sufficient), following the guidelines of the American Academy of Sleep Medicine [31].

3) Covariates

(1) Biological factors

Sex

Sex was used to classify participants into male and female.

(2) Social factors

Grade

Grades were classified as 1st, 2nd, or 3rd grades.

Family's socioeconomic status

Family's socioeconomic status was classified as high, medium, or low, based on participants' responses to a single question about their family's perceived economic status.

(3) Psychological factors

Depressive symptoms

Depressive symptoms were assessed, through a single question about feelings of sadness or hopelessness over the last 12 months, to which participants had to select either a yes or no response.

Daily stress

This factor was assessed through a single question about perceived daily stress levels. Responses were classified as yes or no.

Perceived body shape

This factor was assessed using a question regarding subjective body shape judgment, where responses were categorized as being fat, average, or skinny.

Skipping breakfast

This factor was assessed through a single question about the frequency of skipping or having breakfast over the last seven days. Responses were classified as yes or no.

Fast-food consumption

This factor was evaluated using a question about fast-food consumption frequency over a week. For calculating quartile values based on the total weekly fast-food intake, following Ra [30], frequency of fast-food consumption (times a week), responses were categorized into three quartile groups: Q1 (low, ≤1.5 times a week), Q2 (medium, >1.5 times and ≤3.5 times a week), and Q3 (high, >3.5 times a week).

Moderate and vigorous physical activity

This factor was evaluated through two questions about the frequency of its occurrence in the past seven days. Responses were categorized as ≥3 days or <3 days, following the physical activity recommendations for Korean children [32].

Current cigarette consumption

Current cigarette consumption was assessed through a single question about smoking experiences within a month (30 days). Responses were categorized as yes or no.

Current alcohol consumption

Current alcohol consumption was evaluated using a single question about alcohol experiences within a month (30 days). Responses were categorized as yes or no.

4. Data Analyses

It used IBM SPSS 26 (IBM Corp.) to perform a complex sampling analysis with sampling weights according to a complex sampling method (cluster and strata) based on the 17th (2021) KYRBS's analysis instructions. The prevalence of the outcome variable (adiposity), independent variables (SSB consumption, screen-based sedentary behaviors, and sleep duration), and covariates (biological factors, social factors, and psychological factors) were analyzed using descriptive statistics (unweighted frequency and weighted percentage), whereas the combination effects of SSB consumption, screen-based sedentary behaviors, and sleep duration on obesity were tested using logistic regression analysis. In a logistic analysis model, outcome variables, independent variables, as well as covariates were inputs to controlling effects from covariates.

RESULTS

1. Prevalence of Adiposity and SSB Consumption, Screen-based Sedentary Behaviors, and Sleep Duration

Approximately 32.8% of participants were either overweight or obese. Independently, 37.4%, 26.4%, and 36.2% of participants were categorized into three quartile groups: Q1 (low), Q2 (medium), and Q3 (high), respectively, based on their SSB consumption. In terms of independent screen-based sedentary behaviors and sleep duration, 70.6% of participants manifested excessive screen-based sedentary behav-

iors (≥2 hours a day), whereas 84.5% of participants slept <8 hours a day (short sleep duration) (Table 1). Among the 12 groups created by combining SSB consumption, screen-based sedentary behaviors, and sleep duration, the group with the highest prevalence (22.4%) was identified as having Q3 SSB consumption, screen-based sedentary behaviors, and short sleep duration (Table 1).

2. Independent Effects of SSB Consumption, Screen-based Sedentary Behaviors, and Sleep Duration on Adolescent Obesity

In Q2 and Q3, SSB consumption was associated with a 1.12 and 1.12 fold increased likelihood of obesity (95% confidence interval [CI]=1.01–1.24) and (95% CI=1.01–1.25) than the reference (Q1 of SSB consumption), whereas screen-based sedentary behaviors was not related with obesity. Short sleep duration was linked to a 1.18 fold increased likelihood of obesity (95% CI=1.02–1.35) than the reference (≥8 hours of sleep duration a day) (Table 2).

3. Combination Effects of SSB Consumption, Screen-based Sedentary Behaviors, and Sleep Duration on Adolescent Obesity

Combined SSB consumption, appropriate screen-based sedentary behaviors, and sufficient sleep duration in Q1 was used as a reference. The combination of SSB consumption in Q1 and Q2, excessive screen-based sedentary behaviors, and short sleep durations was linked to a 1.18 and 1.12 fold increased likelihood of obesity (95% CI=1.03–1.35) and (95% CI=1.02–1.22), respectively, compared to the reference. Finally, as compared to the Q1 reference, Q3's combination of: SSB consumption, appropriate screen-based sedentary behaviors, and short sleep duration (adjusted odds ratio [aOR]=1.15, 95% CI=1.01–1.31) and SSB consumption, excessive screen-based sedentary behaviors, and short sleep duration (aOR=1.40, 95% CI=1.16–1.69) were associated with obesity (Table 3).

DISCUSSION

This study identified the combined effects of SSB consumption, screen-based sedentary behaviors, and sleep duration on adolescent obesity. Its results showed that combinations of both, low/medium consumption of SSBs, excessive screen-based sedentary behaviors, and short duration of sleep; and high consumption of SSB, appropriate/excessive screen-based sedentary behaviors, and short sleep duration, were associated with an increased likelihood of obesity in adolescents. Thus, a combination of low/medium/high SSB consumption, excessive screen-based sedentary behaviors, and short sleep durations could be associated with obesity in adolescents. While a combination of high SSB consumption and short sleep durations could be associated with obesity in adolescents, no such association was found for appropriate screen-based sedentary behaviors.

As SSB consumption is a major source for intake of free sugars, it is strongly associated with weight gain. Moreover, as the calorie intake through SSB drinking results in decreased satiety, it could induce overconsumption of foods. According to Magriplis et al. [33], consuming 10% or more of total energy from added sugars is linked to a 1.77 times higher likelihood of obesity after controlling for covariates. In the same vein, Arango-Angarita et al. [34] reported that on an average, SSB consumption of 240 mL a day was linked to approximately a 1.35% increase in obesity prevalence. Similarly, increased SSB consumption of caffeine beverages also resulted in short sleep durations [16]. Sleep duration of less than 5.9 hours a day was associated with a 1.14 fold increased likelihood of obesity in Korean adolescents [14], which might be associated with a greater intake of high-calorie diets (increased SSB consumption), with increased ghrelin levels and decreased leptin levels in the serum, and decreased activity (increased sedentary behaviors) with fatigue. In the same vein, as short sleep duration circularly led to increased SSB consumption in children, SSB consumption was considered a mediator between sleep duration and weight [16]. According to Sampasa-Kanyinga et al. [35], short sleep duration was linked to a 1.64 fold increased SSB consumption in adolescents. Similarly, individuals with short sleep durations tended to have higher energy intakes owing to increased carbohydrate snacks and SSBs [16]. Thus, with increased SSB consumption playing a mediating role, short sleep duration might be indirectly associated with adolescent obesity.

In this study, excessive screen-based sedentary behaviors (≥2 hours a day) were not associated with obesity in adolescents. In the same vein, a systematic review reported that a high dose of screen-based sedentary behaviors was associated with obesity in adolescents, while duration of screen-based sedentary behaviors was linearly not associated with their risk of obesity [9]. In addition, only TV watching was

Table 1. Prevalence of Adiposity and Lifestyle Behaviors among South Korean Adolescents (*N*=20,497)

Variables		Categories	n (%)[b]
Adiposity			
Non-obesity		Underweight	1,643 (8.2)
		Normal weight	12,073 (59.0)
Obesity		Overweight	1,629 (7.9)
		Obesity	5,152 (24.9)
Independent lifestyle behaviors			
Sugar-sweetened beverage consumption[a]		Q1 (low)	7,685 (37.4)
		Q2 (medium)	5,360 (26.4)
		Q3 (high)	7,452 (36.2)
Screen-based sedentary behaviors (hours a day)		<2	5,998 (29.4)
		≥2	14,499 (70.6)
Sleep duration (hours a day)		≥8	3,301 (15.5)
		<8	17,196 (84.5)
Combined lifestyle behaviors			
Sugar-sweetened beverage consumption	Screen based sedentary behaviors (hours a day)	Sleep duration (hours a day)	
Q1 (low)	<2	≥8	428 (2.0)
	<2	<8	1,982 (9.8)
	≥2	≥8	971 (4.7)
	≥2	<8	4,304 (20.9)
Q2 (medium)	<2	≥8	192 (0.9)
	<2	<8	1,361 (6.8)
	≥2	≥8	589 (2.7)
	≥2	<8	3,218 (16.0)
Q3 (high)	<2	≥8	273 (1.3)
	<2	<8	1,762 (8.6)
	≥2	≥8	848 (3.9)
	≥2	<8	4,569 (22.4)
Covariates			
Biological factors			
Sex		Males	10,563 (51.7)
		Females	9,934 (48.3)
Social factors			
Grade		1st	7,115 (32.5)
		2nd	7,079 (33.5)
		3rd	6,303 (34.0)
Family's socioeconomic status		Low	480 (2.2)
		Middle	18,412 (89.8)
		High	1,605 (8.0)
Psychological factors			
Depressive symptoms		Yes	5,394 (26.1)
		No	15,103 (73.9)
Daily stress		Yes	18,149 (88.5)
		No	2,348 (11.5)
Perceived body shape		Being fat	8,065 (39.1)
		In average	7,425 (36.1)
		Skinny	5,007 (24.8)
Skipping breakfast		Yes	15,974 (77.9)
		No	4,523 (22.1)
Fast food consumption[a]		Q1 (low)	14,952 (72.7)
		Q2 (medium)	4,490 (22.1)
		Q3 (high)	1055 (5.2)
Moderate and vigorous physical activity (a week)		≥3 days	7,099 (34.2)
		<3 days	13,398 (65.8)
Current cigarette consumption		Yes	1,317 (6.2)
		No	19,180 (93.8)
Current alcohol consumption		Yes	3,106 (14.9)
		No	17,391 (85.1)

[a]Q1=first quantile, Q2=second quantile, Q3=third quantile; [b]n=unweighted, %=weighted.

Table 2. Independent Effects of Lifestyle Behaviors on Obesity in Adolescents

Independent lifestyle behaviors		Obesity
		aOR (95% CI)[a]
Sugar-sweetened beverage consumption[c]	Q1 (low)	1.00
	Q2 (medium)	1.12 (1.01–1.24)[b]
	Q3 (high)	1.12 (1.01–1.25)[b]
Screen-based sedentary behaviors (hours a day)	<2	1.00
	≥2	0.98 (0.89–1.09)
Sleep duration (hours a day)	≥8	1.00
	<8	1.18 (1.02–1.35)[b]

[a]Adjusted for biological, social, and psychological factors associated with adolescents' depressive symptoms and suicidal ideation; [b]$p<.05$; [c]Q1=first quantile (reference), Q2=second quantile, Q3=third quantile; aOR, adjusted odds ratio; CI, confidence interval.

Table 3. Combination Effects of Lifestyle Behaviors on Obesity in Adolescents

Combined lifestyle behaviors			Obesity
Sugar-sweetened beverage consumption[c]	Screen-based sedentary behaviors (hours a day)	Sleep duration (hours a day)	aOR (95% CI)[a]
Q1 (low)	<2	≥8	1.00
	<2	<8	0.98 (0.75–1.17)
	≥2	≥8	1.02 (0.90–1.16)
	≥2	<8	1.18 (1.03–1.35)[b]
Q2 (medium)	<2	≥8	1.15 (0.95–1.42)
	<2	<8	1.07 (0.96–1.26)
	≥2	≥8	1.17 (0.90–1.51)
	≥2	<8	1.12 (1.02–1.22)[b]
Q3 (high)	<2	≥8	1.03 (0.89–1.30)
	<2	<8	1.15 (1.01–1.31)[b]
	≥2	≥8	1.07 (0.89–1.28)
	≥2	<8	1.40 (1.16–1.69)[b]

[a]Adjusted for biological, social, and psychological factors associated with obesity in adolescents; [b]$p<.05$; [c]Q1=first quantile (reference), Q2=second quantile, Q3=third quantile; aOR, adjusted odds ratio; CI, confidence interval.

associated with obesity of adolescents, not playing video games and using personal computers which could increase physical activity [9]. Thus, obesity development might depend on dose and type of screen-based sedentary behaviors.

Meanwhile, excessive screen-based sedentary behaviors could lead to sleep disturbances, including short sleep durations, which in turn, finally resulted in psychological distress, such as depressive symptoms [22]. Additionally, adolescents with depressive symptoms might report increased sedentary behaviors, including screen-based activities. According to Li et al. [17], short sleep durations contributed to weight gain through the mediation of psychological distress. Thus, short sleep durations due to excessive screen-based sedentary behaviors could result in psychological distress, which in turn, could lead to weight gain with increased screen-based sedentary behaviors involving activities with low energy expenditure.

Screen-based sedentary behaviors are also associated with increased SSB consumption [6,8]. Adolescents with increased screen-based sedentary behaviors might watch more online advertisements regarding sweet snacks and beverages [6]. In the same vein, while using screen-based electronic devices, SSB consumption increases, while regular meals tend to be skipped [6]. According to Gan et al. [6], while watching television, playing video games, and using mobile phones, adolescents showed higher sugar intakes, with increased consumption of sodas and energy drinks. Thus, owing to screen-based sedentary behaviors and increased SSB consumption, adolescents' calorie intake might exceed their daily requirements. In this context, a combination of high SSB consumption, excessive screen-based sedentary behaviors, and short sleep duration might be associated with an increased likelihood of obesity in adolescents.

Based on these results, significant clustering of lifestyle behaviors according to developmental stages need to be identified. According to Carson et al. [36], identifying the target

population's clustering patterns of unhealthy behaviors might be important to develop effective strategies to prevent obesity. Furthermore, while considering the clustering of lifestyle behaviors associated with obesity, integrated and tailored strategies should be developed to prevent obesity in adolescents. To prevent and manage obesity, Carson et al. [36] also emphasized the need for integrated interventions, that consider the multiple behaviors associated with it. Moreover, approaches tailored according to the clustered patterns of lifestyle behaviors were considered more effective than general approaches [27,37].

This study has significant nursing implications for crafting targeted interventions addressing specific lifestyle behaviors among Korean adolescents. Potential interventions include tailored school-based health promotion programs, culturally sensitive nutritional education, and initiatives promoting physical activity for Korean adolescents [37]. Moreover, Koo and Lee [20] recommended family-centered interventions focusing on reducing SSB consumption, limiting screen time, and improving sleep habits for preventing obesity among Korean adolescents. Nurses can also advocate policies for supporting healthy environments in schools and communities, and addressing issues, such as access to nutritious food and regulating the marketing of unhealthy products targeted at adolescents. These strategies are entirely in line with the Guidelines for the Management of Obesity in Korea (2020) [38]. By incorporating culturally sensitive methods, nurses and policymakers can develop effective interventions within the Korean context, fostering improved health outcomes and lasting behavior change among adolescents.

This study's strength was its large sample taken from national data, which enabled identifying the combined effects of lifestyle behaviors by controlling covariates. According to Williams et al. [18], obesity is developed through the influence of biological, social, and psychological factors. It means that controlling of multivariate factors (covariates) is important to identify association between significant factors and obesity. Additionally, our results might be helpful for generalizability of the need for combining interventions for clustered lifestyle behaviors to prevent obesity development among Korean high school students.

However, it also had some limitations. First, adiposity was evaluated using self-reported height and weight, which might have led to misestimation of adolescents' adiposity. Second, as self-reported values were used to evaluate frequency of SSB consumption, hours per day of screen-based sedentary behaviors, and sleep duration, future studies should use objective measurements to correctly evaluate adiposity, SSB consumption, screen-based sedentary behaviors, and sleep duration. Third, many covariates involved in this secondary data analysis were evaluated using a single question, and their answers were categorized as yes or no. To ensure validity and reliability of the measurements, further studies should evaluate covariates using structured instruments, having good validity and reliability. Finally, the prevalence of obesity and lifestyle behaviors associated with it, might be different depending on ethnicity, age, gender, familiar and community environments. Thus, future studies need to confirm this study's results by considering adolescents' biological characteristics and social environments.

CONCLUSION

The results indicate that identifying clustered patterns and combination effects of lifestyle behaviors in adolescents might be the first step toward developing effective integrated interventions for preventing obesity. In particular, strategies tailored according to the significant combining patterns of lifestyle behaviors of individual adolescents should be developed. Notably, this study reported that consumption of SSBs, screen-based sedentary behaviors, and sleep duration might be important targets to prevent adolescent obesity. Hence, integrated and tailored intervention programs should be developed by considering the combined effects of SSB consumption, screen-based sedentary behaviors, and sleep duration among individual adolescents.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

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

Funding

This study was supported by a National Research Foundation of Korea (NRF) grant funded by the Korean government (No. 2021R1A2C100682811).

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):87-96
https://doi.org/10.4094/chnr.2024.001

pISSN 2287-9110
eISSN 2287-9129

CHNR

Association between smartphone overdependence and mental health in South Korean adolescents: a secondary data analysis

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Received: January 13, 2024
Revised: February 14, 2024
Accepted: March 9, 2024

Purpose: The rising prevalence of smartphone overdependence among adolescents and its detrimental impact on mental health have become a growing concern. This study aimed to investigate the association between smartphone overdependence and the mental health of Korean adolescents. **Methods:** Participants were drawn from the 16th Korea Youth Risk Behavior Web-based Survey conducted in 2020. The dependent variable as smartphone overdependence, while the main exposure of interest was mental health, encompassing generalized anxiety disorder (GAD), perceived stress, sources of perceived stress, perceived loneliness, and perceived depressive symptoms. The study employed the Rao-Scott chi-square test and multiple logistic regression using IBM SPSS version 26.0. **Results:** The participants comprised 54,948 adolescents aged 13 to 18 years. Among them, 25.1% (n=13,775) were categorized as smartphone overdependence group. Specifically, 20.3% of adolescents who reported GAD ≥10 and 22.5% of those who reported experiencing high levels of perceived loneliness were identified as smartphone overdependent. The GAD increased a risk of smartphone overdependence by 2.61 times (95% confidence interval [95% CI]: 2.46–2.77). Perceived loneliness was associated with 1.98-fold (95% CI: 1.87–2.09) increased risk of smartphone overdependence. Additionally, conflict with peers was found to increase the risk of smartphone overdependence by 4.63-fold (95% CI: 3.89–5.52), followed by conflict with parents (odds ratio [OR]: 4.52, 95% CI: 3.84–5.31), and family environment (OR: 4.52, 95% CI: 3.75–5.46). **Conclusion:** The findings underscore a significant association between smartphone overdependence and mental health in Korean adolescents. Healthcare services to improve their emotional coping and interpersonal skills are necessary.

Keywords: Adolescent; Korea; Mental health; Smartphone; Behavior, addictive

INTRODUCTION

Smartphones, characterized by their remarkable convenience and accessibility, serve as an essential part of our daily lives for tasks such as accessing information, communication, education, commerce, healthcare, and entertainment [1]. It is estimated that the global smartphone user count will reach approximately 6.7 billion in 2023 [2]. Notably, smartphone ownership is ubiquitous in the United States (72%) and various European countries, including Spain (71%), the United Kingdom (68%), and Germany/Italy (60%) [3]. The highest rate of smartphone ownership can be observed in South Korea [3], where a staggering 97.4% of the population owns a smartphone [4]. Among the younger demographic, smartphones are even more prevalent, with 95% of adolescents in the United States [5] and 99.1% of youth in South Korea own-

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ing a smartphone [6]. This underscores the profound and pervasive influence of smartphones in the lives of young people [7]. Adolescents rely on smartphones to access information, learn, connect with others, and entertain [8]. Despite the widespread ownership and the benefits associated with smartphones [7], there is a growing global concern regarding overdependence on smartphones among young individuals [7,8].

During adolescence, social interaction with peers holds significant developmental importance [7]. The use of smartphone for social media by adolescents contributes to initiating, sustaining, and strengthening their social bonds through communication with peers [7,9]. In particular, the extended period of reduced in-person interactions due to social distancing measures during the COVID-19 pandemic has expedited adolescents' creation of their own virtual spaces for social connections with peers [10]. This situation has also heightened their smartphone dependency among adolescents [10]. The prevalence of Korean adolescents at risk of smartphone dependency has shown a consistent year-over-year rise, with the largest increase observed compared to all other age groups: 35.8% in 2020, 37.0% in 2021, and 40.1% in 2022 [11].

Smartphone overdependence mirrors other addictive behaviors, involving excessive and uncontrolled usage that adversely affects daily life and interpersonal relationships [1,12]. Adolescents often turn to smartphones for instant gratification from content such as videos, games, and social media [1,7]. This overdependence can lead to mental health issues like depression and anxiety, reduced concentration, poor sleep quality, and lower academic achievement [1,8,13].

Overindulgent smartphone usage in adolescents often corresponds to the excessive use of social media platforms [9]. This extended use of social media can result in low self-esteem and heightened feelings of depression, anxiety, and stress as adolescents tend to constantly compare themselves with others [8]. Furthermore, adolescents who develop an addiction to social media frequently experience increased loneliness [8,14]. During adolescence, a period when peer relationships hold significant importance, adolescents often feel pressured to use social networks to avoid being left out of their social circles [8,15]. As smartphone usage becomes more frequent and extensive, adolescents become increasingly reliant on their devices [16] which can hinder their ability to socialize effectively in the real world, eventually leading to feelings of isolation [17].

Mental health issues associated with excessive smartphone overdependence among adolescents have become a global concern [8,13]. It is well-established that problematic smartphone use can exacerbate mental health issues. However, it is less-explored association: individuals with poor mental health have a tendency to become overly dependent on their smartphones [12]. This study aims to bridge this gap by identifying the relationship between mental health and smartphone overdependence. A heightened risk of smartphone overdependence has been identified in individuals with a harm-avoidant temperament, who used to experience elevated anxiety and stress from external factors, leading to excessive smartphone usage as a coping mechanism [18]. Our hypothesis posits that adolescents with poor mental health are more prone to smartphone overdependence, creating a detrimental cycle. To identify at-risk groups, screening for smartphone overdependence can be instrumental in delivering timely mental health support services. Therefore, this study aims to determine the prevalence of smartphone overdependence and investigate its association mental health indicators, including generalized anxiety disorder (GAD), perceived stress, sources of perceived stress, perceived depressive symptoms, and perceived loneliness among Korean adolescents.

METHODS

Ethical statements: This study received an Institutional Review Board (IRB) review exemption from the IRB of Yonsei University Health System (No. 4-2021-1237) due to the use of secondary data with anonymity.

1. Study Design

This study employed cross-sectional and correlational research involving the analysis of secondary data from the 16th Korea Youth Risk Behavior Web-based Survey (KYRBWS; Korea Disease Control and Prevention Agency [KDCA] 2020). The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [19].

2. Sample

The primary data was sourced from the 16th KYRBWS

[20], a government-approved statistical survey conducted annually by the Ministry of Education, the Ministry of Health and Welfare, and the KDCA since 2005. The KYRBWS is designed as an anonymous, self-reported web-based questionnaire to identify risk behaviors among Korean adolescents, such as smoking, drinking, physical activity, and mental health. It plays a crucial role in providing data that informs the development of youth-oriented health promotion policies. The 16th KYRBWS, conducted from August to November 2020, covered 103 items across 15 domains. particularly included an in-depth inquiry into mental health, smartphone overdependence, and health equity.

The KYRBWS was designed as a complex sample survey to ensure the sample's representativeness through stratification (by region and school level), stratified cluster sampling (with the school as a primary sampling unit and the class as a secondary sampling unit), and a multi-stage sampling approach. Additionally, the survey data was weighted to account for the extraction rate, response rate, and demographic composition of the study population. In 2020, the survey encompassed 57,925 students from a total of 800 schools (comprising 400 middle schools and 400 high schools). Finally, 54,948 students from 793 schools (398 middle and 395 high schools) participated in the 16th KYRBWS. Based on the number of students, the participation rate stood at 94.9%. Long-term absent students, those with special needs who cannot participate in the survey on their own, and those with literacy disabilities were excluded from the survey.

3. Variables

1) Dependent variable: smartphone overdependence

The dependent variable is smartphone overdependence using the smartphone overdependence scale designed for adolescents [21]. This scale consists of a 10-item self-reported questionnaire, organized into three sub-domains: salience, out of control, and serious consequences. Respondents rate each item on a four-point Likert scale. The total score ranges from 10 to 40 points, with a higher score indicating a higher level of smartphone overdependence. Based on the total score obtained, individuals can be classified into three groups: a normal group (10–22), a potential-risk group (23–30), and a high-risk group (31–40). For this study, we merged the potential-risk group and high-risk group into the risk group (scores ≥23) and compared it with the normal group (scores <23). Cronbach's alpha was .84 in the original study and .92 in this study.

2) Main exposure variable: mental health

The main exposure variable of interest in this study was mental health, encompassing GAD, perceived stress, sources of perceived stress, perceived loneliness, and perceived depressive symptoms. GAD was measured using the 7-item generalized anxiety disorder scale (GAD-7) [22]. Respondents rated their responses on a 4-point Likert scale. The total score on the GAD-7 scale ranged from 0 to 21, with a higher score indicating a higher level of anxiety. A cut-off point of 10 or higher on the GAD-7 scale indicated significant anxiety. Cronbach's alpha was .92 in the original study, and it was .898 in this study. Perceived stress was measured through a single question about the level of stress, rated on a 5-point Likert scale. The responses ranged from one (not at all) to five (very much), with a higher score indicating a higher level of perceived stress. Participants were categorized into two groups: a high perceived stress group (four to five points) and a low perceived stress group (one to three). The sources of perceived stress included eight categories: conflict with peers, conflict with teachers, conflict with parents, family environment, physical appearance, pressure on grades and career paths, health problem, others, and not applicable. Perceived loneliness was measured using one item, rated on a 5-point Likert scale, ranging from one (never) to five (always). Higher scores indicated more frequent feelings of perceived loneliness. Participants were categorized into two groups: a high perceived loneliness group (four to five points) and a low perceived loneliness group (one to three). Perceived depressive symptoms were measured using one item. Responses were divided into two categories: those who reported having experienced such feelings in the last 12 months and those who did not.

3) Sociodemographic variables

Sociodemographic variables included gender, school type, household economic status, and average time of using smartphone per day.

4. Data Analysis

The KYRBWS employs a complex sample design that requires the application of weights to accurately represent the sample design for data analysis. First, descriptive statistics were used to examine adolescents' demographics, mental

health variables, average smartphone usage, and smartphone dependence. Second, a Rao-Scott Chi-square test was performed to identify the differences in proportions between the normal group and risk group of smartphone overdependence in relation to adolescents' general characteristics and mental health variables like GAD, perceived stress, sources of perceived stress, perceived loneliness, and perceived depressive symptoms. Third, we conducted a multiple logistic regression analysis to identify the factors associated with smartphone overdependence. Given the complex sample design of the KYRBWS, we applied the weighted values, strata, and colony (cluster) provided by the user guidelines. Statistical analyses were performed using IBM SPSS Statistics for Windows (version 26.0; IBM Corp.), with significance level set at .05, two-tailed.

RESULTS

1. General Characteristics of the Study Population and the Results of Chi-square Tests for Smartphone Overdependence

Table 1 displays the general characteristics of the study population and the results of chi-square tests for smartphone overdependence. Of the total participants (n=54,948), 25.1% (n=13,775) were classified as belonging to the smartphone overdependence group. Girls (57.7%) were significantly more prone to smartphone overdependence than boys (42.3%), and high school students (50.2%) were significantly more likely than middle school students (49.8%) to exhibit this behavior. Those classified as smartphone overdependent were more likely to experience poor academic achievement (13.6%) and less likely to come from a high household economic status (8.3%). The smartphone-overdependent group was significantly more likely to report a GAD-7 score of 10 or higher (20.3%), high perceived stress (45.2%), high perceived loneliness (22.5%), and perceived depressive symptoms (35.7%) compared to the normal group. Among adolescents overly dependent on smartphones, the highest proportion identified grades and career pressure as their primary sources of perceived stress (51.0%), physical appearance (13.6%), and conflict with parents (12.2%). The likelihood of being at risk for smartphone overdependence increased with the frequency of smartphone usage per day. The distribution of these two groups exhibited a statistically significant difference ($p<.001$).

2. Results from Multiple Logistic Regressions for Smartphone Overdependence

Table 2 displays the results of multiple logistic regressions for smartphone overdependence. Compared to boys, girls had a 1.36-fold increased risk of smartphone overdependence (95% confidence interval [95% CI]: 1.29–1.43; $p<.001$). High school students had a 1.14-fold increased risk compared to middle school students (95% CI: 1.09–1.20; $p<.001$). Poor academic achievement had a 1.43-fold increased risk compared to good academic achievement (95% CI: 1.31–1.56; $p<.001$) and low household economic status had a 1.29-fold increased risk compared to high household economic status (95% CI: 1.12–1.50; $p<.001$). Individuals who reported GAD-7 more than 10 had a 2.61-fold increased risk of smartphone overdependence (95% CI: 2.46–2.77; $p<.001$). High levels of perceived stress had a 1.68-fold higher risk of smartphone overdependence (95% CI: 1.62–1.75; $p<.001$) and various stress sources, including conflict with peers (odds ratio [OR]: 4.63, 95% CI: 3.89–5.52), conflict with parents (OR: 4.52, 95% CI: 3.84–5.31), family environment (OR: 4.52, 95% CI: 3.75–5.46), physical appearance (OR: 4.32, 95% CI: 3.69–5.06), and grade and career pressure (OR: 3.56, 95% CI: 3.05–4.15; $p<.001$) increased the risk significantly. Those who reported high levels of perceived loneliness showed a 1.98-fold increased risk for smartphone overdependence (95% CI: 1.87–2.09; $p<.001$), and those who reported perceived depressive symptoms showed a 1.78-fold increased risk (95% CI: 1.70–1.86; $p<.001$). Compared to the reference group of individuals who used smartphones for less than 2 hours daily, those who used smartphones for 6–8 hours had a 4.06-fold increased risk (95% CI: 3.61–4.56; $p<.001$), while those who used smartphones for more than 8 hours had a 5.21-fold increased risk (95% CI: 4.64–5.85; $p<.001$).

DISCUSSION

This study examined the link between smartphone overdependence and the mental health of Korean adolescents. The findings revealed that poorer mental health, including conditions such as GAD, perceived stress, perceived loneliness, and perceived depressive symptoms, heightened the risk of adolescents developing smartphone overdependence. Pressure from grades and career paths, physical appearance, and conflicts with parents significantly increased the risk of smartphone overdependence. This finding may indicate that,

Table 1. Results of Chi-square Test for Smartphone Overdependence Depending on Sample Characteristics (N=54,948)

Variables	Total	Smartphone overdependence		χ^2	*p*
	n (%)	Risk group	Normal group		
		n (%)	n (%)		
Total no.	54,948 (100.0)	13,775 (25.1)	41,173 (74.9)		
Sex					
Boy	28,353 (51.9)	5,832 (42.3)	22,521 (54.7)	563.77	<.001
Girl	26,595 (48.1)	7,943 (57.7)	18,652 (45.3)		
Educational stage					
Middle school (age 13–15 years)	28,961 (52.7)	6,865 (49.8)	22,096 (53.7)	97.54	<.001
High school (age 16–18 years)	25,987 (47.3)	6,910 (50.2)	19,077 (46.3)		
Academic achievement					
Good	6,736 (12.2)	1,281 (9.3)	5,455 (13.2)	346.67	<.001
Average	42,679 (77.7)	10,625 (77.1)	32,054 (77.9)		
Poor	5,533 (10.1)	1,869 (13.6)	3,664 (8.9)		
Household economic status					
High	6,039 (11.0)	1,137 (8.3)	4,902 (11.9)	156.69	<.001
Middle	47,634 (86.7)	12,262 (89.0)	35,372 (85.9)		
Low	1,275 (2.3)	376 (2.7)	899 (2.2)		
GAD-7					
<10	48,849 (88.8)	10,972 (79.7)	37,877 (92.0)	1,580.67	<.001
≥10	6,099 (11.2)	2,803 (20.3)	3,296 (8.0)		
Perceived stress					
Low	36,286 (66.0)	7,555 (54.8)	28,731 (69.8)	980.20	<.001
High	18,662 (34.0)	6,220 (45.2)	12,442 (30.2)		
Sources of perceived stress					
Conflict with peers	3,019 (5.5)	931 (6.8)	2,088 (5.0)	610.49	<.001
Conflict with parents	5,611 (10.1)	1,687 (12.2)	3,924 (9.5)		
Family environment	1,330 (2.3)	392 (2.8)	938 (2.3)		
Physical appearance	6,493 (11.8)	1,875 (13.6)	4,618 (11.2)		
Pressure on grade and career paths	27,943 (50.9)	7,027 (51.0)	20,916 (50.8)		
Health problems	1,650 (2.9)	383 (2.8)	1,267 (3.1)		
Conflict with teachers	413 (0.8)	93 (0.7)	320 (0.8)		
Others	6,471 (11.8)	1,211 (8.8)	5,260 (12.8)		
Not applicable	2,018 (3.6)	176 (1.3)	1,842 (4.5)		
Perceived loneliness					
Low	47,182 (85.9)	10,669 (77.5)	36,513 (88.7)	1,087.14	<.001
High	7,766 (14.1)	3,106 (22.5)	4,660 (11.3)		
Perceived depressive symptoms					
No	41,108 (74.8)	8,861 (64.3)	32,247 (78.3)	1,059.80	<.001
Yes	13,840 (25.2)	4,914 (35.7)	8,926 (21.7)		
Time of using smartphone (hour/day)					
<2 hours	5,242 (9.5)	520 (3.8)	4,722 (11.5)	2,142.98	<.001
2–4 hours	13,625 (24.8)	2,309 (16.8)	11,316 (27.5)		
4–6 hours	15,144 (27.6)	3,673 (26.6)	11,471 (27.9)		
6–8 hours	9,484 (17.3)	2,961 (21.5)	6,523 (15.8)		
>8 hours	11,453 (20.8)	4,312 (31.3)	7,141 (17.3)		

GAD-7, generalized anxiety disorder 7-item.

prior to smartphone overdependence, adolescents classified as overly dependent on smartphones may have experienced poor mental health symptoms such as those associated with depression, anxiety, perceived stress, and loneliness.

The prevalence of GAD among Korean adolescents stood at 11.2%, a figure comparable to the 11.5% observed among Chinese adolescents in 2020 during the COVID-19 pandemic [23]. In our study, GAD-7 (≥10) was linked to a 2.61-fold increase in smartphone overdependence. This is a smaller ratio than a previous study, which found that the group addicted to smartphones reported anxiety 4.41 times more than the normal group [24], it is still significantly higher. Anxiety lev-

Table 2. Results of Multiple Logistic Regression for Smartphone Overdependence (*N*=54,948)

Variables	Smartphone overdependence		*p*
	OR	95% CI	
Sex			
Boy	1.00		< .001
Girl	1.36	1.29–1.43	
Educational stage			
Middle school (age 13–15 years)	1.00		< .001
High school (age 16–18 years)	1.14	1.09–1.20	
Academic achievement			
Good	1.00		< .001
Average	1.09	1.02–1.17	
Poor	1.43	1.31–1.56	
Household economic status			
High	1.00		< .001
Middle	1.25	1.16–1.34	
Low	1.29	1.12–1.50	
GAD-7			
< 10	1.00		< .001
≥ 10	2.61	2.46–2.77	
Perceived stress			
Low	1.00		< .001
High	1.68	1.62–1.75	
Sources of perceived stress			
Conflict with peers	4.63	3.89–5.52	< .001
Conflict with parents	4.52	3.84–5.31	< .001
Family environment	4.52	3.75–5.46	< .001
Physical appearance	4.32	3.69–5.06	< .001
Pressure on grade and career paths	3.56	3.05–4.15	< .001
Health problems	3.35	2.78–4.03	< .001
Conflict with teachers	3.05	2.31–4.02	< .001
Others	2.42	2.06–2.86	< .001
Not applicable	1.00		
Perceived loneliness			
Low	1.00		< .001
High	1.98	1.87–2.09	
Perceived depressive symptoms			
No	1.00		< .001
Yes	1.78	1.70–1.86	
Time of using smartphone (hour/day)			
< 2 hours	1.00		< .001
2–4 hours	2.01	1.80–2.26	
4–6 hours	2.96	2.64–3.32	
6–8 hours	4.06	3.61–4.56	
> 8 hours	5.21	4.64–5.85	

CI, confidence interval; GAD-7, generalized anxiety disorder 7-item; OR, odds ratio.

els were observed to rise with advancing academic year, lower levels of social support, limited positive coping strategies, heightened use of negative coping mechanisms, or poorer family functioning [23]. Individuals often turn to excessive smartphone use as an inappropriate coping mechanism for negative emotions [25]. In an effort to relieve anxiety stemming from fear of missing out on peer interactions, girls tended to turn to social media, while boys leaned toward online games [17]. Consequently, the risk of smartphone overdependence tended to be higher among girls primarily because of their usage patterns in social media [17]. These findings underscore the importance of promoting positive coping strategies among adolescents to effectively cope with anxiety.

Adolescents who reported higher levels of perceived stress

had a 1.68 times greater likelihood of being at risk for smartphone overdependence. More than 50% of Korean adolescents both at-risk and not at risk for smartphone overdependence reported pressure on grades and career paths as the leading source of perceived stress, followed by physical appearance accounting for more than 10% of adolescents. Korea's competitive academic environment exerts significant pressure on adolescents to achieve high academic results, resulting in considerable stress [26], and, Koreans are reportedly concerned about their appearance [26]. These sociocultural characteristics make Korean adolescents more susceptible to stress, which increases the risk of smartphone overdependence and suicidal ideation [26,27].

As a response to stress from various sources, such as conflict with peers and parents, family environment, physical appearance, pressure on grade and career paths, and conflict with teachers, adolescents may resort to using smartphones as an inappropriate coping mechanism [17]. Both the at-risk and normal adolescent groups reported similar rates of stressors, suggesting that coping was more important than the source of perceived stress. Given the worsening mental health indicators among adolescents, there is an urgent need to provide students with practical strategies for effectively coping with stress. In the United States, health guidelines for social media use during adolescence have been published [9], the United Kingdom developed a guide for age-appropriate regulations for smartphone use, and a 2022–2024 plan to prevent smartphone addiction has been published in Korea [28]. Most guidelines, regulations, and plans focus on the moderation of smartphone usage. However, from a long-term public health perspective, policies and practices need to be implemented to improve adolescents' mental health and help them cope with stress.

The greater the frequency of experiencing perceived loneliness, the greater the risk of developing smartphone overdependence by a factor of 1.98. Previous studies have identified perceived loneliness as a contributing factor to internet and smartphone addiction among adolescents [14], with increased levels of loneliness associated with increased time spent on smartphones [29]. Adolescents worldwide are increasingly lonely, with girls reporting more loneliness and loneliness associated with greater smartphone and internet use [30,31]. The phenomenon known as the "fear of missing out", which generates a strong desire or urge to stay connected to social reference groups and keep abreast of their activities, can drive heightened use of social media and smartphone usage through social and self-referential processes [15]. Particularly, the COVID-19 pandemic has intensified the social isolation experienced by youth, resulting in increased feelings of perceived loneliness and a greater propensity to immerse themselves in virtual worlds [32]. Therefore, adolescent loneliness must be addressed to combat smartphone overdependence.

In this study, adolescents who reported experiencing perceived depressive symptoms were 1.78 times more likely to exhibit smartphone dependence. A well-established relationship exists between depression and problematic smartphone use [27], with heightened depressive symptoms linked to excessive smartphone use among adolescents [27,33]. Notably, the levels of depression and suicidal ideation were most pronounced in the group identified as smartphone addicts among the Korean adolescent population [30]. Alarmingly, suicide stands as the leading cause of death among South Korean adolescents [34], a concerning trend that has persisted since 2011. In 2020, suicide accounted for more than half (50.1%) of all youth deaths in South Korea [34]. Given the gravity of teen suicide as a pressing societal issue, it is imperative that more attention and proactive measures be directed towards addressing both teen depression and smartphone overdependence.

Time spent on a smartphone is a widely used variable for assessing smartphone dependence [16]. There exists a reciprocal relationship between the amount of time spent on a smartphone and the risk of developing smartphone overdependence [16]. In this study, those who spent more than eight hours per day on their smartphones had a risk of smartphone overdependence that was 5.21 times greater than those who used smartphones for less than two hours per day. However, it is important to exercise caution when interpreting these results because the survey only inquired about the amount of time spent on a smartphone, not the specific types of apps used or the purposes for which the smartphone was used. Given that the risk of smartphone addiction escalates with prolonged use of social media and gaming apps [17], it is essential to consider not only the duration but also the content consumed and the purpose. Moreover, the frequency of smartphone use serves as an indicator of the extent to which smartphone usage distracts or interferes with daily life [16]. Therefore, it would be more meaningful to include this measure as well to comprehensively assess smartphone dependence.

Impaired psychological well-being significantly increases

susceptibility to smartphone overdependence in the Korean adolescent population. Therefore, proactive interventions should be implemented for adolescents at risk of smartphone overdependence, aimed at facilitating effective coping mechanisms for managing negative emotions, with the ultimate goal of improving their mental health.

This study had several limitations that warrant consideration. First, the data was based on self-reporting by adolescents, which may introduce issues related to data reliability, such as recall, estimation, and social desirability bias [35]. Second, the measurement of perceived stress, loneliness, and depressive symptoms in adolescents utilized single-item assessments as categorical variables, which constrained the ability to perform more in-depth exploratory analyses. For example, the measurement of depressive symptoms relied on a single question with a dichotomous response in the KYRBWS, imposing limitations on the analysis and interpretation of the findings. Given that the KYRBWS is a nationally approved survey for Korean adolescents, there is a need to enhance its granularity to yield more meaningful insights into adolescent mental health.

CONCLUSION

This study investigated the association between smartphone overdependence in adolescents and their mental health. The findings revealed a significant association between smartphone overdependence and poor mental health among Korean adolescents. High levels of GAD, perceived stress, perceived loneliness, and perceived depressive symptoms significantly heightened the risk of smartphone overdependence in adolescents. Given the established link between problematic smartphone use and heightened mood disturbances as well as symptoms of depression [33], it is imperative to assess the mental health of adolescents at risk of developing smartphone overdependence. Moreover, tailored interventions must be offered to address this issue effectively.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: Hyeseon Yun; Writing-original draft: Hyeseon Yun; Writing-review and editing: Eun Kyoung Choi; Final approval of published version: all authors.

Conflict of interest

Eun Kyoung Choi has been an editor of *Child Health Nursing Research* since 2020. She was not involved in the review process of this article. No existing or potential conflict of interest relevant to this article was reported.

Funding

This research was supported by the Brain Korea 21 FOUR Project funded by National Research Foundation of Korea (NRF), Yonsei University College of Nursing.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):97-107
https://doi.org/10.4094/chnr.2024.003

pISSN 2287-9110
eISSN 2287-9129

CHNR

Family resilience and caregiver's well-being across different age groups of children with ADHD in the United States: a cross-sectional study

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Received: January 26, 2024
Revised: March 20, 2024
Accepted: April 7, 2024

Purpose: This study aimed to investigate the impact of family resilience on caregiver well-being across various age groups of children diagnosed with ADHD (attention-deficit/hyperactivity disorder) groups (0–5, 6–11, and 12–17 years). **Methods:** Utilizing secondary data from the 2022 US National Survey of Child Health, this cross-sectional study involved 2,752 children who were formally diagnosed with ADHD. Statistical analysis included descriptive analysis, Spearman's rank correlation, chi-square tests, and linear regression, conducted using SPSS version 27. **Results:** The study revealed a moderate positive correlation (r=.35, p<.001) between family resilience and caregiver well-being. Controlling for covariates, family resilience accounted for 25.2%, 21.1%, and 22.1% of caregiver well-being variance in age groups 0–5, 6–11, and 12–17 years, respectively. Additionally, factors like employment status, family structure, and caregiver age showed varying influences on caregiver well-being across these developmental stages. A consistent pattern emerged across these age groups: unemployment and non-traditional family structures were associated with negative impacts on caregiver well-being, whereas older caregiver age positively influenced well-being. **Conclusion:** This research underscores the importance of age-specific family resilience strategies to improve caregiver well-being and family interactions in ADHD contexts. Investigating these aspects through qualitative studies across various cultures could deepen our understanding of well-being and inform culturally sensitive interventions.

Keywords: Attention deficit disorder with hyperactivity; Caregivers; Child; Psychological well-being; Resilience, psychological

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD), characterized by symptoms such as impulsivity, hyperactivity, and difficulties in sustaining attention [1], is estimated to impact around 7.2% of the global population. The early indicators of hyperactivity in ADHD are typically not easily noticeable until a child reaches around four years old, becoming more apparent during their elementary school years. The condition's progression usually follows a recognizable trajectory into early adolescence [2]. In preschool-aged children with ADHD, common symptoms include poor concentration, high levels of activity, impulsiveness, alongside developmental delays, oppositional behavior, and poor social skills. As these children reach school age, they often encounter academic failure, peer rejection, and low self-esteem, which specific learning difficulties in some cases can further complicate. Moving into adolescence, the overt hyperactivity typically seen in younger children with ADHD tends to decrease, but challenges such as inattention, impulsiveness, and inter-

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nal restlessness persist. Adolescents with ADHD may also struggle with a distorted sense of self and disruptions in their self-identity development, coupled with an increased likelihood of exhibiting aggressive and antisocial behaviors [3]. The American Association of Pediatrics guidelines categorize ADHD management by age groups: 4–5 years, 6–11 years, and 12–18 years, focusing primarily on behavioral therapy [4]. In young children, the therapeutic approach centers on training parents in management techniques, while for older children, therapy integrates family-oriented strategies to enhance organizational and impulse control skills, nurturing the child's self-regulation and organizational capabilities.

Caring for children with ADHD can be challenging for caregivers, often leading to frustration due to the complexities in managing the children's behavioral issues, disruptions in social and family dynamics, emotional and physical fatigue, as well as financial burdens [5]. If caregivers' concerns and requirements are not properly acknowledged and if there is a lack of tailored interventions to alleviate their caregiving difficulties, it could lead to a compromise in their mental and physical health [5]. Consequently, this situation might also hinder the caregivers' ability to provide the necessary and appropriate care to the children. When well-being is ignored, children may be impacted. Caregivers experiencing depression can significantly impact the symptomatology of ADHD in children [6]. Well-being, defined as a subjective perception and assessment of one's life and self, characterized by subjective experiences and feelings [7], is crucial for caregivers. Improved caregiver well-being is linked to better mental and physical health and is associated with a lower risk of mortality [8]. When caregivers maintain good mental health, they are better equipped to engage in and foster resilience-building behaviors within the family [9].

Family resilience is characterized by the capability to endure and bounce back from challenges, becoming stronger and more resourceful in the process [10], and is particularly relevant in families with children who have chronic illnesses like ADHD [11]. It involves systemic and relational processes in families, including belief systems, organizational patterns, and communication/problem-solving processes. This can be measured by how the family recognize strength, maintains hope, communicates, and works to solve the problem [12]. The improvement of family resilience not only strengthens family cohesion but also enhances overall family well-being [13]. Further, family cohesion acts as a protective factor which diminishes the relationship between subjective and objective burdens, considered as well-being, perceived by caregivers [14]. This is especially pertinent as different age groups of children with ADHD interact with family resilience and caregiver well-being in varied ways. At the time of diagnosis, family resilience is indispensable. This need becomes even more pronounced in families with adolescents, who face significant adversities, including societal stigma [13] and an increased risk of depression among adolescents [15]. However, in the realm of ADHD research, the majority of studies on family resilience have focused on its effects on children [15-17], with limited attention given to caregivers. Therefore, this study will expand knowledge about how to improve the well-being of caregivers of children with ADHD.

This research aims to investigate the impact of family resilience on caregiver well-being across various age groups of children diagnosed with ADHD groups (0–5, 6–11, and 12–17 years) and to explore how different covariates such as employment status, family structure, and caregiver's age influence this relationship. We hypothesize that higher levels of family resilience are positively associated with caregiver's well-being across different age groups of children with ADHD (H1), family resilience impacts differently on caregiver's well-being across different child age groups (H2), and specific covariates (child's sex, language, caregiver's sex, age, employment status, family structure, and race) have distinct impacts on caregiver well-being in each age group (H3). Variations in well-being across different age groups present a significant concern in the field of mental health and wellness. Understanding the role of family resilience in these variations is crucial for developing age-specific interventions and support systems.

METHODS

Ethical statements: As the study used secondary data which does not contain respondent's identity, IRB is not required. The author received permission from the National Survey of Children Health to use part of the data for this study.

1. Study Design and Data Collection

This research utilized a cross-sectional design, analyzing secondary data collected from July 2022 to January 2023. The analysis itself was conducted over a subsequent period, from July to December 2023. The data were derived from the 2022

US National Survey of Children's Health (NSCH) [18]. This annual survey is carried out to gather data on the physical and emotional well-being of children aged 0 to 17 years across the US [18]. The dataset, publicly accessible, was obtained in SAS format. For this research, the authors received explicit authorization from the US Census Bureau to utilize the data. Rigorous data cleaning procedures were implemented, resulting in a final sample of 2,752 children aged 0 to 17 years diagnosed with ADHD. The primary caregivers of these children served as the respondents for this study. Adherence to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines ensures that the manuscript can be thoroughly understood and rigorously evaluated by the reader [19].

2. Participants

Inclusion criteria for the children in this study were based on a positive response to the question regarding current symptoms of ADHD/ADD (attention deficit disorder), following a formal diagnosis. The children with ADHD were stratified into three age groups for analysis: T1 (0–5 years), T2 (6–11 years), and T3 (12–17 years). The respondents, encompassing primary caregivers, were representative of a diverse demographic, hailing from various states across the US.

3. Measurements

In this study, the demographic data encompassed a range of variables including the child's age, sex, education, employment status, language, family structure, and ethnicity. The independent variables in focus were family resilience including problem-solving, communication, strength recognition, and maintaining hope [12]. For problem-solving, participants were asked, 'When your family faces problems, how often are you likely to work together to solve our problems?' Similarly, for communication, the question was, 'When your family faces problems, how often are you likely to talk together about what to do?' Strength recognition was evaluated with the question, 'When your family faces problems, how often do you know you have strengths to draw on?' Lastly, the aspect of hopefulness was assessed through the question, 'When your family faces problems, how often are you likely to stay hopeful even in difficult times?' Responses to these family resilience questions were scaled from 1 (all of the time) to 4 (none of the time). For meaningful interpretation, scores were reversed, resulting in a scoring range for family resilience from 4 (lowest level of resilience) to 16 (highest level of resilience). The dependent variable in this study was the perceived well-being, encompassing both mental and physical health aspects. Participants were asked to rate their mental health with the question, 'In general, how is your mental or emotional health?' and their physical health with, 'In general, how is your physical health?' Response options for these questions ranged from 1 (excellent) to 5 (poor). To align with the interpretation that higher scores indicate better outcomes, these scores were also reversed. Consequently, the well-being score ranged from 2 (indicating the lowest level of perceived well-being) to 10 (representing the highest level of perceived well-being). The reverse scoring of both metrics does not alter the interpretation of the analysis but ensures that higher scores on both scales are indicative of better outcomes, simplifying comparisons and interpretations. Both family resilience and well-being measurements have been used in this survey annually since 2003 by the Maternal and Child Health Bureau in the US, underscoring their enduring utility and relevance in assessing maternal and child health outcomes.

4. Data Analysis

The analysis of the study data was conducted using the Statistical Package for Social Sciences (SPSS) software, version 27 (IBM Corp.). Descriptive analysis was used to present the socio-demographic data of the participants, including variables such as the child's sex, language, employment, education, family structure, race, and caregiver's age. To ensure the appropriateness of the statistical tests used, the normality of the data was assessed using the Kolmogorov-Smirnov test. To examine the relationship between family resilience and caregiver's well-being, Spearman's rank correlation test was used because data was not normally distributed. Cross-tabulation analysis was performed to examine the distribution of family resilience across the different age groups. Chi-square tests were used to assess the association between these age groups and family resilience and covariates. Next, linear regression analysis was conducted to assess the impact of family resilience on caregiver well-being in each age group, controlling for covariates such as language, employment status, and family structure. The significance level for all tests was set at the .05 level, aligning with standard practices in statistical analysis.

RESULTS

1. Correlation Between Family Resilience and Caregiver Well-being

As shown in Table 1, the analysis revealed a moderate positive correlation between family resilience and caregiver's well-being (r = .35, p < .001). This finding suggests that higher levels of family resilience are associated with better caregiver well-being among children with ADHD across different age groups.

2. Demographic Characteristics

The demographic characteristics of children with ADHD and their caregivers are presented in Table 2. Predominantly, children in the study were male (65.2%), with the highest proportion in the 12–17 years age group. Caregivers were largely female (71.9%), especially in the oldest age group. English was the predominant language spoken by caregivers (96.4%). Employment status showed a majority of caregivers were employed full-time (66.0%), with the highest percentage in the 12–17 years age group. Educational attainment was diverse, with a bachelor's degree being the most common (25.7%). The family structure was predominantly two biological/adoptive parents who were married (54.3%). Regarding race, a significant majority identified as white alone (82.8%). The age distribution of caregivers showed a concentration in the 36–45 years range (42.0%).

3. Non-parametric Test Analysis (Kruskal-Wallis) for Well-being and Family Resilience

The 12–17 years age group showed the highest well-being mean rank (1,407.98) but had the lowest mean rank for family resilience (1,325.23). From the chi-square test, language, employment, family structure, and caregiver's age are associated with child's age. For well-being and family resilience, based on Kruskall–Wallis, there is a difference among groups (Table 3).

Table 1. Spearman's Rank Correlation Coefficient Between Family Resilience and Caregiver Well-being

Variables	Caregiver's well-being	
	r	*p*
Family resilience	.35	< .001

r, correlation.

4. Associations Between Family Resilience, Covariates, and Caregiver's Well-being

1) Age group T1

Controlling for covariates, family resilience was positively associated with the caregiver's well-being in the T1 age group (β = 0.26, p < .001), and it explains 25.2% of its variance (Table 4). For each standard deviation increase in family resilience, the caregiver's well-being increased by 0.26 standard deviations. Among the significant covariates, living in a household with two biological or adoptive parents not currently married was negatively associated with the caregiver's well-being (β = -1.26, p = .040). Additionally, residing in a grandparent household also showed a negative association (β = -1.56, p = .049).

2) Age group T2

In the T2 age group, family resilience continued to demonstrate a significant positive relationship with the caregiver's well-being (β = 0.25, p < .001), and it explains 21.1% of its variance (Table 4). Caregivers not looking for work (β = -0.55, p < .001) and those actively looking for work (β = -0.83, p < .001) were both negatively associated with the caregiver's well-being. The family structure, particularly living in a grandparent household (β = -1.10, p < .001) and being in a household with two biological or adoptive parents not currently married (β = -0.70, p = .010), were negatively associated. Additionally, caregivers in the 26–35 age group (β = -0.32, p = .011) and those older than 56 years (β = 0.69, p < .001) showed significant associations, with the older age group positively associated. Single-mother households were also negatively associated with the caregiver's well-being (β = -0.54, p < .001).

3) Age group T3

For the T3 age group, family resilience again showed a significant positive association (β = 0.22, p < .001), and it explains 22.1% of its variance (Table 4). Employment status, both for caregivers looking for work (β = -0.64, p = .002) and those not looking for work (β = -0.69, p < .001), was negatively associated with the caregiver's well-being. The family structure, especially single-mother households (β = -0.87, p < .001) and grandparent households (β = -0.87, p < .001), and being in a household with two biological or adoptive parents not currently married (β = -0.67, p = .014), were all negatively associated with caregiver's well-being.

Table 2. Chi-square Test Results of the Demographic Characteristics of Study Groups (*N*=2,752)

Demographic variables	T1	T2	T3	Total	*p*
	n (%)	n (%)	n (%)		
Children					
Sex					
Male	101 (5.6)	726 (40.5)	967 (53.9)	1,794 (65.2)	.071
Female	47 (4.9)	351 (36.6)	560 (58.5)	958 (34.8)	
Caregiver					
Language					
English	133 (5.0)	1,037 (39.1)	1,483 (55.9)	2,653 (96.4)	<.001
Spanish	8 (13.8)	21 (36.2)	29 (50.0)	58 (2.1)	
Other	7 (17.1)	19 (46.3)	15 (36.6)	41 (1.5)	
Employment					
Employed full-time	82 (4.5)	688 (37.9)	1,047 (57.6)	1,817 (66.0)	.009
Employed part-time	19 (5.8)	129 (39.6)	178 (54.6)	326 (11.8)	
Working without pay	3 (7.1)	15 (35.7)	24 (57.1)	42 (1.5)	
Not employed but looking for work	11 (8.6)	62 (48.4)	55 (43.0)	128 (4.7)	
Not employed but not looking for work	33 (7.5)	183 (41.7)	223 (50.8)	439 (16.0)	
Education					
8th grade or less	1 (4.5)	8 (36.4)	13 (59.1)	22 (0.8)	.131
9th–12th grade, no diploma	6 (9.4)	32 (50.0)	26 (40.6)	64 (2.3)	
Some college credit	34 (7.5)	176 (39.0)	241 (53.4)	451 (16.4)	
Bachelor's degree	28 (4.0)	293 (41.4)	387 (54.7)	708 (25.7)	
Master's degree	24 (4.7)	195 (37.9)	295 (57.4)	514 (18.7)	
Doctorate or professional degree	7 (3.7)	71 (37.8)	110 (58.5)	188 (6.8)	
Family structure					
Two biological/adoptive parents, married	86 (58.1)	619 (57.5)	791 (51.8)	1,496 (54.3)	<.001
Two biological/adoptive parents, not married	11 (7.4)	34 (3.2)	31 (2.0)	76 (2.8)	
Two parents, one not biological, married	4 (2.7)	62 (5.8)	160 (10.5)	226 (8.2)	
Two parents, one not biological, not married	1 (0.7)	47 (4.4)	38 (2.5)	86 (3.1)	
Single mother	27 (18.2)	182 (16.9)	326 (21.3)	535 (19.4)	
Single father	8 (5.4)	48 (4.5)	78 (5.1)	134 (4.9)	
Grandparent Household	8 (5.4)	66 (6.1)	70 (4.6)	144 (5.2)	
Other relation	3 (2.0)	19 (1.8)	33 (2.2)	55 (2.0)	
Race					
White alone	115 (5.0)	909 (39.9)	1,256 (55.1)	2,280 (82.8)	.463
Black or African American alone	11 (6.9)	49 (30.6)	100 (62.5)	160 (5.8)	
Asian alone	5 (8.9)	20 (35.7)	31 (55.4)	56 (2.0)	
Sex					
Male	36 (4.7)	317 (41.0)	421 (54.4)	774 (28.1)	.332
Female	112 (5.7)	760 (38.4)	1,106 (55.9)	1,978 (71.9)	
Age (year)					
≤25	7 (43.8)	6 (37.5)	3 (18.8)	16 (0.6)	<.001
26–35	60 (16.4)	215 (58.7)	91 (24.9)	366 (13.3)	
36–45	57 (4.9)	551 (47.7)	547 (47.4)	1,155 (42.0)	
46–55	13 (1.5)	204 (24.1)	631 (74.4)	848 (30.8)	
≥56	11 (3.0)	101 (27.5)	255 (69.5)	367 (13.3)	

Group: T1, 0–5 years, n=148; T2, 6–11 years, n=1,077; T3, 12–17 years, n=1,527.

DISCUSSION

The current study provides a comprehensive analysis of the relationships between family resilience, various covariates, and the caregiver's well-being across different age groups. Family resilience constantly displays a positive impact on the caregiver's well-being, while specific characteristics in the employment status, family structure, and caregiver's age vary in all developmental ages.

In this study, family resilience has a positive impact on caregiver's well-being in all children's age groups. This implies its use is imperative in caring for children with ADHD.

Table 3. Non-parametric Test Analysis (Kruskal-Wallis) for Well-being and Family Resilience

Variables	Minimum	Maximum	Mean	SD	T1	T2	T3	χ^2	df	*p*
					Mean rank	Mean rank	Mean rank			
Well-being	1.00	9.00	62.93	167.73	1,149.64	1,363.05	1,407.98	15.32	2	< .001
Family resilience	4.00	16.00	133.42	256.26	1,475.26	1,435.61	1,325.23	15.37	2	< .001

Group: T1, 0–5 years, n=148; T2, 6–11 years, n=1,077; T3, 12–17 years, n=1,527; df, degree of freedom; SD, standard deviation.

Table 4. Linear Regression Analyses for Associations between Family Resilience and Caregiver's Well-being According to Group Age (*N*=2,752)

Predictors	T1			T2			T3		
	β	*p*	95% CI	β	*p*	95% CI	β	*p*	95% CI
Family resilience	0.26	< .001	0.14–0.37	0.25	< .001	0.21–0.28	0.22	< .001	0.19–0.25
English (reference)									
Spanish	0.50	.450	-0.81–1.81	0.34	.310	-0.32–0.99	0.24	.400	-0.31–0.79
Other	-0.40	.600	-1.70–0.99	0.35	.320	-0.34–1.03	0.45	.240	-0.30–1.20
Employed full-time (reference)									
Employed part-time	0.10	.830	-0.83–1.03	-0.10	.470	-0.39–0.18	-0.14	.250	-0.38–0.01
Work without pay	-1.73	.090	-3.76–0.29	-0.39	.315	-1.16–0.38	0.18	.560	-0.42–0.78
Not employed, looking	-0.50	.397	-1.65–0.66	-0.83	< .001	-1.24 to -0.43	-0.64	.002	-1.04 to -0.24
Not employed, not looking	-0.65	.104	-1.44–0.13	-0.55	< .001	-0.81 to -0.29	-0.69	< .001	-0.91 to -0.46
Two biological/adoptive parents, married (reference)									
Two biological/adoptive parents, not married	-1.26	.040	-2.44–0.08	-0.70	.010	-1.23 to -0.10	-0.67	.014	-1.20 to -0.14
Two parents, one not biological, married	0.58	.530	-1.24–2.40	0.02	.910	-0.38–0.43	-0.15	.230	-0.41–0.10
Two parents, one not biological, not married	2.36	.180	-1.10–5.82	-0.70	.002	-1.17 to -0.25	-0.46	.065	-0.95–0.03
Single mother	-0.24	.560	-1.04–0.56	-0.54	< .001	-0.80 to -0.29	-0.87	< .001	-1.06 to -0.67
Single father	-0.03	.960	-1.41–1.34	-0.33	.160	-0.78–0.13	-0.52	.003	-0.87 to -0.18
Grandparent household	-1.56	.049	-3.11–0.01	-1.10	< .001	-1.56 to -0.63	-0.87	< .001	-1.27 to -0.47
Other relation	1.53	.134	-0.48–3.55	-0.23	.500	-0.92–0.46	-0.47	.077	-1.00–0.05
Caregiver's age 36–45 years (reference)									
18–25	-0.38	.610	-1.81–1.06	-0.48	.440	-1.70–0.75	-1.40	.110	-3.09–0.30
26–35	-0.08	.800	-0.75–0.58	-0.32	.011	-0.57 to -0.07	-0.09	.610	-0.42–0.24
46–55	-0.13	.820	-1.23–0.98	0.21	.100	-0.04–0.45	0.18	.050	-0.01–0.35
≥56	1.30	.070	-0.12–2.72	0.69	< .001	0.29–1.09	0.61	< .001	-0.36–0.86

Group: T1, 0–5 years, n=148; T2, 6–11 years, n=1,077; T3, 12–17 years, n=1,527; β, regression coefficient; CI, confidence interval.

Family resilience revolves around the ability of families to recognize their strengths amidst adversity and to rebound from challenges [20]. Enhancing the proactive approach of families towards challenges and maximizing their capacity for problem-solving can significantly aid in their effective management [10], including in families with children diagnosed with ADHD.

In the T1 age group, family resilience was positively associated with the caregiver's well-being (β = 0.26, $p < .001$), indicating that higher levels of resilience correspond to more favorable outcomes. Similarly, in the T2 age group, family resilience remained a significant positive predictor (β = 0.25, $p < .001$). The finding highlights resilience's role in maintaining stability and positive outcomes, even as children grow older. In the T3 age group, family resilience continued to show a significant positive association (β = 0.22, $p < .001$), reinforcing its importance across the lifespan. Family resilience was responsible for 25.2%, 21.1%, and 22.1% of the variation in caregiver well-being for the age groups 0–5, 6–11, and 12–17 years, respectively. The consistency of these percentages across different age groups highlights the sustained importance of family resilience throughout various stages of a child's development. The T1 group employs family resilience slightly higher than other age groups. Family resilience tends to be more significantly employed during crisis periods, focusing on the development and preservation of supportive familial connections and the enhancement of family belief systems [21]. During that period, children are diagnosed with ADHD [22], which explains the use of family resilience in these early years. As children mature, the persistence of challenges in caring for children with ADHD necessitates that caregivers adapt by employing various coping strate-

gies, including the seeking of social support [23]. Hence, collaborating with caregivers to enhance their coping strategies and social support networks presents a viable approach to strengthening resilience within all age groups [24].

In general, employment status, family structure, and caregiver's age play a role in the well-being of caregivers. However, specific characteristics of these variables are different among age groups. In the youngest age group, T1, the well-being of caregivers and children is influenced by several key factors. The structure of the family plays a critical role, with biological/adoptive parents, not currently married showing a notable negative association (β = -1.26). This can be explained that parents who live together without being married tend to be younger, often less equipped for parenting roles, and have a higher likelihood of separating compared to those who are married [25]. This finding points to the potential difficulties faced by single-parent or separated families in this age group. Therefore, the patient's age may be the reason for this difference. Interestingly, older caregivers (> 56 years) demonstrate a positive impact on well-being (β = 1.30), suggesting that older caregivers may have more resources, experience, or coping mechanisms. Moreover, younger caregivers might simultaneously face additional stress factors [20].

As children enter school age, the T2 age group presents distinct trends. The stress of unemployment or job-seeking remains significant, as shown by the negative associations of 'not working, look for work' (β = -0.83) and 'not working, not look for work' (β = -0.55). This underscores the impact of employment challenges on the well-being of caregivers with school-aged children. Single motherhood (β = -0.54) and grandparent-led households (β = -1.10) emerge as factors associated with lower well-being. This aligns with research findings that single mothers often experience reduced well-being due to the challenges of handling daily responsibilities on their own [17]. Mothers raising children alone are typically younger, do not have the support of a second parent, and experience lower levels of social support relative to caregivers in varied family structures [25]. Moreover, in grandparents-led family structures, financial difficulties can often occur, especially among those with lower incomes [26,27]. These grandparents are frequently faced with the economic burden of supporting both their grandchildren and their adult children. Distinct from the grandparent-led family structure, the trend of older caregivers experiencing better well-being continues in this age group, reinforcing the notion that age and accumulated life experience can positively influence caregiver well-being.

In the adolescent T3 age group, several factors significantly impact caregiver well-being. The consistent negative impact of unemployment or job-seeking is evident, highlighting the stress associated with these employment statuses in families of adolescents with ADHD. Challenges in non-traditional family structures are pronounced, with being biological/adopt parents not married, single mothers, single fathers and grandparent-led households showing significant negative impacts. This suggests that the complexities and demands of caregiving in these structures are particularly challenging during the adolescent years. This study also indicates that caregivers aged 36–45 years and above 56 years generally exhibit better well-being. A study from Taiwan demonstrated that long-term multigenerational caregivers, including those caring for grandchildren, report better self-rated health, higher life satisfaction, and fewer depressive symptoms [28], which aligns with the findings of the current research conducted in the US. This sense of contentment can be partially attributed to the adequacy of their social support networks and coping mechanisms [29]. Despite the geographical differences, the similarity in results between the two studies underscores the need for further research to explore this phenomenon across diverse cultural and national contexts.

Understanding family resilience with caregiver well-being across different age groups of children with ADHD is imperative, as highlighted by the findings of this study. The significance of this focus is further supported by other research, which reveals that family resilience scores in families with children diagnosed with ADHD are lower compared to those in families dealing with other chronic illnesses [30] and that the quality of life for caregivers of children with ADHD is lower than that of caregivers of children in general [31]. Given the distinct challenges of caring for children with ADHD, as highlighted by our study and further evidenced by comparisons with both healthy children and those with other chronic conditions, there emerges a pressing need for tailored interventions designed specifically to support families of children with ADHD.

This study carries significant implications for practice, education, and research. The specific implications for nursing practice in each age group are further elucidated below.

Nurses at public health centers or clinics should prioritize strategies that strengthen family resilience for caregivers of children aged 0 to 5 years by providing resources for stress

management and family counseling, and by offering support to older caregivers that leverage their experiences while addressing potential physical health challenges. This is crucial for caregivers of children in this age group where family resilience has a significant positive impact on well-being. A study in Iran stands out for its emphasis on the necessity of training caregivers in problem-solving, anger management, and adaptability skills [5]. Furthermore, in response to the pandemic, telehealth or online parenting resources are proposed to increase the efficacy of family-based interventions [21].

For children aged 6 to 11 years, nurses need to focus on enhancing family communication skills, as well as providing targeted support for single mothers and older caregivers. Introducing programs that foster family bonding and effective communication is crucial [21] as children enter school age. Furthermore, education programs aimed at stress management for caregivers of children in this age group, which encompass training in communication skills, family resilience, emotional-focused family resilience techniques, and comprehensive reviews of effective stress management knowledge, have been shown to significantly enhance their caregiving abilities [32]. Also, nurses should focus on the unique challenges faced by single mothers and grandparents raising children, offering specialized support groups, resources for managing caregiving stress, and connections to community assistance programs. Recognizing the positive impact of older caregivers, nurses should offer health maintenance advice, support for managing chronic conditions, and resources to assist in caregiving responsibilities.

As children grow into adolescence, nurses need to facilitate training focused on stress management and family resilience that addresses the changing dynamics of families with teenagers. Additionally, nurses should provide support for single mothers, single fathers, and grandparent-led households, recognizing the unique challenges these caregivers face. Family therapy can significantly benefit parents by promoting more adaptive family resilience and enhancing their ability to manage the challenges associated with their child's condition in the family context [33]. Moreover, targeted interventions for single mothers, single fathers, and grandparent-led households are essential. These interventions should include adolescent behavioral management strategies, mental health support, and resources for navigating the challenges of raising teenagers.

In education, the incorporation of knowledge about family resilience and caregiver well-being into nursing curricula is essential. This integration not only prepares nursing students with essential skills but also ensures that practicing nurses receive ongoing education to keep updated with the latest research findings.

In research, a qualitative study is needed to refine and expand upon the findings of this study. This approach will allow for a more nuanced understanding of the differences in family resilience and caregiver well-being across various age groups. Additionally, longitudinal studies would offer valuable insights into the changes in caregiver well-being and family resilience strategies as children with ADHD age.

In nursing practice, despite varying factors, unemployment consistently emerges as a key predictor of reduced well-being among caregivers across all age groups. Those unemployed are prone to financial challenges. In this context, nurses can serve as crucial advocates, communicating these insights to policymakers to encourage the establishment of regulations and financial support for families with children who have ADHD, especially during their period of unemployment.

The limitation of this study is its cross-sectional nature, as derived from the NSCH data. Due to this design, the study is unable to establish a causal relationship between the observed variables. This means that while the study can identify associations between caregiver's well-being, family resilience, and child age groups, it cannot conclusively determine cause-and-effect relationships. Moreover, due to the use of secondary data, the variables explored are limited to those available in the NSCH dataset, potentially overlooking other important aspects of family resilience. Additionally, as the research was conducted within the US, its applicability to other countries or cultural contexts may not be warranted, limiting the generalizability of the findings beyond the US demographic.

Despite its limitations, this study has significant strengths. One of the most notable is the large number of respondents involved, which enhances the reliability of the findings. Using national data collected through a representative design is another major strength. This approach ensures that the sample accurately reflects the broader population, thereby increasing the validity of the conclusions drawn from the study.

CONCLUSION

This study reveals that caregiver's well-being in children with ADHD is influenced by a complex interplay of factors that vary across different developmental stages of the child. Family resilience proportionally contributes to this outcome. Also, various characteristics of the caregiver's employment status, family structure, and caregiver's age impact both positively and negatively on the caregiver's well-being. These insights highlight the need for distinct family resilience interventions tailored to different developmental stages. Addressing these specific requirements can significantly enhance caregiver well-being and positively influence family dynamics with children diagnosed with ADHD. Future studies could benefit from a qualitative methodology to delve deeper into the nuances of well-being and family resilience among children with ADHD at different ages, thereby facilitating the improvement of developmentally appropriate interventions. Additionally, conducting similar studies in different cultural contexts would be invaluable in understanding the influence of cultural factors on family resilience and caregiver's well-being.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

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

Funding

None.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):108-117
https://doi.org/10.4094/chnr.2024.006

pISSN 2287-9110
eISSN 2287-9129

CHNR

Association between allergic diseases, generalized anxiety disorder, and depressive symptoms in South Korean adolescents: a secondary data analysis of the 2022 Korea Youth Risk Behavior Survey

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Received: February 15, 2024
Revised: April 4, 2024
Accepted: April 15, 2024

Purpose: This study investigated the relationship between allergic diseases, general anxiety disorder, and depressive symptoms among Korean adolescents. **Methods:** A secondary analysis was conducted on the findings of the 18th Korea Youth Risk Behavior Survey (2022). The study included 51,850 adolescents and analyzed the relationships among allergic diseases, general anxiety disorder, and depressive symptoms using complex samples logistic regression analysis. **Results:** Among the Korean adolescents, 12.7% experienced general anxiety disorder, while 28.7% experienced depressive symptoms. The prevalence of allergic diseases was 5.7% for asthma, 36.3% for allergic rhinitis, and 22.2% for atopic dermatitis. General anxiety disorder was associated with asthma and allergic rhinitis but not atopic dermatitis. Depressive symptoms were associated asthma, allergic rhinitis, and atopic dermatitis. **Conclusion:** Examining the correlation among allergic diseases, general anxiety disorder, and depressive symptoms in adolescents underscores the need for implementing suitable strategies. Moreover, when addressing general anxiety disorder and depressive symptoms in adolescents, it becomes crucial to consider the presence of allergic diseases.

Keywords: Adolescent; Depression; General anxiety disorder; Asthma; Rhinitis, allergic

INTRODUCTION

Allergic disease is a systemic disorder caused by an impaired immune system, and the complex interplay between environmental and genetic factors [1]. Approximately 500 million individuals are diagnosed with allergic disease worldwide [2], and 21% to 25% of 840,448 Korean adolescents aged 12 to 18 years have allergic diseases [3]. Typically, allergic disease—represented by asthma, allergic rhinitis (AR), and atopic dermatitis (AD)—begins in childhood and continues into adolescence and adulthood [1]. As the term "allergic march" reveals, allergic disease begins when children are young and manifests symptoms in various target organs as they grow [1]. AD symptoms that began in infancy may disappear, followed by repeated worsening and improvement in asthma and, over time, AR symptoms [4].

In allergic disease, inflammatory mediators impact the circadian rhythm and directly affect the central nervous system, causing disorders [5]. Mediators released during allergic reactions may act on sensory nerves and affect nervous system processing or transmission of the autonomic nervous system [6]. Patients experience airway obstruction and breathing difficulty in asthma, sleep apnea and other respiratory disorders in AR [7], and itching and reduced sleep frequency and du-

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ration in AD [5].

Several studies reported health problems in patients with allergic diseases [8-10]. Adults with asthma face risks of mental disorders such as depression, anxiety, and panic disorder, which can further worsen their asthma [9]. Studies on patients with AR found the disease to be associated with depression and suicidal ideation [8]; studies on patients with AD reported high stress levels, low sleep quality, and increased depression and suicidal ideation [10].

In adolescence—"a period of storm and stress"—children experience mood disorders and cognitive changes [11]. According to Counselling and Welfare Center for Youth [12], the most common problem dealt with in adolescent counseling is difficulty in interpersonal relationships, followed by mental health issues including depression, anxiety, and suicide-related problems. In adolescence, children are exposed to psychological difficulties, and allergic disease compounds their emotional problems [13]. Among these emotional problems, depression and anxiety (although treated as distinct) share and exacerbate negative feelings; if persistent, they develop into mental disorders [14]. Therefore, early identification and intervention for depression and anxiety are critical.

Children with AD experience itching and poor sleep quality [5]. Sleep is crucial for the physical and mental growth of young children and adolescents [15], as sleep deficiency causes chronic fatigue, hypersensitivity, cognitive dysfunction (e.g., inattention and memory problems), and emotional problems [5]. According to previous studies, sleep deficiency influences depression, anxiety, and suicidal ideation [8]. Psychopathological disorders such as anxiety, depression, and sleep disorders exacerbate the health of patients with allergic diseases or cause other health problems [5]. Hence, it is important to identify risk factors and intervene early [5].

Studies on adolescents with allergic disease focused on its impact on suicidal ideation [16], relationship between sleep disorder and emotional characteristics [16,17], and assessment of emotional state and behavioral problems in specific allergic diseases [8,10]. Although allergic diseases' underlying cause remains the same, their timing of occurrence and symptoms vary across individuals [1,18]. Therefore, different approaches for specific allergic diseases are needed. Liu et al.'s [18] study on allergies in women highlighted the necessity of analyzing specific disease-based allergies. However, in South Korea, limited research has conducted such disease-specific analyses.

Anxiety and depression are the most common problems adolescents experience [19]. Among anxiety types, generalized anxiety disorder (GAD)—first appearing in the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* (1980)— is characterized by chronic anxiety or dread that continues for a long time [20]. Common GAD symptoms are both psychological (e.g., restlessness, anticipated feeling of panic, repetitive negative thinking, and trouble concentrating) and physiological (caused by hypervigilance in the autonomic nervous system) [6,20].

Among the depression types, depressive symptoms (DS) are less severe than major depressive disorder, minor depressive disorder, and subsyndromal depression [20]. However, focusing on DS is important as they have the highest prevalence and are risk factors for more severe depressive disorders [21].

A study analyzing GAD data from the 16th Korea Youth Risk Behavior Survey (KYRBS) [22] classified only 66.6% of Korean youth as normal; 33.4% had mild or more severe anxiety (mild, 22.2%; moderate, 7.6%; severe, 3.6%), and a high proportion (25.2%) of students experienced depression [19]. Accordingly, this study examined both GAD and DS among adolescents.

That is, this study investigated the specific relationship between GAD and DS among Korean middle and high school students using data from the KYRBS, a large-scale cross-sectional survey. It examined the allergic disease-specific links to GAD and DS in Korean youth and the influences of asthma, AR, and AD on both GAD and DS. It thus investigated the (1) prevalence rates of allergic diseases, GAD, and DS in adolescents; (2) differences in GAD and DS according to participants' general characteristics; and (3) the allergic disease-specific relationship between GAD and DS.

METHODS

Ethical statements: This study was a secondary analysis of existing data and did not require institutional review board approval or informed consent.

1. Study Design

This study conducted secondary research to examine the relationships between adolescents' allergic disease and their GAD and DS by analyzing the raw data from the 18th KYRBS [23]. The reporting of this study was based on the

Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [24].

2. Study Subjects and Data Collection

The KYRBS is an online, anonymous, self-administered survey conducted annually to examine the health status of Korean youth [23]. The study subjects were surveyed in April 2022. To minimize sampling errors, the groups were divided into 39 regions and school levels. After receiving the survey guide, students responded to the survey by individually accessing the survey website of the Korea Disease Control and Prevention Agency (KDCA) in a space where internet was available. The 2022 survey was performed by sampling 798 middle and high school students, and a total of 51,850 students participated (participation rate: 92.2%). Data from all participants were analyzed in this study.

The KYRBS is a statistical survey approved and performed by the central government (approval no. 117058). The data are secondary and anonymous and are made publicly accessible by the KDCA [23]. The data in this study were obtained after the researchers filed an approval request in accordance with the relevant KDCA regulations.

3. Research Tools

1) Generalized anxiety disorder

GAD was screened using a GAD screening scale (Seven-item Generalized Anxiety Disorder, GAD-7), which was included in the KYRBS in 2020. The following question was asked for the seven items: "In the last two weeks, how often were you bothered by each of the following problems?". Participants responded using a four-point scale ranging from "never" (0 points) to "almost daily" (3 points); the minimum score was 0 points, and the maximum was 21 points; a score of ≥10 points was classified as moderate-to-severe GAD.

2) Depressive symptoms

The presence or absence of DS was determined by the question "In the last 12 months, have you felt so sad or despaired that you could not carry on your activities of daily living continuously for 2 weeks?"

3) Allergic diseases

For allergic diseases, asthma, AR, and AD were investigated. Regarding asthma, participants who responded "yes" to "Have you ever been diagnosed with asthma by a physician?" were classified as having asthma. Likewise, the presence of AR and AD was determined using the questions "Have you ever been diagnosed with AR by a physician?" and "Have you ever been diagnosed with AD (eczema or heat rash) by a physician?" respectively.

4) General characteristics

For the socio-demographic characteristics, sex, age, BMI (body mass index), perceived economic status, perceived academic performance, living arrangement, and location were examined. BMI was calculated in kg/m^2. Perceived economic status and perceived academic performance were each classified as "high," "middle-high," "middle," "middle-low," and "low." Living arrangement was classified as "with family" and "without family," and the location as "small and medium cities/country area," and "big cities."

For school characteristics, school type and school type by sex were examined. The categories of "middle school" and "high school" were used for school type, and "coeducational school" and "girls/boys' school" were used for school type by sex.

With respect to mental health characteristics, perceived stress, sleep satisfaction, self-rated health, and body weight perception were examined. Perceived stress level was classified into "very high," "high," "middle," "low," and "very low." Sleep satisfaction was classified into "very satisfied," "satisfied," "neutral," "dissatisfied," and "very dissatisfied." Self-rated health was classified into "very good," "good," "average," "poor," and "very poor," and body weight perception was classified into "very underweight," "slightly underweight," "right weight," "slightly overweight," and "very overweight."

4. Data Analysis Method

Data analysis was performed using the IBM SPSS Statistics 25 software (IBM Corp.). To perform complex sampling analysis, information regarding strata, cluster, weight, and finite population correction factor, all provided by the KDCA, was used [23]. For descriptive statistics, frequencies, weighted percentages and weighted means, standard error.

To examine the difference in GAD and DS based on the presence versus absence of each allergic disease, a chi-square test was conducted. To identify factors affecting GAD and DS, complex samples simple/multinomial logistic regression

analysis was performed; Nagelkerke R^2 was used to test the logistic regression models, and odds ratios and the 95% confidence interval were computed for each factor.

RESULTS

1. General Characteristics in Adolescents

Regarding socio-demographic characteristics, 51.6% were boys and 48.4% were girls. The mean age was 15.20 years, and the mean BMI was 21.36 kg/m^2. Moreover 46.0% perceived their economic status as "middle," while 30.0% perceived their academic performance level to be "middle"; 95.5% lived with family, and 41.5% lived in big cities; 51.6% were middle school students, and 48.4% were high school students; 68.7% attended coeducational schools. Regarding mental health characteristics, 41.9% of the respondents felt "middle"-level stress, and sleep satisfaction was "neutral" for 31.9%. Self-rated health was "good" among 43.0% of the respondents, and body weight perception was "right weight" for 36.1% (Table 1).

2. Differences between GAD and DS by General Characteristics in Adolescents

Among the socio-demographic characteristics, sex, age, perceived economic status, perceived academic performance, and living arrangement were statistically significantly different based on the presence and absence of GAD ($p<.001$). Among the mental health characteristics, perceived stress, sleep satisfaction, self-rated health, and body weight perception were statistically significantly different based on the presence and absence of GAD ($p<.001$; Table 1).

As regards the presence versus absence of DS, the following variables of socio-demographic characteristics showed significant differences: sex ($p<.001$), age ($p=.003$), BMI ($p<.001$), perceived economic status ($p<.001$), perceived academic performance ($p<.001$), and living arrangement ($p<.001$). Among the school characteristics, both school type ($p=.021$) and school type by sex ($p<.001$) were significantly different. Among the mental health characteristics, perceived stress, sleep satisfaction, and self-rated health were significantly different ($p<.001$; Table 1).

3. GAD, DS, and Allergic Diseases in Adolescents

Of all participants, 6,587 (12.7%) experienced GAD with a mean GAD score of 4.22, and 14,956 (28.7%) experienced DS. In addition, 2,934 (5.7%) of those with allergic diseases experienced asthma, 18,319 (36.3%) experienced AR, and 11,440 (22.2%) experienced AD (Table 2).

4. Differences between GAD and Depression Symptoms by Allergic Disease

Asthma, AR, and AD were all significantly different in the presence versus absence of both GAD and DS ($p<.001$; Table 3).

5. Association of Allergic Diseases on GAD and DS

The effect of allergic diseases on GAD and DS was examined by performing complex samples simple/multiple logistic regression analysis (Tables 4 and 5). In each regression model, the dependent variable was coded 1 if GAD or DS was present and 0 if not. For the independent variables regarding allergic diseases, values 1 and 0 were used to indicate the presence and absence of each disease, respectively. Covariates were included in the complex multinomial logistic regression analysis. There were 13 covariates which were significant variables in the chi-square tests conducted to compare the presence versus absence of both GAD and DS, as shown in Table 1.

Nine covariates (sex, age, perceived economic status, perceived academic performance, living arrangement, perceived stress, sleep satisfaction, self-rated health, and body weight perception) were included in the model testing GAD. Moreover, 11 covariates (sex, age, BMI, perceived economic status, perceived academic performance, living arrangement, school type, school type by sex, perceived stress, sleep satisfaction, and self-rated health) were included in the model testing DS.

The complex samples simple logistic regression analysis (Table 4) found that all three allergic diseases (i.e., asthma, AR, and AD) were significant in GAD and DS ($p<.001$). For each allergic disease, the level of both GAD and DS increased in the disease's presence.

The results of complex samples multinomial logistic regression analysis with covariates based on allergic disease (Table 5) are as follows. Asthma was significantly different in the presence versus absence of both GAD ($p=.013$) and DS ($p<.001$): in participants with asthma, the likelihood of GAD

Table 1. Comparison of General Characteristics according to Generalized Anxiety Disorder and Depressive Symptoms among Adolescents (*N*=51,850)

Variables	Categories	n (%)[a]	M±SE[b]	Generalized anxiety disorder χ^{2c} / t (*p*)	Depressive symptoms χ^{2c} / t (*p*)
Socio-demographic characteristics					
Sex	Male	26,397 (51.6)		448.47 (<.001)	551.04 (<.001)
	Female	25,453 (48.4)			
Age (year) (n=51,767)	-		15.20±0.024	3.61 (<.001)	2.94 (.003)
Body mass index (kg/m^2) (n=50,455)	-		21.36±0.033	-0.17 (.865)	-6.40 (<.001)
Perceived economic status (n=51,847)	High	5,984 (11.9)		11.98 (<.001)	11.28 (<.001)
	Middle-high	15,904 (31.4)			
	Middle	24,143 (46.0)			
	Middle-low	4,807 (8.8)			
	Low	1,009 (1.9)			
Perceived academic performance (n=51,848)	High	6,935 (13.5)		9.74 (<.001)	19.90 (<.001)
	Middle-high	13,116 (25.3)			
	Middle	15,484 (30.0)			
	Middle-low	11,380 (21.8)			
	Low	4,933 (9.4)			
Living arrangement (n=51,845)	With family	49,182 (95.5)		15.02 (<.001)	40.32 (<.001)
	Without family	2,663 (4.5)			
Location	Small and medium cities/ Country area	29,638 (58.5)		0.38 (.608)	0.52 (.566)
	Big cities	22,212 (41.5)			
School characteristics					
School type	High school	23,835 (48.4)		5.59 (.052)	8.64 (.021)
	Middle school	28,015 (51.6)			
School type by sex	Coeducational school	35,527 (68.7)		5.71 (.060)	51.87 (<.001)
	Girls/Boys' school	16,323 (31.3)			
Mental health characteristics					
Perceived stress	Very high	6,343 (12.3)		-68.45 (<.001)	-78.52 (<.001)
	High	15,053 (29.0)			
	Middle	21,641 (41.9)			
	Low	7,316 (13.9)			
	Very low	1,497 (2.9)			
Sleep satisfaction	Very satisfied	3,550 (6.7)		38.30 (<.001)	43.49 (<.001)
	Satisfied	8,109 (15.5)			
	Neutral	16,656 (31.9)			
	Dissatisfied	15,342 (29.8)			
	Very dissatisfied	8,193 (16.0)			
Self-rated health	Very good	10,543 (20.2)		40.60 (<.001)	33.27 (<.001)
	Good	22,337 (43.0)			
	Average	13,565 (26.3)			
	Poor	5,038 (9.8)			
	Very poor	367 (0.7)			
Body weight perception	Very underweight	2,539 (5.0)		8.37 (<.001)	0.10 (.921)
	Slightly underweight	11,122 (21.8)			
	Right weight	18,602 (36.1)			
	Slightly overweight	15,791 (30.2)			
	Very overweight	3,796 (6.9)			

[a]Weighted %; [b]Weighted mean; [c]Rao-Scott χ^2; M, mean; SE, standard error.

increased by 1.17 times and that of DS by 1.26 times.

AR also showed a significant difference in the presence versus absence of both GAD (p<.001) and DS (p=.027): in participants with AR, the likelihood of GAD and DS increased by 1.12 and 1.05 times, respectively. AD was significantly different in the presence versus absence of DS (p=.009)

Table 2. Generalized Anxiety Disorder, Depressive Symptoms, and Allergic Diseases among Adolescents (*N*=51,850)

Variables	Categories	n (%)[a]	M±SE[b]
Generalized anxiety disorder	Yes	6,587 (12.7)	
	No	45,263 (87.3)	
	Total score (range=0–21)		4.22±0.029
Depressive symptoms	Yes	14,956 (28.7)	
	No	36,894 (71.3)	
Allergic diseases			
Asthma	Yes	2,934 (5.7)	
	No	48,916 (94.3)	
Allergic rhinitis	Yes	18,319 (36.3)	
	No	33,531 (63.7)	
Atopic dermatitis	Yes	11,440 (22.2)	
	No	40,410 (77.8)	

[a]Weighted %; [b]Weighted mean; M, mean; SE, standard error.

Table 3. Comparison of Allergic Diseases according to Generalized Anxiety Disorder and Depressive Symptoms among Adolescents (*N*=51,850)

Variables	Categories	Generalized anxiety disorder			Depressive symptoms		
		No	Yes	χ^2 (*p*)[b]	No	Yes	χ^2 (*p*)[b]
		n (%)[a]	n (%)[a]		n (%)[a]	n (%)[a]	
Asthma	Yes	2,435 (5.5)	499 (7.7)	49.06 (<.001)	1,860 (5.2)	1,074 (7.1)	72.23 (<.001)
	No	42,828 (94.5)	6,088 (92.3)		35,034 (94.8)	13,882 (92.9)	
Allergic rhinitis	Yes	15,659 (35.5)	2,660 (41.4)	83.46 (<.001)	12,690 (35.4)	5,629 (38.4)	41.63 (<.001)
	No	29,604 (64.5)	3,927 (58.6)		24,204 (64.6)	9,327 (61.6)	
Atopic dermatitis	Yes	9,730 (21.7)	1,710 (26.0)	58.56 (<.001)	7,796 (21.3)	3,644 (24.4)	57.61 (<.001)
	No	35,533 (78.3)	4,877 (74.0)		29,098 (78.7)	11,312 (75.6)	

[a]Weighted %; [b]Rao-Scott χ^2.

Table 4. Associations Between Independent variables and Allergic Diseases and Dependent variables among Adolescents[a] (*N*=51,850)

Independent variables (reference)	Categories	Dependent variables					
		Generalized anxiety disorder			Depressive symptoms		
		OR (95% CI)	*p*	Nagelkerke R^2	OR (95% CI)	*p*	Nagelkerke R^2
Asthma (No)	Yes	1.44 (1.30–1.61)	<.001	.002	1.41 (1.30–1.53)	<.001	.002
Allergic rhinitis (No)	Yes	1.28 (1.21–1.35)	<.001	.003	1.14 (1.09–1.19)	<.001	.001
Atopic dermatitis (No)	Yes	1.27 (1.19–1.35)	<.001	.002	1.19 (1.14–1.25)	<.001	.002

[a]Complex sample simple logistic regression analysis; CI, confidence interval; OR, odds ratio.

Table 5. Associations Between Independent Variables and Allergic Diseases and Dependent variables among Adolescents[a] (*N*=51,850)

Independent variables (reference)	Categories	Dependent variables					
		Generalized anxiety disorder			Depressive symptoms		
		OR (95% CI)	*p*	Nagelkerke R^2	OR (95% CI)	*p*	Nagelkerke R^2
Asthma (No)	Yes	1.17 (1.03–1.33)	.013	.306	1.26 (1.15–1.39)	<.001	.210
Allergic rhinitis (No)	Yes	1.12 (1.06–1.19)	<.001	.306	1.05 (1.01–1.10)	.027	.210
Atopic dermatitis (No)	Yes	1.07 (0.99–1.15)	.064	.306	1.07 (1.02–1.12)	.009	.210

[a]Complex sample multiple logistic regression analysis; CI, confidence interval; OR, odds ratio.

but not of GAD (p = .064): in participants with AD, the likelihood of DS increased by 1.07 times.

DISCUSSION

This study was conducted to examine the presence of both GAD and DS in adolescents with specific allergic diseases (asthma, AR, and AD) and investigate the effect of each allergic disease on GAD and DS. As a result, GAD was associated with asthma and allergic disease. DS was associated with asthma, AR, and AD. The study findings are discussed below.

Of the participants, 12.7% experienced GAD and 28.7% DS. In a study that analyzed data from the 16th KYRBS (2020) [19], the proportion of adolescents experiencing GAD (≥10 points) was 11.2%, and the proportion of those experiencing DS was 25.2%. A follow-up study is needed because the current study examined data from the 18th survey [23], which was conducted after the COVID-19 pandemic, and this point is a factor in the slight decrease in both GAD and DS. According to Park [25], during the pandemic, psychological anxiety and depression were aggravated among adolescents in vulnerable families due to school closures. This is likely because adolescents had to care for their family members because of the family's economic or health problems [26], but this aspect must be confirmed in future research.

Additionally, this study only investigated GAD and DS, but the results for other types of anxiety and depressive disorders may differ. Further, because depression and GAD are known to share many symptoms and the cases in which they co-exist tend to be severe [20], it is recommended to investigate how the disorders' or symptoms' co-existence affects mental health.

This study found that adolescents experiencing asthma, AR, or AD were more likely to have GAD and DS compared with both control groups, confirming their association with allergic diseases and the diseases' effects. This finding is consistent with previous studies' findings and shows that Korean adolescents with allergic disease also experience emotional difficulty [8-10].

Adolescence is an important period in which children go through psychological difficulties due to physical changes, and they develop into adulthood after adequately overcoming the difficulties. Adolescents experiencing anxiety and depression due to an illness in this period may develop psychiatric disorders in adulthood [27]. Moreover, anxiety and depression in adolescence are affected by not only personal factors but also other diverse factors such as academic performance, relationship with parents, and support system [13]. In this study, analysis was performed by controlling the variables of general characteristics that significantly affected anxiety and depression; moreover, asthma and AR were found to influence both anxiety and depression, whereas AD was found to influence depression only.

Allergic disease begins in childhood, and the symptoms manifest in diverse forms and lead to a variety of diagnoses, reducing quality of life and inducing problems such as depression and anxiety. Consistent with previous research, this study found that children diagnosed with asthma were more likely to experience GAD and DS compared to the control group. Currently, a direct mechanism for the linkage between asthma and depression is unknown. It is reported, however, that the younger the child with the condition, the more likely they are to feel that their condition is life-threatening and experience anxiety, panic, and depression due to low quality of life [7]. According to a previous study, among patients with various allergic diseases, patients with asthma were more likely to complain of anxiety and panic attacks and visit the hospital due to such psychological problems [28]. The researchers stated that emotional problems aggravated symptoms, as such problems increased contraction in the bronchi or impacted the immune system through the vagus nerve [1]. Anxiety and depression may persist even if asthma symptoms improve [7]; hence, patients should be regularly screened for anxiety and depression.

Patients with AR showed a significant difference in GAD and DS. In particular, anxiety increased by 1.12 times in the AR versus control groups. In a previous study conducted with adolescents, anxiety increased in cases with AR, which may be linked to sleep disturbance [29]. AR is seasonally affected, and symptoms are more severe during a particular period in a year, thus increasing anxiety [1]. Moreover, sleep disturbance makes it difficult to maintain sleep, reducing sleep duration and quality, and may cause psychiatric symptoms, impulses, and suicidal ideation [8,16]. The use of drugs to relieve symptoms also causes sleep disturbance [6]. Mou et al. [30] reported that the duration of symptoms, comorbidities, medications used, immune inflammatory response, etc., are related to depression caused by AR, which is consistent with the results of this study. It is believed that it is necessary to approach psychological problems (anxiety and depression) related to drug use, which were not included as vari-

ables in this study.

Unlike other allergic diseases, AD was found to influence depression only. AD decreases sleep quality due to not only visible symptoms (e.g., sensitivity, dryness, redness, flaking, and bleeding caused by scratching and skin deformation) but also diet restriction, symptom recurrence, and severe itching [31]. Patients with AD withdraw from daily living activities due to the symptoms, which lowers their quality of life and induces depression [10,17]. Jaworek et al. [31] reported that severe AD was linked to depression and low serum serotonin levels. Previous studies also supported the validity of the current study's findings. Anxiety increases in situations in which a threat is highly likely to occur [32]; this finding is interpreted as demonstrating that AD—a chronic recurrent disease—does not influence anxiety because it does not occur or worsen suddenly, unlike asthma and AR.

This study is of significance because it identified allergic disease-specific factors affecting depression and anxiety in adolescents. It is notable that the analysis was performed by controlling several variables and using only disease characteristics. A study limitation is that the survey investigated only the presence or absence of the diagnosis of allergic disease, and data on its timing of occurrence or severity level were not collected. In the future, a repeat study should be conducted to investigate depression and anxiety levels by also collecting the aforementioned information in subjects with allergic diseases. Additionally, it is suggested to conduct studies that investigate how the characteristics of specific allergic diseases impact one's emotional and behavioral problems, such as those caused by depression and anxiety. This is because specific allergic diseases may have different effects on stress.

CONCLUSION

This study analyzed data from the 18th KYRBS (2022) to determine the relationship between allergic diseases, GAD, and DS among Korean adolescents. The results revealed that GAD was associated with asthma, AR, and AD. DS were associated with asthma and AR but not with AD. The results allowed the identification of depression and anxiety in adolescents caused by allergic disease. Moreover, it showed the necessity of regularly evaluating depression and anxiety in adolescents with allergic diseases during the initial treatment process.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

Jaeyoung Lee has been an editor of *Child Health Nursing Research* since 2022. She was not involved in the review process of this article. No existing or potential conflict of interest relevant to this article was reported.

Funding

None.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):118-128
https://doi.org/10.4094/chnr.2024.007

pISSN 2287-9110
eISSN 2287-9129

CHNR

Changes in parents' health concerns by post-preterm birth period in South Korea: a cross-sectional study

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Received: February 15, 2024
Revised: March 17, 2024
Accepted: March 31, 2024

Purpose: This study aimed to examine the health concerns of parents regarding their premature infants and to identify changes in these concerns during perinatal period and after discharge. **Methods:** This was a retrospective study performed at a single tertiary center that enrolled 119 premature infants who were discharged from the neonatal intensive care unit (NICU) and visited the outpatient pediatrics department between December 2018 and October 2021. Data on the concerns of 176 parents regarding enrolled premature infants' health from before birth to 1 week after NICU discharge were obtained from outpatient records. The t test and with the chi-squared test were used to analyze the data for this study. **Results:** The consistently greatest focus of parents' health concerns was the respiratory system. The second focus of parents' health concerns before discharge was the central nervous system. However, during the first week after NICU discharge, the gastrointestinal system was the second-most frequent focus of parents' health concerns among parents of infants without diseases related to prematurity and infants with older gestational ages. **Conclusion:** The results of this study offer insights into the health concerns among parents of premature infants. Parental health concerns about premature infants vary over time, from before birth to post-discharge, necessitating supportive interventions to enhance parental understanding of their child's health status.

Keywords: Parents; Infant, premature; Expression of concern

INTRODUCTION

Preterm birth rates are increasing worldwide [1]. In addition, according to the Korea National Statistical Office, the proportion of premature births in Korea increases every year. In 2021, the proportion of premature births (<37 weeks of gestation) was 9.2%, which was a 0.7% increase from that of the previous year [2]. Correspondingly, the prevalence of prematurity-related diseases is also increasing [3]. Prematurity is the main cause of neonatal death globally. Preterm birth consequences lead to a higher risk of neurological, cognitive, sensory, respiratory, digestive, renal, cardiovascular, metabolic, immune, and psychosocial disturbances in both the short and long term. Pathologies related to prematurity include respiratory distress disease (RDS), necrotizing enterocolitis (NEC), retinopathy of prematurity (ROP), and intraventricular hemorrhage (IVH) [4,5]. Preterm infants have a higher risk of developing bronchopulmonary dysplasia (BPD), pulmonary hypertension, asthma, cerebral palsy, cognitive disability, and seizure disorders as long-term consequences [4].

Furthermore, data regarding various diseases that are related to premature birth can easily be accessed on the Internet, and medical data about which diseases occur most fre-

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quently after birth are well-documented [6]. The risks for preterm infants do not end after hospitalization, and they continue to have high vulnerability even after discharge. The care they receive at home has a crucial impact on their well-being in the long term [7].

Therefore, parents of premature infants can have negative thoughts and fears [8,9], and numerous articles about their emotional stress have been published. In addition, many studies have been published about parental stress caused by the medical conditions of their infants, the prematurity of their infants [10-12], and a lack of information about the diagnosis or treatment of their infants [12]. Therefore, many studies have been conducted on the emotional experiences of the parents of infants hospitalized in the neonatal intensive care unit (NICU). Their highest stressor was the parental role, and parental stress was influenced by the length of the NICU stay, gestational age, infant's need for respiratory support, and cardiovascular diagnosis [8,10]. Parents experienced difficulties in coping with hospitalization stress, grief, isolation, and a lack of preparation for the transition to parenthood [13]. Therefore, it is necessary to identify parental risk factors immediately after preterm birth to assist in reducing parents' negative emotions and stress [8], and parents need to be prepared for the transition of childcare from the hospital to home. The process of preparing parents for preterm infant care should be gradual and dynamic, starting from admission. Through this preparation, parents acquire the knowledge and skills needed to care for preterm infants at home, as well as emotional stability and a sense of security. The preparation process for transitioning from the NICU to home should be tailored to the individual social circumstances of the parents, and the specific conditions and needs of each preterm infant. The child's clinical progression and the parents' adaptation to the situation should also be considered [14]. Parents of preterm infants in Korea have supportive care needs, including a vague fear of caring for a baby upon imminent NICU discharge, real-world difficulties encountered while caring for preterm children, concerns about growth and development problems, and anxiety about possible complications [15].

However, there has been little research on the health problems of the greatest parental concern in their premature infants and whether these concerns change over time in South Korea. The purpose of this study was to identify health-related concerns among the parents of preterm infants, changes in their parental concerns over time, and the factors that affected them during the perinatal period and after discharge. In addition, based on the results of this study, basic data for developing supportive care interventions according to parents' concerns that change from the birth of a premature baby to after discharge from the hospital was provided.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Kosin University Gospel Hospital (No. 2022-03-045). This study received a consent waiver.

1. Study Design

This was a retrospective study [16] in which data were obtained and analyzed through the contents of outpatient medical records for premature infants. This retrospective study investigated the concerns of the mothers and fathers of premature infants through medical examinations during outpatient visits. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [17].

2. Study Setting and Participants

The researchers intended to record the medical aspects of parents' concerns about their infants in order to help support parenting interventions while performing long-term follow-up management of preterm infants when they return to the hospital for their first outpatient visit after discharge from the NICU. As established by a previous study [18], the researchers interviewed parents of premature infants in the outpatient department (OPD) about concerns regarding neonatal problems related to preterm birth and let them select one answer (Supplement 1. Questionnaire). Data obtained longitudinally were analyzed to extract data cross sectionally.

In this study, 177 premature infants who visited the neonatal clinic of the Department of Pediatrics between December 1, 2018, and October 31, 2021, were investigated. These infants with <37 weeks of gestation were born at the hospital, hospitalized, and discharged from the NICU. The hospital is a level III unit with 18 NICU beds. Information about parents' health concerns regarding their premature infants was recorded in the OPD chart. Parents who were not asked for

information about their concerns regarding the health of their preterm infants (n=39), preterm infants who were transferred from other hospitals (n=17), and infants who died (n=2) were excluded from this study. No infants with congenital anomalies were enrolled. Finally, 119 premature infants were included in this study, and information was gathered from a total of 176 parents, as 57 out of the 119 premature infants had both the father and mother responding.

3. Variables

1) Clinical characteristics of premature infants

The clinical characteristics of premature infants included gestational age, birth weight, sex, delivery type, 1- and 5-minute Apgar scores, the first baby or not, total length of hospital stay, need for resuscitation and blood transfusion, disease, and central catheter insertion.

2) Maternal characteristics

The maternal characteristics included maternal age and maternal pregnancy complications (e.g., pregnancy-induced hypertension, gestational diabetes mellitus, hyperthyroidism, and hypothyroidism) were investigated.

3) Parents' greatest concerns regarding their premature infants' health

The questionnaire in this study consisted of 1 item to investigate either the father or mother and 5 items regarding the greatest concerns with their infants' health at five different times: before birth, immediately after birth, 7 days after birth, before hospital discharge, and 1 week after hospital discharge to home (Supplement 1. Questionnaire).

4. Data Collection

This study was conducted after receiving approval for the research plan and a waiver of informed consent from the institutional review board (IRB) of the university hospital. The electronic medical records (EMRs) of the patients were collected as anonymous data with the cooperation of the medical information management office from December 1, 2018, to October 31, 2021. Neonatal problems associated with premature birth are classified in pediatric textbooks by organ system as follows: respiratory, cardiovascular, hematologic, gastrointestinal (GI), metabolic endocrine, central nervous system (CNS), renal, and infection [6]. Common problems in premature infants arise in these systems and are explained to the parents on the day of neonatal admission to the NICU. Both during hospitalization and upon discharge from the NICU, parents were provided with documents summarizing the medical conditions of their infants and any consequences that occurred during hospitalization. During outpatient visits, diseases of prematurity that had been explained during hospitalization and upon discharge were fully explained again, and the parents' concerns about their infants' health were confirmed in the outpatient clinic during follow-up and management of the premature infants. Based on a previous study during which Korean mothers of premature infants were interviewed regarding emotional adjustment and concerns at five distinct points in time from immediately after NICU hospitalization to infant discharge [9], parents were also asked about their greatest health concerns regarding their infants at different times, including before birth, immediately after birth, 7 days after birth, before hospital discharge, and 1 week after hospital discharge to home [18], and their answers were recorded on the outpatient medical records forms. We investigated these data in this study because parental responses and stress are influenced by obstetric and infant characteristics [19].

5. Data Analysis

The investigated items were entered into Microsoft Excel (Microsoft Corp.) for management and IBM SPSS Statistics version 25.0 (IBM Corp.) for the comparison of continuous variables with the t test and of categorical variables with the chi-squared test [20]. All test results with $p<.05$ were considered statistically significant.

RESULTS

1. Clinical Characteristics of Premature Infant and Maternal Characteristics of Their Mothers

Table 1 shows the infant, obstetric, and parental characteristics. The mean gestational age of the infants was 33.02±2.91 weeks (23.86–36.86 weeks). The mean birth weight was 1,991.53±570.84 g (600.00–3,600.00 g). There were 69 males (58.0%) and 50 females (42.0%). The mean Apgar scores at 1 and 5 minutes were 6.37±1.63 (1–9 range) and 8.15±1.01 (5–9 range), respectively. Most parents had no other children (67/119 cases [56.3%]), and most infants were born via cesar-

Table 1. Patient Characteristics of the Premature Infants (*N*=119) and Their Parents (*N*=176)

Characteristics		n (%)	M±SD	Range
Premature infants				
Gestational age (week)			33.02±2.91	23.86–36.86
	<32	35 (29.4)		
	32^{+0}–36^{+6}	84 (70.6)		
Birth weight (g)			1,991.53±570.84	600.00–3,600.00
	<1,500	20 (16.8)		
	1,500–2,499	75 (63.0)		
	≥2,500	24 (20.2)		
Sex	Male	69 (58.0)		
	Female	50 (42.0)		
Type of delivery	Cesarean	100 (84.0)		
	Vaginal	19 (16.0)		
Apgar score at 1 minute			6.37±1.63	1–9
Apgar score at 5 minutes			8.15±1.01	5–9
No other children		67 (56.3)		
Required resuscitation at birth		14 (11.8)		
Disease of the infant	RDS	37 (31.1)		
	BPD	25 (21.0)		
	PDA	25 (21.0)		
	ROP	4 (3.4)		
	IVH	19 (16.0)		
	PVL	6 (5.0)		
	Sepsis	22 (18.5)		
Central catheter insertion required		61 (51.3)		
Transfusion required		17 (14.3)		
Length of hospital stay (day)			40.64±31.74	8–166
Maternal information				
Maternal age (year)			33.34±4.84	22–44
	<35	74 (62.2)		
	≥35	45 (37.8)		
Maternal pregnancy complications		42 (35.3)		
	Hypertension	24 (20.2)		
	Diabetes mellitus	9 (7.6)		
	Thyroid disease	8 (6.7)		
	Diabetes mellitus and thyroid disease	1 (0.8)		
Responder				
Mother		113 (64.2)		
Father		63 (35.8)		

BPD, bronchopulmonary dysplasia; IVH, intraventricular hemorrhage; M, mean; PDA, patent ductus arteriosus; PVL, periventricular leukomalacia; RDS, respiratory distress syndrome; ROP, retinopathy of prematurity; SD, standard deviation.

ean delivery (84.0%). The number of infants who needed resuscitation at birth, blood transfusions, and central catheter insertion were 14 (11.8%), 17 (14.3%), and 61 (51.3%), respectively. The mean total length of the infants' hospital stay was 40.64±31.74 days (8–166 days). Among the infants, 37 (31.1%) were diagnosed with RDS, 25 (21.0%) with BPD, 25 (21.0%) with patent ductus arteriosus, 4 (3.4%) with ROP, 19 (16.0%) with IVH, 6 (5.0%) with periventricular leukomalacia (PVL), and 22 (18.5%) with sepsis. There were some infants who had multiple overlapping diseases. The mean age of the mothers was 33.34±4.84 years (22–44 years) and maternal pregnancy complications occurred in 42 infants (35.3%) (Table 1). Among the responders, 113 were mothers (64.2%) and 63 were fathers (35.8%), with no statistically significant difference in responder type.

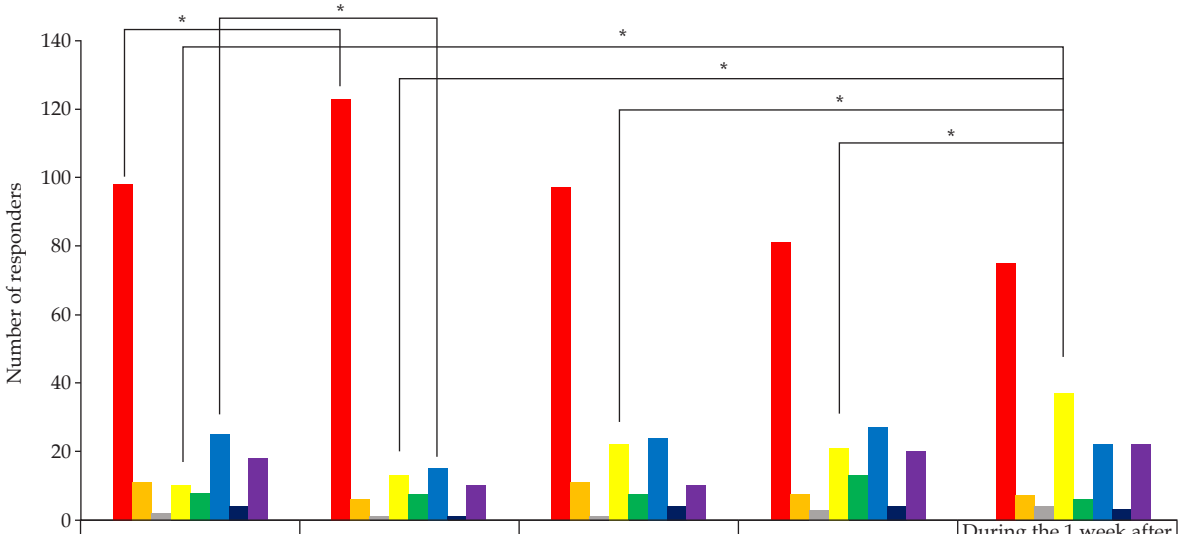
2. Parental Concerns about Prematurity-related Diseases

The analysis of parents' concerns about their premature

infants revealed that most parents were concerned about their respiratory system throughout the entire period from before birth to 1 week after NICU discharge (Figure 1). Throughout the entire period, it can be seen in Figure 1 that parents showed the most concern about the respiratory system after birth, with responses from 77 mothers (77/123, 62.6%) and 46 fathers (46/123, 37.4%). In addition, the CNS was the second most concerning system from before birth until before discharge and statistically significant differences were observed before and after birth. Furthermore, during the first week after hospital discharge, the second most concerning system shifted to the GI system from the CNS, and the degree of concern regarding the GI system during the first week after hospital discharge significantly increased when compared to respectively different points in time, such as before birth, after birth, seven days after birth, and before discharge (Figure 1).

3. Differences in Infants and Maternal Characteristics Between the Greatest and Second-greatest Concerns of Parents

Table 2 presents the data and results for the greatest and second-greatest concerns of parents about their premature infants according to time. The premature infants of parents with respiratory system concerns after birth had younger gestational ages; moreover, a substantial percentage of these infants had a birth weight of <1,500 g (Table 2). Respiratory system concerns significantly increased after birth compared to those before birth (98 vs. 123 respondents, respectively; $p<.001$) (Figure 1). The only related factor that was associated with respiratory system concerns pre-birth was cesarean delivery; however, cesarean delivery was a statistically significant factor associated with respiratory system concerns during the entire study period (Table 2). The average 1- and 5-minute Apgar scores of the infants of parents with respiratory system concerns were also considerably lower than those of infants whose parents had different concerns (Table 2). The parents of infants with a diagnosis of RDS and the parents of infants with a diagnosis of BPD before discharge had significant concerns about the respiratory system. Moreover, parental concerns about the respiratory system were significantly affected by transfusion requirements after birth, longer phototherapy within 7 days after birth, longer antibiotic treatment during the hospital stay before discharge, and longer hospital duration (Table 2).



	Before birth	After birth	7 days after birth	Before discharge	During the 1 week after hospital discharge
1 Respiratory system	98	123	97	81	75
2 Cardiovascular system	11	6	11	7	7
3 Hematologic system	2	1	1	3	4
4 Gastrointestinal system	10	13	22	21	37
5 Metabolic endocrine system	8	7	7	13	6
6 Central nervous system	25	15	24	27	22
7 Renal system	4	1	4	4	3
8 Infections	18	10	10	20	22

Figure 1. Parents' health concerns about the health problems of their premature infants according to time (*$p<.05$).

https://doi.org/10.4094/chnr.2024.007

Table 2. Parental First and Second Health Concerns Regarding Preterm Infants According to Time (*N*=176)

		Before birth		Immediately after birth		7 days after birth		Before hospital discharge		1 week after hospital discharge		Total n (%) or M±SD
		Resp. system	CNS	Resp. system	CNS	Resp. system	CNS	Resp. system	CNS	Resp. system	GI	
		n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	
Frequency (%)		98 (55.7)	25 (14.2)	123 (69.9)	15 (8.5)	97 (55.1)	24 (13.6)	81 (46.0)	27 (15.3)	75 (42.6)	37 (21.0)	176 (100)
Hospitalization duration (day)		40.76±32.65	55.80±26.37[a]	43.04±34.19	52.33±23.33	44.87±35.52[a]	49.29±28.46	47.30±37.71[a]	38.40±24.00	46.76±38.17[a]	35.57±27.38	40.64±31.74
Gestational age (week)		32.81±3.1	32.20±2.79	32.70±3.10[a]	33.07±2.55	32.53±3.06[a]	32.03±2.99	32.41±3.24[a]	33.10±2.40	32.37±3.28[a]	33.90±2.48[a]	33.02±2.91
< 32 week		31 (55.4)	14 (25.0)[a]	43 (76.8)	5 (8.9)	34 (60.7)	12 (21.4)[a]	31 (55.4)	9 (16.1)	30 (53.6)[a]	8 (14.3)	56 (100)
Birth weight (g)		1,983.42±584.07	1,738.40±424.29[a]	1,955.61±615.36	1,942.00±293.48	1,933.04±636.76	1,938.75±482.01	1,916.42±653.41	2,051.90±445.60	1,910.13±681.31	2,044.86±450.18	1,991.53±570.84
< 1,500 g		18 (54.5)	7 (21.2)	30 (90.9)[a]	0	26 (78.8)[a]	4 (12.1)	20 (60.6)	5 (15.2)	22 (66.7)[a]	3 (9.1)	33 (100)
Sex	Male	55 (56.1)	14 (14.3)	70 (71.4)	13 (13.3)[a]	54 (55.1)	15 (15.3)	43 (43.9)	19 (19.4)	41 (41.8)	21 (21.4)	98 (100)
No other children		62 (60.2)	14 (13.6)	76 (73.8)	7 (6.8)	63 (61.2)	14 (13.6)	54 (52.4)[a]	21 (20.3)[a]	50 (48.5)	24 (23.3)	103 (100)
Apgar score at 1 minute				6.11±1.64[a]	7.27±1.53[a]	5.92±1.59[a]	6.33±1.95	5.69±1.75[a]	6.60±1.30	5.67±1.82[a]	6.76±1.36	6.37±1.63
Apgar score at 5 minutes				8.07±0.97	8.40±0.99	7.97±0.99[a]	8.04±1.27	7.85±1.12[a]	8.30±0.90	7.84±1.16[a]	8.35±0.75	8.15±1.01
Cesarean delivery		89 (59.3)[a]	19 (12.7)	111 (74.0)[a]	13 (8.7)	88 (58.7)[a]	18 (12.0)	76 (50.7)[a]	22 (14.7)	73 (48.7)[a]	29 (19.3)	150 (100)
Resuscitation at birth				18 (81.8)	0 (0.0)	16 (72.7)	3 (13.6)	18 (81.8)[a]	0(0.0)	17 (77.3)[a]	3 (13.6)	22 (100)
Disease of the infant	RDS			46 (80.7)[a]	6 (10.5)	40 (70.2)[a]	11 (19.3)	37 (64.9)[a]	11 (19.3)	34 (59.6)[a]	7 (12.3)[a]	57 (100)
	BPD							25 (59.5)[a]	7 (16.7)	25 (59.5)[a]	6 (14.3)	42 (100)
	PDA			31 (75.6)	1 (2.4)	24 (58.5)	6 (14.6)	20 (48.8)	4 (9.8)	18 (43.9)	10 (24.4)	41 (100)
	ROP							5 (83.3)	1 (16.7)	5 (83.3)[a]	0(0.0)	6 (100)
	IVH			24 (82.8)	3 (10.3)	19 (65.5)	7 (24.1)	15 (51.7)	8 (27.6)[a]	15 (51.7)	2 (6.9)[a]	29 (100)
	PVL					3 (33.3)	4 (44.4)[a]	3 (33.3)	5 (55.6)[a]	3 (33.3)	1 (11.1)	9 (100)
	Sepsis			23 (67.6)	5 (14.7)	19 (55.9)	9 (26.5)[a]	21 (61.8)[a]	6 (17.6)	18 (52.9)	4 (11.8)	34 (100)
Central catheterization				66 (71.7)	12 (13.0)[a]	55 (59.8)	16 (17.4)	47 (51.1)	14 (15.2)	45 (48.9)	14 (15.2)[a]	92 (100)
TPN duration (day)								16.23±18.83	8.50±8.10[a]	16.16±19.19	12.70±14.20	13.35±16.42
Phototherapy duration (day)				3.04±4.13[a]	1.40±2.03	3.22±4.14[a]	2.33±3.20	3.38±4.45	2.50±3.30	3.23±4.25	2.16±3.60	2.58±3.72
Antibiotics Tx. (day)								4.11±8.40[a]	1.90±3.50	4.09±8.69[a]	0.97±2.85[a]	2.49±6.26
Transfusion requirement				24 (85.7)[a]	3 (10.7)	21 (75.0)[a]	6 (21.4)	21 (75.0)[a]	4 (14.3)	20 (71.4)[a]	3 (10.7)	28 (100)
Maternal age (year)		33.39±5.07	33.32±4.28	33.39±4.69	33.47±4.07	33.67±4.44	33.63±5.45	33.37±4.87	32.4±5.1	33.83±5.01	32.65±4.80	33.34±4.84
Maternal pregnancy Cx.		24 (57.1)	5 (11.9)	28 (66.7)	5 (11.9)	23 (54.8)	4 (9.5)	22 (52.4)	4 (9.5)	20 (47.6)	7 (16.7)	42 (100)
Responder of parents	Mother	58 (51.3)	18 (15.9)	77 (68.1)	10 (8.8)	60 (53.1)	16 (14.2)	52 (46.0)	18 (15.9)	46 (40.7)	26 (23.0)	113 (100)
	Father	40 (63.5)	7 (11.1)	46 (73.0)	5 (7.9)	37 (58.7)	8 (12.7)	29 (46.0)	9 (14.3)	29 (46.0)	11 (17.5)	63 (100)

[a]p<.05; BPD, bronchopulmonary dysplasia; CNS, central nervous system; Cx., complications; GI, gastrointestinal; IVH, intraventricular hemorrhage; M, mean; PDA, patent ductus arteriosus; PVL, periventricular leukomalacia; RDS, respiratory distress syndrome; Resp., respiratory; ROP, retinopathy of prematurity; SD, standard deviation; TPN, total parenteral nutrition; Tx., treatment.

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Concerns about the CNS system were the second-most common type from before birth to before hospital discharge. Concerns about the CNS decreased after birth compared to those reported before birth (25 vs. 15 respondents, respectively; $p < .001$) (Figure 1). However, concerns about the CNS subsequently increased again to a level similar to that seen immediately before birth and before hospital discharge (Figure 1). Most of the parents of infants with a diagnosis of IVH or PVL before discharge also had significant CNS concerns (Table 2). Parents of infants with a gestational age of less than 32 weeks had the second-greatest concerns about the CNS before birth and at seven days after birth.

Table 3 shows that concern about the GI system was the second-most common at 1 week after discharge from the NICU and was compared to other organ systems. These concerns significantly increased after discharge compared to those before birth, after birth, 7 days after birth, and before discharge (37 vs. 10, 13, 22, and 21 respondents; $p < .05$) (Figure 1). As a result of analyzing the factors that increased concerns about GI problems during the post-hospital period, the gestational ages of the infants of parents with GI concerns (33.90±2.48 weeks) were significantly increased compared to those of the infants of parents who had other concerns (32.78±2.98 weeks; $p = .039$) (Table 3). Other significant factors included birth weights of ≥1,500 g ($p = .021$) and the absence of diagnoses of RDS ($p = .030$), ROP ($p = .014$), or IVH ($p = .007$) (Table 3). The duration of antibiotic treatment for infants whose parents had concerns about their GI systems was shorter than that of infants whose parents had concerns about other organ systems.

Table 3. Concerns of Parents about the GI System Compared to Those about Other Organ Systems at 1 Week after Hospital Discharge (*N*=176)

	GI system (n=37)	Other organ systems (n=139)	*p*
	n (%) or M±SD	n (%) or M±SD	
Gestational age (week)	33.90±2.48	32.78±2.98	.039
Birth weight (≥1,500 g)	34 (91.9)	109 (78.4)	.021
RDS	7 (18.9)	50 (36.0)	.030
ROP	0 (0)	6 (4.3)	.014
IVH	2 (5.4)	27 (19.4)	.007
Catheter insertion	14 (37.8)	78 (56.1)	.048
Antibiotic treatment (day)	0.97±2.85	2.89±6.84	.011

GI, gastrointestinal; IVH, intraventricular hemorrhage; M, mean; RDS, respiratory distress syndrome; ROP, retinopathy of prematurity; SD, standard deviation.

DISCUSSION

The parents of premature infants in this study were the most concerned about the respiratory system at all times from before birth to 1 week after NICU discharge to home, which was similar to the results of a previous study [18]. This concern was probably the greatest because proper breathing is the most crucial aspect for life after birth [21]. Moreover, no differences in responses existed between mothers and fathers in this study. Unlike the differences found between mothers and fathers in terms of emotional stress experienced by the parents of premature infants [7,15], it was evident that mothers and fathers shared the same medical health concerns during the current study. The existence of this similarity is plausible because it is generally well-known that proper breathing is the most important aspect of life after the birth of a premature infant [22]. Although cesarean delivery was one of the risk factors for respiratory system concerns throughout the study period, it was the only statistically significant risk factor for the existence of concerns regarding the respiratory system during the prepartum period. It is a commonly accepted fact that, compared with vaginal delivery, cesarean delivery is associated with greater risks for diseases related to respiration in newborns [23]. Furthermore, this is also due to the fact that cesarean delivery is the only factor among those considered that the general public can easily explore and understand through websites, books, or television programs that provide information about pregnancy and childbirth. Respiratory system concerns were also more common after birth among parents whose premature infants had birth weights <1,500 g or younger gestational ages. There was a significant increase in concerns compared to those present before birth because newborns with younger gestational ages at birth or lower birth weights are more likely to experience respiratory problems. In addition, there were clearly other common characteristics of preterm infants whose parents were concerned about respiratory problems, including lower 1- and 5-minute Apgar scores, a diagnosis of RDS, a diagnosis of BPD, and the need for blood transfusions. This result suggested that parents of premature infants with low gestational age or low birth weight were concerned about the respiratory system because their infants had experienced RDS immediately after birth, or had sometimes been diagnosed with BPD.

In this study, the second-most common concern was CNS disorders from before birth to before hospital discharge. In

previous studies [18], the second-most common parental concerns were focused on the CNS, cardiovascular system, GI system, and infection, and these varied according to time (with no significant differences among times). In the present study, the mean gestational age and mean birth weight were lower (33.0±2.9 weeks and 1,991.5±570.8 g) than the values reported by previous investigators (33.1±3.0 weeks and 2,124.4±685.1 g) [13]. Overall, the premature infants of parents who had CNS concerns had the lowest gestational ages; however, this trend was not statistically significant, and it was not affected by birth weight. Only the parents of premature infants diagnosed with brain abnormalities, such as IVH or PVL had statistically significant increases in CNS concerns. This result could be due to the bias caused by intervention by the medical staff because parental interviews were conducted due to the presence of brain abnormalities. However, this could also have occurred because the mothers were focused on the current conditions and future development of their infants [9,24], and because concerns about CNS disorders are naturally common among parents of premature infants. In addition, mothers who are aware of serious problems in their premature infants continue to experience guilt and worry about the health of their infants [9]. Concerns about CNS development are inevitable because of the long-term consequences.

When the gestational age was older and the infants had no disease specifically attributable to prematurity, concerns about the GI system were the second-most common health concerns among parents at 1 week after NICU discharge. This trend might have existed because changes in the health concerns of parents were similar to the changes in their emotions after hospital discharge [9,25,26]. When infants are in objectively good health, parents feed them directly and witness their development at home after discharge, unlike in the hospital. It was also evident that GI system concerns among parents increased as infants spent more of their time consuming formula or breast milk and sleeping; these are activities that parents directly engage in to support their fragile infants so that they can grow in good health at home. Therefore, parents had high levels of concern about the GI system related to feeding, in which the rate of parental involvement is high, even when their premature babies did not have any specific GI disease and had an older gestational age. It has been said that most of the reasons why late preterm infants are often readmitted within the first 7 to 10 days after discharge are problems related to feeding [27,28]. This could result in increased GI concerns during the post-discharge period. Under these circumstances, parents are mainly interested in factors related to infant nutritional status and follow-up care, with the expectation that their premature infants will develop normally after discharge [9].

Therefore, health care providers will be able to proactively provide psychological support, education, and intervention by offering GI-specific information and support during outpatient care of preterm infants, knowing that parents have concerns about the GI system after discharge. In addition, it would be valuable to conduct a clinical study to confirm the results of intervention when educational support regarding the development of the digestive system in premature infants and the prevention of digestive issues is prospectively provided to parents during neonatal transitional care in discharge education given the retrospective evaluation results of this study. After the most common type of concerns (regarding the respiratory system) was excluded, the next-most common concern varied for parents of premature infants at the time of discharge from the NICU. This result was significantly dependent on the gestational age at birth and the specific diseases diagnosed. This could be the result of the emotional changes that occur in mothers as their focus shifts from survival to caring for their physically frail infants at home after discharge [9]. Knowledge that the focus of the parents of premature infants changes over time, especially after NICU discharge, may be helpful when supporting parents with concerns after discharge and may improve outpatient follow-up care of premature infants. The long-term relief of parents' emotional and medical concerns might be achieved through additional research and analysis of changes in parents' concerns and identifying factors that affect these changes at milestones during the development of their premature infants.

In conclusion, proactive strategies are necessary to promote the growth and development of preterm infants and to meet parental healthcare needs for premature infants after NICU discharge. The level of preparation for the transition to home of a premature baby can impact parent and child survival and fitness. Healthcare professionals must provide education on respiratory and GI care during the transitional period during hospitalization before discharge because the growth and development trajectory of premature babies can be markedly different from those of a term infant and tailored support may be needed [29]. It is necessary to offer tailored education to parents based on the specific characteristics of their preterm infant, considering factors including ges-

tational age, birth weight, and CNS conditions. However, research on the supportive care needs and interventions for parents of preterm infants is insufficient in South Korea [15]. Therefore, we suggest the longitudinal assessment of specific needs based on the concerns of parents of premature infants from before birth to post-discharge, and the development and implementation of supportive interventions to meet those needs during each phase.

This study had several limitations. First, because this study only included participants from a single NICU and of a single ethnic group and because the distributions of gestational age and birth weight were not even among study participants, the study findings are not representative of the entire population. Second, memory bias might have influenced the results because parents of premature infants were asked to recall information about their health concerns. Finally, the number of participants was small; therefore, further large-scale studies are necessary.

CONCLUSION

Among parents of premature infants, the most common focus of medical concerns in the period from birth to 1 week after NICU discharge was the respiratory system. The second-most common focus of medical concerns after NICU discharge changed based on the gestational age and diseases of the premature infants. This information may help to increase the understanding of the health concerns of parents about their infants from before birth to after NICU discharge and how these concerns may change over time. Therefore, it is necessary to develop and implement supportive interventions to reduce parental anxiety when caring for their premature infants. In addition, it is essential to offer multidisciplinary interventions involving doctors, nurses, development experts, and others, to support the individual growth and development of preterm infants and to assist in managing complications.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

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

Funding

This study was supported by a grant from the Kosin University College of Medicine (2021). The funder had no role in the study design; in the collection, analysis, or interpretation of data; in the writing of the report; or in the decision to submit the article for publication.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

This study was supported by a grant from the Kosin University College of Medicine (2021).

Supplementary material

Supplement 1. Questionnaire

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):129-141
https://doi.org/10.4094/chnr.2024.011

pISSN 2287-9110
eISSN 2287-9129

CHNR

Factors influencing children's emotional and behavioral problems perceived by North Korean refugee mothers: a descriptive study

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Received: March 5, 2024
Revised: April 3, 2024
Accepted: April 8, 2024

Purpose: The study investigated the relationships between key variables, including the level of parenting knowledge, acculturative stress, depression, and the strengths and difficulties associated with their children's emotions and behavior, among North Korean refugee mothers who faced the challenging task of adapting to Korean society while raising their children. **Methods:** A descriptive study design was used. Data were collected from 130 North Korean refugee mothers between September and November 2023. **Results:** The participants had very limited parenting knowledge, and 82.3% of them scored 21 or higher on the depression scale used in community epidemiological studies. Higher levels of parenting knowledge and lower levels of depression were associated with lower levels of acculturative stress. Moreover, higher levels of depression were associated with more emotional and behavioral difficulties in children. Maternal depression, age, and employment status were identified as factors that influenced emotional and behavioral problems in preschool-aged children. **Conclusion:** These findings underscore the importance of providing parent education and mental health support programs for North Korean refugee families in order to improve parents' parenting skills and emotional well-being.

Keywords: Parenting; Depression; Problem behavior; Refugees; Democratic People's Republic of Korea

INTRODUCTION

Parenting knowledge refers to a mother's understanding of the realities of parenting [1]. During childbirth and child-rearing, it is crucial for mothers to be knowledgeable about their child's normal growth and development, as well as healthcare. A mother's parenting knowledge significantly influences her parenting behaviors and expectations, which in turn impact the child's development [2]. When a mother possesses accurate developmental knowledge about her child, she can better understand their behavior, engage with them effectively, and foster their development by setting realistic expectations for their abilities. Additionally, a mother's insight into her child's development enables her to apply appropriate parenting techniques and provide environmental stimulation that aligns with their developmental stage [3]. Knowledge about parenting is crucial for creating a high-quality parenting environment. Therefore, parenting knowledge plays a pivotal role in shaping maternal parenting behaviors and influencing children's development. It has also been reported that accurate parenting knowledge is linked to positive parenting behaviors and beneficially affects child development [4].

Women who defect from North Korea have been reported

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to face significant acculturative stress when integrating into South Korean society, resulting in specific psychological and mental symptoms such as post-traumatic stress disorder, depression, and anxiety [5,6]. North Korean refugee women often report conflicts with their children and difficulties in raising them within South Korean society. These challenges with their children are major factors affecting the acculturation of North Korean refugee women [7]. After entering South Korea, these women face various burdens, such as caring for or bringing their remaining family members, including children from North Korea or China, into the country. They also experience challenges in raising children and solving financial difficulties, all of which negatively impact their mental health [8]. Maternal psychological and emotional characteristics also play a significant role in children's development. It has been observed that mothers with unstable and depressive tendencies have lower levels of positive parenting attitudes, which they transmit to their younger children. This, in turn, leads to a variety of behavioral issues in these children and increases the likelihood of them mirroring their mothers' emotional tendencies [9].

Meanwhile, problem behavior in early childhood is a significant predictor of later maladaptive and regressive development. This term refers to behaviors that deviate from societal norms or are inappropriate for a specific environmental context [10]. Such behaviors are maladaptive and manifest across various developmental areas, including a child's physical, cognitive, emotional, moral, and social skills [11]. Problem behavior in young children is not confined to childhood alone but also affects subsequent developmental processes. Therefore, it is crucial to identify the causes early and prevent these behaviors at a young age [12]. To understand problem behaviors in children, it is essential to consider the environmental context in which the child is situated [13]. The most influential environments are typically the child's home and the parents. The parent who has the closest relationship with the child often has the most significant impact. Factors related to this parent are likely to play a crucial role [9]. It has been suggested that the psychological characteristics and environment of the parents are particularly significant for children in early childhood, as they develop social skills within their surrounding environment [14]. Thus, identifying the psychological characteristics of parents that influence a child's problem behavior is a critical aspect of understanding these issues [15].

North Korean refugee mothers often struggle to adjust to South Korean society and face challenges in raising their children [7]. These difficulties stem from cultural differences, psychological anxieties such as depression, and economic hardships. Unfortunately, these struggles can negatively impact their ability to effectively raise their children. Additionally, the stress caused by their unstable lives can lead to problematic behaviors in their children [16]. Therefore, this study aims to investigate the relationship between North Korean refugee mothers' caregiving knowledge and psychological characteristics, including acculturative stress and depression, and their children's problem behaviors. This research is particularly important as these mothers face the dual challenges of adapting to South Korean society and raising their children. It also aims to provide a foundation for developing programs that will assist North Korean women in overcoming psychological difficulties and raising healthy children. Furthermore, it seeks to support parents and family members in improving their mental health and aiding their psychological adjustment.

The objective of this study was to assess the parenting knowledge, acculturative stress, depression, and emotional and behavioral problems of preschool-aged children among mothers who have defected from North Korea. The findings will provide foundational information for developing an educational program aimed at promoting the healthy growth and development of their children. The specific objectives are as follows: 1) To assess the levels of parenting knowledge, acculturative stress, and depression among North Korean refugee mothers; 2) To identify the emotional and behavioral problems exhibited by children of North Korean refugee mothers; 3) To explore variations in parenting knowledge, acculturative stress, depression, and children's emotional and behavioral problems based on the general characteristics of North Korean refugee mothers; and 4) To analyze the factors influencing children's emotional and behavioral problems.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Hannam University (No. 2023-01-10-0804). Informed consent was obtained from all participants.

1. Study Design

This descriptive survey study examined the levels of knowledge about parenting, acculturative stress, depression, and children's emotional and behavioral problems among North Korean refugee mothers with preschool-aged children, and also analyzed the correlations between major variables. This study was reported according to the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [17].

2. Participants

The target population for this study consisted of North Korean refugee mothers registered at local community centers for North Korean refugees. Eligible participants were those who understood the study's aims, methods, and questionnaires, and who voluntarily agreed to participate. The selection criteria included: (1) women (over 18 years old) with preschool-aged children; (2) ability to communicate effectively; and (3) absence of chronic disabilities, diseases, or psychological issues. The sample size was determined to account for potential invalid data due to errors and omissions in self-report questionnaires. Using the G*Power 3.1 program, a sample size of 129 was calculated based on a significance level of .05, an effect size of .25, a power of .95, and the requirement of 4 predictors for regression analysis. To accommodate an anticipated dropout rate of about 10%, the sample size was adjusted to 142. Of the 142 North Korean refugee women who met the selection criteria, data from 130 respondents were analyzed. This analysis followed the exclusion of 12 questionnaires due to insincere survey responses.

3. Study Tools

1) Parenting knowledge

The parenting knowledge of North Korean refugee mothers was assessed using the same tool employed in a previous study by Lim [18]. This tool comprises 29 questions designed to evaluate personal knowledge regarding the emotional, cognitive, physical, and social development of infants and toddlers from birth up to 3 years of age. Each question is scored 1 for a correct answer and 0 for an incorrect one, allowing for a total score ranging from 0 to 29. Higher scores indicate a more comprehensive understanding of infant and toddler development. The reliability of the parenting knowledge scale from Lim's study [18] was determined using Cronbach's α, which yielded values of .57 for emotional development, .59 for cognitive development, .42 for physical development, and .42 for social development. Additionally, the overall reliability for all items, as measured by Cronbach's α, was .77. In the current study, the overall Cronbach's α improved to .85, with scores of .69 for emotional development, .61 for cognitive development, .66 for physical development, and .77 for social development.

2) Depression

The depression scale used in this study is the Center for Epidemiological Studies-Depression Scale (CES-D), a 20-item self-report screening tool originally developed by the National Institute of Mental Health in the United States. This scale has been adapted from the Korean revised version by Chon et al [19]. Participants rated the frequency of depressive symptoms they experienced over the past week using a 4-point Likert scale, which ranged from "extremely rarely (0 points)" to "almost every day (3 points)." Items 4, 8, 12, and 16 were reverse-scored due to their positive connotations. The total possible score on the scale ranges from 0 to 60, with higher scores indicating greater depression. Initially, a score of 16 or more was considered indicative of clinical depression, but community epidemiological studies in Korea have suggested a threshold of 21 or more [20]. Cronbach's α coefficients were .89 in both the original study by Chon et al. [19] and in the current study.

3) Acculturative stress

Acculturative stress was assessed using the acculturative stress scale for international students, originally developed by Sandhu and Asrabadi [21]. This scale was later modified and expanded by Lee [22] to comprise a total of 33 items. The instrument includes seven sub-scales: six items address perceived discrimination, four cover homesickness, five assess perceived hostility, three focus on culture shock, four relate to fear, two pertain to guilt, and nine items evaluate social isolation, inferiority, mistrust, communication, and other factors. Responses are recorded on a Likert scale ranging from 1 to 5. To avoid confusion, negative statements were rephrased as positive ones. The language of the scale was carefully chosen to resonate with the characteristics of the target audience. After modifications, the scales were reviewed and approved by an educator experienced with North Korea and North Korean refugees. Initially, the reliability of the scale was demon-

strated by a Cronbach's α value of .94; in this study, Cronbach's α was .83.

4) Emotional and behavioral problems of children

To measure children's emotional and behavioral problems, we used a parent-reported questionnaire known as the Korean version of the Strengths and Difficulties Checklist (SDQ-Kr) [23]. The SDQ-Kr scale comprises 25 questions, divided equally among five categories: prosocial behavior, hyperactivity, emotional symptoms, conduct problems, and peer problems. Prosocial behavior is categorized as a strength, whereas hyperactivity, emotional symptoms, conduct problems, and peer problems are considered difficulties. The term "hyperactivity" refers to traits such as an inability to stay still for extended periods or being easily distracted. "Emotional symptoms" encompass internalizing symptoms such as depression and anxiety. "Conduct problems" represent common externalizing issues closely associated with antisocial behavior in children and adolescents. "Peer problems" include challenges in forming peer relationships and experiences of rejection. Parents evaluate each item using a three-point rating scale: "not at all" (0 points), "somewhat true" (1 point), and "definitely true" (2 points), reflecting their child's behavior over the previous six months. The maximum total score for strengths is 10 points, with higher scores indicating more positive behavior. Conversely, the maximum possible total score for difficulties is 40 points, with each difficulty subscale having a maximum of 10 points. For difficulties, lower scores here suggest more favorable behavior. The SDQ-Kr is designed to be unaffected by the educational level of the parents, as it employs short and straightforward sentences. The reliability of the tool was initially established with a Cronbach's α of .74, and in this study, Cronbach's α was .87.

4. Data Collection

Data were collected through self-report questionnaires between September and November 2023. Prior to data collection, permission was obtained from the heads of the South-North Hana Centers, a network that provides medical counseling and resettlement support to North Korean refugees, after explaining the purpose of the study. Participants were recruited through both online and offline posters. Participants' identities were not disclosed to the heads of the individual centers, and the survey was conducted in the conference or counseling rooms of each center with the assistance of staff members. The purpose of the study, participant anonymity and confidentiality, the use of survey results for academic purposes only, and the participants' right to withdraw from the study at any time were explained to the women. The questionnaires were distributed by the principal investigator and a pre-trained assistant, who then immediately retrieved the completed questionnaires. If the participants needed assistance in filling out the questionnaire, the research director or assistant provided help. The questionnaires were collected immediately after completion, and each participant was informed that they could withdraw from the survey without any disadvantages. It took approximately 20 minutes to complete the questionnaire. Each participant received a small token of appreciation after completing the questionnaire.

5. Data Analysis

The data were analyzed using SPSS version 23.0 (IBM Corp.). Differences in the dependent variables (knowledge of parenting, acculturative stress, depression, and emotional and behavioral problems of children) according to the general characteristics of the mothers were presented as frequency, percentage, mean, and standard deviation. Analysis of variance and the Scheffé test were used to determine the relationships between the dependent variables. Pearson correlation coefficients were used to analyze intervariable correlations. Time series regression was conducted to identify the factors that influence children's emotional and behavioral problems.

RESULTS

1. Participants' General Characteristics and Differences in Variables according to General Characteristics

Almost half (47.7%) of the participants were aged 31 to 40 years, 39.2% were aged 41 years or older, and 13.1% were aged 30 years or younger. In terms of education, 62.3% had completed high school or junior high, while 25.4% held a college or university degree or higher. Employment status showed that 57.7% were unemployed or on leave, 32.3% were employed part-time, and 10.3% were full-time workers. Regarding duration of residence in the country, 11.5% had been there for 5 years or less, 56.2% for 5 to 10 years, and 32.3% for more than 10 years. Family composition was as fol-

lows: 54.6% had one child, 37.7% had two children, and 7.7% had three or more children. Additionally, 52.3% were single-parent families, 36.2% were nuclear families, and 11.5% were extended family members living alone or with parents. A substantial proportion (82.3%) scored 21 or higher on the CES-D, indicating clinical depression.

The scores for children's emotional and behavioral strengths differed by participants' age. Although the significance of the relationship with the age group was not confirmed in post hoc testing, the scores for children's emotional and behavioral strengths were significantly higher in the 30 years and under age group (F=4.91, p=.009). The scores for children's emotional and behavioral difficulties were significantly different by participants' age and occupation. The significance of the relationship with age group was not confirmed in post hoc testing, but the score for children's emotional and behavioral difficulties was significantly higher in the 41 years or older age group (F=5.57, p=.005), as well as in the part-time and unemployed or off-work groups compared to the full-time group (F=6.19, p=.003) and in participants with a CES-D score above the cutoff of 21 (t=–2.68, p=.008) (Table 1).

2. Parenting Knowledge, Depression, Adjustment Stress, and Children's Emotional and Behavioral Problems (Strengths/Difficulties)

The average score for participants' parenting knowledge was 12.50±4.03 out of 29 points. In terms of sub-areas, physical development had the highest item-level mean of 0.55±0.24 out of 1 (total subscale score: 2.19±0.97), followed by emotional development with an item-level mean score of 0.48±0.20 out of 1 (total subscale score: 3.83±1.64), cognitive development with an item-level mean score of 0.43±0.20 out of 1 (total subscale score: 3.46±1.56), and social development with an item-level mean score of 0.34±0.17/1 (total subscale score: 3.05±1.50).

A high proportion of participants (82.3%) exceeded the

Table 1. General Characteristics, Differences in Children's Emotional and Behavioral Problems (Strengths/Difficulties) according to General Characteristics (*N*=130)

Variables	Categories	n (%)	Children's emotional and behavioral problems (strengths)		Children's emotional and behavioral problems (difficulties)	
			M±SD	t/F or χ^2 (p)	M±SD	t/F or χ^2 (p)
Age[a] (year) (20.0–55.0)	≤30	17 (13.1)	4.88±2.20	4.91 (.009)	15.82±3.80	5.57 (.005)
	31–40	62 (47.7)	3.95±1.81		13.87±4.47	
	≥41	51 (39.2)	5.02±1.86		16.67±4.74	
Education level	≤Elementary school	16 (12.3)	4.07±1.88	1.88 (.157)	14.94±4.15	0.06 (.946)
	Middle-high school	81 (62.3)	4.36±2.06		15.32±4.36	
	≥College or University	33 (25.4)	5.03±1.57		15.12±5.64	
Employment	Employees (including blue-collar workers, office workers, and professional workers)	13 (10.0)	5.38±1.45	1.60 (.206)	11.08±3.88[a]	6.19 (.003) a<b
	Part-time	42 (32.3)	4.48±1.82		15.64±3.94[b]	
	Unemployed or leave of absence	75 (57.7)	4.35±2.06		15.71±4.84[b]	
Duration of residency in South Korea[b] (month) (25–241)	≤60	15 (11.5)	5.00±2.04	2.25 (.109)	14.80±3.84	2.49 (.087)
	>60, ≤120	73 (56.2)	4.18±1.89		14.56±4.65	
	>120	42 (32.3)	4.86±1.95		16.52±4.76	
Number of children	1	71 (54.6)	4.54±1.95	0.24 (.786)	15.39±4.57	1.44 (.241)
	2	49 (37.7)	4.37±1.90		14.57±4.77	
	≥3	10 (7.7)	4.80±2.25		17.20±4.49	
Family type	Nuclear family	47 (36.2)	4.38±1.88	2.18 (.118)	14.19±4.36	1.85 (.162)
	Single-parent family	68 (52.3)	4.35±1.91		15.85±4.75	
	Others (extended family or single-person household)	15 (11.5)	5.47±2.10		15.60±4.87	
Depression score	≤20	23 (17.7)	4.74±2.07	0.67 (.504)	12.91±5.04	-2.68 (.008)
	≥21	107 (82.3)	4.44±1.92		15.72±4.44	

[a]M±SD: 39.81±7.37 years; [b]M±SD: 104.12±45.01 months; M, mean; SD, standard deviation.

depression threshold of 21 or above on the CES-D instrument. The participants' acculturative stress was measured at 105.44±10.46 out of a possible 165 points, which corresponds to 3.20±0.32 on a 5-point scale. Among the sub-scales, nostalgia scored the highest at 3.85±0.79, followed by guilt at 3.37±0.61. Other categories included social isolation or feelings of inferiority at 3.21±0.44, perceived discrimination at 3.10±0.43, fear at 2.97±0.48, and culture shock at 2.96±0.58.

The score for children's emotional and behavioral strengths was 4.49±1.94 out of 10, equivalent to 2.96±0.56 on a 5-point scale. The score for children's emotional and behavioral difficulties was 15.22±4.66 out of 40, with an average of 3.80±1.17. The sub-scores included 4.63±1.52 for hyperactivity, 3.99±1.28 for peer problems, 3.53±1.99 for emotional symptoms, and 3.07±1.28 for behavioral problems. Parents reported that their children were most likely to be distracted or unable to sit still for extended periods (Table 2).

3. Relationships among Parenting Knowledge, Depression, Acculturative Stress, and Children's Emotional and Behavioral Problems (Strengths/Difficulties)

The following correlations were found among the main variables: parenting knowledge had a negative correlation with acculturative stress (r=–.24, p=.006), depression had positive correlations with acculturative stress (r=.35, p<.001) and children's emotional and behavioral difficulties (r=.38, p<.001), and children's emotional and behavioral strengths had a negative correlation with acculturative stress (r=–.33, p<.001). In other words, higher parenting knowledge and lower depression were associated with lower acculturative stress. Lower maternal acculturative stress was associated with higher scores for children's emotional and behavioral strengths, and lower depression was associated with lower infant emotional behavior difficulties (Table 3).

4. Factors Influencing Children's Emotional and Behavioral Problems (Difficulties)

To investigate the factors influencing children's emotional and behavioral problems, we conducted an analysis using various variables. The primary variable, depression, was included along with age and employment status (represented as dummy variables), which exhibited significant variations in general characteristics. In testing the basic assumptions of regression analysis, we checked for residual autocorrelation, residual normality and linearity (using normality P-P plots

Table 2. Parenting Knowledge, Depression, Acculturative Stress, and Children's Emotional and Behavioral Problems (Strengths/Difficulties) (*N*=130)

	Categories	M±SD	Range (Min–Max)	Item M±SD
Parenting knowledge	Total (29)	12.50±4.03	3–21	0.43±0.14
	Emotional development	3.83±1.64	0–8	0.48±0.20
	Cognitive development	3.46±1.56	0–7	0.43±0.20
	Physical development	2.19±0.97	0–4	0.55±0.24
	Social development	3.05±1.50	0–7	0.34±0.17
Depression	Total (20)	28.01±8.80	4–53	1.40±0.44
Acculturative stress	Total (33)	105.44±10.46	69–125	3.20±0.32
	Perceived discrimination	18.65±2.58	11–25	3.10±0.43
	Homesickness	15.39±3.17	7–20	3.85±0.79
	Perceived hostility	14.98±2.16	10–20	3.00±0.43
	Fear	8.90±1.45	5–13	2.97±0.48
	Culture shock	11.85±2.31	5–17	2.96±0.58
	Guilt	6.74±1.23	2–10	3.37±0.61
	Others (social isolation and inferiority, mistrust, and communication)	28.92±3.97	15–37	3.21±0.44
Children's emotional and behavioral strengths (5)	Prosocial behavior	4.49±1.94	0–9	4.49±1.94
Children's emotional and behavioral difficulties (20)	Hyperactivity	4.63±1.52	0–9	
	Emotional symptoms	3.53±1.99	0–11	
	Conduct problems	3.07±1.55	0–7	
	Peer problems	3.99±1.28	1–8	
	Difficulties total	15.22±4.66	4–28	3.80±1.17

M, mean; SD, standard deviation.

Table 3. Correlations among Parenting Knowledge, Depression, Acculturative Stress, and Children's Emotional and Behavioral Problems (Strengths/Difficulties) (*N*=130)

	Parenting knowledge	Depression	Acculturative stress	Children's emotional and behavioral strengths
	r (*p*)			
Depression	–.12 (.181)			
Acculturative stress	–.24 (.006)	.35 (< .001)		
Children's emotional and behavioral strengths	.10 (.257)	.01 (.872)	–.33 (< .001)	
Children's emotional and behavioral difficulties	.07 (.404)	.38 (< .001)	.12 (.177)	.14 (.118)

and histograms), and the homogeneity of residuals (using scatter plots). Additionally, the tolerance for checking multicollinearity of errors in this study's model ranged from .53 to .91, with a variance inflation factor between 1.01 and 2.94, well below the threshold of 10. This confirmed that the basic assumptions were met. However, the residual autocorrelation revealed a Durbin-Watson statistic of 1.53. Therefore, a time series regression analysis was conducted. The Ljung-Box Q (18) for the model yielded a value of 24.65 with a significance probability of .103, indicating the absence of autocorrelation in the residuals and confirming the model's significance. The combined effects of depression, age, and employment status (part-time, unemployed, or on leave) accounted for 30.0% of the emotional and behavioral problems observed in children. In other words, we found that parents who experienced higher levels of depression, were older, and worked part-time were more likely to have children with emotional and behavioral problems (Table 4).

DISCUSSION

This study investigated the knowledge and psychological characteristics of North Korean refugee mothers, particularly in relation to their care for infants and toddlers. These mothers confront the dual challenge of adapting to South Korean society and raising children. Additionally, the study examined how acculturative stress and depression affect the emotional and behavioral problems in children, with a specific focus on difficulties.

The participants' parenting knowledge scored 12.50 out of a total of 29 points. The assessed sub-domains included physical development (0.55 points), emotional development (0.48 points), cognitive development (0.43 points), and social development (0.34 points). In a previous study [18], the group that participated in parent education scored 18.88 points, while the group that did not participate scored 17.32 points. These scores were higher than those obtained in this study, indicating that the parenting knowledge of North Korean refugee mothers was lower than that of South Korean mothers.

Research suggests that knowledgeable parents are more adept at creating environments that cater to their children's abilities and fostering healthy development [2]. They are also better at recognizing early signs of mental delays or abnormalities, enabling timely interventions that are vital for the overall health and prevention of diseases in children [24]. Therefore, improving parental knowledge about child-rearing can significantly contribute to the normal growth and development of children. It is advisable for parents to receive education during regular visits throughout the pregnancy and childbirth process to ensure they have access to accurate information about child development.

In this study, the average depression score among the participants was 28.01 out of 60. Using 21 points as the threshold, 82.3% of the participants were classified as depressed, a significantly higher percentage compared to a previous study [25], where only 33.5% of female marriage immigrants were classified as such. Furthermore, when using a threshold of 16 points, the depression score among mothers of young children in certain regions of Korea reached 93.1%, far exceeding the 37.8% observed among all mothers [26]. According to research by Lee and Kim [27], which analyzed depression levels in 1,332 mothers over 5 years, 59.9% of those in the 'risk of depression' group experienced depression at least once within the first 5 years postpartum, with the prevalence increasing annually. Raising infants and young children significantly limits personal freedom, affecting interpersonal relationships and hobbies, and can lead to feelings of burden, psychological frustration, or depression. Additionally, the physical demands of childcare, such as caring, monitoring, putting to sleep, waking, feeding, and dressing children, predominantly fall on mothers, significantly influencing their mental health [28]. For mothers who defected from North Korea, the participants of this study, the dual burden of motherhood,

Table 4. Time Series Regression of Variables Influencing Children's Emotional and Behavioral Problems among North Korean Refugee Mothers (*N*=130)

Variables	B	SE	t	*p*	Ljung-Box Q (18)			R^2
					F	df	*p*	
AR (1)	0.24	0.09	2.70	.008	24.65	17	.103	.30
Depression	0.18	0.05	4.09	<.001				
Age	0.12	0.05	2.31	.023				
Employment (ref.: full-time or self-employed)[a]								
Part-time	3.54	1.25	2.83	.005				
Unemployed or on leave	4.29	1.17	3.68	<.001				

[a]Dummy variable; AR, autoregression; SE, standard error.

compounded by the unique challenges faced by North Korean refugees, is presumed to have a significant impact on their depression levels. Depressed mothers may become insensitive to their children's cues and react helplessly, or they might display overly strict or controlling behaviors, complicating smooth interactions. Specifically, depression in mothers of young children affects not only the child's physical and mental development and academic performance but also their readiness for school during the preschool years [29]. Therefore, there is a pressing need for programs aimed at reducing and preventing depression among women with preschool-aged children. The presence of multiple and unique environmental stressors can heighten women's vulnerability to depression. These stressors include poverty, discrimination, multigenerational exposure to poor housing, limited access to healthcare, and unequal access to resources that facilitate social mobility [9]. When these are combined with strained relationships with young children, the impact can be even more profound. To tackle this issue, it is essential to provide education and programs for women with preschool children, focusing on reducing depression and enhancing their understanding of the condition. Additionally, these women require a support system that can effectively treat depression when it arises and assist them in learning preventive measures for their mental health.

Participants experienced acculturative stress, with a mean score of 3.20 out of 5. The sub-domains had varying scores: 3.85 for nostalgia, 3.37 for guilt, 3.21 for other social isolation or feelings of inferiority, 3.10 for perceived discrimination, 2.97 for fear, and 2.96 for culture shock. These scores were similar to the overall average score of 3.35 in a previous study by Lee et al. [6], but there were differences in the sub-domains. Nostalgia had the highest score (3.85 points) in the previous study [6] but the lowest score in this study (2.84 points). Additionally, the previous study found higher scores for perceived hostility, discrimination, culture shock, and fear, whereas in this study, only guilt and other social isolation and inferiority categories showed slightly higher than average scores.

In the past, there was a lack of social acceptance and understanding toward North Korean refugees and immigrants due to insufficient multicultural policies. However, as Korean society has begun to emphasize multicultural values, discrimination and hostile attitudes have decreased, leading to a shift in perceptions toward North Korean refugees and immigrants. It is believed that their perceived hostility and sense of discrimination have also diminished. According to the 2023 North-South Social Integration Survey [30], 16.1% of respondents reported experiences of discrimination or being ignored, marking a 3.4 percentage point decrease from 2022. This result indicates that 24.4% of people experienced discrimination in 2016, with a steady decline observed since then. Rather than quickly adapting to new cultures and values, there appears to be an increase in longing for one's hometown. The acculturation stress experienced by parents from multicultural families often makes it challenging to provide appropriate attention and support to their children. This stress can lead to a neglectful parenting attitude and hinder their children's adaptation to school life by making it difficult to gather education-related information and guide their learning [31]. Therefore, it is crucial to actively intervene and provide support to North Korean mothers to facilitate their acculturation and ensure the well-being of their children.

The score for children's emotional and behavioral strengths was 4.49 out of 10, while the difficulty score was 15.22 out of a possible 40 points (average 3.80). The sub-scales had the following scores: 4.63 for hyperactivity, 3.99 for peer problems, 3.53 for emotional symptoms, and 3.07 for conduct. A study by Yang and Yim [32] using the same tool reported a strength score (socially oriented behavior) of 7.09 for Korean preschool children aged 4 to 6 years and 6.66 for children from multicultural families. For difficulties, the average

scores were 2.13 for Korean preschool children and 2.39 for children from multicultural families. These differences indicate that North Korean refugee mothers in this study perceived their children's strengths as lower and difficulties as higher compared to the previous study [32]; however, caution is advised in interpretation. Although a higher total difficulty score suggests psychosocial problems, it does not alone justify whether psychotherapy is needed [33]. Immigrant parents may retain cultural influences from their countries of origin, which could affect how they report on their children's behavior, potentially due to differing social norms [34]. This is because expectations for child behavior and developmental milestones vary, and the likelihood of reporting problem behaviors may depend on the social desirability of those behaviors [35]. Research focusing on diverse global populations is still limited, making it difficult to confirm cultural differences. In the future, if norms vary across countries, comparing respondents to each country's norm scores and calculating a weighted norm score from these may offer more meaningful insights. This approach is relevant because psychosocial functioning is known to vary by country and culture [36]. In our study, despite potential differences in parental response styles and social norms, the use of the SDQ-Kr, a widely recognized tool for mental health screening, allows for meaningful comparisons among North Korean refugees. Future studies will be necessary to confirm these findings.

Additionally, this study found that the children's emotional and behavioral strengths varied based on the general characteristics of the participants, specifically maternal age. Mothers under 30 years of age reported higher levels of emotional and behavioral strengths in their children, while mothers over 40 years of age reported significantly higher scores for emotional and behavioral difficulties. Specifically, mothers under 30 years gave higher ratings for socially oriented (prosocial) behavior and lower ratings for hyperactivity, depression, anxiety, behavior, and peer problems. This suggests that even among the same group of North Korean refugees, there are differences based on age. It can also be inferred that there are differences in norms and parenting values between different generations, especially among mothers over 40 years. Moreover, the study revealed a significant difference in the child's scores for emotional and behavioral difficulties based on the mother's occupation. Scores were significantly higher among children of mothers who were part-time workers, unemployed, or on leave, compared to those whose mothers worked full-time. These findings support previous research suggesting a correlation between children from economically disadvantaged families and emotional issues [37]. It is speculated that North Korean mothers who are unemployed or on leave may experience higher levels of stress and distress due to their unstable financial situation. Additionally, mothers who are unemployed or on leave may be more attuned to their children's emotional and behavioral problems because they spend more time with them compared to mothers who work full-time.

The correlations between the main variables observed in this study suggest that greater parenting knowledge and lower depression are linked to lower acculturative stress. Furthermore, lower maternal acculturative stress was found to be correlated with greater emotional and behavioral strength in children, while lower depression was associated with lower scores for emotional and behavioral difficulties. These findings are consistent with previous research [16,38], which identified a positive correlation between maternal depression and externalizing problem behaviors in preschool children.

Furthermore, higher parental knowledge of child development and parenting practices has been shown to significantly reduce reported child maltreatment 3 to 5 years later, improve children's behavioral problems, and decrease maternal anxiety and depression [39]. Additionally, a study involving Syrian refugees in Lebanon demonstrated that increased stress due to poverty, inadequate housing, and other environmental stressors resulted in negative changes in child-rearing practices and heightened behavioral and emotional problems in children, corroborating earlier findings [40]. Given that adapting to South Korean society can increase the psychological burden, there is a need for intervention measures to improve the parenting knowledge of North Korean refugee mothers and to alleviate their acculturative stress.

Several previous studies have shown that maternal depression is highly correlated with infant problem behavior. Specifically, maternal depression is a significant positive predictor of children's problem behavior [9,14]. This study also identified depression as a significant predictive factor for children's emotional and behavioral problems, reinforcing earlier research findings. Previous research has indicated that mothers with high levels of depression tend to exhibit less responsive and nurturing parenting behaviors towards their children. This, in turn, contributes to the development of externalizing and internalizing problem behaviors in their chil-

dren [9,16]. Therefore, it is crucial to provide support for the psychological health, including depression, of North Korean refugee mothers. However, this study did not observe the impact of acculturative stress experienced by mothers on the emotional and behavioral problems of their children, contrary to the findings of previous research [16]. The length of time since the participants arrived in South Korea ranged from 2 years to over 10 years. As individuals adapt to South Korean society, their perception of children's issues may also evolve. Additionally, the relationship between acculturative stress and children's behavioral problems may be influenced by the varying lengths of time mothers have spent in South Korea. These findings should be further examined in future replication studies.

In terms of general characteristics, children whose mothers were older and either employed part-time, unemployed, or on leave exhibited higher scores for emotional and behavioral difficulties compared to those whose mothers worked full-time or were self-employed. Older mothers might be less engaged in economic or social activities than their younger counterparts. Furthermore, older mothers may face physical or mental constraints that hinder their ability to care for their children effectively. This could lead to insufficient supervision or educational support, thereby increasing the likelihood of emotional and behavioral difficulties in children.

Moreover, more than 70% of North Korean refugees are women, many of whom are single mothers. These mothers face numerous challenges in raising their children [6,7]. North Korean refugee women who have endured prolonged periods of living on the run, along with experiences of marriage and childbirth, may face significant career interruptions and attrition. Upon resettlement in South Korea, they often confront an unstable labor market characterized by limited job opportunities due to their lack of skills. Consequently, the harsh realities of employment and economic instability [30] can lead to stress in their daily lives and in parenting, potentially affecting their children's emotions and behaviors.

It is crucial for North Korean refugees to integrate quickly into our society and establish stable family lives and economic activities to become independent members of society. Providing a foundation for stable settlement and independence for women refugees ensures that their children are neither neglected nor marginalized. These children will grow up with the appropriate protection of their parents and society, become active members of society, and shape the future era of unification. Therefore, it is necessary to develop specific and systematic policies that address the needs of North Korean refugees.

The limitations of this study and suggestions for follow-up research are as follows:

First, this study focused exclusively on parents with infants and toddlers aged 1 to 6 years. Consequently, future research should explore differences among parents of infants under 1 year old, who are at a higher risk of developing postpartum depression. Second, one of the measurement tools used in this study assessed parenting knowledge, which gauges an individual's understanding of the emotional, cognitive, physical, and social development of infants and toddlers from birth to age 3 years. However, gathering data from mothers of 36-month-old infants and toddlers proved challenging. Therefore, we expanded the scope of the measure to include mothers of children up to 5 years old. Although this approach does not reflect the current ages of their children, it remains a valuable resource for policy development, especially considering the ongoing influx of North Korean women into the country. For instance, it can enhance parenting education programs for North Korean women by assessing their knowledge levels and identifying areas where they lack information, which may affect their future decisions regarding childbearing and parenting. Third, this study did not consider various factors such as the unique circumstances and living environments of North Korean defectors, as well as the personality and temperament traits of their children. As a result, the potential influence of these external variables on their children's problem behaviors was not taken into consideration.

In light of these points, we propose the following suggestions. First, more in-depth qualitative research is required to better understand the emotional and behavioral problems of children from North Korean refugee families. Second, it is essential to examine not only the home environment but also factors such as counseling, psychological support, policies, and other forms of social support to determine their influence on the emotional and behavioral problems of these children. Furthermore, it is crucial to develop and evaluate practical interventions and support programs based on the findings of this research.

CONCLUSION

This study investigated the relationship between parenting knowledge, acculturative stress, and depression, and chil-

dren's emotional and behavioral strengths and difficulties in North Korean refugee mothers with preschool children.

The participants demonstrated notably low parenting knowledge, with an average score of 12.50 out of 29. Their depression scores averaged 28.01 out of 60, with 82.3% of participants scoring 21 or higher, a threshold for depression as suggested by community epidemiological studies. The acculturative stress score among the participants was 105.44 out of 165. Regarding the children's emotional and behavioral assessments, the strength score was 4.49 out of 10, and the difficulties score was 15.22 out of 40. The findings indicated that higher parenting knowledge and lower depression levels were linked to reduced adaptive stress. Furthermore, lower acculturative stress in mothers correlated with higher emotional and behavioral strength scores in their children. Conversely, higher maternal depression was associated with increased emotional and behavioral difficulties in children. The study also identified maternal depression, age, and employment status as significant factors influencing emotional and behavioral issues in preschool children. Given the significant role of depression in the development of emotional and behavioral problems in children, especially in economically unstable families, it is essential to improve parenting skills and emotional stability among parents in North Korean refugee families. This improvement can be facilitated through targeted parent education and mental health support programs. Implementing such measures is crucial for promoting the healthy growth and development of children in these families.

These findings emphasize the importance of improving parenting skills and emotional stability among parents through educational programs and mental health support for North Korean refugee families. It is also essential to explore methods to bolster social and economic support for mothers and to alleviate stress in the home. Furthermore, this study emphasizes the necessity of early identification of emotional and behavioral problems in children, which can have enduring adverse effects, and highlights the critical need for interventions and support to mitigate behavioral difficulties.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

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

Funding

This study was supported by a National Research Foundation of Korea (NRF) grant funded by the Korean government (No. NRF-2023R1A2C1006197).

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):142-153
https://doi.org/10.4094/chnr.2024.012

pISSN 2287-9110
eISSN 2287-9129

CHNR

Developing a pediatric nursing simulation scenario template in South Korea: applying real-time Delphi methods

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Received: March 19, 2024
Revised: April 15, 2024
Accepted: April 21, 2024

Purpose: This study aimed to describe the process of developing a validated pediatric nursing simulation scenario template using the real-time Delphi method. **Methods:** A panel of 13 pediatric nursing experts participated in a real-time Delphi survey conducted over two rounds. Initially, 83 items were included in the questionnaire focusing on the structure and content of the simulation scenario template. Data analysis involved calculating the content validity ratio (CVR) and the coefficient of variation to assess item validity and stability. **Results:** Through iterative rounds of the Delphi survey, a consensus was reached among the experts, resulting in the development of a pediatric nursing simulation scenario template comprising 41 items across nine parts. The CVR values ranged from 0.85 to 1.0, indicating a high consensus among experts regarding the inclusion of all items in the template. **Conclusion:** This study presents a novel approach for developing a pediatric nursing simulation scenario template using real-time Delphi methods. The real-time Delphi method facilitated the development of a comprehensive and scientifically grounded pediatric nursing simulation scenario template. Our template aligns with the International Nursing Association for Clinical Simulation and Learning standards, and provides valuable guidance for educators in designing effective simulation scenarios, contributing to enhanced learning outcomes and better preparation for pediatric clinical practice. However, consideration of cultural and contextual adaptations is necessary, and further research should explore alternative consensus criteria.

Keywords: Education, nursing; Simulation training; Delphi technique

INTRODUCTION

Simulation education enables repeated learning in a safe environment similar to clinical situations, allowing for the experience of serious and rare clinical situations without risking humans [1]. This educational method is effective in improving clinical performance abilities, clinical reasoning capacities, and nursing practitioners' confidence [2]. Especially in situations where direct patient care in clinical settings is limited, simulation education plays an essential role in enhancing knowledge, skills, and decision-making abilities [3]. In simulation education, students repeatedly learn various complex scenarios, and the process of giving and receiving feedback through debriefing can enhance their learning outcomes [4]. This process develops the competencies needed in situations similar to real clinical environments and prepares them for actual patient care [3].

In recent years, owing to the impact of low birth rates, the number of births in 2022 has decreased to 249,000 in South Korea, a 4.4% decrease compared with that in 2021 [5]. This

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rapid decline in the number of births has affected opportunities in pediatric nursing practice and education. Moreover, the emergence of various new infectious diseases like the coronavirus disease-19 (COVID-19), has increased the risk of infection, limiting pediatric nursing practice [6]. In this context, simulation education has been established as a method that provides students with the opportunity to experience various clinical cases and effectively acquire the skills and knowledge necessary for patient care [7].

Simulation education programs in the fields of medicine and nursing, which began in the 1960s, have significantly evolved since then [8]. During this development, simulators for teaching cardiopulmonary resuscitation became widespread as an example, bringing revolutionary changes to medical and nursing education [8]. In particular, pediatric nurses require a high level of flexibility and rapid response capabilities to address the diverse and complex health conditions and clinical situations that arise during a child's growth and development process [9]. Children may experience physical and mental health issues at different stages of development that demand special attention and a professional approach to pediatric nursing practice [9]. As a key strategy to meet these demands, simulation education supports better preparation for complex challenges encountered in pediatric nursing [7].

The components of simulation education generally include educational goals, reproducibility, complexity, cues, and debriefing [10]. This necessitates clear educational objectives to maximize learners' educational effects. Reproducibility and complexity are related to the range of education that realistically represents simulation, which should be planned from simple to complex [4]. Cues are information provided by instructors to help students effectively approach simulation scenarios, and debriefing is the process of critically thinking and discussing complex situations with each other, connecting theory, practice, and research for students' positive experiences and learning effects. The most significant learning effects can be obtained in this area, including nursing knowledge and technical aspects, learner satisfaction, and improvement in critical thinking and confidence [11].

A well-designed template is crucial for effective implementation of the core components of simulation education. The International Nursing Association for Clinical Simulation and Learning (INACSL) emphasizes the importance of evidence-based design templates that educators can use to effectively design simulation scenarios in their standard guidelines. Such templates assist in standardizing the simulation process and ensuring consistent quality and evidence-based approaches during scenario composition and implementation by educators [12].

However, owing to the absence of universal and effective tools currently used for scientifically validating and evaluating scenarios [13], it is challenging to identify the essential components of a scenario and determine an ideal template structure. The standards and guidelines provided by the INACSL for clinical simulation and learning offer a crucial framework for developing and evaluating pediatric nursing simulation scenarios. However, they do not completely resolve the differences in components and expressions across various scenarios [14]. In addition, although some studies have emphasized the importance of pediatric simulation-based education [9], there has been no research on the development of standardized simulation scenario templates for pediatric nursing.

Therefore, efforts are needed to ensure the consistency and standardization of scenario templates for effective learning and assessment. This includes setting objectives that consider learners' levels, verifying the authenticity of patient information, and concretizing effective debriefing and feedback. Additionally, according to previous studies, although simulation education is spreading globally, many scenarios published in various countries do not fully comply with the INACSL's standard guidelines. In particular, the template elements analyzed according to the INACSL standards show differences in the order and expression of components and sub-elements in various scenarios, indicating limitations in ensuring consistency [15].

To address these issues, the real-time Delphi method can play a crucial role in integrating the opinions of various experts to determine the key components and structure of the template. This approach contributes to determining a balance between educational value and practical feasibility by deriving a broad consensus among experts [16]. This process will allow the development of scientifically validated, realistic, and educationally effective pediatric nursing simulation templates by reconciling differences in opinions during the scenario development process.

The real-time Delphi method enables the collection and analysis of panel members' opinions through rounds of real-time feedback based on the initial responses of the expert panel [17]. This process ultimately leads to more precise decision-making, playing a pivotal role in the development of

pediatric nursing simulation templates. Consequently, this study aimed to use the real-time Delphi method to assemble a panel of experts in pediatric nursing to develop a simulation template. Through this process, it is anticipated that a fundamental structure for pediatric nursing simulations can be established by applying an evidence-based process as the basis for scenario development.

This study describes the process of developing a pediatric nursing simulation template using a real-time Delphi technique.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of the Gangneung-Wonju National University (No. GWNUIRB-2023-11). Informed consent was obtained from all participants.

1. Study Design

This study employed a real-time Delphi survey to develop a pediatric nursing simulation template. This involved gathering and reaching a consensus among expert panel opinions. Reporting of this study was based on the Conducting and Reporting Delphi Studies (CREDES) guidelines [18].

2. Development of Questionnaire

To construct a pediatric nursing simulation scenario template, a content analysis of the scenarios developed for current pediatric nursing simulations was conducted [15]. For directed qualitative content analysis, 32 pediatric patient nursing simulation scenarios were collected and analyzed using the PRISMA 2020 method. Additionally, content analysis was performed based on the INACSL protocol to analyze the contents of the scenarios. The study results led us to establish preliminary principles for developing essential components and contents guided by the INACSL Standards of Best Practice: Simulation. The "*INACSL Standards of Best Practice: Simulation*" is publicly available, providing specific standards for simulation educators [19]. Our template was structured into 9 parts consisting of 59 items. The questionnaire comprised 83 items, including 59 for the template structure, 19 for the scenario theme, and five for the target developmental stage (Table 1).

Table 1. Contents of the Preliminary Survey Questionnaire for the Pediatric Nursing Simulation Scenario Template

Section	Contents
Part 1. Initial elements (13 items)	1. Title, 2. Target learners, 3. Target skill acquiring, 4. Approximate Timing, 5. Prerequisite competencies, 6. Brief description of case, 7. Instructors, 8. Facilitators, 9–13. Following options
Part 2. Objectives and expected outcomes (6 items)	1. Scenario Objectives, 2. Expected outcomes, 3. Evaluation, 4. Specific, measurable, attainable, relevant, timely test, 5–6. Following options
Part 3. Preparation (7 items)	1. Environment and Setting, 2. Fidelity & Patient, 3. Equipment required, 4. Embedded participants and Roles, 5–7. Following options
Part 4. Pre-briefing plan (3 items)	1–2. Briefing lists, 2. Psychologically safe learning environment
Part 5. Case information (8 item)	1. Name, Age, Sex, Weight, Height, Head Circumference, 2. Chief complaints & Concerns, 3. Present Illness & medications, 4. Past health history & medications, 5. Allergies, 6. Family history, 7–8. Attachment
Part 6. Scenario progression (9 items)	1 Initial Stage, 2. Secondary Stage, 3. Third Stage, 4. Final Stage, 5. Time, 6. Patient status, 7. Learner Actions, 8. Modifiers & Trigger to Move to Next state, 9. Facilitator Notes
Part 7. Debriefing planning (6 items)	1. Types, 2. Group size, 3. Gather stage, 4. Analyze stage, 5. Summarize stage, 5. Self-reflection, 6. Discussion
Part 8. Evaluation tools development of scenario (4 items)	1. Reaction, 2. Learning Outcomes (Pre-test/post-test), 3. Competency checklist, 4. Results (Debriefing)
Part 9. Development of scenario (4 items)	1. Content validity, 2. Reliability, 3. Evidence & reference, 4. Theoretical framework
Theme of scenario (19 items)	Acute stage care (7 items), Symptom management (5 items), Skill training (7 items)
Target developmental stage (5 items)	Infant, Toddler, Preschooler, Schooler, Adolescent
Appropriate skill level by academic grade (20 items)	Skill level by Freshman, Sophomore, Junior, Senior

3. Selection of Experts

The expert panel for this study composed of 13 experts with sufficient background knowledge and experience in the field related to the pediatric research topic. The selection criteria for the experts participating in the study were as follows: individuals with 10 or more years of experience in nursing education and practice, individuals with five or more years of experience in conducting simulation training, or researchers in the field of simulation. The researcher invited experts after assessing their suitability as research participants.

4. The Real-Delphi Survey Process

A real-time Delphi survey was conducted in two phases. The first survey was conducted from September 22 to 28, 2023, and the second from October 30 to November 10, 2023. A dedicated website (https://k-realtimedelphi.net/) was developed to apply the real-time Delphi method. This website's automated tasks are traditionally performed manually in the Delphi method, such as collecting expert panel responses, survey coding, statistical analysis, and providing feedback. This enabled the effective participation of both researchers and expert panels.

1) Round 1 real-time Delphi survey

The first survey, which used the real-time Delphi method, was structured into nine parts for the initial template. The experts were asked to review the appropriateness of including each part and to evaluate the items and content of those parts. Examples of the survey question included: "Do you think it is appropriate to include 'Title' in part 1. Initial Elements?" The survey responses were structured as Keep, Delete, Modify, or Additional Comments. If the experts felt the contents were appropriate for a part, they would select Keep; if inappropriate, Delete; if appropriate but needing modifications, Modify or leave Additional Comments.

2) Round 2 real-time Delphi survey

The template was revised and enhanced following the first real-time Delphi survey result, considering experts' opinions, content validity ratio (CVR), and coefficient of variation (CV). While maintaining the structure of the template, some content within each part was added or modified based on the comments of the panelists or the CVR values. Unlike the first survey, the second-round questions focused on whether each part and its content within the template could be appropriately used. The scale ranged from "Strongly Agree" to "Strongly Disagree" on a 4-point scale, and optional section for "Other" was provided for additional comments.

5. Data Analysis

The data collected through the two rounds of Delphi surveys were analyzed by calculating the CVR and CV for each item using Microsoft Excel. The interpretation of the CVR values followed the criteria set by Lawshe [20]. Figure 1 displays the flowchart of the decision-making process based on the analyzed results.

The CVR depends on the number of panel members. For the first Delphi survey with 13 panel members, a CVR value of 0.54 or higher was required to consider the content valid. Therefore, items with a CVR value less than 0.54 in the first survey were considered to have low content validity and were subject to deletion or modification. A CV of less than 0.5 indicates high consistency in expert responses; thus, it is considered stable and reliable [20].

RESULTS

1. General Characteristics of the Participants

The general characteristics of the experts who participated in the real-time Delphi survey are presented in Table 2. The average age was 41.38±10.65 years, with a range of 32 to 63 years old. 12 out of 13 participants (92.3%) were female, and the total career experience as a nurse was 79.23±65.60 months, with a range of 25 to 254 months. The career length as teaching professionals in nursing was 159.85±97.24 months, ranging from 19 to 326 months. The most common nursing specialty among the experts was pediatrics, with 10 (66.7%) responses. When asked about their experience with simulation-related research or projects, 11 participants (84.6%) reported being experienced. All experts had experience in simulation scenario development and operating simulation education.

2. Assessment of Appropriate Themes and Skill Levels for Pediatric Nursing Simulation Scenarios

The results on the appropriate age for developing pediatric

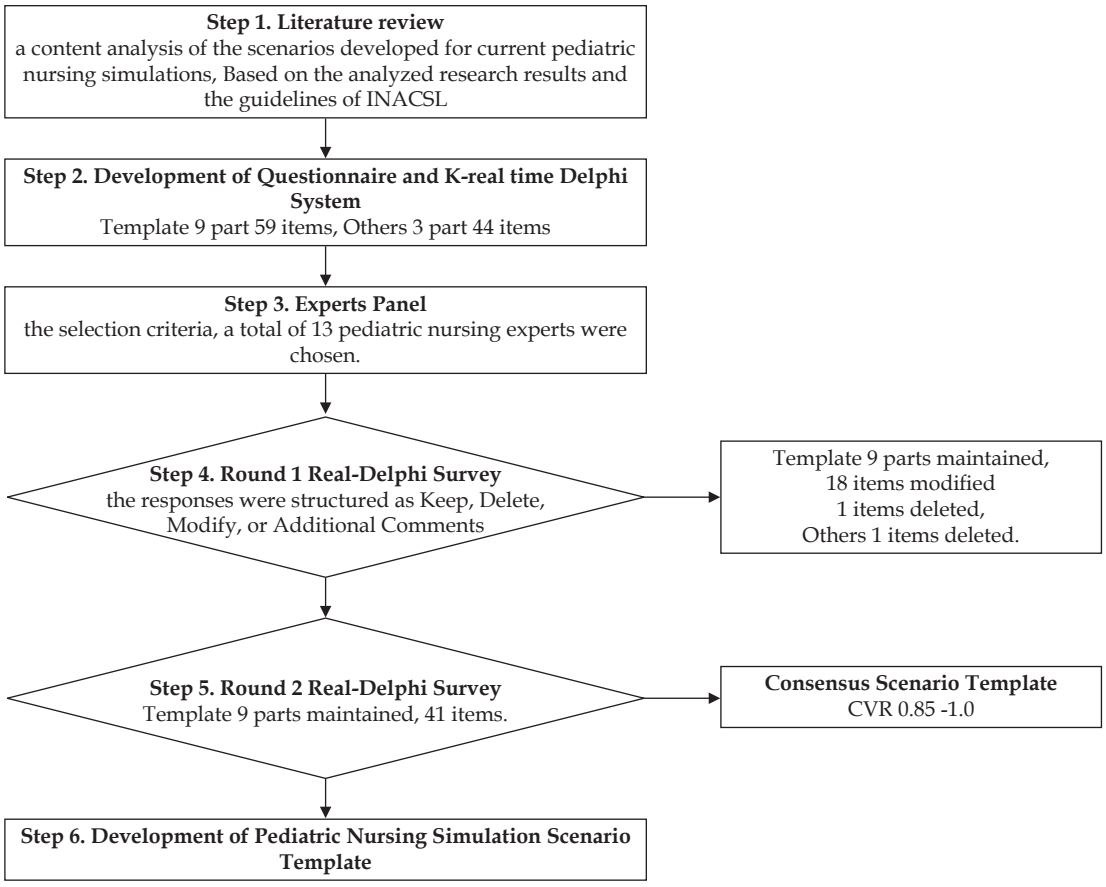

Figure 1. Flowchart of real time Delphi survey. CVR, content validity ratio; INACSL, International Nursing Association for Clinical Simulation and Learning.

Table 2. General Characteristics of Experts Participating in the Survey (*N*=13)

Variables		n (%)	M±SD	Min	Max
Age (year)			41.38±10.65	32	63
Sex	Male	1 (7.7)			
	Female	12 (92.3)			
Total career (nurse) experience (month)			79.23±65.60	25	254
Total career (teaching in nursing) experience (month)			159.85±97.24	19	326
Field of specialization (duplicated responses)	Elderly	1 (6.7)			
	Pediatrics	10 (66.7)			
	Emergency	2 (13.3)			
	ICU (pediatrics)	2 (13.3)			
Experience in simulation-related research or projects, presentations, and publications	Yes	11 (84.6)			
	No	2 (15.4)			
Experience in simulation scenario development	Yes	13 (100)			
	No	0 (0)			
Experience in operating simulation education	Yes	13 (100)			
	No	0 (0)			

ICU, intensive care unit; M, mean; SD, standard deviation.

nursing simulation scenarios showed that "Preschooler" was considered most valid with CVR of 1 (Table 3). The survey results for the appropriate skill level for each academic year for the freshman, "Level 1 Novice" had a CVR of 0.67 and a CV of 0.11. For sophomores, "Level 1 Novice" and "Level 2 Advanced Beginner" had CVRs of 0.56 and 0.67, and CVs of

Table 3. Assessment of Appropriate Themes and Skill Levels for Pediatric Nursing Simulation Scenarios

Categories	Theme	CVR	CV
Acute stage care	Cardiopulmonary resuscitation	1	0.08
	Anaphylaxis	0.89	0.20
	Asthma	1	0.08
	Seizure	0.89	0.19
	Sepsis	0.89	0.20
	Prematurity	1	0
	Hypoglycemia of newborn	1	0.14
Symptom management	Fever	1	0
	Fracture	0.78	0.30
	Gastroenteritis	1	0.08
	Sickle cell anemia	0.44	0.37
	Acute pyelonephritis	0.67	0.28
Skill training	Intravenous insertion	0.89	0.19
	Levin tube feeding	1	0.14
	Transfusion	0.89	0.20
	Postoperation care	0.78	0.32
	Developmental assess & communication	1	0.11
	Helping babies breathe training	0.67	0.34
	Well child check up	1	0.14
Target developmental Stage	Infant	0.89	0.11
	Toddler	0.78	0.24
	Preschooler	1	0.14
	Schooler	0.67	0.35
	Adolescent	0.67	0.41
Appropriate skill level by academic grade			
Freshman	Level 1 Novice	0.67	0.11
	Level 2 Advanced beginner	0.22	0.27
	Level 3 Competent	0.11	0.40
	Level 4 Proficient	0	0.19
	Level 5 Expert	0	0.10
Sophomore	Level 1 Novice	0.56	0.28
	Level 2 Advanced beginner	0.67	0.33
	Level 3 Competent	0.11	0.40
	Level 4 Proficient	0.11	0.28
	Level 5 Expert	0	0.26
Junior	Level 1 Novice	0.22	0.45
	Level 2 Advanced beginner	0.44	0.54
	Level 3 Competent	0.67	0.41
	Level 4 Proficient	0.33	0.44
	Level 5 Expert	0.11	0.51
Senior	Level 1 Novice	0.33	0.30
	Level 2 Advanced beginner	0.33	0.35
	Level 3 Competent	0.78	0.37
	Level 4 Proficient	0.78	0.37
	Level 5 Expert	0.33	0.30

CV, coefficient of variation; CVR, content validity ratio.

0.28 and 0.33, respectively. In the junior, "Level 3 Competent" was indicated with a CVR of 0.67 and a CV of 0.41. For the senior, "Level 3 Competent" and "Level 4 Proficient" showed a CVR of 0.78 and a CV of 0.37.

3. Real-time Delphi First and Second Round

The final number of respondents in the first round of the real-time Delphi survey was 13. Initially, the CVR and CV values for each item were calculated. The range of content

validity index (CVI) ranged from 0.32 to 1, with the "Development of scenario: Is it appropriate to include the 'Theoretical framework' item?" having the lowest score of 0.31, and "part 2. Objectives and Expected Outcomes: Do you think it is appropriate to include the following options in the 'Evaluation' section?" being the second lowest at 0.46 (Table 4).

In the development of pediatric nursing simulation scenarios, the CV values were below 0.5 for all themes, indicating a high level of stability in these assessments (Table 4). However, Kendall's W value was 0.00072 (χ^2 value = 43.65, p = .319), indicating an overall low consensus among experts in round 1 (Table 4). This may suggest some variability or lack of consistency among the experts' opinions. Based on the results of the first-round Delphi process, we removed or modified items with a CVR of 0.54 or below. The remaining items were consolidated, reclassified, or newly generated, yielding 41 items. For all 41 items, the CVR ranged from a minimum of 0.85 to a maximum of 1.0, with the lowest average and standard deviation, including the newly generated items, being 3.31 ± 1.11 and highest being 4.00 ± 0.00, indicating a high lev-

Table 4. Results of the Real-time Delphi for the First Round and Second Round of the Development of Pediatric Nursing Simulation Scenario Template

Order in round 1	Comments	CVR	CV	Decision	Order in Round 2	CVR	CV	M ± SD
1	Part 1. Initial Elements: Title	1	0	Retained	1	1	0.09	3.85 ± 0.38
2	Part 1. Initial Elements: Target learners	0.85	0.09	Revised	2	1	0.11	3.77 ± 0.44
3	Part 1. Initial Elements: Following options for Target learners	0.54	0.30					
4	Part 1. Initial Elements: Target skill acquiring	0.62	0.22	Revised	3	1	0.09	3.85 ± 0.38
5	Part 1. Initial Elements: Target skill acquiring	0.62	0.22					
6	Part 1. Initial Elements: Approximate Timing	0.92	0.14	Revised	4	1	0.09	3.85 ± 0.38
7	Part 1. Initial Elements: Following options for Approximate Timing	0.92	0.14					
8	Part 1. Initial Elements: Prerequisite competencies	0.92	0.14	Revised	5	1	0.09	3.85 ± 0.38
9	Part 1. Initial Elements: Following options for Prerequisite competencies	0.77	0.24					
10	Part 1. Initial Elements: Brief description of case	1	0	Revised	6	1	0.13	3.69 ± .048
11	Part 1. Initial Elements: Following options for Brief description of case	0.54	0.30					
12	Part 1. Initial Elements: Instructors	0.77	0.20	Revised	7	1	0.07	3.92 ± 0.28
13	Part 1. Initial Elements: Facilitators	0.62	0.25					
14	Part 2. Objectives and Expected Outcomes: Scenario Objectives	0.85	0.20	Revised	8	1	0.07	3.92 ± 0.28
15	Part 2. Objectives and Expected Outcomes: Following options for Scenario Objectives	0.69	0.13					
16	Part 2. Objectives and Expected Outcomes: Expected outcomes	0.92	0.14	Revised	9	0.92	0.17	3.62 ± 0.65
17	Part 2. Objectives and Expected Outcomes: Following options for Expected outcomes	0.62	0.25					
18	Part 2. Objectives and Expected Outcomes: Evaluation	0.77	0.20	Revised	10	0.92	0.15	3.77 ± 0.60
19	Part 2. Objectives and Expected Outcomes: Following options for Evaluation	0.46	0.27	Deleted				
20	Part 3. Preparation: Environment and Setting	0.92	0.14	Revised	11	1	0.09	3.85 ± 0.38
21	Part 3. Preparation: Following options for Environment and Setting	0.62	0.28					
22	Part 3. Preparation: Fidelity & Patient	1	0	Revised	12	1	0	4.00 ± 0.00
23	Part 3. Preparation: Following options for Fidelity & Patient	0.77	0.24					
24	Part 3. Preparation: Equipment required	0.92	0.14	Revised	13	0.92	0.15	3.77 ± 0.60

(Continued to the next page)

Table 4. Continued

Order in round 1	Comments	CVR	CV	Decision	Order in Round 2	CVR	CV	M±SD
25	Part 3. Preparation: Following options for Equipment required	0.77	0.20					
26	Part 3. Preparation: Embedded participants and Roles	0.85	0.20	Retained	14	1	0.09	3.85±0.38
27	Part 4. Pre-briefing Plan: Briefing Lists	0.85	0.15	Revised	15	1	0.07	3.92±0.28
28	Part 4. Pre-briefing Plan: Following options for Briefing Lists	0.77	0.20					
29	Part 4. Pre-briefing Plan: Psychologically Safe Learning Environment	0.85	0.20	Retained	16	1	0.13	3.69±0.48
30	Part 5. Case Information: Name, Age, Gender, Weight	0.77	0.24	Retained	17	0.92	0.16	3.69±0.63
31	Part 5. Case Information: Chief complaints	0.92	0.14	Retained	18	1	0	4.00±0.00
32	Part 5. Case Information: Past history & medical, medications	0.77	0.24	Retained	19	1	0.09	3.85±0.38
33	Part 5. Case Information: Allergies	1	0	Retained	20	1	0.11	3.77±0.44
34	Part 5. Case Information: Family history	1	0	Retained	21	1	0.07	3.92±0.28
35	Part 5. Case Information: Physical exam	0.85	0.20	Revised	22	1	0.09	3.85±0.38
36	Part 5. Case Information: Attachment	0.85	0.20					
37	Part 5. Case Information: Following options for Attachment	0.77	0.24	Retained	23	1	0.09	3.85±0.38
38	Part 6. Scenario Progression: Categories	0.85	0.20	Revised	24	1	0.07	3.92±0.28
39	Part 6. Scenario Progression: Initial State	1	0					
40	Part 6. Scenario Progression: Following options for Initial State	0.77	0.24					
41	Part 6. Scenario Progression: Secondary State	0.92	0.14	Revised	25	0.92	0.21	3.77±0.83
42	Part 6. Scenario Progression: Following options for Secondary State	0.85	0.20					
43	Part 6. Scenario Progression: Third State	0.85	0.15	Revised	26	0.85	0.31	3.54±1.13
44	Part 6. Scenario Progression: Following options for Third State	0.77	0.20					
45	Part 6. Scenario Progression: Final State	1	0	Revised	27	0.92	0.15	3.69±0.85
46	Part 6. Scenario Progression: Following options for Final State	0.77	0.23					
47	Part 7. Debriefing Planning: Types	1	0	Retained	28	1	0.23	3.77±0.44
48	Part 7. Debriefing Planning: Following options for Types	0.77	0.23	Retained				
49	Part 7. Debriefing Planning: Gather	0.85	0.15	Retained	29	0.92	0.15	3.77±0.60
50	Part 7. Debriefing Planning: Analyze	0.85	0.20	Retained	30	1	0.07	3.92±0.28
51	Part 7. Debriefing Planning: Summarize	0.77	0.20	Retained	31	0.92	0.15	3.77±0.60
52	Part 8. Evaluation Tools: Reaction	0.77	0.24	Retained	34	0.92	0.22	3.69±0.85
53	Part 8. Evaluation Tools: Learning	0.77	0.24	Retained	35	0.85	0.32	3.31±1.11
54	Part 8. Evaluation Tools: Behavior	0.92	0.14	Retained	36	1	0.30	3.77±0.44
55	Part 8. Evaluation Tools: Results	0.77	0.24	Retained	37	0.85	0.27	3.38±0.96
56	Part 9. Development of scenario: Theoretical framework	0.31	0.24	Revised	38	0.92	0.17	3.62±0.65
57	Part 9. Development of scenario: Content validity	0.69	0.17	Retained	39	0.92	0.23	3.62±087
58	Part 9. Development of scenario: Reliability	0.62	0.18	Retained	40	0.92	0.23	3.54±0.88
59	Part 9. Development of scenario: Evidence & Reference	0.77	0.20	Retained	41	0.92	0.17	3.62±0.65
	Part 7. Debriefing Plan: self-reflection			Newly added	32	1	0	4.00±0.00
	Part 7. Debriefing Plan: Discussion			Newly added	33	1	0.11	3.77±0.44
	W value: 0.00072, χ^2 value: 43.65, p value: .319				W value: 0.34986, χ^2 value: 181.93, p value: <.001			

CV, coefficient of variation; CVR, content validity ratio; M, mean; SD, standard deviation.

el of agreement among the experts. Additionally, Kendall's W value was 0.34986 (χ^2 value=181.93, $p<.001$), confirming consistency among the experts' opinions. Consequently, the Delphi rounds for the template were concluded based on this consensus (Table 4).

DISCUSSION

This study developed a pediatric simulation template reflecting the views and opinions of 13 pediatric nursing experts using the real-time Delphi technique. This process yielded a final template comprising 41 items across 9 sections, deemed suitable for application as a pediatric simulation template (Supplement 1). All 41 items demonstrated high consensus, ranging from 0.85 to 1 in CVR, indicating their essential inclusion. The CV values for all items were also low ranging from 0.07 to 0.32, indicating good agreement between the predictions or evaluations expressed by the experts [21].

In addition to evaluating the CV and CVR values that provided information on whether to maintain or delete the items, qualitative changes were made to the items based on expert feedback, including modifications to the wording or format. For example, some categories were modified in part 1 (initial elements). Reflecting on the first-round comment on this categorization, we combined the two groups into one group (nurses) for simplicity and conciseness. Specific options were added to certain items in the environment and setting from part 3. We added options "pediatric and adolescent ward/pediatric emergency department/NICU/NR/PICU/Others" in the environment part. The provision of specific options was also added in the "Equipment required and embedded patients and roles" in part 3. Through the round 1 Delphi survey, this specification suggested more concrete information on the template, which would guide educators in preparing for the required equipment, as well as how to set up the designated environment and setting. Only one item (objectives and expected outcomes: following options for evaluation) was deleted from the 42 full items based on the first survey, presenting low CVR (0.46) and high CV (0.27) values, which suggest deletion. A low CVR may be explained due to having a very similar item (objectives and expected outcomes: evaluation), which would be deemed as a repeated question.

In addition to the noted changes, two new items were proposed through the first-round survey: self-reflection and discussion in part 7 (Debriefing Planning). This addition is in line with the INACSL Standard, emphasizing the essential point of integrating the debriefing process into simulation-based experiences that enhance learning and increase participants' self-awareness and self-efficacy [12]. Many studies have reported that high self-reflection predicts higher nursing competence and mediates the relationship between students' anxiety and nursing competence [22,23]. A previous study also reported that students enjoyed a more meaningful learning experience when they engaged in self-reflective practices by examining and understanding their emotions, attitudes toward self and others, and reactions to everyday professional situations [24]. Even though our study was mainly developed for template development, and did not include a sample question, future studies may consider a guide comment to facilitate students' self-reflection in debriefing plans based on the developed scenario content.

The themes of these scenarios were categorized into acute stage care, symptom management, and skill training. Acute stage care and skill training themes generally had high CVR values ranging from 0.89 to 1, indicating their significant inclusion. However, symptom management themes showed more varied CVR values, including fever and gastroenteritis (1), fracture (0.78), acute pyelonephritis (0.67), and sickle cell anemia (SCA; 0.44), suggesting the potential for selective inclusion. These findings offer valuable guidance for prioritizing scenario themes in curriculum development. Although we decided to maintain SCA in the template, the results imply that SCA is a subject of controversy and can thus be skipped depending on the educator.

The results on the appropriate themes represent what content should be prioritized, which would offer helpful information when selecting themes for simulation curriculum development. In order to assess learners' abilities, academic grades were matched to specific skill levels. The results indicated that skill level increased as the academic grade increased. As it is difficult to determine the level of goals and expected outcomes, this type of question could assist educators in establishing suitable objectives and offering assessment tools aligned with learners' abilities.

The real-time Delphi technique enabled experts to simultaneously refer to other panelists' responses and comments while completing their surveys. In the real-time Delphi procedure, participants were provided entry into an online survey platform for a defined duration. Upon entering the platform, expert panelists could view their own responses along-

side continuous updates, thus providing real-time, anonymized responses from fellow panelists. The primary novelty of real-time Delphi investigation lies in the concurrent computation and provision of feedback. Unlike the traditional approach, participants in a real-time Delphi approach are not restricted to evaluating at fixed intervals (such as rounds), but can alter their viewpoints as frequently as desired within a designated timeframe [17,25].

The Delphi technique has not been widely used for simulation template development, and only a few studies have used it for survey tool development, such as violence and self-reporting triage survey tools [26,27]. In this aspect, our study is important because it is the first to apply the real-time Delphi method for simulation template development, providing significant findings through the Delphi process. A noteworthy strength of this study is the application of INACSL standards and a previous comprehensive finding on pediatric simulation scenarios. For instance, we included the role of the facilitator in our template, as INACSL emphasized the facilitator's role as a necessary element in achieving the desired goals throughout the process of scenario-based learning, and that a program to train facilitators should be provided [15]. Since previous findings have reported that only half of the examined scenarios addressed facilitation, integrating facilitator guidelines into this template would serve as a reminder of their significance and underscore the necessity for facilitator training programs. Furthermore, a prompt was displayed in the rightmost section, designed to prompt educators to review each section [15]. INACSL emphasizes the importance of a more effective learning experience and achievement of educational objectives. As one of the ways to achieve this goal, INACSL recommends applying SMART (specific, measurable, attainable, relevant, timely) standards when establishing a simulation template. We included the SMART section in the right column to assist educators in formulating scenario objectives. This addition would remind educators to use action verbs to enable the performance of skills and competencies in scenario-based learning processes [15]. Moreover, we added criteria for expected outcomes and evaluation, such as psychomotor function, cognition, and affectation, which are listed in line with the INACSL guidelines. This reminder serves as a crucial element in ensuring the achievement of the desired learning objectives during the completion of the template [26,27].

The limitations of this study are as follows. First, we did not account for the applicability of the template to various cultural, educational, or local healthcare system contexts because our primary aim was to develop a universal template without considering specific contexts. For example, this study did not consider a virtual reality education method, potentially rendering it unsuitable for such applications. Future template users should customize their content to align with their local contexts and specific requirements. Second, although this study reached predetermined consensus levels, this is not always recommended because psychometric criteria are typically utilized in positivist methodologies [25]. In fact, some studies opt to select an appropriate level within the data rather than relying solely on preset levels. While achieving consensus may not entirely eliminate the panel bias associated with self-interest issues, investigators should be mindful of this concern when determining consensus levels [27]. Our high CVR results for most items and the consensus reached in the two rounds suggest that controversial issues did not arise during the survey process. However, future studies should establish their own criteria to enhance the credibility of the analyzed data when employing the Delphi method for survey development.

CONCLUSION

This study used the Delphi technique to create a pediatric simulation scenario aimed at enhancing the quality of pediatric nursing simulation education. As mentioned previously, this study highlights the need for a standardized pediatric scenario template to ensure consistency and effectiveness in learning and assessment. Our study presents significant findings, as it is the first to employ the real-time Delphi technique in crafting a pediatric simulation template following the INACSL guidelines and drawing upon comprehensive prior research. The broader dissemination of this template will result in an enhanced version incorporating updates suggested by other pediatric nursing education experts in the future.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

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

Funding

This study was supported by a National Research Foundation of Korea (NRF) grant funded by the Korean government (No. 2021R1A2C1095530).

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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Supplementary material

Supplement 1. Pediatric Simulation Template

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ORIGINAL ARTICLE

Child Health Nurs Res, Vol.30, No.2, April 2024;30(2):154-163
https://doi.org/10.4094/chnr.2024.013

pISSN 2287-9110
eISSN 2287-9129

CHNR

Factors influencing stigma among college students with COVID-19 in South Korea: a descriptive study

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Received: March 28, 2024
Revised: April 15, 2024
Accepted: April 25, 2024

Purpose: This study is descriptive research aiming to identify factors influencing the stigma experienced by college students with coronavirus disease 2019 (COVID-19), focusing on COVID-19 pandemic stress, depression, and fear of negative evaluation as the main variables. **Methods:** An online survey was administered to 175 college students who had been diagnosed with COVID-19 from January to May 2022 and were enrolled in universities in Seoul, Cheongju, and Daegu, South Korea. The survey collected data on pandemic stress, depression, fear of negative evaluation, and stigma. The data were analyzed using the t-test, ANOVA, the Scheffé test, Pearson's correlation coefficients, and stepwise multiple regression in SPSS/WIN 26.0. **Results:** We analyzed differences in stigma scores based on general characteristics of the college students and found significant differences in stigma scores by age, major satisfaction, interpersonal satisfaction, date of COVID-19 confirmation, treatment modality, and recent subjective health condition. Factors influencing stigmatization were identified as COVID-19 pandemic stress, depression, date of COVID-19 confirmation, treatment modality, recent subjective health condition, and major satisfaction, with an overall explanatory power of 37.6%. **Conclusion:** This study is significant as it identifies emotional changes across various aspects of pandemic stress, depression, fear of negative evaluation, and stigma among college students who have been diagnosed with COVID-19. The findings of this study suggest the development of programs to reduce psychological distress and enhance mental health management skills among these students.

Keywords: COVID-19; Stress, psychological; Depression; Social stigma; Students

INTRODUCTION

Coronavirus disease 2019 (COVID-19), first identified in December 2019, was declared a "pandemic" in March 2020. As of a relatively recent report, there have been more than 682 million confirmed cases worldwide [1]. In South Korea, the first case of COVID-19 was reported on January 20, 2020. By January 2022, approximately two years later, the cumulative number of cases had surpassed 750,000. As of August 2023, this number had escalated to more than 34 million, affecting a significant portion of the population [2]. The pandemic has compelled people globally to adapt to numerous changes in their daily routines has been linked to adverse mental health outcomes, including increased levels of stress, depression, and anxiety compared to pre-pandemic times [3].

Stigmatization not only causes public anger, fear, and disgust towards those infected and the diseases themselves, potentially leading to social division and impeding control poli-

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cies [4], but it is also associated with prolonged stigma. This includes significant mental stress and social disadvantage for the infected individuals and their families even after recovery from the infection [5].

Transitioning into adulthood marks a significant phase between adolescence and full adulthood. During this time, individuals typically experience a noticeable expansion in the scope of their life activities. It is a crucial period for accomplishing developmental tasks such as forming a sense of identity, exploring future possibilities, and beginning to enter the workforce [6]. However, the pandemic has imposed restrictions on most social activities, leading to reports of heightened stress, anxiety, and depression among various age group, including college students [7].

COVID-19 pandemic stress encompasses the stress individuals face due to the ongoing COVID-19 pandemic situation [8]. In this study, we specifically measured COVID-19 pandemic stress, as opposed to general stress, to pinpoint the stress experienced by individuals infected with COVID-19. A report indicating that 50% of patients hospitalized with COVID-19 in South Korea had depression underscored the prevalence of mental health issues during this pandemic [9].

Fear of negative evaluation refers to the fear of being judged negatively by others. This fear frequently co-occurs with depression in people with COVID-19 [10].

The ongoing COVID-19 pandemic places people at a heightened risk of stigmatization, which includes intense anxiety and fear of contracting the virus, as well as sensitivity to judgment from others if diagnosed [11]. Moreover, depression during the COVID-19 pandemic has been linked to stigmatization [12]. Consequently, the fear of social stigmatization not only increases anxiety but also adversely affects quality of life, highlighting the importance of identifying and addressing stigma [13]. During the peak of the COVID-19 pandemic from 2020 to 2021, the fear associated with COVID-19 stigma was found to be more intense than that associated with a COVID-19 diagnosis itself [14]. This study focused on the impact of COVID-19 stigma among college students who tested positive for the virus in 2022, a time when social distancing measures were officially lifted, yet COVID-19 infections continued. Although there is extensive research on social stigma related to COVID-19 [15,16], there is a lack of studies on individuals who have actually received a COVID-19 diagnosis. Therefore, it is important to investigate the stigmatizing factors associated with COVID-19 diagnosis within the Korean cultural context.

Therefore, this study was conducted to examine the factors contributing to stigma among college students with COVID-19, with the goal of providing foundational data to assist college students in better adapting. To achieve this, the following objectives were formulated: (1) examining differences in stigma according to the general characteristics of college students; (2) identifying the levels of COVID-19 pandemic stress, depression, fear of negative evaluation, and stigma in college students; (3) calculating the correlations among major variables; and (4) determining the factors influencing stigma in college students.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Seoul Women's College of Nursing (No SWCN-202202-HR-001-02). Informed consent was obtained from all participants.

1. Study Design

This study employed a descriptive survey design to explore the relationship between COVID-19 pandemic stress, depression, fear of negative evaluation, and stigma among college students diagnosed with COVID-19. It also is aimed to identify factors that influence stigma. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [17].

2. Participants

The study population included 175 college students diagnosed with COVID-19 from January to May in 2022, from three universities in Seoul, Chungcheongbuk province, and Gyeongsangbuk province. Students diagnosed before 2022 were excluded from data collection, as the level of stigmatization may have differed across the stage of the COVID-19 outbreak.

The sample size for this study was determined using the G*power 3.1 program. With a medium effect size of .15, a significance level of .05, a power of .95 and nine predictors in a multiple linear regression analysis, it was determined that at least 166 participants would be needed.

3. Research Instruments

1) COVID-19 pandemic stress

The Korean Version of the COVID-19 Pandemic Stress Questionnaire for College Students (K-CPSQ), developed by Jeong and Yang [8], was utilized to evaluate pandemic-related stress among college students. This tool comprises 13 questions categorized into four groups: three questions address disruptions to daily life, four pertain to interpersonal relationships, three relate to economic factors, and three evaluate task performance. Responses are scored on a 6-point scale, where 5 indicates "very severe," 1 denotes "not at all severe," and 0 means "not experienced." Higher scores reflect greater levels of pandemic stress. In the original study by Jeong and Yang [8], the Cronbach's alpha was .84, a reliability measure that was replicated in this study with the same alpha value of .84.

2) Depression

The Korean version of the Center for Epidemiologic Studies Depression Scale (CES-D), which was adapted from Cho and Kim [18]. This instrument is a 20-item, 4-point scale where 3 indicates "most of the time," 2 signifies "often," 1 represents "sometimes," and 0 means "extremely rarely." Higher scores on this scale indicate more severe depression. Cronbach's alpha in the study by Cho and Kim [18] was .91 and in this study, it was .93.

3) Fear of negative evaluation

We utilized a shortened version of Leary's scale [19] that measures fear of negative evaluation by others, and which Lee and Choi [20] adapted into Korean. This scale comprises 12 items, such as "I am worried that people will notice my flaws," each rated on a 5-point Likert scale. Higher scores indicate a greater fear of negative evaluation. In the study by Lee and Choi [20], the Cronbach's alpha for college students was .90, while in our study, it was .92.

4) Stigma

To assess the degree of stigma perception, we utilized The Explanatory Model Interview Catalogue (EMIC), originally developed by Weiss [21] and subsequently adapted by Al-Zamel et al. [22] for COVID-19 patients. The stigma perception scale was translated and modified by the researchers to align with the Korean context. A bilingual professor of psychiatric nursing conducted the forward translation, while a certified English translator, a native English speaker, performed the backward translation. The final Korean version of the EMIC was reviewed by all coauthors to ensure face and content validity. It was approved after determining that there were no significant differences between the forward- and backward-translated versions of the EMIC and the original scale. The research instrument is a 12-item, 4-point scale ranging from "yes" (3) to "not at all" (0), with higher scores indicating greater levels of stigma perception. In the study by Al-Zamel et al. [22], Cronbach's alpha was .79 and it was .81 in this study.

4. Data Collection

This study received approval from the Institutional Review Board of "S" University. Data collection occurred from May to July 2022 through a non-face-to-face mobile questionnaire survey using Google Forms. To safeguard personal information, we did not collect items containing personally identifiable information separately, instead, we assigned serial numbers to each questionnaire to maintain confidentiality. We advertised the recruitment of research participants on a social media platform accessed by all college students. The advertisement included a link to the Google Form for the online consent form and information sheet. Completing the questionnaire took approximately 15 minutes. As a token of appreciation for their participation, respondents who provided their personal contact information received mobile drink coupons. Once the coupons were issued, all personal information was promptly destroyed.

5. Data Analysis

Data collected in the study were analyzed using the IBM SPSS Statistics 26.0 program (IBM Corp). The general characteristics of the participants were analyzed using frequency/percentage and mean/standard deviation (SD). We assessed differences in stigma based on general characteristics using the independent t-test and one-way analysis of variance, with Scheffé test employed for post hoc analysis. The correlations between COVID-19 pandemic stress, depression, fear of negative evaluation, and stigma were calculated using Pearson's correlation coefficients. Additionally, stepwise multiple regression analysis was conducted to identify the factors influencing the participants' stigma.

RESULTS

1. Participants' General Characteristics

The average age of the study participants was 21.80±2.57 years. The group comprised 85.1% females and 14.9% males, with seniors making up the largest subgroup at 34.3%, followed by juniors at 24.0%, freshmen at 21.1%, and sophomores at 20.6%. A majority of the students, 79.4% were enrolled in health-related major, while 20.6% pursued non-health-related majors. Geographically, 44.6% of participants resided in Gyeongsang province, 36.0% in Seoul, and 19.4% in Chungcheong province. Regarding living arrangements, 56.6% lived with their family, 24.6% lived alone, and 18.9% lived with friends. In terms of perceived economic status, 72.6% identified as "middle class," 14.3% as "poor," and 13.1% as "rich." Religiously, 73.7% of respondents had no affiliation, followed by Christians at 12.6%, Catholics at 10.9%, and Buddhists at 2.9%. Satisfaction level varied across different aspects of university life: 66.9% of students were satisfied with their major, 28.0% were neutral, and 5.1% were unsatisfied. Satisfaction with academic achievement showed 45.7% neutral, 39.4% satisfied, and 14.9% unsatisfied. Satisfaction with university life overall was reported as 53.7% satisfied, 34.9% neutral, and 11.4% unsatisfied. In terms of interpersonal relationships, 75.4% were satisfied, 18.9% neutral, and 5.7% unsatisfied. The majority (82.3%) of study participants were diagnosed with COVID-19 between January and March 2022, whereas 17.7% were diagnosed between April and May 2022. Treatment predominantly occurred at home (97.1%), with living treatment centers accounting for 1.7% and hospitalization for 1.1%. The severity of COVID-19 symptoms was classified as moderate in 49.1% of cases, mild in 30.9%, and severe in 20.0%. Before contacting COVID-19, 67.4% of participants considered themselves "healthy," 28.0% "fair," and 4.6% "unhealthy." Post-infection, these perceptions changed to 44.0% feeling "healthy," 39.4% "fair," and 16.6% "unhealthy" (Table 1).

Complications were reported by 65.1% of the cases, with the most common being cough (20.0%), sputum (7.6%), fatigue (6.4%), shortness of breath (6.0%), sore throat (4.8%), decreased or loss of smell (3.6%), weakness (2.8%), chest pain (2.4%), decreased or loss of taste (2.4%), and runny nose (2.0%) (Table 2).

2. Differences in Stigma by General Characteristics

The degree of stigmatization among the study participants varied significantly based on several characteristics, including age ($F=3.84$, $p=.023$), major satisfaction ($F=3.85$, $p=.023$), interpersonal satisfaction ($F=5.03$, $p=.008$), date of COVID-19 confirmation ($F=3.16$, $p=.002$), COVID-19 treatment modality ($F=3.46$, $p=.034$), and recent subjective health status ($F=9.99$, $p<.001$) (Table 1). Post-tests revealed that participants aged 25 and older experienced more stigmatization compared to those aged 19 to 21 years. Regarding satisfaction, individuals who were "unsatisfied" reported higher stigma levels than the those who were "neutral" or "satisfied" in terms of major satisfaction and higher than those who reported being "satisfied" interpersonally. Stigma scores were also higher for participants who were hospitalized than in those in living treatment centers or undergoing home treatment. Similarly, participants who rated their health as "fair" or "unhealthy" had higher stigma than who considered themselves "healthy" (Table 1).

3. COVID-19 Pandemic Stress, Depression, Fear of Negative Evaluation, and Stigma Levels

The participants' mean scores was 1.81±0.89 out of 5 for COVID-19 pandemic stress, 1.16±0.36 out of 3 for depression, 3.21±0.82 out of 5 fear of negative evaluation, and 0.63±0.51 out of 3 for mean stigma (Table 3).

4. Correlations among COVID-19 Pandemic Stress, Depression, Fear of Negative Evaluation, and Stigma

Stigma showed significant positive correlations with the COVID-19 pandemic stress ($r=.50$, $p<.001$) and depression ($r=.41$, $p<.001$). COVID-19 pandemic stress showed a significant positive correlation with the depression ($r=.32$, $p<.001$), and fear of negative evaluation ($r=.17$, $p=.023$). Depression exhibited a significant positive correlation with fear of negative evaluation ($r=.35$, $p<.001$) (Table 4).

5. Determinants of Stigma

Factors affecting stigma among college students were analyzed using stepwise multiple regression analysis. Variables that influenced stigma scores, including participants' general characteristics, COVID-19 pandemic stress, and depression,

Table 1. General Characteristics of the Participants Related to Stigma (*N*=175)

Variables	Categories	n (%)	M±SD	t/F (*p*) Scheffé
Age (year)	19–21[a]	93 (53.1)	0.56±0.46	
	22–24[b]	64 (36.6)	0.67±0.49	3.84 (.023)
	≤25[c]	18 (10.3)	0.91±0.73	a<c
	Total		21.80±2.57	
Sex	Female	149 (85.1)	0.63±0.50	-0.27 (.788)
	Male	26 (14.9)	0.66±0.58	
Grade	Freshman	37 (21.1)	0.57±0.52	
	Sophomore	36 (20.6)	0.63±0.50	0.61 (.610)
	Junior	42 (24.0)	0.60±0.44	
	Senior	60 (34.3)	0.70±0.57	
Major	Healthcare	139 (79.4)	0.62±0.49	-0.79 (.429)
	Non healthcare	36 (20.6)	0.69±0.60	
Residential area	Seoul	63 (36.0)	0.70±0.59	
	Chungcheong province	34 (19.4)	0.45±0.36	2.71 (.070)
	Gyeongsang province	78 (44.6)	0.66±0.49	
Residential form	Staying with family	99 (56.6)	0.66±0.55	
	Living alone	43 (24.6)	0.62±0.50	0.54 (.586)
	Staying with a friend	33 (18.9)	0.56±0.42	
Economic state	Rich	23 (13.1)	0.76±0.62	
	Meddle	127 (72.6)	0.60±0.47	1.18 (.311)
	Poor	25 (14.3)	0.70±0.60	
Religion	No affiliation	129 (73.7)	0.60±0.47	
	Catholic	19 (10.9)	0.85±0.70	1.63 (.185)
	Christian	22 (12.6)	0.62±0.49	
	Buddhist	5 (2.9)	0.85±0.69	
Satisfaction with major	Unsatisfied[a]	9[a] (5.1)	1.07±0.74	
	Neutral[b]	49[b] (28.0)	0.57±0.51	3.85 (.023)
	Satisfied[c]	117[c] (66.9)	0.63±0.48	a>b,c
Satisfaction with academic achievement	Unsatisfied	26 (14.9)	0.69±0.47	
	Neutral	80 (45.7)	0.64±0.56	0.22 (.800)
	Satisfied	69 (39.4)	0.61±0.47	
Satisfaction with university life	Unsatisfied	20 (11.4)	0.76±0.58	
	Neutral	61 (34.9)	0.68±0.55	1.50 (.226)
	Satisfied	94 (53.7)	0.58±0.47	
Interpersonal satisfaction	Unsatisfied[a]	10[a] (5.7)	1.04±0.34	
	Neutral[b]	33[b] (18.9)	0.75±0.57	5.03 (.008)
	Satisfied[c]	132[c] (75.4)	0.57±0.49	a>c
Date of COVID-19 confirmed	January to March 2022	144 (82.3)	0.69±0.53	3.16 (.002)
	April to May 2022	31 (17.7)	0.38±0.31	
Treatment modality	Hospitalization[a]	2 (1.1)	1.57±0.33	
	Living treatment center[b]	3 (1.7)	0.56±0.62	3.46 (.034)
	Home treatment[c]	170 (97.1)	0.62±0.51	a>b,c
Severity of COVID-19 symptoms	Mild	54 (30.9)	0.65±0.58	
	Moderate	86 (49.1)	0.60±0.47	0.34 (.714)
	Severe	35 (20.0)	0.68±0.51	
Presence of complications	Yes	114 (65.1)	0.66±0.55	0.97 (.334)
	No	61 (34.9)	0.58±0.45	
Pre-COVID-19 Health condition	Unhealthy	8 (4.6)	0.63±0.59	
	Fair	49 (28.0)	0.77±0.61	2.52 (.084)
	Healthy	118 (67.4)	0.58±0.45	
Recent subjective health condition	Unhealthy[a]	29 (16.6)	0.88±0.63	
	Fair[b]	69 (39.4)	0.73±0.54	9.99 (<.001)
	Healthy[c]	77 (44.0)	0.46±0.37	a,b>c

COVID-19, coronavirus disease 2019; M, mean; SD, standard deviation.

Table 2. Types of Post-COVID Conditions (*N*=175)[a)]

Categories	n (%)	Categories	n (%)	Categories	n (%)
Cough	50 (20.0)	Menstrual irregularity	4 (1.6)	Palpitations	1 (0.4)
Sputum	19 (7.6)	Headache	4 (1.6)	Ear pain	1 (0.4)
Fatigue	16 (6.4)	Shivering/ chills	3 (1.2)	Feeling dazed	1 (0.4)
Shortness of breath	15 (6.0)	Rhinitis/ rhinitis exacerbation	3 (1.2)	Deepening hypotension	1 (0.4)
Sore throat	12 (4.8)	Nasal congestion	3 (1.2)	Taste change	1 (0.4)
Loss of smell	9 (3.6)	Dry throat	2 (0.8)	Muscle pain	1 (0.4)
Weakness	7 (2.8)	Hoarseness	2 (0.8)	Indigestion	1 (0.4)
Chest pain	6 (2.4)	Depression	2 (0.8)	Sickness	1 (0.4)
Loss of taste	6 (2.4)	Dizziness	2 (0.8)	Skin spots	1 (0.4)
Runny nose	5 (2.0)	Tinnitus	2 (0.8)	Enterocolitis	1 (0.4)

[a)]Multiple responses; Missing data is not included in the values; COVID-19, coronavirus disease 2019.

Table 3. Score of COVID-19 Pandemic Stress, Depression, Fear of Negative Evaluation, and Stigma (*N*=175)

Variables	M±SD	Min	Max	Possible range
COVID-19 pandemic stress	1.81±0.89	0.08	4.08	0–5
Depression	1.16±0.36	0.85	2.45	0–3
Fear of negative evaluation	3.21±0.82	1.08	5.00	1–5
Stigma	0.63±0.51	0.00	2.27	0–3

COVID-19, coronavirus disease 2019; M, mean; SD, standard deviation.

Table 4. Correlations among COVID-19 Pandemic Stress, Depression, Fear of Negative Evaluation, and Stigma (*N*=175)

Variables	COVID-19 pandemic stress	Depression	Fear of negative evaluation	Stigma
	r (*p*)	r (*p*)	r (*p*)	r (*p*)
COVID-19 pandemic stress	1			
Depression	.32 (<.001)	1		
Fear of negative evaluation	.17 (.023)	.35 (<.001)	1	
Stigma	.50 (<.001)	.41 (<.001)	.15 (.055)	1

COVID-19, coronavirus disease 2019.

were identified and set as independent variables. Categorical variables were treated as dummy variables, with reference groups defined as "25 years old or older" for age, "satisfied" major satisfaction and interpersonal satisfaction, January to March 2022 for the time of COVID-19 diagnosis, "home treatment" as the treatment type, and "healthy" for recent subjective health status as reference variables. To identify multicollinearity among the independent variables, the tolerance before the regression analysis was conducted was .76 to .98, which was greater than 0.1 and less than 10, and the variance inflation factor ranged from 1.02 to 1.32, lower than 10, with all variables determined to have no problem with multicollinearity. Analysis of the residuals confirmed the normality of error terms, homogeneity of variances, and the linearity of the model. In the autocorrelation test, the Durbin-Watson statistic stood at 1.95, indicating the absence of autocorrelation. Consequently, the regression model was found to be statistically significant ($F=18.46$, $p<.001$), with its explanatory power calculated at 37.6%. The most important factor influencing stigma was COVID-19 pandemic stress ($\beta=.36$, $p<0.001$), followed by depression ($\beta=.26$, $p<0.001$), date of COVID-19 confirmation (January–March 2022) ($\beta=.18$, $p=.003$), treatment modality (hospitalization) ($\beta=.13$, $p=.034$), recent subjective health condition (fair) ($\beta=.13$, $p=.038$) and satisfaction with major (unsatisfied) ($\beta=.12$, $p=.042$) (Table 5).

DISCUSSION

As COVID-19 was an unprecedented global pandemic that has significantly impacted the economy, society, and psychosocial functioning of nations, it is crucial to address the stress it has caused and the subsequent mental health issues. This study investigates the levels of COVID-19 pandemic stress, depression, fear of negative evaluation, and stigmatization among college students diagnosed with the COVID-19 virus

Table 5. Factors Influencing Stigma among College Students with COVID-19 (*N*=175)

Variables	B	SE	β	t (*p*)	R^2 (Adj R^2)	F (*p*)
(constant)	–0.45	0.13		–3.50 (.001)	.397 (.376)	18.46 (<.001)
COVID-19 pandemic stress	0.21	0.04	.36	5.69 (<.001)		
Depression	0.37	0.09	.26	4.04 (<.001)		
Date of COVID-19 to be confirmed (January to March 2022)[a]	0.25	0.08	.18	3.02 (.003)		
Treatment modality (hospitalization)[b]	0.63	0.29	.13	2.14 (.034)		
Recent subjective health condition (fair)[c]	0.13	0.06	.13	2.09 (.038)		
Satisfaction with major (unsatisfied)[d]	0.29	0.14	.12	2.05 (.042)		

[a]Dummy variables (ref. April to May 2022); [b]Dummy variables (ref. home treatment); [c]Dummy variables (ref. healthy); [d]Dummy variables (ref. satisfied); COVID-19, coronavirus disease 2019; SE, standard error.

in the first half of 2022. During this period, students were still grappling with the ongoing pandemic but had more resources to manage the infection. The study also explores the key factors influencing their perceptions of stigma. Importantly, this research focuses on individuals who have personally experienced a COVID-19 diagnosis, rather than those who are merely observers of the situation. A discussion of the study's key findings is presented below.

First, when examining differences in stigma levels based on the general characteristics of the participants, it was observed that older age group perceived more stigma. Participants who were less satisfied with their major and those with lower interpersonal satisfaction also exhibited higher levels of stigmatization. Although there are no previous studies confirming the difference in stigma according to major satisfaction and interpersonal satisfaction, it is believed that major satisfaction and interpersonal relationships are related to depression, and depression is correlated with stigma. In the future, we propose a study to confirm the effect of major satisfaction and interpersonal satisfaction on stigma using depression as a parameter. Using April 2022, when social distancing measures were officially lifted, as a reference point, college students diagnosed with COVID-19 prior to this date reported higher levels of stigmatization compared to those diagnosed between April and May 2022. Additionally, those who underwent inpatient treatment experienced more stigma than those treated at living treatment centers or at home. Lastly, individuals who perceived their health as having deteriorated post-COVID-19 diagnosis reported higher stigma levels, a finding supported by Park et al. [11], who noted that an increase fear of social stigma correlates with more negative perceptions of life changes.

While most people can resume normal activities after recovering from a COVID-19 infection, some may experience symptoms that persist for weeks or even months. Symptoms that continue for more than 12 weeks post-diagnosis and cannot be attributed to other conditions are known as post-COVID conditions (also referred to as long-term COVID, long COVID, or chronic COVID), though there is no globally accepted definition [23]. This study found that college students in early adulthood primarily reported persistent respiratory symptoms such as cough, sputum production, sore throat, and runny nose. They also experienced systemic symptoms like fatigue and weakness. Common cardiovascular symptoms included dyspnea and chest pain, along with disturbance in smell and taste.

Historically, large-scale pandemics have led to significant emotional difficulties, including severe stress, depression, and anxiety [24]. Recent research indicates a notable rise in anxiety and depression during the current pandemic [25], with a specific study from Korean highlighting that college students in early adulthood are particularly affected [7]. The term "COVID-19 Pandemic Stress" encapsulates the stress experienced due to the ongoing pandemic, impacting various aspects of life and presenting a more pervasive form of daily stress as it affects family, economic, educational, and work domains. Recent findings suggest that about 25% of the surveyed population is experiencing high stress levels due to COVID-19, leading to negative emotions such as anxiety, depression, and frustration [25]. In this study, the COVID-19 pandemic stress level among participants was 36.2%, significantly lower than the 47.8% reported in a similar study among nursing students in a different region at a comparable time [26]. The lower stress scores in this study may be attributed to the inclusion of a broader demographic of general university students, as opposed to nursing students who faced additional pressures due to their clinical responsibilities during the pandemic. Conversely, depression scores were higher among general students, with a total score of 23.2 compared to 17.2 among nursing students [26]. This dis-

crepancy suggests that general university students may be frustrated by the lack of realistic experience of college life due to the transition of all classes to face-to-face compared to nursing majors, who have mandatory provisions such as meeting practicum hours in terms of class participation [27], and may also be more susceptible to misinformation via social media and other media outlets during outbreaks of new infectious diseases like COVID-19, which may lead to feelings of helplessness. Therefore, it is crucial to provide these students with education on managing emerging infectious diseases, which is expected to enhance their sense of personal control over the disease through accurate information on quarantine and personal hygiene management.

Stigma was positively associated with COVID-19 pandemic stress and depression, with fear of negative evaluation being linked to higher levels of both COVID-19 pandemic stress and depression. Since fear of a negative evaluation can increase depression levels among individuals, enhancing psychological health to better cope with such fear is considered necessary. Higher levels of COVID-19 pandemic stress were associated with increased depression levels, consistent with findings from a study involving healthy college students [27].

Finally, stress related to the COVID-19 pandemic was identified as the strongest predictor of stigma, followed by depressive variables. A later diagnosis of COVID-19 was associated with lower levels of stigmatization. Other influential factors included hospitalization, feeling fairly healthy recently, and reduced satisfaction with one's major, collectively explaining 37.6% of the variance. In particular, in South Korea, adults have reported high levels of fear regarding social stigma [28]. This is attributed to the rapid increase in confirmed cases in specific regions and among certain religious groups, as well as widespread social condemnation. As information about individuals quarantined or infected with COVID-19 is shared on social media and their identities become public, the social stigmatization may increase not only for those infected but also for the general public observing the situation. In Korean society, there is a prevalent belief that contracting COVID-19 is due to personal failings, leading people to search for causes within individual's life or lifestyle [29]. This perception intensifies the fear of infection and psychological decline. Social stigmatization can thus worsen individual distress, complicate resolution efforts, and contribute to emotional issues such as depression.

Fear of negative evaluation was not identified as a cause of stigma in this study. Although fear of negative evaluation is an underlying emotion that leads to mistrust, suspicion, and a sense of victimization of others [30], it may not have been a direct cause of stigma in this study. This could be because the public perceived the pandemic as a part of everyday life to which they had successfully adapted after April 2022, when COVID-19 transitioned into pandemic phase 2 [31].

Based on our findings, the limitations and suggestions for future research are as following. Firstly, the participants in this study were early adult in good health, which does not reflect the typical demographics of health, medical, and service occupations, where there is a higher fear of actual infection. Secondly, the data collection occurred after the peak of the COVID-19 outbreak, which may affect the generalizability of the results. Thirdly, mental health experts identify the three years following a pandemic as the most critical period for psychiatric sequelae. Therefore, ongoing research is essential to monitor this potentially serious social issue. Consequently, our study recommends the development of programs that proactively educate individuals about the factors influencing social stigma and aim to alleviate psychological distress while enhancing mental health management skills among college students who have encountered COVID-19.

CONCLUSION

This study is significant as it explores the emotional changes associated with pandemic stress, depression, fear of negative evaluation, and stigma among college students who have been diagnosed with COVID-19. In practical terms, it is essential to provide accurate information about the disease and to support those who are quarantined or infected without bias, especially in the context of an infectious disease like COVID-19, for which no definitive treatment has yet been established.

Consequently, the findings of this study advocate for the creation of programs designed to educate individuals about the effects of social stigma on mental health. These programs aim to alleviate psychological difficulties and enhance the mental health management skills of college students who have contracted COVID-19.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: Sun Nam Park, Jongeun Lee; Data collec-

tion, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

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

Funding

This research was supported by the research fund from Seoul Women's College of Nursing (No. snjc 2021-005).

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

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Author Guidelines

CHNR
Child Health Nursing Research

Child Health Nursing Research
Enacted in April 2006 and most recently revised in February 2023 and applied from Vol 29, No 2 (April 2023)

I. General Information

1. About the Journal

Child Health Nursing Research (CHNR) is the official peer-reviewed research journal of the Korean Academy of Child Health Nursing. CHNR is a multidisciplinary, double-blind peer-reviewed, open-access journal that publishes original research, theory, and review papers on health care and nursing from the beginning of life to young adulthood, including both children and their families. It is devoted to all fields of child health, including global and cultural issues, aimed at both domestic and international healthcare professionals. The journal is published quarterly (Jan 31, Apr 30, July 31, and Oct 31) in English. The journal welcomes submissions from healthcare professionals around the world, and encourages the submission of papers dealing with cultural issues and those studied by international research teams.

- Indexed in major databases: PubMed Central, PubMed, Scopus, CINAHL, DOAJ, Crossref Metadata, Google Scholar, ScienceCentral, KCI (Korea Citation Index), RISS, KoreaMed, and KoMCI.
- Its abbreviated title is *Child Health Nurs Res*.
- Open access: All articles published in the journal are freely available with an open access license for everyone to read and download from the CHNR website (http://www.e-chnr.org/) immediately and permanently after publication.

2. Aims and Scope

Child Health Nursing Research aims to promote the health, development, and well-being of children and their families in Korea and all over the world by providing research on evidence-based practices.

Its scope includes the most recent clinically and academically relevant topics in health care and nursing from the beginning of life to young adulthood, including both children and their families. The journal deals with articles that address research, theory, and practice in a wide range of child health nursing areas and relevant cultural issues. Its regional scope is mainly Korea, but it welcomes submissions from researchers and nurses worldwide.

The primary readers of this journal are healthcare professionals, administrators and scientists serving newborns, infants, children, adolescents, young adults, and their families, including nurses, midwives, physicians, developmental specialists, public health workers, scientists, educators, epidemiologists, and other health caregivers.

The ultimate goal of *Child Health Nursing Research* is to develop a body of knowledge on the health of newborns, infants, children, adolescents, young adults, and their families while improving the clinical field and community with evidence-based practices to promote the health of children and families all over the world.

3. Readership

This journal is published for health care professionals and administrators serving infants, children, adolescents, and families, working to promote child care and welfare. Through CHNR, readers obtain information on the most recent clinically and academically relevant topics in health care and nursing for the life span from the beginning of life to young adulthood, including both children and their family members. Specifically, nurses, midwives, physicians, developmental specialists, and public health workers in the field can obtain the most recent information about health problems and nursing strategies for children and families. Administrators of healthcare facilities and public health centers can access various data regarding health problems and obtain insights into healthcare planning for children and families. Social scientists and epidemiologists can access and utilize data on recent health problems of infants, children, adolescents, and families. Child health educators can obtain the

most up-to-date information on child health to convey that knowledge to students in the field of child health care and nursing. Researchers can learn about state-of-the-art research methodology for child health care.

II. Research and Publication Ethics

1. Research Ethics

1) Statements of Human and Animal Rights and Protection: CHNR endorses and follows international standards of ethical practice in human rights and protection and the principles addressed in the Declaration of Helsinki (Ethical Principles for Medical Research Involving Human Subjects, https://www.wma.net/wp-content/uploads/2016/11/DoH-Oct2013-JAMA.pdf). According to the Bioethics and Biosafety Act of Korea and in order to meet international standards for ethical practice in human rights and protection, any research involving human subjects must be approved by an Institutional Review Board (IRB). When animals are used as research subjects, the study must be conducted in correspondence with related regulations, such as those of the Institutional Animal Care and Use Committees (IACUCs, https://ori.hhs.gov/education/products/ncstate/iacuc.htm), or National Institutes of Health (NIH) Guide for the Care and Use of Laboratory Animals (https://grants.nih.gov/grants/olaw/guide-for-the-care-and-use-of-laboratory-animals.pdf). Any treatment methods in conflict with the regulations must be described and may be grounds for rejection of the paper.

2) Statements of Informed Consent: The researcher(s) must also obtain written voluntary informed consent from the participants or their parents or legal guardian. If the research involves a child or any vulnerable subject in any way, special and sensitive protection is needed to ensure the safety and human rights of the subject. When necessary, the editor of CHNR may ask the author(s) to present the relevant document(s) on the human rights and protection issues related to the manuscript, such as the informed consent form or the evidence for the IRB approval of the study.

2. Submission declaration and verification

Duplicate publication or duplicate submission is prohibited in accordance with the ICMJE recommendations (https://publicationethics.org/resources/flowcharts/redundant-duplicate-publication-published-article). Manuscripts that have been published or are being submitted to other journal(s) should not be submitted to CHNR. Manuscripts that have been published or are currently under consideration for publication in CHNR must not be submitted to another journal. Upon notice of a duplicate submission, submission privileges to CHNR will be suspended for 2 years.

1) Decision criteria for duplicate publication
   The manuscript has never been published in another language or any medium—print, electronic media, or an academic journal.
2) The corresponding author must obtain approval from the editor-in-chief of each related journal if she or he wishes to reprint the published manuscript in another language.
3) The editorial board will determine the nature and degree of the manuscript's duplicate publication or duplicate submission.

3. Publication Ethics and Malpractice Statements

The publication and research ethics of CHNR strictly follow the ICMJE guidelines (http://www.icmje.org/).

1) Reporting standards: Authors should report on their work accurately and objectively without inappropriate manipulation. Authors should describe their methods and procedures in enough detail and present sufficient references so that others can replicate the work. Authors should not produce, record, or report non-existent data and results and should not change or omit data. Authors should also avoid producing multiple publications ("salami slicing") from content that should be only one substantial manuscript. Manuscripts that do not follow the international ethical standards of research and publication (i.e., those that involve fabrication, falsification, salami slicing, plagiarism, or simultaneous/duplicate submission) will not be considered for publication in CHNR. The editorial board will adjudicate the specific reasons for rejection.

2) Authorship of the manuscript: Authorship is be limited to those who have made a substantial contribution to the manuscript in terms of conception and design, as well as the collection, analysis, and interpretation of the data. All authors should be involved in drafting and reviewing the

manuscript and must approve the final version of the manuscript. The corresponding author is required to confirm that all appropriate persons are listed as authors in the manuscript. All authors must agree to be accountable for all aspects of their work and to ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

3) **Originality and plagiarism:** Authors are required to submit original manuscripts and confirm that they have cited or quoted others' ideas and texts appropriately and accurately. Plagiarism means the appropriation of another person's ideas, research processes, results, or text as one's This includes using previously published material of oneself or any other author without citing the references. The editorial board of CHNR uses the Crossref Similarity Check tool to check for plagiarism. If plagiarism is discovered in the manuscript, the manuscript will not be published.

4) **Multiple, simultaneous, or duplicate submission:** Authors should not submit the same research to more than one journal and should not publish the manuscript in different languages. If authors wish to pursue a secondary publication of the manuscript in another language, they should obtain approval from the editor-in-chief of both related journals. The editorial board will determine the nature and degree of duplicate publication or duplicate submission for the manuscript.

5) **Data access and retention:** Authors should retain research data and be prepared to allow access to the data in case the editorial board asks them to provide the raw data in connection with the editorial review.

6) **Disclosure and conflict of interest:** Authors are required to disclose commercial or similar relationships to products or companies mentioned in the article being submitted or related to its subject matter.

7) **Acknowledgment of sources:** Sources of funding for the manuscript should be acknowledged. Authors should use or report the information obtained privately with explicit, written permission from sources.

8) **Fundamental errors in a manuscript:** When authors find a fundamental error in a published manuscript, they should immediately inform the editor and cooperate with the editor to correct or withdraw the manuscript.

9) **Process for managing publication malpractice:** When reviewers or readers suspect publication malpractice such as fabrication, falsification, salami slicing, plagiarism, or simultaneous/duplicate publication; inappropriate changes in authorship, an undisclosed conflict of interest, ethical problems with a submitted manuscript, a reviewer who has appropriated an author's idea or data, complaints against editors, and so on, the process of resolution will be initiated following the flowchart provided by the Committee on Publication Ethics (COPE) (http://publicationethics.org/resources/flowcharts). The ethics committee will discuss and adjudicate cases of suspected publication malpractice, as well as complaints and appeals against editors. CHNR will not hesitate to publish errata, corrigenda, clarifications, retractions, apologies, and expressions of concern when needed.

4. Conflict of Interest

An article's corresponding author is required to notify the editor of any potential conflicts of interest that might have affected the study's findings or the way the data were interpreted. Even when the authors are certain that their respective judgments were unaffected when producing the article, a potential conflict of interest should be stated on the title page and at the conclusion of the main text. Conflicts of interest can include ties to pharmaceutical corporations on a personal or financial level, political pressure from special interest organizations, or issues in the classroom. The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest (https://www.icmje.org/disclosure-of-interest/) should be used as the model for the disclosure form. The editor will determine whether the conflict of interest disclosure should be made in the final version of the work. All funding sources for a study should be specifically identified. Before assessing a particular paper, CHNR requests that referees notify the editor if they have any conflicts of interest. All article submissions from editors, staff members, or editorial board members are handled in the same manner as unsolicited submissions. They will not participate in the decision-making or reviewer selection process. Even for commissioned manuscripts, editors will not handle their own work.

5. Authorship

The practices of CHNR regarding research and publication ethics strictly follow the International Committee of Medical Journal Editors (ICMJE) guidelines (http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html), and the Good Publication Practice Guidelines for Medical Journals 4th Edition (ISMPP, 2022, https://www.ismpp.org/gpp-2022).

1) Authorship credit

All other contributors should be credited in the acknowledgments. After the initial submission of a manuscript, any changes whatsoever in authorship (adding author[s], deleting author[s], or re-arranging the order of authors) must be explained in a letter to the editor from the authors concerned. All authors of the paper must sign this letter. Every author must also complete a copyright assignment.

2) Authorship Taxonomy

The corresponding author is responsible for ensuring that the descriptions are accurate and agreed upon by all authors. The role(s) of all authors should be listed, using the above relevant categories. Authors may have contributed in multiple roles. CRediT in no way changes the journal's criteria to qualify for authorship. Please select the CRediT (https://credit.niso.org/) statements provided below during the submission process. This information will appear above references section of the published paper, as shown below as an example.

3) Corresponding author and first author: CHNR does not allow multiple corresponding authors for a single article. Only one author for each article should correspond with the editorial office and reviewers. CHNR does not allow multiple first authors for a single article.

4) Correction of authorship after publication: CHNR does not correct authorship after publication unless the editorial staff has made a mistake. Authorship may be corrected after submission and before publication if all authors involved with the manuscript request an authorship correction.

III. Guidelines for Manuscript Preparation

1. Types of Manuscripts

This journal publishes original articles, review articles, and

Table 1. Authorship Taxonomy(https://credit.niso.org/)

Term	Definition
Conceptualization	Ideas; formulation or evolution of overarching research goals and aims
Methodology	Development or design of methodology; creation of models
Software	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components
Validation	Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection
Resources	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools
Data Curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse
Writing – Original Draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)
Writing – Review & Editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary, or revision – including pre-or post-publication stages
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/ data presentation
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team
Project administration	Management and coordination responsibility for the research activity planning and execution
Funding acquisition	Acquisition of the financial support for the project leading to this publication

editorials on health care and nursing for birth to young people and their families.

- ***Original articles:*** CHNR publishes original articles that fit the journal's aims and scope. These comprise comprehensive papers outlining novel research. These are reports of empirical data from top-notch scientific and clinical research studies that have relevance to nursing and health care for people from the beginning of life to young adulthood and their families. Original articles cover children's health issues, with topics encompassing nursing theory, practice, and education, among others. The articles published in CHNR present significant research results obtained using a variety of methodologies, including mixed-method designs, observational, quasi-experimental, and experimental investigations, as well as qualitative methods and measurements, including the development and evaluation of instruments. The appropriate standards should be followed when writing research papers.
- ***Review articles:*** Critical presentations on themes of interest and importance to child health nursing theory, practice, and education are included. A review article's body should consist of a thorough evaluation of the literature that is supported by academic research, critical analysis, and reasoned conclusions. We publish comprehensive literature reviews, as well as systematic reviews which target specific research problems, such as scoping reviews. We also release discussion papers, which are academic works with a discursive or argumentative tone. There must always be a discussion and critical evaluation of a significant body of research or other scholarship.
- ***Editorials:*** These are by invitation only and feature remarks made by institutional representatives or individual authors on topics of current interest. Authors should get in touch with the manager in the editorial office if they have any suggestions for editorials that deal with topics that are critically important to the discipline, especially those that are contentious or closely related to recent or upcoming journal articles.

2. Authors of Manuscripts

1) Anyone may submit a manuscript for publication in CHNR.
2) If the manuscript is the product of a dissertation, the author must disclose that the manuscript is the product of a dissertation for an academic degree program. The first author must be the author of the dissertation.

3. General Information

1) Submission system

The manuscript must be submitted online through http://www.e-chnr.org/ (website of CHNR) or http://www.chnr-submission.org/ (peer review system of CHNR). There, authors may review the submission instructions and access all submission forms, including the author checklist.

2) Language and style

Every manuscript should be written in English. The author can submit the manuscript as a Microsoft Word file or HWP file with an A4 paper size layout. The margins of the paper should be set as follows: top 30 mm, bottom 25 mm, left 25 mm, and right 25 mm. A 10-point font size should be used, and the text should be double-spaced.

3) Manuscript length

Abstracts, texts, references, tables, and figures included in the manuscript have different limits depending on the type of manuscript submitted, but all submissions must comply with the contents of Table 1. The number of references is recommended to be 30 or fewer for an article. However, the authors can include more references depending on the various article types, which have no limit on references.

Table 2. Recommended maximums for articles submitted to *Child Health Nursing Research*

	Abstract	Text	Tables & Figures
Original article	250	6,000	5
Review article	250	8,000	5
Editorial	None	2,500	5

4) Abbreviations used

If authors choose to use an English abbreviation, the complete spelling must be used upon first mention, and the abbreviation may be used after that. The title should not include any abbreviations.

5) Samples and participants

Authors should confirm the correct use of the words "sex" (when reporting biological factors) and "gender" (identity, psychosocial, or cultural factors), and report the sex or gender of study participants. Authors should define how they determined race or ethnicity and justify its relevance. If the

study was done involving an entire population, the authors should explain the reason.

6) Prior approval for the use of psychosocial questionnaires (survey tools)

Authors must acquire permission for the utilization of any psychosocial questionnaire from the tool's copyright holder.

7) Describing machinery or technical equipment

When identifying machinery and equipment, the following should be included in parentheses: the model, manufacturer. Brand names are identified by ™, ®, etc. Brand names should be used only when necessary.

8) When the manuscript is submitted, references and citations may follow any accepted style:

Examples include National Library of Medicine (NLM) and American Psychological Association (APA) style. However, after the manuscript is accepted, all references and citations must be converted to follow Citing Medicine: The NLM Style Guide for Authors, Editors, and Publishers, 2nd Edition (2007). It is the responsibility of the submitting author(s) to confirm that NLM style guidelines are adhered to prior to final publication.

4. Reporting Guidelines for Specific Study Designs

Research reports frequently omit important information. As such, reporting guidelines have been developed for a number of study designs. Authors are encouraged to adhere to relevant reporting guidelines when describing their study. A good source of reporting guidelines is the EQUATOR Network (http://www.equator-network.org/home/) and the United States National Institutes of Health/ National Library of Medicine (http://www.nlm.nih.gov/services/research_report_guide.html).

- *Observational cohort, case-control, and cross-sectional studies*

  Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)

  Meta-analysis of Observational Studies in Epidemiology (MOOSE)
- *Qualitative studies*

  Consolidated Criteria for Reporting Qualitative Research (COREQ)

  Standards for Reporting Qualitative Research (SRQR)
- *Quasi-experimental/ non-randomized trials*

  Transparent Reporting of Evaluations with Non-randomized Designs (TREND)
- *Randomized (and quasi-randomized) controlled trials*

  Consolidated Standards of Reporting Trials (CONSORT)
- *Study of Diagnostic accuracy/assessment scale*

  Standards for the Reporting of Diagnostic Accuracy Studies (STARD)
- *Systematic Review and meta-analysis*

  Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA)

  Meta-analysis of Observational Studies in Epidemiology (MOOSE)
- *Quality improvement studies*

  Standards for Quality Improvement Reporting Excellence (SQUIRE)

5. Sequence of Headings in an Original Article

The manuscript should be organized as follows. Each section should be clearly delineated. Instructions for each appear below the list.

Beginning section	- Cover letter - Title page - Abstract and keywords
Middle section (Main text)	- Introduction - Materials and Methods - Results - Discussion - Conclusion
Ending section	- ORCID and ResearcherID - Authors' contribution - Conflict of interest - Funding resource - Data availability - Acknowledgements - Supplementary materials - References
Other elements	- Tables and Figures

1) Beginning section

(1) Cover letter

The authors should address a cover letter to the editor in which they summarize the main components of the manuscript and what makes its contribution original and relevant to the Aims and Scope of CHNR. The author(s) should also address any other matters associated with authorship and publication they wish the editors to consider.

(2) Title page

① The content of the title page should appear as follows in this order: Title, running title, type of manuscript, author(s), corresponding author, conflict of interest, IRB approval, MeSH (Medical Subject Headings, https://www.ncbi.nlm.nih.gov/mesh/) keywords, number of references, and number of words of the English abstract. More specific requirements for these components are detailed below.

② Type of manuscript: One of the following should be noted: original article, review article, editorial, or invited paper.

③ Author(s): This section should list the names of all authors, each with their position and affiliation including title, department, and location of institutions to which the work should be attributed. It should also present each author's ORCID number and describe the author's role in this study.

④ Corresponding author: The corresponding author should be identified with the address (zip code), email, telephone, fax, and ORCID number.

⑤ Conflict of interest: Any matter pertaining to the research should be noted here, such as the source of research funds, conflicts of interest, or indication that the manuscript is derived from a dissertation or thesis for an academic degree program.

⑥ IRB approval: The author should fill in information about the institution that provided IRB approval, including the approval number, and informed consent. However, if it is not a study of humans or animals, a statement should be made about IRB exemption.

⑦ MeSH Keywords: The keywords are drawn from the MeSH list (not more than five).

⑧ Number of references: It is recommended that an article include no more than 30 references. However, for articles that have no reference restriction, such as meta-analyses, systematic reviews, or structural equation models, authors are free to provide more references.

⑨ Number of words of the English abstract: The number of words in the English abstract should be noted. The total should be no more than 250 words.

(3) Abstract and keywords

An abstract of up to 250 words for articles (including reviews) should be typed double-spaced on a separate page. It should cover the main factual points, including statements of the purpose, methods, results, and conclusions. The abstract should be accompanied by a list of three to five keywords for indexing purposes. The keywords should be as specific as possible and drawn from the list of MeSH keywords.

2) Middle section

The text should be composed in the following order: introduction, methods, results, discussion, conclusion.

(1) Introduction

The introduction should clearly state the need for this study and the main question or hypothesis of the study. A literature review or summary of background information related to the study should be presented.

(2) Methods

This section should describe the study design, setting and samples, ethical considerations, measurements/instruments, data collection/procedure, and data analysis used. If the study is qualitative, the research instrument can be omitted. An “Ethics statement” should be provided after the "Methods" heading in a text-box format.

> Example)
> Ethics statement: This study was approved by the Human Ethics Committee of the University of XXX (IRB No. 202104-0002-03). Informed consent was obtained from all participants.

(3) Results

The main results should be summarized in concise paragraphs. Levels of statistical significance and confidence intervals should be noted where appropriate.

(4) Discussion

The discussion should be based only on the reported results. The discussion is recommended to reflect advances in nursing practice and nursing knowledge development.

(5) Conclusion

Conclusions and recommendations for further study should be presented here, but the study results should not be summarized again.

3) Ending section

(1) ORCID and ResearcherID

The authors should provide the ORCID number and ResearcherID.

(2) Authors' contribution

Authors' contribution should be based on the authorship taxonomy.

(3) Conflict of interest

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. If there are no conflicts of interest, the following is an example of a sentence that can be used: "No existing or potential conflict of interest relevant to this article was reported."

(4) Funding resource

Funding institutions' policies should acknowledge sources of funding for the manuscript. If there is no funding resource, the following is an example of a sentence that can be used: "None".

(5) Data availability

Based on the degree of sharing plan, authors should deposit their data after deidentification and report the DOI of the data and the registered site. Please contact the corresponding author for data availability.

(6) Acknowledgments

Any persons who contributed to the study or the manuscript but did not meet the authorship requirements can be listed here. Written permission should be obtained from any person or organization mentioned in this section.

(7) Supplementary materials

If there are supplementary materials to help the understanding of readers or too much data to be included in the main text, it may be presented as supplementary data.

(8) References

When the manuscript is submitted, references and citations may follow any accepted style. Examples include National Library of Medicine (NLM) and American Psychological Association (APA) style. However, after the manuscript is accepted, all references and citations must be converted to follow Citing Medicine: The NLM Style Guide for Authors, Editors, and Publishers, 2nd Edition (2007). It is the responsibility of the submitting author(s) to confirm that NLM style guidelines are adhered to prior to final publication. Authors are responsible for the accuracy of the references. Use of DOIs is highly encouraged.

4) Other Elements

(1) Tables and Figures

Tables and figures, including illustrations and photos, should be presented or described in English. The figures should be on separate pages. The total number of tables and figures in a manuscript is no more than 5.

All tables and figures should be easy to understand, even when presented separately from the rest of the manuscript, and should present information relevant to the study.

6. References format

1) Style

A description of the References section is provided below. The References follow the NLM Style Guide for Authors, Editors, and Publishers, 2nd Edition (2007) (http://www.nlm.nih.gov/citingmedicine) if not mentioned below. References should be numbered serially in the order of appearance in the text, with numbers in brackets [ ]. The original reference number should be used if a reference is cited more than once.

2) Citation format

If authors wish to cite references, please use the following format.

(1) Cited work's author

If there are 7 or more authors of a cited work, the first 6 should be listed, followed by "et al."

Example: Wolchik SA, West SG, Sandler IN, Tein J, Coatsworth D, Lengua L, et al.

(2) Journals

The name of the journal should be written in full.

① Journal articles

- For 6 or fewer authors, all authors should be listed

Example:
Diego MA, Field T, Hernandez-Reif M. Preterm infant weight gain is increased by massage therapy and exercise via different underlying mechanisms. Early Human Development. 2014;90(3):137-140. https://doi.org/10.1016/j.earlhumdev.2014.01.009

- For more than 6 authors, the first 6 should be listed, followed by et al.
  Example:
  Kang HK, Kim TB, Kim KH, Kim MJ, Kim JH, Kim HY, et al. Development and effect of a metabolic syndrome prevention program for university students using mobile application. Child Health Nursing Research. 2014;20(3):205-214. https://doi.org/10.4094/chnr.2014.20.3.205
- Journals on the internet
  Example:
  Yoon SH, Kim SJ. A study on the relativeness between safety knowledge and safety behavior of elementary school children. Journal of the Korean Society of School Health. [Internet]. 2012 June [cited 2017 November 7];25(1):39-50. Available from: http://www.jkssh.or.kr/journal/view.html?uid=81&page=&sort=&scale=10&all_k=&s_t=&s_a=&s_k=&s_v=25&s_n=1&spage=&pn=search&year=&vmd=Full
- Newspaper articles
  Example:
  Cho CU. Stem cell windpipe gives Korean toddler new life. The Korea Herald. 2013 May 2;Sect. 01.

(3) Books

① Reference to an entire book
Example:
Brown B. Braving the wilderness: The quest for true belonging and the courage to stand alone. 1st ed. Random House: 2017. p. 132.
Example:
Peate I. The student's guide to becoming a nurse. 2nd ed. John Wiley & Sons; 2012. p. 59-90.
Example:
Min KA, Kim CG. Nursing management. Knowledge & Future; 2012. p. 45-62.

② Chapter in an edited book
Example:
Bochner BH. Identification of nodal metastases: The role of iron oxide enhanced MRI. In: Lee CT, Wood DP, Editors. Bladder cancer. 1st ed. Humana Press; 2010. p. 67-77.

③ Entire books on the internet
Example:
Radley DC, How SKH, Fryer AK, McCarthy D, Schoen C. Rising to the challenge: Results from a scorecard on local health system performance, 2012 [Internet]. Commonwealth Fund; 2012 March [cited 2017 February 8]. 14 p. Available from: http://www.commonwealthfund.org/~/media/files/publications/fund-report/2012/mar/local-scorecard/1578_commission_rising_to_challenge_local_scorecard_2012_finalv2.pdf

(4) Scientific and technical reports

Example:
Korean Women's Development Institute. 2015 National multicultural family survey report. Survey Report. Seoul: Ministry of Gender Equality & Family; 2016. Report No.: MOGEF2016-3.
Example:
Won YJ, Shin HR, Jeong GW, Shin AS, Gong HJ, Oh CM, et al. Cancer registration & statistics branch, division of cancer registration & surveillance. National Cancer Control Institute Annual Report. Seoul: National Cancer Center; 2012 November. Report No.: 2012.11-13520000010145-10.

(5) Unpublished theses or dissertations

Example:
Lee YH. Development and effects of nocturnal emission and menstruation education program using CAI for Korean elementary school children [dissertation]. Seoul: Ewha Womans University; 2010. p. 1-118.
Example:
Choi JW. Clinical characteristics and treatment outcomes of pediatric neurofibromatosis type 2: Neurosurgical series [master's thesis]. Seoul: Seoul National University; 2013. p. 1-45.

(6) Conference proceedings

Example:
Bell JM. Highlights from the 10th international family nursing conference. Making family nursing visible: From knowledge building to knowledge translation 10th international family nursing conference; 2011 June 24-48; Kyoto International Conference Center. Kyoto: Sage Publications; 2012. p. 135-139.

(7) Web

Example:

Statistics Korea. Cause of death statistics in 2015 [Internet]. 2016 [cited 2016 September 27]. Available from: http://kostat.go.kr/portal/eng/pressReleases/8/10/index.board?bmode=read&bSeq=&aSeq=357968&pageNo=1&rowNum=10&navCount=10&currPg=&sTarget=title&sTxt=

Example:

Statistics Korea. 2014 Maternal birth rate by age [Internet]. 2014 [cited 2015 February 10]. Available from: http://kosis.kr/index/index.do

7. Tables and Figures format

1) Table formatting

① All lines are to be single. Vertical lines should not be used.

② The title of a table should appear above the table. The first letter of important words in the title should be capitalized (title case).

Example: Table 1. Responses to Question Types

③ Tables should be numbered consecutively, e.g., Table 1., Table 2., and so on.

④ Table data should be explained in the footnotes. All abbreviations used in the tables should be defined in the footnotes of every table in which they appear.

Example: HR, heart rate; T, temperature.

⑤ In a table, use a superscript lowercase letter to indicate each footnote. The tables should be placed beneath the footnotes.

Example: [a)]Surviving case; [b)]Deceased case.

⑥ If the value of a decimal exceeds 1, a 0 should appear before the decimal point; otherwise, nothing should appear before the decimal point.

Example: $t = 0.26$, $F = 0.92$

Example: $p < .001$, $r = .01$, $R^2 = .61$

⑦ The statistical significance (p value) should be written without a footnote and should be rounded to three decimal places. (For example: $p = .003$)

If p is 0.000, then indicate that p is less than 0.001 ($p < .001$).

If p is 1.000, then indicate that p is greater than 0.999 ($p > .999$).

2) Illustration and Photograph Format Rules

① The title should appear below an image. Only the first letter of the first word should be capitalized (sentence case).

Example: Figure 1. Mean responses to questions by student grade categories.

② The size of the image should be 102 × 152 mm (4 × 6 inches). Larger images may be permitted; however, each image should not exceed 203 × 254 mm (8 × 10 inches).

③ If one figure contains 2 or more images, consecutive alphabet letters should be used to distinguish among the images.

Example: Figure 1-A, Figure 1-B

④ The photomicrograph of a tissue sample, the region from which the tissue was extracted, and the staining method should be noted. The magnification scale must be included.

⑤ The following symbols should be used in graphs in the following order: ●,■,▶,◆,○,□,▷,◇.

8. Quotations from Other Sources

Citations may follow any style, for example, NLM, APA, or others.

IV. Manuscript Submission, Review, and Publication Process

1. Submission process

1) Before submission

- The authors can use any files, such as MS Word, .hwp, and so on.
- Manuscripts must be submitted through the CHNR website (http://www.e-chnr.org/) or CHNR peer review system (http://www.chnr-submission.org/).
- Authors may review the submission instructions and access all submission forms, including the author checklist.

2) During submission

(1) Preview: The editorial committee of editorial staff members initially evaluates each submission. The main goal is quickly selecting which papers should not be put up for peer review and whether to send them for review. In order to prevent delays for authors who might want to seek publication elsewhere, papers that

do not meet basic standards or are unlikely to be published regardless of a favorable peer review, for example, because their novel contribution is insufficient or the relevance to the discipline is unclear, may be rejected at this stage.

(2) Peer review process

- All manuscripts are treated as confidential and peer-reviewed by experts in the field.
- The manuscripts are reviewed within a few days of submission to determine whether they adhere to the journal's policies and fit the submission guidelines. Any submission may be rejected for publication by the Editorial Board without cause.
- More details on other pertinent regulations are available on the journal's website. Should there be any questions on how to use the online submission system, authors may contact the editorial office of CHNR.

3) After the acceptance of the manuscript

After the acceptance of the manuscript, the author must submit the copyright transfer agreement and conflict of interest disclosure statement. All forms (the author's checklist, copyright transfer agreement, and disclosure of conflicts of interest) are available on the websites of the journal (http://www.e-chnr.org/) and the Korean Academy of Child Health Nursing (http://www.childnursing.or.kr).

All authors should print their names and sign the copyright transfer agreement and conflict of interest disclosure form.

2. Peer review process

1) Number of reviewers

Two or more reviewers and the editor will conduct a double-blind peer review of each of these manuscripts.

2) Peer review process and the author's response to the reviewers' comments

There is a two-week peer review period, and the first decision is made after the evaluation is finished. Following the review, the Editorial Board will decide between the options: acceptable options include minor revision, major revision, or rejection. The Editorial Board may request authors to make changes to the manuscript in response to reviewers' comments. The author should reasonably indicate if the reviewer's opinion is unacceptable or if the reviewer is thought to have misinterpreted the data. The authors should try their best to comply with any requests made by the reviewers to modify the manuscript.

After making changes to the manuscript, the author should upload the updated files along with a response to each reviewer's comment. Revisions from the author must be finished within 15 days of the request. The Editorial Board will inform the author if it is not received by the deadline. The author should discuss an extension with the Editorial Board if they want to prolong the revision window past 15 days. Up to two rounds of the manuscript evaluation process may be offered. The Editorial Board may consider further review if the authors request it. The Editorial Board will ultimately decide whether to approve the submitted manuscript for publication and may, if necessary, ask for additional alterations, edits, and deletions to the article text. Statistical editing is also done if a statistician needs to review the data professionally.

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Authors in developing countries (https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf) may be exempt from author fees after negotiation with the Editorial Board.

If at least one of the authors is a Korean Academy of Child Health Nursing member, the paper will qualify for a discounted submission.

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Table 3. 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	No
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).			

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4. Data sharing policy

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" (https://doi.org/10.3346/jkms.2017.32.7.1051). As of July 1, 2018, manuscripts submitted to ICMJE journals that report the results of interventional clinical trials must contain a data sharing statement as described below. Clinical trials that begin enrolling participants on or after January 1, 2019 must include a data sharing plan in the trial's registration. The ICMJE's policy regarding trial registration is explained at https://www.icmje.org/recommendations/browse/publishing-and-editorial-issues/clinical-trial-registration.html. 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 authors of research articles dealing with interventional clinical trials must submit a data sharing plan (see examples 1 to 4 in Table 3). Based on the degree of sharing plan, authors should deposit their data after deidentification and report the DOI of the data and the registered site.

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