

CHNR

Child Health Nursing Research

Vol.30, No.1, January 2024

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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.

Manuscripts should be submitted via the online Manuscript Central website (<http://www.e-chnr.org>). Other correspondences can be sent by an e-mail to the Editor, Dr. Yunsoo Kim, Department of Nursing, Catholic Kwandong University, Gangneung, Korea (Tel: +82-33-649-7614, Fax: +82-33-649-7620, e-mail: agneskim@cku.ac.kr).

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Celebration of the 30th anniversary of the Korean Academy of Child Health Nursing

Hyun Young Koo

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The Korean Academy of Child Health Nursing (KACHN) is the most prominent and representative academic institution in the field of child health care in Korea. KACHN is dedicated to supporting children—from newborns to adolescents—and their families in preserving and improving their health, as well as in preventing diseases.

The majority of members of KACHN are faculty members and researchers at academic institutions, as well as child care specialists working in hospitals and community settings. KACHN is dedicated to advancing the theoretical and practical aspects of child health nursing by facilitating scholarly and multidisciplinary exchanges among its members.

KACHN engages in various activities, including hosting two conferences annually, providing research grants, presenting awards for outstanding research, and offering empowerment programs for junior scholars. These programs are designed to improve their skills in education and research pertaining to child health care. *Child Health Nursing Research* (CHNR) is the official journal of KACHN. It is a double-blind, peer-reviewed, open-access publication that

disseminates original research and review articles on nursing and health care for children and their families, covering the spectrum from the beginning of life to young adulthood.

1. The Mission and Vision of the Korean Academy of Child Health Nursing

The mission of KACHN is to support the development of children into future societal leaders by fostering a secure and healthy environment. To achieve this, we explore nursing knowledge related to children and families, establish best practices for child care, and disseminate this information to enhance the health and well-being of children.

The vision of KACHN is to be the most trustworthy research organization in the field of child health nursing, the leading advocacy group for child health nursing, and the most respected professional body within the child health nursing community.

The members of KACHN will conduct themselves in the following manner in order to fulfill its mission and vision. We pledge to protect children from all threats to their health as part of our calling as specialists in child health nursing. We are committed to child health nursing research, carrying out evidence-based nursing practices, and sharing research results with our society and others dedicated to the highest standard of child health care. Our commitment encompasses safety and health education so that children do not suffer needlessly from injuries or illnesses. We are dedicated to protecting children from physically and mentally harmful situa-

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tions and/or abuse to ensure that they can lead fruitful lives and live happily. We advocate for the healthy growth and development of all children and the rights of children from vulnerable backgrounds, including those from single-parent families, grandparent-headed families, low-income families, and multicultural families.

2. The History of the Korean Academy of Child Health Nursing

Our academy originated as the Academy of Obstetric and Pediatric Nursing, an academic division of the Korean Society of Nursing Science, in June 1971. In February 1979, it was rebranded as an affiliated Academy of Maternal and Child Health Nursing under the same society. The name was revised once more in March 1987, becoming the Academy of Maternal and Child Health Nursing.

In December 1994, we separated from the parent organization to establish the Academy of Child Health Nursing. We celebrated the 43rd anniversary of the founding and the 20th anniversary of the Academy's restructuring in June 2014. In October 2015, we incorporated "Korea" into the society's Korean name, thus becoming the KACHN. This year, we will celebrate the 30th anniversary of the restructuring of the KACHN.

We held our first academic conference in July 1994, and since then, we have held two conferences per year, focusing on current issues in child health care. We also organize annual educational seminars and workshops for university faculty, researchers, and child care specialists. During the COVID-19 pandemic, we held online web seminars for pediatric nursing education and clinical care.

In January 1995, we held our first overseas training program about pediatric critical care nursing at the Hawaii Honolulu Center for Asia Pacific Exchange. We also held overseas clinical education programs for advanced nursing practice for child health care at the University of Cincinnati College of Nursing and Cincinnati Children's Hospital in July 2007 and July 2023.

We published the first issue of the *Korean Journal of Child Health Nursing*, which included four survey studies, one instrument development study [1], and a literature review [2]. The journal changed its name to the *Journal of the Korean Academy of Child Health Nursing* in May 2005 and was listed in the Korea Citation Index (KCI) in January 2006.

The journal changed its name to CHNR in January 2013. In

2018, CHNR was indexed in Scopus and started to be published in English once a year. In 2019, CHNR published two English-language issues, and in 2020, it published three issues in English. Since volume 27, issue 3 in 2020, all articles in CHNR have been published in English. The transition of CHNR to an all-English publication has resulted in an increase in international submissions [3]. CHNR was indexed in PubMed Central (PMC) in January 2022, and was the first nursing journal in Korea to become a PMC journal [4].

3. Future Perspectives of the Korean Academy of Child Health Nursing

To date, KACHN has established itself as a leader in research, theory, and practice within the field of child health nursing. Its members deliver health care services to children and their families, both domestically and internationally.

As specialists in child health nursing, we are committed to protecting children from health hazards and fostering a safe environment for their well-being. Numerous severe health risks for children have been linked to environmental threats such as air pollution and climate change. Because children are still developing, the long-term effects of a harmful environment are disproportionately greater for them [5]. Given that nature and the environment will play a crucial role in shaping their future, it is essential for children to recognize the importance of the environment, engage in active environmental conservation, and express their opinions. Adults should be attentive to the perspectives of children as well [6]. As professionals in the field, we must acknowledge the significance of the environment in children's lives and commit to conducting future research to generate relevant evidence in child health nursing.

We will continue to hold high-quality academic conferences, education seminars, and research workshops to support child health nursing research, the implementation of evidence-based nursing practices, and the dissemination of research findings with our society. Our journal, CHNR, remains dedicated to promoting 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.

We are committed to safety and health education to prevent children from suffering unnecessary injuries or illnesses. Child maltreatment includes various forms of exploitation and neglect, as well as physical, psychological, and sexual

abuse that threaten a child's development, life, health, or dignity [7]. Much of this maltreatment occurs repeatedly within the home. Therefore, it is essential to establish a safe home environment for children. Our dedication extends to shielding children from physically and mentally harmful circumstances, including abuse, to enable them to lead successful and happy lives.

We will advocate for the healthy growth and development of all children, as well as their rights, particularly in vulnerable families. Adolescents from multicultural families often face challenges in forming relationships with their peers, suffering from low self-esteem and identity issues due to social marginalization and the prejudice of not being recognized as Korean [8]. With the rise of multicultural families in South Korea and other countries, it is crucial to understand the unique characteristics of these families. Our goal is to support children from multicultural backgrounds in integrating into mainstream Korean society in a way that promotes healthy interactions while preserving their distinct cultures and identities.

As members of KACHN, we are proud of our contribution to children's health and remain committed to our academic organization's mission and duty to eradicate health disparities. We will continue to strive for equitable access to a wide range of resources for children and their families.

ARTICLE INFORMATION

Authors' contribution

All the work was done by Hyun Young Koo.

Conflict of interest

Hyun Young Koo has been an editor of *Child Health Nursing Research* since 2016. She was not involved in the review process of this article. No existing or potential conflict of interest relevant to this article was reported.

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Data availability

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REFERENCES

1. Hong KJ. Validity and reliability test of the Health Self-Determinism Index for American Children. *Korean Journal of Child Health Nursing*. 1995;1(1):47-58.
2. Kim HS. Support care for families of developmentally delayed children. *Korean Journal of Child Health Nursing*. 1995;1(1): 59-65.
3. Koo HY. Journal statistics, directions for development, and appreciation for reviewers. *Child Health Nursing Research*. 2022;28(1):5-8. <https://doi.org/10.4094/chnr.2022.28.1.5>
4. Huh S. Marking the inclusion of the Korean Journal of Women Health Nursing in PubMed Central and strategies to be promoted to a top-tier journal in the nursing category. *Korean Journal of Women Health Nursing*. 2022;28(3):165-168. <https://doi.org/10.4069/kjwhn.2022.08.19>
5. Schmidt CW. Growing a new study: environmental influences on child health outcomes. *Environmental Health Perspectives*. 2015;123(10):A260-A263. <https://doi.org/10.1289/ehp.123-a260>
6. Bang KS. The environment and children's health. *Child Health Nursing Research*. 2023;29(1):1-4. <https://doi.org/10.4094/chnr.2023.29.1.1>
7. World Health Organization (WHO). Child maltreatment [Internet]. 2020 [cited 2021 September 28]. Available from: <https://www.who.int/news-room/fact-sheets/detail/child-maltreatment>
8. Choi Y, Lee J, Kang S. A phenomenological study on the daily experience of multicultural families adolescents. *Journal of Humanities and Social Sciences* 21. 2020;11(1):1747-1761. <https://doi.org/10.22143/HSS21.11.1.127>

Journal statistics in 2023 and catalysts for the future transformation of *Child Health Nursing Research*

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Happy New Year to all the readers of *Child Health Nursing Research* (CHNR) around the world! My name is Yunsoo Kim, and I have the honor of serving as the Editor-in-Chief of CHNR for the 2024–2025 term. As we celebrate the 30th anniversary of CHNR, I am eager to build upon the successes of my predecessors and to further advance the journal. In this article, I will outline the current status of the journal and share our plans for its development in 2023.

Volume 29 of CHNR was published in 2023, comprising four issues with a total of 30 articles in English. The average number of authors per article was 2.61 (standard deviation, 1.85; range, 2–8) (Table 1). Notably, 92.7% of the authors were Korean, with the remaining 7.3% hailing from Indonesia, Jordan, and Ghana. The proportion of foreign authors decreased by 8.4% from the previous year. In 2023, 60.0% of the articles were funded by national organizations, universities, or public institutions.

The distribution of article types remained consistent with that of 2022, with five editorials (16.6%), 16 original articles (53.4%), and nine review articles (30.0%) (Table 2). Descrip-

tive and cross-sectional studies were the most common type of original articles, accounting for 30.0% of the total, followed by cohort studies at 10.0%, secondary analysis studies at 6.7%, and methodology studies (program development) and Q-methodology studies at 3.3% each. Although the total number of original articles remained the same as in 2022, the variety of article types increased. In 2023, CHNR published a diverse range of articles, including systematic and meta-analyses, concept analyses, text network analyses, integrative reviews, and a narrative literature review.

Although the total number of articles published was the same as in 2022, this expansion in article types demonstrates our commitment to providing comprehensive coverage of the field. While we continue to face challenges in terms of author diversity and article volume, we remain confident in our ability to deliver high-quality content to our readers. CHNR will continue to publish high-quality articles on children's health written by authors from countries throughout the globe.

CHNR is indexed in the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scopus, Directory of Open Access Journals (DOAJ), Google Scholar, Crossref, Korea Citation Index (KCI), KoreaMed, and Korean Medical Citation Index (KOMCI), which maintain records of all publications published in CHNR. The DOAJ and Scopus Content Selection and Advisory Boards both approved CHNR for inclusion in their databases in July 2019 and February 2018, respectively. Additionally, the National Research Foundation of Korea (NRF) updated its assessment of CHNR in 2020,

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Table 1. Bibliometric Analysis of *Child Health Nursing Research* in 2023 (N=30)

Categories	n (%) or M ± SD	Range
Number of articles		
29 (1)	9 (30.0)	
29 (2)	6 (20.0)	
29 (3)	8 (26.7)	
29 (4)	7 (23.3)	
Language of articles		
English	30 (100.0)	
Number of authors per article	2.61 ± 1.85	2–8
Country of authors ^{a)}		
Korea	63 (92.7)	
Indonesia	2 (2.9)	
Jordan	2 (2.9)	
Ghana	1 (1.5)	
Funding source		
Not supported	12 (40.0)	
Supported		
By a national institution	11 (36.7)	
By a university	6 (20.0)	
By a public foundation	1 (3.3)	

^{a)}Means duplicate data; M, mean; SD, standard deviation.

and it is now part of the KCI. Immediately upon publication, all manuscripts published in CHNR are indefinitely accessible to the public, with open access for anybody to read and download from the CHNR website (<http://www.e-chnr.org/>). CHNR was indexed in PubMed Central (PMC) in December 2021, and it is available in PMC from the January 2019 issue (Vol. 26, issue 1) onward. The members of the CHNR journal editorial board are actively working to have the journal included in MEDLINE and Emerging Sources Citation Index (ESCI), as well as PMC.

CHNR's aim is to promote the health, development, and well-being of children and their families in Korea and worldwide. We encourage submissions on recent and relevant healthcare and nursing topics for children from early childhood to young adulthood, including those from diverse countries and cultures.

All parties involved, including the editorial board members, peer reviewers, and authors, must make a concerted effort to maintain a high standard of quality at CHNR. The peer reviewers and editors strive to improve the quality of articles submitted by authors. CHNR expects strict adherence to reporting guidelines (<https://www.equator-network.org/>) in accordance with the research methodology. Authors submitting to CHNR are required to follow the reporting guidelines that correspond to their research methodology.

Table 2. Research Subjects, Article Types, and Methodologies of Publications in *Child Health Nursing Research* in 2023 (N=30)

Categories	n (%)
Article type	
Editorial	5 (16.6)
Original article	16 (53.4)
Review article	9 (30.0)
Methodologies	
Editorial	5 (16.6)
Original articles	
Descriptive and/or cross-sectional study	9 (30.0)
Cohort study	3 (10.0)
Secondary analysis study	2 (6.7)
Methodology study (program development)	1 (3.3)
Q-methodology study	1 (3.3)
Review articles	
Systematic review and meta-analysis	2 (6.7)
Concept analysis	2 (6.7)
Text network analysis	2 (6.7)
Integrative review	2 (6.7)
Narrative literature review	1 (3.3)

As we approach our 30th anniversary in 2024, we remain committed to maintaining the highest standards of research and publication. CHNR has made significant progress since its inception, thanks to the efforts of many people. I express my sincere gratitude to the authors for submitting their articles to CHNR, the reviewers for their valuable feedback, and the members of the editorial board for their diligent efforts in improving the quality of the journal. I also extend my thanks to the past officers of the Korean Society of Child Nursing for their unwavering support in improving the quality of CHNR. Your efforts and dedication will establish CHNR as a landmark in the field of child nursing.

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.

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Data availability

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Factors affecting the health-related quality of life of children with cerebral palsy in Indonesia: a cross-sectional study

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Purpose: Children with cerebral palsy (CP) and their parents experience various problems that can affect their quality of life. This study examined factors affecting the quality of life of children with CP. **Methods:** A cross-sectional study was conducted in Yogyakarta, Indonesia, from January to August 2019. The participants were consecutively recruited children with CP aged 2 to 18 years and their parents. Ninety-eight children with CP and their parents, specifically their mothers, were recruited. Children's health-related quality of life (HRQoL) was measured using the Pediatrics Quality of Life Cerebral Palsy. Parental HRQoL and stress were measured using the WHOQOL-BREF and Parenting Stress Index (PSI). **Results:** Functional level V was the most common category for both Gross Motor Function Classification System (GMFCS) and Bimanual Fine Motor Function (BFMF) (35% and 28%, respectively). Children's mean HRQoL was medium (49.81±20.35). The mean total PSI score was high (94.93±17.02), and 64% of parents experienced severe stress. Bivariate analysis showed that GMFCS, BFMF, number of comorbidities, presence of pain, and parental stress were significantly correlated with the total score for children's HRQoL ($p<.05$). Multiple linear regression analysis ($p<.05$) demonstrated that more severe GMFCS and parental stress were associated with lower mean HRQoL scores in children. **Conclusion:** Factors including the level of GMFCS and parental stress affected the HRQoL of children with CP. Parental stress management should be included in the comprehensive management of these children.

Keywords: Cerebral palsy; Child; Quality of life; Stress, psychological

INTRODUCTION

Cerebral palsy (CP) is the leading cause of childhood disability, presenting a significant burden in low- and middle-income countries (LMICs) [1]. It is the most prevalent motor disability in children, often accompanied by issues related to sensation, perception, cognition, communication, and behavior, as well as epilepsy and secondary musculoskeletal problems [2]. Recent epidemiological data estimate

the global prevalence of CP to be between 1 and approximately 4 per 1,000 live births, or children of the same age. However, it has been difficult to estimate the prevalence of CP in Indonesia due to a lack of comprehensive epidemiological data on CP [3]. Yogyakarta, a region in Indonesia, has reported an increasing number of CP cases in children each year [1]. According to an internal report from the Wahana Keluarga Cerebral Palsy (WKCP), the prevalence of children with CP has been rising annually, with a total of 121 and 392

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registered members in the WKCP in 2017 and 2022, respectively.

Children with CP often face limitations in physical activity, verbal and non-verbal communication, and social interactions. According to the Centers for Disease Control and Prevention, over half of children with CP (58.2%) are able to walk independently, while the majority suffer from spastic CP (77.4%). Additionally, 11.3% of these children walk using a hand-held mobility device, and 30.6% experience mobility disruption or lack the ability to walk. Approximately 60% of these children experience developmental disorders with more than one condition by the age of eight [4]. Children with CP from LMICs are at a high risk of poor health-related quality of life (HRQoL), especially physical well-being, which is associated with impaired motor function [5]. Pain, psychological problems, and parenting stress have been identified as predictors of lower HRQoL among adolescents with CP across most domains [6].

Children with CP often experience disabilities that can hinder their developmental progress towards achieving independence. These conditions can also negatively impact their parents in various ways, including physical and mental health, financial stability, and social interaction [6]. In LMICs, particularly in Indonesia, both children and parents are required to navigate a range of long-term medical and non-medical treatments for CP. This not only incurs significant financial costs and time commitments, but also disrupts parents' daily routines and can lead to psychological distress [7]. The effects of physical activity limitations on the quality of life for both children and their parents are not yet fully understood. Gaining insight into the most challenging aspects of this situation is vital, as it allows nurses to provide interventions that are tailored to the specific needs of both parents and children, taking into account Indonesian cultural norms. However, many studies investigating the HRQoL of Indonesian children with CP have been limited by small sample sizes [3,8]. This survey based study was designed to explore the factors affecting the quality of life of children with CP.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Medicine, Public health, and Nursing, Universitas Gadjah Mada, Indonesia (No. KE/FK/0023/EC/2019). Informed consent was obtained from all participants.

1. Study Design

This research descriptive and cross-sectional study investigated the factors affecting the quality of life of children with CP in Yogyakarta, Indonesia. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [9].

2. Study Participants

The study participants were children diagnosed with CP, along with their parents, who were members of the WKCP, a family association for cerebral palsy, and received treatment at an academic hospital in Yogyakarta, Indonesia. The exclusion criteria for the study were as follows: children who were hospitalized at the time of data collection, parents who did not reside in the same household as the child, and parents who did not fully complete the questionnaire. Out of the total participants, 106 mothers agreed to participate, but eight of them did not fill out the questionnaire in its entirety. Consequently, the final analysis included 98 children with CP and their respective mothers. A sample size calculation based on the Lemeshow formula, using a 95% confidence level, 50% as the assumed population proportion, and 10% for absolute error, resulted in a minimum sample size of 96.

3. Measurements

The study variables analyzed were the demographic characteristics of the participants and their parents, type of CP, HRQoL in children with CP and their parents, motor function related to CP, and parenting stress. The measurement tools used for primary data collection were the Indonesian versions of developed questionnaires.

1) Demographic characteristics

The demographic characteristics of children with CP and their parents were collected using several question items. These items pertained to the child's age, sex, and weight, and were derived from the primary data. Additionally, questions related to the characteristics of both parents were included, covering aspects such as age, education level, employment status, family income, health insurance, and any history of disability. The parents of the participants were responsible for completing these question items.

2) Type of cerebral palsy

A pediatrician directly assessed the type of CP (spastic, ataxic, dyskinetic, or mixed) in children with CP based on their movement and body parts affected.

3) Comorbidities

Comorbidities were evaluated by a professional physician through a physical examination, interview with parents, and specific tests related to hearing and vision problems, as well as hip dislocation. These comorbidities were categorized into several types, including pain, hearing issues, visual impairments, emotional disturbances, epilepsy, dysphagia, constipation, hip dislocation, and urination disturbances. Using the Galeazzi test maneuver, the pediatrician screened for potential hip dislocation.

4) Pain assessment

Children with CP often experience difficulties in expressing their emotions, including pain, both verbally and non-verbally. The Face, Legs, Activity, Cry, and Consolability (FLACC) scale is a tool used to measure pain, especially in children with disabilities such as CP. This user-friendly tool is valid for children with cognitive impairments, as it thoroughly assesses changes in behavior related to pain including facial expressions, leg movements, activity levels, crying, and consolability. Parents, due to their role as caregivers and their understanding of their children's conditions, completed the pain perception section using the Indonesian validated version of the FLACC questionnaire. Pain was categorized as no pain (score 0), mild pain (scores 1-3), moderate pain (scores 4-6), and severe pain (scores 7-10) [10].

5) Motor function assessment

The pediatrician evaluated the motor function of children with CP to determine the severity of their condition based on their daily needs, using the Gross Motor Function Classification System – Expanded and Revised (GMFCS-E&R) and the Bimanual Fine Motor Function (BFMF) version 2.0. The GMFCS-E&R, which is available in 22 languages, has been validated in numerous countries. The GMFCS is a system used to classify gross motor abilities. The levels of GMFCS are defined as follows: level I indicates the child is ambulant without limitations; level II signifies the child is ambulant but with limitations; level III indicates the need for a hand-held mobility device; level IV means the child is self-mobile but with limitations; and level V signifies the need for a manual

wheelchair [11,12].

BFMF is a classification system that assesses an individual's fine motor abilities and limitations at a specific point in time. The BFMF system is divided into five levels. Level I indicates that both hands can manipulate objects without any restrictions. Level II signifies that both hands can manipulate objects, but with some limitations. Level III denotes that one hand can manipulate with limitations, while the other hand is only capable of grasping or less. Level IV indicates that both hands are only able to grasp. Lastly, Level V means that both hands can only hold objects [11].

6) Pediatric HRQoL

The HRQoL of children with CP was assessed, taking into account daily activities, school activities, movement and balance, pain, fatigue, eating habits, language, and communication. This was done using the Indonesian version of the HRQoL questionnaire (PedsQL Cerebral Palsy Module Version 3.0 Questionnaire). The original questionnaire has previously undergone validity, reliability, and sensitivity testing, yielding medium to large Pearson's product-moment correlation coefficient effects and an Cronbach's α value of .79 [13]. Furthermore, all question items were translated into Indonesian and validated according to the guidelines set by the Mapi Trust Organization [2]. Each question uses a Likert scale, ranging from 0 (never) to 4 (almost always). These scores are then transformed onto a scale of 0 to 100, with each question scored in reverse: 0=100, 1=75, 2=50, 3=25, 4=0. Next, the score for each dimension is calculated, although the score cannot be computed if more than half of the items in the scale are missing. The mean score is then calculated as the sum of the items' scores divided by the number of items answered. A mean score closer to 100 indicates better QoL. There is no total score.

7) Parental HRQoL

This study utilized the Indonesian version of the WHO-QOL-BREF, to measure parents' quality of life. The WHO-QOL-BREF is a validated instrument comprising 26 questions that assess four broad domains: physical health, psychological health, social relations, and the environment. In addition to these, two separate items were included to gauge an individual's overall perception of their quality of life (rated as very poor, poor, neither poor nor good, good, or very good) and their overall perception of their health (rated as very dissatisfied, dissatisfied, neither dissatisfied nor satis-

fied, satisfied, or very satisfied). This questionnaire has been translated into Indonesian and validated for use. Respondents were instructed to select a number from 1 to 5 for each question. The mean scores were then multiplied by 4 to align the domain scores with those used in the WHOQOL-100 and subsequently converted to a 0–100 scale. The domain scores are scaled positively, with higher scores indicating a higher HRQoL.

8) Parenting stress index

This study examined parental stress levels using the Parenting Stress Index (PSI), which consists of 36 questions. The Indonesian version of the PSI showed a satisfactory level of reliability (Cronbach's $\alpha = .823$) [14]. Each question has a Likert-scale response, from 1 (strong disagreement) to 5 (strong agreement). The scores on the PSI are interpreted as the total scores, which are obtained by adding the scores for parental distress (PD) (score for items 1–12), parent-child dysfunction interaction (PCDI) (scores for items 13–24), and difficult child (DC) (scores for items 25–36). The total score was adjusted for the percentile raw scores for classification of participants based on their level of stress. Parental stress levels are categorized as typical stress (normal) (1st to 10th percentile), high stress (mild to moderate stress level) (15th to 80th percentile), and clinically significant stress (severe stress) (85th to 100th percentile).

4. Data Collection

Data collection involving children with CP and their parents took place in Yogyakarta, Indonesia, from January to August 2019, at an academic hospital in Yogyakarta. This study systematically recruited children with CP from both the WKCP and an academic hospital in Yogyakarta, Indonesia. All members of the WKCP and children with CP who were patients at an academic hospital in Yogyakarta were invited to receive a detailed explanation of the study. A pediatrician conducted physical examinations and health assessments for the children with CP. Concurrently, their parents were asked to participate in a survey, which involved filling out questionnaires. This was done after obtaining written consent from the parents.

The data collection process utilized case report form questionnaires by parent's report, which encompassed demographic and medical characteristics. These questionnaires included the Indonesian version of an HRQoL questionnaire

(PedsQL Cerebral Palsy Module Version 3.0 Questionnaire), the Indonesian version of an instrument for evaluating parents' HRQoL (WHOQOL-BREF), and the PSI. A pediatrician was responsible for assessing the children's level of GMFCS-E&R and BFMF version 2.0.

5. Data Analysis

The data collected in this study were analyzed using SPSS 22.0 (IBM Corp.). Descriptive statistics were used for the demographic and clinical characteristics of children with CP. Analysis of variance was used to confirm the relationships between the independent variables and the mean HRQoL score of the children, which was treated as the dependent variable. The independent variables included the PSI as a measure of parental stress, the GMFCS level, the BFMF level, the mother's level of education, parental HRQoL, the number of comorbidities, and the presence of pain. We used multiple linear regression to analyze the relationship between the predicted confounding variables and the mean QoL score of the children. A *p*-value of less than .05 was deemed statistically significant.

RESULTS

1. The Demographic and Clinical Characteristics of Participants

The demographic and clinical characteristics of the children with CP are shown in Table 1. Of the 210 WKCP members, 106 children with CP participated in the study. There were no significant differences in demographic characteristics between the participants and non-participants. Eight parents did not complete the questionnaire. The study analyzed a total of 98 children with CP (mean age 6.27 ± 3.37 years) and their parents. The mean ages of the parents were 35.33 ± 6.63 years and 38.43 ± 7.31 years for fathers and mothers, respectively.

The majority of these children were boys (63%), and most had the spastic type of CP (88%). The percentages of children with a history of low birth weight and very low birth weight were 28% and 14%, respectively. Most of the children were classified as having a severe level of GMFCS and BFMF. The majority of the children had two or more comorbidities, with pain (54%) being the most common, followed by epilepsy (45%).

The characteristics of the parents are outlined in Table 2.

Table 1. Characteristics of Children with Cerebral Palsy According to Socio-demographics, Degree of Motor Function, and Comorbidities (N=98)

Characteristics	n or M±SD	%
Age (year)	6.27±3.37	
Sex		
Boy	62	63
Girl	36	37
Birth weight (g)		
≥2,500	57	58
1,500 to <2,500	27	28
<1,500	14	14
Type of cerebral palsy		
Spastic	86	88
Ataxic	0	0
Dyskinetic	5	5
Mixed	7	7
GMFCS level		
Level I	18	18
Level II	8	8
Level III	25	26
Level IV	13	13
Level V	34	35
BFMF level		
Level I	18	18
Level II	27	28
Level III	12	12
Level IV	14	14
Level V	27	28
Comorbidities ^{a)}		
Pain	53	54
Hearing problems	10	10
Visual problems	11	11
Emotional disturbance	16	16
Epilepsy	44	45
Dysphagia	25	26
Constipation	16	16
Hip dislocation	12	12
Urination disturbance	3	3
Number of comorbidities		
0	10	10
1–2	52	53
>3	36	37

^{a)}Multiple responses; BFMF, Bimanual Fine Motor Function; GMFCS, Gross Motor Function Classification System; M, mean; SD, standard deviation.

Most parents had a low educational background, with 62% of mothers and 67% of fathers falling into this category. The average income was below the regional minimum wage in the province of Yogyakarta. A significant majority of these families, 90%, had health insurance. The mean PSI total score was 94.93 (standard deviation [SD]=17.02). According to the PSI total score, severe stress was experienced by 64% of par-

Table 2. Socio-demographic and Clinical Characteristics of Parents (N=98)

Characteristics	M±SD	n (%)
Age (year)		
Mother	35.33±6.63	
Father	38.43±7.31	
Mother's education		
Low		61 (62)
High		37 (38)
Father's education		
Low		66 (67)
High		32 (33)
Parent's work		
Mother		30 (31)
Father		94 (95)
Family income		
<Regional minimum salary		31 (32)
≥Regional minimum salary		67 (68)
Health insurance		
Yes		88 (90)
No		10 (10)
Other family members with disabilities		
Yes		6 (6)
No		92 (94)
Parenting Stress Index (PSI)	94.93±17.02	
PSI total score level		
Normal		21 (22)
Mild-moderate		14 (14)
Severe		63 (64)
Parent-child dysfunctional interaction		
Normal		4 (4)
Mild-moderate		2 (2)
Severe		92 (94)
Difficult child		
Normal		67 (67)
Mild-moderate		16 (17)
Severe		15 (16)
Parental distress		
Normal		61 (62)
Mild-moderate		9 (9)
Severe		28 (29)

M, mean; SD, standard deviation.

ents. A high percentage of parents (94%) experienced severe stress in the PCDI domain. Meanwhile, 29% faced severe stress in the PD domain, and 16% in the DC domain.

2. Health-related Quality of Life of Children with Cerebral Palsy and Their Parents

The HRQoL of children with CP is presented in [Table 3](#). The domains of school activity and daily activity received the lowest scores. The HRQoL of parents is also presented in [Ta-](#)

Table 3. Health-related Quality of Life of Children with Cerebral Palsy and Their Parents (N=98)

Domains	Quality of life	
	Mean	SD
Children's health-related quality of life (n=98)		
Mean total score	49.81	20.35
Daily activity	34.37	26.91
School activity	33.52	30.13
Movement and balance	51.25	28.81
Pain	70.32	29.75
Exhausted	62.25	27.50
Eating activity	49.12	30.77
Language and communication	50.04	34.29
Parental health-related quality of life (n=98)		
Mean total score ^{a)}	55.76	8.19
Physical health	50.67	8.15
Psychologist health	53.47	14.28
Social interaction	60.69	12.43
Environment	58.64	11.69

^{a)}Parental health-related quality of life is divided into good (mean score≥55.76) and poor (mean score<55.76) based on total mean score; SD, standard deviation.

ble 3, with a total mean score of 55.76 (SD=8.19). Approximately 47% of parents reported having a good HRQoL. The domain of physical health received the lowest mean score, 50.67 (SD=8.15), while the social interaction domain received the highest, 60.69 (SD=12.43). When asked to rate their overall perception of HRQoL, parents responded as follows: 2% rated it as poor, 47% as neither poor nor good, 47% as good, and 4% as very good. When asked about their overall perception of their health, parents responded as follows: 7% were not satisfied, 49% were neither dissatisfied nor satisfied, 42% were satisfied, and 2% were very satisfied.

3. Differences in Quality of Life of Children with Cerebral Palsy according to Demographic and Clinical Characteristics of Children and Their Parents

One-way analysis of variance showed significant differences in the mean total score of children's HRQoL according to the level of GMFCS, level of BFMF, number of comorbidities, and parental stress ($p < .05$) (Table 4).

4. Factors Affecting the Health-related Quality of Life of the Children with Cerebral Palsy

Multivariate analysis using linear regression identified the significant factors affecting children's HRQoL. Apart from the PSI value, GMFCS levels were a significant variable that

Table 4. Differences in Quality of Life of Children with Cerebral Palsy according to Demographic and Clinical Characteristics of Children and Their Parents (N=98)

	Health-related quality of life in children with cerebral palsy M±SD	F	p
Level of GMFCS			
Level I (n=18)	63.89±15.52	11.02	<.001
Level II (n=8)	52.38±10.26		
Level III (n=25)	50.47±14.97		
Level IV (n=13)	49.50±19.27		
Level V (n=34)	34.45±16.25		
Level of BFMF			
Level I (n=18)	60.75±14.28	8.41	<.001
Level II (n=27)	54.83±17.58		
Level III (n=12)	44.56±13.74		
Level IV (n=14)	41.47±16.76		
Level V (n=27)	35.42±17.62		
Mother's education			
Low (n=61)	46.17±19.94	0.69	.408
High (n=37)	49.44±16.96		
Parental quality of life			
Good (n=46)	48.56±19.71	0.06	.805
Poor (n=37)	46.20±18.04		
Number of comorbidities			
0 (n=10)	50.63±18.67	3.95	.022
1-2 (n=52)	51.50±19.50		
>2 (n=35)	40.59±16.29		
The presence of pain			
No pain (n=45)	51.09±18.04	3.25	.074
Mild pain (n=41)	48.67±14.84		
Moderate pain (n=8)	40.33±25.36		
Severe pain (n=4)	33.23±17.05		
PSI			
Total score of PSI			
Normal (n=21)	58.50±18.73	5.24	.007
Mild-moderate stress (n=2)	47.19±14.97		
Severe stress (n=63)	43.75±18.46		
PCDI			
Normal (n=4)	71.29±10.66	3.90	.024
Mild-moderate stress (n=2)	57.17±20.03		
Severe stress (n=92)	46.15±18.49		
Difficult child			
Normal (n=52)	46.91±19.60	0.11	.895
Mild-moderate stress (n=18)	49.30±17.76		
Severe stress (n=28)	47.09±18.70		
Parent distress			
Normal (n=61)	49.70±19.19	1.35	.265
Mild-moderate stress (n=9)	46.45±13.76		
Severe stress (n=28)	42.69±18.86		

BFMF, Bimanual Fine Motor Function; GMFCS, Gross Motor Function Classification System; M, mean; PCDI, parent-child dysfunction interaction; PSI, Parenting Stress Index; SD, standard deviation.

affected HRQoL in children. An increase in the parental stress level reduced the mean score of HRQoL children by -5.52 points ($p = .004$), while an increased severity level in the GMFCS also reduced the mean score of HRQoL in children by -4.65 points ($p = .004$) (Table 5).

DISCUSSION

Children with CP often transition into adulthood with various limitations and associated diseases, such as intellectual disabilities, developmental disorders, vision problems, and epilepsy, which is a major comorbidity in children with CP [15]. This study showed that pain was the most common comorbidity in children with CP, followed by epilepsy, dysphagia, and constipation. Pain is a primary predictor of quality of life among children with CP and tends to increase with age. Therefore, understanding and managing pain signals is crucial for maintaining their quality of life. A study reported that approximately 65% of 104 non-verbal children with CP in Malaysia experienced pain, which was more frequent in older children with CP and those with spastic quadriplegia [16]. Another 5-year longitudinal study conducted in Europe concluded that pain was a strong predictor of adult HRQoL [17]. This study found that a higher severity of pain corresponded to a lower HRQoL score in children with CP ($p = .045$). Therefore, it is necessary to assess the presence of pain using the FLACC pain scale in the overall evaluation of children with CP to manage their symptoms appropriately. Pelvic dislocation should be evaluated using the Galeazzi test as a physical examination for early diagnosis, rather than a radiological examination, due to its usefulness in assessing the growth and development of the hip in children older than 4 to 6 months [18]. This study found that 12% of children with CP were suspected of having pelvic dislocation.

The prevalence of pelvic dislocation in children with CP was reported to be approximately 10% to 15%. Immediate treatment of pelvic and hip displacements is recommended to prevent an increased prevalence of morbidity and a decrease in quality of life [19]. These findings also highlight several comorbidities related to the HRQoL score in children. This is consistent with other studies that reported a strong relationship between the number of comorbidities and the HRQoL of children with CP.

This study reveals that the average HRQoL score for children with CP was 49.81 ± 20.35 , indicating a moderate quality of life. The lowest score was observed in school activities (mean 33.52 ± 30.13), while the highest score was in pain (mean 70.31 ± 29.75). This may be attributed to the fact that the children with CP in this study predominantly had severe physical disabilities, classified as level V on the GMFCS. The severity level on the GMFCS corresponded to a decrease in the average HRQoL score by 4.72 points ($p = .003$), due to deteriorating motor abilities and movement restrictions, leading to disruptions in school activities. It is crucial, therefore, that caregivers of CP patients increase their attention and understanding of the patients' conditions and needs to ensure the maintenance of their quality of life [20].

The domain of pain does not appear to be a significant issue for children with CP, despite pain being recognized as the most common comorbidity. This may be due to our assessment of the HRQoL of these children being based on parental reports rather than self-reports. This approach was necessitated by the constraints of our study population, which primarily consisted of children with CP who have severe GMFCS and BFMF levels and limited verbal language abilities. A longitudinal study reported on the HRQoL of preschool children with CP, focusing on motor function after a 6-month observation period [20]. Children with CP who have severe physical disabilities (GMFCS level V) were found to have improved motor and cognitive functions, but they also exhibited severe emotional function problems compared to those with milder disabilities. Another study highlighted the variation in the condition of children with CP across different countries, particularly in terms of the distribution of GMFCS levels and the superior HRQoL of children with CP [11,12]. A systematic review reported that children with CP aged 2 to 18 years from LMICs had a significantly lower HRQoL than their counterparts from high-income countries [5].

Previous research in Indonesia has not widely reported the

Table 5. Factor Affecting of the Health-related Quality of Life in Children with Cerebral Palsy ($N=98$)

Variables ^{a)}	B	SE	β	p
Constant	87.28	5.99		<.001
Level of GMFCS	-4.65	1.56	-.37	.004
Level of BFMF	-2.30	1.55	-.18	.140
PSI total score	-5.52	1.87	-.24	.004
Number of comorbidities	-2.95	2.47	-.10	.235

^{a)}Dependent variable: The quality of life in children with cerebral palsy (PEDSQL score); Analysis with linear regression ($R^2=0.393$); BFMF, Bimanual Fine Motor Function; GMFCS, Gross Motor Function Classification System; PSI, Parenting Stress Index; SE, standard error.

HRQoL of parents. This study found that the mean parental HRQoL score was 55.76 (SD=8.19), a score lower than those reported in most European and East Asian countries, with the exception of Saudi Arabia [21]. The lowest mean was found in physical health (50.67 ± 8.15), while social relations scored the highest (60.69 ± 12.43). No significant correlation was found between the HRQoL of parents and that of their children ($p = .486$). Interestingly, we noted high average HRQoL scores in the social relationship domain among parents. This could be attributed to the Indonesian cultural practice of cooperation and mutual assistance, which may influence parents' perceptions in the social relation domain [22]. As the severity of motor function increased, the health burden also increased, necessitating intensive care from parents. This resulted in parents experiencing increased physical fatigue, contributing to the lowest score in the physical health domain. Several studies have explored HRQoL and related factors in parents of children with CP, including the HRQoL of the children and their functional status. These studies found no correlation between maternal HRQoL and child functional level, asserting that there is no correlation with parents' HRQoL. However, lower parenting stress levels and adequate social support play a significant role in higher HRQoL among parents [21]. Chalipat et al. [22] examined the HRQoL of caregivers of children with CP using the WHO-QOL-BREF questionnaire. They reported that caregivers' HRQoL had a low mean in all aspects, with the lowest in the social domain (9.33 ± 1.49), followed by the psychological domain (18.23 ± 1.50). Approximately 70% of parents described their HRQoL as moderate, and around 66.7% expressed satisfaction with their health condition [22].

The mean total PSI score was 94.93 (SD = 17.02), indicating that the majority of parents fell into the severe stress category. According to PSI domains, 94% of parents experienced severe stress in the PCDI domain. The mean HRQoL for children decreased by 5.46 points as parental stress severity increased, both in the total PSI score and in the PSI domains (PD, PCDI, and DC) ($p < .05$). Parenting stress can impact many aspects, particularly in terms of caring for their children, meeting their children's needs, and the effectiveness of their communication, which directly contributes to a decrease in children's quality of life by up to 5% [23,24]. A severe degree of dysfunction in parent-child interactions reflects feelings of disappointment, rejection, and a lack of bonding between the parent and child. Support from groups and professional experts is necessary to help reduce parental

stress and enhance the parent-child bond. Parent distress refers to the stress parents experience when caring for their children, leading to withdrawal from relationships, social life, and potentially causing depression. The term "difficult child" describes the characteristics of the child's behavior and its impact on the parents [23]. A study showed that the PCDI and DC domains are the main contributors to the total PSI score in parents of children with CP. Parents are more likely to experience severe stress when the child has communication loss (odds ratio [OR]=1.9; 95% confidence interval [95% CI]=1.2-3.0), severe pain (OR=1.7; 95% CI=1.1-2.4), or intellectual disabilities (OR=1.8; 95% CI=1.2-2.9) [25]. A European study comparing parents of children with CP to parents of typically developing children found that 26% of parents of children with CP experience a very severe degree of stress, five times more severe than the control group [25]. Mothers of children with CP experience more severe stress as the child's motor function deteriorates compared to mothers of typically developing children [26]. This study demonstrated a correlation between the degree of parental stress and the HRQoL of children with CP. Improved parent-child interaction can be achieved by encouraging parents to participate in support groups and seek professional intervention to reduce parental stress [27,28]. Parents who receive adequate professional support will gain a better understanding of their child's progress and acquire the knowledge and skills needed to effectively manage their child's behavior [28]. Providing early explanations related to the condition of the disease and information on parents' expectations regarding the child's functional abilities can help reduce parental stress [27,28].

This study also has limitations. We relied on proxy reports to evaluate the children's HRQoL, as most children struggle with communication and find interviews challenging. Another study has indicated that self-reported HRQoL tends to score higher than proxy reports, and that elevated stress levels in parenting can negatively impact parents' perception of their child's HRQoL [29]. This study did not collect cognitive and adaptive function tests, nor did it involve specific examinations of hearing and vision dysfunction by professional physicians. Despite these limitations, this study is the first to analyze the stress levels in parents in relation to the HRQoL of children with CP in Indonesia. As such, it can serve as a reference for future long-term intervention strategies for children with CP.

CONCLUSION

Parenting stress was found to be associated with HRQoL in children with CP. These findings suggest that healthcare professionals, such as clinicians and nurses, should offer attention, support, and counseling to parents to improve the quality of life for both the children and their parents. Identifying the most impactful and significant type of healthcare worker intervention is crucial for enhancing parenting stress and HRQoL in children with CP. The comprehensive management of children with CP should incorporate strategies for improving parental stress.

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Authors' contribution

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Conflict of interest

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

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Data availability

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REFERENCES

1. Lestari AS, Prasetyawati H, Saffanah RF, Saripah, Sutrisno A, Anggraini D, et al. Potret anak cerebral palsy di Daerah Istimewa Yogyakarta: laporan survei situasi anak cerebral palsy di DIY 2019-2020. *Pustaka Pelajar*; 2020. p. 27-30.
2. Izzah AN, Irwanto I, Andriati A, Gunawan PI. Assessment quality of life in children with cerebral palsy, ages 2-18 years. *Periodic Epidemiology Journal*. 2021;9(2):166-174. <https://doi.org/10.20473/jbe.V9I22021.166-174>
3. Jahan I, Al Imam MH, Karim T, Muhit M, Hardianto D, Das MC, et al. Epidemiology of cerebral palsy in Sumba Island, Indonesia. *Developmental Medicine and Child Neurology*. 2020;62(12):1414-1422. <https://doi.org/10.1111/dmcn.14616>
4. Centers for Disease Control and Prevention (CDC). What is cerebral palsy? [Internet]. 2021 [cited 2023 June 17]. Available from: <https://www.cdc.gov/ncbddd/cp/facts.html>
5. Power R, King C, Muhit M, Heanoy E, Galea C, Jones C, et al. Health-related quality of life of children and adolescents with cerebral palsy in low- and middle-income countries: a systematic review. *Developmental Medicine and Child Neurology*. 2018;60(5):469-479. <https://doi.org/10.1111/dmcn.13681>
6. Irwin L, Jesmont C, Basu A. A systematic review and meta-analysis of the effectiveness of interventions to improve psychological well-being in the parents of children with cerebral palsy. *Research in Developmental Disabilities*. 2019;95:103511. <https://doi.org/10.1016/j.ridd.2019.103511>
7. Nurhidayah I, Nugraha MN, Nuraeni A. Quality of life among parents of cerebral palsy children. *Malaysian Journal of Medicine and Health Sciences*. 2022;18(Suppl 3):181-185.
8. Puspitarini Z. Factors associated with quality of life children with cerebral palsy in Yogyakarta [dissertation]. Universitas Gadjah Mada; 2016. p. 1-87.
9. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Medicine*. 2007;4(10):e296. <https://doi.org/10.1371/journal.pmed.0040296>
10. Fox MA, Ayyangar R, Parten R, Haapala HJ, Schilling SG, Kalpakjian CZ. Self-report of pain in young people and adults with spastic cerebral palsy: interrater reliability of the revised Face, Legs, Activi-

- ty, Cry, and Consolability (r-FLACC) scale ratings. *Developmental Medicine and Child Neurology*. 2019;61(1):69-74. <https://doi.org/10.1111/dmcn.13980>
11. Elvrum AG, Johansen GO, Vik T, Krumlinde-Sundholm L. External validity of the Both Hands Assessment for evaluating bimanual performance in children with bilateral cerebral palsy. *Developmental Medicine and Child Neurology*. 2022;64(5):586-592. <https://doi.org/10.1111/dmcn.15127>
 12. Piscitelli D, Ferrarello F, Ugolini A, Verola S, Pellicciari L. Measurement properties of the Gross Motor Function Classification System, Gross Motor Function Classification System-Expanded & Revised, Manual Ability Classification System, and Communication Function Classification System in cerebral palsy: a systematic review with meta-analysis. *Developmental Medicine and Child Neurology*. 2021;63(11):1251-1261. <https://doi.org/10.1111/dmcn.14910>
 13. Varni JW, Burwinkle TM, Berrin SJ, Sherman SA, Artavia K, Malcarne VL, et al. The PedsQL in pediatric cerebral palsy: reliability, validity, and sensitivity of the Generic Core Scales and Cerebral Palsy Module. *Developmental Medicine and Child Neurology*. 2006;48(6):442-449. <https://doi.org/10.1111/j.1469-8749.2006.tb01293.x>
 14. Daulany N, Ramadhani N, Hadjam MNR. Validity and reliability of parenting stress construct among mothers of children with autistic spectrum disorder. *Jurnal Psikologi*. 2020;47(1):1-17. <https://doi.org/10.22146/jpsi.43744>
 15. Pavone P, Gulizia C, Le Pira A, Greco F, Parisi P, Di Cara G, et al. Cerebral palsy and epilepsy in children: clinical perspectives on a common comorbidity. *Children (Basel)*. 2020;8(1):16. <https://doi.org/10.3390/children8010016>
 16. Jayanath S, Ong LC, Marret MJ, Fauzi AA. Parent-reported pain in non-verbal children and adolescents with cerebral palsy. *Developmental Medicine and Child Neurology*. 2016;58(4):395-401. <https://doi.org/10.1111/dmcn.12943>
 17. Rapp M, Eisemann N, Arnaud C, Ehlinger V, Fauconnier J, Marcelli M, et al. Predictors of parent-reported quality of life of adolescents with cerebral palsy: a longitudinal study. *Research in Developmental Disabilities*. 2017;62:259-270. <https://doi.org/10.1016/j.ridd.2016.12.005>
 18. Vaquero-Picado A, González-Morán G, Garay EG, Moraleda L. Developmental dysplasia of the hip: update of management. *EFORT Open Reviews*. 2019;4(9):548-556. <https://doi.org/10.1302/2058-5241.4.180019>
 19. Aroojis A, Mantri N, Johari AN. Hip displacement in cerebral palsy: the role of surveillance. *Indian Journal of Orthopaedics*. 2020;55(1):5-19. <https://doi.org/10.1007/s43465-020-00162-y>
 20. Lai CJ, Chen CY, Chen CL, Chan PS, Shen IH, Wu CY. Longitudinal changes in health-related quality of life in preschool children with cerebral palsy of different levels of motor severity. *Research in Developmental Disabilities*. 2017;61:11-18. <https://doi.org/10.1016/j.ridd.2016.11.013>
 21. Lee MH, Matthews AK, Park C. Determinants of health-related quality of life among mothers of children with cerebral palsy. *Journal of Pediatric Nursing*. 2019;44:1-8. <https://doi.org/10.1016/j.pedn.2018.10.001>
 22. Chalipat S, Malwade SD, Karambelkar GR, Agarkhedkar SR, Kannan VT. Assessment of quality of life of parents of children with cerebral palsy. *Journal of Evidence based Medicine and Healthcare*. 2016;3(85):4673-4677.
 23. Dieleman LM, Soenens B, Prinzie P, De Clercq L, Ortibus E, De Pauw SSW. Daily parenting of children with cerebral palsy: the role of daily child behavior, parents' daily psychological needs, and mindful parenting. *Development and Psychopathology*. 2021; 33(1):184-200. <https://doi.org/10.1017/s0954579419001688>
 24. Lestari AF. Hubungan antara stres orangtua dengan kualitas hidup anak cerebral palsy [master's thesis]. Universitas Gadjah Mada; 2021. p. 1-61.
 25. Parkes J, Caravale B, Marcelli M, Franco F, Colver A. Parenting stress and children with cerebral palsy: a European cross-sectional survey. *Developmental Medicine and Child Neurology*. 2011;53(9): 815-821. <https://doi.org/10.1111/j.1469-8749.2011.04014.x>
 26. Park EY. Relationship among gross motor function, parenting stress, sense of control, and depression in mothers of children with cerebral palsy. *International Journal of Environmental Research and Public Health*. 2021;18(17):9285. <https://doi.org/10.3390/ijerph18179285>
 27. Abdi P, Kumar S. Effects of parental support group on perceived stress and self-esteem among parents of children with special needs. *International Journal of Indian Psychology*. 2022;10(4):348-355. <https://doi.org/10.25215/1004.031>
 28. Cheng AWY, Lai CYY. Parental stress in families of children with special educational needs: a systematic review. *Frontiers in Psychiatry*. 2023;14:1198302. <https://doi.org/10.3389/fpsy.2023.1198302>
 29. Vila-Nova F, Santos S, Oliveira R, Cordovil R. Parent-report health-related quality of life in school-aged children with cerebral palsy: a cross-sectional study. *Frontiers in Rehabilitation Sciences*. 2022;3:1080146. <https://doi.org/10.3389/fresc.2022.1080146>

Healthcare coaching program for youth with type 1 diabetes in South Korea: a pilot study

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Purpose: This pilot study aimed to assess the feasibility, preliminary efficacy, and effects of a mobile app healthcare coaching program developed based on self-regulation theory among youths with type 1 diabetes. **Methods:** A mixed-method design was utilized. Participants were randomly assigned into intervention (n=23, 12-week coaching program) or control groups (n=16, usual care). Pre- and post-intervention assessments included self-efficacy, diabetes management behavior, and health outcomes (quality of life, depression, and HbA1c). Quantitative data were analyzed with SPSS/WIN ver. 26.0. The narrative information from the participants in the healthcare coaching program underwent content analysis. **Results:** The intervention group had significantly lower depression scores ($t=2.57, p=.014$) than the control group. No significant differences were observed in self-efficacy, diabetes management behavior, and health outcomes between the two groups. The average frequency of health behavior monitoring per week among the participants was 1.86 ± 1.60 . The qualitative findings indicated that participants perceived improved diabetes self-management with the intervention; however, challenges during vacations, dietary control difficulties, and a lack of disease awareness were identified. **Conclusion:** The healthcare coaching program improved psychological aspects for youth with type 1 diabetes. Further research is needed to develop and implement mobile app interventions aimed at enhancing compliance with diabetes management in pediatric and adolescent populations.

Keywords: Diabetes mellitus, type 1; Mobile applications; Adolescent; Self-management

INTRODUCTION

In 2022, out of the global population of 8.75 million individuals with type 1 diabetes (T1D), 1.52 million were under the age of 20 years. It is estimated that 108,200 children and adolescents under 15 years are diagnosed with T1D each year [1]. The Centers for Disease Control and Prevention (CDC) reported a notable surge in the diagnosis of T1D in the United States from 2017 to 2020. The overall increase was

approximately 30.0%, with a particularly significant rise in the incidence rates among adolescents aged 10 to 14 years reaching 33.5%, and children aged 5–9 years, where the rate spiked to 37.0% [2]. Against this backdrop, glycemic control remains a substantial challenge, particularly for youth with T1D.

T1D treatment involves daily insulin administration, regular glucose monitoring, education, and support [3]. Optimal glycemic control is crucial to reduce the risk of diabetes-relat-

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ed complications and mortality in patients with T1D [4,5]. Despite this, self-management in youth with T1D is notably poor, with 73.0% of youths having an HbA1c of 8.0% or higher [5]. Additionally, approximately 55.0% of youths with T1D engage in alcohol consumption, which negatively influences diabetes management and growth [6]. This underscores the need to address the significant challenges youths with T1D face and to enhance their suboptimal diabetes management.

Adolescence is a period marked by physical hormonal changes, rapid growth in height and weight, increased metabolism, elevated insulin requirements, and psychological and cognitive shifts [7]. This phase involves various life changes, including academic and social aspects, which can interfere with effective diabetes management. Consequently, youths with T1D encounter additional complexities during this transitional time [8]. Effective self-management is crucial during this period, as poorly controlled diabetes leads to the development of acute and chronic complications [3].

Given that 95.0% of teens own a cell phone and 67.0%–95.0% use social media almost constantly, the use of mobile technology is a promising method to engage youths with T1D in their self-care [9]. Recently, mobile apps for diabetes management have been developed and utilized to enhance diabetes self-management. A meta-analysis examining mobile app interventions for T1D highlighted their effectiveness in improving HbA1c [10]. Alfonsi et al. [11] employed a mobile app for carbohydrate counting to calculate insulin doses for injections, which resulted in a reduction in HbA1c, and 43.0% of users continued to use the app after program completion. According to a report by Barnes et al. [12], 75.0% of adolescents and nearly 69.0% of parents of young patients expressed willingness to use mobile apps to manage diabetes. Thus, adopting a mobile application as a self-management tool for youth with T1D is expected to aid in achieving long-term diabetes control, reducing complications, and enhancing overall health.

Recently, a mobile app program was developed to assist individuals with type 2 diabetes (T2D) in managing their condition through the self-regulation model [13]. Participants can input, oversee, and manage multiple health behaviors—exercise, diet, blood glucose, and medication—while receiving automated personalized feedback and goals from the collected app data. We anticipate that youths with T1D can utilize the developed mobile app to monitor their self-management, as well as obtain personalized feedback and goals based on their history. This approach is expected to aid in achieving long-term diabetes control, reducing the risk of de-

veloping complications, and enhancing their overall health.

Accordingly, we aimed to explore the feasibility of a self-regulation theory-based healthcare coaching program delivered through a mobile app for youths with T1D. Our goal was to assess the program's feasibility and preliminary effects and to investigate participants' experience through qualitative data. Throughout this study, we investigated the following hypotheses:

H1. The intervention group will have higher levels of self-efficacy for diabetes self-management.

H2. The intervention group will have higher levels of health behaviors.

H3. The intervention group will have higher levels of health outcomes compared to the control group.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Pusan National University Yangsan Hospital (No. 05-2022-021). Informed consent was obtained from all participants.

1. Study Design

This study was a concurrent mixed methods research where the qualitative and quantitative data were collected and analyzed during the same timeframe. Our mixed methods research included a pilot randomized controlled trial to evaluate the feasibility of a self-regulation theory-based healthcare coaching program via a mobile app for youths with T1D (CRIS identifier: KCT0008734). The reporting of this study was based on the Consolidated Standards of Reporting Trials (CONSORT) 2010 statement [14].

2. Study Setting

The study was conducted in Pusan National University Children's Hospital, Yangsan, South Korea from February 8, 2022 to February 6, 2023.

3. Quantitative Study

1) Participants

The inclusion criteria for participants were as follows: (1)

aged 10 to 18 years; (2) receiving insulin treatment (including multiple doses of insulin, insulin pump, or those utilizing continuous glucose monitoring) following a diagnosis of T1D; (3) obtained consent from both participants and parents/legal guardians; (4) capable of operating an Android smartphone; and (5) absence of medical conditions that would impede physical activity. The exclusion criteria encompassed individuals with:

(1) cognitive impairments that could impact questionnaire completion; (2) a history of psychiatric disorders or current use of psychotropic medication; and (3) severe coexisting conditions requiring treatment beyond T1D. Prior research suggests a minimum of 25 participants per group for a pilot study with a moderate effect size (0.5) [15]. Therefore, considering the dropout rate [16], a total of 60 patients were recruited (26 and 21 in the intervention and control groups, respectively) in a 3:2 ratio using an Excel-generated list (ver. 2019; Microsoft). Initially, 47 participants agreed to participate, 26 and 21 of whom were assigned to the intervention and control groups, respectively. Three participants in the intervention group dropped out during the intervention due to a decline and a failure to make contact, and five participants in the control group declined to participate the study at the post-test. A total of 39 participants (intervention group = 23,

control group = 16) were included in the final analysis (Figure 1). Participants and researchers were not blinded to the random assignment.

2) Measurements

(1) General and disease-related characteristics

Participant characteristics, including age, sex, grade level, alcohol consumption, and smoking habits, were collected via structured questionnaires. Disease-related information included diabetes duration, height, weight, blood glucose measurement type, insulin injection methods, occurrences of diabetes-related complications leading to hospitalization, and blood glucose levels during the interview.

(2) Self-efficacy for diabetes self-management

Self-efficacy was measured using the Korean version of the self-efficacy for diabetes self-management (SEDM) scale [17]. Authorization for the use of the Korean version of the SEDM scale [17] was obtained from the Korean translator; however, attempts to contact the original developer of the scale for permission were unsuccessful. The scale comprises ten items assessing self-confidence in diabetes self-management. An example item is “Do you think you can make healthy food choices when you go out to eat?”. Responses varied from 0

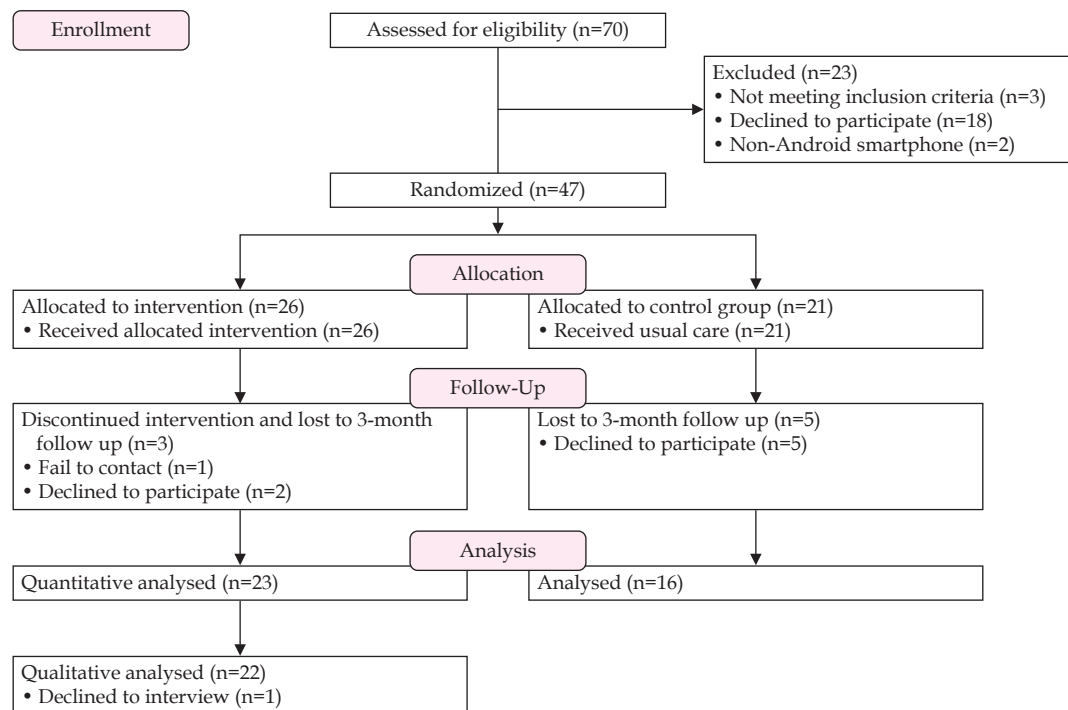


Figure 1. Flowchart of a healthcare coaching program for youth with type 1 diabetes.

(not at all confident) to 10 (very confident). The total self-efficacy scores were computed by averaging the 10-item scores, with higher scores indicating enhanced self-efficacy. The Cronbach's α was .90 at the time of tool development [18]. In the study by Boo et al. [17], conducted with Korean children with diabetes, the reported Cronbach's α was .87, while in this study it was .91.

(3) Health behaviors

Health behaviors in this study include the diabetes management behaviors and dietary intake. Diabetes management behaviors were measured using the Korean version of diabetes management behavior scale (DMBS) [17]. Authorization for the use of the Korean version of the DMBS was obtained from the Korean translator; however, attempts to contact the original developer of the scale for permission were unsuccessful. The scale comprises 36 items with four sub-domains (daily preventive behaviors, modifying diabetes management plan, intervention behaviors in the past 7 days, and other diabetes management behaviors), and assesses the ability to perform behaviors for diabetes management. Responses vary from 0 (never) to 4 (always) and from 0 (occurred 0 times) to 5 (occurred 5 times). Due to the various responses for each item, all items were converted to a scale ranging from 0 to 1. The total score was calculated as the mean of each item and ranged between 0 and 1, with higher scores indicating better diabetes control. In the study by Boo et al. [17], conducted with Korean children with diabetes, the reported Cronbach's α was .86, while in this study it was .89.

Dietary intake over a 3-day period was measured using the 24-hour recall method [19]. Utilizing the Computer Aided Nutritional Analysis Program 4.0 (CAN Pro 4.0; The Korean Nutrition Society) from the Korean Nutrition Society, the mean intake for each food group was computed over three days based on United States Department of Agriculture (USDA) MyPlate guidelines [20]. Caloric intake calculations employed standard weight, activity levels, and daily exchange units per food group from Dudek's textbook [21]. To determine the actual intake compared to the recommended serving size, we computed the individual's actual intake ratio by dividing the consumed serving sizes by the recommended serving sizes and multiplying the result by 100.

(4) Health outcomes

Health outcomes in this study include quality of life, depression, and HbA1c. Quality of life was measured using the

PedsQL 4.0 generic core scales, which were acquired and utilized under the authorized permission of Mapi Research Trust (<http://www.pedsq.org>). The scale comprises 23 items tailored for adolescents aged 13 to 18 years and measures four sub-domains of functioning: physical, emotional, social, and school. Responses, collected on a 5-point Likert scale, were reverse-scored and linearly transformed to a 0–100 scale (0=100, 1=75, 2=50, 3=25, 4=0), with higher scores indicating a better quality of life. Cronbach's α was .90 at the time of tool development [22] and .94 in this study. Depression was measured using the Korean-translated BDI-II depression scales for adolescents [23] to evaluate symptoms over the preceding two weeks. The scales were acquired and utilized with permission from Korea Psychology Corporation, which provided the scoring system and categorization of depression severity: 0–13 (minimal), 14–19 (mild), 20–28 (moderate), and 29–63 (severe) [24]. The scale consists of 21 items rated on a severity scale of 0–3, with the exception of two items that are rated on a scale of 0–6. Cronbach's α was .89 at the time of tool development [23] and .85 in this study. Participants visited outpatient clinics approximately every 3 months, and HbA1c measurements were conducted every 3 to 6 months. HbA1c values were collected from medical records, and the nearest HbA1c value to the data collection date was obtained from the chart, considering the frequency of patient visits and HbA1c measurements.

3) Data collection

Quantitative data was collected between February 8, 2022, and February 6, 2023. The researcher (DL) collected data from participants face-to-face when potential participants visited outpatient clinic. Parents and youths were provided with an explanation of the research objectives, procedures, and their right to withdraw from the research at any time. Those who voluntarily agreed to participate in the research signed consent forms. All collected data were treated anonymously and stored on the researcher's personal computer with a password. Documented materials were kept in a locked cabinet and, in accordance with the IRB, will be discarded after a retention period. The intervention group completed a 12-week program, while the control group did pre-surveys and post-surveys over the same 12-week period. Both groups received \$5 gift cards upon completing data collection.

4) Data analysis

Data analysis was performed using SPSS version 26.0 (IBM

Corp.) with a significance level set at $p \leq .05$. Homogeneity between intervention and control groups at pre-test was assessed using the χ^2 -test, the Fisher's exact test, and independent t-test for the characteristics of the participants and dependent variables. The normality of dependent variables was assessed using the Kolmogorov-Smirnov test. Most dependent variables showed a normal distribution in the Kolmogorov-Smirnov analysis ($p > .05$), except of diabetes management behavior, food intake (dairy and fruit intake), and sub-domains of quality of life (physical and psychosocial health), and HbA1c. Within-group differences in the dependent variables were evaluated using paired t-tests or Wilcoxon signed-rank tests. Specifically, variables such as self-efficacy for diabetes self-management, dietary intake (grains, protein, and vegetables), and quality of life, which demonstrated a normal distribution, were examined through paired t-tests. Wilcoxon signed-rank tests were employed for the remaining variables that did not follow a normal distribution. Group differences in the dependent variables between pre- and post-tests were analyzed using either the independent t-test or Mann-Whitney U test, depending on the normality of the data. Variables, including self-efficacy for diabetes self-management, dietary intake (grains, protein, and vegetables), quality of life, and depression, which exhibited a normal distribution, were evaluated using independent t-tests. For the remaining variables that did not follow a normal distribution, Mann-Whitney U tests were employed.

4. Qualitative Study

1) Participants

Participants in the intervention group who were willing to participate in the interview and understood the study's subject, objectives, methodology (including the necessity of qualitative interviews and audio recordings) participated in the qualitative study at the post-test. Participants were informed of their right to discontinue or withdraw from participation at any time without negative consequences.

2) Qualitative interviews

The researcher (DL) conducted qualitative interview. A semi-structured questionnaire was used to inquire about participants' feelings toward the healthcare coaching program and whether their diabetes habits had changed since engaging in the program. The interviews were conducted using the following main questions: "How was participating in the

healthcare coaching program?", "What efforts have you made to manage diabetes during participating in the program?", and "Have there been people or environments that were helpful or hindered your diabetes management while participating in the program?". Interviews were conducted after participants' outpatient clinic visits in an empty medical office in the hospital, either with the child alone or with the child and their parent. The interviews lasted 10 to 15 minutes. All interviews were recorded and the researcher (DL) transcribed the recordings by carefully listening to participants' spoken words and cross-checking by re-listening to the recordings.

3) Data analysis

Transcribed records were analyzed using an inductive approach and followed the content analysis method outlined by Elo and Kyngäs [25]. Participants were provided comprehensive information about the research, including its purpose, assurances of confidentiality, absence of compensation or risk, and the right to refrain from answering or withdraw at any point. Interviews, which were recorded with the option to pause, were transcribed and assigned random anonymized numbers for confidentiality. In the preparation phase, data were thoroughly understood by reviewing transcribed records. In the categorization phase, sentences representing participants' experiences were selected as the analytical unit through open coding, and similar content was grouped to create categories and sub-categories. The results were reviewed by a nursing professor for credibility, and the researcher's neutrality supported objectivity and ensured confirmability of the results. The integration of qualitative and quantitative findings was conducted through narrative and contiguous approach [26]. Using the approach, we analyzed and reported the quantitative findings from the first half and the qualitative findings concerning participants' feelings toward the healthcare coaching program or their changes in diabetes habits in the second half.

5. Healthcare Coaching Program

The healthcare coaching program in this study was based on the Automated Personalized Self-Care program [13], which was originally developed for T2D and modified for youths with T1D (Table 1). It included goal setting, education, monitoring, and feedback. The program allowed participants to monitor physical activity, diet, blood glucose, and

Table 1. Contents of the Healthcare Coaching Program for Youth with Type 1 Diabetes

Components	Contents	Self-regulatory phase	Methods
Goal setting	<ul style="list-style-type: none"> •Physical activity goal: Starting with 50 minutes of exercise daily at a moderate intensity and personalizing every week •Diet goal: Appropriate calorie intake for each food group •Medication compliance goal: 100.0% •Blood glucose monitoring goal: daily •Human facilitator encouraged participants to set weekly goals 	Forethought	Mobile app and phone call
Education	<ul style="list-style-type: none"> •Physical activity: Exercise advantages, methods, and types •Diet: Healthy eating habits, benefits of MyPlate •Medication: Insulin injection method and site, importance of medication adherence •Blood glucose: Importance of regular blood glucose monitoring •Coping strategies for hypoglycemia •Foot care: Diabetes foot care guidelines 	Forethought	Mobile app
Monitoring	<ul style="list-style-type: none"> •Daily: Physical activity, diet, medication, blood glucose •Weekly: Foot care 	Performance/volitional control	Mobile app
Feedback	<ul style="list-style-type: none"> •Goal achievement rate provided through automated messages (daily) •Providing positive feedback via phone calls or text messages (weekly) •Encourage using the mobile app if it is not used at least three times a week •Financial incentives according to the frequency of inputs into the mobile app and quiz (monthly) 	Self-reflection	Mobile app or text message

medication following MyPlate and physical activity guidelines [27]. Weekly messages, calls supported goal tracking, and education content were delivered via cartoons, videos, and materials from Pusan National University Yangsan Hospital. Daily monitoring included blood glucose, diet, physical activity, medication, and insulin injections, and achievement rates were displayed. Average frequency of health behavior monitoring per week among the participants was 1.86 ± 1.60 . Weekly feedback and incentives were provided for engagement, and the researcher offered positive feedback to encourage app use via calls or messages.

RESULTS

1. Quantitative Results

1) Demographic characteristics

A total of 70 participants were assessed for eligibility. A total of 47 were enrolled, with 26 in the intervention group and 21 in the control group. During the intervention, four from each group withdrew, resulting in a final sample of 39 participants (Figure 1). The mean age of the participants was 13.59 ± 2.66 years, with 61.5% being female. Participants' mean HbA1c exceeded 8.6%. Approximately 56.4% of partic-

ipants had been diagnosed with T1D for less than five years, and 28.2% had an experience of alcohol drinking. The majority used multiple doses of insulin (89.7%) and monitored their blood glucose levels with a blood glucose meter (61.5%). Nine participants (23.1%) had been hospitalized due to diabetes-related complications.

2) Test of baseline homogeneity of variables between groups

For the pre-test variables, there were no significant differences in self-efficacy for diabetes self-management, diabetes management behaviors, food intake, and quality of life (both overall and its sub-domains), depression, and HbA1c, indicating homogeneity between groups at pre-test. However, a significant difference between groups was observed in other diabetes care practice, a sub-domain of diabetes management behavior (Table 2).

3) Hypothesis testing

There was no harm or unintended effects in each group. Table 3 summarizes the intervention outcomes. The between-group difference in self-efficacy for diabetes self-management was not statistically significant ($t = -1.07, p = .294$), so H1 was rejected. Similarly, the between-group difference in diabetes management behavior was not statistically significant

Table 2. Characteristics of the Participants and the Levels of Outcome Variables at Pre-test (N=39)

Characteristics		Total	IG (n=23)	CG (n=16)	t or χ^2	p
		n (%) or M±SD				
Age (year)		13.59±2.66	13.30±2.69	14.00±2.66	0.80	.430
Sex	Male	15 (38.5)	9 (39.1)	6 (37.5)	0.01	.918
	Female	24 (61.5)	14 (60.9)	10 (62.5)		
Duration of T1D (year)	<5	22 (56.4)	11 (47.8)	11 (68.8)	1.68	.195
	≥5	17 (43.6)	12 (52.2)	5 (31.3)		
Body mass index (percentile)	Normal (5.0–84.9)	28 (71.8)	17 (74.0)	11 (68.8)	0.24 ^{a)}	.879
	Overweight (85.0–94.9)	6 (15.4)	3 (13.0)	3 (18.8)		
	Obesity (≥95.0)	5 (12.8)	3 (13.0)	2 (12.4)		
Treatment type	MDI	35 (89.7)	21 (91.3)	14 (87.5)	0.15 ^{a)}	> .999
	Insulin pump	4 (10.3)	2 (8.7)	2 (12.5)		
Blood glucose measurement method	BGM	24 (61.5)	15 (65.2)	9 (56.3)	0.32	.571
	CGM	15 (38.5)	8 (34.8)	7 (43.8)		
Smoking	Yes	0 (0.0)	0 (0.0)	0 (0.0)	-	-
	No	39 (100.0)	23 (100.0)	16 (100.0)		
Alcohol	Yes	11 (28.2)	6 (26.1)	5 (31.3)	0.12 ^{a)}	.734
	No	28 (71.8)	17 (73.9)	11 (68.8)		
Hospitalized due to complications secondary to diabetes	Yes	9 (23.1)	4 (17.4)	5 (31.3)	1.02 ^{a)}	.444
	No	30 (76.9)	19 (82.6)	11 (68.8)		
Self-efficacy for diabetes self-management		6.45±2.01	6.63±1.91	6.19±2.19	-0.68	.503
Healthy behavior						
Diabetes management behaviors						
	Daily prevention behaviors	0.65±0.12	0.69±0.08	0.60±0.16	-2.03	.056
	Modifications of diabetes care plane	0.69±0.14	0.71±0.09	0.65±0.18	-1.33	.199
	Intervention behaviors	0.52±0.21	0.56±0.20	0.45±0.21	-1.67	.104
Other diabetes care practice						
		0.66±0.17	0.70±0.13	0.60±0.22	-1.53	.141
Food intake, IG (n = 19), CG (n = 15)						
	Grains intake (ounce eq/day)	0.68±0.14	0.73±0.11	0.61±0.15	-2.76	.009
	Protein foods intake (ounce eq/day)	1.89±0.51	1.99±0.48	1.76±0.53	-1.29	.206
	Vegetables intake (cup eq/day)	2.14±1.02	2.12±0.88	2.18±1.21	-0.16 ^{b)}	.891
	Dairy intake (cup eq/day)	0.35±0.21	0.37±0.20	0.33±0.22	-0.58	.564
	Fruits intake (cup eq/day)	0.49±0.43	0.44±0.34	0.56±0.52	-0.40 ^{b)}	.706
Health outcomes						
Quality of life						
	Physical health	0.10±0.11	0.12±0.10	0.08±0.12	-1.23 ^{b)}	.228
	Psychosocial health	86.09±13.31	83.93±14.06	89.20±11.90	-1.19 ^{b)}	.239
Depression (n=38)						
	Minimal (0–13)	86.46±14.45	84.38±16.29	89.45±11.11	1.08	.286
	Mild (14–19)	85.90±14.64	83.70±15.24	89.06±13.58	-1.19 ^{b)}	.239
	≥Moderate (20–28)	7.95±8.04	8.22±6.89	7.53±9.80	-0.90 ^{b)}	.375
	HbA1c (%)	30 (78.9)	18 (78.3)	12 (80.0)	0.19 ^{a)}	> .999
		6 (15.8)	4 (17.4)	2 (13.3)		
		2 (5.3)	1 (4.3)	1 (6.7)		
		8.61±2.11	8.38±1.47	8.94±2.82	-0.20 ^{b)}	.855

^{a)}Fisher's exact test; ^{b)}Mann–Whitney U test; BGM, blood glucose meter; CG, control group; CGM, continuous glucose monitoring; HbA1c, hemoglobin A1c; IG, intervention group; M, mean; MDI, multiple doses of insulin; SD, standard deviation; T1D, type 1 diabetes.

(Z = -0.60, p = .563), so H2 was rejected. However, in the within-group analysis, the control group exhibited significant differences in sub-domains of the diabetes management behaviors—a significant decrease in daily preventive behaviors (t = -2.26, p = .039) and a significant increase in modification of the diabetes care plan (t = 2.66, p = .018). Moreover, in the within-group analysis, the intervention group showed a sig-

nificant decrease in grain intake (t = -3.37, p = .003). H3 was partially supported. The between-group difference in quality of life was not statistically significant (t = -1.94, p = .060). However, in the within-group analysis, the intervention group exhibited a significant increase in overall quality of life (t = 2.96, p = .007) and in the quality of life sub-domain of psychosocial health (Z = -2.07, p = .039). The between-group difference in

Table 3. Effects of the Mobile App Healthcare Coaching Program on Self-efficacy, Healthy Behaviors, and Health Outcomes (N=39)

Variables	Groups	T1	T2	t or Z ^{a)} (p)	Mean differences (T2-T1)	
		n (%) or M±SD			M±SD	t or Z ^{b)} (p)
Self-efficacy for diabetes self-management	IG	6.63±1.91	6.94±1.70	0.97 (.341)	0.31±1.52	-1.07 (.294)
	CG	6.19±2.19	5.88±2.14	-0.59 (.556)	-0.31±2.09	
Healthy behaviors						
Diabetes management behaviors	IG	0.69±0.08	0.67±0.09	-0.58 ^{a)} (.563)	-0.01±0.08	-0.60 ^{b)} (.563)
	CG	0.60±0.16	0.61±0.16	0.21 (.866)	0.00±0.09	
Daily prevention behaviors	IG	0.71±0.09	0.71±0.11	-0.05 (.962)	-0.00±0.09	-1.78 (.084)
	CG	0.65±0.18	0.59±0.17	-2.26 (.039)	-0.06±0.10	
Modifications of diabetes care plane	IG	0.56±0.20	0.59±0.20	0.68 (.505)	0.03±0.19	1.63 (.112)
	CG	0.45±0.21	0.58±0.25	2.66 (.018)	0.13±0.20	
Intervention behaviors	IG	0.70±0.13	0.65±0.15	-1.69 (.105)	-0.05±0.14	2.03 (.050)
	CG	0.60±0.22	0.66±0.21	1.21 (.244)	0.06±0.19	
Other diabetes care practice	IG	0.73±0.11	0.68±0.09	-2.05 (.053)	-0.05±0.12	1.27 (.213)
	CG	0.61±0.15	0.61±0.14	0.06 (.952)	0.00±0.14	
Dietary intake (AIR), IG (n=19), CG (n=15)						
Grains intake (ounce eq/day)	IG	1.99±0.48	1.54±0.31	-3.37 (.003)	-0.44±0.57	1.26 (.217)
	CG	1.76±0.53	1.58±0.70	-1.18 (.257)	-0.19±0.61	
Protein Foods intake (ounce eq/day)	IG	2.12±0.88	2.06±0.93	-0.23 (.822)	-0.06±1.10	-0.91 (.370)
	CG	2.18±1.21	1.69±1.01	-1.14 (.273)	-0.49±1.65	
Vegetables intake (cup eq/day)	IG	0.37±0.20	0.33±0.15	-0.78 (.447)	-0.04±0.24	-0.36 (.718)
	CG	0.33±0.22	0.26±0.12	-1.60 (.131)	-0.07±0.17	
Dairy intake (cup eq/day)	IG	0.44±0.34	0.31±0.32	-1.13 (.274)	-0.13±0.49	-0.04 ^{b)} (.973)
	CG	0.56±0.52	0.53±0.64	-1.04 ^{a)} (.300)	-0.03±0.67	
Fruits intake (cup eq/day)	IG	0.12±0.10	0.08±0.10	-1.59 (.130)	-0.04±0.11	-1.58 ^{b)} (.120)
	CG	0.08±0.12	0.09±0.08	-0.66 ^{a)} (.510)	0.01±0.15	
Health outcomes						
Quality of Life	IG	83.93±14.06	89.70±8.46	2.96 (.007)	5.77±9.33	-1.94 (.060)
	CG	89.20±11.90	88.59±12.08	-0.22 (.828)	-0.61±11.08	
Physical health	IG	84.38±16.29	88.99±12.74	-1.88 ^{a)} (.060)	4.62±10.78	-0.28 ^{b)} (.789)
	CG	89.45±11.11	90.63±11.97	0.35 (.733)	1.17±13.50	
Psychosocial health	IG	83.70±15.24	90.07±9.01	-2.07 ^{a)} (.039)	6.38±13.77	-1.48 ^{b)} (.143)
	CG	89.06±13.58	87.50±14.13	-0.52 (.614)	-1.56±12.13	
Depression (n=38)	IG	8.22±6.89	5.91±5.66	-3.40 (.003)	-2.30±3.25	2.57 (.014)
	CG	7.53±9.80	8.47±10.36	0.80 (.436)	0.93±4.51	
Minimal (0–13)	IG	18 (78.3)	21 (91.3)	-	-	-
	CG	12 (80.0)	12 (80.0)	-	-	-
Mild (14–19)	IG	4 (17.4)	1 (4.3)	-	-	-
	CG	2 (13.3)	0 (0.0)	-	-	-
≥Moderate (20–28)	IG	1 (4.3)	1 (4.3)	-	-	-
	CG	1 (6.7)	3 (20.0)	-	-	-
HbA1c (%)	IG	8.38±1.47	8.00±1.21	-1.16 ^{a)} (.247)	-0.37±1.48	-1.32 ^{b)} (.196)
	CG	8.94±2.82	8.79±2.79	-0.85 ^{a)} (.396)	-0.16±1.65	

^{a)}Wilcoxon signed-rank test; ^{b)}Mann–Whitney U test; AIR, actually intake/recommended foods intake in the MyPlate guideline; CG, control group; HbA1c, hemoglobin A1c; IG, intervention group; M, mean; SD, standard deviation.

depression was statistically significant ($t=2.57, p=.014$) and the intervention group exhibited a significant decrease in depression compared to the control group. In the within-group analysis, the intervention group exhibited a significant decrease in depression ($t=-3.40, p=.003$). The between-group difference in HbA1c levels did not show significant changes

($Z=-1.32, p=.196$).

2. Qualitative Results

A total of 22 participants from the intervention group participated in narrative interviews, leading to the identification

of three themes and 11 sub-themes (Table 4).

1) Theme 1: Diabetes management challenges

(1) Sub-theme 1a: The challenges of diabetes management due to surrounding conditions/environment

This sub-theme shows how participants faced challenges in managing their diabetes due to external circumstances such as schoolwork and vacations.

“I’ve been trying to work out... I used to work out a lot. During the semester, I get busy and don’t do as much...” (Participants 9)

(2) Sub-theme 1b: Choosing between temptation and restraint

This sub-theme indicates that participants would put dia-

betes management on the back burner due to difficulties with food moderation and wanting to hang out with friends.

“I thought I had to type in the mobile app even if it was annoying. I thought it was fun to play with my friend, but it didn’t work. I got really into playing.” (Participants 22)

(3) Sub-theme 1c: Hassle of diabetes management and lack of time due to busy schedule

This sub-theme emphasizes that participants struggled with mobile app diabetes management due to laziness and annoyance.

“I’m a bit of a nuisance, so over time, I think, ‘I have to type now,’ but after I exercise and shower, I forget that I have to type. There were many times when I was chatting after mid-

Table 4. Qualitative Themes and Sub-themes Related to the Experience of Healthcare Coaching Program (N=22)

Themes	Sub-themes	n (%)	Statement
Diabetes management challenges (n=8)	Challenges of diabetes management due to surrounding conditions/environment	8 (36.4)	When my blood sugar went down... I think it was when I was in school, and when my blood sugar went up, I was on winter break, so I was a little bit more in control of my blood sugar when I was in school. (Participant 36)
	Choosing between temptation and restraint	3 (13.6)	I want to manage my diabetes, but... if I don't see sweets in front of me, I can't be bothered to go get them, and I'm not really interested. But there are sweets in front of me, I eat them all. (Participant 4)
	Hassle with diabetes management and lack of time due to busy schedule	4 (18.2)	I didn't feel like going on the app. I had to attend cram school and then went for taekwondo practice. After that, I needed to finish my homework, and then in the evening. (Participant 14)
	Failure to alert for illness	1 (4.5)	Knowing about my condition... That's crucial. Right now, I'm not quite aware because I feel the same whether my blood sugar is high or low. (Participant 12)
Positive change (n= 15)	Reflecting on and improving their diabetes management after participating in the program	17 (77.3)	You know what's cool? I just type in what I ate and boom, a graph pops up. Then I can see what I've had, check if there's been too much rice or meat, and think about cutting back a bit. If I notice I've had too few vegetables, I remind myself to add more of those to my plate. (Participant 42)
	Setting and reaching goals to manage your diabetes	2 (9.1)	When I was keeping track of my diabetes, I had this weekly goal, you know? Setting a goal made me think and act more, so that felt pretty good to me. (Participant 42)
	Increased awareness of diabetes management	4 (18.2)	I didn't pay much attention to my feet, even though my dad stressed its importance. Now, the program educates me on foot care, and I've realized its significance and decided to take better care of my feet. (Participant 26)
Advantages and limitations of using mobile apps to manage diabetes (n=6)	Convenience of the mobile app	6 (27.3)	I found the graphs helpful. It's nice to be able to look at the graph and see that I ate a lot of this and a little bit of that. (Participant 1)
	Difficulties with the types of foods that can be entered in the mobile app	3 (13.6)	There were a lot of ambiguities when entering food into the app. There are so many types of food... The app doesn't have what I've eaten, so it's hard to know how to record it, and it's hard to record what I've eaten outside because I don't know how many grams I've eaten. (Participant 11)

night and realized that I didn't type, but I didn't type." (*Participants 4*)

(4) Sub-theme 1d: Failure to alert for illness

This sub-theme emphasizes that diabetes complications did not develop immediately, indicating a lack of awareness of the disease.

"Knowing about my condition... That's crucial. Right now, I'm not quite aware because I feel the same whether my blood sugar is high or low." (*Participant 12*)

2) Theme 2: Positive change

(1) Sub-theme 2a: Reflecting on and improving their diabetes management after participating in the program

This sub-theme indicates that the feedback participants' received after entering the mobile app made them reflect on and improve their diabetes management.

"When I put it in the app, I saw I was having too much meat and not enough veggies. So, I attempted to cut down on meat and include more vegetables. Also, when dining out, I aimed to opt for vegetable dishes." (*Participant 36*)

(2) Sub-theme 2b: Setting and reaching goals to manage your diabetes

This sub-theme indicates that participants found it helpful to set goals to manage their diabetes.

"I would type it into the mobile app and check it, and sometimes my workout would go up to 90%, and I was so happy to see that, I slept so well." (*Participant 42*)

(3) Sub-theme 2c: Increased awareness of diabetes management

This sub-theme emphasizes that participants gained insights into their diabetes management through program engagement using a mobile app.

"The first one is...now I know things that I didn't know, so I'm trying to be a little bit more careful with that...for example, I'm trying to be careful with my feet now, like you said I can't hurt my feet anymore...so I'm trying to be careful with my feet." (*Participant 42*)

3) Theme 3: Advantages and limitations of using mobile apps to manage diabetes

(1) Sub-theme 3a: The convenience of a mobile app

This sub-theme indicates that the mobile app is easy to use and that the diabetes management feedback is helpful.

"I don't need to carry around a notebook or anything. It's easier to track everything on my phone now. I can view what I've eaten, monitor the quantity, and identify when I've gone over the limit, making things a bit more convenient." (*Participant 36*)

(2) Sub-theme 3b: Difficulties with the types of food that can be entered in the mobile app

This sub-theme highlights app limitations, such as a restricted food variety and challenges in finding specific types of food, such as snacks and foreign dishes.

"Entering food into the app was confusing. There are so many types of food... I didn't know how to record what I ate because it wasn't in the app." (*Participant 4*)

DISCUSSION

This study aimed to evaluate the feasibility and preliminary effects of a healthcare coaching program while exploring participants' experiences through qualitative data. The study included youths with an average age of 13.6 years, of whom 61.5% were female, and 61.5% monitored their blood sugar with a glucometer. Notably, 28.2% were classified as overweight or obese, and 28.2% reported alcohol consumption. Considering the mean age of the youths in this study (13.59±2.66 years), the alcohol consumption rates was notably high. For the youths with T1D and a mean age of 21.3 years [6], the alcohol consumption rates was much higher, reaching 55.0%. Additionally, the rate of overweight or obese adolescents with T1D in the previous study [5] were higher than that in this study, reaching 38.8%. Alcohol use was associated with worsened HbA1c levels, high lipid levels, and concurrent smoking [6]. Moreover, overweight status was a significant risk factor for compromised HbA1c levels [5]. Consequently, it is advisable to actively promote education and practices in diabetes management for youths with T1D starting from an early age.

The participants in this study reported slightly higher than the medium levels of self-efficacy in diabetes self-manage-

ment, diabetes management behavior, and quality of life, representing 6.45 ± 2.01 , 0.65 ± 0.12 , and 86.09 ± 13.31 , respectively. The levels of HbA1c was $8.61\% \pm 2.11\%$, which exceeds the target range of $<7.5\%$. Participants reported minimal levels of depression, with a score of 7.95 ± 8.04 . Soufi et al. [28] reported a similar level of self-efficacy (6.80 ± 1.60), and HbA1c ($8.40\% \pm 1.30\%$) score for participants in their study compared with those in our study. Participants in our study with higher baseline self-efficacy showed strong association with adherence and diabetes management, which aligns with the finding of another study deploying a pathway model [29]. Strong self-efficacy might help adolescents manage T1D despite its challenges and enable them to improve self-management and HbA1c levels. This suggests the need for diabetes management and education in Korean youths with T1D and increased attention to improve their psychosocial and clinical factors.

The healthcare coaching program effectively alleviated depression among youths with T1D but failed to demonstrate significant improvements in diabetes self-efficacy, health behaviors (including diabetes management and dietary intake), and health outcomes (such as quality of life and HbA1c levels). In the control group, the levels of depression did not show significant changes between the pre- and post-tests, whereas in the intervention group, there was a significant decrease in depression levels at the post-test. The coaching program in this study was grounded in self-regulation theory, which has been proven to be an effective strategy in alleviating depressive symptoms among adolescents with T1D. Participants in the intervention group mentioned during the interviews that setting weekly goals and receiving feedback through a mobile app were beneficial for managing diabetes. A meta-analysis assessing the effectiveness of self-regulation theory-based interventions with youths also reported their effectiveness in improving self-regulation and reducing depression [30]. Given the strong correlation between depression and low quality of life [17] as well as elevated levels of HbA1c [29], these findings underscore the significance of self-regulation theory-based interventions in reducing depression and their potential impact on improving HbA1c control in youths with T1D. Self-regulation can serve as an effective strategy for improving glycemic control and managing negative emotions (e.g., depression and anxiety) that may overwhelm youths with T1D.

The healthcare coaching program in this study did not significantly improve self-efficacy, diabetes self-management, or

HbA1c levels in youths with T1D. A meta-analysis [10] of randomized clinical trial studies on mHealth in people with T1D showed no significant change in HbA1c reduction in adolescents, but a sub-analysis found a significant change in adults. This is consistent with the results of several previous studies [31]. Management of T1D in adolescents is complex, influenced by various factors, including physical activity, diet, growth, insulin resistance, and psychological elements [3,7]. Youths with T1D face significant psychological and cognitive changes, which present challenges in diabetes management and are influenced by factors such as schoolwork and friendships [12,28,29]. The participants in this study might have had fewer self-management skills than adults and a less comprehensive understanding of health education. Poor adherence in diabetes management can impact HbA1c level [5]. In a study by Lansing et al. [32], where incentives were provided for achieving diabetes management goals, goal attainment ranged from 80.0% to 93.3%. As a result, significant improvements in self-monitoring of blood glucose and HbA1c levels were observed. Interventions utilizing mobile apps demonstrate promise for diabetes management in adolescents. However, they require refinement to address this age group's specific needs. Accordingly, further research to identify effective self-management interventions is necessary.

The program in this study did not lead to significant improvements in dietary intake (grains, protein, vegetables, dairy, and fruit), as there were no notable group differences observed at the post-test. However, significant differences were observed within the intervention group. Specifically, grain intake significantly decreased from pre-test to post-test among participants in the intervention group. Given the association of grain intake with HbA1c levels and insulin injection doses [4,11], the mobile app's potential to facilitate dietary modifications appears promising. During interviews conducted after program completion in this study, participants in the intervention group expressed their efforts to understand and refine their dietary habits through graph feedback for food entries. However, in the intervention group, only three participants demonstrated high adherence to the intervention by entering their blood glucose levels five times per week, which contrasts with an average of one entry per week for the entire intervention group. Goyal et al. [31] observed a significant reduction in HbA1c levels among a subgroup that monitored their blood glucose more than five times a day, indicating a relationship between monitoring

and adherence. In chronic conditions such as T1D in youths, adherence has been linked to self-management [29]. Hence, interventions aimed at enhancing adherence should be developed to prevent diabetes complications.

The dietary assessment of youths with T1D revealed excessive intake of grains and protein surpassing the recommended amounts and indicated insufficient consumption of fruits, dairy products, and vegetables. This finding aligns with Seckold et al.'s research [4], which showed that only 50% of T1D youths met the recommended fruit and vegetable intake levels. These results underscore the necessity to enhance dietary habits among youths with T1D. A meta-analysis [33] revealed a strong correlation between consuming 35 g of dietary fiber daily and a significant decrease in premature mortality ranging from 10.0% to 48.0%. This fiber intake level also led to notable improvements in HbA1c, lipid profiles, and body weight. Moreover, a sufficient intake of dietary fiber promotes a smoother post-prandial glucose profile, which emphasizes the importance of regular consumption of fruit and vegetables in the diet of youths with T1D.

This study holds significance as it employs a mixed methods research approach to assess the effectiveness of a mobile app healthcare coaching program for adolescents with T1D in South Korea. The research combines quantitative methods to evaluate program efficacy with qualitative methods exploring participants' experiences. This study confirms the effectiveness of an intervention based on self-regulation theory in improving depression. However, several limitations should be noted, including low adherence among adolescents with T1D. Adherence might influence self-efficacy, health behaviors (diabetes management behavior and dietary intake), and health outcomes (quality of life, depression, and HbA1c). Therefore, it is necessary to evaluate the intervention's effectiveness, considering adherence as a key factor. Furthermore, the intervention had a small number of participants, so it is necessary to recruit a large sample to validate the intervention's effectiveness. Additionally, the limited variety of foods that could be entered in the dietary input of the mobile app posed challenges in providing comprehensive dietary feedback. Based on the above discussion, several future suggestions emerge. First, we propose future research to develop strategies to enhance adherence and to evaluate the effectiveness. Second, we recommend expanding the participant pool to validate the intervention's effectiveness. Third, we suggest increasing the variety of foods that can be entered into the mobile app for the intervention. Finally, the dietary

analysis of youths with T1D was not conducted by food group; hence, we recommend analyzing by food group in the future.

CONCLUSION

This study aimed to evaluate the feasibility and preliminary effects of a healthcare coaching program while exploring participants' experiences through qualitative data. The program successfully reduced depression in youths with T1D but did not significantly improve self-efficacy, health behaviors (including diabetes management and diet), or health outcomes (quality of life and HbA1c levels). Participants had a diet low in dairy, vegetables and fruits but high in grains and proteins. App feedback improved diabetes management behavior, but inconsistent usage due to laziness, annoyance, and dietary entry issues resulted in low compliance. However, using the app itself was not problematic. The findings underscore the necessity of diabetes management interventions that develop strategies to enhance youths' adherence to diabetes management. Future studies should expand the variety of foods that can be entered into the mobile app to improve ease of use. Additionally, considering incentives for achieving each goal could be beneficial in enhancing adherence to the intervention.

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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.

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Data availability

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REFERENCES

1. International Diabetes Federation (IDF). Type 1 diabetes [Internet]. 2023 [cited 2023 September 27]. Available from: <https://idf.org/about-diabetes/type-1-diabetes/>
2. Baechle C, Stahl-Pehe A, Prinz N, Meissner T, Kamrath C, Holl RW, et al. Prevalence trends of type 1 and type 2 diabetes in children and adolescents in North Rhine-Westphalia, the most populous federal state in Germany, 2002-2020. *Diabetes Research and Clinical Practice*. 2022;190:109995. <https://doi.org/10.1016/j.diabres.2022.109995>
3. ElSayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Brue-mmmer D, et al. 14. Children and adolescents: standards of care in diabetes-2023. *Diabetes Care*. 2023;46(Suppl 1):S230-S253. <https://doi.org/10.2337/dc23-s014>
4. Seckold R, Howley P, King BR, Bell K, Smith A, Smart CE. Dietary intake and eating patterns of young children with type 1 diabetes achieving glycemic targets. *BMJ Open Diabetes Research & Care*. 2019;7(1):e000663. <https://doi.org/10.1136/bmjdr-2019-000663>
5. Yetim A, Alikasıfoğlu M, Baş F, Eliaçık K, Çığ G, Erginöz E, et al. Glycemic control and health behaviors in adolescents with type 1 diabetes. *Turkish Journal of Pediatrics*. 2018;60(3):244-254. <https://doi.org/10.24953/turkjped.2018.03.003>
6. Roberts AJ, Law JR, Suerken CK, Reboussin BA, Lawrence JM, Taplin CE, et al. Alcohol consumption patterns in young adults with type 1 diabetes: the SEARCH for diabetes in youth study. *Diabetes Research and Clinical Practice*. 2020;159:107980. <https://doi.org/10.1016/j.diabres.2019.107980>
7. Skog O, Korsgren O. Aetiology of type 1 diabetes: physiological growth in children affects disease progression. *Diabetes, Obesity & Metabolism*. 2018;20(4):775-785. <https://doi.org/10.1111/dom.13144>
8. Majumder E, Cogen FR, Monaghan M. Self-management strategies in emerging adults with type 1 diabetes. *Journal of Pediatric Health Care*. 2017;31(1):29-36. <https://doi.org/10.1016/j.pedhc.2016.01.003>
9. Vogels E, Gelles-Watnick R, Massarat N. Teens, social media and technology 2022 [Internet]. 2022 [cited 2023 November 11]. Available from: <https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022/>
10. Wang X, Shu W, Du J, Du M, Wang P, Xue M, et al. Mobile health in the management of type 1 diabetes: a systematic review and meta-analysis. *BMC Endocrine Disorders*. 2019;19(1):21. <https://doi.org/10.1186/s12902-019-0347-6>
11. Alfonsi JE, Choi EEY, Arshad T, Sammott SS, Pais V, Nguyen C, et al. Carbohydrate counting app using image recognition for youth with type 1 diabetes: pilot randomized control trial. *JMIR mHealth and uHealth*. 2020;8(10):e22074. <https://doi.org/10.2196/22074>
12. Barnes TL, Lee S, Thompson N, Mullen K, Chatterton P, Gandrud L. Barriers to glucose testing and attitudes toward mobile app and device use in a large cohort of T1D pediatric patients: implications for diabetes management. *Journal of Diabetes Science and Technology*. 2018;12(6):1246-1247. <https://doi.org/10.1177/1932296818794706>
13. Park G, Lee H, Khang AR. The development of automated personalized self-care (APSC) program for patients with type 2 diabetes mellitus. *Journal of Korean Academy of Nursing*. 2022;52(5):535-549. <https://doi.org/10.4040/jkan.22046>
14. Schulz KF, Altman DG, Moher D; CONSORT Group. CONSORT 2010 statement: updated guidelines for reporting parallel group randomized trials. *Annals of Internal Medicine*. 2010;152(11):726-732. <https://doi.org/10.7326/0003-4819-152-11-201006010-00232>
15. Whitehead AL, Julious SA, Cooper CL, Campbell MJ. Estimating the sample size for a pilot randomised trial to minimise the overall trial sample size for the external pilot and main trial for a continuous outcome variable. *Statistical Methods in Medical Research*. 2016;25(3):1057-1073. <https://doi.org/10.1177/0962280215588241>
16. Kirwan M, Vandelanotte C, Fenning A, Duncan MJ. Diabetes self-management smartphone application for adults with type 1 diabetes: randomized controlled trial. *Journal of Medical Internet Research*. 2013;15(11):e235. <https://doi.org/10.2196/jmir.2588>
17. Boo S, Ahn Y, Lee JE, Kang N, Kang H, Sohn M. Diabetes-specific quality of life of Korean children and adolescents with type 1 diabetes. *International Journal of Nursing Knowledge*. 2016;27(2):62-69. <https://doi.org/10.1111/2047-3095.12075>
18. Iannotti RJ, Schneider S, Nansel TR, Haynie DL, Plotnick LP, Clark LM, et al. Self-efficacy, outcome expectations, and diabetes

- self-management in adolescents with type 1 diabetes. *Journal of Developmental and Behavioral Pediatrics*. 2006;27(2):98-105. <https://doi.org/10.1097/00004703-200604000-00003>
19. Shamah-Levy T, Rodríguez-Ramírez S, Gaona-Pineda EB, Cuevas-Nasu L, Carriquiry AL, Rivera JA. Three 24-hour recalls in comparison with one improve the estimates of energy and nutrient intakes in an urban Mexican population. *Journal of Nutrition*. 2016;146(5):1043-1050. <https://doi.org/10.3945/jn.115.219683>
 20. U.S. Department of Agriculture (USDA), U.S. Department of Health and Human Services. *Dietary guidelines for Americans, 2020-2025*. 9th ed. USDA; 2020. p. 71-91.
 21. Dudek SG. *Nutrition essentials for nursing practice*. 7th ed. Lippincott Williams & Wilkins; 2013. p. 497-534.
 22. Kook SH, Varni JW. Validation of the Korean version of the pediatric quality of life inventory 4.0 (PedsQL) generic core scales in school children and adolescents using the Rasch model. *Health and Quality of Life Outcomes*. 2008;6:41. <https://doi.org/10.1186/1477-7525-6-41>
 23. Lee EH, Lee SJ, Hwang ST, Hong SH, Kim JH. Reliability and validity of the Beck Depression Inventory-II among Korean adolescents. *Psychiatry Investigation*. 2017;14(1):30-36. <https://doi.org/10.4306/pi.2017.14.1.30>
 24. Kim JH, Lee EH, Hwang ST, Hong SH. *Manual for the K-BDI-II*. Korea Psychology; 2015. p 2.
 25. Elo S, Kyngäs H. The qualitative content analysis process. *Journal of Advanced Nursing*. 2008;62(1):107-115. <https://doi.org/10.1111/j.1365-2648.2007.04569.x>
 26. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs-principles and practices. *Health Services Research*. 2013;48(6 Pt 2):2134-2156. <https://doi.org/10.1111/1475-6773.12117>
 27. Butte NF, Watson KB, Ridley K, Zakeri IF, McMurray RG, Pfeiffer KA, et al. A youth compendium of physical activities: activity codes and metabolic intensities. *Medicine and Science in Sports and Exercise*. 2018;50(2):246-256. <https://doi.org/10.1249/mss.0000000000001430>
 28. Soufi A, Mok E, Henderson M, Dasgupta K, Rahme E, Nakhla M. Association of stigma, diabetes distress and self-efficacy with quality of life in adolescents with type 1 diabetes preparing to transition to adult care. *Diabetic Medicine*. 2024;41(1):e15159. <https://doi.org/10.1111/dme.15159>
 29. Kristensen LJ, Birkebaek NH, Mose AH, Berg Jensen M, Thastum M. Multi-informant path models of the influence of psychosocial and treatment-related variables on adherence and metabolic control in adolescents with type 1 diabetes mellitus. *PLoS One*. 2018;13(9):e0204176. <https://doi.org/10.1371/journal.pone.0204176>
 30. Pandey A, Hale D, Das S, Goddings AL, Blakemore SJ, Viner RM. Effectiveness of universal self-regulation-based interventions in children and adolescents: a systematic review and meta-analysis. *JAMA Pediatrics*. 2018;172(6):566-575. <https://doi.org/10.1001/jamapediatrics.2018.0232>
 31. Goyal S, Nunn CA, Rotondi M, Couperthwaite AB, Reiser S, Simone A, et al. A mobile app for the self-management of type 1 diabetes among adolescents: a randomized controlled trial. *JMIR mHealth and uHealth*. 2017;5(6):e82. <https://doi.org/10.2196/mhealth.7336>
 32. Lansing AH, Stanger C, Budney A, Christiano AS, Casella SJ. Pilot study of a web-delivered multicomponent intervention for rural teens with poorly controlled type 1 diabetes. *Journal of Diabetes Research*. 2016;2016:7485613. <https://doi.org/10.1155/2016/7485613>
 33. Reynolds AN, Akerman AP, Mann J. Dietary fibre and whole grains in diabetes management: systematic review and meta-analyses. *PLoS Medicine*. 2020;17(3):e1003053. <https://doi.org/10.1371/journal.pmed.1003053>

Infant-rearing experiences of parents during the COVID-19 pandemic in South Korea: a mixed-methods approach

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Purpose: This study aimed to identify the infant-rearing experiences of parents during the coronavirus disease 2019 (COVID-19) pandemic and provide foundational data for the development of infant-rearing support programs during pandemic situations. **Methods:** Convergent mixed methods were used to better understand the research outcomes by converging both quantitative and qualitative data. A total of 149 parents with infant-rearing experiences during the pandemic responded to a self-report survey, and 10 parents participated in the interviews. Data were analyzed using Colaizzi's method, descriptive statistics, t-test, one-way analysis of variance, the Scheffé test, Pearson correlation coefficients, and hierarchical regression. **Results:** Analysis of qualitative data yielded the following three categories: five theme clusters, ten themes, and thirty-nine sub-themes. The factors influencing infant-rearing behavior were nuclear family ($\beta=.34$, $p<.001$) and rearing stress ($\beta=-.39$, $p<.001$). The explanatory power of the regression equation was 26.6%. **Conclusion:** Infectious disease disasters, such as the COVID-19 pandemic, can quickly alter infant-rearing conditions, causing heightened parental anxiety. This may affect infant-rearing behaviors and hinder healthy infant development. Future research should develop a comprehensive tool to measure holistic health-related parenting behaviors across the different stages of child development. Additionally, pediatric nurse practitioners can play an active role in educating parents, supporting parenting, and promoting healthy infant development in their communities, making pediatric nurse practitioners a highly relevant and necessary healthcare profession during infectious disease disasters. Thus, there is a need to improve institutions and build infrastructure at the national level to support them.

Keywords: Infant; Child rearing; Infant care; COVID-19

INTRODUCTION

The world has endured immense suffering due to the outbreak of coronavirus disease 2019 (COVID-19) in December 2019. The World Health Organization (WHO) declared it a global pandemic. The COVID-19 pandemic has triggered global responses, including border closures, quarantine mea-

asures, social distancing, and disruptions in education and caregiving services. Their effects have been far-reaching across society and the economy [1,2].

The prolonged COVID-19 pandemic has had various adverse effects on parents raising infants. With the escalation of the pandemic, numerous directives affecting everyday life, such as social distancing, have been introduced. Owing to

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the pandemic, many parents who spent more time at home with their infants experienced physical and psychological challenges [3]. Social distancing and online education caused by the pandemic have drastically changed the family environment, emphasizing the role of parents. Consequently, parents who must combine work, family life, and childcare at home are more likely to become physically exhausted. In addition, fear of coronavirus infection and psychological pressure have amplified the anxiety and stress associated with rearing. In addition, the COVID-19 pandemic led to an increase in childcare costs with the implementation of high-intensity social distancing measures at the end of March 2020 [4]. Moreover, many nursery schools have begun to close, resulting in increased stress and responsibility for parents who have to care for their infants at home [5].

The rearing quality is crucial in infants [6]. The growth, development, and health of infants are influenced not only by pre-birth biological and genetic factors but also, to a greater extent, by the physical, social, and emotional rearing environment after birth. Unlike in the past, when caregiving practices were naturally transmitted within extended families, today's families are mainly nuclear and lack clear parental role models. This is particularly challenging during infancy, as inexperienced parents without prior childcare experience often face numerous challenges while assuming these roles [7]. Therefore, parents require support and access to desirable infant-rearing models. Although numerous childcare experts are available, the nursing profession is the most accessible to parents of infants in medical institutions and local communities. Pediatric nurse practitioners (PNPs), with their extensive knowledge and skills in child development and healthcare, are best suited for supporting parental roles and recommending effective childcare policies [8].

In the context of the COVID-19 pandemic, prior research on parental caregiving experiences has primarily focused on quantitatively exploring the negative impact of maternal child rearing rather than that of both parents [9,10]. Qualitative research has also been conducted, but it has primarily focused on specific populations, such as mothers of children with disabilities and working mothers' families [11,12]. Despite the unprecedented and disastrous nature of the COVID-19 pandemic, various perspectives and experiences related to infant rearing during the crisis must be examined. However, research that simultaneously investigated the quantitative and qualitative aspects of rearing parents with infants during the pandemic is lacking. The application of

the mixed method allows the researcher to examine a phenomenon from multiple perspectives and thus pursue a broader view of the research concept. Furthermore, combining qualitative and quantitative research methods can combine the strengths of both methods while simultaneously compensating for their weaknesses. Therefore, the results derived from the mixed methods can help generate a substantive theory by providing a holistic view of the phenomenon and additional insights into its various components [13].

Therefore, this study aimed to analyze parents' infant-rearing experiences during the COVID-19 pandemic by applying a convergent mixed-methods approach, which can complement the limitations of previous studies conducted with a single method of quantitative or qualitative research. Additionally, we aimed to provide foundational data to support the development and enhancement of specialized infant-rearing support programs, including infant health management, while considering situational contexts. The findings of this study will undoubtedly assist parents in rearing infants effectively and healthily, even during infectious disease disasters.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Sahmyook University (No. SYU 2022-12-003-001). Informed consent was obtained from all participants.

1. Study Design

In this study, we employed a convergent mixed-methods design to identify the infant-rearing experiences of parents with infants during the COVID-19 pandemic (Figure 1). This design involves the collection and analysis of both qualitative and quantitative data, with the subsequent comparison and interpretation of the results [14]. This method enhances the comprehension of phenomena by using both quantitative and qualitative data. The reporting of this study was based on the Consolidated Criteria for Reporting Qualitative Research (COREQ) reporting guidelines [15] and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [16].

2. Participants and Data Collection

In this study, we planned and implemented qualitative

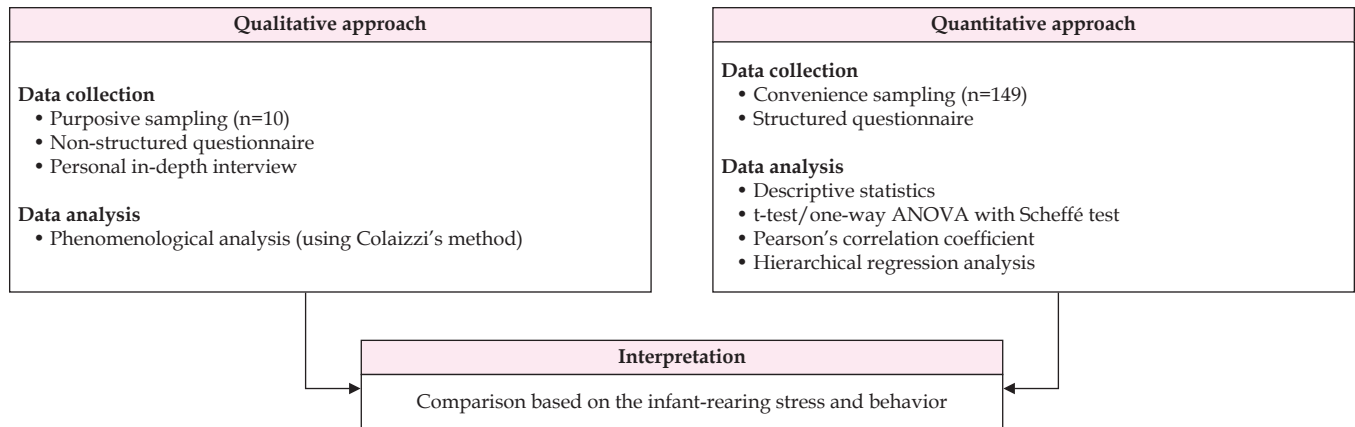


Figure 1. The research design of Infant-rearing experiences of parents during the COVID-19 pandemic: convergent model of a mixed-method.

and quantitative data collection while considering the purpose of a convergent mixed-method design. Participants were recruited by contacting the same five nursery schools in Seoul and Gyeonggi for both qualitative and quantitative studies. We attempted to control for exogenous factors that could affect the results of this study by blinding each participant to participate in a qualitative interview or quantitative survey. To collect qualitative data, we designed interview questions to understand parents' experiences of rearing infants during the COVID-19 pandemic. To collect quantitative data, we used a questionnaire. Details of the qualitative and quantitative data collection are as follows.

1) Qualitative study

We used purposeful sampling to obtain data from parents currently raising infants born between 2020 and 2022 during the COVID-19 pandemic, who could provide comprehensive insights into their infant-rearing experiences. We contacted five nursery schools in Seoul and Gyeonggi provinces to recruit parents of infants attending these schools. The participants were informed of the purpose of the study and volunteered to participate. Foster parents, multicultural households, and parents of children with rare medical conditions were excluded because their experiences differed significantly from their research focus. We selected ten participants, reaching a point of saturation where no new insights about the phenomenon emerged during the interviews. This number of participants was considered appropriate because the objective was to uncover the essence of their experiences. Data were collected from February 8, 2022, to June 30, 2023, via individual, in-depth interviews. Each participant underwent one to two hours of interview. Informed consent was

obtained from all participants before the interviews were recorded to prevent data loss. We received training in qualitative research methodologies and have extensive experience in this field. To collect qualitative data, we asked participants the following questions: "What was your experience of rearing an infant during the COVID-19 pandemic?" "What were some of the challenges of rearing an infant during the pandemic?" "What have been some of the good experiences of rearing an infant during the pandemic?" "What do you think is important in rearing an infant during an infectious disease disaster like the COVID-19 pandemic, and why?"

2) Quantitative study

For quantitative data, parents of infants born between 2020 and 2022 during the COVID-19 pandemic were conveniently sampled from five nursery schools in Seoul and Gyeonggi Province. After explaining the purpose of the study, we administered the survey to willing participants. The data were collected from June 15 to June 30, 2023. The criteria for selecting and excluding study participants were the same as those used for qualitative research participants. Based on our calculations from prior research by Kim and Chae [17], the minimum sample size required for multiple regression analysis with five explanatory variables—an effect size of 0.15, a significance level of 0.05, and a power of 0.95—was determined to be 138 using G*Power. We planned to recruit 152 participants, adding 10% to account for the dropout rate. However, only 149 volunteered to participate. This met the target number of participants; therefore, we collected quantitative data from 149 participants.

The following instruments were used to collect data:

(1) Rearing behavior

Rearing behavior refers to the behavior of parents in various situations while rearing their children [18]. In addition, the MeSH term defines “child rearing” separately from “parenting.” It differs from “parenting” in that in child rearing, the emphasis is on the act of training or bringing up the child and the interaction between the parent and child, while parenting emphasizes the responsibility and qualities of exemplary behavior of the parent [19].

In this study, the Infant and Toddler Health Promotion Behavior Scale developed by Kim et al. [20] was modified and supplemented to measure infant-rearing behavior, which reflects the meaning of child rearing based on the definition of the MeSH term. The scale comprises 30 items organized into seven subdomains: safety, emotional support, activity/rest, disease prevention, appropriate clothing, nutrition, and cleanliness/hygiene. The revised Infant-Rearing Behavior Scale was validated for content validity by a group of eight experts. The item-level content validity (I-CVI) of the scale ranged from .75 to 1.00. One item had an I-CVI of .75, which did not meet Lynn’s suggested criterion of .78; therefore, we revised the item. The scale-level content validity was .97, indicating that the scale is a valid measure of infant care behaviors. On this 4-point Likert scale, higher scores indicate higher levels of infant-rearing behavior. In the study by Kim et al. [20], Cronbach’s α was .88; in this study, it was .92.

(2) Rearing stress

Rearing stress refers to the psychological and physical tensions experienced as a result of the difficulties and challenges arising from the performance of the parental role in raising children [21].

In this study, we used the Korean version of the Parenting Stress Index, Fourth Edition Short Form, which is a shortened version of Abidin’s [22] Parenting Stress Index, Fourth Edition (PSI-4), standardized for the Korean context by Chung et al. [23]. The measurement tool in question is commercially distributed, and we purchased it through “Inpsyt,” the distributor, as the number of participants in this study. This index consists of 36 items on a 5-point Likert scale. It is composed of three subscales: Parental Distress, Parent-Child Dysfunctional Interactions, and Difficult Child. Higher scores indicate higher stress levels. In the study by Chung et al. [23], Cronbach’s α was .93, in this study, it was .90.

3. Data Analysis

Qualitative and quantitative data were analyzed simultaneously. The detailed analytical methods for each research method are as follows.

1) Qualitative study

The data were analyzed using Colaizzi’s method [24], a phenomenological research approach capable of extracting both individual participants’ experiences and common attributes of the overall shared experience. The analysis involved transcribing verbal statements and observational notes, reviewing recorded interviews for data consistency, and extracting significant statements. These were used to formulate universal meanings, identify themes, and derive categories. To ensure the reliability and validity of our findings, we follow Lincoln and Guba’s [25] evaluation criteria for truth value, applicability, consistency, and neutrality.

2) Quantitative study

The collected data were analyzed using IBM SPSS version 25.0 (IBM Corp.). The participants’ demographic characteristics were analyzed using frequencies, percentages, means, and standard deviations. Differences in infant-rearing behavior and stress based on demographic characteristics were analyzed using an independent t-test, one-way analysis of variance (ANOVA), and Scheffé’s post-hoc test. A correlation analysis was conducted to examine the relationships between the variables, and a hierarchical multiple regression analysis was performed to identify the factors influencing infant-rearing.

RESULTS

1. Qualitative Results

The study involved ten participants: six mothers and four fathers. Their average age was 36.00 (standard deviation=3.97), and two fathers and six mothers were primary caregivers, while the other two fathers provided secondary caregiving support to their spouses. The analysis of the participants’ experiences of rearing infants during the COVID-19 pandemic yielded three categories: five theme clusters, ten themes, and thirty-nine subthemes (Table 1). The three main categories that emerged from the analysis were “Infant-rearing stress,” “Infant-rearing behavior,” and “Infant-rearing

Table 1. Infant-rearing Experiences of Parents During the COVID-19 Pandemic

Subtheme (39)	Theme (10)	Theme cluster (5)	Category (3)
Avoidance of going out and contact with outsiders because of the fear of contracting COVID-19	Anxiety due to the risk of infection		
Concerns about infant infection risks within the family			
Increased depression resulting from social distancing	Experiencing the unintended consequences of social distancing	Confusion due to isolation	
Anger associated with social distancing			
Concerns about children's developmental growth due to social distancing			
Difficulties caused by excessive isolation in childcare facilities	Public backlash against infection control guidelines as lacking consideration for infants		Infant-rearing stress
Frustration experienced in the unique child-rearing environment produced because of an infectious disease			
A lack of public empathy for the developmental characteristics of infants	Burnout		
Feeling disheartened by cold social gazes			
Infant-rearing burden exacerbated by isolation and detachment	Loss of infant-rearing efficacy		
Exhaustion from a lifestyle without infant-rearing breaks			
Exhaustion from infant care leading to giving up on future family plans	Family relationships growing stronger	Increased family cohesion	
Loss of emotion control			
Despair and self-blame in the face of uncontrollable circumstances	Maintaining social connections and changing attitudes		Infant-rearing behavior
The father's burden and helplessness regarding not being able to participate in infant-rearing because of a job			
Experiencing infant-rearing conflicts among family members	Efforts made for child's infection prevention and nutrition management	Proactive coping with changed rearing situations	
Greater closeness with a spouse			
A spouse who becomes the most reliable parenting partner	Efforts to normalize the wearing of masks in daily life		
Improvement in parent-child relationships resulting from increased time together			
Efforts to maintain a sense of connection with the outside world by continuously watching TV	Efforts to take responsibility for the child's nutritional status		
Gaining strength through communication in a parental support group			

(Continued to the next page)

Table 1. Continued

Subtheme (39)	Theme (10)	Theme cluster (5)	Category (3)
Emotional distress of parents due to invasive examinations of infant	Vividly experiencing the vulnerable pediatric healthcare system	Recognizing the need for a new national response system and support policies tailored to the pandemic situation	Infant-rearing support needs due to the pandemic
Experiencing exhaustion resulting from the inability to alternate caregivers during hospitalization			
Becoming a victim as a result of an inadequate infectious disease response system			
A severe shortage of specialized pediatric hospitals			
Difficulties accessing hospital care and feeling neglected by hospitals			
Resignation regarding formal medical policies and healthcare services			
Distrust of uncertain information			
Difficulty obtaining professional infant-rearing information in the sea of overwhelming information			
Recognizing the need for father-specific infant-rearing education			
Recognizing the need for visitation-based rearing support to overcome social distancing			
The urgent need for specialized infant-rearing support policies tailored to the developmental stages of children			
Recognizing the need for healthcare support for infants with weakened immune systems			
The need for direct infant-rearing support services provided by medical professionals			
The need for nutritional support for the healthy development of infants			

support needs due to the pandemic.”

1) Infant-rearing stress

(1) Confusion due to isolation

Most participants experienced isolation and confusion during the pandemic. This was evident through two main themes: “Anxiety due to the risk of infection” and “Experiencing the unintended consequences of social distancing.” Participants experienced extreme anxiety owing to the risk of infection, especially in their infants. This fear leads to reduced outdoor activities and avoidance of visits from close relatives. Nationwide social distancing measures also present additional challenges. Reduced outdoor activities during the pandemic have affected infant development, leading to delays:

It was a time when I was worried about my in-laws, or my family, or someone coming to my house, and I think I was very

anxious that they might catch it. (Participant 9)

I wonder if language development is a little slower because he’s a corona baby and can’t go outside freely anymore... He tries to stay with mom... and I think he’s more shy. (Participant 4)

(2) Intensifying infant-rearing stress

Participants experienced increasing infant-rearing stress in the rapidly changing childcare environment because of the COVID-19 pandemic, which emerged in three main themes: “Public backlash against infection control guidelines as lacking consideration for infants,” “Burnout,” and “Loss of infant-rearing efficacy.” Participants faced public backlash and quarantine guidelines that lacked consideration for infants, leading to feelings of guilt despite sacrificing child rearing. The pandemic-induced social isolation and confinement have amplified the challenges of rearing infants, resulting in burnout due to the endless repetition of caregiving. Consequently, some of the participants had to alter their family

plans. Exhausted parents struggled to manage their emotions and experienced despair and self-blame during the pandemic, losing their sense of rearing efficacy, as exemplified below:

I'm a sinner at work, at these cafes and everywhere I go... We're sacrificing so much, we're raising the future members of society... Should we just look the other way? (Participant 9)

It was really tough. Because of COVID, it was even more challenging. Originally, we had planned for at least two children, but the thought of a second child completely disappeared. (Participant 7)

The moments when I couldn't regulate my emotions with the children linger as regrets, leaving me with feelings of guilt and disappointment in myself, as well as experiencing a decline in my rearing efficacy. (Participant 5)

2) Infant-rearing behavior

(1) Increased family cohesion

Participants experienced stronger family relationships than they did before the pandemic. This manifested in the main theme: "Family relationships growing stronger." Participants noted that the increase in working from home caused by social distancing increased the amount of time couples spent raising their infants together. They mentioned that co-rearing strengthened the trust between spouses and improved relationships, bringing them closer to their families:

I think I've become more of a family man than I was in my first year... I think it's because I'm now working from home because of COVID-19, so I'm spending more time with my kids. (Participant 2)

(2) Proactive coping with changed rearing situations

Participants faced isolation and challenges while raising infants during the pandemic. However, instead of being discouraged, they were proactive in overcoming them and coping. This manifested in two main themes: "Maintaining social connections and changing attitudes" and "Efforts made for child's infection prevention and nutrition management." The participants experienced profound isolation while rearing their infants during the pandemic. To maintain a connection with the outside world, they engaged in various efforts, such as keeping a TV on all day or seeking support from fellow parents. Participants struggled to prevent infant infections and enhance nutrition, feeling a deep responsibility for their children's health through good hygiene practices and wear-

ing masks. Additionally, parents whose infants were at home because of nursery school closures had concerns about providing meals throughout the day and fearing nutritional imbalances:

Since the start of COVID-19, I felt so lonely that I ended up turning on the TV almost every day. ... I just wanted to hear people talking, even if it was just their voices ... Doing that made me feel more connected to the outside world. (Participant 3)

Due to the corona, all the children at the nursery schools are wearing masks, so there is no infection or anything like that. ... Because my baby doesn't go to nursery school, I've had to take on a lot of the nutritional responsibility. I've been trying to balance his meals throughout the day. ... I also purchased baby supplements and fed him regularly. (Participant 1)

3) Infant-rearing support needs due to the pandemic

(1) Recognizing the need for a new national response system and support policies tailored to the pandemic situation

Participants personally experienced vulnerabilities in pediatric healthcare during the COVID-19 pandemic and recognized the need for new infant-rearing support for infectious disease disasters. Two distinct themes emerged: "Vividly experiencing the vulnerable pediatric healthcare system" and "Increase in demand for new infant-rearing support." Many participants struggled to access medical care for their children during the pandemic. They experienced worry and anger due to inadequate infectious disease response systems and frustration with excessive and inappropriate medical treatments for infants. Furthermore, the participants expressed the need for new support to address pandemic-induced challenges. This includes visits from healthcare professionals such as nurses and direct infant-rearing support:

The ambulance responders only contact hospitals with pediatric emergency rooms, but they often don't answer because of COVID. ... I just feel trapped in the hospital with no options. (Participant 8)

Having nurses or medical professionals come directly to check the baby's condition and provide basic infant-rearing skills in a professional manner would be helpful. (Participant 1)

Supporting the nutritional aspect during infancy would not only benefit the children's health but also provide assistance to parents who find it challenging to provide three meals a day during the pandemic. (Participant 10)

2. Quantitative Results

1) Differences in infant-rearing stress and rearing behaviors during the COVID-19 pandemic based on participant characteristics

During the COVID-19 pandemic, the level of infant-rearing stress among the participants averaged 2.3 ± 0.5 out of 5 points, while the level of infant-rearing behavior averaged 3.5 ± 0.3 out of 4 points (Table 2). Rearing stress varied significantly according to the general characteristics of the participants and their children, with significant differences observed based on monthly income ($F = 5.45, p = .005$) and the child's temperament ($F = 10.30, p < .001$). Significant differences in infant-rearing behaviors were observed based on family structure ($t = 4.41, p < .001$), with infant-rearing behaviors being significantly higher in nuclear families than in extended families. Based on Scheffé's post hoc analysis of variables associated with significant differences, rearing stress was higher when a household's monthly income was less than 3 million won than when it was over 5 million won. Additionally, higher stress levels were observed when a child's temperament was more difficult than when it was easy or moderate (Table 3).

2) The correlation between infant-rearing stress and rearing behavior

During the COVID-19 pandemic, infant-rearing stress among parents had a significant negative correlation with in-

fant-rearing behaviors ($r = -.39, p < .001$).

3) Factors influencing infant-rearing behavior

To identify the factors influencing the participants' infant-rearing behaviors during the pandemic, we conducted a hierarchical regression analysis of family type, average monthly income, and children's temperament, which differed significantly based on the participants' general characteristics. We use a first-stage regression model for our analysis. Rearing stress was added to the second-stage regression model, and a significant correlation was found (Table 4). The regression model was statistically significant in both model I ($F = 5.99, p < .001$) and II ($F = 9.92, p < .001$), with an explanatory power of 14.4% ($Adj R^2$) in model I and 26.6% ($Adj R^2$) in model II. The Durbin-Watson statistic was 2.06, which is close to 2, indicating that the assumption of independence of the residuals was not problematic. The variance inflation factor (VIF) was also small, with values below 10, indicating that multicollinearity was not a problem. Therefore, the regression model adequately explained the dependent variables.

DISCUSSION

Here, we discuss the results obtained in this study (a convergent mixed-method design) regarding infant-rearing experiences of parents during the COVID-19 pandemic. Qualitative and quantitative research findings on infant-rearing stress and behavior are compared and discussed.

The categories of infant-rearing stress that emerged from the qualitative findings of this study included "confusion due to isolation" and "intensifying infant-rearing stress" as theme clusters. Themes related to "confusion due to isolation" in the qualitative outcomes included "anxiety due to the risk of infection" and "Experiencing the unintended consequences of social distancing," which were related to "parent-child dysfunctional interactions" in the quantitative rearing stress sub-factor. In this study, the mean for this sub-factor was 1.8, similar to the mean of 1.98 in a study by Kim and Chae [17]. Pre-pandemic studies found that "parent-child dysfunctional interactions" averaged 1.63 [26], indicating that rearing stress was higher during the pandemic than before. The qualitative findings of this study showed that during the pandemic, participants tried to avoid going out and contacting outsiders as much as possible. They also expressed that their depression, anger, and anxiety about their infant child's growth and development increased as the pandemic pro-

Table 2. Descriptive Statistics on Rearing Stress and Behavior of Parents During the COVID-19 Pandemic (N=149)

Variables	Total	Item	Rank
	M±SD	M±SD	
Rearing stress (5 point liked scale)	83.5±16.3	2.3±0.5	
Parental distress	35.9±7.6	3.0±0.6	1
Parent-child dysfunctional interactions	21.5±5.6	1.8±0.5	3
Difficult child	26.1±7.1	2.2±0.6	2
Rearing behavior (4 point liked scale)	106.4±9.1	3.5±0.3	
Safety	28.9±2.7	3.6±0.3	2
Emotional support	14.2±1.7	3.5±0.4	4
Activity/Rest	10.4±1.3	3.5±0.4	4
Disease prevention	14.5±1.5	3.6±0.4	2
Appropriate clothing	11.0±1.2	3.7±0.4	1
Nutrition	10.5±1.3	3.5±0.4	4
Cleanliness/Hygiene	16.8±2.1	3.4±0.4	5

M, mean; SD, standard deviation.

Table 3. Rearing Stress and Behavior During the COVID-19 Pandemic according to General Characteristics (N=149)

Variables	Categories	n (%) or M±SD	Rearing stress			Rearing behavior		
			M±SD	t or F	p	M±SD	t or F	p
Parental characteristics								
Relationship with infant	Mother	119 (79.9)	84.1±15.9	0.98	.330	106.0±9.2	-1.04	.299
	Father	30 (20.1)	80.9±18.1			107.9±8.7		
Age (yr)	≤29	5 (3.4)	82.8±7.0	0.08	.927	110.6±6.6	1.36	.260
	30–39	121 (81.2)	83.7±16.4			105.8±9.3		
	≥40	23 (15.4)	82.3±17.7			108.4±8.3		
			35.8±4.5					
Educational level	≤High school	39 (26.2)	84.7±16.5	0.57	.572	104.9±8.8	-1.22	.226
	≥College	110 (73.8)	83.0±16.3			106.9±9.2		
Employment status	Working	124 (83.2)	83.0±16.6	-0.70	.485	106.5±9.0	0.45	.653
	Not working	25 (16.8)	85.6±14.8			105.6±9.4		
Occupational type	Service industry	13 (8.7)	84.4±11.8	1.05	.384	104.6±8.4	0.38	.825
	Office work	31 (20.8)	80.8±17.0			106.5±9.8		
	Professional	43 (28.9)	82.2±17.2			107.6±8.8		
	Homemaker	43 (28.9)	87.5±16.6			105.8±8.9		
	Other	19 (12.8)	80.8±15.1			105.9±10.0		
Family structure	Nuclear	136 (91.3)	83.0±16.3	-1.07	.288	107.3±8.6	4.41	<.001
	Extended	13 (8.7)	88.1±16.2			96.4±8.2		
Monthly income (10,000 KRW)	<300 ^a	25 (16.8)	90.9±21.6	5.45	.005 (a>c) ^{a)}	105.3±9.4	0.35	.708
	300–500 ^b	54 (36.2)	85.3±15.4			106.1±9.2		
	≥500 ^c	70 (47.0)	79.4±13.7			107.0±9.0		
Number of children	1	94 (63.1)	82.6±16.2	-0.86	.389	106.7±9.3	0.57	.571
	≥2	55 (36.9)	85.0±16.5			105.8±8.7		
Infant's characteristics								
Sex	Male	79 (53.0)	84.2±17.8	0.58	.562	106.2±8.9	-0.21	.833
	Female	70 (47.0)	82.6±14.6			106.6±9.4		
Age (yr)		1.7±0.8						
Health status	Unhealthy	6 (4.0)	81.3±12.8	0.61	.544	107.3±11.1	0.29	.752
	Moderate	8 (5.4)	89.5±21.2			104.1±9.4		
	Healthy	135 (90.6)	83.2±16.2			106.5±9.0		
Temperament	Difficult ^a	30 (20.1)	93.8±18.3	10.30	<.001 (a>b, c) ^{a)}	107.1±9.5	2.22	.112
	Moderate ^b	66 (44.3)	83.3±15.2			104.7±9.1		
	Gentle ^c	53 (35.6)	77.8±3.8			108.1±8.6		

^{a)}Scheffé test; M, mean; SD, standard deviation.

Table 4. Factors Influencing Infant-rearing Behavior During the COVID-19 Pandemic

Variables	Model I						Model II					
	B	SE	β	t	p	VIF	B	SE	β	t	p	VIF
(Constant)	98.27	2.52		38.96	<.001		115.6	4.2		27.51	<.001	
Family type^{a)} (Ref: Extended)												
Nuclear	12.25	2.49	.38	4.91	<.001	1.05	10.77	2.33	.34	4.62	<.001	1.06
Monthly income (10,000 KRW)^{a)} (Ref: ≥500)												
<300	-2.76	1.98	-.11	-1.40	.164	1.15	-0.28	1.90	-.01	-0.15	.882	1.24
300–499	-2.24	1.55	-.12	-1.45	.149	1.16	-0.73	1.46	-.04	-0.50	.620	1.22
Temperament^{a)} (Ref: Easy)												
Difficult	-0.52	1.93	-.02	-0.27	.787	1.26	2.82	1.91	.13	1.48	.142	1.44
Moderate	-3.80	1.56	-.21	-2.44	.016	1.26	-2.60	1.46	-.14	-1.78	.077	1.30
Rearing stress												
R ²	.173						.295					
Adj R ²	.144						.266					
F (p)	5.99 (<.001)						9.92 (<.001)					

^{a)}Dummy variable; B, unstandardized coefficients; β, standardized coefficients; SE, standard error; VIF, variance inflation factor; Durbin–Watson index: 2.06.

longed. Russell et al. [27] also reported high levels of depression among primary caregivers because of isolation while raising children during the COVID-19 pandemic. Examples of items measuring rearing stress related to "Dysfunctional parent-child interactions" in this study include "My child does not seem to learn as quickly as other children same age." and "It is difficult for me to feel as close and warm to my child as I had hoped" [20]. Taken together, these qualitative and quantitative findings suggest that the relatively high scores of "Dysfunctional parent-child interactions" among the participants in this study may be attributed to the isolation, depression, anger, and anxiety experienced by parents due to the disruption caused by the pandemic.

The themes pertaining to "Intensifying infant-rearing stress" in the qualitative results included "Public backlash against infection control guidelines as lacking consideration for infants," "Burnout," and "Loss of infant-rearing efficacy," all of which were related to "Parental distress" in the quantitative rearing stress sub-factor. The quantitative outcomes of parenting stress during the pandemic had a mean of 2.3 out of 5. No prior research has measured rearing stress alone in parents of infants during the pandemic using the same instrument. However, a previous study of mothers of infants and toddlers [17] found that rearing stress was similar to that found in the present study, with a mean of 2.41. Parental distress (mean = 3.03) was the highest among the sub-factors [17] and was highest in this study, with a score of 3.0. In a study conducted before the pandemic [28], the total score for rearing stress was 57.51, which was very low compared to the total score of 83.5 in this study. In addition, among the subdomains of rearing stress, "Parental distress" was found to have an average score of 2.74 [26], indicating that "Parental distress" increased more during the pandemic than before. The qualitative and quantitative results of this study were integrated to explore the factors that lead to an increase in parental distress. The participants in this study experienced isolation due to fear of infection risk and implementation of social distancing policies and were forced to bear the burden of rearing alone without social support. In addition, the rapidly changing rearing situation during the pandemic, in which parents must combine endless childcare with their existing daily routines [29], may have increased rearing stress compared to that before the pandemic.

The quantitative data in this study indicate that infant-rearing stress was significantly greater when the average monthly income was less than 3 million won than when it was

more than 5 million won. This finding might be related to the subtheme, "Infant-rearing burden exacerbated by isolation and detachment," in the qualitative data. Consistent with our qualitative findings, prior research [4,30] revealed a notable surge in infant and toddler care costs during the pandemic due to increased time spent at home by children, resulting in economic instability and a heightened childcare burden for numerous families. The findings of this study and Kim's [3] study, which reported an inverse correlation between household income and child-rearing stress during the pandemic, indicate that household economic insecurity is a source of parental distress and an important factor to consider when identifying child-rearing stress.

The quantitative results also showed that infant-rearing stress depends on the infant's temperament, with "Difficult child" being the second highest sub-factor. Kim [3] found that, in general, rearing stress was higher for families rearing infants than for those rearing toddlers. In addition, rearing stress was higher for families rearing infants than toddlers and for families rearing children with difficult temperaments during the pandemic. This is consistent with previous findings that infant temperament affects parenting stress and that mothers of difficult infants experience higher levels of stress [31]. Generally, child-rearing stress is higher for families that rear infants than toddlers [3]. Infants find it extremely difficult to communicate verbally with others and must rely entirely on their parents. Thus, infants with difficult temperaments have an impact on increased parenting stress not only during the COVID-19 pandemic but also in typical rearing situations.

Regarding the findings related to infant-rearing behavior, when examining the qualitative data, a theme cluster emerged that encompassed the themes of "Increased family cohesion" and "Proactive coping with changed rearing situations." Themes such as "Maintaining social connections and changing attitudes," "Family relationships growing stronger," and "Efforts made for child's infection prevention and nutrition management" were also observed. When examining the quantitative results related to the theme, "Efforts made for child's infection prevention and nutrition management," derived from the qualitative findings, effective rearing behavior was reported as relatively high, with an average score of 3.5 out of 4 on rearing behavior. The infant-rearing behavior measure tool used in this study assesses the extent to which participants engage in health-based rearing behaviors aimed at the healthy growth and development of their infants. The

results of this study showed that participants scored uniformly high across each sub-factor, indicating that they engage in balanced rearing behaviors for infant health. The qualitative results showed that participants reinforced rearing behaviors related to hygiene and nutrition, which were similar to COVID-19 prevention behaviors. Participants were willing to put up with the inconvenience of wearing masks at home to protect their infants from infection and provided them with high-quality, nutritious food to boost their immunity. These findings are consistent with previous studies on preventive behaviors against COVID-19 [32]. This previous study also indicated that mothers of infants practiced preventive measures more effectively than the other groups, reinforcing the results of our study. Kim's study [33], conducted before the pandemic, found that "Disease prevention" scored 3.37, "Nutrition" scored 2.89, and "Cleanliness/Hygiene" scored 3.29. Compared with the results of this study, the scores of rearing behaviors corresponding to these sub-factors increased during the pandemic to 3.6, 3.5, and 3.4, respectively. This suggests that to prevent their infants from contracting the coronavirus, parents strengthened the performance of rearing behaviors that could directly affect their health status.

Regarding the theme of "Maintaining social connections and changing attitude," derived from the qualitative results, participants transformed their responses to infectious diseases, overcoming initial anxiety in the early pandemic stages. They actively engaged in child rearing and enhanced their communication with their parents.

Additionally, concerning the theme "Family relationships growing stronger," the quantitative results revealed that rearing behaviors were higher for nuclear families. Paradoxically, social distancing measures resulted in increased rearing time, and qualitative findings showed that parents reported closer bonds with their children. The results showed that the increased time spent at home by all family members due to the pandemic led parents to make efforts to spend more time with their children [34].

A noteworthy aspect highlighted in the qualitative research findings of this study is the identification of "Infant-rearing support needs during the pandemic." The theme cluster, "Recognizing the need for a new national response system and support policies tailored to the pandemic situation," was identified in the qualitative findings. Related themes included "Vividly experiencing the vulnerable pediatric healthcare system" and "Increase in demand for new rearing support." The COVID-19 pandemic has revealed vul-

nerabilities in the pediatric healthcare system, causing parents to endure pain, mental exhaustion, and physical fatigue. Pandemic control measures did not adequately consider infants, leading to isolation and treatment issues [35]. Unlike adults, the medical needs of infants vary with their developmental stage. However, the pediatric healthcare system has recently been disrupted owing to a shortage of specialized medical personnel [35], which has made it difficult to provide differentiated care for infants. Taken together, these findings suggest that, to prepare for future pandemics, it is crucial to strengthen and improve the pediatric healthcare system. PNP's are the ideal healthcare professionals to address these shortages. PNP's are registered nurses with specialized training and clinical experience in caring for children. They are an invaluable group of nurses who can provide quality nursing care across the spectrum of healthcare, including community, primary, acute, and specialty care settings [36]. PNP's also have expertise in child development, health promotion, and disease prevention and can contribute to the healthy growth of children and the well-being of families through nursing care. Therefore, there is a need to train PNP's and build institutional infrastructure to enable them to play a dynamic role in communities where they are closest to parents and children in preparation for future disease disasters, such as the COVID-19 pandemic.

This mixed-methods study is meaningful because of its qualitative and quantitative comparative analyses of infant-rearing experiences of parents during the COVID-19 pandemic. Additionally, quantitative outcomes related to infant-rearing behaviors have drawn attention owing to their focus on infant health issues in infectious disease situations, setting them apart from other disciplines.

One limitation of this study is that the data were collected after the pandemic ended, requiring participants to recall their memories. Another limitation was that we were unable to examine differences in the timing of infant and toddler parenting experiences before, during, and after the pandemic for the same participants. The significant factors influencing rearing behaviors during the pandemic found in this study were identified as a result of the research; therefore, it was not possible to include them as exogenous variables in the initial design of the study. The factors that influenced rearing behaviors during the pandemic in this study (family structure, monthly income, and infant temperament) can be considered pandemic-related influencing variables and should be considered in future studies. In addition, there are limita-

tions to not considering specific contextual exogenous variables, such as the birth order of children or whether the couple works. In future studies, it is necessary to consider other exogenous variables that may affect rearing behavior and stress. Finally, since we studied both parents, we could not differentiate infant-rearing stress and behavior between mothers and fathers based on their characteristics.

CONCLUSION

Infectious disease disasters such as the COVID-19 pandemic rapidly change rearing situations and can lead to increased anxiety among parents, possibly affecting infant-rearing behaviors and impeding the healthy growth and development of infants. Therefore, it is necessary to examine health-based rearing behaviors from a nursing perspective. For this purpose, future research should develop a rearing behavior tool that includes all domains of holistic health and measures rearing behaviors specific to each developmental stage of the child. Providing health-based rearing behaviors also requires PNPs to play an active role in the community. If PNPs educate and support parents rearing infants in the community to engage in effective health-based rearing behaviors, they can reduce rearing stress and burden, and promote healthy growth and development of infants. Institutional support must also be provided to enable pediatric nurse practitioners to become effective facilitators of infant care.

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REFERENCES

- World Bank. The global economic outlook during the COVID-19 pandemic: a changed world [Internet]. 2020 [cited 2023 September 2]. Available from: <https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world>
- Kang YJ. Lessons learned from cases of COVID-19 infection in South Korea. *Disaster Medicine and Public Health Preparedness*. 2020;14(6):818-825. <https://doi.org/10.1017/dmp.2020.141>
- Kim SH. A study on the stress of young children's parents in COVID-19 pandemic - focusing on COVID-19 stress and parenting stress -. *Korean Journal of Safety Culture*. 2021;13:375-390.
- Choi HM. Changes in child-rearing costs for young children before and after COVID-19. *Korean Journal of Child Care and Education Policy*. 2023;17(1):3-26. <https://doi.org/10.5718/kcep.2023.17.1.3>
- Brown SM, Doom JR, Lechuga-Peña S, Watamura SE, Koppels T. Stress and parenting during the global COVID-19 pandemic. *Child Abuse & Neglect*. 2020;110(Pt 2):104699. <https://doi.org/10.1016/j.chiabu.2020.104699>
- Lee DW, Kwon IS. An analysis of nursing research on child rearing in Korea. *Child Health Nursing Research*. 2014;20(4):264-274. <https://doi.org/10.4094/chnr.2014.20.4.264>
- Park SM. Child rearing experience and needs for parent education of mother with infancy children. *Korean Journal of Parents and Guardians*. 2014;1(1):63-87.
- Song IH, Kang KA. Research trends over 10 years (2010-2021) in infant and toddler rearing behavior by family caregivers in South Korea: text network and topic modeling. *Child Health Nursing Research*. 2023;29(3):182-194. <https://doi.org/10.4094/chnr.2023.29.3.182>
- Bae EJ, Park KJ. COVID-19 pandemic: effects of changes in chil-

- dren's daily-lives and concerns regarding infection on maternal parenting stress. *Korean Journal of Child Studies*. 2021;42(4):445-456. <https://doi.org/10.5723/kjcs.2021.42.4.445>
10. Cho SI. The work-family reconciliation status and needs of dual-earner families amidst the COVID-19 situation. *Korea Institute of Child Care and Education*. 2021;68:18-28.
 11. Park KJ. A phenomenological study on the hardship of parenting disabled children in COVID-19: focused on the experience of mother in dual income family. *Counseling Psychology Education Welfare*. 2021;8(2):245-259.
 12. Jung SH. A phenomenological study of working mom's work and parenting lived experience in the Covid-19 crisis. *Korean Journal of Christian Counseling*. 2021;32(3):245-277.
 13. Dawadi S, Shrestha S, Giri RA. Mixed-methods research: a discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education*. 2021;2(2):25-36. <https://doi.org/10.46809/jpse.v2i2.20>
 14. Wu YP, Deatrick JA, McQuaid EL, Thompson D. A primer on mixed methods for pediatric researchers. *Journal of Pediatric Psychology*. 2019;44(8):905-913. <https://doi.org/10.1093/jpepsy/jsz052>
 15. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007;19(6):349-357. <https://doi.org/10.1093/intqhc/mzm042>
 16. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Medicine*. 2007;4(10):e296. <https://doi.org/10.1371/journal.pmed.0040296>
 17. Kim MR, Chae SM. Factors influencing changes in parenting behavior during Coronavirus disease 2019 pandemic. *Journal of the Korean Society of Maternal and Child Health*. 2022;26(2):80-90. <https://doi.org/10.21896/jksmch.2022.26.2.80>
 18. Kim K, Hwang Y. Development and validation of parenting competency scale for parents of young child. *Journal of Open Parent Education*. 2020;12(4):133-152. <https://doi.org/10.36431/JPE.12.4.7>
 19. National Library of Medicine (NLM). Child rearing [Internet]. 2014 [cited 2023 November 24]. Available from: <https://www.ncbi.nlm.nih.gov/mesh/68002668>
 20. Kim SJ, Kang KA, Yun J, Kwon OJ. Development of a tool to measure health promotion behavior for infants & toddlers. *Journal of Korean Academy of Child Health Nursing*. 2007;13(1):21-32.
 21. Abidin RR. The determinants of parenting behavior. *Journal of Clinical Child Psychology*. 1992;21(4):407-412. https://doi.org/10.1207/s15374424jccp2104_12
 22. Abidin RR. Parenting Stress Index: PSI-4; professional manual. 4th ed. *Psychological Assessment Resources*; 2012. p. 1-167.
 23. Chung KM, Yang YJ, Jung S, Lee KS, Park JA. Standardization study for the Korean version of Parenting Stress Index Fourth Edition Short Form (K-PSI-4-SF). *Korean Journal of Health Psychology*. 2019;24(4):785-807. <https://doi.org/10.17315/kjhp.2019.24.4.001>
 24. Colaizzi PF. Psychological research as the phenomenologist views it. In: Valle RS, King M, Editors. *Existential-phenomenological alternatives for psychology*. Oxford University Press; 1978. p 6.
 25. Lincoln YS, Guba EG. *Naturalistic inquiry*. Sage Publications; 1985. p. 289-331.
 26. Kim Y, Kim J. The study of relationship between maternal parenting stress and infant development: the mediating effects of mother's responsible interaction and parenting efficacy. *Korean Journal of Early Childhood Education*. 2017;37(2):169-187. <https://doi.org/10.18023/kjece.2017.37.2.008>
 27. Russell BS, Hutchison M, Tambling R, Tomkunaj AJ, Horton AL. Initial challenges of caregiving during COVID-19: caregiver burden, mental health, and the parent-child relationship. *Child Psychiatry and Human Development*. 2020;51(5):671-682. <https://doi.org/10.1007/s10578-020-01037-x>
 28. Song NR, Rha JH. Exploring variables effecting parental stress of fathers with infants. *Korean Journal of Childcare and Education*. 2018;14(1):187-202. <https://doi.org/10.14698/jkce.2018.14.01.187>
 29. Ju HR, Han AR. The study on the emotional experience of an infant mothers using the emergency child care after COVID-19. *Journal of Korea Open Association for Early Childhood Education*. 2021;26(1):209-227. <https://doi.org/10.20437/KOAECE26-1-09>
 30. Kim D, Eo Y. Understanding the sources of high inflation in Korea after COVID-19: evidence from disaggregate CPI inflation rates by expenditure category. *Korean Economic Forum*. 2022;15(2):1-20. <https://doi.org/10.22841/kefdoi.2022.15.2.001>
 31. Seo SW, Lee DK. The effects of mother's marital satisfaction, couple conflict and infants' emotional temperament on mother's parenting stress. *Korean Journal of Early Childhood Education*. 2013;33(5):279-298. <https://doi.org/10.18023/kjece.2013.33.5.012>
 32. Lee SJ, Jin X, Lee S. Factors influencing COVID-19 related anxiety among infant's mothers. *Korean Society for Wellness*. 2021;16(3):309-316. <https://doi.org/10.21097/ksw.2021.08.16.3.309>
 33. Kim HJ. Influencing factors on child health promoting behaviors of the mothers with infants and toddlers [master's thesis]. *Kyunghee University*; 2015. p. 1-83.
 34. Seok MA, Moon IK, Lee BH. A study on parent's experience of in-home childcare due to the COVID-19 pandemic. *Journal of Korea Open Association for Early Childhood Education*. 2021;26(3):199-230. <https://doi.org/10.20437/KOAECE26-3-08>
 35. Kim HJ, Do SL, Song MR, Jang YI. The experience of facility isola-

- tion by children infected with COVID-19. *Journal of Korean Council for Children & Rights*. 2021;25(3):421-445. <https://doi.org/10.21459/kccr.2021.25.3.421>
36. Gigli KH, Beauchesne MA, Dirks MS, Peck JL. White paper: critical shortage of pediatric nurse practitioners predicted. *Journal of Pediatric Health Care*. 2019;33(3):347-355. <https://doi.org/10.1016/j.pedhc.2019.02.008>

Development of a chatbot for school violence prevention among elementary school students in South Korea: a methodological study

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Purpose: This study develops a chatbot for school violence prevention (C-SVP) among elementary school students. **Methods:** Among the analysis, design, development, implementation, and evaluation (ADDIE) models, ADD phases were applied to develop a C-SVP. Students' learning needs were identified by constructing content with a design that attracted their attention. Subsequently, a formative evaluation was conducted on the developed C-SVP to test its applicability by ten elementary school students targeting the 5th and 6th grades. **Results:** The chatbot was designed using KakaoTalk and named "School Guardian Angel." The formative evaluation revealed that the developed C-SVP was easily accessible and useful for elementary school students. **Conclusion:** The developed C-SVP is expected to be effective in preventing violence among elementary school students. However, further research involving children of various age groups is required.

Keywords: Artificial intelligence; Child; Schools; Violence

INTRODUCTION

The 4th industrial revolution is denoted by technical development. The advent of artificial intelligence (AI) is known to be the greatest innovation for humanity and is therefore expected to have profound impact on our life [1,2]. Furthermore, AI refers to systems or machines that imitate human intelligence to perform tasks and can self-heal based on collected information, especially in learning [2]. They also reported that students' lack of interest and motivation in learning was influenced by monotonous and less varied learning media.

One application of the AI technology is chatbot technology. Chatbots are natural language processing software programs that use AI [3] and are designed to mimic human con-

versations through text [4]. Chatbots interact with users [5] for understanding questions faster, provide efficient answers, and extract critical information from large user-defined datasets to improve timing [3,6]. In addition, with the recent changes in educational paradigms, various learning modalities have emerged. This has been further stimulated by the COVID-19 pandemic, and teachers are considering alternatives to conventional learning environments [7]. Thus, they can be used to develop learning media as presenters of interactive and interesting educational areas by increasing user engagement [1,4,8]. With a rapidly growing trend in education, chatbots have been adopted as educational agents [1,5].

Violence, which is prevalent worldwide, refers to intense and severe power that causes injury or destruction [9]. Violence against elementary school students is a serious and

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persistent social problem in South Korea [10]. According to the Korean Ministry of Education's 2021 School Violence Survey, elementary school kids (ages 9 to 11) were more likely than middle and high school students to suffer violence [11]. A pressing problem is that school violence is not just a one-time incident but is continuous and is increasingly becoming a common behavior in schools [12].

Considering the seriousness of violence, each elementary school runs a school violence prevention education program as part of its formal education [11]. Most programs aimed at preventing school violence are taught through face-to-face instruction and self-report measures. However, it is unclear whether this approach is effective. Additionally, there are other limiting conditions, such as the number of students per teacher, lack of instructors' pedagogical knowledge of the question, and limited class time [7,11,13]. To overcome this barrier, a reliable and practical educational modality is required to assist teachers in facilitating students' effective and efficient participation in learning activity [14].

Today's students, known as Generation Z, have grown up in a digital environment surrounded by computers, the internet, and smartphones [4]. Digital tools have become an integral part of students' lives in this generation, resulting in their superior dexterity with technological devices compared to previous generations [3]. New educational methods that suit the preferences of younger generations have distinct advantages over conventional teaching and learning approaches [15]. Interacting with chatbots in a human-like manner appears to positively contribute to providing support and information [2,4]. Furthermore, students who are unable to ask questions can find answers to their queries at any time of the day with the assistance of chatbots, which supplement teachers [3]. Additionally, chatbots have the potential to encourage students to ask questions, even when the topic is difficult, such as school violence [16].

Therefore, research on chatbot applications is considered valuable. However, research on chatbots that applies it to educational programs for elementary school students is in its infancy, and the development of chatbots is limited [16]. Therefore, it is necessary to develop a chatbot for school violence prevention (C-SVP) to prevent school violence effectively. Thus, it is a practical guideline to help children live a safe school life by preventing and reducing violence among elementary school children.

This study develops a C-SVP that can be used to provide helpful information for elementary school students. The ob-

jective of this study is to a) develop a C-SVP, b) test the validity of the developed C-SVP with the help of experts, and c) identify the satisfaction of elementary school students.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Hallym University (No. HIRB-2023-037). Informed consent was obtained from all participants.

1. Study Design

This methodological study developed a C-SVP for elementary school children. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [17].

2. Study Procedure

To achieve study objectives, only the analysis, design, and development (ADD) phase of Seels and Richey's analysis, design, development, implementing, and evaluation (ADDIE) model [18] was applied as the developmental method (Figure 1). The reason we adopted this model was that it was the most suitable for this study as it helps to develop the chatbot by reviewing existing literature and analyzing the students' awareness of chatbots. Further, it reflects opinions through formative evaluation and feedback from a group of experts (computer program developers, teachers, and child health nursing professors) and students who will use the developed chatbot.

1) Analysis phase

In this phase, an analysis of the learner's needs and the learning environment is required. We searched literature related to school violence prevention in children published in the last 10 years using keywords such as "school violence prevention," and "chatbot" from April to June, 2022. We conducted preliminary research to identify students' awareness of the use of chatbots for school violence prevention [13]. In total, 215 fifth- to sixth-grade students were surveyed between July 1 to July 22, 2022 at school using a self-reported questionnaire consisting of 22 items. From the results, it was noted that the students perceived chatbots positively as indicated by the mean score of 3.43 ± 0.83 out of 5 points.

To analyze the educational environment, students' smartphone ownership rate required to use a chatbot was investigated. We identified whether the students had used the KakaoTalk application. As shown by the survey of the use of Internet services in 2023 Youth statistics [19], all elementary school students had smartphones, installed the KakaoTalk app, and used it for text messaging.

2) Design phase

In the design phase, the Attention (A), Relevance (R), Confidence (C), and Satisfaction (S) (ARCS) theory on teaching strategies [20] was used to construct the contents of the C-SVP. The intent was to compose emoticons or letters to attract students' attention (A), and the content was related to students' actual experiences of school violence to induce in-

terest (R). In addition, students were provided with information that could be easily understood, thus making them feel confident about preventing and coping with school violence and satisfied with the answers from the chatbot (C and S).

Chatbot design is a core step in its development [21]. Based on natural language processing that uses AI, chatbots answer questions using a database that is already stored and available (Figure 1) [21]. Therefore, chatbots with abundant knowledge can improve their response accuracy [6,21]. Considering the elementary learner's cognitive level [22], the content should be kid-friendly texts with attractive features, such as a human-like appearance using empathy and humor, small talk with tips, and referrals to websites or other resources.

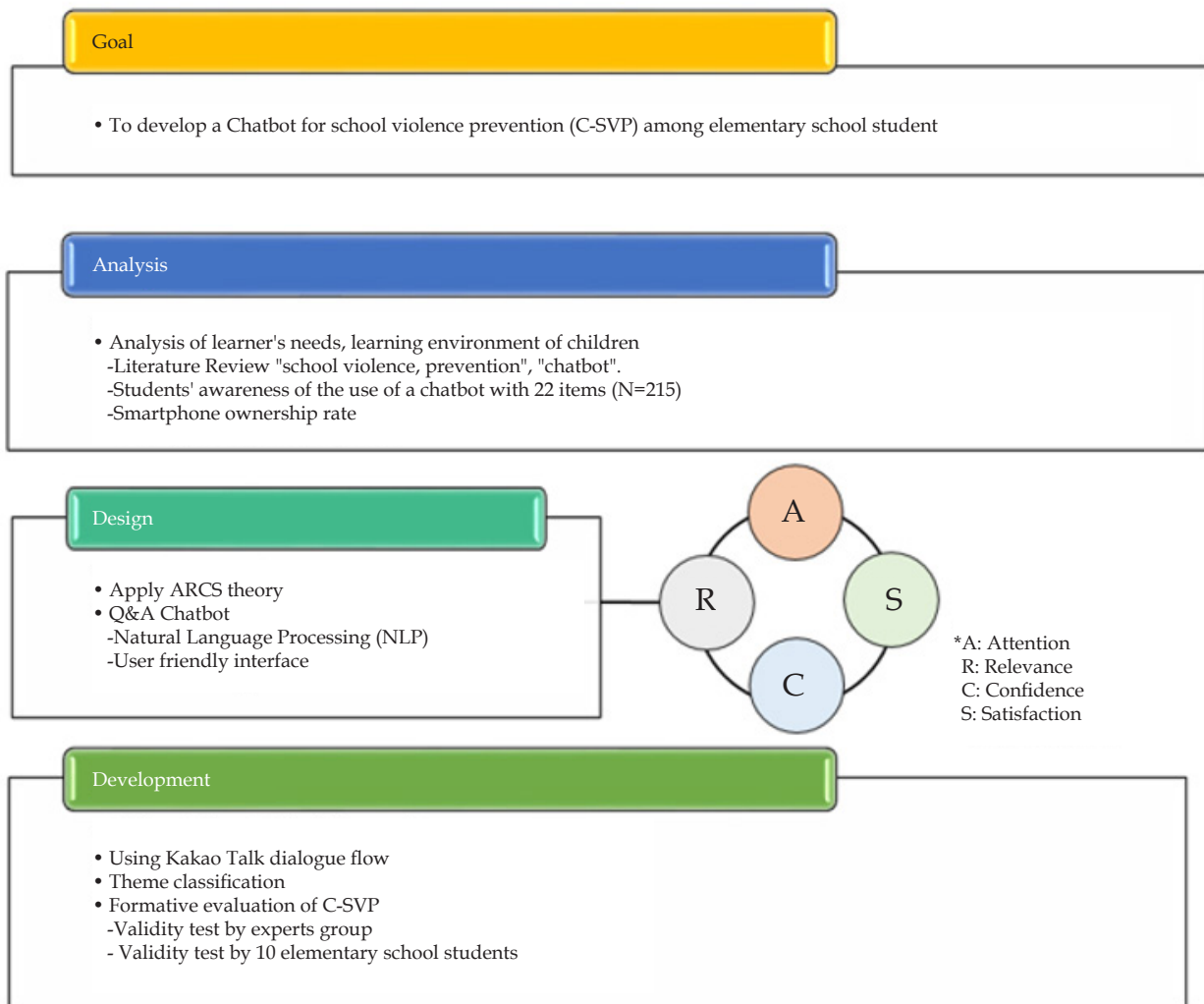


Figure 1. The process of develop a chatbot for school violence prevention (C-SVP) among elementary school students according to the ADDIE model. ADDIE, analysis, design, development, implementation, and evaluation.

3) Development phase

The main content was developed using KakaoTalk (Figure 1). A basic conversation structure was created using user-created nodes, where each unique node represented a specific scenario of the dialogue. When designing a specific scenario for each conversation, the data must be built into various sentence structures or formats for questions and answers [23]. The software platform was based on the dialogue flow in which the children were free to ask any questions to a chatbot, and the conversation started by the students (Figure 2). The KakaoTalk screen was designed with clear colors, fonts, and font sizes that are easily noticeable for elementary school students. The text uses simple and easy-to-understand words that match the reading level of elementary school students. The themes were classified into the following: (1) the definition of violence, (2) the type of violence that students may experience, and (3) Questions and Answers (Q&A).

Formative evaluation includes obtaining adequate information and using it as the groundwork for further development [18]. A group of experts, including three child health nursing professors, three elementary school teachers, two health teachers, and two computer program staff, were requested to verify the validity of the contents regarding work, scope, contents, and infrastructure. The content validity index (CVI) consisted of nine items using a 4-point Likert scale

(1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant).

The satisfaction questionnaire regarding C-SVP was developed based on Davis [24] technology acceptance model, which explains the behavior of accepting new technologies. It consisted of 10 items in terms of professionalism, usefulness, ease of use, trustworthiness, and interest in the developed program, using a 4-point Likert scale (1 = strongly disagree, 2 = mildly disagree, 3 = mildly agree, and 4 = strongly agree). After obtaining permission from the elementary school principal and class teacher, informed consent forms were collected from 10 students and their parents on school letter. We introduced 10 students (six girls and four boys) to the developed C-SVP and allowed them to use it for approximately 30 minutes. Following this, a satisfaction questionnaire was administered to them on October 14 to 15, 2023. Each student's satisfaction level was assessed by checking their degree of satisfaction. In this study, Cronbach's alpha for reliability was .76.

RESULTS

1. A Chatbot for School Violence Prevention among Elementary School Students

In this study, a C-SVP was developed following the algorithm in Figure 2. We built a prototypical chatbot, developed C-SVP using social network, and deployed KakaoTalk channel using key words like "School Guardian Angel." The final C-SVP is shown in Figure 3.

- Opening mind: Students who were curious about school violence could access C-SVP through KakaoTalk. When the students enter the "School Guardian Angel" on KakaoTalk, the bot asks "Are you curious about the school violence?"
- Start: At the same time, "definition of violence," "types of violence," and "Q&A" message would appear. By clicking on it, the user's content is displayed.
- Definition of school violence: This section helps students understand school violence by providing an accurate definition, including what school violence is and what behaviors constitute school violence.
- Types of violence: Related content was shown with pictures corresponding to each type to increase Attention. Each type of violence includes physical violence, verbal

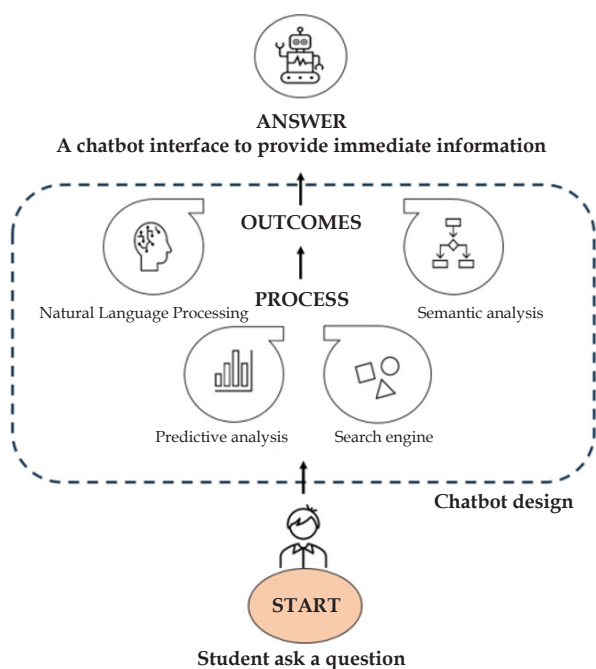


Figure 2. Flow of chatbot design for school violence prevention.

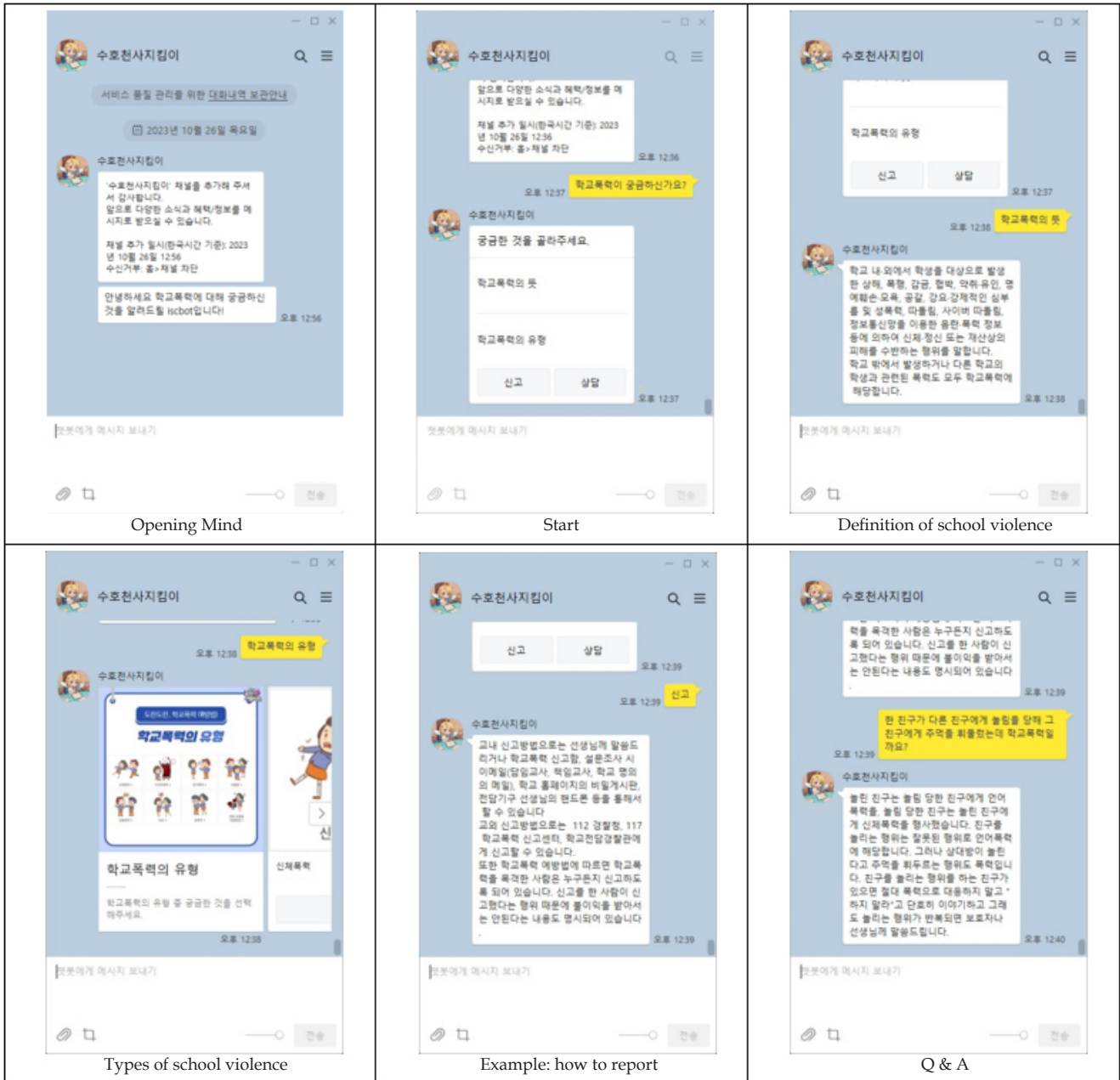


Figure 3. Screenshot of developed a chatbot for school violence prevention.

violence, extortion, coercion, bullying, sexual violence, and cyberviolence. If they wanted to know more, they could click on the item and an explanation would be provided separately.

- Q&A: In this part, it consists of a question and an appropriate answer. When the students ask a question regarding school violence prevention, a C-SVP (School Guardian Angel) recognizes key words and provides an answer.

The number of questions was not limited. The chatbot's answers came from information already stored, including various cases that are common among children of this age. Cases that frequently occur among elementary school students make them *Relevant*. Additionally, suggestions on preventing violence could help them gain *Confidence* in preventing violence. In addition, while experiencing school violence, organizations providing on-

line reporting, phone reporting, and counseling services provided a link, so that if they clicked on it immediate help could be sought.

2. Formative Evaluation

In the validity test of the expert group, the CVI scores ranged from 0.90 to 1.00, with an average of 0.97, indicating that the developed C-SVP was suitable [25]. Thus, the C-SVP was verified to be valid.

The evaluation targeted elementary school students who would use the developed “School Guardian Angel” chatbot and was conducted in September 20, 2023, at school during a class hour (Table 1). Satisfaction with the developed C-SVP showed a total mean score of 3.51 (standard deviation [SD]=0.29) at 5 (Table 1). The mean scores for the five subcategories were professionalism, 3.57 (SD=0.44); usefulness, 3.50 (SD=0.28); ease of use, 3.71 (SD=0.48); trustworthiness, 3.36 (SD=0.47); and interest 3.14 (SD=0.37).

Based on formative evaluation, the developed C-SVP was considered appropriate for elementary school students.

DISCUSSION

There is no doubt that the younger generation is shifting towards technology and will continue to grow [2]. Chatbots are computer programs designed to conduct automated conversations with users. They are equipped with knowledge of specific domains and are intended to achieve particular goals [16]. Ibrahim et al. [15] reported that the younger generation showed a preference for computer technology in learning.

Education using chatbots is personalized and can enhance their satisfaction [26].

This C-SVP was based on an educational modality composed of prevention information regarding school violence that occurs in various situations and assumes that it would contribute to the safety and health of children. In this study, we used the analysis, design, and development phases of the ADDIE model to develop a C-SVP. In each phase, a literature review was conducted and expert opinions were obtained. Keller’s ARCS theory [27] was also applied to help users provide optimal information and stimulate the active exploration of the unknown or curious things. In this theory, *Attention* was used by focusing C-SVP on the start to achieve a goal, and *Relevance* was applied to provide the experiences of various cases around elementary school students’, thus encouraging the students to think for themselves. *Confidence* made users believe that they are successful at preventing school violence when they are prepared with sufficient information. *Satisfaction* refers to feeling a sense of accomplishment by answering questions, and its importance is that it motivates the use of C-SVPs.

In addition, as Doi et al. [23] pointed out, preparing a question list for creating a chatbot is a labor-intensive task. There was a problem of looking up sentences in the Q&A database. We also generated other related questions from the Q&A database. Chatbots based on user preferences and needs are lacking [4]. Therefore, this study developed a C-SVP that can be directly utilized not only for children but also in the educational field to help teachers educate elementary school students in the context of rapidly increasing childhood school violence.

Table 1. Elementary School Students’ Satisfaction with the Developed Chatbot for School Violence Prevention (N=10)

Sub category	Questions on satisfaction (4-point Likert scale)	Each item		Sub-total	
		Mean	SD	Mean	SD
Professionalism	1. The C-SVP quickly answered the questions I asked.	3.43	0.53	3.57	0.44
	2. The C-SVP solved exactly what I was curious about.	3.29	0.48		
Ease of use	3. The contents of the C-SVP are easy to understand.	3.29	0.48	3.50	0.28
	4. Using the C-SVP is easy.	3.71	0.48		
	5. I think this C-SVP is important.	3.86	0.37		
Usefulness	6. The information provided by the C-SVP was helpful for me.	3.43	0.78	3.71	0.48
	7. I think this C-SVP will help prevent school violence.	3.86	0.37		
Trustfulness	8. The information provided by the C-SVP is trustworthy.	3.43	0.78	3.36	0.47
	9. I think it would be good if education would be conducted using this C-SVP in school.	3.29	0.48		
Interest	10. The information provided by the C-SVP is interesting.	3.14	0.37	3.14	0.37
	Total	3.51	0.29		

C-SVP, chatbot for school violence prevention; SD, standard deviation.

A chatbot works on recognition and uses natural processing languages to serve user queries [21]. Chatbot algorithms use question and answer trees to handle various student situations and encourage meaningful responses with quick analysis of their inquiries [14]. To be acquainted with the types of questions the students ask in relation to school violence, the researchers consulted a list of 319 anonymized words and put them into the C-SVP.

Formative evaluation is a process of ensuring validity by verifying a developed program on a small number of participants to determine whether it can be applied in the field; it is conducted before the actual implementation of the developed program to verify its effectiveness. Formative evaluation consists of two processes: collecting the opinions of a group of experts, and conducting a preliminary survey on a small number of people to whom the evaluation will be applied [18]. Through this, the applicability of the program was judged, and its validity was secured. In previous studies on the prevention of violence in children, evaluations such as validity and satisfaction during the process were uncommon [28].

This study was conducted through a satisfaction survey targeting 10 elementary school children belonging to the 5th and 6th grade and showed scores above the midpoint score. According to Wilson and Marasoiu [2], chatbots are particularly needed in this sensitive domain given that violence prevention is appropriate. In a study conducted by Topal et al. [3] targeting 5th grade elementary school science students showed that the students reported positively and additionally stated that they would like to use chatbot activities in other courses.

Chatbots increase user engagement, attention, and interest [4]. For Generation Z, chatbot applications can be an effective educational modality to attract them to the learning-teaching environment, including preventing violence. According to the results of this study, it can be concluded that students perceived the chatbot as a guide to help them learn topics outside the classroom. Chatbots have been found to be good assistants for learning outside the classroom [3].

Elementary school teachers can utilize and integrate the developed C-SVP as material in effective media that can stimulate and challenge students to learn about it. If teachers cannot adapt to technical advances in education, the learning process will continue to be carried out conventionally. Teachers need to focus on creating and enhancing program references for more effective and productive education. In this re-

spect, this study contributes to teachers' efforts in using chatbots as learning media.

Specifically, the students were satisfied that the chatbot was fast, accurate, easy to use, interesting, and trustworthy. Rebelo et al. [29] emphasized that one of the most prominent advantages of chatbots is accessibility. Chatbots could have a more instrumental function to assist elementary school students with ambiguities and difficulties with applications. Furthermore, one of the main features of a chatbot is that it provides a technical link for the user [30]. A study conducted on 5th grade elementary school students [3] reported that the experimental group reported a positive impact on their online learning experience due to the chatbot applications. Students found the chatbot to be useful, enjoyable, and it induced eagerness to use it for other courses. Additionally, it provided helpful assistance for learning outside the classroom, allowed them to repeat the course without referrals, and increased the reliability of the chatbot's responses [4].

The C-SVP developed in this study may be considered a practical tool to prevent violence in children, and efforts should be made to disseminate it in schools. The C-SVP can be expanded to other developmental stages. Additionally, since the contents and methods for school violence prevention can change according to the times, social demand, and emergence of new technologies, they need to be continuously upgraded to meet each need. Thus, the significance of this study is that the developed C-SVP provides a foundation for promoting the health of elementary school students by providing information that is appropriate and interesting to the target population.

This methodological study has several limitations. First, to develop the C-SVP, we used the ADD phase of the ADDIE model instead of the entire phase. Further studies are needed to investigate the effectiveness of C-SVPs as a learning modality, and the outcomes of C-SVPs should be evaluated. Second, this study verified the developed C-SVP, which cannot be generalized because a formative evaluation was performed with a small number of elementary school students. Therefore, verification through continuous interventional research on elementary students across various regions is recommended. Third, C-SVP provides information by finding answers based on keywords asked by users, so it cannot provide answers that the user wants or answer questions about content that are not asked. Finally, it should periodically check whether it adequately answers users' questions, includes new content, and corrects errors if found.

CONCLUSION

This study developed a chatbot for violence prevention among elementary school students. We expect that this will contribute to the prevention of violence among elementary school students. Further studies to examine the effectiveness of C-SVPs are needed to generalize and expand among children by continuously updating the chatbot based on user feedback. Thus, more acceptable chatbots with increased usability and educational efficacy should be developed.

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

Shin-Jeong Kim has been an editor of *Child Health Nursing Research* since 2010. She was not involved in the review process of this article. No existing or potential conflict of interest relevant to this article was reported.

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Data availability

Please contact the corresponding author for data availability.

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REFERENCES

1. Dewi DA, Julia J, Jonathan C. Digital training in building chatbot-based online learning media: action research for teachers in semarang city through the "train the teachers" training. *Mimbar Sekolah Dasar*. 2022;9(1):188-208. <https://doi.org/10.53400/mimbar-sd.v9i1.44460>
2. Wilson L, Marasoiu M. The development and use of chatbots in public health: scoping review. *JMIR Human Factors*. 2022;9(4):e35882. <https://doi.org/10.2196/35882>
3. Deveci Topal A, Dilek Eren C, Kolburan Geçer A. Chatbot application in a 5th grade science course. *Education and Information Technologies*. 2021;26(5):6241-6265. <https://doi.org/10.1007/s10639-021-10627-8>
4. Maenhout L, Peuters C, Cardon G, Compernelle S, Crombez G, DeSmet A. Participatory development and pilot testing of an adolescent health promotion chatbot. *Frontiers in Public Health*. 2021;9:724779. <https://doi.org/10.3389/fpubh.2021.724779>
5. Oh EY, Song D, Hong H. Interactive computing technology in anti-bullying education: the effects of conversation-bot's role on K-12 students' attitude change toward bullying problems. *Journal of Educational Computing Research*. 2020;58(1):200-219. <https://doi.org/10.1177/0735633119839177>
6. Sebastian D, Nugraha KA Academic customer service chatbot development using Telegrambot API. Paper presented at: 2nd International Conference on Innovative and Creative Information Technology (ICITech); 2021 Sep 23-25; Salatiga, Indonesia. Piscataway (NJ): IEEE, 2021. p. 221-2255.
7. Erturk E, Reynolds GB The expanding role of immersive media in education. Paper presented at: 14th International Association for the Development of the Information Society (IADIS) International Conference e-Learning 2020 (part of Multi Conference on Computer Science and Information Systems 2020); 2020 Jul 21-23. Lisbon: IADIS Press, 2020. p. 191-194.
8. Wijaya MH, Sarosa M, Tolle H. [Design of chatbot learning java on Google classroom and Facebook messenger]. *Jurnal Teknologi Informasi dan Ilmu Kompute*. 2018;5(3):287-296. Indonesian. <https://doi.org/10.25126/jtiik.201853837>
9. Standard Korean Language Dictionary. Violence [Internet]. National Institute of Korean Language; 2020 [cited 2020 August 15]. Available

- able from: <https://stdict.korean.go.kr/main/main.do>
10. Ahn IY, Lee CS, Park CS, Kim BJ, Cha BS, Lee S, et al. Relationship among suicidal ideation, addictive mobile phone use and depressive symptoms in bullies. *Journal of the Korean Society of Biological Therapies in Psychiatry*. 2013;19(1):39-46.
 11. Ministry of Education (MOE). Announcement of the results of the first survey on school violence in 2019 [Internet]. 2019 [cited 2023 September 2]. Available from: <https://if-blog.tistory.com/9216>
 12. Park SW, Park KY. An exploration the definition of school character education and character education policy improvement: based on French policy. *Korean Journal of Educational Administration*. 2017;35(2):21-44.
 13. Kang KA, Kim SJ, Kang SR. Elementary school students' awareness of the use of artificial intelligence chatbots in violence prevention education in South Korea: a descriptive study. *Child Health Nursing Research*. 2022;28(4):291-298. <https://doi.org/10.4094/chnr.2022.28.4.291>
 14. Chu SY, Min DG. Development of an AI chatbot-based teaching model for English picture book retelling activities. *Modern English Education*. 2021;22(4):37-50. <http://doi.org/10.18095/meeso.2021.22.4.37>
 15. Ibrahim R, Yusoff RCM, Khalil K, Jaafar A Factors affecting undergraduates' acceptance of educational game: an application of technology acceptance model (TAM). Paper presented at: 2nd International Visual Informatics Conference; 2011 Nov 9-11; Selangor, Malaysia. Berlin: Springer, 2011. p. 135-146.
 16. Liu CC, Liao MG, Chang CH, Lin HM. An analysis of children' interaction with an AI chatbot and its impact on their interest in reading. *Computers & Education*. 2022;189:104576. <https://doi.org/10.1016/j.compedu.2022.104576>
 17. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC; Vandembroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Medicine*. 2007;4(10):e296. <https://doi.org/10.1371/journal.pmed.0040296>
 18. Seels BB, Richey RC. Instructional technology: the definition and domains of the field. *Association for Educational Communications and Technology*; 1994. p. 186.
 19. Ministry of Gender Equality & Family (MOGEF). Use of internet services. In: MOGEF, Editor. 2023 Youth statistics. MOGEF; 2023. p 26.
 20. Keller JM. Motivational design for learning and performance: the ARCS model approach. Springer; 2010. p. 353.
 21. Kaur K, Thanuja T, Dahiya O, Sai PT, Kaur H, Singh J Design and development of a ticket booking system using Smart bot. Paper presented at: 10th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO); 2022 Oct 13-14; Noida, India. Piscataway (NJ): IEEE, 2022. p. 1-6.
 22. Nguyen H. Let's teach Kibot: discovering discussion patterns between student groups and two conversational agent designs. *British Journal of Educational Technology*. 2022;53(6):1864-1884. <https://doi.org/10.1111/bjet.13219>
 23. Doi R, Charoenporn T, Sornlertlamvanich V Automatic question generation for chatbot development. Paper presented at: 7th International Conference on Business and Industrial Research (ICBIR); 2022 May 19-20; Bangkok, Thailand. Piscataway (NJ): IEEE, 2022. p. 301-305.
 24. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*. 1989;13(3):319-340. <https://doi.org/10.2307/249008>
 25. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in Nursing & Health*. 2007;30(4):459-467. <https://doi.org/10.1002/nur.20199>
 26. Dosovitsky G, Bunge E. Development of a chatbot for depression: adolescent perceptions and recommendations. *Child and Adolescent Mental Health*. 2023;28(1):124-127. <https://doi.org/10.1111/camh.12627>
 27. World Health Organization (WHO). Definition and typology of violence [Internet]. [cited 2020 August 15]. Available from: <https://www.who.int/groups/violence-prevention-alliance/approach>
 28. Bark SY, Yoo SH, Kim YR. Effects of a human rights-based empathy program on the school violence attitude and empathy of high school students. *Journal of Fisheries and Marine Sciences Education*. 2017;29(4):1259-1270. <https://doi.org/10.13000/JFMSE.2017.29.4.1259>
 29. Rebelo N, Sanders L, Li K, Chow JCL. Learning the treatment process in radiotherapy using an artificial intelligence-assisted chatbot: development study. *JMIR Formative Research*. 2022;6(12):e39443. <https://doi.org/10.2196/39443>
 30. Rawat B, Bist AS, Rahardja U, Aini Q, Ayu Sanjaya YP Recent deep learning based NLP techniques for chatbot development: an exhaustive survey. Paper presented at: 10th International Conference on Cyber and IT Service Management (CITSM); 2022 Sep 20-21; Yogyakarta, Indonesia. Piscataway (NJ): IEEE, 2022. p. 1-4.

Participation in and perceptions of antibiotic stewardship behaviors among nurses at a children's hospital in South Korea: a descriptive study

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Purpose: This study investigated participation in and perceptions of antibiotic stewardship among nurses at a children's hospital. **Methods:** This descriptive study included 125 nurses working in the inpatient ward, intensive care unit and emergency room of a single tertiary children's hospital. The study measured 14 factors influencing antibiotic stewardship behaviors using the theoretical domains framework. Each factor was analyzed by categorizing it into components (capability, opportunity, and motivation) that have been proposed as influencing factors in the COM-B model of behavior. One-way analysis of variance and Pearson correlation coefficients were used to explore differences in antibiotic stewardship behaviors and influencing factors according to general characteristics and the correlation between antibiotic stewardship behaviors and COM-B components. **Results:** No statistically significant difference in antibiotic stewardship behaviors was found based on the experience of antibiotic stewardship education or the nursing department. However, significant differences were observed in the perception levels of factors related to antibiotic stewardship behaviors according to the experience of antibiotic stewardship education in skill (physical) ($p=.042$), knowledge ($p=.027$), intentions ($p=.028$), and social influences ($p=.010$). Additionally, significant differences were observed in perception levels according to the sub-components of the COM-B model, specifically physical capability ($p=.042$), psychological capability ($p=.027$), and social opportunity ($p=.010$). **Conclusion:** To expand nurses' involvement and roles in antibiotic stewardship, nurses should acknowledge the significance of appropriate antibiotic use, aiming to enhance the quality of medical care and ensure patient safety. In pursuit of this objective, tailored education aligning with the specific needs and practices of nurses is essential.

Keywords: Antimicrobial stewardship; Nurses; Hospitals; Pediatrics

INTRODUCTION

It is undeniable that the development and widespread use of antibiotics have revolutionized the management of infectious diseases. However, the emergence of antibiotic resistance has become a global concern. With limited progress in the development of new antibiotics, the spread of antibiotic

resistance poses a significant threat to public health. The consequences of antibiotic resistance include worsening patient outcomes and increasing medical costs [1]. According to a report by Jim O'Neill, approximately 700,000 people worldwide die each year from infections caused by antibiotic-resistant bacteria. If the issue of antibiotic resistance is not addressed, projections suggest that by 2050, there could be as

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many as 10 million deaths annually due to antibiotic-resistant infections, with economic losses potentially reaching 100 trillion dollars [2].

In response to this critical situation, the World Health Organization declared antibiotic resistance a major health crisis that endangers human life and introduced a global action plan in 2015 [3]. Similarly, the Korean government tackled this issue by unveiling the National Antibiotic Resistance Management Plan (2021–2025) at the ministry level in 2021. This national plan prioritizes the appropriate use of antibiotics, with a key task being the introduction and promotion of antibiotic stewardship programs in medical institutions [4].

The increasing use of antibiotics, along with their misuse, is contributing to the growth of antibiotic resistance. This escalation in resistance results in greater dependence on broad-spectrum antibiotics, which in turn leads to more misuse, creating a harmful cycle. Breaking this cycle is critical, and to do so, proactive management of antibiotic use must be implemented. These programs are designed to encourage the responsible use of antibiotics, which can improve patient outcomes and reduce the negative consequences of antibiotic use. These consequences include higher medical expenses, the development of antibiotic-resistant bacteria, and conditions such as *Clostridioides difficile*-induced enteritis [5].

Antibiotic stewardship involves coordinated interventions designed to improve and evaluate the appropriate use of antibiotic agents. It promotes the selection of the optimal antibiotic regimen, taking into account factors such as dosing, duration of therapy, and route of administration. The primary goal of antibiotic stewardship is to achieve the best clinical outcomes related to antibiotic use while simultaneously minimizing toxicity and other adverse effects. In doing so, antibiotic stewardship seeks to limit the selective pressure exerted on bacterial populations, thus reducing the development of antibiotic-resistant strains [1].

In essence, antibiotic stewardship can be defined as a comprehensive strategy that aims to prevent the spread of antibiotic resistance, enhance patient safety, and improve the quality of medical care by ensuring antibiotics are used wisely. The term “antibiotic stewardship” appears across various contexts in the literature and embodies several core concepts: (1) controlling antibiotic use, which involves the careful management of antibiotics to select the most suitable treatment, taking into account the correct dose, duration, and route of administration; (2) optimizing clinical outcomes, which focuses on achieving the best possible clinical results while

minimizing adverse effects and the risk of developing antibiotic resistance; (3) integrated interventions, which refer to a suite of coordinated measures designed to evaluate, improve, and promote the proper use of antibiotics. A multifaceted approach involves a variety of strategies, including policies, guidelines, surveillance, education, and audits. These are five key components identified as crucial elements in preventing the emergence of antibiotic resistance. Responsible use of antibiotics focuses on maximizing their effectiveness both in the present and for future generations. This entails judicious use that prevents unnecessary usage and ensures targeted, limited treatment [5].

The pathogens responsible for healthcare-associated infections and their antibiotic resistance patterns differ significantly between adult and pediatric patients [6,7]. Moreover, the infectious diseases commonly seen in children, along with their symptoms and trends in antibiotic susceptibility, are distinct from those observed in adults. Additionally, the pharmacokinetic and pharmacodynamic properties of drugs in pediatric patients are influenced by factors such as age, weight, and the presence of disease. These differences underscore the importance of creating antibiotic stewardship guidelines that are specifically designed for the pediatric population [8]. In recognition of the unique needs of pediatric patients, the “Guidelines for Developing an Institutional Program to Enhance Antibiotic Stewardship” issued by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America highlight the necessity of assessing the effectiveness of antibiotic stewardship in hospitalized patient subpopulations, including neonates, infants, and children. This assessment is identified as a top research priority, underlining the critical need for antibiotic stewardship strategies that are tailored to pediatric populations [9].

The successful implementation of antibiotic stewardship requires collaboration among a diverse group of healthcare professionals, such as doctors, pharmacists, nurses, microbiologists, infection prevention specialists, and information technology experts. Nurses, in particular, with their pivotal role in patient care workflow and communication, are essential to the success of antibiotic stewardship programs [10]. In developed countries, there is an increasing recognition of the substantial role that nurses play in antibiotic stewardship, and their involvement is being acknowledged more frequently [11].

In the United States, the critical role of nurses in antibiotic

stewardship has been emphasized by the Centers for Disease Control and Prevention (CDC). The Core Elements of Hospital Antibiotic Stewardship Programs: 2019 includes nursing-based interventions, underscoring the indispensable contributions of nurses to these initiatives [11]. Nurses are instrumental in ensuring the appropriate use of antibiotics through a range of key responsibilities. These include collecting specimens correctly before starting antibiotic therapy, interpreting microbiological test results to assist physicians in choosing the best antibiotics or deciding when to stop them, monitoring for early signs of bacterial infection to initiate antibiotics promptly, engaging in the assessment and discussion of antibiotic usage and de-escalation strategies, providing guidance on intravenous and oral antibiotic administration, verifying antibiotic allergies in patient histories, and educating patients and their families about antibiotic treatments [12,13].

While numerous international guidelines stress the critical role of nurses in the success of antibiotic stewardship programs, there is a notable lack of knowledge and awareness among Korean nurses about antibiotic stewardship in certain regions. Additionally, the precise role of nurses within these programs has yet to be clearly delineated, highlighting the need for additional research in this area [14].

In addition, a growing body of evidence supports the efficacy of antibiotic stewardship programs in reducing antibiotic overuse and enhancing patient outcomes across various pediatric settings [15]. However, implementing recommendations in acute pediatric settings presents unique challenges due to the vulnerability and complexity of the patient population. Pediatric nurses play a pivotal role in collaborating with both parents and children to ensure that consumers are well-informed and actively involved in these critical aspects of their care [16]. Despite this, research on antibiotic stewardship participation and the factors influencing it among nurses working in children's hospitals has been limited.

In this study, we utilized the theoretical domains framework (TDF) to understand the determinants of behavior. The TDF was created through a collaborative effort between behavioral scientists and implementation researchers. They identified key theories related to implementation and organized the constructs from these theories into domains [17]. This effort resulted in the integration of 33 behavior and behavior change theories into 14 domains: "knowledge," "skills," "social/ professional role and identity," "beliefs about capabilities," "optimism," "beliefs about consequenc-

es," "reinforcement," "intentions," "goals," "memory, attention and decision processes," "environmental context and resources," "social influences," "emotions," and "behavioral regulation" [18]. The TDF provides a comprehensive set of potential mediators for behavior change, particularly in relation to clinical actions [19]. It is an invaluable conceptual tool for investigating implementation challenges, designing interventions to improve healthcare practices, and comprehending the processes of behavior change in the implementation of evidence-based care [19].

In intervention design, the TDF effectively aligns with the behavior change wheel (BCW) [18]. The BCW defines the target behavior using the capability, opportunity, and motivation model (the COM-B system), where capability encompasses both psychological and physical components, opportunity includes social and physical elements, and motivation comprises reflective and automatic processes [18]. Behavior change experts have independently mapped the TDF domains onto the COM-B components, achieving unanimous consensus (Supplement 1) [18,20]. The COM-B system forms the foundation of the BCW, featuring nine intervention functions that address deficits in one or more of the COM-B conditions. Surrounding the BCW are seven policy categories that can support the implementation of these interventions [20]. Utilizing the COM-B system can assist in identifying which TDF domains are most relevant for modifying behavior. By beginning with such a behavioral analysis, intervention designers can selectively focus on the domains that will most effectively inform the development of the intervention [18].

Therefore, the objective of this study was to assess the extent of participation in and perceptions of antibiotic stewardship behaviors among nurses at children's hospitals. Additionally, the study aimed to gather nurses' perspectives on interventions for appropriate antibiotic use and to contribute to the development of strategies for establishing and disseminating antibiotic stewardship practices within healthcare facilities, particularly those focused on pediatric care.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Seoul National University Hospital (No. H-2303-044-1410). Informed consent was obtained from all participants.

1. Study Design

This study was a descriptive research investigation focused on examining the perceptions of and participation in antibiotic stewardship among nurses in children's hospitals. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [21].

2. Participants

The participants in this study were nurses employed at a single tertiary children's hospital in Seoul, Korea, who voluntarily consented to participate. The target population comprised all nurses working in the inpatient ward, intensive care unit, and emergency room of the hospital, excluding those who were newly hired or transferred during the orientation period. Nurses who met the inclusion criteria and were not subject to the exclusion criteria were deemed eligible for participation. The survey was distributed to a total of 150 individuals, and 125 participants ultimately agreed to and completed the survey.

3. Measurements

In this study, we utilized a tool previously employed by Chater et al. [22] to identify factors influencing nurses' participation in antibiotic stewardship behaviors. This tool was translated and back-translated following approval from the original tool developer, Angel Chater (a.chater@ucl.ac.uk), who granted permission via email. Initially, one researcher translated the original questionnaire into Korean. Another researcher then reviewed the Korean translation for accuracy and contextual appropriateness. Both researchers collaborated to consolidate their feedback and finalize the Korean version. An individual proficient in both English and Korean subsequently back-translated this final version into English. The back-translated questionnaire was compared with the original to ensure consistency in meaning. The comparison confirmed that the English and Korean versions conveyed the same meaning, affirming the suitability of the translated version for use. The questionnaire consisted of 61 questions in total, which included 9 questions on behaviors promoting responsible antibiotic use, 42 questions on influences affecting nurses' behaviors in antibiotic stewardship, and 10 questions on general characteristics.

1) General characteristics

The questions related to general characteristics covered a range of aspects, such as gender, age, educational level, clinical experience, nursing department, job title, experience with education on antibiotic stewardship, types of completed antibiotic stewardship education, the existence of a department dedicated to antibiotic management within the respondent's health-care facility, and the identification of interventions deemed most effective in promoting the appropriate use of antibiotics.

2) Participation in antibiotic stewardship behaviors

The questions pertaining to behaviors that promote responsible antibiotic use were presented on a 7-point Likert scale. Respondents were asked to indicate the frequency with which they engage in these actions. The scale extends from "none of the time" (1 point) to "all of the time" (7 points), thereby gauging the degree to which these behaviors are practiced. A higher score signifies greater adherence to the behavior in question.

3) Perceptions of antibiotic stewardship behaviors

In this study, we assessed 14 factors that influence antibiotic stewardship behavior using the TDF. We further analyzed each factor by categorizing it into the three components suggested by the COM-B model as influencing behavior: capability (15 questions), opportunity (23 questions), and motivation (4 questions) [20,22]. We structured the questions about nurses' perceptions of the factors that influence their antibiotic stewardship behaviors on a 7-point Likert scale. This scale ranged from "strongly disagree" (1 point) to "strongly agree" (7 points), with a higher score indicating a stronger agreement with the statement. We calculated the Cronbach's alpha value to measure internal consistency and found it to be .947 in this study.

4. Data Collection

This study was approved by the Institutional Review Board (IRB). Following approval, we posted a recruitment notice for research participants in the nurses' ward or lounge, with the department head's consent. Interested individuals received a detailed explanation of the research, which clearly stated that there would be no repercussions for choosing not to participate. It also highlighted their right to discontinue the survey at any point. Participants who willingly chose to participate in the study expressed their consent by signing

the questionnaire before beginning. After completing the questionnaire, they placed it in a paper envelope provided for this purpose, sealed it, and deposited it into a designated collection box. To maintain the confidentiality and anonymity of the responses, the researcher personally collected the sealed questionnaires from the box.

Participants who consented to the use of their personal information and provided their personal mobile phone numbers were compensated with a mobile gift card valued at 5,000 KRW upon completion of the survey. The survey required approximately 15 minutes to complete, and data collection occurred from April 11 to May 11, 2023.

5. Data Analysis

The collected data were analyzed using SPSS for Windows (version 20.0; IBM Corp.). Descriptive statistics were used to examine the general characteristics, the level of participation in antibiotic stewardship, and the factors that influence it. To investigate differences in the level of participation and the influencing factors in antibiotic stewardship based on general characteristics, a one-way analysis of variance was performed. When significant differences were found, the Scheffé test was applied for post hoc analysis. Pearson correlation coefficients were utilized to assess the relationship between the degree of antibiotic stewardship behaviors and the components of the COM-B model.

RESULTS

1. General Characteristics

The majority of participants (95.2%) were female, and 89.6% held a bachelor's degree. The average work experience among them was 86.7 months, with the most common job title being staff nurse, representing 93.6% of the group. The intensive care unit was the department where the largest proportion of participants (46.4%) worked, followed by the general ward (44.8%), and the emergency room (8.8%). A total of 16.8% of the participants reported having received training in antibiotic stewardship, with the vast majority (90.5%) indicating that they completed this training through continuing education programs. When asked if there was a dedicated department, team, or committee for antibiotic management, 60.8% answered "yes," while 34.4% responded "don't know" (Table 1).

Table 1. General Characteristics of Children's Hospital Nurses in the Study (*N*=125)

Variables	Categories	n (%) or M ± SD
Sex	Male	6 (4.8)
	Female	119 (95.2)
Age (year)		30.5 ± 5.82
Level of education	Bachelor's degree	112 (89.6)
	Master's degree	13 (10.4)
Clinical career (month)		86.7 ± 69.13
Working department	ICU	58 (46.4)
	Ward	56 (44.8)
	ER	11 (8.8)
Position	Staff nurse	117 (93.6)
	Education nurse	3 (2.4)
	Charge nurse	3 (2.4)
	Head nurse	2 (1.6)
Education experience on antibiotic stewardship	Yes	21 (16.8)
	No	104 (83.2)
Types of antibiotic stewardship education	No	104 (83.2)
	Continuing education	19 (15.2)
	Departmental education	2 (1.6)
Aware on the department related to antibiotic management	Yes	76 (60.8)
	No	6 (4.8)
	Don't know	43 (34.4)

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

2. Antibiotic Stewardship Behaviors

The highest level of performance for antibiotic stewardship was found for "apply standard infection control precautions in healthcare environments," followed by "communicate promptly when receiving laboratory results (i.e., culture and sensitivity) and review therapy." The lowest level of performance was found for "discuss with patient/carer their expectations of the antibiotics and the need to use them appropriately, recognizing patient vulnerability and those that need support" (Table 2).

3. Differences in Antibiotic Stewardship Behaviors Depending on Education Completion and Nursing Department

Antibiotic stewardship behaviors showed no significant difference based on education on the topic or the nursing department where the participant worked. However, a more detailed analysis revealed that specific behaviors exhibited statistically significant differences. These included "recognize the appropriate response to antibiotic treatment and the main signs that demonstrate antibiotic treatment failures"

Table 2. Antibiotic Stewardship Behaviors of Children’s Hospital Nurses (N=125)

Items	Total		Education		t	p	Department		F	p	Scheffé
	M±SD	No (n=104) M±SD	Yes (n=21) M±SD	No (n=104) M±SD			ER (n=11) M±SD	ICU (n=58) M±SD			
1. Apply standard infection control precautions in healthcare environments	6.2±0.79	6.1±0.83	6.2±0.78	6.2±0.78	-0.41	.681	5.9±1.22	6.2±0.79	6.2±0.68	0.69	.504
2. Recognize the appropriate response to antibiotic treatment and the main signs that demonstrate antibiotic treatment failures	5.6±1.14	5.8±0.75	5.6±1.20	5.6±1.19 ^a	1.06	.296	6.3±1.19 ^a	5.4±1.25 ^b	5.8±0.93 ^c	4.07	.020
3. Recognize and act upon the signs and symptoms of infection and isolate patients as appropriate	6.0±0.87	6.1±0.63	6.0±0.91	6.0±0.91	0.41	.681	6.3±0.65	6.0±0.92	6.0±0.85	0.49	.612
4. Collaborate with the interprofessional team, ensuring appropriate antibiotic use	5.7±1.46	5.9±1.20	5.7±1.51	5.7±1.51	0.65	.523	5.9±1.70	5.5±1.53	5.9±1.34	0.98	.378
5. Monitor patients on antibiotic therapy and act upon the common side effects associated with these antibiotics	6.0±0.98	6.1±0.79	6.0±1.01	6.0±1.01	0.65	.516	6.6±0.82 ^a	5.8±1.07 ^b	6.1±0.85 ^c	3.39	.037
6. Communicate promptly when receiving laboratory results (i.e., culture and sensitivity) and review therapy	6.1±1.03	6.1±0.94	6.1±1.05	6.1±1.05	-0.20	.843	5.3±2.05 ^a	6.4±0.72 ^b	6.0±0.91 ^c	6.57	.002
7. Obtain and record an accurate penicillin drug allergy history	5.4±1.71	4.9±2.06	5.5±1.63	5.5±1.63	-1.63	.107	5.6±1.75	4.9±1.84	5.9±1.40	6.09	.003
8. Initiate the switch from intravenous antibiotics to oral therapy and/or the discontinuation of antibiotic therapy	5.4±1.58	5.0±1.86	5.5±1.51	5.5±1.51	-1.43	.156	4.9±2.12	5.2±1.67	5.7±1.32	1.98	.143
9. Discuss with patient/carer their expectations of antibiotics and the need to use them appropriately, recognizing patient vulnerability and those that need support	5.0±1.61	4.9±1.38	5.0±1.66	5.0±1.66	-0.17	.864	5.3±1.49	4.8±1.72	5.1±1.52	0.89	.413
Antibiotic stewardship behavior, total	51.4±7.56	50.8±5.88	51.6±7.87	51.6±7.87	-0.41	.681	52.0±8.74	50.1±7.98	52.8±6.72	1.88	.158

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

($p = .020$), “monitor patients on antibiotic therapy and act upon the common side effects associated with these antibiotics” ($p = .037$), “communicate promptly when receiving laboratory results (i.e., culture and sensitivity) and review therapy” ($p = .002$), and “obtain and record an accurate penicillin drug allergy history” ($p = .003$), with variations depending on the nursing department (Table 2).

In the emergency room, the highest level of performance was found for “monitor patients on antibiotic therapy and act upon the common side effects associated with these antibiotics,” followed by “recognize the appropriate response to antibiotic treatment and the main signs that demonstrate antibiotic treatment failures,” and “recognize and act upon the signs and symptoms of infection and isolate patients as appropriate.” In the intensive care unit, the highest level of performance was found for “communicate promptly when receiving laboratory results (i.e., culture and sensitivity) and review therapy,” followed by “apply standard infection control precautions in healthcare environments,” and “recognize and act upon the signs and symptoms of infection and isolate patients as appropriate.” In the ward, the highest performance level was found for “apply standard infection control precautions in healthcare environments,” followed by “monitor patients on antibiotic therapy and act upon the common side effects associated with these antibiotics,” and “communicate promptly when receiving laboratory results (i.e., culture and sensitivity) and review therapy” (Table 2).

Conversely, in the emergency room, the lowest level of performance was observed for “initiate the switch from intravenous antibiotic to oral therapy and/or the discontinuation of antibiotic therapy.” In both the ward and intensive care unit, the lowest performance level was found for “discuss with patient/carer their expectations of antibiotics and the need to use them appropriately, recognizing patient vulnerability and those that need support” (Table 2).

The ward demonstrated a significantly higher likelihood of performing “obtain and record an accurate penicillin drug allergy history” than other nursing departments. The intensive care unit showed a greater likelihood of performing “communicate promptly when receiving laboratory results (i.e., culture and sensitivity) and review therapy” than other departments; however, the performance of “obtain and record an accurate penicillin drug allergy history,” “recognize the appropriate response to antibiotic treatment and the main signs that demonstrate antibiotic treatment failures,” and “monitor patients on antibiotic therapy and act upon the

common side effects associated with these antibiotics” was lower.

The emergency room had a higher level of performance than the other nursing departments for “monitor patients on antibiotic therapy and act upon the common side effects associated with these antibiotics” and “recognize the appropriate response to antibiotic treatment and the main signs that demonstrate antibiotic treatment failures.” However, the performance of “communicate promptly when receiving laboratory results (i.e., culture and sensitivity) and review therapy” was lower (Table 2).

4. Differences in the Perceptions of Factors Influencing Antibiotic Stewardship Behaviors according to the Completion of Education

As a result of analyzing the perception of factors influencing antibiotic stewardship behaviors, divided into 14 factors based on the TDF, the highest level of recognition was observed for “beliefs about consequences,” followed by “social/professional role and identity,” and “skills,” with “optimism” also scoring high. The level of perception was lower for “environmental context and resources” and “memory, attention and decision-making” (Table 3).

When applying the COM-B model for further analysis, the scores for capability and opportunity were lower than those for motivation. Upon closer examination, the level of perception in the areas of “physical capability” and “reflective motivation” was high, whereas the level of perception in the areas of “physical opportunity” and “psychological capability” was lower (Table 3).

Comparing the level of perception by factors influencing antibiotic stewardship behaviors based on the completion of antibiotic stewardship education revealed significant differences in “skill (physical)” ($p = .042$), “knowledge” ($p = .027$), “intentions” ($p = .028$), and “social influences” ($p = .010$). When antibiotic stewardship education was completed, the levels of perception for “skill (physical),” “knowledge,” “intentions,” and “social influences” were higher (Table 3).

In the comparison of perception levels based on the sub-components of the COM-B model, significant differences were found in “physical capability” ($p = .042$), “psychological capability” ($p = .027$), and “social opportunity” ($p = .010$). The level of awareness of capability and social opportunity was higher when antibiotic stewardship education was completed than in other scenarios (Table 3).

Table 3. Differences between Theoretical Domains Framework Domains according to Education Experience about Antibiotic Stewardship (N=125)

COM-B constructs	COM-B components	TDF domains	Total (n= 125) M±SD	Education		t	p
				Yes (n=21) M±SD	No (n= 104) M±SD		
Capability	Physical capability	Skill (physical)	5.1±1.29	5.5±0.84	5.0±1.35	2.10	.042
		Psychological capability	4.3±1.39	4.9±1.00	4.1±1.42	2.24	.027
		Skills (psychological)	5.1±1.34	5.5±0.84	5.0±1.35	1.75	.088
		Memory, attention and decision making	3.7±0.80	3.6±0.77	3.7±0.81	-0.28	.779
		Behavioral regulation	4.0±1.18	4.5±1.05	3.9±1.19	1.95	.054
		Sub total	4.1±0.82	4.9±1.00	4.1±1.42	2.24	.027
	Capability total	4.2±0.83	4.5±0.63	4.1±0.85	2.14	.035	
Opportunity	Physical opportunity	Environmental context and resources	3.5±1.24	3.7±0.99	3.4±1.28	0.87	.385
		Social opportunity	4.9±1.38	5.6±1.04	4.8±1.40	2.61	.010
		Opportunity total	4.2±1.13	4.6±0.85	4.1±1.16	2.06	.042
Motivation	Reflective motivation	Social/professional role and identity	5.5±1.35	5.8±0.95	5.4±1.39	1.26	.211
		Beliefs about capabilities	4.9±1.36	5.2±1.17	4.8±1.39	1.02	.308
		Optimism	5.0±1.29	5.4±0.91	5.0±1.34	1.27	.205
		Beliefs about consequences	5.6±1.11	5.8±1.06	5.5±1.12	0.9	.371
		Intentions	4.8±1.37	5.4±1.09	4.7±1.39	2.23	.028
		Goals	4.5±0.99	4.5±1.01	4.5±0.99	-0.37	.714
		Sub total	5.0±0.96	5.3±0.78	5.0±0.99	1.56	.121
	Automatic motivation	Reinforcement	4.5±1.42	4.8±1.15	4.4±1.46	1.25	.212
		Emotion	4.1±0.93	4.3±0.72	4.1±0.97	0.84	.403
		Sub total	4.2±0.91	4.5±0.67	4.2±0.95	1.30	.198
	Motivation total	4.9±0.89	5.2±0.68	4.8±0.92	1.61	.109	

COM-B, capability, opportunity, motivation and behavior; M, mean; SD, standard deviation; TDF, theoretical domains framework.

5. Correlation between Antibiotic Stewardship Behaviors and COM-B Components

An analysis of the correlation between antibiotic stewardship behaviors and COM-B components revealed that all six components were significantly correlated with antibiotic stewardship behaviors (Table 4).

6. Opinions on Interventions to Improve the Proper Use of Antibiotics

When asked about interventions they believe would be most helpful in improving the proper use of antibiotics in their medical environment (multiple responses allowed), their responses were as follows, in descending order: “knowledge of accurate allergy reporting” (21.1%), “evaluation of antibiotics after 48 hours of therapy” (18.9%), “antibiotic restrictions” (17.8%), “pharmacy interventions” (12.4%), “lectures” (12.1%), “online education modules” (10.4%), and “auditing of charts” (7.3%) (Table 5).

DISCUSSION

In this study, we aimed to assess the extent of nurses’ participation in and perceptions of antibiotic stewardship in children’s hospitals. Our goal is to promote the involvement of nurses in the development of antibiotic stewardship programs within medical institutions and to encourage more proactive antibiotic management in actual healthcare settings.

In the implementation of antibiotic stewardship activities, tasks that were integrated into routine nursing duties and infection control education—such as compliance with standard precautions, prompt communication upon reviewing test results, recognition of signs and symptoms of infection, and appropriate isolation—demonstrated a higher level of performance. This was in contrast to activities that involved switching from intravenous antibiotics to oral therapy, discontinuing antibiotic use, obtaining a history of penicillin allergy, collaborating with the interprofessional team for appropriate antibiotic use, and discussing antibiotic expecta-

Table 4. Correlation between Antibiotic Stewardship Behaviors and COM-B Components (N=125)

Variables	Antimicrobial stewardship	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation
	r	r	r	r	r	r	r
Antimicrobial stewardship	1						
Physical capability	.50 ^{a)}	1					
Psychological capability	.52 ^{a)}	.69 ^{a)}	1				
Physical opportunity	.33 ^{a)}	.41 ^{a)}	.64 ^{a)}	1			
Social opportunity	.53 ^{a)}	.59 ^{a)}	.60 ^{a)}	.49 ^{a)}	1		
Reflective motivation	.58 ^{a)}	.73 ^{a)}	.70 ^{a)}	.45 ^{a)}	.81 ^{a)}	1	
Automatic motivation	.36 ^{a)}	.46 ^{a)}	.53 ^{a)}	.48 ^{a)}	.63 ^{a)}	.63 ^{a)}	1

^{a)}Correlation is significant at $p < 0.01$ level; COM-B, capability, opportunity, motivation and behavior.

Table 5. Opinions on Interventions that Would Be Most Helpful in Improving the Appropriate Use of Antibiotics (Multiple Response) (N=125)

Interventions	n (%)
Knowledge of accurate allergy reporting	75 (21.1)
Evaluation of antibiotics after 48 hours of therapy	67 (18.9)
Antibiotic restrictions	63 (17.8)
Pharmacy interventions	44 (12.4)
Lectures	43 (12.1)
Online education modules	37 (10.4)
Auditing of charts	26 (7.3)
Total	355 (100.0)

tions and proper usage with patients or carers. These findings are consistent with those reported by Chater et al. [22], who also found a lower level of performance in activities related to converting intravenous antibiotics to oral therapy, considering the discontinuation of antibiotic use, and engaging in discussions with patients or carers about antibiotic expectations and proper usage, as opposed to activities associated with standard precautions, recognizing symptoms of infection, and proper isolation.

In previous studies, it was discovered that many nurses were not familiar with the term “antibiotic stewardship,” despite being aware of their role in ensuring the appropriate and safe use of antibiotics for patients [16,23]. Furthermore, nurses' knowledge of antibiotic stewardship has been identified as lacking [12], which hinders their active participation in antibiotic stewardship programs [24]. A study by Ju et al. [25] that focused on Korean nurses revealed that only 75% agreed that nurses should be involved in interventions to improve antibiotic use, and there was a notable lack of awareness regarding the responsibility of nurses in the proper use of antibiotics. Consequently, it is crucial to develop a variety of strategies to bolster nurses' understanding of antibiotic stewardship and to clarify the specific and comprehensive roles they have within it, thereby encouraging their active in-

volvement.

The level of antibiotic stewardship behaviors did not differ significantly based on whether individuals had completed antibiotic stewardship education. This absence of a significant difference could be due to the small proportion of respondents (16.8%) who had undergone such education. Although the analysis by nursing department revealed no statistically significant differences in overall performance, significant disparities were noted in responses to specific items. Therefore, it is essential to create education and intervention strategies that reflect variations in work characteristics and performance levels across various departments.

When asked about the presence of a department related to antibiotic management in their hospital, 49.2% of the nurses surveyed responded with “none” or “don't know.” This response indicates a significant lack of awareness among nurses about the existence and activities of their hospital's antibiotic management team. Furthermore, only 16.8% of the nurses reported having completed education in antibiotic stewardship, underscoring the need for broader and more robust educational initiatives to promote proper antibiotic use. Notably, the majority of those who had completed such education did so through continuing education programs. Given that continuing education is often available to only a limited number of participants, it is critical to provide a variety of educational opportunities related to antibiotic stewardship. This could include incorporating antibiotic stewardship topics into the existing in-hospital infection control education or creating and offering online educational modules.

The American Nurses Association and the CDC have recommended a deeper understanding of microbiology and pharmacology related to infections and drug therapy as a means to establish antibiotic stewardship [12]. Several previous studies have confirmed a positive correlation between providing antibiotic stewardship education and nurses' ac-

tive participation in antibiotic stewardship programs [26]. These studies underscore the necessity of enhancing knowledge, education, and information provision in this area [27]. However, a survey of 217 Korean hospitals with more than 150 beds showed that only 14.3% offered regular education on the correct use of antibiotics. Among the hospitals that did provide such education, a mere 51.2% included medical personnel other than doctors [28]. Furthermore, a study involving 84 Korean hospitals with over 500 beds found that 60.7% of the respondents identified a lack of knowledge about antibiotic stewardship and infection control as an obstacle to collaborating with other departments for the appropriate use of antibiotics [29].

Hence, there is a need to develop educational content and broaden educational opportunities, encompassing pertinent knowledge, to integrate and implement antibiotic stewardship activities into routine nursing responsibilities. This should be coupled with an emphasis on the concept and significance of antibiotic stewardship, along with the roles nurses play in this context. Moreover, there was a notable demand for interventions such as “accurate allergy reporting” and “evaluating antibiotics after 48 hours” to increase the proper use of antibiotics. Identifying patient needs and incorporating the specific components of antibiotic stewardship into practical nursing activities and clinical settings will be of vital importance.

Upon analyzing factors that influenced perceptions of antibiotic stewardship activities, it was found that nurses generally viewed antibiotic stewardship as an important duty, responsibility, and mission. They also held optimistic and positive expectations toward these activities. However, awareness of support or networks for antibiotic stewardship was notably low, and there was a lack of focus on implementing such activities. This underscores the need for targeted education and the dissemination of information about antibiotic stewardship, with an emphasis on specific and practical applications. It is particularly concerning that 49.2% of respondents were unaware of the existence of their in-hospital antibiotic management team. This finding indicates the importance of actively informing nurses about the role and ongoing efforts of these teams within their institutions.

The study found a significant correlation between antibiotic stewardship behaviors and the components of the COM-B model, confirming the model's effectiveness as a theoretical framework for understanding behavioral changes. The COM-B model is valuable not only as an explanatory tool for

behavioral changes but also as a basis for creating interventions to alter behavior [20]. Therefore, when utilizing this model for intervention design, it is crucial to clearly define the target behavior and determine which aspects of the behavior system must be modified to bring about the intended change [20].

The analysis of awareness regarding factors that influence antibiotic stewardship behaviors, based on the sub-components of the COM-B model, revealed relatively low awareness in the areas of physical opportunity and psychological capability. According to the COM-B model, these areas can be improved through environmental changes, knowledge transfer, and training in emotional, cognitive, and behavioral skills. This suggests intervention strategies such as education, training, environmental restructuring, and enablement to strengthen these components [20]. Furthermore, the study confirmed the effectiveness of education in improving the capability area, albeit to a limited degree. Given these findings, strategies to encourage nurses' participation in antibiotic stewardship behaviors should include initiatives such as intensified education and campaigns on antibiotic stewardship. These initiatives could leverage the expertise of in-hospital infection control teams, antibiotic management teams, and infection specialists. It is believed that the active involvement of these teams in educating staff about in-hospital antibiotic management activities and in developing intervention strategies will be more effective.

Furthermore, actively sharing information about the current status of antibiotic use, as well as antibiotic resistance rates both domestically and internationally, along with relevant data from medical institutions, can be advantageous. By disseminating this information through various channels, medical staff involved in patient care become aware of the existing issues and challenges associated with the proper use of antibiotics. Such transparency enables them to evaluate the effectiveness of antibiotic stewardship activities and serves as motivation for nurses to actively participate in these initiatives.

Antibiotic stewardship necessitates collaborative efforts from multiple disciplines, including doctors, nurses, and pharmacists. It is essential for professionals from various related fields to understand the concept and importance of antibiotic stewardship and to actively engage in its implementation. Nurses, in particular, are crucial to patient care workflows and communication, making them indispensable contributors to the successful execution of antibiotic stewardship

initiatives. Therefore, it is vital to ensure that nurses receive ongoing education and training in antibiotic resistance and stewardship to equip them with the necessary knowledge and skills. Additionally, it is important to recognize nurses as integral to antibiotic stewardship activities at both institutional and governmental levels. Providing the necessary support ensures that nurses are aware of the significance of proper antibiotic use, enabling them to effectively carry out their roles in their daily practice.

This study has a limitation in that it was conducted among nurses at a single hospital. Therefore, the results must be interpreted and generalized with caution. Future research should aim to include larger samples from a variety of healthcare facilities. Based on the results of this study, we suggest a further study to develop strategies to improve nurses' participation in antibiotic stewardship and to evaluate their effectiveness.

CONCLUSION

This study aimed to assess the degree of participation in and perceptions of antibiotic stewardship among nurses at children's hospitals. There were several important findings. First, nurses demonstrated varying levels of participation in antibiotic stewardship activities, indicating a need for targeted education and interventions to address specific challenges. The study identified a low completion rate of antibiotic stewardship education among respondents, underscoring the necessity to expand educational opportunities. Additionally, a lack of awareness regarding antibiotic management teams within medical institutions was noted, emphasizing the need to better inform nurses about these essential resources.

Recognizing nurses as essential contributors to antibiotic stewardship, the study underscores the necessity for their active participation in initiatives that directly impact patient treatment. To empower nurses in this role, it is vital for them to understand the importance of proper antibiotic usage, which enhances the quality of medical care and ensures patient safety. Education tailored to the specific needs and practices of nurses is considered critical for developing this understanding. Furthermore, the study highlights the central role of nurses in patient monitoring, communication, and education, positioning them as key figures in promoting collaboration among various healthcare professionals for successful antibiotic stewardship. The findings indicate that future research should concentrate on creating strategies to

strengthen the involvement of nurses in antibiotic stewardship efforts.

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Authors' contribution

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Supplementary material

Supplement 1. The Theoretical Domains Framework Mapped to the Sub-component of the Capability, Opportunity, Motivation-Behavior (COM-B) Model

REFERENCES

1. Fishman N. Policy statement on antimicrobial stewardship by the Society for Healthcare Epidemiology of America (SHEA), the Infec-

- tious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS). *Infection Control & Hospital Epidemiology*. 2012;33(4):322-327. <https://doi.org/10.1086/665010>
2. O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. *Review on Antimicrobial Resistance*; 2016. p. 1.
 3. World Health Organization (WHO). Global antimicrobial resistance surveillance system: manual for early implementation. WHO; 2015. p. 1-5.
 4. Ministry of Health and Welfare (MOHW). National action plan on antimicrobial resistance (2021-2025) [Internet]. 2021 [cited 2023 July 15]. Available from: https://cdn.who.int/media/docs/default-source/antimicrobial-resistance/amr-spc-npm/nap-library/korea-2021-25-2nd-national-action-plan-on-antimicrobial-resistance.pdf?sfvrsn=ccf8a437_4&download=true
 5. Kwon KT. Implementation of antimicrobial stewardship programs. *Journal of the Korean Medical Association*. 2022;65(8):498-504. <https://doi.org/10.5124/jkma.2022.65.8.498>
 6. Tamma PD, Robinson GL, Gerber JS, Newland JG, DeLisle CM, Zaoutis TE, et al. Pediatric antimicrobial susceptibility trends across the United States. *Infection Control and Hospital Epidemiology*. 2013;34(12):1244-1251. <https://doi.org/10.1086/673974>
 7. Weiner-Lastinger LM, Abner S, Benin AL, Edwards JR, Kallen AJ, Karlsson M, et al. Antimicrobial-resistant pathogens associated with pediatric healthcare-associated infections: summary of data reported to the National Healthcare Safety Network, 2015-2017. *Infection Control and Hospital Epidemiology*. 2020;41(1):19-30. <https://doi.org/10.1017/ice.2019.297>
 8. Klatte JM. Pediatric antimicrobial stewardship programs: current perspectives. *Pediatric Health, Medicine and Therapeutics*. 2020;11:245-255. <https://doi.org/10.2147/phmt.s224774>
 9. Dellit TH, Owens RC, McGowan JE, Jr, Gerding DN, Weinstein RA, Burke JP, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clinical Infectious Diseases*. 2007;44(2):159-177. <https://doi.org/10.1086/510393>
 10. Yoon YK, Kwon KT, Jeong SJ, Moon C, Kim B, Kiem S, et al. Guidelines on implementing antimicrobial stewardship programs in Korea. *Infection & Chemotherapy*. 2021;53(3):617-659. <https://doi.org/10.3947/ic.2021.0098>
 11. Centers for Disease Control and Prevention (CDC). The core elements of hospital antibiotic stewardship programs: 2019. Atlanta: CDC; 2019. p. 8, 20.
 12. American Nurses Association (ANA), Centers for Disease Control and Prevention. Redefining the antibiotic stewardship team: recommendations from the American Nurses Association/Centers for Disease Control and Prevention workgroup on the role of registered nurses in hospital antibiotic stewardship practices [Internet]. 2017 [cited 2023 July 15]. Available from: <https://www.cdc.gov/antibiotic-use/healthcare/pdfs/ANA-CDC-whitepaper.pdf>
 13. Courtenay M, Chater A. Antimicrobial stewardship: a competency framework to support the role of nurses. *Primary Health Care*. 2021;31(2):36-42. <https://doi.org/10.7748/phc.2021.e1709>
 14. Gotterson F, Buising K, Manias E. Nurse role and contribution to antimicrobial stewardship: an integrative review. *International Journal of Nursing Studies*. 2021;117:103787. <https://doi.org/10.1016/j.ijnurstu.2020.103787>
 15. Gerber JS, Jackson MA, Tamma PD, Zaoutis TE, Maldonado YA, O'Leary ST, et al. Antibiotic stewardship in pediatrics. *Pediatrics*. 2021;147(1):e2020040295. <https://doi.org/10.1542/peds.2020-040295>
 16. Kilpatrick M, Hutchinson A, Manias E, Bouchoucha SL. Paediatric nurses', children's and parents' adherence to infection prevention and control and knowledge of antimicrobial stewardship: a systematic review. *American Journal of Infection Control*. 2021;49(5):622-639. <https://doi.org/10.1016/j.ajic.2020.11.025>
 17. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, et al. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implementation Science*. 2017;12:77. <https://doi.org/10.1186/s13012-017-0605-9>
 18. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*. 2012;7:37. <https://doi.org/10.1186/1748-5908-7-37>
 19. Francis JJ, O'Connor D, Curran J. Theories of behaviour change synthesised into a set of theoretical groupings: introducing a thematic series on the theoretical domains framework. *Implementation Science*. 2012;7:35. <https://doi.org/10.1186/1748-5908-7-35>
 20. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Science*. 2011;6:42. <https://doi.org/10.1186/1748-5908-6-42>
 21. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Medicine*. 2007;4(10):e296. <https://doi.org/10.1371/journal.pmed.0040296>
 22. Chater AM, Family H, Abraao LM, Burnett E, Castro-Sanchez E, Du Toit B, et al. Influences on nurses' engagement in antimicrobial stewardship behaviours: a multi-country survey using the Theoretical Domains Framework. *Journal of Hospital Infection*. 2022;129:171-180. <https://doi.org/10.1016/j.jhin.2022.07.010>

23. Olans RD, Hausman NB, Olans RN. Nurses and antimicrobial stewardship: past, present, and future. *Infectious Disease Clinics of North America*. 2020;34(1):67-82. <https://doi.org/10.1016/j.idc.2019.10.008>
24. Monsees EA, Tamma PD, Cosgrove SE, Miller MA, Fabre V. Integrating bedside nurses into antibiotic stewardship: a practical approach. *Infection Control and Hospital Epidemiology*. 2019;40(5):579-584. <https://doi.org/10.1017/ice.2018.362>
25. Ju J, Han K, Ryu J, Cho H. Nurses' attitudes toward antimicrobial stewardship in South Korea. *Journal of Hospital Infection*. 2022; 129:162-170. <https://doi.org/10.1016/j.jhin.2022.07.016>
26. Davey K, Aveyard H. Nurses' perceptions of their role in antimicrobial stewardship within the hospital environment. An integrative literature review. *Journal of Clinical Nursing*. 2022;31(21-22):3011-3020. <https://doi.org/10.1111/jocn.16204>
27. Monsees E, Goldman J, Popejoy L. Staff nurses as antimicrobial stewards: an integrative literature review. *American Journal of Infection Control*. 2017;45(8):917-922. <https://doi.org/10.1016/j.ajic.2017.03.009>
28. Lee MJ, Moon SM, Kim B, Park SY, Park JY, Koo H, et al.; Korea Study Group for Antimicrobial Stewardship (KOSGAP). Status of antimicrobial stewardship programmes in Korean hospitals including small to medium-sized hospitals and the awareness and demands of physicians: a nationwide survey in 2020. *Journal of Global Antimicrobial Resistance*. 2021;26:180-187. <https://doi.org/10.1016/j.jgar.2021.06.001>
29. Kim B, Lee MJ, Moon SM, Park SY, Song KH, Lee H, et al.; Korea Study Group for Antimicrobial Stewardship (KOSGAP). Current status of antimicrobial stewardship programmes in Korean hospitals: results of a 2018 nationwide survey. *Journal of Hospital Infection*. 2020;104(2):172-180. <https://doi.org/10.1016/j.jhin.2019.09.003>

Predictive factors of substance misuse and abuse in South Korean adolescents: a secondary data analysis of the 2021 Youth Risk Behavior Web-based Survey

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Purpose: This study aimed to identify the general characteristics and health behaviors of students with non-therapeutic substance use. **Methods:** This secondary data analysis used data from the 17th Korea Youth Risk Behavior Web-based Survey (2021). Analyses of the 54,848 adolescents used descriptive statistics, the Rao-Scott χ^2 test, and logistic regression. **Results:** The risk factors for substance use among students were anxiety, loneliness, living separately from family, suicidal ideation, e-cigarette use, and high stress. **Conclusion:** The findings help identify the risk factors for non-therapeutic drug use among adolescents. Since South Korea does not have a drug prevention program for its adolescent population, an educational plan based on these findings could help prevent adolescent substance abuse.

Keywords: Adolescent; Adolescent behavior; Substance abuse, oral; Health risk behaviors

INTRODUCTION

The use of substances for non-therapeutic purposes is a significant global issue. According to the United Nations Office on Drugs and Crime [1], the number of individuals diagnosed with substance use is steadily increasing, representing approximately 39 million individuals. Adolescence is the critical onset period for such use and is reportedly the highest among young people aged 18 to 25 years [1]. This issue is aggravated in South Korea, which is considered relatively safe from drug and substance misuse and abuse, particularly among adolescents [2].

Adolescence is referred to as a “time of storm and stress.” Adolescents begin to think and act psychologically independent of the protection and observation of older generations; however, they often feel conflicted and easily overwhelmed by enthusiasm or anxiety due to their psychological immaturity [3]. Adolescents are highly susceptible to drug or sub-

stance misuse or abuse as they are naturally curious, seek challenges, rebel against established norms, and often experience low self-esteem and peer pressure [3]. Further, the brain undergoes significant cognitive and emotional development during adolescence. Hence, substance use during this period of psychosocial transformation causes serious health problems [3] and hinders young people’s successful transition to adulthood [4]. Therefore, adolescents may experience cognitive impairment, mental illness, low academic achievement, inflammation, or vascular disorders. Moreover, the use of a single substance typically leads to the use of other dangerous ones [5]. Further, the risk of exacerbating existing health problems exists since adolescents are more likely to engage in substance use in areas without medical surveillance than in safe and legal spaces [1]. The recent increase in the prevalence of mental illness has contributed to an increase in the legal purchase of substances online or directly from overseas through messengers, the ease of which has reached danger-

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ous levels [2].

According to historical data provided by the Counseling and Welfare Center for Youth, the number of adolescent counseling cases for cigarette “smoking, drinking, and substance misuse and abuse” increased by 9.3% compared with 2020 [6]. Conversely, while most behavioral problems significantly decrease by the time they reach adulthood [7], substance abuse-related problems tend to persist or become more complex later in life. Complete recovery from adolescent substance abuse is challenging because it cannot be achieved through the simple cessation of substance use; rather, it requires addressing the frequent recurrence of substance dependency symptoms, withdrawal, and an increase in tolerance [5].

Prevention is divided into the following stages: primary intervention, early intervention (secondary prevention), treatment, rehabilitation, and relapse prevention (tertiary prevention) [8]. Primary prevention occurs before addiction and includes enhancing awareness through substance education programs, strengthening legal sanctions, and promoting substance use prevention through mass media. Secondary prevention involves the early detection and treatment of substance use, whereas tertiary prevention involves rehabilitation. Effective addiction prevention is only possible when all primary, secondary, and tertiary preventive measures are implemented. Botvin and Griffin [9] argued that identifying risk factors is the most important aspect of the development of prevention programs, helping to limit abuse in conjunction with clarifying adolescents’ developmental processes through research. Nawi et al. [10] revealed the risk factors and reported that various demographic factors, such as one’s growth environment and community, are important determinants of substance abuse risk. Furthermore, the Drug Abuse Resistance Education and School Program to Educate and Control Drug Abuse provide preventive education in the U.S. Countries such as England, Germany, and the Netherlands proactively offer substance education to adolescent populations [11]. However, in South Korea, such education is limited to one-time events or promotional programs.

Numerous studies on adolescent health are currently being conducted. Most research on adolescents’ problem behaviors has focused on digital addiction [12], smoking or drinking [13,14], violence [15], and suicide [16]. In a literature review on addiction, Lee [17] noted that studies on substance use in Korea are scarce. Furthermore, Chae [18] reported that substance misuse and abuse in adults highlights the necessity of

identifying the risk factors according to which prevention and treatment programs should be customized. However, research on the risk factors for substance abuse among adolescents in South Korea is lacking.

Adolescents spend most of their time at school with their peers. Hence, to obtain a comprehensive idea of their propensity for substance abuse, data analysis based on systematic research at the national level is required. Accordingly, this study identified the predictive factors for substance use in adolescents who have experienced substance use and used data from the 17th Korea Youth Risk Behavior Web-based Survey conducted in 2021. We hoped to apply these results to recommend guidelines for safe substance use among adolescents. This study aimed to identify the relationship between non-therapeutic substance use, general characteristics, and health behavior and to identify predictors of non-therapeutic substance use.

METHODS

Ethical statements: This study received an Institutional Review Board (IRB) review exemption from the IRB of Dong-A University (No. 2-1040709-AB-N-01-202308-HR-031-02) due to the use of secondary data with anonymity.

1. Study Design

I conducted a secondary analysis of raw data from the 17th Korea Youth Risk Behavior Web-based Survey conducted in 2021 to identify the predictive factors of adolescent substance use for non-therapeutic purposes. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [19].

2. Participants and Data Collection

The survey is an annual anonymous self-report online survey of middle- to high-school Korean adolescents that identifies their health behaviors by referring to smoking, drinking, obesity, diet, and physical activity. Individuals were randomly selected through stratified cluster sampling to minimize sampling errors after dividing the population into 39 regional groups and school levels as stratified variables and then further stratifying the population by city size, school level, and school type using proportional allocation. The 17th edi-

tion of the survey was conducted from August 30 to November 11, 2021, and included 54,848 students, with a participation rate of 92.9%. Survey data were collected using unique coding numbers to avoid identifying the participants' personal information. Thus, the survey guaranteed the participants' anonymity and confidentiality and consisted of 113 questions and 109 indicators. In this study, the dependent variable was the experience of substance use for non-therapeutic purposes, and the explanatory variables were selected according to the findings of earlier studies [20]. A raw data request form was prepared and submitted to the Korea Disease Control and Prevention Agency. The data for the relevant year were downloaded and used after obtaining approval from the representative agency in accordance with the raw data disclosure and utilization regulations of the Youth Risk Behavior Web-based Survey.

3. Study Variables

1) Participants' general characteristics

The general participant characteristics considered in this study were sex, city of residence, school type, level of academic achievement, socioeconomic status, and family cohabitation. Academic achievement and socioeconomic status were categorized as "high" for high and upper-middle, "middle" for middle, and "low" for low and lower-middle. Responses other than "living with family" to the question "What is your current living situation?" (e.g., living in the house of a relative, boarding house, dormitory, care facility, or living alone) were categorized as "not living with family."

2) Participants' health-behavior related characteristics

Students' health behavior-related characteristics included problem behaviors and mental health variables. Problem behaviors included smoking, drinking, substance use, perceived health status, and subjective sleep satisfaction. This study considered individuals' drinking and smoking experiences, excluding those related to religious or cultural rituals. Substance use included the habitual use of stimulants, tranquilizers, butane, and toluene for non-therapeutic purposes. The responses "very healthy" and "healthy" as the perceived mental health status were reclassified as "healthy," and all the other responses as "unhealthy." For subjective sleep satisfaction, the responses indicating sleep as "very adequate" or "adequate" for fatigue recovery were reclassified as "adequate" and all the other responses as "inadequate."

The mental health self-assessments included stress, depression, suicidal ideation, suicidal plans, suicide attempts, loneliness, and anxiety. In general, the responses indicating "very high" and "high" levels of perceived stress were reclassified as "high," whereas all other responses as "low." The responses "yes" and "no" regarding any experience of depression, suicidal ideation, suicide plans, and suicide attempts over the preceding 12 months were used. Further, the responses "always" and "often" concerning the experience of loneliness were reclassified as "high," and the other responses as "low." For anxiety, the original 1–4 scoring scale in the instrument used generalized anxiety disorder (GAD-7) [21] was modified to a 0–3 scale, and composite scores of less than 5 points were reclassified as "minimal," 5–9 points as "mild," 10–14 points as "moderate," and 15–21 points as "severe."

4. Data Analysis

This study used a complex sampling design to analyze the data, reflecting the stratification, clustering, weighting, and finite population correction factors provided in the 2021 survey. The IBM SPSS/Win 22 statistical program (IBM Corp.) was used to perform the complex samples general linear model procedure and complex sample Rao–Scott χ^2 test to analyze substance use according to subjects' general characteristics, problem behaviors, and health behaviors. The data analysis was conducted using the corrected, weighted variables. Descriptive statistical analysis was used to analyze the participants' general characteristics, problem behaviors, and health behaviors and were presented as frequencies that did not reflect the weights and as percentages that reflected the weights. Factors influencing participants' substance use were analyzed using complex sample multinomial logistic regression. The independent variables found to be significant ($p < .05$) in the univariate analysis were used to calculate the odds ratios and 95% confidence intervals (CIs) for each factor.

RESULTS

1. Comparison of Participants' General Characteristics and Health Behaviors according to Their Substance Use Experience

In this study, 395 respondents reported having used substances for non-therapeutic purposes (0.7%). Table 1 presents a comparison of adolescents' general characteristics and

health behaviors according to their experience of substance use. Most (67.8%; $\chi^2 = 12.12, p = .002$) attended coeducational schools. Individuals in the substance-using group most frequently reported “high” for subjective academic performance (39.2%; $\chi^2 = 18.18, p < .001$) and “middle” for subjective economic status (40.3%; $\chi^2 = 33.23, p < .001$). A considerable proportion, 13.9%, of the substance-using group did not live

with their parents compared with only 4.3% of the non-using group ($\chi^2 = 103.73, p < .001$).

Regarding problem behaviors in the substance-using group, 51.9% had experienced drinking ($\chi^2 = 67.46, p < .001$), 26.3% had experienced smoking ($\chi^2 = 140.88, p < .001$), and 24.1% had used e-cigarettes ($\chi^2 = 210.96, p < .001$). Furthermore, regarding perceived health status, 50.6% of the sub-

Table 1. Differences in Substance Use according to Participants’ General Characteristics and Health Behaviors (N=54,848)

Variables	Categories	Drug use		χ^2 (p)
		Yes	No	
		n (%)	n (%)	
Sex	Male	234 (59.2)	28,167 (51.7)	3.43 (.074)
	Female	161 (40.8)	26,286 (48.3)	
Location	Big cities	158 (40.0)	23,704 (43.5)	4.48 (.078)
	Small and medium cities	206 (52.2)	26,658 (49.0)	
	Countryside	31 (7.8)	4,091 (7.5)	
School type	Girls’ school	40 (10.1)	8,793 (16.1)	12.12 (.002)
	Boys’ school	87 (22.0)	8,589 (15.8)	
	Coeducational	268 (67.8)	37,071 (68.1)	
Academic performance	High	155 (39.2)	20,373 (37.4)	18.81 (< .001)
	Middle	92 (23.3)	16,811 (30.9)	
	Low	148 (37.5)	17,269 (31.7)	
Economic status	High	158 (40.0)	21,410 (49.3)	33.23 (< .001)
	Middle	159 (40.3)	26,918 (49.4)	
	Low	78 (19.7)	6,125 (11.2)	
Living with family	Yes	340 (86.1)	52,086 (95.7)	103.73 (< .001)
	No	55 (13.9)	2,367 (4.3)	
Drinker	Yes	205 (51.9)	17,734 (32.6)	67.46 (< .001)
	No	190 (48.1)	36,719 (67.4)	
Smoker	Yes	104 (26.3)	5,225 (9.6)	140.88 (< .001)
	No	291 (73.7)	49,228 (90.4)	
Smoker (e-cigarettes)	Yes	95 (24.1)	3,681 (6.8)	210.96 (< .001)
	No	300 (75.9)	50,772 (93.2)	
Perceived health status	Healthy	195 (49.4)	35,334 (64.9)	47.24 (< .001)
	Unhealthy	200 (50.6)	19,119 (35.1)	
Sleep satisfaction	Adequate	330 (83.5)	41,679 (76.5)	10.84 (.002)
	Inadequate	65 (16.5)	12,774 (23.5)	
Perceived stress	High	244 (61.8)	21,001 (38.6)	77.47 (< .001)
	Low	151 (38.2)	33,452 (61.4)	
Depression	Yes	202 (51.1)	14,490 (26.6)	129.71 (< .001)
	No	193 (48.9)	39,963 (73.4)	
Suicidal ideation	Yes	159 (40.3)	6,797 (12.5)	282.93 (< .001)
	No	236 (59.7)	47,656 (87.5)	
Suicidal plan	Yes	90 (22.8)	2,116 (3.9)	457.07 (< .001)
	No	305 (77.2)	52,337 (96.1)	
Suicide attempt	Yes	60 (15.2)	1,185 (2.2)	353.55 (< .001)
	No	335 (84.8)	53,268 (97.8)	
Loneliness experience	High	165 (41.8)	8,590 (15.8)	224.31 (< .001)
	Low	230 (58.2)	45,863 (84.2)	
Generalized anxiety disorder	Minimal	150 (38.0)	35,514 (65.2)	404.37 (< .001)
	Mild	99 (25.1)	12,380 (22.7)	
	Moderate	65 (16.5)	4,406 (8.1)	
	Severe	81 (20.5)	2,153 (4.0)	

stance-using group reported being “unhealthy” ($\chi^2=47.24$, $p<.001$), whereas 83.5% reported “adequate” recovery from fatigue after sleep ($\chi^2=10.84$, $p=.002$). Regarding perceived stress, 61.8% and 38.6% of the using and non-using groups, respectively, reported having experienced stress ($\chi^2=77.47$, $p<.001$), and 51.1% of the substance-using group reported having experienced depression ($\chi^2=129.71$, $p<.001$). A higher proportion of the substance-using group reported having had suicidal ideation ($\chi^2=282.93$, $p<.001$) and suicidal plans ($\chi^2=457.07$, $p<.001$) and having made suicide attempts ($\chi^2=353.55$, $p<.001$) than the non-using group. Furthermore, 41.8% and 15.8% of the former and latter groups, respectively, experienced loneliness ($\chi^2=224.31$, $p<.001$). The level of generalized anxiety disorder was significantly higher in the substance-use group than in the non-use group ($\chi^2=404.37$, $p<.001$). The proportions of those with moderate anxiety were 16.5% and 8.1% in the substance use and non-use groups, respectively. Moreover, the proportions of those with severe anxiety disorder were 20.5% and 4.0% in the former and latter groups, respectively.

2. Factors Influencing Individuals’ Experience of Substance Use

Complex-sample logistic regression analysis was performed to identify the factors affecting individuals’ experiences of substance use. These factors were examined in the order of their significance (Table 2).

There were 3.78 times more adolescents who did not live with their parents than those who did (95% CI, 2.70–5.31), 2.65 times more used e-cigarettes than those who did not (95% CI, 1.66–4.23) and 2.42 times more adolescents reported stress than those who did not (95% CI, 1.98–2.95). There were 2.76 times more individuals who had planned to commit suicide than those who did not (95% CI, 1.96–3.90), 4.13 times more individuals who had experienced loneliness than those who did not (95% CI, 3.37–5.05). The group with severe anxiety levels was 10.21 times larger than the group with a minimal level of anxiety, while the group with moderate anxiety levels was 3.20 times larger (95% CI, 2.39–4.29).

DISCUSSION

This study identified risk factors for non-therapeutic substance use using raw data from the 17th Korea Youth Risk Behavior Web-based Survey conducted in 2021. According to

Table 2. Factors Affecting Substance Use in Adolescents (N=54,848)

Variables	Categories	OR	95% CI	p
Academic performance	Middle	0.72	0.55–0.93	.020
	Low	1.19	0.93–1.51	.028
	High (ref)			
Economic status	Middle	0.83	0.66–1.05	.020
	Low	1.57	1.17–2.12	<.001
	High (ref)			
Living with family	No	3.78	2.70–5.31	<.001
	Yes (ref)			
Drinker	Yes	1.32	0.83–2.09	<.001
	No (ref)			
Smoker	Yes	1.44	1.13–1.85	<.001
	No (ref)			
Smoker (e-cigarettes)	Yes	2.65	1.66–4.23	<.001
	No (ref)			
Perceived health status	Unhealthy	1.42	1.15–1.76	<.001
	Healthy (ref)			
Sleep satisfaction	Not adequate	1.57	1.18–2.08	<.001
	Inadequate (ref)			
Perceived stress	High	2.42	1.98–2.95	<.001
	Low (ref)			
Depression	Yes	1.59	1.26–2.01	<.001
	No (ref)			
Suicidal ideation	Yes	1.96	1.46–2.57	<.001
	No (ref)			
Suicidal plan	Yes	2.76	1.96–3.90	<.001
	No (ref)			
Suicide attempt	Yes	1.95	1.35–2.82	<.001
	No (ref)			
Loneliness experience	Yes	4.13	3.37–5.05	<.001
	No (ref)			
Generalized anxiety disorder	Mild	1.99	1.54–2.57	<.001
	Moderate	3.20	2.39–4.29	<.001
	Severe	10.21	7.79–13.36	<.001
	Minimal (ref)			

CI, confidence interval; OR, odds ratio.

a survey, the proportion of adolescents who habitually use substances for non-therapeutic purposes increased from 0.4% in 2016 to 0.7% in 2021 [22]. The number of teenagers classified as drug offenders approximately doubled between 2018 and 2022 [23].

Misuse or abuse of drugs does not always result in problematic substance use; however, it can cause other issues or increase the likelihood of substance use if individuals lack adequate coping skills to resolve such problems. This study also clarified factors influencing substance use.

This study revealed that high anxiety and stress levels are associated with an increased likelihood of substance use. Nawi et al. [10] identified the risk and protective factors for adolescent substance use at the individual, family, and com-

munity levels and found that individual factors were related to behavioral problems, depressive disorders, emotional problems, and e-cigarette use, consistent with the current findings showing higher anxiety and stress levels in the substance-using group than in the non-use group.

This study also revealed that the proportion of the substance-using group reporting loneliness was higher than that of the non-use group. Hosseinbor et al. [24] stated that loneliness causes severe psychological and physical issues and reported significantly high levels of loneliness among drug users. One must engage in social interactions to lead a healthy life, and loneliness affects individuals' social interactions, cognitive functions, and emotional behaviors [25]. Similarly, our findings indicated a higher likelihood of substance use among individuals who do not live with their families. According to Nawi et al. [10], the likelihood of substance use may increase to dangerous levels in the absence of appropriate family control or support. Similarly, Supriyanto et al. [26] reported that families provide support at the emotional and cognitive levels in the context of inappropriate substance use, which can increase an individual's self-esteem regarding safe substance use. These are considered important factors because the presence of family members and other supporters can encourage adolescents to develop a perception of safe substance use, thereby avoiding harm or danger. Moreover, earlier studies have indicated that healthy beliefs; strong connections to one's school, family, and local resources; and organized healthy activities can be protective factors against substance use [10,26].

This study found that more individuals planned suicide in the substance-using group than in the non-use group. Similarly, Lee [17] reported that adolescents who have experienced substance use are at a higher risk of suicidal ideation than those with no such experience and that the degree of such ideation is increased by feelings of depression, stress, and anxiety. Since the risk of suicide is high among adolescents with substance use experiences [27], suicidal ideation must be considered a crucial risk factor for adolescents.

Moreover, anxiety, stress, living with parents, and making suicide plans were identified as predictors that increase the risk factors. As Lee [17] stated, several factors can act as protective or risk factors for addiction, which must be considered because they differ according to an individual's social or cultural background. Further, Kim [28] highlighted the necessity of conducting research to understand the changes in unsafe substance use among adolescents and to prepare adequate countermeasures. The misuse of drugs can lead to

problematic substance use in adolescents [23]. Considering these predictive factors identified in this study, adolescents cannot independently resolve these issues. Therefore, society must recognize that this is not an individual problem, and proactive preventive education is required.

This study had several limitations. The analysis was performed using only variables included in the 17th Korea Youth Risk Behavior Web-based Survey, and the interpretation was limited by the question of whether an individual experienced substance use for non-therapeutic purposes. Nevertheless, the current context of non-therapeutic substance use among Korean adolescents was examined using a large-scale survey that targeted all students, and our findings can be utilized to ensure adolescents' safe substance use and healthy growth.

This study is meaningful in that it detected and analyzed the factors related to adolescent substance use in Korea and had implications for suitable prevention strategies, contributing to the development of solutions to many substance-use-related social problems. Accordingly, programs should be developed to enable active substance abuse prevention and therapeutic intervention based on adolescents' environment and personal situations.

CONCLUSION

This study identified the risk factors for adolescents' non-therapeutic substance use with raw data from the 17th Korea Youth Risk Behavior Web-based Survey of 2021. The identified risk factors for substance use among students were anxiety, loneliness, living separately from family, suicidal ideation, using e-cigarettes, and high stress. Educational plans based on these factors should be developed to prevent substance use among adolescents. Additionally, several recommendations can be made based on this study's findings. First, more studies should be conducted to identify substance abuse risk factors based on earlier research, including studies on childhood psychological difficulties and family factors. Second, programs promoting safe substance use based on adolescent characteristics should be developed.

ARTICLE INFORMATION

Authors' contribution

All the work was done by So Yeon Park.

Conflict of interest

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Data availability

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REFERENCES

1. United Nations Office on Drugs and Crime (UNODC). World drug report 2023. UNODC; 2023. p. 12-39.
2. Lee EY, Jeon YK. A study on the actual conditions of new drug offenders in Korea. *Korean Association of Addiction Crime Review*. 2022;12(3):85-102. <https://doi.org/10.26606/kaac.2022.12.3.5>
3. Degenhardt L, Stockings E, Patton G, Hall WD, Lynskey M. The increasing global health priority of substance use in young people. *Lancet Psychiatry*. 2016;3(3):251-264. [https://doi.org/10.1016/S2215-0366\(15\)00508-8](https://doi.org/10.1016/S2215-0366(15)00508-8)
4. Steiner RJ, Sheremenko G, Lesesne C, Dittus PJ, Sieving RE, Ethier KA. Adolescent connectedness and adult health outcomes. *Pediatrics*. 2019;144(1):e20183766. <https://doi.org/10.1542/peds.2018-3766>
5. Garofoli M. Adolescent substance abuse. *Primary Care*. 2020;47(2):383-394. <https://doi.org/10.1016/j.pop.2020.02.013>
6. Ministry of Gender Equality & Family (MOGEF). Youth white paper 2022. MOGEF; 2022. p. 206-266.
7. Schulte MT, Hser YI. Substance use and associated health conditions throughout the lifespan. *Public Health Reviews*. 2014;35(2):3. <https://doi.org/10.1007/bf03391702>
8. Park EJ, Lee JA. Current state and challenges of substance abuse prevention policy. *Health and Welfare Policy Forum*. 2015;229:17-24. <https://doi.org/10.23062/2015.11.3>
9. Botvin GJ, Griffin KW. School-based programmes to prevent alcohol, tobacco and other drug use. *International Review of Psychiatry*. 2007;19(6):607-615. <https://doi.org/10.1080/09540260701797753>
10. Nawi AM, Ismail R, Ibrahim F, Hassan MR, Manaf MRA, Amit N, et al. Risk and protective factors of drug abuse among adolescents: a systematic review. *BMC Public Health*. 2021;21(1):2088. <https://doi.org/10.1186/s12889-021-11906-2>
11. Choi JY, Lee KS. A study on adolescent legitimate drug abuse and social medical approach. *Journal of Korean Society of Health-System Pharmacists*. 2011;28(1):38-65. <https://doi.org/10.32429/jkshp.2011.28.1.004>
12. Hong S, Jo K, Jang Y. A meta-analysis of youth digital addiction prevention programs. *Journal of Learner-Centered Curriculum and Instruction*. 2023;23(12):657-673. <https://doi.org/10.22251/jlcci.2023.23.12.657>
13. Cho HC. A meta-analysis on the factors related to adolescents' alcohol use: from 1990 to 2012. *Korean Journal of Youth Studies*. 2014;21(6):191-221.
14. Lee T, Lee M, Shin M, Kim S. Effects of mental health and drinking behavior on youth smoking: using the 2019 Youth Health Behavior Survey. *Korean Journal of Family Practice*. 2021;11(2):127-134. <https://doi.org/10.21215/kjfp.2021.11.2.127>
15. Moon DK. A meta-analysis of the factors related to bullying damage experience of adolescent. *Journal of the Korea Academia-Industrial cooperation Society*. 2020;21(1):685-697. <https://doi.org/10.5762/KAIS.2020.21.1.685>
16. Kim BY, Lee CS. A meta-analysis of variables related to suicidal ideation in adolescents. *Journal of Korean Academy of Nursing*. 2009;39(5):651-661. <https://doi.org/10.4040/jkan.2009.39.5.651>
17. Lee HK. Predictors of suicide risk in adolescents with drug experience: focusing on smoking, drinking behavior and mental health characteristics. *Journal of Social Sciences*. 2020;59(1):291-327. <https://doi.org/10.22418/JSS.2020.6.59.1.291>
18. Chae S. Drug abuse and policy implications. *Health and Welfare Forum*. 2015;228:66-76.
19. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Medicine*. 2007;4(10):e296. <https://doi.org/10.1371/journal.pmed.0040296>
20. Bae J, Panuncio R. Construction of the structural equation model on substance use in adolescents. *Journal of Korean Academy of Nursing*. 2009;39(3):446-457. <https://doi.org/10.4040/jkan.2009.39.3.446>
21. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of In-*

- ternal Medicine. 2006;166(10):1092-1097. <https://doi.org/10.1001/archinte.166.10.1092>
22. Korea Disease Control and Prevention Agency (KDCA). The 18th Korea Youth Risk Behavior Survey: guidelines for the use of raw data [Internet]. 2022 [cited 2023 July 30]. Available from: <https://www.kdca.go.kr/yhs/home.jsp>
23. Park SH, Hong G. A study on the problems of adolescent drug crime. *Korean Association of Addiction Crime Review*. 2023;13(3):67-91. <https://doi.org/10.26606/kaac.2023.13.3.4>
24. Hosseinbor M, Yassini Ardekani SM, Bakhshani S, Bakhshani S. Emotional and social loneliness in individuals with and without substance dependence disorder. *International Journal of High Risk Behaviors & Addiction*. 2014;3(3):e22688. <https://doi.org/10.5812/ijhrba.22688>
25. Heinrich LM, Gullone E. The clinical significance of loneliness: a literature review. *Clinical Psychology Review*. 2006;26(6):695-718. <https://doi.org/10.1016/j.cpr.2006.04.002>
26. Supriyanto A, Hendiani N, Hartini S, Sabri F. Addiction counselor profession: perception of family support for recovering from drug abuse addiction. *Counsellia*. 2021;11(1):17-30. <http://doi.org/10.25273/counsellia.v11i1.8585>
27. Jeon HS. Effects of smoking, drinking and drug use on the adolescent's suicidal ideation by using the data of the Korea Youth Risk Behavior Web-based Survey through from 2008 to 2014. *Journal of the Korean Society of School Health*. 2015;28(2): 99-110. <https://doi.org/10.15434/kssh.2015.28.2.99>
28. Kim HS. Trend and countermeasures of drug crimes of teenagers. *Dankook Law Review*. 2012;36(1):469-505. <https://doi.org/10.17252/dlr.2012.36.1.018>

Child Health Nursing Research

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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 be-

ginning 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://>

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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 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 au-

thor 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 TM, ®, 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 Psy-

chological 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, Ed-
tors. *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.commonwealth-fund.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.

The editor-in-chief of CHNR will make the final decision regarding the manuscript's publication based on the reviewers' comments and the scientific merits of the manuscript. Any potential or existing conflict and issues in the manuscript must be discussed in detail with the Editorial Board.

All manuscripts from editors, employees or editorial board members are processed the same way as other unsolicited manuscripts. Editors will not handle their own manuscripts even if they are commissioned ones. During the review process, they will not engage in the selection of reviewers and the decision process.

V. Article-processing Charge

After the acceptance of the manuscript, the author is responsible for the following fees: a publication fee, a special typesetting fee, and the printing fee for each volume of the paper.

Upon acceptance, an article-processing charge (APC) of 600 USD (600,000 Korean won) per article is requested from the corresponding author.

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.

VI. Copyright, Open Access Policy, and Data Sharing Policy

1. Copyright

- 1) After the acceptance of the manuscript, the author must submit the copyright transfer agreement to the Korean Academy of Child Health Nursing. All authors should print their names and sign the copyright transfer agreement.
- 2) All manuscripts published in CHNR are protected by copyright. The copyright and the transfer right of the digital content of the published paper and journal are owned by the Korean Academy of Child Health Nursing. All au-

thors should agree to the copyright transfer during the submission process.

2. Open access policy

Child Health Nursing Research (CHNR) is an open-access journal. Articles are distributed under the terms of the Creative Commons Attribution - Non Commercial - No Derivatives (CC BY-NC-ND) license, which permits copying and distributing the material in any medium or format in unadapted form only, for noncommercial purposes only, and only so long as attribution is given to the CHNR. This is in accordance with the Budapest Open Access Initiative definition of open access. It also follows the open access policy of PubMed Central at United States National Library of Medicine

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
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