www.e-chnr.org

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

CHNR

Child Health Nursing Research

Vol.32, No.3, July 2026

Korean Academy of Child Health Nursing

Child Health Nursing Research

Vol. 32, No. 3, July 2026

www.e-chnr.org

CHNR

Child Health Nursing Research

Vol.32, No.3, July 2026

www.e-chnr.org

CHNR
Child Health Nursing Research

pISSN 2287-9110
eISSN 2287-9129

About the Journal

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

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

Aims and Scope

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

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. YeoJin Im, College of Nursing Science & Graduate School of Nursing, Kyung Hee University, Korea (Tel: +82-2-961-9424, e-mail: imyj@khu.ac.kr).

Correspondence concerning business matters should be addressed to Treasurer, Yoo-Jin Heo, College of Nursing, Dankook University, Korea (Tel: +82-41-550-1456, e-mail: yoojin.heo@dankook.ac.kr). The subscription price of this journal is Korean Won, 200,000 (US$ 187.00 or equivalent) annually.
Back issues are available. Please contact the office of the Korean Academy of Child Health Nursing.

© 2026 Korean Academy of Child Health Nursing
Printed July 31, 2026 Published July 31, 2026

Published by the Korean Academy of Child Health Nursing

College of Nursing, Korea University, Korea
Tel:+82-2-3290-4034, Fax: +82-2-928-9107, e-mail: childnursing@childnursing.or.kr, office@e-chnr.org

Printed by M2PI

#805, 26 Sangwon 1-gil, Seongdong-gu, Seoul 04779, Korea
Tel: +82-2-6966-4930, Fax: +82-2-6966-4945, E-mail: support@m2-pi.com

It is identical to Creative Commons Non-Commercial License.
This paper meets the requirements of KS X ISO 9706, ISO 9706-1994 and ANSI/NISO Z.39.48-1992 (Permanence of Paper).

Editorial Board

pISSN 2287-9110
eISSN 2287-9129

Editor in Chief

YeoJin Im PhD, CPNP-PC, RN
Professor, College of Nursing Science & Graduate School of Nursing, Kyung Hee University, Republic of Korea

Associate Editor

Bo Ryeong Lee RN, PhD
Assistant Professor, College of Nursing, Daegu Catholic University, Republic of Korea

Anna Lee RN, PhD
Assistant Professor, College of Nursing, Yonsei University, Republic of Korea

Editorial Board

Korean Board Members

HyunJu Kang RN, PhD
Associate Professor, College of Nursing, Kangwon National University, Republic of Korea

Hyun Young Koo RN, PhD
Professor, College of Nursing, Daegu Catholic University, Republic of Korea

Gaeun Kim RN, PhD
Assistant Professor, College of Nursing, Keimyung University, Republic of Korea

Donghee Kim RN, PhD
Professor, College of Nursing, Sungshin Womens University, Republic of Korea

Yunsoo Kim RN, PhD
Associate Professor, Department of Nursing, Catholic Kwandong University, Republic of Korea

YoungAh Park RN, PhD
Assistant Professor, College of Nursing, Eulji University, Republic of Korea

Won-Oak Oh RN, PhD
Professor, College of Nursing, Korea University, Republic of Korea

Jaeyoung Lee RN, PhD
Associate Professor, Department of Nursing Science, Kyungsung University, Republic of Korea

Haeryun Cho RN, PhD
Professor, College of Nursing, Wonkwang University, Republic of Korea

Eun Kyoung Choi RN, PhD, CPNP
Associate Professor, College of Nursing, Yonsei University, Republic of Korea

International Board Members

T. Robin Bartlett PhD, RN, FAAN
Capstone College of Nursing, The University of Alabama, Tuscaloosa, AL, USA

Bernie Carter RN, PhD
Professor, Faculty of Health and Social Care, Edge Hill University, UK

Cheryl Chiahui Chen
National Taiwan University

Hsiao-Yean (Shannon) Chiu
College of Nursing, Taipei Medical University

Eunji Cho RN, PhD
Assistant Professor, Connell School of Nursing, Boston College, USA

Nirmal Gautam PhD
University of Southern Queensland, Australia

Noriyo Kaneko RN, PhD
Associate Professor, School of Nursing, Nagoya City University, Japan

Eunjung Kim PhD
University of Washington, Seattle, WA, USA

Minjin Kim PhD, RN
University of Cincinnati College of Nursing, USA

Marianne Lin-Lewry
National Taiwan University

Jinhee Park PhD, RN, FAAN
Boston College William F. Connell School of Nursing, USA

Nguyen Thi Anh Phuong MD, PhD
Professor, University of Medicine and Pharmacy, Hue University, Vietnam

Mohammed Nader Shalaby PhD
Associate Professor, Biological Sciences and Sports Health Department, Faculty of Physical Education, Suez Canal University, Egypt

Lai Har WU RN, PhD
Professor, School of Nursing, The Hong Kong Polytechnic University, Hong Kong

Kyeongra Yang PhD, MPH, RN, CNE
Rutgers University School of Nursing, Newark, NJ, USA

Ethics Editor

Kyung-Ah Kang RN, PhD
Professor, College of Nursing, Sahmyook University, Republic of Korea

Hyun Young Koo RN, PhD
Professor, College of Nursing, Daegu Catholic University, Republic of Korea

Young Mee Ahn RN, PhD
Professor, Department of Nursing, Inha University, Republic of Korea

Shin-Jeong Kim RN, PhD
Professor, School of Nursing, Hallym University, Republic of Korea

YeoJin Im PhD, CPNP-PC, RN
Professor, College of Nursing Science & Graduate School of Nursing, Kyung Hee University, Republic of Korea

Statistics Editor

Seongyong Kim PhD
Assistant Professor, Department of Big Data and AI, Hoseo University, Republic of Korea

Junyeong Yang PhD
Professor, Graduate School of Education, Kyung Hee University, Republic of Korea

English Editor

Andrew Dombrowski PhD
Compecs, Inc. Seoul, Republic of Korea

Manuscript Editor

Hyun Joo Kim
InfoLumi Co., Seongnam, Republic of Korea

BoKyeong Kim
Kyung Hee University, Republic of Korea

Layout Editor

Seo Yoon Choi
M2PI, Republic of Korea

Website and JATS XML File Producers

Hye Yoon Roh
M2PI, Republic of Korea

Manuscript Reviewers

pISSN 2287-9110
eISSN 2287-9129

Hye Young Ahn RN, PhD
College of Nursing, Eulji University, Republic of Korea

Sung Yun Ahn RN, PhD
Department of Nursing, Pai Chai University, Republic of Korea

Kyung-Sook Bang RN, PhD
College of Nursing, Seoul National University, Republic of Korea

T. Robin Bartlett RN, PhD, FAAN
Capstone College of Nursing, The University of Alabama, Tuscaloosa, AL, USA

Bernie Carter RN, PhD
Faculty of Health and Social Care, Edge Hill University, UK

Sun-Mi Chae RN, PhD, CPNP-PC
College of Nursing, Seoul National University, Republic of Korea

Cheryl Chiahui Chen
National Taiwan University, Taiwan

Hsiao-Yean (Shannon) Chiu
College of Nursing, Taipei Medical University, Taiwan

Eunji Cho RN, PhD
Connell School of Nursing, Boston College, USA

Haeryun Cho RN, PhD
Department of Nursing, Wonkwang University, Republic of Korea

Hun-Ha Cho RN, PhD
College of Nursing, Kosin University, Republic of Korea

In Young Cho RN, PhD
College of Nursing, Chonnam National University, Republic of Korea

Kyungmi Cho RN, PhD
Department of Nursing, Kyung-In Women's College, Republic of Korea

Eun Kyoung Choi RN, PhD, CPNP
College of Nursing, Yonsei University, Republic of Korea

Hye Sun Choi RN, PhD
Department of Nursing, Woo Suk University, Republic of Korea

Jihea Choi RN, CPNP, PhD
Department of Nursing, Yonsei University Wonju College of Medicine, Republic of Korea

Mi-Young Choi RN, PhD
Department of Nursing, Chungbuk National University, Republic of Korea

Yoon Jung Chung
Dongnam Health University, Republic of Korea

Nirmal Gautam PhD
University of Southern Queensland, Australia

Gyumin Han
College of Nursing, Pusan National University, Republic of Korea

Soo-Yeon Han
Department of Nursing, Bucheon University, Republic of Korea

Yoo-Jin Heo RN, PhD
Department of Nursing, Dankook University, Republic of Korea

Kyung-Hye Hwang RN, PhD
Department of Nursing, Suwon Science College, Republic of Korea

YeoJin Im RN, PhD, CPNP-PC
College of Nursing Science, Kyung Hee University, Republic of Korea

Sangyoun Jang
Catholic Kwandong University, Republic of Korea

Gun-Ja Jang RN, PhD
College of Nursing, Daegu University, Republic of Korea

Eun A Ji RN, PhD
Department of Nursing, Hyejeon College, Republic of Korea

Eun Sun Ji RN, PhD
Department of Nursing, Konkuk University Glocal Campus, Republic of Korea

Hyeon-Ok Ju RN, PhD
Department of Nursing, Dong-A University, Republic of Korea

Hyang-Mi Jung RN, PhD
Department of Nursing, Dongeui University, Republic of Korea

Myung Jin Jung RN, PhD
Department of Nursing, Jungwon University, Republic of Korea

So Young Jung RN, PhD, CHNP
Department of Nursing, Ansan University, Republic of Korea

Noriyo Kaneko RN, PhD
School of Nursing, Nagoya City University, Japan

HyunJu Kang RN, PhD
College of Nursing, Kangwon National University, Republic of Korea

Kyung-Ah Kang RN, PhD
Department of Nursing, Sahmyook University, Republic of Korea

So Ra Kang RN, PhD
Department of Nursing, Wonkwang University, Republic of Korea

Dong Yeon Kim RN, PhD
The Catholic University of Korea, Seoul St. Mary's Hospital, Republic of Korea

Dong-Hee Kim RN, PhD
College of Nursing, Sungshin Women's University, Republic of Korea

Eun Joo Kim RN, PhD
Department of Nursing, Gangneung-Wonju National University, Republic of Korea

Eunjung Kim PhD
University of Washington, Seattle, WA, USA

Gaeun Kim RN, PhD
College of Nursing, Keimyung University, Republic of Korea

Hyun-Ok Kim RN, PhD
College of Nursing, Jeonbuk National University, Republic of Korea

Jeong-Mi Kim RN, PhD
Department of Nursing, Kaya University, Republic of Korea

Ji-Soo Kim RN, PhD
College of Nursing, Gachon University, Republic of Korea

Jin Sun Kim RN, PhD
Department of Nursing, Chosun University, Republic of Korea

Minjin Kim RN, PhD
University of Cincinnati College of Nursing, USA

Sunghee Kim RN, PhD
Red Cross College of Nursing, Chung-Ang University, Republic of Korea

Yunsoo Kim RN, PhD
Department of Nursing, Catholic Kwandong University, Republic of Korea

Hyun Young Koo RN, PhD
College of Nursing, Daegu Catholic University, Republic of Korea

Anna Lee RN, PhD
College of Nursing, Yonsei University, Republic of Korea

Bo Ryeong Lee RN, PhD
College of Nursing, Daegu Catholic University, Republic of Korea

Eun Jee Lee RN, PhD
College of Nursing, Jeonbuk National University, Republic of Korea

Hana Lee RN, PhD
Department of Nursing, Jeonbuk Science College, Republic of Korea

Hyejung Lee RN, PhD
College of Nursing, Yonsei University, Republic of Korea

InSook Lee RN, PhD
Department of Nursing, Hannam University, Republic of Korea

Jaeyoung Lee RN, PhD
Department of Nursing Science, Kyungsung University, Republic of Korea

Joohyun Lee RN, PhD
College of Nursing, Eulji University, Republic of Korea

Sangmi Lee RN, PhD
Department of Nursing, Dongyang University, Republic of Korea

Sunhee Lee RN, PhD
College of Nursing, The Catholic University of Korea, Republic of Korea

Yunah Lee RN, PhD
University of Illinois Chicago, College of Nursing, Department of Population Health Nursing Science, USA

Marianne Lin-Lewry
National Taiwan University, Taiwan

Hyeon-Ah Nam RN, PhD
Department of Nursing, Howon University, Republic of Korea

Jina Oh RN, PhD
Department of Nursing, Inje University, Republic of Korea

Won-Oak Oh RN, PhD
College of Nursing, Korea University, Republic of Korea

Il Tae Park RN, PhD
College of Health and Welfare, Woosong University, Republic of Korea

Jinhee Park RN, PhD, FAAN
Boston College William F. Connell School of Nursing, USA

Jiyoung Park RN, PhD
Department of Nursing, College of Medicine, Inje University, Republic of Korea

Mina Park RN, PhD
Department of Nursing, Soonchunhyang University, Republic of Korea

Sun-Nam Park RN, PhD
Seoul Women's College of Nursing, Republic of Korea

Sunghee Park RN, PhD
Department of Nursing, Kunsan National University, Republic of Korea

YoungAh Park RN, PhD
Department of Nursing, Eulji University, Republic of Korea

Nguyen Thi Anh Phuong MD, PhD
University of Medicine and Pharmacy, Hue University, Vietnam

Jin Suk Ra RN, NNP, PhD
College of Nursing, Chungnam National University, Republic of Korea

Dahae Rim RN, PhD
Department of Nursing, Chonnam National University, Republic of Korea

Mohammed Nader Shalaby PhD
Biological Sciences and Sports Health Department, Faculty of Physical Education, Suez Canal University, Egypt

Kaka Shim RN, PhD
Department of Nursing, Sang Myung University, Republic of Korea

Hyewon Shin RN, PhD
College of Nursing, Ewha Womans University, Republic of Korea

Hyunsook Shin RN, APN, CPNP, PhD
College of Nursing Science, Kyung Hee University, Republic of Korea

Hyun-Mi Sohn RN, PhD
College of Nursing, Pusan National University, Republic of Korea

Min Sohn RN, PhD
Department of Nursing, Inha University, Republic of Korea

Lai Har Wu RN, PhD
School of Nursing, The Hong Kong Polytechnic University, Hong Kong

Seung Hyeon Yang RN, PhD
Department of Nursing, Gachon University, Republic of Korea

Kyeongra Yang RN, PhD, MPH, CNE
Rutgers University School of Nursing, Newark, NJ, USA

Ji-Young Yeo RN, PhD
Department of Nursing, Hanyang University, Republic of Korea

Hana Yoo RN, PhD
Department of Nursing, Daejeon University, Republic of Korea

Juyoun Yu RN, PhD
Department of Nursing, Changwon National University, Republic of Korea

The Board of Directors

pISSN 2287-9110
eISSN 2287-9129

President

Won-Oak Oh [RN, PhD]
College of Nursing, Korea University, Republic of Korea

Vice-president

Eun Sun Ji [RN, PhD]
Department of Nursing, Konkuk University Glocal Campus, Republic of Korea

Director of General Affairs

In Young Cho [RN, PhD]
College of Nursing, Chonnam National University, Republic of Korea

Editor-in-Chief, Child Health Nursing Research

YeoJin Im [PhD, CPNP-PC, RN]
College of Nursing Science & Graduate School of Nursing, Kyung Hee University, Republic of Korea

Director of Academic Affairs

Dong-Hee Kim [RN, PhD]
College of Nursing, Sungshin Women's University, Republic of Korea

Treasurer

Yoo-Jin Heo [RN, PhD]
College of Nursing, Dankook University, Republic of Korea

Director of Public Relations

Hyunju Kang [RN, PhD]
College of Nursing, Kangwon National University, Republic of Korea

Director of Educational Affairs

Eun Kyoung Choi [RN, PhD, CPNP]
College of Nursing, Yonsei University, Republic of Korea

Director of Publication

Hyun-Mi Sohn [RN, PhD]
College of Nursing, Pusan National University, Republic of Korea

Director of Secretary Affairs

Hana Lee [RN, PhD]
College of Nursing, Jeonbuk Science College, Republic of Korea

Advisory Committee

Hyun Young Koo [RN, PhD]
College of Nursing, Daegu Catholic University, Republic of Korea

Sangmi Lee [RN, PhD]
Department of Nursing, Dongyang University, Republic of Korea

CHNR
Child Health Nursing Research

pISSN 2287-9110
eISSN 2287-9129

Vol.32, No.3, July 2026

Editorial
225 What pediatric nursing must prepare for now and in the future
Dong Hee Kim

Review Article
229 The impact of project-based learning on pediatric nursing education: an integrative review
Hyun Young Koo, Bo Ryeong Lee

Original Articles
247 Factors affecting the performance of standard precautions focusing on the health belief model in South Korea: a cross-sectional study
Yu Jin Son, Chae Eun Ahn, Yeong Seo Park, In Young Cho

260 Risk and protective factors for the intergenerational transmission of child maltreatment in South Korea: a secondary analysis of data from the Family with Children's Life Experience Survey
Mina Jang, Sue Kim, Eun Kyoung Choi, Chang Gi Park, Hyejung Lee

274 Factors associated with birth weight and birth length among term newborns in Vietnam: a retrospective cross-sectional study
Do Thi Thu Huyen, Quang Vu Van, Hoang Thi Oanh, Do Thi Lan Anh

287 Associations of asthma with obesity phenotypes and dyslipidemia among Korean adolescents: a secondary data analysis of the Eighth Korea National Health and Nutrition Examination Survey
Heashoon Lee

297 Impact of nurse–parent partnership, social support, and uncertainty on parental efficacy among mothers of children hospitalized in pediatric wards in South Korea: a cross-sectional study
Dan A Kim, Mi-Young Choi

308 Job stress experiences among Korean pediatric ward nurses: a qualitative content analysis
Hyemi Mun, Yonghwan Hyeon, Juhyun Jin

320 Factors related to prenatal depression among hospitalized high-risk pregnant women in South Korea: a cross-sectional study focused on resilience, pregnancy stress, and marital satisfaction
Misun Jin, Soonyoung Shon

330 Development and pilot evaluation of an AI-based pediatric medication safety virtual simulation program for nursing students: a quasi-experimental study in South Korea
In Young Cho, Soohyeon Cho, Min Yeong Im, Hui Jung Jeong, Jimin Choi, In Hyeong Choi, Hee Young Kim

344 Factors associated with the health-related quality of life of adolescents with atopic dermatitis in South Korea: a cross-sectional study
Youna Lee, Anna Lee, Yoon Jung Shin, Eun Kyoung Choi

EDITORIAL

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):225-228
https://doi.org/10.4094/chnr.2026.032

pISSN 2287-9110
eISSN 2287-9129

CHNR

What pediatric nursing must prepare for now and in the future

Dong Hee Kim

Professor, College of Nursing, Sungshin Women's University, Seoul, Korea
Chair of Academic Committee, Korean Academy of Child Health Nursing

Over the first quarter of the 21st century, major gains in child survival and pediatric technology have changed the case mix of child health. The pediatric agenda is no longer defined only by whether children survive acute illness, but increasingly by whether they can develop, function, and thrive across home, school, digital, and community settings. Mental health problems now shape morbidity on a broad scale; digital routines influence sleep, mood, and learning; chronic health risks are appearing earlier in life; more children with disabilities and medical complexity are living longer at home; and environmental instability is becoming a pediatric care issue rather than a distant policy concern. Accordingly, pediatric nursing must prepare not only for disease management but also for longitudinal risk, family caregiving demands, and equitable access to both in-person and digital care [1-4].

1. Child Mental Health as a Core Outcome

Mental health problems among children and adolescents are no longer peripheral concerns but have become major drivers of both current and future morbidity. During the COVID-19 (coronavirus disease 2019) pandemic, symptoms of depression and anxiety increased substantially among children and adolescents worldwide, highlighting the vulnerability of youth mental health to large-scale social disruption [3]. For pediatric nursing, this shift underscores the need to recognize emotional distress as a core pediatric outcome because it affects treatment adherence, sleep, school participation, family functioning, and long-term developmental trajectories.

The recent worsening of child and adolescent mental health is best understood as the cumulative result of interacting factors that have intensified over the past decade rather than as the consequence of a single, time-limited disruption. Pandemic-related school closures served as an acute trigger by removing daily structure, peer interaction, and access to school-based support while increasing loneliness and social isolation. However, these patterns largely reflect the acceleration of pre-existing trends in social disconnection and family stress. Loneliness has emerged as a particularly important contributor as childhood is increasingly characterized by reduced face-to-face interaction and weakened community networks. Evidence suggests that loneliness predicts both current and future depression and anxiety, with longer durations of loneliness associated with a greater risk of mental health problems. Family conflict, parental distress, and reduced emotional availability may also act as chronic stressors that contribute to children's emotional difficulties. In addition, disruptions in school connectedness may weaken a critical source of social support, belonging, and emotional stability for children and adolescents. Collectively, these findings suggest that contemporary child mental health problems are cumulative and socially embedded, arising from the interaction of family, school, and community environments [3,5].

Corresponding author
Dong Hee Kim
College of Nursing, Sungshin Women's University, 55 Dobong-ro 76ga-gil, Gangbuk-gu, Seoul 01133, Korea
Tel: +82-2-920-7727
E-mail: dhkim@sungshin.ac.kr

Received: June 17, 2026 **Accepted:** June 23, 2026

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

The practical implication for pediatric nursing is a shift from reactive, referral-based care to structured mental health pathways integrated into routine pediatric encounters. Pediatric nurses should incorporate age-appropriate mental health screening into well-child, chronic care, school-linked, and transition visits; ensure prompt escalation of care for suicide risk; and assess sleep, social connectedness, bullying, family stress, and digital behaviors as interconnected determinants of well-being. Nursing outcomes should also extend beyond screening rates to include timely follow-up, completion of safety planning, symptom improvement, and successful re-engagement in daily activities.

2. Digital Exposure as a Clinical Determinant

The digital issue is no longer limited to device ownership but increasingly concerns how, when, and why digital technologies are used. Evidence suggests that problematic smartphone use is associated with depression, anxiety, stress, poor sleep, and poorer educational outcomes, while greater screen exposure is consistently linked to shorter sleep duration and an increased risk of sleep-related problems [2,6]. As digital technologies become increasingly integrated into children's daily lives, the assessment of digital habits should become a routine component of pediatric nursing care.

For pediatric nurses, the goal is not moral alarm but clinically meaningful assessment. Attention should focus on patterns of use, timing, content, and function, including whether digital engagement primarily serves learning, social connection, coping, or avoidance. Counseling can then emphasize practical and achievable strategies, such as maintaining healthy presleep routines, limiting device use in bed, promoting positive caregiver modeling, and distinguishing beneficial digital engagement from patterns that disrupt sleep, well-being, or daily functioning.

3. Early Chronicity and Home-Based Complexity

Chronic conditions are emerging earlier in life, and advances in pediatric care are enabling more children with disabilities and medical complexity to survive and live longer at home. Consequently, an increasing proportion of pediatric care is devoted to the long-term management of chronic conditions and complex health needs beyond the hospital setting. Recent evidence emphasizes that pediatric home health care is medically necessary not only for physiologic stability but also for supporting children's participation and functioning across home, school, and community environments [1]. Collectively, these shifts are moving the focus of pediatric care from episodic, hospital-based treatment toward ongoing management integrated into daily life [7].

For pediatric nursing, success can no longer be defined solely by the avoidance of readmission. Transitional and home-based care must evaluate whether families can safely provide care, recognize signs of deterioration, maintain daily routines, and sustain quality of life over time. Evidence suggests that limitations in home nursing support can impose substantial financial and caregiving burdens on families of children with medical complexity, underscoring the importance of family capacity as a measurable outcome rather than an implicit assumption [7].

Pediatric nursing should therefore focus on supporting children and families as they adapt to long-term care in the home setting. This includes building caregiver confidence and competence, facilitating care coordination across healthcare, school, and community settings, supporting equipment and medication management, coaching families to recognize early warning signs, and continually assessing caregiver burden and practical challenges. By supporting both clinical management and family capacity, pediatric nursing can promote safer and more sustainable care for children living with chronic conditions and medical complexity at home [1,7].

4. Climate and Environmental Risk

Climate and environmental instability have become significant determinants of child health rather than distant public health concerns. The World Health Organization identifies climate change, air pollution, unsafe water and sanitation, chemicals, radiation, and e-waste as major environmental threats to children, who are particularly vulnerable because of their developing organ systems and higher exposure levels relative to their body size [8]. Recent evidence further demonstrates that climate-related exposures contribute to respiratory illness, heat-related morbidity, and other adverse health outcomes among children [9].

For pediatric nursing, the priority is to make environmental risk clinically visible. Assessment should extend beyond traditional household exposures to include heat, wildfire smoke, dampness and mold, traffic-related pollution, unsafe housing conditions, flooding, and access to safe outdoor environments. Anticipatory guidance provided in asthma,

newborn, school, and home-care settings should address heat illness prevention, air-quality alerts, hydration, disaster preparedness, and the continuity of essential medications and medical equipment. Because environmental exposures and adaptive resources are unevenly distributed, environmental health should also be recognized as a health equity issue that requires targeted support for vulnerable children and families [8,9].

5. Equity as a Clinical Requirement

Equity has emerged as a central issue in pediatric nursing because contemporary child health risks and access to healthcare are increasingly shaped by social and structural conditions rather than by clinical factors alone. Mental health vulnerability, chronic disease burden, environmental exposures, and barriers to healthcare access are disproportionately concentrated among children living in socioeconomically disadvantaged communities. At the same time, the rapid digitalization of pediatric healthcare is transforming how children and families access assessment, treatment, and ongoing support. Telehealth, digital therapeutics, remote monitoring, and other technology-enabled services are increasingly integrated into routine care. Consequently, inequities in digital access are no longer peripheral concerns but have become potential barriers to essential healthcare, increasing the risk that existing disparities may be perpetuated or amplified [4,10].

Recent evidence suggests that access itself is rarely operationalized in evaluations of pediatric digital health despite the growing reliance on digital care systems. These findings have prompted increased emphasis on equity-focused implementation frameworks that incorporate measurable indicators, such as digital access, language support, service availability, and follow-up completion, into pediatric care systems [4,10]. Equity, therefore, should be understood not as an aspirational goal but as a clinical design requirement that is embedded within referral pathways, telehealth delivery, communication systems, and outcome monitoring.

For pediatric nursing, this means systematically assessing barriers that may limit families' ability to engage in care, including digital access, language needs, caregiving constraints, transportation challenges, disability accommodations, and previous healthcare experiences. Nursing workflows should incorporate flexible and accessible care pathways that respond to diverse family circumstances. Ultimately, programs should be evaluated not only by service uptake but also by their ability to reduce barriers to care and strengthen families' capacity to participate in ongoing health management [4,10].

6. Conclusion

Pediatric nursing is entering an era in which its effectiveness will be judged not only by the management of illness but also by its ability to anticipate risk, strengthen family capacity, and support children across the settings in which they live, learn, and grow. Future pediatric nursing must move beyond episodic encounters toward continuous, coordinated, and context-sensitive care that reflects the realities of contemporary childhood. This will require nurses to integrate mental health, digital health, chronic care management, environmental health, and equity into routine practice rather than addressing them as separate domains. By leading this transformation, pediatric nursing can help build resilient systems that promote not only survival but also the long-term health and well-being of children and families.

ARTICLE INFORMATION

Authors' contribution

All the work was done by Dong Hee Kim.

Conflict of interest

Dong Hee Kim has been a member of the editorial board of *Child Health Nursing Research*. She was not involved in the review process of this editorial. No existing or potential conflict of interest relevant to this article was reported.

Funding

None.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

ORCID and ResearcherID

Dong Hee Kim https://orcid.org/0000-0002-9514-9734
https://researcherid.com/rid/NSV-0266-2025

REFERENCES

1. Foster C, Lin E, Feinstein JA, Seltzer R, Graham RJ, Coleman C, et al. Home health care research for children with disability and medical complexity. Pediatrics. 2025;155(2):e2024067966. https://doi.org/10.1542/peds.2024-067966
2. He X, Pan B, Ma N, Li D, Kong W, Liu Q, et al. The association of screen time and the risk of sleep outcomes: a systematic review and meta-analysis. Front Psychiatry. 2025;16:1640263. https://doi.org/10.3389/fpsyt.2025.1640263
3. Racine N, McArthur BA, Cooke JE, Eirich R, Zhu J, Madigan S. Global prevalence of depressive and anxiety symptoms in children and adolescents during COVID-19: a meta-analysis. JAMA Pediatr. 2021;175(11):1142-1150. https://doi.org/10.1001/jamapediatrics.2021.2482
4. Whitehead L, Robinson S, Arabiat D, Jenkins M, Morelius E. The report of access and engagement with digital health interventions among children and young people: systematic review. JMIR Pediatr Parent. 2024;7:e44199. https://doi.org/10.2196/44199
5. Loades ME, Chatburn E, Higson-Sweeney N, Reynolds S, Shafran R, Brigden A, et al. Rapid systematic review: the impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19. J Am Acad Child Adolesc Psychiatry. 2020;59(11):1218-1239. https://doi.org/10.1016/j.jaac.2020.05.009
6. Sohn SY, Rees P, Wildridge B, Kalk NJ, Carter B. Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: a systematic review, meta-analysis and GRADE of the evidence. BMC Psychiatry. 2019;19(1):356. https://doi.org/10.1186/s12888-019-2350-x
7. Wright SM, Lee B, Belzer LT, Goodwin EJ, Colvin JD. Understaffed home nursing and wellbeing of families of children with medical complexity. Children (Basel). 2025;12(4):455. https://doi.org/10.3390/children12040455
8. World Health Organization. Children's environmental health [Internet]. World Health Organization; c2026 [cited 2026 May 28]. Available from: https://www.who.int/health-topics/children-environmental-health
9. Weeda LJ, Bradshaw CJ, Judge MA, Saraswati CM, Le Souëf PN. How climate change degrades child health: a systematic review and meta-analysis. Sci Total Environ. 2024;920:170944. https://doi.org/10.1016/j.scitotenv.2024.170944
10. Luke MJ, Craig S, Pak-Gorstein S, Arellano M, Zhang J, Wright SM, et al. Narrowing the digital divide: framework for creating telehealth equity dashboards. Interact J Med Res. 2024;13:e57435. https://doi.org/10.2196/57435

REVIEW ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):229-246
https://doi.org/10.4094/chnr.2026.011

pISSN 2287-9110
eISSN 2287-9129

CHNR

The impact of project-based learning on pediatric nursing education: an integrative review

Hyun Young Koo[1], Bo Ryeong Lee[2]

[1]Professor, College of Nursing, Daegu Catholic University, Daegu, Korea
[2]Assistant Professor, College of Nursing, Daegu Catholic University, Daegu, Korea

Corresponding author
Bo Ryeong Lee
College of Nursing, Daegu Catholic University, 33 Duryugongwon-ro 17 gil, Nam-gu, Daegu 42472, Korea
Tel: +82-53-650-4889
Fax: +82-53-650-4392
E-mail: brlee@cu.ac.kr

Received: February 11, 2026
Revised: March 30, 2026
Accepted: April 14, 2026

Purpose: This integrative review aimed to examine the application and outcomes of project-based learning (PjBL) in pediatric nursing education and to identify its key characteristics.

Methods: Following the integrative review methodology proposed by Whittemore and Knafl, a comprehensive literature search was conducted in May 2025 across PubMed, Embase, CENTRAL, CINAHL, KCI, RISS, ProQuest, and Google Scholar. Studies published in both English and Korean were included. Two reviewers independently screened and selected eligible studies addressing the use of PjBL in pediatric nursing education.

Results: Six studies met the inclusion criteria and were included in the final review. Learning outcomes were categorized into 3 domains: cognitive outcomes (improvements in knowledge and critical thinking), affective-attitudinal outcomes (reduced stress and enhanced positive attitudes and self-confidence), and psychomotor outcomes (improvements in performance skills). The role of faculty members as facilitators, supporters, and coordinators emerged as a key determinant of successful PjBL implementation. PjBL may provide beneficial learning outcomes across multiple domains in pediatric nursing education; however, the overall level of evidence ranged from low to moderate, and the findings should therefore be interpreted with caution.

Conclusion: For successful implementation, faculty play a critical role in guiding and supporting the learning process. Accordingly, PjBL should be more widely incorporated into nursing curricula, accompanied by adequate faculty development initiatives.

Keywords: Child health; Learning; Pediatric nursing; Students, nursing

INTRODUCTION

To become competent nurses who can accurately identify and address nursing problems in pediatric patients and their families, nursing students must learn to comprehensively assess children's health status, recognize potential risks, and implement appropriate interventions [1]. Because children undergo dynamic growth and developmental changes while remaining physically immature, students must understand age-specific norms and develop refined assessment skills to detect subtle physiological changes that may signal deterioration in a child's condition [1,2].

In addition, nursing students must apply their theoretical knowledge of pediatric nursing within clinical environments to develop into proficient nurses capable of providing autonomous care for pediatric patients [2]. Consequently, a range

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

of nursing education methodologies has been adopted to enhance students' ability to apply theoretical nursing knowledge in real-world clinical contexts. In particular, providing students with opportunities to engage in authentic professional settings that allow them to solve problems and develop expertise is strongly recommended [3]. Project-based learning (PjBL) has emerged as a particularly promising approach for achieving this goal, given its emphasis on active engagement with complex, real-world challenges [4]. PjBL is an educational method in which learners solve real-world problems and construct knowledge in authentic contexts by working collaboratively to complete projects and produce clearly defined outputs [5].

As an inquiry-based instructional strategy, PjBL promotes active engagement by organizing learning around meaningful projects that produce tangible, real-world results [3]. Students must therefore integrate, apply, and expand their existing knowledge as they address authentic problems within a collaborative framework [5]. Although PjBL shares similarities with problem-based learning (PBL) in its emphasis on real-world problem solving and student-centered team activities, a key distinction is that PjBL culminates in clearly defined and observable outcomes [3]. These visible outcomes enable learners to recognize that their efforts produce meaningful results, which in turn can enhance engagement and sustained interest in specialized subject areas [5].

PjBL has been recognized by nursing students as an effective approach for strengthening teamwork and enhancing problem-solving and decision-making abilities, as well as for compensating for limited experience and understanding of real-world clinical situations [6]. This educational strategy may also help reduce practicum-related stress by alleviating feelings of boredom and powerlessness, particularly in pediatric settings where direct patient access is often restricted due to patient vulnerability, safety concerns, and demanding clinical environments [7]. In addition, PjBL has demonstrated effectiveness in promoting self-regulated learning. For example, an experimental group of college students who participated in PjBL during a theory-based course exhibited significantly higher levels of self-regulated learning than a control group [8]. Furthermore, college students engaged in PjBL have consistently reported high levels of satisfaction and enjoyment with the learning process [9].

Although PjBL can enhance learners' knowledge and skills by promoting active engagement, it may also impose additional learning demands on students [5,10]. Previous studies examining the experiences and effects of PjBL in nursing education have highlighted both its educational benefits and inherent challenges. However, despite the accumulation of quantitative and qualitative evidence, findings remain fragmented, highlighting the need for a comprehensive synthesis of PjBL's overall impact in the specialized context of pediatric nursing education. Therefore, this study aims to analyze the application and outcomes of PjBL in pediatric nursing education through an integrative review. This methodology was selected because it allows diverse research designs to be included simultaneously, thereby supporting a more nuanced understanding than would be possible through a traditional systematic review alone.

Following the framework proposed by Whittemore and Knafl [11], this review followed 5 stages: problem identification, literature search, data evaluation, data analysis, and presentation. By integrating disparate evidence, this study sought to provide a foundational evidence base for implementing PjBL to strengthen pediatric nursing competencies. This integrative review therefore examined the application and outcomes of project-based learning in pediatric nursing education and identified its key characteristics. Specifically, it addressed the following research questions: What contextual factors necessitate project-based learning in pediatric nursing education? What are the key characteristics of project-based learning in pediatric nursing education? What learning outcomes are associated with project-based learning in pediatric nursing education? What factors facilitate or hinder the implementation of project-based learning in pediatric nursing education?

METHODS

Ethical statements: This study is a literature review of previously published studies and was therefore exempt from Institutional Review Board approval.

1. Literature Review Method

To obtain a comprehensive understanding of PjBL in pediatric nursing education, an integrative review was conducted to incorporate diverse research perspectives. This approach allowed for the inclusion of studies using various methodological designs. The review strictly followed the methodological framework developed by Whittemore and Knafl [11].

2. Aim

The aim of this study was to synthesize existing research on PjBL in pediatric nursing education and to evaluate its key characteristics and its impact on nursing students' learning outcomes.

3. Literature Search

1) Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) Population: studies involving undergraduate nursing students or graduate nursing students; (2) Intervention: educational interventions in the field of pediatric nursing that applied PjBL; and (3) Study design: qualitative, quantitative, or mixed-methods studies, as well as systematic, integrative, scoping, or literature reviews. For this review, PjBL was operationally defined as an educational approach in which learners engaged in a project centered on an authentic pediatric nursing problem or task, participated in a structured inquiry process, and produced project outputs. Additional elements supporting classification as PjBL included student choice, reflection, feedback or revision, and public sharing. The exclusion criteria were as follows: (1) studies aimed at improving medical or nursing care or patient health outcomes rather than learners' educational outcomes; (2) studies that did not report clear learning outcomes; (3) studies describing simple group assignments, simulation activities, or educational tasks without sufficient evidence of core PjBL elements; and (4) studies published in languages other than English or Korean. No restrictions were applied regarding the year of publication.

2) Search methods and results

The literature search was conducted by one reviewer. The retrieved records were then screened independently by 2 reviewers, who compared and cross-checked their decisions at each stage of the study selection process. Any disagreements were resolved through discussion until consensus was reached. The literature search included 6 academic databases: PubMed, Embase, the Cochrane Central Register of Controlled Trials (CENTRAL), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Korea Citation Index (KCI), and Research Information Sharing Service (RISS). It also included 2 gray literature sources, ProQuest and RISS; hand searching using Google Scholar; and citation searching through manual screening of the reference lists of the included studies. Detailed search strategies and final search dates for each information source are provided in Supplement 1. The searches were conducted between May 8 and May 15, 2025, with the final search completed on May 15, 2025. The primary search terms used for the academic database searches included "Project," "Learning," and "Pediatrics," which were combined with relevant Medical Subject Headings (MeSH), Emtree terms, natural language terms, and abbreviations. Boolean operators (AND, OR) and truncation were applied to refine the search strategy, and search terms were adapted for each database according to its indexing system. The initial database search identified a total of 50,048 records. After duplicate records were removed using reference management software, 48,346 records remained for screening. Following title and abstract screening, 29 articles were selected for full-text review, of which 5 met the inclusion criteria.

To identify additional studies not captured through database searches, gray literature searches were conducted using ProQuest and RISS. In addition, hand searching was performed using Google Scholar with the search terms "project based learning" AND "pediatric nursing." The reference lists of included studies were also manually reviewed. These additional search methods identified 1,135 records. Duplicate records within gray literature sources were removed using EndNote 2025 (Clarivate). Citation searching and hand searching were excluded from duplicate removal, resulting in 4 duplicate records. After title and abstract screening, 2 articles were selected for full-text review, and one additional study was included. Ultimately, a total of 6 studies were included in the final analysis (Figure 1). The 6 included studies incorporated core PjBL components, including an authentic pediatric nursing problem or task, an inquiry process, and production of project outputs.

4. Quality Appraisal

Quality appraisal was conducted using design-specific appraisal tools according to the methodological characteristics of each study. The Mixed Methods Appraisal Tool (MMAT) [12] was applied to descriptive, case study, and mixed-methods studies, and the Joanna Briggs Institute (JBI) critical appraisal tools [13] were used for quasi-experimental studies. Quality appraisal was performed independently by one reviewer and subsequently verified by a second reviewer. Any disagreements were resolved through discussion until consensus was achieved. The methodological quality of each

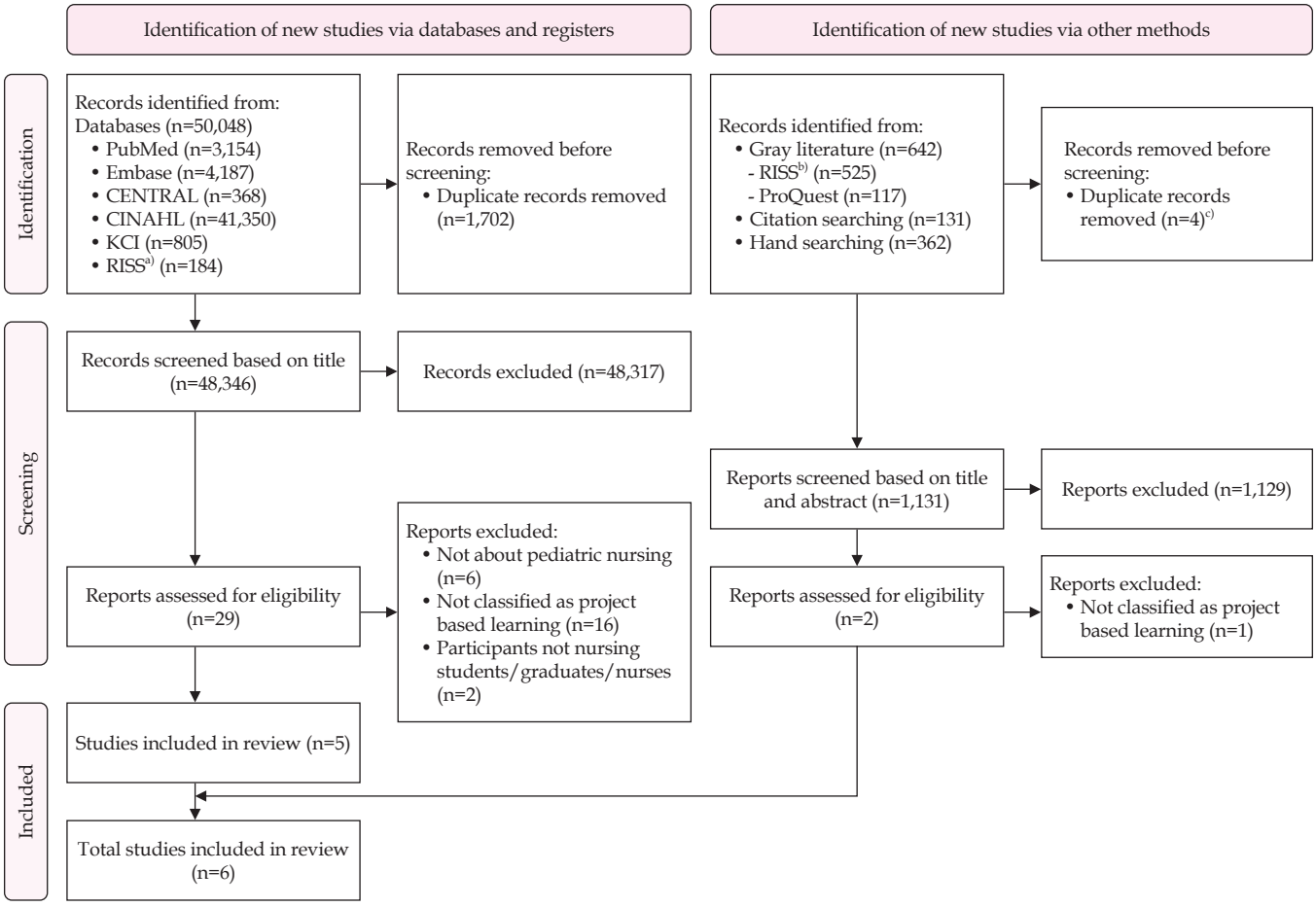

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. [a]Journal articles identified through RISS. [b]Gray literature (theses, dissertations, books, and research reports) identified through RISS. [c]Citation searching and hand searching: duplicates not removed. CENTRAL, Cochrane Central Register of Controlled Trials; CINAHL, Cumulative Index to Nursing and Allied Health Literature; KCI, Korea Citation Index; RISS, Research Information Sharing Service.

study was assessed and categorized as low, low–moderate, or moderate according to the number and severity of methodological limitations identified. The quality appraisal results are presented in Table 1 [7,14-18]. Because the purpose of this review was to examine not only the learning outcomes of PjBL in pediatric nursing education but also its characteristics, all eligible studies were included in the analysis regardless of their level of evidence. Nevertheless, methodological limitations of individual studies were carefully considered during the data synthesis process.

5. Data Analysis and Synthesis

A data extraction sheet was developed to systematically document the information required for reviewing each included study. One reviewer conducted the study-specific review and data extraction, while a second reviewer evaluated the appropriateness of the summarized and condensed content produced during the extraction process. The extracted data were then organized into tables according to the general characteristics of the studies and the specific characteristics of PjBL. During table development, the data were further condensed and summarized (Tables 2, 3) [7,14-18]. The completed tables were used to compare similarities and differences across the included studies. Through repeated comparison, review, and analysis of the tabulated data, patterns and themes related to the characteristics of PjBL and its associated learning outcomes were identified. Meaningful units were coded and grouped into categories based on similarities and differences. Learning outcomes were then classified into cognitive, affective–attitudinal, and psychomotor domains according to Bloom's taxonomy [19]. The final integrated and

Table 1. Summary of methodological weaknesses in included studies

Author	Study design	Appraisal tool	Methodological weaknesses	Overall quality
Vasset et al. [16]	Descriptive study	MMAT (mixed methods)	• Lack of reflexivity regarding the researcher–participant relationship: potential power dynamics and response bias • Insufficient procedures to ensure the trustworthiness of qualitative analysis (e.g., use of participant quotations, investigator triangulation, methodological triangulation) • Single-site study	Moderate
Woodley et al. [15]	Case study	MMAT (mixed methods)	• Limited rigor and transparency in reporting both qualitative and quantitative analyses • Inadequate sampling strategy and representativeness, with concerns about bias due to participant attrition • Single-site study	Moderate
Koo et al. [7]	Quasi-experimental	JBI	• Absence of random assignment, raising the possibility of selection bias • Single-site study without longitudinal follow-up	Moderate
Commendador et al. [14]	Case study	MMAT (quantitative descriptive)	• Limitations in sampling strategy and representativeness • Lack of validated and reliable measurement tools to assess the achievement of educational goals • Single-site study	Low–moderate
Pohl et al. [18]	Case study	MMAT (quantitative descriptive)	• Reliance on voluntary participation, limiting representativeness • Lack of transparency in the qualitative analysis process • Single-site study	Low–moderate
Rossman et al. [17]	Case study	MMAT (quantitative descriptive)	• Single-case study without a control group, limiting internal validity • Lack of validated quantitative tools and qualitative methods to evaluate educational effects • Single-site study	Low

JBI, Joanna Briggs Institute; MMAT, Mixed Methods Appraisal Tool.

synthesized findings were subsequently re-examined in conjunction with the original studies to ensure accuracy, and individual studies were cited in the presentation of the conclusions.

Effect sizes, including mean differences (MDs) and 95% confidence intervals (CIs), were calculated using Microsoft Excel (Microsoft Corp.) based on the data reported in the original studies, including sample size, mean, and standard deviation for each group. Effect sizes were calculated to examine the magnitude of effects in individual studies.

RESULTS

1. What Contexts Necessitate the Application of PjBL in Pediatric Nursing Education?

PjBL was implemented in pediatric nursing education to address limited pediatric nursing knowledge and clinical experience, increase learner engagement in restricted clinical environments, and expand learning opportunities across diverse contexts, including community and home settings.

PjBL was used as a pedagogical strategy to support students in integratively understanding the characteristics of pediatric diseases and children's developmental needs and in applying this understanding to actual nursing practice, particularly in contexts where students possessed limited pediatric nursing knowledge and clinical experience. For instance, Woodley et al. [15] implemented a project in which students designed developmentally appropriate play activities for hospitalized children during clinical practicums, addressing the contextual limitation that pediatric growth and development concepts are difficult to fully comprehend through theoretical instruction alone. Similarly, Vasset and Sundal [16] developed a project in which students with limited pediatric nursing experience interviewed nurses caring for children with acute and chronic illnesses and the children's parents, conducted literature reviews, and produced research reports on pediatric nursing care for acute and chronic conditions, thereby enabling students to explore disease-specific pediatric nursing within an authentic clinical context.

Table 2. General characteristics of the included studies

Author (year)	Country	Study design	Setting	Participants (undergraduate nursing students)			Analysis methods	Key findings and highlights
				Level	Intervention	Comparison		
					n (unit of activity)	n (type)		
Vasset and Sundal [16] (2024)	Norway	Descriptive study	University + pediatric ward	2nd, 3rd	159 (3–5 students/team)	None	• Text analysis [22]: quantitative analysis & content analysis	• PjBL helped fill the educational gap caused by limited clinical pediatric experience. • Interviews, literature search, and self-selected topics were key factors in improving learning outcomes. • Both face-to-face guidance and the digital platform (Canvas) were used, but students expressed a greater need for in-person instruction.
Woodley et al. [15] (2023)	USA	Case study	Pediatric clinical field	Not stated	206-159-122[a] (individual)	Not stated (pre-project students)	• Descriptive statistics • Content analysis	• The problem source was derived from the illnesses and developmental needs of hospitalized children, and the play and toys designed accordingly by nursing students were noteworthy as creative outcomes. • The Pediatric Play Project, based on Kolb's experiential learning theory [20], helped nursing students apply growth and development concepts to real clinical situations. • Some students reported that the project was time-consuming, the reflective report repetitive, and material preparation limited by financial constraints.
Koo et al. [7] (2022)	Republic of Korea	Quasi-experimental study	University + pediatric ward	3rd	24 (5–7 students/team)	21 (usual care)	• Repeated-measures ANOVA	• PjBL can be an effective learning method in clinical settings such as the NICU, where student practice is limited. • Provides a hybrid learning environment by combining the NICU and the school lab. • Project-produced NICU video was used as a next-year student resource.
Commendador and Flood [14] (2016)	USA	Case study	Elementary school	Not stated	4 (4 students/team)	None	• Descriptive statistics • Narrative description	• Nursing students designed, implemented, and evaluated child health education, simulating nurses' health promotion activities. • Using children as mediators of health education can contribute to community health promotion. • PjBL served as a community–nursing school partnership model combining clinical training with community health promotion. • Positive outcomes led to additional funding, expanding PjBL to multiple elementary schools in the community.
Pohl et al. [18] (2014)	USA	Case study	Home visit	4th	47–24[b] (team, not stated)	None	• Descriptive statistics	• Nursing students received opportunities to learn in the child's home environment and used a strength-based approach.

(Continued on the next page)

Table 2. Continued

Author (year)	Country	Study design	Setting	Participants (undergraduate nursing students)			Analysis methods	Key findings and highlights
				Level	Intervention n (unit of activity)	Comparison n (type)		
							• Qualitative content analysis	• Open communication among students, faculty, and school nurse was essential to secure time for building relationships with new families. • A unique feature was delivering the student-developed family care plan to families in the form of a letter.
Rossman et al. [17] (2012)	USA	Case study	Elementary school	3rd	20 (1–2 students/team)	None	• Descriptive qualitative analysis	• Nursing students gained practical school health experience as school nurse extenders. • Through PjBL, they produced various outcomes such as nursing care plans, educational materials, and health management reports. • As a community–university partnership model, the project had positive effects on both student education and school health services.

ANOVA, analysis of variance; NICU, neonatal intensive care unit; PjBL, project-based learning.
[a]PjBL participants: 206, surveyed: 159, respondents: 122. [b]PjBL participants: 47, focus group participants: 24.

PjBL was also employed as a pedagogical strategy to promote active learner engagement in pediatric clinical practicum settings where opportunities for direct nursing care were constrained. Koo et al. [7] implemented a project involving the development of educational video clips on high-risk newborn care during neonatal intensive care unit (NICU) practicums, thereby providing students with opportunities to utilize the NICU environment and medical equipment and to interact with practicing nurses.

In addition, PjBL was combined with diverse contexts, including community and home settings, to broaden the scope of pediatric nursing learning. Rossman et al. [17] addressed a community-level issue (namely, shortages in school health personnel) by engaging nursing students as school nurse extenders in elementary schools, through which students experienced the practical roles of school health nursing. Pohl et al. [18] implemented a home visit project for children with chronic illnesses, enabling students to assess children's health status in home environments, communicate with families, and plan and implement family-centered nursing care. Commendador and Flood [14] linked pediatric health education with community health promotion by engaging nursing students in a blood pressure education project for elementary school students.

2. What Factors Should Be Considered When Designing and Implementing PjBL Courses in Pediatric Nursing Education?

Studies applying PjBL in pediatric nursing education were analyzed as having considered learning objectives, design rationales and structures, and evaluation strategies during the implementation of PjBL.

Regarding project topics, Vasset and Sundal [16] focused on nursing care for children with acute, chronic, and critical illnesses; Koo et al. [7] addressed high-risk newborn care; and Rossman et al. [17] emphasized school health nursing. By selecting topics directly aligned with core competencies in pediatric nursing, these studies clearly articulated the instructional focus of PjBL. However, in some studies, the project purpose and learning objectives were presented in a mixed manner, or explicit statements of learning objectives were insufficient [14,15].

When designing PjBL, the application of theoretical frameworks helped manage the complexity associated with the learning problem, the instructional process, learner and fac-

Table 3. Characteristics of project-based learning

Author	Project name	Model or theory	Learning challenge	Source of problem	Output	Role		Duration	Major outcome (tool): MD (95% CI)
						Student	Educator		
Vasset et al. [16]	Project children	Motivation theory [21]	Identifying problems related to the nursing care of children with acute, critical, chronic, and complex diseases and seeking solutions to them	Students	• Report • Oral presentation	• Selects a pediatric nursing topic • Formulates a clear problem statement including age range • Conducts stakeholder interviews and literature review • Writes and presents a report	(Teacher) • Provides orientation, encourages topic selection, and offers motivation • Provides feedback, assists with literature search in collaboration with librarians, and reviews report drafts • Conducts process-oriented evaluation and outcome evaluation	2 weeks	• Project participation broadened students' knowledge and understanding of clinical pediatric nursing. • Students emphasized the particular value of conducting team interviews with nurses and parents. • Allowing self-selected topics enhanced students' motivation for learning. • Students expressed a need for increased face-to-face guidance from instructors. • Students reported difficulty in completing the project within a short period.
Woodley et al. [15]	Pediatric play project	Experiential learning theory [20]	Designing play tailored to the illnesses and developmental needs of hospitalized children	Hospitalized children	• Designed a toy or play activity • Presentation: role play, demonstration, PPT materials • Reflective summary report	• Discusses learning regarding growth and development • Selects children • Identifies developmental tasks through milestones • Designs and applies tailored play/toy activities • Completes a presentation • Writes and submits a reflective report	(Clinical faculty) • Provides orientation • Guides students on applying growth and development knowledge to actual children • Facilitates discussion on the impact of hospitalization on development and the importance of play • Adjusts the project to include various pediatric diagnoses • Provides feedback during student presentations	Not stated	• Over 90% of students reported that the project was effective for learning about growth and development. • Students stated that it was enjoyable and useful to explore ways of promoting growth and development as nurses. • Students with project experience achieved significantly higher scores on growth/development test items than those without. (No detailed statistics reported.) • Clinical faculty evaluated project students as more proficient than former students in developmental nursing interventions and communication.

(Continued on the next page)

https://doi.org/10.4094/chnr.2026.011

Table 3. Continued

Author	Project name	Model or theory	Learning challenge	Source of problem	Output	Role		Duration	Major outcome (tool): MD (95% CI)
						Student	Educator		
Koo et al. [7]	Project of producing an educational video clip about high-risk newborn care	Not specified	Developing a video clip to teach high-risk newborn care to peers, considering the NICU environment where direct nursing by students is difficult	CPF	• Educational video clip	• Conducts a literature review and sets learning objectives • Divides roles (script, teaching, filming, editing) • Develops a plan for a product • Films and edits a 10–15 min educational video • Views and reflects on the video	(CPF & CNI) • Provides project orientation and worksheets • Assigns topics • Encourages project progress • Reviews project plans and gives feedback as needed • Coordinates access to skills lab, NICU, equipment, and manikins	1 week	• Nursing competency for high-risk newborns (developed by the authors): MD, 3.75 (95% CI, 1.40 to 6.10) • Self-leadership (RSLQ): MD, 1.70 (95% CI, –7.28 to 10.68) • Practicum-related stress: MD, –13.71 (95% CI, –27.11 to –0.31)
Commendador et al. [14]	Blood pressure pilot project	Not specified	Enhancing hypertension awareness among sixth-grade students to promote community awareness	Local organization	• Teaching materials and tools • Adult BP data measured by elementary students • Newspaper article featuring the project	• Sets project goals and evaluation plan • Develops teaching materials and tools on blood pressure • Conducts 2 education sessions (1 hr/session) • Collects and evaluates data gathered by elementary students • Evaluates project and suggests improvements	(Nursing faculty) • Provides guidance on project goals and evaluation plan • Adjusts to include the project in clinical practice	3 weeks (90 min/wk)	• Performance goals (nursing students' knowledge and skills): 100% achieved • Outcome goals (elementary students' knowledge and skills): 3 of 4 achieved (75%) • Among 375 adults whose BP was measured by elementary students, 135 (36.0%) had hypertension; about half intended further BP follow-up

(Continued on the next page)

CHNR

Table 3. Continued

Author	Project name	Model or theory	Learning challenge	Source of problem	Output	Role		Duration	Major outcome (tool): MD (95% CI)
						Student	Educator		
Pohl et al. [18]	Family outreach project	Not specified	Identifying problems and developing/implementing nursing care plans	Children with chronic conditions and their families	• Family care plan	• Prepares for a home visit: Family and Child Health History and Assessment Interview Guide • Conducts role-play practice: initial phone call, history taking • Carries out a family assessment: rapport building, applying strength-based approach • Develops a care plan • Reflects through focus group interview participation	(Clinical faculty, school nurse) • Promotes the use of a strength-based approach • Supports students in preparing for home visits • Guides role-play • Recruits families and obtains consent • Facilitates smooth student–family interaction • Reviews student-developed care plans	1 semester	• Focus group interviews revealed that students found observing the child's home environment beneficial and experienced improvements in both knowledge and critical thinking. However, they reported difficulties in preparing and conducting home visits and concerns when families were already well adapted with little nursing care needed. • The family survey (n = 10) indicated that students were professional and treated families with respect.
Rossman et al. [17]	Student nurses as school nurse-extenders	Not specified	Serving as school nurse extenders to supplement the shortage of elementary school nurses and to manage the health of children	School children	• Nursing care plan • Health education material • Reports on health management outcomes	• Conducts daily health office management • Assesses student health needs • Provides first aid and emergency care • Carries out health education and preventive activities • Provides administrative support by assisting with paperwork and record management	(School nurses & faculty members) • Conducts an orientation to school nurse roles • Facilitates and guides health needs review and care planning • Provides feedback on health education and management • Delegates routine tasks and monitors student activities • Coordinates school–university collaboration	10 weeks	• Nursing students learned the role of school nursing and how to provide education to elementary school children. • Nursing students experienced the impact of chronic diseases on elementary children's daily lives and learned by implementing appropriate interventions to improve their health. • Through the project, detailed child health information was collected, medications for the school were secured, and action plans were established to address children's chronic health problems.

BP, blood pressure; CI, confidence interval; CNI, clinical nursing instructor; CPF, clinical practice faculty; MD, mean difference; NICU, neonatal intensive care unit; PPT, PowerPoint; RSLQ, the Korean version of the Revised Self-Leadership Questionnaire.

ulty roles, and the educational environment. Woodley et al. [15] designed their project based on experiential learning theory [20], linking theoretical concepts of child growth and development to students' observational experiences with hospitalized children in pediatric wards. Following a structured reflection phase, the project progressed to active experimentation, during which students designed play activities tailored to the developmental needs of hospitalized children. Vasset and Sundal [16] applied motivation theory [21] to ensure that students recognized the significance of the task through a clearly defined problem statement at the initial stage of the project. Their design incorporated diverse learning strategies, including interviews, literature reviews, and discussions, thereby enhancing methodological diversity. In addition, clearly defined outputs were used to strengthen task identity, and although autonomy was emphasized throughout the project, continuous feedback was provided to promote learning motivation and engagement.

PjBL was predominantly designed and implemented within clinical settings, such as pediatric wards, elementary schools, and home environments [14,17,18]. However, several studies adopted hybrid structures that integrated school-based learning with clinical field experiences. For example, Koo et al. [7] utilized not only the NICU but also on-campus skills laboratories and simulation models to complete an educational video project on high-risk newborn care. Similarly, Vasset and Sundal [16] conducted interviews in pediatric wards and subsequently returned to academic settings, where students completed literature reviews with librarian support and finalized research reports in collaboration with faculty members.

PjBL interventions in pediatric nursing education were commonly structured in sequential stages, including preparation, implementation, planning, practice, and reflection, with student reflection consistently identified as a core component [7,14,15,18]. However, only one study employed a cyclical structure in which revised plans were re-applied and re-implemented following reflection [14]. In contrast, 3 studies were limited to a single cycle of project implementation followed by reflection [7,15,18]. Furthermore, 2 studies did not report a formal student reflection process [16,17].

Although project outputs were disseminated to diverse audiences using various methods, formal evaluation of these outputs was reported in only one study. Across the included studies, outputs were shared through presentations [15,16], role-playing activities [15], demonstrations [7,15], and publication in local newspapers [14]. The audiences extended beyond students and faculty to include clinical preceptors [15], school health teachers [17,18], children's parents [18], and community members [14]. However, only one study reported conducting formal evaluations of project outputs [16], whereas the remaining studies either did not evaluate project outcomes or did not describe their evaluation methods [7,14,15,17,18].

3. What Learning Outcomes Can Be Achieved through PjBL in Pediatric Nursing Education?

Learning outcomes were classified into cognitive, affective–attitudinal, and psychomotor domains based on the taxonomy of educational objectives by Bloom et al. [19]. Among the included studies, only one quantitatively measured learning outcomes [7], whereas the remaining studies primarily reported learning outcomes derived from qualitative data.

With respect to cognitive outcomes, PjBL was associated with improvements in pediatric nursing knowledge and critical thinking. Rossman et al. [17] reported that students, while serving as school nurse extenders, developed an understanding of school health nursing roles, disease pathophysiology appropriate to the elementary school level, and children's growth, development, and physical assessment. Pohl et al. [18] found that through home visit experiences, learners gained insights into interactions among family members of children with chronic illnesses, the influence of home environments on children's health and care, and family strengths in adapting to children's illnesses, while also developing nursing care plans and engaging in critical thinking. Woodley et al. [15] reported that PjBL involving the design of age-appropriate play activities was effective in enhancing understanding of child growth and development. They further reported that participants in the project achieved significantly higher scores on growth- and development-related examination items than students who had previously completed the same course. Vasset and Sundal [16] described improvements in learners' critical thinking through the process of analyzing nursing problems and identifying solutions for children with acute, chronic, and critical illnesses, and concluded that PjBL was useful for achieving learning outcomes; however, these outcomes were not directly measured.

In terms of affective–attitudinal outcomes, reductions in practicum-related stress, positive attitudes toward PjBL, and

increased senses of achievement and self-confidence were reported. Koo et al. [7] found that following implementation of a PjBL project involving the production of educational video clips on high-risk newborn care, learners' NICU practicum-related stress significantly decreased. The authors suggested that this reduction may be attributable to the creation of a learning environment that facilitated natural communication and questioning with nurses during the project, as well as the use of a mobile-based video production format that was familiar to students and may have reduced learning burden [7]. Woodley et al. [15] reported that most students perceived PjBL as effective for understanding course content, enhancing confidence, and supporting application of learning to practice.

Learning outcomes related to psychomotor domains were reported to a limited extent. Commendador and Flood [14] reported that nursing students achieved intended performance goals by explaining basic knowledge of blood pressure to elementary school students and demonstrating blood pressure measurement; however, no quantitative analysis was provided regarding the magnitude of improvement in knowledge or skills. Koo et al. [7] reported improvements in competencies related to high-risk newborn care following PjBL implementation. The authors interpreted these changes as being associated with students' clearer recognition of their academic level and achievement goals during the process of producing educational videos for peer learning [7].

4. What Facilitators Support the Implementation of PjBL in Pediatric Nursing Education?

Facilitators identified in studies applying PjBL in pediatric nursing education were categorized into learning motivation, appropriate faculty roles, and the availability of sufficient financial and time resources.

First, learning motivation was identified as a key facilitator of PjBL implementation. Learners' exposure to authentic problem contexts was reported to enhance their motivation for learning. Rossman et al. [17] reported that students' learning motivation was strengthened through direct experiences with elementary school students while serving as school nurse extenders. Pohl et al. [18] stated that through home visits, students encountered children with chronic illnesses and their families and described the experience as learning from children rather than from textbooks. Vasset and Sundal [16] reported that allowing students to select their own project topics and address issues they perceived as important within pediatric nursing contexts increased learning motivation.

Second, faculty roles as facilitators, supporters, and coordinators were identified as critical factors enabling smooth implementation of PjBL and sustained learner engagement (Table 4). Koo et al. [7] provided systematically developed worksheets to guide project implementation and facilitated students' access to spaces and equipment in both the NICU and on-campus skills laboratories. Woodley et al. [15] adjusted project scope to allow students to explore diverse aspects of child growth and development and provided orientations prior to project initiation, enabling early immersion in project

Table 4. Instructor roles and functions in pediatric nursing project-based learning

Role type	Primary role	Specific functions	Example
Facilitator	Facilitates learning and provides overall direction for the learning process	• Guides learning direction • Explains project purpose and procedures • Promotes learner immersion and engagement	Koo et al. [7]: Provided project orientation and worksheets to guide project activities
Supporter	Provides practical and professional support during project implementation	• Provides feedback on data collection, interview design, report writing, and presentations • Connects students with external resources	Vasset and Sundal [16]: Connected students who experienced difficulties in searching recent literature with a librarian
Coordinator	Manages and coordinates project operations and collaborative processes	• Manages schedules and coordinates role allocation • Facilitates communication among students and between students and clinical preceptors • Mediates conflicts within teams	Woodley et al. [15]: Adjusted project scope to ensure inclusion of diverse pediatric patient groups

activities. Vasset and Sundal [16] used an online platform to deliver feedback and coordinate learning directions throughout the project. The authors emphasized that when online platforms are used, structured support is necessary to ensure predictable access to assistance, including clear guidance on resource locations, question-asking procedures, and pathways to additional information [16]. In studies where PjBL was implemented outside the nursing school, such as in hospitals, communities, and home environments, collaboration with on-site professionals provided learners with ongoing support and guidance [7,17,18] (Table 4).

Third, the availability of sufficient financial and time resources was identified as a condition enabling practical project implementation and the production of outputs [7,15,17]. Commendador and Flood [14] notably secured financial support from community organizations by linking PjBL with community-based issues. In the study by Rossman et al. [17], students were able to perform a wide range of activities—including health screening, preventive health services, routine health care, chronic illness management, emergency response, and documentation—while serving as school nurse extenders over an extended period of 10 weeks. However, when sufficient time was not available, PjBL was still implemented efficiently by integrating projects into clinical practicums [7,14,15].

5. What Barriers Hinder the Implementation of PjBL in Pediatric Nursing Education?

The barriers reported in studies applying PjBL in pediatric nursing education were categorized into inefficient project design and limitations in faculty guidance, constraints related to ethical procedures, issues in team dynamics, and limitations associated with financial and time resources.

First, inefficient project design and limitations in faculty guidance were identified as barriers to PjBL implementation. Because PjBL involves multiple stages, including problem definition, data collection, and output production, learners experienced confusion and burden when project components were designed inefficiently or were overly complex, or when faculty guidance did not adequately meet learners' needs. Pohl et al. [18] reported that students experienced difficulties due to the absence of clear guidelines regarding when to contact families for home visits, how long to wait for responses, and how to address communication-related problems. Commendador and Flood [14] noted that the complexity of forms used in the project hindered learners' achievement of learning objectives, and Woodley et al. [15] reported that redundant or repetitive report-writing requirements during project implementation imposed an additional burden on students. Rossman et al. [17] pointed out that, given the nature of a 10-week project requiring sustained student participation, it was difficult for students to receive continuous guidance and support from members of participating institutions. Vasset and Sundal [16] reported as a limitation that students desired substantial guidance from faculty during project implementation and preferred face-to-face guidance over online supervision; however, providing such support sufficiently was challenging.

Second, constraints related to ethical procedures emerged as a significant barrier in projects involving children. Pohl et al. [18] reported that obtaining parental consent required considerable time and effort, reducing students' actual activity time when project durations were limited. Delays in the consent process sometimes necessitated changes in participants or reductions in the scope of activities, which in turn affected output production and overall project completeness.

Third, issues related to team dynamics in team-based learning were identified as additional barriers. Pohl et al. [18] reported that differences in participation levels among team members, imbalances in role allocation, and increased time required for coordinating opinions made project implementation more difficult.

Fourth, constraints related to financial and time resources were reported as barriers to PjBL implementation. Woodley et al. [15] reported that although producing toys was not mandatory in projects involving the design of developmentally appropriate play activities, some students faced limitations in output production due to financial constraints, highlighting the need for institutional support when monetary costs are incurred. Vasset and Sundal [16] reported that, given the complexity of tasks involving interviews with nurses and parents caring for children with acute and chronic illnesses, literature reviews, and final report preparation, a 2-week project period was insufficient. However, the authors also noted that securing sufficient time was challenging when taking learners' overall curricular demands into account [16].

6. Methodological Weaknesses

Several common methodological weaknesses were identi-

fied across the studies included in this integrative review. These weaknesses were categorized into limitations related to study design and sampling, insufficient measurement of learning outcomes and limited outcome validity, lack of transparency in qualitative research procedures, and ambiguity in the PjBL concept.

First, limitations related to study design and sampling were observed across multiple studies. Most studies were conducted at a single institution and relied on convenience sampling, which restricted the generalizability of the findings. The study by Rossman et al. [17] employed a single-case design without a control group, thereby limiting internal validity and precluding verification of changes or effects attributable to PjBL implementation. In the study by Koo et al. [7], random assignment to groups was not performed, raising the possibility of selection bias.

Second, insufficient measurement of learning outcomes and limited outcome validity were identified. In the studies by Rossman et al. [17] and Commendador and Flood [14], project outputs and activity descriptions were reported as performance results; however, no quantitative instruments or analytical strategies were employed to systematically evaluate educational effects. Woodley et al. [15] reported comparisons of examination scores with those of previous cohorts; however, interpretation of these findings was constrained by the absence of detailed information regarding comparison group characteristics, sample size, statistical analysis methods, and specific statistical values. Vasset and Sundal [16] identified the achievement of learning outcomes as a primary research focus, but outcome validity was limited because learning outcomes were not operationally defined and no quantitative or qualitative indicators were provided to assess the level of achievement.

Third, deficiencies were identified in strategies used to ensure transparency and trustworthiness in qualitative research procedures. Pohl et al. [18] and Woodley et al. [15] provided insufficient methodological descriptions of the coding, categorization, and analytical processes used in qualitative data analysis, making it difficult to assess the rigor of result derivation. In particular, the study by Pohl et al. [18] relied on voluntary participation for interviews and surveys, which limited sample representativeness. In addition, although Vasset and Sundal [16] involved researchers who served as both educators and data collectors, reflexivity regarding the researcher–participant relationship was not sufficiently described, and strategies to enhance credibility, such as the use of participant quotations or triangulation, were limited.

DISCUSSION

PjBL was applied in contexts that emphasized the development of complex problem-solving abilities within pediatric nursing settings, rather than focusing solely on the acquisition of discrete knowledge or technical skills [7,14-18]. Because nurses must accurately interpret clinical challenges and resolve them by integrating available resources and situational factors [2], nursing students are required to develop the capacity to adaptively apply theoretical knowledge and nursing skills to clinical practice [23]. To strengthen this application capability, effective instructional strategies are essential. In particular, pediatric nursing practicums require educational approaches that address the limitations of direct patient care arising from the heightened vulnerability of neonates and children to infection and injury [24]. PjBL can function as an effective learning method in this context, as it provides structured opportunities to bridge theory and practice through projects aligned with nursing students' developmental levels and scopes of practice. In other words, the context necessitating PjBL in pediatric nursing is one in which students must acquire diverse and complex pediatric nursing competencies demanded by clinical settings, despite the temporal, spatial, and practical constraints of the educational environment.

Because PjBL is an educational intervention rather than a simple execution of projects, its successful implementation in pediatric nursing requires clear topic selection, systematic design, and careful evaluation of the project process. The PjBL studies analyzed [7,16,17] addressed topics closely related to pediatric nursing competencies, including care for children with acute and chronic illnesses, high-risk neonatal care, and school health nursing. However, PjBL must clearly define not only the problems students are expected to address or the overarching purpose of the project, but also the specific learning objectives to be achieved [25]. Because the ultimate goal of PjBL in pediatric nursing is the enhancement of nursing competencies, project topics should be explicitly aligned with core pediatric nursing competencies to ensure attainment of intended educational outcomes. Furthermore, PjBL must be designed in a systematic, efficient, and ethical manner. In projects involving children, it is particularly important to verify ethical procedures, obtain prior parental consent, and ensure that all project activities are conducted

ethically. Overly complex designs or project operations lacking clear procedural guidance may impede effective implementation of PjBL. PjBL can be flexibly adapted to different contexts by employing field-based designs that include communities, hospitals, and home settings [14,17,18], as well as hybrid designs that integrate nursing colleges with clinical sites [7,16]. Such hybrid designs may serve as effective strategies for preserving educational authenticity while compensating for limitations in clinical accessibility. In addition, for PjBL to be established as a standard teaching method in pediatric nursing, ongoing refinement and improvement through appropriate evaluation are essential. Given that PjBL represents a non-traditional educational approach, deliberate efforts are required to develop diverse and suitable evaluation strategies.

The learning outcomes of PjBL in pediatric nursing can be classified into 3 domains: cognitive, affective-attitudinal, and psychomotor. This study demonstrated that PjBL contributed to the enhancement of pediatric nursing knowledge and critical thinking from a cognitive perspective. Previous research has shown that PjBL supports students' understanding of knowledge and concepts [5], improves academic achievement [26], and promotes critical analysis and problem-solving abilities [27]. In the present review, students not only expanded their knowledge of child growth, development, and pediatric diseases but also strengthened their critical thinking as they identified, analyzed, and sought solutions to pediatric nursing problems. Because real-world clinical issues served as the starting point for project activities, analytical reasoning and judgment were required at each stage of the learning process, which likely contributed to improvements in critical thinking. In addition, with respect to affective and attitudinal domains, pediatric nursing PjBL yielded positive learning outcomes, including reduced clinical practicum-related stress, more positive attitudes toward learning, and enhanced senses of achievement and self-confidence. Although PjBL shares similarities with PBL in its focus on real-world problems, it enables students to experience a greater sense of achievement and self-confidence through the production and completion of tangible project outcomes. These outcomes included written reports [16], toys or play activities [15], educational video clips [7], and health education materials [17]. Although students' performance skills may have improved during the process of producing these outputs, empirical evidence regarding psychomotor learning outcomes remains limited. In particular, only a small number of included studies directly measured psychomotor outcomes, and most inferred performance improvement indirectly. Therefore, conclusions regarding psychomotor outcomes should be interpreted cautiously. Because the ultimate goal of PjBL in pediatric nursing is the development of nursing competencies, future research should more actively measure and analyze learning outcomes related to actual clinical performance.

In this review, the facilitators of PjBL in pediatric nursing included learning motivation, availability of resources, and the role of the instructor. Because solving authentic problems and completing project outputs require competencies that extend beyond students' existing knowledge and skills, PjBL naturally stimulates motivation for further learning. In the included studies, exposure to problem-based environments—such as direct interactions with children and their families—was reported to enhance students' learning motivation [17,18]. Such meaningful learning experiences are often initiated and sustained through the instructor's role, underscoring the importance of instructors' efforts to design strategies that enhance and maintain students' motivation throughout the PjBL process.

Ultimately, the instructor's role is pivotal to the success of PjBL, as instructor guidance directly enables students to achieve the intended learning outcomes. Instructors must present clear project topics and encourage learner-led inquiry within a predefined instructional framework [3]. Whereas the primary activity of PBL involves exploration of problem situations within a flexibly defined structure, PjBL emphasizes project management and the completion of practically applicable outputs [3]. Accordingly, instructors must facilitate learning by providing clear and explicit guidance throughout the project process. In addition, instructors function as supporters by offering feedback and encouragement that assist students' learning processes during PjBL [16], and as coordinators who manage project operations to ensure effective collaboration [15]. Because PjBL is inherently team-based, team composition and role allocation are critical to successful project execution [28]. Although team members collaborate toward shared goals [29], challenges in team dynamics can impede project progress [18]; therefore, instructors must coordinate roles and perspectives while mediating conflicts among team members. In this context, instructors should serve as providers of instructional "scaffolding" by continuously guiding students to remain aligned with project goals, encouraging the application of existing knowledge and skills,

and offering concrete, practical support. Without adequate instructional guidance, learners may experience confusion and unnecessary burden. Future research should examine learning outcomes in relation to specific instructor roles in PjBL and explore strategies to strengthen teaching competencies. In addition, effective programs aimed at enhancing instructors' PjBL-related capabilities should be developed and implemented to support the sustainable integration of PjBL in nursing education.

While PjBL is a pedagogical approach that enables students to develop the complex competencies required for real-world problem solving, its successful implementation depends on the availability of adequate financial and temporal resources. Because insufficient funding and limited time function as barriers to PjBL, it is essential to allocate sufficient instructional time in consideration of both project complexity and the overall curriculum. In other words, the effective operation of PjBL requires not only pedagogical commitment but also robust administrative and financial support, as well as sustained institutional commitment from educational organizations.

The methodological quality of the included studies ranged from low to moderate. Most studies were limited by single-site designs, small sample sizes, and insufficient use of validated outcome measures. Therefore, the findings of this review should be interpreted with caution. Despite these limitations, the included studies consistently reported positive educational outcomes, suggesting the potential effectiveness of PjBL in pediatric nursing education. However, further well-designed studies with rigorous methodologies are needed to strengthen the evidence base.

This study has several limitations, on the basis of which the following recommendations are proposed. First, methodological vulnerabilities were commonly identified among the studies included in this integrative review. Future PjBL research should incorporate core elements of PjBL more rigorously; specifically, quantitative studies should verify effects through randomized group assignment and validated quantitative outcome measures, while qualitative studies should ensure transparency and credibility in their methodological procedures. Second, as an integrative review, this study did not include a meta-analysis to estimate the effect size of PjBL. It is anticipated that future intervention studies developing and testing diverse PjBL models in nursing education will be conducted, followed by meta-analyses to determine the magnitude of PjBL effects in pediatric nursing. Third, this study did not separately examine the application of PjBL in theoretical versus clinical practice courses. Future research is therefore needed to apply PjBL more extensively across nursing curricula and to provide detailed analyses of PjBL content and learning outcomes according to course-specific characteristics.

CONCLUSION

This integrative review examined the implementation and outcomes of PjBL in pediatric nursing education. Synthesis of the 6 included studies suggested that PjBL may yield multifaceted benefits, particularly in cognitive and affective-attitudinal domains, while evidence for psychomotor outcomes was limited. Specifically, PjBL was associated with improvements in pediatric nursing knowledge and critical thinking, reductions in academic stress, and the promotion of positive attitudes toward learning. In addition, although some studies suggested improvements in performance-related skills, empirical evidence for psychomotor outcomes remains insufficient. To maximize the educational impact of PjBL, the role of faculty is critical in guiding students' learning directions, motivating the integration of knowledge and skills, and providing concrete instructional scaffolding throughout the learning process. Accordingly, the successful integration of PjBL into nursing curricula requires sustained institutional support combined with structured and ongoing faculty guidance. However, although the included studies reported positive outcomes, the overall level of evidence ranged from low to moderate. Future research using more rigorous study designs and validated outcome measures is therefore required to establish stronger evidence for the effectiveness of PjBL in pediatric nursing education.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors. Data collection: all authors. 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

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. Bo Ryeong Lee has been an editor of

Child Health Nursing Research since 2024. She was not involved in the review process of this article. No other existing or potential conflict of interest relevant to this article was reported.

Funding

This study was supported by the research fund of Daegu Catholic University in 2024.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

AI use disclosure

No generative AI tools were used for writing.

Supplementary material

Supplement 1. Search strategies for all databases.

ORCID and ResearcherID

Hyun Young Koo https://orcid.org/0000-0001-5848-2143
https://researcherid.com/rid/AHA-3307-2022
Bo Ryeong Lee https://orcid.org/0000-0003-4014-9056
https://researcherid.com/rid/KQV-0491-2024

REFERENCES

1. Kim MY, Kang JS, Kwon YJ, Kwon IS, Kim SH, Kim JS, et al. Child health promotion care. Soomoonsa; 2018.
2. Korean Society of Nursing Science. Learning objectives of subjects for nursing students. Korean Society of Nursing Science; 2017.
3. Brundiers K, Wiek A. Do we teach what we preach?: an international comparison of problem-and project-based learning courses in sustainability. Sustainability. 2013;5(4):1725-1746. https://doi.org/10.3390/su5041725
4. Parra-Anguita L, López-Franco MD, Martínez-Galiano JM, González-Cabrera M, Moreno-Cámara S, Granero-Moya N. Evaluation of the use of project-based learning in the nursing degree. Nurs Rep. 2023;13(4):1648-1657. https://doi.org/10.3390/nursrep13040136
5. Guo P, Saab N, Post LS, Admiraal W. A review of project-based learning in higher education: student outcomes and measures. Int J Educ Res. 2020;102:101586. https://doi.org/10.1016/j.ijer.2020.101586
6. Kaya H, Şenyuva E, Işık B, Bodur G. Nursing students' opinions regarding project based learning. Procedia Soc Behav Sci. 2014;152:379-385. https://doi.org/10.1016/j.sbspro.2014.09.216
7. Koo HY, Gu YE, Lee BR. Development of a project-based learning program on high-risk newborn care for nursing students and its effects: a quasi-experimental study. Int J Environ Res Public Health. 2022;19(9):5249. https://doi.org/10.3390/ijerph19095249
8. Park HY. The effects of team-based project learning on creativity and self-regulated learning ability of university students. J Educ Cult. 2019;25(4):283-297. https://doi.org/10.24159/joec.2019.25.4.283
9. Shin YH, Ryu KS. The study on instructional effect and satisfaction of project-based learning. J Korea Contents Assoc. 2020;20(12):1-12. https://doi.org/10.5392/JKCA.2020.20.12.001
10. Wu TT, Huang YM, Su CY, Chang L, Lu YC. Application and analysis of a mobile e-book system based on project-based learning in community health nursing practice courses. J Educ Technol Soc. 2018;21(4):143-156.
11. Whittemore R, Knafl K. The integrative review: updated methodology. J Adv Nurs. 2005;52(5):546-553. https://doi.org/10.1111/j.1365-2648.2005.03621.x
12. Hong QN, Pluye P, Fàbregues S, Bartlett G, Boardman F, Cargo M. Mixed Methods Appraisal Tool (MMAT), version 2018: user guide [Internet]. Canadian Intellectual Property Office, Industry Canada; 2018 [cited 2025 Aug 20]. Available from: http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/fetch/127916259/MMAT_2018_criteria-manual_2018-08-01_ENG.pdf
13. Joanna Briggs Institute. Critical appraisal tools for use in JBI systematic reviews: checklist for case reports, cohort studies, case control studies, randomized controlled trials, and quasi-experimental studies [Internet]. The Joanna Briggs Institute; 2017 [cited 2025 Aug 18]. Available from: https://jbi.global/critical-appraisal-tools
14. Commendador K, Flood J. Teaching children to be health educators. Am J Nurs. 2016;116(10):64-67. https://doi.org/10.1097/01.NAJ.0000503310.83251.32
15. Woodley LK, Cosgrove B, Stone E, Stanley E, Nance J, De La Grana A. Experiential learning of childhood growth and development through a pediatric play project. Nurs Educ Perspect. 2023;44(4):257-258. https://doi.org/10.1097/01.NEP.0000000000001037
16. Vasset FP, Sundal H. Paediatric nursing: implementation and evaluation of project-based learning in nursing studies. Soc Sci Humanit Open. 2024;10:101022. https://doi.org/10.1016/j.ssaho.2024.101022
17. Rossman CL, Dood FV, Squires DA. Student nurses as school nurse extenders. J Pediatr Nurs. 2012;27(6):734-741. https://doi.org/10.1016/j.pedn.2012.02.005
18. Pohl CJ, Malin S, Kennell L. Reinventing the home visit for undergraduate nursing students. J Nurs Educ. 2014;53(12):696-698.

https://doi.org/10.3928/01484834-20141120-05
19. Bloom BS, Engelhart MD, Furst EJ, Hill WH, Krathwohl DR. Taxonomy of educational objectives: the classification of educational goals. Longman; 1956.
20. Kolb DA. Experiential learning: experience as the source of learning and development. 2nd ed. Pearson Education; 2015.
21. Hackman JR, Oldham GR. The job diagnostic survey: an instrument for the diagnosis of jobs and the evaluation of job redesign projects. Yale University, Department of Administrative Sciences; 1974.
22. Newman IB. Meaning, materiality, and power: an introduction to discourse analysis. Studentlitteratur; 2003.
23. Korean Accreditation Board of Nursing Education (KABONE). The manual of nursing education accreditation for university. KABONE; 2021.
24. Koo HY, Lee BR. Educational needs for practicing neonatal intensive care among Korean nursing students. Child Health Nurs Res. 2021;27(4):339-353. https://doi.org/10.4094/chnr.2021.27.4.339
25. PBLWorks. Gold standard PBL: essential project design elements [Internet]. Buck Institute for Education; 2015 [cited 2025 Aug 18]. Available from: https://www.pblworks.org/what-is-pbl/gold-standard-project-design
26. Chen CH, Yang YC. Revisiting the effects of project-based learning on students' academic achievement: a meta-analysis investigating moderators. Educ Res Rev. 2019;26:71-81. https://doi.org/10.1016/j.edurev.2018.11.001
27. Aley M, Lee R, Wang J, Wang J, Zheng S. Project-based learning and student outcomes in health professions education: a literature review. Health Prof Educ. 2024;10(3):11. https://doi.org/10.55890/2452-3011.1292
28. Aranzabal A, Epelde E, Artetxe M. Team formation on the basis of Belbin's roles to enhance students' performance in project based learning. Educ Chem Eng. 2021;38:22-37. https://doi.org/10.1016/j.ece.2021.09.001
29. Dearnley C, Rhodes C, Roberts P, Williams P, Prenton S. Team based learning in nursing and midwifery higher education; a systematic review of the evidence for change. Nurse Educ Today. 2018;60:75-83. https://doi.org/10.1016/j.nedt.2017.09.012

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):247-259
https://doi.org/10.4094/chnr.2025.044

pISSN 2287-9110
eISSN 2287-9129

CHNR

Factors affecting the performance of standard precautions focusing on the health belief model in South Korea: a cross-sectional study

Yu Jin Son[1], Chae Eun Ahn[2], Yeong Seo Park[3], In Young Cho[4,5]

[1]Registered Nurse, Department of Nursing, Seoul National University Bundang Hospital, Seongnam, Korea
[2]School Health Teacher, Gwangju Girls' High School, Gwangju, Korea
[3]Registered Nurse, Department of Nursing, Samsung Medical Center, Seoul, Korea
[4]Associate Professor, College of Nursing, Chonnam National University, Gwangju, Korea
[5]Associate Professor, Research Institute of Nursing Science, Chonnam National University, Gwangju, Korea

Corresponding author
In Young Cho
College of Nursing, Chonnam National University, 160 Baekseo-ro, Dong-gu, Gwangju 61469, Korea
Tel: +82-62-530-4947
Fax: +82-62-220-4544
E-mail: kikiin1024@jnu.ac.kr

Received: October 1, 2025
Revised: January 29, 2026
Accepted: March 3, 2026

Purpose: This study aimed to examine the factors affecting the performance of standard precautions among third- and fourth-year nursing students. Focusing on the health belief model, it included individual factors such as knowledge of standard precautions, health beliefs, and self-efficacy, along with patient safety culture factor—conceptualized as an environmental factor of the performance of standard precautions.
Methods: This study included 160 third- and fourth-year nursing students in South Korea. Participants completed self-report questionnaires assessing factors influencing the performance of standard precautions during clinical practice.
Results: The hierarchical multiple regression analysis revealed that self-efficacy (β=.58, p<.001), experience with healthcare-associated infections (HAIs) (β=–.15, p=.01), age (β=.12, p=.02), and knowledge of standard precautions (β=.14, p=.04) were significant predictors of the performance of standard precautions. Explanatory power of the model was 64.7%.
Conclusion: To enhance the performance of standard precautions among third- and fourth-year nursing students, ongoing education and strategies to improve their self-efficacy for health behaviors are essential. Tailored programs should be developed to prevent HAIs based on the specific self-efficacy levels of these students.

Keywords: Health belief model; Knowledge; Nursing; Self-efficacy; Universal precaution

INTRODUCTION

According to the United states (US) Centers for Disease Control and Prevention, major healthcare-associated infections (HAIs), such as central line-associated bloodstream infections, catheter-associated urinary tract infections, and ventilator-associated events, increased during the coronavirus disease 2019 (COVID-19), with reported increases ranging from approximately 19% to 47% in 2021 compared with 2019 [1]. An HAI is an infection acquired during hospitalization that was not present upon admission. HAIs occur in 5%–10% of hospitalized patients, affecting both patients and healthcare workers. HAIs during medical procedures prolong recovery and increase healthcare costs owing to extended hospital stays, organ damage, and higher mortality rates [1,2].

The prevention and management of HAIs have become increasingly crucial owing to the rising number of elderly patients, immunocompromised individuals, and those at higher infection risk. Previous study has shown that following performance of standard precautions can reduce HAIs [1,2]. Preventive measures, including hand hygiene, aseptic practices, environmental management, and staff infection prevention

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

are vital, with adherence to standard precautions crucial for reducing HAIs [2,3].

Within this context, nurses play a pivotal role, as they constitute the largest segment of the healthcare workforce and are in frequent direct contact with patients. They are particularly vulnerable to infection because of their direct contact with patients and performance of various invasive procedures. Therefore, regular education and training on these precautions are recommended for healthcare workers, patients, visitors, and nursing students [4].

In accordance with the Korean Accreditation Board of Nursing Education [5], future nurses (i.e., nursing students) must complete over 22 credits of clinical practice during their undergraduate curriculum. During clinical practice, they interact with patients with various diseases, similar to practicing nurses. However, nursing students often lack familiarity with clinical situations, increasing their susceptibility to infections due to inexperience, inadequate practice transfer, and personal anxiety, leading to significant challenges in implementation. Jeong [6] found that 71.5% of nursing students are exposed to infections, 41.7% experience needlestick injuries, 9.4% are injured by sharp instruments, and 58.9% come in direct contact with blood or body fluids. These findings underscore the significant occupational risks nursing students face due to their limited expertise and experience.

Therefore, nursing students must practice standard precautions to protect themselves and prevent the transmission of infections to patients. As key personnel in clinical patient care after graduation, prospective nurses should develop competency in performance of standard precautions for HAIs even before performing clinical practice [7].

To explain the performance of standard precautions, the health belief model (HBM) can be applicable to promote infection-control behaviors in nursing students and help prevent infections during clinical practice. Developed by American social psychologists in the 1950s, the model serves as a framework for predicting and explaining health-related behaviors [8]. It posits that individuals develop behaviors when they believe those behaviors can prevent or reduce the risk of diseases. The original HBM included perceived susceptibility, perceived severity, perceived benefits, and perceived barriers; and self-efficacy was added later [8]. Therefore, a theory-based approach is essential to understand and improve adherence to standard precautions. The HBM can provide a powerful framework for explaining infection control behaviors by emphasizing perceived vulnerability, perceived severity, perceived benefits, perceived barriers, and self-efficacy.

This study indicates that individual factors, including beliefs about health and self-efficacy, can enhance the performance of standard precautions among third- and fourth-year nursing students. In addition, as a modifying factor, knowledge of standard precautions refers to awareness of the Centers for Disease Control and Prevention (CDC) guidelines for standard care [9]. Although some studies have found no significant effect of such knowledge on performance of standard precautions [7], more recent research has reported a significant positive correlation [3]. Therefore, it is necessary to investigate whether nursing students' knowledge of standard precautions influences their actual practice of those precautions.

For individual beliefs, health beliefs influence the performance of standard precautions. Healthcare professionals widely use these beliefs to predict and explain specific behaviors derived from health beliefs. According to the HBM, higher perceived susceptibility (risk of contracting a disease), higher perceived severity (seriousness of the condition), higher perceived benefits (advantages of the behavior), and lower perceived barriers (obstacles to the behavior) increase the likelihood of engaging in recommended health behaviors when appropriate cues to action are present [10]. Empirical studies have demonstrated positive correlations between the performance of standard precautions and perceived susceptibility, severity, and benefits, and a negative correlation with perceived barriers [4]. Thus, health beliefs may play a crucial role in shaping nursing students' adherence to standard precautions.

Self-efficacy, which was added to the HBM in 1988, is defined as an individual's confidence in their ability to perform a specific behavior successfully [8]. Successful or unsuccessful experiences with a given behavior influence self-efficacy; higher self-efficacy leads to positive coping behaviors and better performance of challenging tasks [11]. Health beliefs and self-efficacy influence motivation to adopt health behaviors and the probability of taking action. Self-efficacy plays a crucial role in facilitating and sustaining achievement, potentially influencing behavior change more significantly than the other 4 variables in the HBM [11]. Previous studies have reported a significant positive correlation between nursing students' self-efficacy and the performance of standard precautions [4]. Therefore, self-efficacy is an important predictor of nursing students' implementation of standard precautions during clinical practice.

In addition to individual factors, patient safety culture is an environmental factor, which encompasses the collective values, attitudes, perceptions, abilities, and behaviors that determine an organization's commitment to patient safety [12]. An organization that values safety fosters individuals' motivation to engage in safety behaviors, thereby enhancing infection-prevention activities. The clinical practice environment also influences nursing students' performance of standard precautions [3]. Additionally, a hospital's patient safety culture affects nurses' safety behaviors, leading to better adherence to standard precautions [13].

Individual factors such as knowledge, self-efficacy, nursing professionalism have been studied as variables affecting nursing students' performance of standard precautions [3,7]. Furthermore, recent research suggests that environmental influences, particularly the patient safety culture within clinical settings, significantly influence safety-related behaviors. However, research on environmental factors—particularly the relationship between patient safety culture and performance of standard precautions grounded in the HBM—remains limited. Moreover, earlier research, especially concerning the influence of knowledge, shows inconsistencies, indicating that individual cognition by itself cannot completely account for preventive behaviors [3,7,14].

A comprehensive study that integrates individual factors and environmental influences based on the HBM is essential to identify the mechanisms by which nursing students implement standard preventive measures and to provide information necessary for developing effective educational and organizational interventions to prevent HAIs. Therefore, this study aimed to identify the factors affecting nursing students' performance of standard precautions, focusing on HBM, thereby providing foundational data for developing a standard precaution program to prevent HAIs.

1. Research Questions

- What differences exist in nursing students' performance of standard precautions across their general characteristics?
- What is the level of nursing students' performance of standard precautions during clinical practicum?
- What are the relationships between nursing students' performance of standard precautions and knowledge of standard precautions, health beliefs, self-efficacy, and patient safety culture?
- Which individual and environmental factors significantly affect performance of standard precautions among nursing students during clinical practicum?

2. Conceptual Framework

Drawing upon the HBM and a comprehensive literature review, we established a conceptual framework to identify the individual and environmental factors affecting the performance of standard precautions during clinical practice among third- and fourth-year nursing students. We constructed a conceptual framework that includes individual factors, such as modifying factors and personal belief factors, which influence an individual's standard-based performance behavior, as well as environmental factors including patient safety culture.

Modifying factors, including individual knowledge of standard precautions, were conceptualized as variables that influence health behavior by shaping individuals' perceptions within the HBM. Individual belief factors, such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action, which are the core components of the model, were categorized as individual factors influencing health behaviors [8]. In addition, patient safety culture within hospitals was identified as an environmental factor affecting the performance of standard precautions based on insights from prior studies [3,13]. Patient safety culture, which reflects organizational norms and practices regarding safety, was included as an external determinant of health behavior in the modified HBM. The resulting conceptual framework, based on the HBM, is depicted in Figure 1.

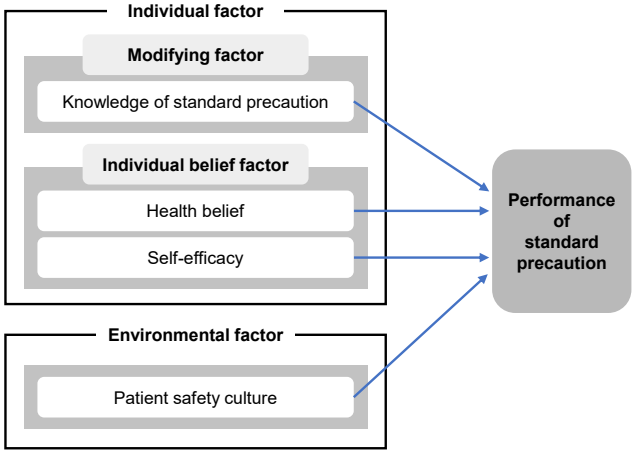

Figure 1. Conceptual framework.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Chonnam National University in South Korea (IRB No. 1040198-240529-HR-087-02). All procedures involving human participants followed ethical standards established by the institutional and national research committee following the 1964 Helsinki Declaration and its amendments. Informed consent was obtained from all participants.

1. Study Design

This cross-sectional study identified factors affecting the performance of standard precautions during clinical practicum in third- and fourth-year nursing students. Reporting followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [15].

2. Participants

The study population comprised third- and fourth-year nursing students in South Korea. Inclusion criteria were as follows: (1) students who understood the purpose of the study and completed the questionnaire and (2) students who had clinical practice experience in the nursing curriculum. Participants who confirmed understanding of the study voluntarily agreed to participate.

We used the G Power ver. 3.1.9.7 program to calculate the minimum required sample size [16]. Based on the 13 predictor variables, a significance level of .05, a medium effect size of .15 and a power of .80 for regression analysis, the minimum required number of participants was estimated to be 135. We distributed questionnaires to 161 students via online platform (Google Forms; Google LLC), accounting for an anticipated 15% dropout rate. After excluding one incomplete response, our final sample included 160 participants.

3. Measurement Tools

1) Knowledge of standard precautions

To assess students' knowledge of standard precautions, we employed a measurement tool developed by Cho [17] and subsequently modified by Suh and Oh [18] and Baek [19]. It consists of 29 items across 7 areas (conception of standard precautions, hand hygiene, personal protective equipment (PPE), care of the environment, safe injection practices, respiratory etiquette, and patient placement) with possible responses of "yes," "no," or "unknown." "Yes" is given 1 point, and "no" or "unknown" is given 0 points; the maximum possible score is 29. Measurements include items such as "Gown should be worn when blood or body fluids are likely to contaminate skin and clothing." Lee et al. [20] used the version employed by Baek [19] and reported a Kuder-Richardson formula 20 of 0.81, whereas it was 0.90 in the present study.

2) Health belief

We employed the Health Belief Scale developed by Erkin and Özsoy [21] and subsequently modified by Kim and Cha [22] and Rhew [23] to align with standard precautions guidelines. This tool comprises 29 items across 5 domains (perceived susceptibility, perceived benefits, perceived severity, perceived barriers, and cues to action). This measurement is a 5-point Likert scale, ranging from 1 (not at all) to 5 (very much). Sample items include statements such as "I can be exposed to HAIs at any time." A higher score reflects a stronger health belief. Rhew [23] calculated a Cronbach's α of .81, whereas in this study, it was .73.

3) Self-efficacy

We used the Self-Efficacy Scale developed by Sherer et al. [24] and subsequently modified by Jung [25]. This tool is composed of 17 items encompassing 5 areas (conviction, achievement, putting into practice, effort-making, and ordeal). Each item was rated on a 5-point Likert scale, ranging from 1 (not at all) to 5 (very much). The scale includes items such as "When I plan something, I am confident that I can do it." A higher score indicates greater self-efficacy. Jung [25] found Cronbach's α to be .86; it was .94 in this study.

4) Patient safety culture

To assess nursing students' awareness of patient safety culture, we used a tool based on the Hospital Survey on Patient Safety Culture developed by the Agency for Healthcare Research and Quality in 2004. This survey was translated by Kim et al. [26] and revised by Han [27] and Yoo et al. [12]. The tool comprises 39 items across several areas: hospital/ward practice environment, manager, communication and procedures, and hospital area. Each item was rated on a 5-point Likert scale, ranging from 1 (not at all) to 5 (very much). Sample items include statements such as "The ward has enough staff to handle the assigned workload." A higher

score indicates a greater awareness of patient safety culture. Yoo et al. [12] reported Cronbach's α as .86, whereas it was .70 in this study.

5) Performance of standard precautions

We employed a tool based on the CDC standard precautions guidelines revised in 2007. This instrument was translated into Korean by Jeong [28] and modified by Hong et al. [29]. The tool is composed of 36 items measured on a 5-point Likert scale, ranging from 1 (not at all) to 5 (very much). The scale includes items such as "If there are visible contaminants such as blood or body fluids, I wash my hands with soap and water." A higher score indicates better adherence to standard precautions. Hong et al. [29] determined a Cronbach's α of .95; herein, it was .97.

4. Data Collection

Data collection occurred between July and August 2024. Data were collected online after obtaining permission from the administrators of a nationwide nursing student community and its social networking platform. Subsequently, participation announcement and online survey, which included an explanation and consent form was posted. Furthermore, participants received a brochure describing the study's objectives, methods, provisions for confidentiality and anonymity, the voluntary nature of participation and right to withdraw, as well as the risks and benefits of participation. Only those who voluntarily signed the written consent form completed a 15-minute online self-report questionnaire. Participants were offered a small present as a token of appreciation.

5. Data Analyses

The data was analyzed using IBM SPSS Statistics ver. 29.0 (IBM Corp., Armonk, NY, USA). The level of statistical significance was set at .05. We identified differences in the performance of standard precautions based on the general characteristics using independent t-tests and one-way analysis of variance. Additionally, we explored correlations among main variables using Pearson's correlation coefficient. Hierarchical regression analysis was conducted to identify factors affecting nursing students' performance of standard precautions based on theoretical considerations. Before hierarchical regression analysis, assumptions of normality, homoscedasticity, and multicollinearity were examined. In Model 1, general characteristics that showed significant differences in the univariate analyses were entered. In Model 2, individual factors among the main independent variables were added to examine their effects on the dependent variable. Finally, in Model 3, environmental factors were additionally entered to assess their incremental explanatory power.

RESULTS

1. Performance of Standard Precautions according to General Characteristics

Table 1 presents the general characteristics of participants. The average age of the nursing students was 23.2 years (standard deviation=2.6), with the majority (n=147; 91.9%) being women. Among them, 89 (55.6%) attended nursing colleges in Seoul or the metropolitan area. There were 88 (55.0%) participants in their fourth year and 72 (45.0%) in their third year. Overall, 99 participants (61.8%) were satisfied with their major. The most frequently reported clinical practice setting was university hospital (137 of 197 responses, 69.5%), followed by general hospitals (47 of 197 responses, 23.9%) and clinics (13 of 197 responses, 6.6%). The most common clinical practice duration was between 6 and 12 weeks (n=68, 42.5%). Almost all participants (n=151; 94.4%) had received education on standard precautions (Table 1).

We observed significant differences in nursing students' performance of standard precautions based on participants' age ($F=3.39$, $p=.036$), school year ($t=3.44$, $p<.001$), satisfaction with their major area of study ($F=15.55$, $p<.001$), clinical practice period ($F=5.19$, $p=.002$), and experience of HAI ($F=17.23$, $p<.001$). Participants satisfied with their major, those with 18 weeks or more of clinical practice, and those without HAI experience demonstrated higher adherence to standard precautions. However, no significant differences were observed for other characteristics (Table 1).

2. Descriptive Statistics for Measured Variables

Participants' performance level in adhering to standard precautions was 3.98±0.95 (5-point Likert scale). Their health-beliefs scores averaged 3.46±0.36, whereas self-efficacy and patient safety culture were rated at 4.17±0.68 and 3.24±0.32, respectively (5-point Likert scale) (Table 2).

Knowledge of standard precautions was 22.44±5.80, with "yes" responses assigned 1 point and "no" or "unknown" re-

Table 1. Performance of standard precautions according to general characteristics (N=160)

Characteristic	No. (%)	Mean±SD	t/F	*p*
Age (yr)		23.23±2.58		
Age group (yr)			3.39	.036
20–22	76 (47.5)	4.07±0.80		
23–24	53 (33.1)	4.09±0.99		
≥25	31 (19.4)	3.60±1.14		
Sex			1.01	.316
Female	147 (91.9)	3.96±0.97		
Male	13 (8.1)	4.24±0.68		
Nursing college area			1.05	.372
Seoul/metropolitan area	89 (55.6)	3.89±1.05		
Hoseo/Gwandong Province	14 (8.8)	4.28±0.62		
Yeungnam Province	11 (6.9)	4.26±0.59		
Honam/Jeju Province	46 (28.7)	4.00±0.89		
School year			3.44	<.001
Third year	72 (45.0)	3.70±1.04		
Fourth year	88 (55.0)	4.21±0.80		
Satisfaction with major			15.55	<.001
Satisfied[a]	99 (61.8)	4.28±0.72		a>b, a>c
Neutral[b]	51 (31.9)	3.54±1.07		
Dissatisfied[c]	10 (6.3)	3.28±1.10		
Clinical practice period (wk)			5.19	.002
<6[a]	9 (5.6)	3.52±0.71		c<d
6–11[b]	68 (42.5)	3.87±0.98		
12–17[c]	35 (21.9)	3.76±1.09		
≥18[d]	48 (30.0)	4.40±0.66		
Type of hospital[a)]			0.77	.482
University hospital	137 (69.5)	4.02±0.98		
General hospital	47 (23.9)	3.81±0.78		
Clinic	13 (6.6)	3.46±0.53		
Experience in standard precautions education			0.39	.533
Yes	151 (94.4)	4.01±0.95		
No	9 (5.6)	3.60±0.81		
HAI experience			17.23	<.001
Indirect experience[a]	75 (46.9)	3.80±0.97		a<c, b<c
Direct experience[b]	21 (13.1)	3.30±1.02		
No experience[c]	64 (40.0)	4.44±0.66		

HAI, healthcare-associated infection; SD, standard deviation.
[a)]Multiple response item.

sponses assigned 0 points (maximum possible score=29). The average correct-response rate among participants was 77.4%. The items with the highest correct-response rate (90.6%) were: "Gown should be worn when blood or body fluids are likely to contaminate skin and clothing," and "Be careful not to contaminate clothing, skin, or mucous membranes with contaminated linens, and care should be taken not to contaminate other items." The items with the lowest correct-response rates were: "Personal protective equipment (gloves, gowns, etc.) should always be worn during work" (41.3%) and "After the patient has been treated, perform hand hygiene before removing the gown before leaving the room", "Disposable or reusable gloves may be used when cleaning the environment and medical equipment" (42.5%), as presented in Supplement 1.

Table 2. Descriptive statistics for measured variables (N=160)

Variable	Mean±SD
Knowledge of standard precautions	22.44±5.80
Health beliefs	3.46±0.36
Self-efficacy	4.17±0.68
Patient safety culture	3.24±0.32
Performance of standard precautions	3.98±0.95

SD, standard deviation.

3. Correlation between Performance of Standard Precautions and Related Factors

A positive correlation was found between the performance of standard precautions and self-efficacy (r = .78, p < .001) and knowledge of standard precautions (r = .62, p < .001), health beliefs (r = .42, p < .001) and patient safety culture (r = .26, p < .001). In addition, age was not significantly correlated with performance of standard precautions (r = –.04, p = .631) as presented in Table 3.

4. Factors Affecting Performance of Standard Precautions during Clinical Practice in Third- and Fourth-Year Nursing Students

Using hierarchical multiple regression analysis, we found that nursing students' knowledge of standard precautions and self-efficacy significantly influenced their performance of standard precautions after controlling for general characteristics. After univariate analysis, we conducted multiple regression using variables that showed a significant relationship with performance (p < .05) as independent variables. We examined multicollinearity and residual independence in the regression model; no predictor correlation coefficients exceeded .80.

The regression model (Model 1), which included age, school year, satisfaction with major area of study, clinical practice period, and experience of HAI, was statistically significant (F = 8.61, p < .001) and explained 30.1% of the variance in performance (adjusted R^2 = .301). According to Model 1, high satisfaction with major (β = .37, p = .013), indirect (β = –.29, p < .001), and direct HAI (β = –.31, p < .001) experience was a significant predictor. The tolerance values for Model 1 ranged from .21 to .91, and the variance inflation factor (VIF) ranged from 1.10 to 5.03 (Table 4).

Model 2 introduced individual variables of this study, including knowledge of standard precautions, health beliefs, and self-efficacy. Model 3 added the environmental variable (patient safety culture) to the previous main variables. The tolerance values for Model 3 ranged from .19 to .88, and the VIF values ranged from 1.10 to 5.24. Additionally, no evidence of multicollinearity was noted, and the residuals met assumptions of normality and homoscedasticity.

After verifying the basic assumptions of the error term, the Durbin-Watson statistic indicated no autocorrelation (value = 2.107). The tolerance values for multicollinearity were ≥ .10, and the VIF values were less than 10.0 for both models. The residuals also satisfied the assumptions of normality and homoscedasticity. Influence was interpreted using the standardized coefficients. Model 3 showed that the following variables exhibited the strongest influence on performance, in descending order of effect: self-efficacy (β = .58, p < .001), experience with HAI (β = –.15, p = .008), age (β = .12, p = .019), and knowledge of standard precautions (β = .14, p = .043). The model's explanatory power was 64.7% (adjusted R^2 = .647, F = 23.42, p < .001) (Table 4).

DISCUSSION

We analyzed factors affecting the performance of standard precautions of nursing students applying the HBM as a conceptual framework. This study analyzed factors influencing nursing students' performance of standard precaution using the HBM as a theoretical framework. The results showed that the performance of standard precaution knowledge and self-efficacy significantly influenced the performance, while health beliefs and patient safety culture did not directly influence the performance. However, from the perspective of the HBM, health beliefs such as perceived susceptibility, severity, benefits, and barriers do not directly predict health behav-

Table 3. Correlations among measured variables (N=160)

	Performance of standard precautions	Knowledge of standard precautions	Health beliefs	Self-efficacy	Patient safety culture	Age
Performance of standard precautions	1					
Knowledge of standard precautions	.62 (< .001)	1				
Health beliefs	.42 (< .001)	.47 (< .001)	1			
Self-efficacy	.78 (< .001)	.69 (< .001)	.46 (< .001)	1		
Patient safety culture	.26 (< .001)	.18 (.024)	.49 (< .001)	.26 (< .001)	1	
Age	–.04 (.631)	–.18 (.022)	–.14 (.089)	–.21 (.009)	–.12 (.145)	1

Values are presented as r (p).

Table 4. Summary of hierarchical multiple regression analysis (N=160)

Variable	Model I					Model II					Model III				
	B	SE	β	t	*p*	B	SE	β	t	*p*	B	SE	β	t	*p*
(Constant)	3.91	0.65		5.99	< .001	−1.82	0.72		−2.54	.012	−2.12	0.77		−2.85	.005
Age	0.01	0.03	.03	0.41	.682	0.04	0.02	.12	2.31	.022	0.04	0.02	.12	2.37	.019
School year	−0.31	0.17	−.16	−1.86	.065	−0.15	0.12	−.08	−1.27	.205	−0.14	0.12	−.07	−1.19	.237
Satisfaction with major[a]															
Satisfied	0.73	0.29	.37	2.51	.013	0.28	0.21	.14	1.32	.188	0.25	0.21	.13	1.18	.242
Neutral	0.17	0.29	.08	0.59	.558	0.13	0.21	.07	0.64	.523	0.12	0.21	.06	0.56	.579
Clinical practice period (wk)[b]															
< 6	−0.21	0.20	−.09	−1.05	.296	0.01	0.14	.04	0.69	.491	0.12	0.14	.05	0.81	.422
6–11	−0.25	0.19	−.13	−1.31	.191	0.05	0.14	.03	0.36	.717	0.02	0.14	.01	0.17	.869
12–17	−0.29	0.32	−.07	−0.90	.367	−0.16	0.23	−.04	−0.67	.506	−0.18	0.23	−.04	−0.78	.436
HAI experience[c]															
Indirect experience	−0.54	0.14	−.29	−3.95	< .001	−0.26	0.10	−.14	−2.57	.011	−0.28	0.10	−.15	−2.70	.008
Direct experience	−0.87	0.23	−.31	−3.85	< .001	−0.12	0.17	−.04	−0.70	.488	−0.16	0.18	−.06	−0.89	.374
Knowledge						0.02	0.01	.14	1.96	.052	0.02	0.01	.14	2.05	.043
Health belief						0.25	0.15	.09	1.65	.101	0.16	0.16	.06	0.95	.345
Self-efficacy						0.82	0.10	.59	7.86	< .001	0.81	0.10	.58	7.73	< .001
Patient safety culture											0.23	0.17	.08	1.32	.190
R^2	.341					.672					.676				
Adjusted R^2	.307 (F = 8.61, *p* < .001)					.645 (F = 25.10, *p* < .001)					.647 (F = 23.42, *p* < .001)				

HAI, healthcare-associated infection; SE, standard error.
[a]Dummy variable: Reference=dissatisfied. [b]Dummy variable: Reference = ≥18 weeks. [c]Dummy variable: Reference=no experience.

iors, but rather shape motivational readiness to perform the behavior [10]. Furthermore, organizational environmental factors, such as patient safety culture, may act as modifiers, influencing health belief formation and the perception of the likelihood of performing behaviors, rather than directly influencing individual health behaviors.

The mean performance score for standard precautions among participants was 3.98±0.95 out of 5, lower than the scores of 4.19 reported by Kang et al. [30]. The study by Kang et al. [30] included both nursing students and nurses, whereas this study involved nursing students with clinical practice experience. These differences in inclusion criteria may explain the discrepancy. Additionally, Kim and Kim [13] found that nurses had higher performance scores of 4.47. Nursing students' lower scores are understandable due to their limited familiarity and experience with standard precautions. Infection control education must be provided prior to clinical practice, along with simulation-based training that covers diverse clinical scenarios.

To improve nursing students' performance of standard precautions, we need an approach that goes beyond knowledge transfer and strengthens their self-efficacy for actual practice. Therefore, scenario-based simulations and repetitive practice reflecting the procedural nature of performance of standard precautions should be used to provide successful experiences. Furthermore, the practical application of knowledge should be enhanced by ensuring a clear understanding of the application criteria for performance of standard precautions and their transmission pathways.

This study found that the mean knowledge score for standard precautions was 22.44±5.80 out of 29, indicating a 77.4% correct-response rate. This score is lower than those reported in previous studies by Baek [19]. This result suggests that nursing students have had fewer opportunities to gain knowledge about performance of standard precautions compared to nurses with diverse experience in clinical settings.

The highest correct-response rate (90.6%) was seen for the questions: "Be careful not to contaminate clothing, skin, or mucous membranes with contaminated linens, and care should be taken not to contaminate other items" and "A gown should be worn when blood or body fluids are likely to contaminate skin and clothing." The lowest correct-re-

sponse rate (41.3%) was seen for the question: "Personal protective equipment (gloves, gowns, etc.) should always be worn during work." These findings indicate a gap in understanding the difference between route-specific and standard precautions. Therefore, future nursing curricula should integrate theory-based instruction with experiential learning strategies that explicitly address the situational application of PPE to enhance students' understanding of infection prevention principles and promote safe, evidence-based clinical practice.

Performance of standard precautions varied significantly based on satisfaction with their major, clinical practice duration, school year, age, and experience with HAI. This aligns with the studies by Hwang and Lim [31], which reported that higher satisfaction during clinical practice correlated with better adherence to standard precautions. It is hypothesized that satisfaction with their major helps nursing students focus on coursework, ultimately enhancing their performance in clinical training. Additionally, Lee and Yang [32] indicated that confidence in basic nursing skills with scenario-based simulation training boosts satisfaction with their major, leading to better adherence to safety protocols.

Moreover, the performance of standard precautions improved with longer clinical practice periods, with students who practiced for 18 weeks or more performing best. This finding is similar to the findings reported by Lee [33], which can be inferred that prolonged exposure to clinical practice experiences may influence students' adherence to standard precautions for infection control. Therefore, continuous education on infection control before clinical practice each semester, along with the accumulation of experience in core basic nursing skills as their grade level increases, may have influenced their performance of standard precautions.

In this study, self-efficacy and knowledge of standard precautions, age, and experience with HAI were identified as key factors influencing performance, with an explanatory power of 64.7%. Self-efficacy had the strongest effect on third- and fourth-year nursing students' adherence to standard precautions. This supports the findings of Jang et al. [4] and Park and Byun [11]. Nursing students' self-efficacy can significantly affect their motivation and likelihood of performing standard precautions [11]. Self-efficacy is not simply an attitude or perception but rather a crucial factor that enables actual behavioral execution. While health beliefs provide cognitive judgments about "Why something should be done," self-efficacy provides behavioral confidence about "Whether it can actually be done." These results support the HBM [8].

Third- and fourth-year nursing students experience situations through clinical practice where the performance of standard precautions by nurses and other nursing students is necessary. These experiences have allowed third- and fourth-year students to gain successes and failures in performing standard precautions, potentially impacting their self-efficacy and adherence to these practices [11]. As nursing students gain confidence in performing standard precautions independently based on these experiences, improving nursing students' self-efficacy is essential for enhancing their performance of standard precautions.

Accordingly, observing clinical nurses or upper-level students performing standard precautions can help students recognize this behavior as a feasible nursing competency. In addition, specific and positive feedback from instructors and clinical supervisors can clarify performance and enhance confidence. An emotionally safe learning environment and debriefing can alleviate performance anxiety and sustain self-efficacy. Additionally, developing various infection scenario-based simulation exercises related to infection control is essential for improving the self-efficacy of nursing students, who represent the future nursing workforce.

HAI with indirect experience was also found to be a factor influencing the performance of standard precautions. In other words, hospital-related indirect experience negatively affected the performance of standard precautions suggests that learning effects in clinical settings may be difficult to achieve through indirect exposure alone. In simpler terms, watching others go through infection experiences might cause students to view infection control situations as easier than they really are or to downplay the risks, which can result in a lack of compliance with standard practices. For nursing students, indirect experiences such as news reports, cases of infection in others, or witnessing HAIs during clinical practice, rather than direct management or control of HAIs, may lead to an excessive recognition of the severity of the infection, which may increase anxiety or fear. It is necessary to educationally reconstruct this indirect experience to enhance self-efficacy and a sense of control. Therefore, infection control education should incorporate simulation training or hands-on approaches that prepare students to effectively handle infections in real-world scenarios.

In addition, nursing students' knowledge of standard precautions was also an influential factor in their performance of

standard precautions. This outcome supports the findings of previous studies by Ayele et al. [3]. However, it contradicts the findings reported by Jang et al. [4]. Continuous education is necessary, especially in relation to the hospital care environment, as nursing students' knowledge of standard precautions leads to improved performance. Therefore, it is important for nursing students to acquire sufficient knowledge on infection prevention measures and standard precautions through basic nursing and nursing management before going to clinical practice. Rather than directly inducing health behaviors, knowledge of standard precautions can act as a modifying factor that shapes awareness of the need for infection prevention, thereby strengthening beliefs about the possibility of performing the behaviors, which can then lead to actual performance through self-efficacy.

However, health beliefs did not affect third- and fourth-year nursing students' performance of standard precautions. While health beliefs mainly reflect an individual's cognitive factors regarding the risk of infection, the performance of standard precautions is a procedural and behavioral practice area that requires situational judgment, skill performance, and repetitive application, and it may be difficult to directly translate simple perceptions or attitudes into actual clinical practice [3,8]. These results indicate that health beliefs likely influence performance of standard precautions indirectly through self-efficacy or actual performance ability.

Meanwhile, previous studies by Ahn [7] found health beliefs to be a significant factor. Nurses may be more aware of HAIs' severity in clinical settings than nursing students. To improve nursing students' adherence to standard practices, it is necessary to go beyond simply promoting health beliefs through education. Instead, we should implement practical experiences, and positive role models to create a solid educational and environmental foundation that transforms health beliefs into actual practice. In the HBM, health beliefs are viewed as cognitive factors that shape motivational readiness to perform a behavior, rather than directly predicting behavior. Further research is required to assess if health beliefs influence performance via self-efficacy or cues to action.

Patient safety culture did not influence nursing students' performance of standard precautions. This finding contrasts with those reported by Kim and Kim [13], who found that patient safety culture was significantly associated with nursing students' performance of standard precautions. Few studies have examined patient safety culture among third- and fourth-year nursing students, making comparisons difficult. The finding that patient safety culture did not independently influence standard precautions in this study can be interpreted as suggesting that environmental factors may influence behavioral performance through cognitive or motivational processes rather than directly affecting health behaviors.

Patient safety culture refers to the values, beliefs, and behavioral norms regarding patient safety shared by organizational members and is considered an important environmental factor promoting safe nursing practice in clinical settings [12,13,26]. In particular, nursing students have limited direct decision-making authority and responsibility for independent nursing practice within the clinical practice environment, making it difficult for their perception of the organization's patient safety culture to immediately translate into actual standard precautions. Furthermore, because nursing students often engage in observation-based learning within a limited role scope during clinical practice, their perception of organizational safety culture may remain at a cognitive level, such as assessing individual performance potential or building confidence, rather than influencing individual performance behavior.

Therefore, infection control education for nursing students should go beyond simply conveying awareness of organizational patient safety culture. It is necessary to provide an environment where students can actually practice safety-related behaviors through experiential learning opportunities, such as simulation-based training or role-based practice. This educational approach can contribute to linking patient safety awareness to action. Furthermore, further research is needed to more clearly elucidate the relationship between patient safety culture and cognitive or behavioral factors in the performance of standard precautions by nursing students. The results of this study suggest that cognitive awareness of the need for infection control and organizational environmental factors may indirectly influence performance behaviors through self-efficacy, rather than directly affecting performance of standard precautions.

In light of the study's limitations, we propose the following recommendations to enhance third- and fourth-year nursing students' adherence to standard precautions during clinical practice. First, the measure of standard-precaution performance in this study was based on a self-report survey, which involves subjectivity and may differ from actual performance. Self-reported surveys are inherently susceptible to response bias. Future research should include larger samples

and conduct long-term surveys across multiple research sites. Second, although the HBM was used as a theoretical framework, some of the factor such as health beliefs (perceived susceptibility, severity, benefit, and barrier) didn't show a significant effect on performance of standard precaution. Therefore, further research is needed to identify the detailed pathways for this.

As this study used a cross-sectional design, it is limited in clearly establishing causal relationships between variables. A longitudinal study is needed to determine whether nursing students' performance of standard precautions changes over the course of their internship. Nevertheless, the significance of this study is the fact that it identified the standard performance factors of nursing students in a nation-wide population, including a large domestic region, based on the HBM.

The results of this study highlight the need for clinically applicable practice strategies to help nursing students better implement standard precautions in clinical settings. Since self-efficacy was identified as the strongest predictor of standard precaution implementation, nursing education programs should enhance self-efficacy through various case-based simulation training and repetitive practice, enabling students to apply standard precautions in realistic clinical situations. Additionally, educational content should focus on the practical application of PPE, the differences between standard and route-based precautions, and the nurse's role in environmental management in real-world nursing settings.

Furthermore, considering the limitations and variability of clinical practice periods, clinical training institutions should provide consistent guidance on standard precautions, support active supervision, and encourage clinical instructors and nurses to serve as positive role models. These practice-oriented strategies will enhance nursing student adherence to standard precautions and help prevent HAIs in clinical settings.

CONCLUSION

This study identified third- and fourth-year nursing students' knowledge of standard precautions, health beliefs, self-efficacy, and patient safety culture, as well as their correlation with adherence to standard precautions during clinical practice. The results indicated that self-efficacy, indirect HAI experience, age and knowledge of standard Precautions significantly influenced performance. To enhance adherence to standard precautions among third- and fourth-year nursing students, continuous education and interventions aimed at improving self-efficacy are essential. Multifaceted educational interventions that enhance self-efficacy, experiential learning, and practical skill development are crucial for preparing nursing students to effectively practice standard precautions in clinical settings and help prevent HAIs.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors. Methodology: all authors. Data collection: all authors. Formal analysis: IYC, YJS, CEA, YSP. Writing–original draft: all authors. Writing–review & editing: IYC, YJS, CEA. Final approval of published version: all authors.

Conflict of interest

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

Funding

This research was funded by grants from the Alumni Scholarship Foundation of the College of Nursing, Chonnam National University.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

AI use disclosure

None.

Supplementary material

Supplement 1. Standard precaution knowledge response rate (N=160).

ORCID and ResearcherID

Yu Jin Son	https://orcid.org/0009-0007-2716-2404
	https://researcherid.com/rid/ODL-3438-2025
Chae Eun Ahn	https://orcid.org/0009-0008-6318-6291
	https://researcherid.com/rid/JHT-0291-2023
Yeong Seo Park	https://orcid.org/0009-0008-8032-3497
	https://researcherid.com/rid/ODL-3650-2025

In Young Cho https://orcid.org/0000-0002-6265-6342
https://researcherid.com/rid/MGT-6277-2025

REFERENCES

1. Centers for Disease Control and Prevention (CDC). COVID-19 impact on healthcare-associated infections (HAIs) [Internet]. U.S. Department of Health and Human Services, CDC; 2024 [cited 2025 Sep 25]. Available from: https://www.cdc.gov/healthcare-associated-infections/php/data/covid-impact.html
2. Kim Y. Effect of health beliefs and critical thinking disposition on the performance of taking standard precautions of nursing students. J Converg Inf Technol. 2021;11(11):85-94. https://doi.org/10.22156/CS4SMB.2021.11.11.085
3. Ayele DG, Baye Tezera Z, Demissie NG, Woretaw AW. Compliance with standard precautions and associated factors among undergraduate nursing students at governmental universities of Amhara region, Northwest Ethiopia. BMC Nurs. 2022;21(1):375. https://doi.org/10.1186/s12912-022-01165-w
4. Jang KS, Choi S, Lee JO. Knowledge, health belief, self-efficacy and performance on standard precautions of infection control in nursing students. Korean Assoc Learn Cent Curric Instr. 2020;20(12):743-763. https://doi.org/10.22251/jlcci.2020.20.12.743
5. Korean Accreditation Board of Nursing Education. 2026 Nursing Education Accreditation Handbook for Universities (Spring and Fall Cycles) [Internet]. Korean Accreditation Board of Nursing Education; 2026 [cited 2026 Jun 20]. Available from: https://www.kabone.or.kr/notice/list/view.do?num=943
6. Jeong MH. Survey of exposure to blood and body fluids, knowledge, awareness and performance on standard precautions of infection control in nursing students. J Korea Contents Assoc. 2015;15(4):316-329. https://doi.org/10.5392/JKCA.2015.15.04.316
7. Ahn JY. Influence of knowledge, health belief, nursing professionalism on the performance standard precaution in nursing students [master's thesis]. Daejeon: Daejeon University; 2021.
8. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the Health Belief Model. Health Educ Q. 1988;15(2):175-183. https://doi.org/10.1177/109019818801500203
9. Cho GL, Choi JS. Knowledge of and compliance with standard precautions by nurses in intensive care unit. J Korean Acad Fundam Nurs. 2010;17(1):73-81.
10. Rosenstock IM. The health belief model and preventive health behavior. Health Educ Monogr. 1974;2(4):354-386. https://doi.org/10.1177/109019817400200405
11. Park SH, Byun EK. Effects of self-efficacy, standard precaution knowledge, awareness on performance of nursing students. J Korea Acad Ind Coop Soc. 2020;21(7):127-135. https://doi.org/10.5762/KAIS.2020.21.7.127
12. Yoo S, Park JY, Kwon SH. Factors affecting on the practice of patient safety management (PSM) in nursing college students. J Digit Converg. 2019;17(11):279-288. https://doi.org/10.14400/JDC.2019.17.11.279
13. Kim EJ, Kim SY. The influences of grit, patient safety culture and environment for healthcare-associated infection control on performance of standard precautions in hospital nurses. J Korea Contents Assoc. 2022;22(11):820-830. https://doi.org/10.5392/JKCA.2022.22.11.820
14. Alves RF. The relationship between health-related knowledge and attitudes and health risk behaviours among Portuguese university students. Glob Health Promot. 2024;31(1):36-44. https://doi.org/10.1177/17579759231195561
15. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol. 2008;61(4):344-349. https://doi.org/10.1016/j.jclinepi.2007.11.008
16. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009;41(4):1149-1160. https://doi.org/10.3758/BRM.41.4.1149
17. Cho GL. Influencing factors on the compliance about standard precautions among ICU and ER nurses [master's thesis]. Seoul: Seoul National University; 2007. https://doi.org/10.23170/snu.000000044459.11032.0000626
18. Suh YH, Oh HY. Knowledge, perception, safety climate, and compliance with hospital infection standard precautions among hospital nurses. J Korean Clin Nurs Res. 2010;16(1):61-70. https://doi.org/10.22650/JKCNR.2010.16.1.61
19. Baek KS. Effects of nurses' knowledge, administrative support and environment for infection control on compliance of standard precautions in geriatric hospital, 1-75 [master's thesis]. Seoul: Yonsei University; 2016.
20. Lee SJ, Park JY, Jo N. Influence of knowledge and awareness on nursing students' performance of standard infection control guidelines. J Korean Acad Nurs Adm. 2017;23(4):347-358. https://doi.org/10.11111/jkana.2017.23.4.347
21. Erkin Ö, Özsoy S. Validity and reliability of health belief model applied to influenza. Acad Res Int. 2012;2(3):31-40.
22. Kim S, Cha C. Factors related to the management of multidrug-resistant organisms among intensive care unit nurses: an application of the health belief model. J Korean Acad Fundam Nurs. 2015;22(3):268-276. https://doi.org/10.7739/jkafn.2015.22.3.268
23. Rhew SH. Factors influencing on compliance with standard precau-

tion in clinical nurses: an application of the health belief model [master's thesis]. Busan: Pusan National University; 2017. https://doi.org/10.23172/pusan.000000120732.21016.0000278

24. Sherer M, Maddux JE, Mercandante B, Prentice-Dunn S, Jacobs B, Rogers RW. The self-efficacy scale: construction and validation. Psychol Rep. 1982;51(2):663-671. https://doi.org/10.2466/pr0.1982.51.2.663
25. Jung AS. A study on the relations between a health promoting behaviors and self-efficacy in general hospital nurse [master's thesis]. Seoul: Hanyang University; 2007.
26. Kim J, An K, Yun SH. Nurses' perception of the hospital environment and communication process related to patient safety in Korea. J Korean Soc Med Inf [Internet]. 2004 [cited 2025 Sep 25];10(suppl 1):130-135. Available from: https://share.google/FeJKdtpKkhDEu6lYg
27. Han JH. Nurses' management of safety accidents for hospitalized children: a structural equation model [master's thesis]. Seoul: Korea University; 2018. https://doi.org/10.23186/korea.000000080668.11009.0000810
28. Jeong SY. Standard guidelines. Proceedings of the 13th Academic Conference Korean Society for Nosocomial Infection Control; 2008 Apr 11; Seoul, Korea. Korean Society for Nosocomial Infection Control; 2008. p. 3-8.
29. Hong SY, Kwon YS, Park HO. Nursing students' awareness and performance on standard precautions of infection control in the hospital. J Korean Acad Soc Nurs Educ. 2012;18(2):293-302. https://doi.org/10.5977/jkasne.2012.18.2.293
30. Kang KN, Kim JH, Han JW. Mediation effect of self-leadership between awareness and performance on the standard precaution of nursing student and clinical nurse. Asia Pac J Multimed Serv Converg Art Humanit Sociol. 2018;8(1):457-469. https://doi.org/10.35873/ajmahs.2018.8.1.047
31. Hwang HJ, Lim MR. The effects of nursing students' moral sensitivity and nursing professionalism standard precautions. J Ind Converg. 2022;20(1):97-105. https://doi.org/10.22678/JIC.2022.20.1.097
32. Lee SH, Yang IS. Empowering hospital-associated infection prevention and control: a quasi-experimental study on the effect of scenario-based simulation training. Nurse Educ Pract. 2024;76:103936. https://doi.org/10.1016/j.nepr.2024.103936
33. Lee SJ. Awareness and performance about standard precautions for infection control. Glob Soc Welf Rev [Internet]. 2017 [cited 2025 Sep 25];7(2):7-21. Available from: https://kiss.kstudy.com/Detail/Ar?key=3566006

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):260-273
https://doi.org/10.4094/chnr.2026.009

pISSN 2287-9110
eISSN 2287-9129

CHNR

Risk and protective factors for the intergenerational transmission of child maltreatment in South Korea: a secondary analysis of data from the Family with Children's Life Experience Survey

Mina Jang[1], Sue Kim[2], Eun Kyoung Choi[2], Chang Gi Park[3], Hyejung Lee[2]

[1]Registered Nurse, Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, Seoul, Korea
[2]Professor, Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, Seoul, Korea
[3]Research Assistant Professor, College of Nursing, University of Illinois at Chicago, Chicago, IL, USA

Corresponding author
Hyejung Lee
Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, 50 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea
Tel: +82-2-2228-3345
Fax: +82-2-2227-8303
E-mail: HLEE26@yuhs.ac

Received: February 2, 2026
Revised: March 17, 2026
Accepted: June 22, 2026

Purpose: This study aimed to identify ecological risk and protective factors associated with membership in latent classes characterized by heterogeneous associations between parental adverse childhood experiences (ACEs) and the intergenerational transmission of child maltreatment (ITCM).

Methods: This secondary analysis used data from the 2017 Family with Children's Life Experience Survey. Participants were parents who had a spouse and children younger than 18 years. Guided by Belsky's ecological model, the covariates were categorized as parent-, family/household-, and community-level contextual factors. Latent class regression was used to identify classes with differing associations between parental ACEs and child maltreatment, and multinomial logistic regression was used to examine factors associated with class membership.

Results: Three classes were identified: the "None-ACE-Association" class (58.5%), the "Partial-ACE-Association" class (23.3%), and the "Comprehensive-ACE-Association" class (18.2%). Factors across multiple ecological domains differentiated class membership. Acceptance of corporal punishment significantly distinguished the None-ACE-Association class from the Partial-ACE-Association class. In comparisons involving the Comprehensive-ACE-Association class, membership was significantly associated with several parent- and family/household-level factors, including depressive symptoms, parenting stress, partner violence/control, and family relationship quality. Significant associations were also observed for the number of children, the age group of the youngest child, and residential area.

Conclusion: Distinct latent class profiles characterized by heterogeneous associations between parental ACEs and child maltreatment support the need for tailored, risk-stratified prevention strategies. Combining the assessment of parental ACEs with the assessment of modifiable factors could improve early identification and inform nursing and community-based interventions intended to interrupt the ITCM.

Keywords: Adverse childhood experiences; Child abuse; Intergenerational relations; Latent class analysis; Risk

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.

© 2026 Korean Academy of Child Health Nursing

INTRODUCTION

Child maltreatment is increasingly being treated as a major public concern and addressed through an expanded government role in South Korea's child protection system [1]. Nevertheless, physical discipline continues to be widely perceived as an effective child-rearing practice, often discussed in relation to Confucian-influenced norms, which may increase maltreatment risk [2]. A national survey in Korea reported that approximately 83% of child maltreatment perpetrators were parents, underscoring the need to identify parent-related determinants and inform family focused prevention efforts [3].

Among parent-related risks, adverse childhood experiences (ACEs) are critical for understanding the current maltreatment risk [4]. Parental ACEs have been linked to intergenerational risk processes that may compromise sensitive and responsive caregiving and increase the likelihood of child maltreatment and related adverse outcomes [5]. These patterns are broadly discussed in the literature as intergenerational transmission of child maltreatment (ITCM), defined as the continuity of maltreatment-related risk across generations, whereby parents' childhood maltreatment histories or other adverse childhood experiences are associated with an increased likelihood of maltreatment-related parenting toward their children [6,7]. Theoretically, ITCM has been examined through multiple frameworks, with attachment theory and trauma-related models being particularly prominent, while ecological, social, developmental, and biological perspectives have also contributed to understanding how intergenerational risk is shaped by early caregiving experiences, learned relational patterns, and broader developmental and contextual processes [8]. Importantly, this continuity should not be understood as deterministic; rather, meta-analytic and review evidence indicates that parental maltreatment history is a consistent but non-uniform risk factor, underscoring substantial heterogeneity in ITCM [6,7,9]. Such heterogeneity is reflected in variation in maltreatment subtypes, chronicity, developmental timing, and psychosocial risk and protective factors operating across individual, relational, contextual, and historical levels [6,7,10].

Reported ITCM prevalence varies widely (approximately 7%–70%), likely due in part to methodological differences in the operational definition of ITCM, the measurement of parental adversity and child maltreatment, the maltreatment subtypes included, the potential for self-report bias, and the analytic strategies used [11,12]. To better address such heterogeneity, person-oriented analytic approaches have gained attention in child maltreatment research [10]. Unlike variable-oriented approaches, which estimate average associations across the full sample, person-oriented approaches are designed to identify subgroups of individuals who show distinct patterns within the phenomenon of interest [11]. In child maltreatment research, person-oriented methods such as latent class analysis and latent profile analysis have often been used to classify individuals according to patterns of maltreatment or adversity exposure [10]. By contrast, latent class regression was particularly appropriate for the present study because it enabled us to examine whether the associations between parental ACEs and current child maltreatment differed across subgroups, rather than assuming a single average pattern across the full sample [11-13]. However, many ITCM studies have relied primarily on variable-oriented approaches (e.g., linear regression or structural equation modeling) [11,12], which may obscure meaningful heterogeneity. In the present study, latent class regression was used to identify subgroups characterized by graded levels of maltreatment involvement and differential ACE-domain associations, rather than clearly distinct transmission pathways [13].

In addition to heterogeneity in ACEs–ITCM pathways, ITCM is shaped by multilevel risk and protective factors. Therefore, ecological frameworks are widely used to conceptualize ITCM as arising from interacting influences embedded within nested contexts [14]. The ecological model of child maltreatment by Belsky [15] emphasizes that child maltreatment reflects the interplay of influences ranging from parental functioning and family interaction patterns to broader social stressors and cultural norms. Guided by this perspective, and given the constraints of the secondary dataset, we operationalized ecological influences according to their proximity to the parent–child relationship and organized covariates into parent-level, family/household-level, and community-contextual factors. Nonetheless, the evidence base remains limited in integrating ecological, multilevel influences alongside research on risk and protective factors in the ITCM [6]. In the present study, ITCM is used to refer to intergenerational continuity of risk reflected in the association between parental ACEs and current child maltreatment, rather than confirmed causal or subtype-specific transmission.

Therefore, this study integrates a person-oriented analytic strategy with a multilevel ecological lens to advance the un-

derstanding of ITCM in the Korean context. Specifically, this study aims (1) to identify latent classes of parents based on differential associations between parental ACEs and ITCM and (2) to examine parent-level, family/household-level, and community-contextual risk and protective factors that differentiate class membership. By linking heterogeneous ACEs–ITCM pathways to potentially modifiable ecological influences, this study seeks to inform targeted prevention and intervention efforts to disrupt the intergenerational cycles of maltreatment.

METHODS

Ethical statements: This study was a secondary analysis of existing data and was therefore exempt from the Human Ethics Committee of Yonsei University (IRB No. 4-2022-0041).

1. Study Design

This study was a secondary analysis of cross-sectional data and was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The survey was conducted by the Korea Institute for Health and Social Affairs in 2017 and is the first national survey to examine the experiences of maltreatment and violence in the present (in the past year), which were divided into childhood and adulthood violence and abuse experiences. No follow-up national survey using comparable instruments to assess childhood adverse experiences and child maltreatment has been conducted since 2017. Although several national child-related surveys have been administered after 2017, their survey frameworks and item definitions differ substantially from the 2017 survey, making them unsuitable for direct comparison or as substitute data sources in the present study.

2. Study Setting and Sample

The survey period was from August 23 to October 13, 2017, during which data collectors visited households directly and conducted interviews using a tablet. The census output area was selected by applying the Population and Housing Census, and samples were allocated based on the adult population aged 19–59 years to construct representative data on a national scale. A stratified sampling method was employed, in which the respondents' gender ratio was considered and proportionally distributed according to the population composition by region and age. A nationwide sample of 4,008 adults (fathers or mothers) who had children under the age of 18 at the time of the survey was obtained, and only 1 father or 1 mother in each household was allowed to participate in the survey. Only 3,945 participants with spouses (married, cohabitated, and separated partners) and children were included in this study. Considering the sensitivity of the survey questions, the participants directly responded to the tablet for questions related to child maltreatment and violence. To address potential response distortion in self-report data, a social desirability scale was included in the original survey [16]. There was no missing data for any of the variables included in this study.

3. Variables and Measurements

Based on Belsky's ecological model of child maltreatment, the study variables were organized across ecological levels according to their proximity to the parent–child relationship. Specifically, covariates were operationalized into 3 domains: parent-level factors, family/household-level factors, and community-contextual factors. As macrosystem-level indicators were limited to the secondary dataset, the present analysis focused on indicators available within these 3 domains. Supplement 1 summarizes the survey variables and instruments used to measure them.

1) Intergenerational transmission of child maltreatment

In the present study, ITCM was operationalized as intergenerational continuity of risk, reflected in the association between parental ACEs and current child maltreatment. Accordingly, the analysis was intended to identify heterogeneous patterns of intergenerational risk across latent classes rather than to test confirmed causal or subtype-specific transmission

(1) Parental adverse childhood experiences

The translated and modified Adverse Childhood Experiences International Questionnaire (ACE-IQ) was adopted for the survey [17]. This scale contains items on experiences before the age of 18 years and comprises 30 items categorized into 13 domains. Notably, among the domains of direct harm and witnessing collective violence, only the "Experience of victims and witnesses of collective violence" domain was modified to suit the Korean context. Following the ACE-IQ

scoring guidelines [18], each item was coded as "yes (1)" if it had been experienced at least once and "no (0)." To examine the effects of specific types of ACEs based on prior research, ACE domains were summed and grouped into neglect, abuse, family dysfunction, and violence [18]. Cronbach's α was .80 in a previous study [19] and .84 in this study.

(2) Child maltreatment

The Parent–Child Conflict Tactics Scale (CTS-PC) was translated and modified for this survey [20]. The CTS-PC assesses the occurrence of maltreatment-related behaviors during the past year. The original scale comprised 32 items across non-violent discipline, psychological aggression, physical assault, and neglect. The present survey included 4 domains (14 items): psychological aggression (2 items), physical assault (7 items), neglect (4 items), and sexual abuse (1 item). A total score of 0 indicates no maltreatment, whereas a total score of 1 or higher indicates the presence of maltreatment. In the present analysis, this score is best interpreted as indexing the number of maltreatment acts/items reported on the CTS-PC rather than the frequency, chronicity, or severity of repeated maltreatment. Accordingly, the latent classes derived in this study should be understood in relation to a gradient of reported maltreatment acts rather than differences in maltreatment intensity or chronicity. At the time of development, Cronbach's α ranged from .22 to .60 [20]; in this study, Cronbach's α was .57.

2) Parent-level factors

Parent-level factors included parents' general characteristics (gender, age, educational level, and work status) and psychological/attitudinal characteristics (depression, self-esteem, and acceptance of corporal punishment).

(1) Depression

Parental depression was measured using the 11-item Center for Epidemiologic Studies–Depression scale (CESD-11), an abbreviated form of Radloff's CES-D that assesses depressive symptoms over the past week [21]. Score range from 0 to 33, with higher scores indicating greater depressive symptoms. Cronbach's α was .81 for the CESD-11 compared with .86 for the CES-D [21]; in this study, Cronbach's α was .68.

(2) Self-esteem

Parental self-esteem was measured using Rosenberg's Self-Esteem Scale [22], which was translated and modified for this survey. The scale comprises 10 items rated on a 4-point Likert scale, with higher scores indicating higher self-esteem. In a study with parents, Cronbach's α was .83 [23]; in this study, it was .75.

(3) Acceptance of corporal punishment

Parental acceptance of corporal punishment was assessed using a single item ("What do you think about corporal punishment of children?") rated on a 4-point Likert scale (1 = never allowed to 4 = always acceptable).

3) Family/household-level factors

Family/household-level factors captured characteristics of the immediate caregiving context, including household composition (number of children, child age, and gender), parent-child interaction (parenting stress), household socioeconomic conditions (family monthly income), and marital and family relationships (partner violence or control and family relationship).

(1) Parenting stress

Parenting stress was measured using a modified version of Abidin's Parenting Stress Index–Short Form for the Family Life Experiences Survey [24]. Five items were rated on a 4-point Likert scale and reverse-coded (3 = strongly agree to 0 = not at all). Scores range from 0 to 15, with higher scores indicating greater parenting stress. Cronbach's α was .76–.80 in a previous study using the same tool and .85 in this study [20].

(2) Partner violence or control

Partner violence/control was measured using the Conflict Tactics Scale (CTS2) [25], translated and modified for this survey, and items assessing economic violence/control from the National Domestic Violence Survey. The CTS2 includes 10 items covering 5 types of spousal violence (negotiation, emotional, physical, injury, and sexual violence). Three additional items assessed economic violence/control. Responses were coded as "yes (1)" to indicate any violence/damage and "no (0)" to indicate none; negotiation items were reverse coded to align directionality with other subscales. Cronbach's α at development ranged from .79 to .95 [25]. In this study, it was .85.

(3) Family relationship

Family relationship quality was measured using the Family Relationship Scale based on the 10 items used in the 2010 National Survey of Elderly Abuse [16]. Items were rated on a 4-point Likert scale (1=strongly agree to 4=not at all) and reverse-coded, with higher total scores indicating more positive family relationships. The Cronbach's α was .91 in this study.

4) Community-contextual factors

Community-contextual factors included residential area and social support.

(1) Residential area

Residential areas were categorized as urban, suburban, or rural.

(2) Social support

Social support was measured using the translated and modified Lubben Social Support Scale [26]. The scale includes 6 items assessing the perceived availability of support from family/relatives as well as from neighbors/friends. Example items include: 'How many people do you meet or contact with at least once a month?', "How many people are close enough for you to ask for help?", and "How many people can you comfortably talk to privately?" The response options were scored as 0 (none), 1 (1 person), 2 (2 people), 3 (3–4 people), 4 (5–8 people), and 5 (9 or more people). Higher total scores indicate greater social support. In a Korean validation study, Cronbach's α was .75 [27]; in this study, it was .84.

4. Statistical Analysis

After sequentially applying the design weight, non-response correction weight, and extreme weight adjustment, the post-stratification weights were computed. All analyses incorporated sampling weights to account for the complex survey design. Because partner violence/control variables pertained to marital relationships, the analyses were restricted to respondents with spouses.

Data analyses were conducted using IBM SPSS ver. 28.0 (IBM Corp.) for descriptive statistics, chi-square tests, and multinomial logistic regression; LatentGOLD ver. 6.0 (Statistical Innovations Europe) for latent class regression (LC regression); and STATA ver. 17.0 (Stata Corp.) for estimating and graphing marginal effects using the "margins" and "marginsplot" commands.

First, descriptive statistics were used to summarize child maltreatment, parental ACEs, and covariates across the 3 ecological domains (parent-, family/household-, and community-contextual factors). To assess potential response distortion, we examined bivariate correlations between social desirability scores and key study variables (parental ACEs and child maltreatment) (Supplement 2). Given the small magnitude of these correlations, social desirability was not included as an additional covariate in the multinomial logistic regression models predicting class membership. As a sensitivity check, models additionally adjusting for social desirability yielded materially unchanged estimates and conclusions, supporting the robustness of the presented results.

Second, LC regression was employed to identify latent classes characterized by differential associations between parental ACEs and child maltreatment.

Third, the marginal effects of ACE domains on the predicted probabilities of child maltreatment were examined by class membership and are presented graphically.

Fourth, multinomial logistic regression was conducted to examine whether parent-, family/household-, and community-contextual factors differentially predicted class membership.

RESULTS

1. Description of Study Factors

The average age of parents was 40.8 years (standard deviation=6.23). Of the participants, 2,038 (51.7%) were mothers and 68.4% had a university degree or higher. Supplement 3 summarizes the study factors, including parent-level, family/household-level, and community contextual factors.

2. Description of Parental Adverse Childhood Experiences and Child Maltreatment

The most prevalent types of parental ACEs were direct harm and witnessing collective violence (49.4%), violence in the community (49.3%), witnessing domestic violence (46.8%), and emotional abuse (46.3%). Parents who reported at least 1 ACE accounted for 77.7% of all participants, and 38.6% reported 4 or more ACEs.

Psychological aggression (38.5%) was the most prevalent form of maltreatment. Neglect and sexual abuse were report-

Table 1. Description of parental adverse childhood experiences and child maltreatment

Domain	No. (%)	Mean±SD	Possible score range (min, max)
Adverse childhood experiences			
Neglect		0.23±0.48	0–2 (0, 2)
Neglect of emotion	654 (16.6)		
Neglect of body	271 (6.9)		
Abuse		0.73±0.85	0–3 (0, 3)
Emotional abuse	1,828 (46.3)		
Physical abuse	929 (23.5)		
Sexual abuse	112 (2.8)		
Family dysfunction		0.59±0.69	0–5 (0, 5)
Alcohol and drug use by family members	186 (4.7)		
Chronic depression of family members	49 (1.2)		
Imprisonment of family members	7 (0.2)		
Separation and death of parents	230 (5.8)		
Witnessing domestic violence	1,846 (46.8)		
Violence		1.29±1.08	0–3 (0, 3)
Peer violence	1,177 (29.8)		
Violence in the community	1,944 (49.3)		
Direct harm and witnessing collective violence	1,950 (49.4)		
Adverse childhood experience score		2.83±2.37	0–13 (0, 11)
0	878 (22.3)		
1	613 (15.5)		
2	450 (11.4)		
3	480 (12.2)		
4+	1,524 (38.6)		
Child maltreatment			
Psychological aggression	1,547 (38.5)		
Physical assault	397 (10.1)		
Neglect	78 (1.9)		
Sexual abuse	2 (0.0)		
Child maltreatment score		0.71±1.05	0–14 (0, 14)
0	2,314 (58.5)		
1	928 (23.4)		
2+	716 (18.1)		

All values are weighted.
SD, standard deviation.

ed by fewer than 2% of parents, with sexual abuse reported by only 2 parents. The most frequent child maltreatment score was zero, reported by 2,314 parents (58.5%) (Table 1). Given the very low prevalence of neglect and sexual abuse, the latent class solution was likely shaped primarily by psychological aggression and, to a lesser extent, physical assault. Accordingly, the identified classes should be interpreted primarily as reflecting heterogeneity in the more prevalent maltreatment forms rather than stable subtype-specific differences in the less prevalent maltreatment subtypes.

3. Identification of the Latent Class for Intergenerational Transmission of Child Maltreatment

1) Model selection for intergenerational transmission of child maltreatment

To determine the best-fitting solution, latent-class regression models with increasing numbers of classes were compared for up to 4 classes. The fit indices are presented in Table 2. Although Akaike information criterion (AIC) and Bayesian information criterion (BIC) favored the 4-class solution, improvements in AIC, BIC, and Vuong–Lo–Mendell–Rubin likelihood ratio test, and increases in entropy diminished from the 3-class solution to the 4-class solution. The log-likelihood also showed substantial improvement from

the 1-class to the 3-class model, followed by leveling-off for the 4-class model. In addition, the 4-class solution yielded a class comprising less than 10% of the sample, limiting interpretability.

In the 3-class solution, Class 1 comprised 58.5% of the sample, followed by Class 2 (23.3%), and Class 3 (18.2%). The entropy of the 3-class model was .99, indicating an excellent classification. Overall, the 3-class model provides the optimal and most interpretable solutions.

2) Description of the 3-class solution

We identified 3 classes of parents characterized by heterogeneous associations between parental ACEs and child maltreatment (Table 3). The 3-class solution was retained, and the classes were labeled as the None-ACE-Association class (58.5%), the Partial-ACE-Association class (23.3%), and the Comprehensive-ACE-Association class (18.2%). These labels were chosen to provide a descriptive and methodologically neutral summary of the observed ACE-domain association patterns across classes. Class 1 was characterized by a high probability of reporting no child maltreatment acts (score=0), Class 2 by a high probability of reporting 1 child maltreatment act (score=1), and Class 3 by a high probability of reporting 2 or more child maltreatment acts (score≥2). Mean ACE-domain scores increased monotonically across classes (Class 3>Class 2>Class 1).

As shown in Figure 1, the Comprehensive-ACE-Association class exhibited consistently positive average marginal effects across all 4 ACE domains. The Partial-ACE-Association class showed positive average marginal effects for abuse, family dysfunction, and violence, but not for neglect. By contrast, the None-ACE-Association class showed comparatively attenuated associations across ACE domains. These differences indicate variation in ACE-domain marginal-effect patterns across the 3 classes, but they are more appropriately interpreted in the context of the graded distribution of reported child maltreatment acts than as evidence of distinct intergenerational transmission mechanisms. These class differences should also be interpreted in light of the low prevalence of neglect and sexual abuse, suggesting that the 3-class solution likely reflects variation driven mainly by the more prevalent maltreatment forms.

Table 2. Fit Indices for latent class regression

Criterion	Class 1	Class 2	Class 3	Class 4
Log-likelihood	–5,436.52	2,640.14	6,043.81	7,664.34
No. of parameters	6	13	20	27
AIC	10,885.04	–5,254.28	–12,047.63	–15,274.68
BIC	10,922.74	–5,172.60	–11,921.96	–15,105.03
Entropy	1.00	.98	.99	1.00
VLMR		16,153.32 (<.001)	6,807.35 (<.001)	3,241.05 (<.001)
Class 1 (%)	100	58.2	58.5	58.5
Class 2 (%)		41.8	23.3	23.4
Class 3 (%)			18.2	10.3
Class 4 (%)				7.8
Class 5 (%)				

AIC, Akaike information criterion; BIC, Bayesian information criterion; VLMR, Vuong-Lo-Mendell-Rubin ratio test of model fit.

Table 3. Child maltreatment and adverse childhood experiences for the 3-class model

	Class 1 (58.5%) None-ACE-Association class	Class 2 (23.3%) Partial-ACE-Association class	Class 3 (18.2%) Comprehensive-ACE-Association class	F	Scheffe
Child maltreatment	0±0.00	1±0.00	2.59±0.91	12,780.98***	3>2>1
Adverse childhood experiences	2.24±2.19	3.19±2.08	4.75±2.23	372.67***	
Neglect	0.17±0.41	0.23±0.46	0.40±0.61	71.08***	
Abuse	0.52±0.77	0.88±0.85	1.43±0.88	357.17***	
Family dysfunction	0.49±0.70	0.65±0.61	1.02±0.76	162.17***	
Violence	1.06±1.02	1.42±0.96	1.89±0.96	198.10***	

Values are presented as mean±standard deviation unless otherwise stated.
ACE, adverse childhood experience.
***p<.001.

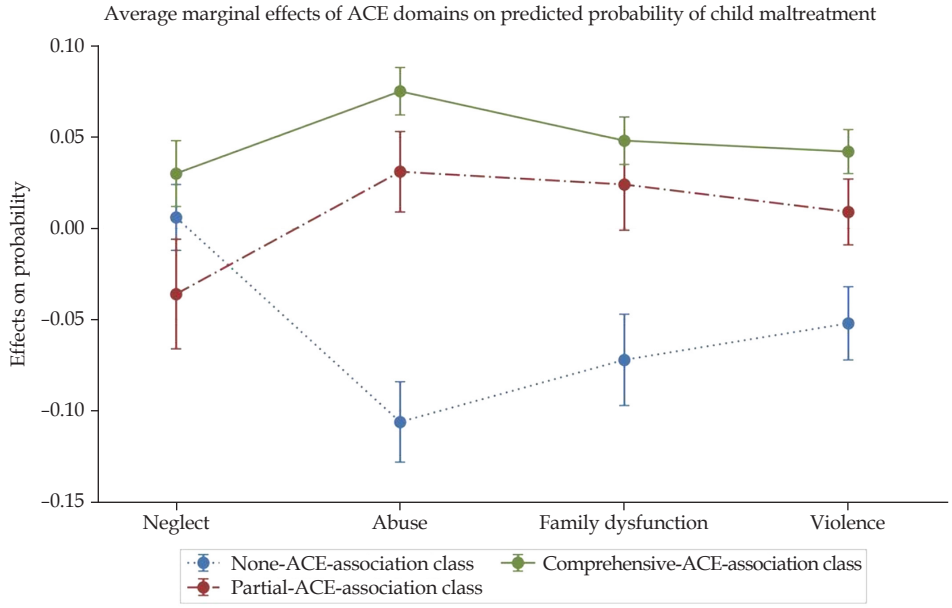

Figure 1. Average marginal effects of adverse childhood experience (ACE) domains on the predicted probability of child maltreatment across the 3-class solution.

3) Factors on class membership

Multinomial logistic regression was conducted to identify the factors associated with class membership in the relationship between parental ACEs and child maltreatment. Predictors were entered as parent-level, family/household-level, and community-contextual factors. In Table 4, Exp (B) represents the odds ratio (OR) of membership in the comparison class (left-hand column header) relative to the reference class (right-hand column header); ORs <1 indicate lower odds and ORs >1 indicate higher odds of membership in the comparison class.

Several parent-level factors (parental age and gender, depression, acceptance of corporal punishment) and family/household-level factors (number of children, parenting stress, partner violence/control, family relationship, and the age group of the youngest child) differentiated the "None-ACE-Association" class from the "Comprehensive-ACE-Association" class. Older parents and parents with more children were less likely to be in the "None-ACE-Association" class than in the "Comprehensive-ACE-Association" class (OR, .96; $p=.004$; OR, .56; $p<.001$). Mothers were less likely than fathers to be in the "None-ACE-Association" class (OR, .66; $p=.002$). Higher levels of depression, parenting stress, and partner violence/control were associated with lower odds of membership in the "None-ACE-Association" class relative to the "Comprehensive-ACE-Association" class (OR, .96; $p=.001$; OR, .83; $p<.001$; OR, .77; $p<.001$), whereas more positive family relationship quality was associated with higher odds (OR, 1.04; $p<.001$). Compared with parents of infants and toddlers, parents whose youngest child was a preschooler, school-aged, or an adolescent were less likely to be the "None-ACE-Association" class than in the "Comprehensive-ACE-Association" class (OR, .44, .28, and .29, respectively; all $p<.001$).

Regarding community contextual factors, residential area was significant. Compared with parents living in urban areas, those living in suburban and rural areas were more likely to be in "None-ACE-Association" class than in the "Comprehensive-ACE-Association" class (OR, 2.04; $p<.001$; OR, 1.55; $p=.020$).

The pattern of significant predictors differentiating "Partial-ACE-Association" class from the "Comprehensive-ACE-Association" class was largely similar. However, employment status emerged as an additional parent-level factor and the patterns for the youngest child's age group and residential area differed. Compared with regular employees, unemployed parents were more likely to be in the "Partial-ACE-Association" class than in the "Comprehensive-ACE-Association" class (OR, 1.54; $p=.007$). Relative to parents of infants and toddlers, parents whose youngest child was an adolescent were less likely to be in the "Partial-ACE-Association" class than in the "Comprehensive-ACE-Association" class (OR, .53; $p=.012$). Regarding community-contextual factors, parents living in suburban ar-

Table 4. Multinomial logistic regression of parent-level factors, family/household-level factors, and community-contextual factors on class membership

	None-ACE-Association vs. Comprehensive-ACE-Association (ref)				Partial-ACE-Association vs. Comprehensive-ACE-Association (ref)				None-ACE-Association vs. Partial-ACE-Association (ref)			
	B	SE	*p*	Exp (B)	B	SE	*p*	Exp (B)	B	SE	*p*	Exp (B)
Constant	6.99	915.82	< .001		2.18	7.84	.014		4.81	0.65	< .001	
Parent-level factors												
Parental age	–0.04	0.01	.004	0.96	–0.04	0.01	.013	0.96	–0.003	0.01	.731	1.00
Gender (ref: male)	–0.41	0.09	.002	0.66	–0.36	0.10	.010	0.70	–0.05	0.11	.660	0.95
Educational level (ref: high school graduate & under)	0.15	0.14	.216	1.16	–0.08	0.11	.523	0.93	0.22	0.10	.021	1.25
Work status (ref: regular employee)												
Temporary employee	–0.29	0.17	.199	0.75	–0.18	0.20	.465	0.84	–0.12	0.21	.580	0.89
Own business	–0.21	0.12	.144	0.81	–0.02	0.15	.893	0.98	–0.19	0.12	.115	0.83
Unemployed	–0.04	0.15	.817	0.97	0.43	0.25	.007	1.54	–0.47	0.13	< .001	0.63
Depression	–0.04	0.01	.001	0.96	–0.05	0.01	< .001	0.95	0.01	0.01	.580	1.01
Self-esteem	–0.02	0.02	.168	0.98	0.00	0.02	.839	1.00	–0.03	0.01	.568	0.98
Acceptance of corporal punishment (ref: never allowed)	–1.67	0.03	< .001	0.19	–0.29	0.11	.052	0.75	–1.38	0.10	< .001	0.25
Family/household-level factors												
No. of children	–0.58	0.05	< .001	0.56	–0.21	0.08	.025	0.81	–0.97	0.07	< .001	0.69
Gender of youngest child (ref: male)	0.20	0.13	.053	1.22	0.21	0.13	.058	1.23	–0.004	0.08	.958	1.00
Age group of youngest child (ref: infant + toddler)												
Pre-schooler	–0.83	0.09	< .001	0.44	–0.17	0.18	.416	0.84	–0.66	0.13	< .001	0.52
School age	–1.26	0.06	< .001	0.28	–0.42	0.14	.055	0.66	–0.85	0.15	< .001	0.43
Adolescents	–1.23	0.07	< .001	0.29	–0.64	0.13	.012	0.53	–0.59	0.18	.001	0.55
Parenting stress	–0.18	0.02	< .001	0.83	–0.07	0.02	< .001	0.93	–0.12	0.01	< .001	0.89
Family monthly income	0.00	0.00	.069	1.00	0.00	0.00	.264	1.00	0.00	0.00	.378	1.00
Partner violence or control	–0.26	0.03	< .001	0.77	–0.15	0.03	< .001	0.86	–0.11	0.03	< .001	0.90
Family relationship	0.04	0.01	.001	1.04	0.06	0.01	< .001	1.06	–0.01	0.01	.268	0.99
Community-contextual factors												
Residential area (ref: urban)												
Suburban	0.71	0.23	< .001	2.04	0.36	0.17	.002	1.43	0.36	0.09	< .001	1.43
Rural	0.44	0.30	.020	1.55	–0.41	0.14	.053	0.66	0.86	0.18	< .001	2.35
Social support	–0.02	0.01	.076	0.98	–0.01	0.01	.353	0.99	–0.01	0.01	.314	0.99

Each column presents a separate multinomial logistic contrast. The comparison class and reference class are identified in the column heading. Exp (B) values greater than 1 indicate higher odds of membership in the comparison class relative to the reference class, whereas Exp (B) values less than 1 indicate lower odds of membership in the comparison class. Because the reference class differs across columns, effect estimates and significance levels should not be compared directly across columns without accounting for this difference. All values are weighted.
ACE, adverse childhood experience; Ref, reference; SE, standard error.

eas were more likely to be in the "Partial-ACE-Association" class than in the "Comprehensive-ACE-Association" class than in those living in urban areas (OR, 1.43; $p = .002$).

Finally, acceptance of corporal punishment was a significant parent-level factor differentiating the "None-ACE-Association" class from the "Partial-ACE-Association" class. Parents who reported corporal punishment were less likely to be in the "None-ACE-Association" class than in the "Partial-ACE-Association" class compared with those who never allowed it (OR, .25; $p < .001$).

Social desirability showed only small correlations with the key study variables (Supplement 2). In sensitivity analyses additionally adjusting for social desirability, the main associations remained materially unchanged, indicating that the findings were robust to potential response distortion.

DISCUSSION

This study examines the ITCM by combining a person-oriented analytic strategy with an ecological perspective. Using

latent class regression with a nationally representative Korean sample, we identified 3 distinct classes: None-ACE-Association, Partial-ACE-Association, and Comprehensive-ACE-Association, suggesting heterogeneity in the association between) ACEs and child maltreatment. This person-oriented approach suggests that subgroup-specific association patterns may be obscured in variable-oriented models that assume a single average pathway from parental ACEs to child maltreatment.

Only a limited number of studies have examined parental ACEs specifically in the context of ITCM [6,7,10]. This study extends prior work by modeling heterogeneity in the associations between parental ACEs and child maltreatment using a person-oriented approach. Building on this framework, the latent class regression findings are more appropriately interpreted as reflecting a graded pattern of maltreatment involvement across classes, with differential ACE-domain associations by class, rather than clearly distinct transmission pathways or a single uniform ACE-to-maltreatment process. The class-specific marginal-effects pattern supports domain-level heterogeneity, with abuse-related ACEs emerging as a potentially salient factor distinguishing classes characterized by more extensive child maltreatment-act endorsement (Figure 1). This interpretation is broadly consistent with prior person-centered evidence showing that ACE profiles characterized by abuse-related and more cumulative adversities are associated with elevated risk of child maltreatment compared with low-adversity profiles [12]. However, these class-specific patterns should be interpreted with caution because neglect and sexual abuse were extremely rare in the present sample, suggesting that the observed class structure was shaped primarily by the more prevalent forms of maltreatment. Clinically, this domain-informed heterogeneity suggests the potential utility of risk stratification and tailored assessment—especially prioritizing parental histories of abuse and related violence contexts—and supports multi-level prevention and early intervention strategies to interrupt intergenerational transmission [14,15,28].

Multinomial logistic regression results further clarified how ecological predictors differentiated the 3 classes—the None-ACE-Association class, the Partial-ACE-Association class, and the Comprehensive-ACE-Association class—suggesting that ITCM prevention should address modifiable risks across multiple ecological levels [27]. Overall, many predictors operated in similar directions when contrasting the Comprehensive-ACE-Association class with the None-ACE-Association and Partial-ACE-Association class, whereas a smaller subset of factors more specifically differentiated the None-ACE-Association class from the Partial-ACE-Association class. This pattern suggests that some ecological factors may be particularly relevant to distinctions at the lower end of the observed child maltreatment act-count distribution.

At the parent level, predictors showed a more contrast-specific pattern. Unemployment emerged as a differentiator primarily when distinguishing the Partial-ACE-Association class from the Comprehensive-ACE-Association class, whereas greater acceptance of corporal punishment more clearly distinguished the None-ACE-Association class from the Partial-ACE-Association class. These findings support prevention strategies that provide culturally sensitive parenting education and promote non-violent discipline strategies as practical alternatives to physical punishment [2]. The youngest child's age group also differentiated class membership, largely in contrast involving the Comprehensive-ACE-Association class, suggesting that developmental timing may shape how ACE-related vulnerabilities are expressed within the family. Recent evidence indicates that caregivers' adverse childhood experiences are associated with higher levels of adversity among their children, underscoring intergenerational vulnerability to cumulative and potentially multi-type adverse experiences [9]. Notably, class contrasts involving the Comprehensive-ACE-Association class suggested greater vulnerability among adolescents than among infants/toddlers, a pattern that is broadly consistent with WHO guidance noting heightened vulnerability at both developmental ends, particularly among children under age 4 and adolescents [29]. This discrepancy may reflect the influence of unmeasured child and family processes (e.g., temperament, behavioral problems, academic difficulties, or parent–adolescent conflict), underscoring the need for future studies to incorporate a broader set of child-level and family process indicators. However, because the dataset did not include child-level mechanisms needed to evaluate these possibilities, this interpretation remains speculative rather than evidentiary.

At the family/household level, in contrast involving the Comprehensive-ACE-Association class versus the None-ACE-Association and Partial-ACE-Association class, both larger family size and elevated parenting stress were associated with membership in the Comprehensive-ACE-Association class. These findings are consistent with prior reviews

highlighting the role of family- and caregiver-level psychosocial risk and protective factors in intergenerational cycles of maltreatment [11]. Having more children may amplify risk by increasing parenting demands while simultaneously reducing available resources per child [28]. Higher parenting stress, in turn, can contribute to negative parenting behaviors and increase the likelihood of maltreatment [8]. Taken together, these findings imply that prevention efforts should consider caregiving load when providing parenting support and include coping and stress-management components that help families maintain supportive and nurturing environments.

At the community-contextual level, residential-area differences were observed most clearly in contrasts involving the Comprehensive-ACE-Association class, but evidence on residence-based differences in ITCM remains limited and mixed [30]. Because residential area was operationalized as a broad proxy for community context, these findings should be interpreted cautiously and should not be taken as evidence of specific community-level mechanisms. Future research should incorporate more granular community indicators (e.g., neighborhood disadvantage, service accessibility, and social resource availability) to clarify how community context may relate to class membership.

Although the present study used data collected in 2017, the findings remain informative for contemporary child health practice in Korea. Notably, Korea's child protection and child-abuse response system has undergone major reforms, including a transition toward a more public-centered model beginning in 2020 with expanded governmental responsibility for investigation and case management [1]. These system-level reforms may have influenced detection, reporting, and service-delivery processes; therefore, prevalence estimates should be interpreted within the 2017 policy context. Nevertheless, the primary contribution of this study is not to provide updated prevalence rates but to clarify heterogeneous, class-specific association patterns linking parental ACE domains and child maltreatment within an ecological framework. Accordingly, these findings can support current practice by informing risk stratification and class-tailored prevention and linkage-to-care strategies under the evolving public-centered child protection system. Future studies should examine whether these patterns are replicated in more recent cohorts and across changing policy and service contexts.

These findings have implications for pediatric and community health nurses in South Korea. As mandated reporters of child maltreatment, nurses working in primary care settings, pediatric clinics, and community health centers are well positioned to identify families at risk for ITCM and provide early intervention. Identifying distinct class profiles may support tailored screening protocols and prevention strategies aligned with family-specific risk patterns. In practice, nurses should consider routinely assessing parents' histories of adversity and current parenting stress, particularly in families with multiple children, and evaluating parental mental health as a potentially modifiable risk factor. In addition, culturally sensitive parenting guidance that emphasizes positive, non-violent discipline may help shift attitudes toward corporal punishment [2]. Connecting families with more extensive risk associations to mental health services, parenting support programs, and accessible community resources may be especially important when risk accumulates across parent-, family-, household-, and community-contextual domains.

This study had several limitations. First, the CTS-PC maltreatment subtypes were summarized primarily at the overall-sample level, and several subtypes were rare; most notably, neglect was reported by fewer than 2% of parents and sexual abuse by only 2 parents. As a result, stable class-stratified subtype comparisons were not feasible, and the latent class solution was likely shaped primarily by psychological aggression and, to a lesser extent, physical assault. Accordingly, the identified classes should be interpreted cautiously and may not fully capture heterogeneity in the less prevalent maltreatment subtypes. Second, although this study was guided by Belsky's ecological model of child maltreatment, the use of secondary data constrained the range of ecological indicators that could be operationalized; in particular, only a limited set of community-contextual variables was available. Third, because macrosystem-level factors (e.g., policy contexts and broader cultural indicators) could not be comprehensively measured in the dataset, conclusions regarding macrosystem influences on ITCM should be interpreted cautiously. Future studies should incorporate explicit policy/cultural measures or link individual-level data to community- and policy-level indicators to test multilevel pathways more fully. Finally, although the CTS-PC is one of the most widely used measures in child maltreatment research, the modified version used in this sample showed modest internal consistency (Cronbach's $\alpha = .57$). Moreover, because child maltreatment and ACEs are socially sensitive topics, under-

reporting may have introduced additional measurement error. Importantly, because child maltreatment indicators were used to define the latent classes, these measurement limitations may have affected not only effect estimates but also the latent class solution itself. Specifically, imperfect measurement may have contributed to misclassification, obscured smaller or more distinct subgroups, and attenuated contrasts across classes and their associations with ecological predictors. In addition, the relatively low internal consistency may partly reflect the heterogeneous nature of child maltreatment behaviors, the low base rates of some maltreatment subtypes, and restricted variability due to underreporting in self-reports. Therefore, the findings should be interpreted cautiously as potentially conservative estimates. Future research would benefit from using more behavior-specific or subtype-specific measures, incorporating multiple informants or administrative data, and applying longitudinal designs to improve measurement precision and strengthen inferences about intergenerational continuity of risk.

CONCLUSION

Using latent class regression, this study identified heterogeneous patterns in the association between parental ACEs and child maltreatment, distinguishing between the None-ACE-Association, Partial-ACE-Association, and Comprehensive-ACE-Association. Class membership was differentiated by parent-, family/household-, and community-contextual factors, indicating that intergenerational risk is shaped by influences across multiple ecological domains. By linking subgroup-specific ACEs–child maltreatment association patterns to modifiable ecological correlates (e.g., parental depression, parenting stress, partner violence/control, and attitudes toward corporal punishment), these findings can inform screening efforts and support the development of tailored prevention and intervention strategies aimed at disrupting intergenerational cycles of maltreatment.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: MJ, SK, EKC, CGP, HL. Methodology: CGP, HL. Data curation: MJ. Formal analysis: MJ, CGP. Investigation: MJ. Validation: SK, EKC. Supervision: HL. Writing–original draft: MJ. Writing–review and editing: SK, EKC, HL. Final approval of published version: all authors.

Conflict of interest

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

Funding

None.

Data availability

The data analyzed in this study are available from the Korea Institute for Health and Social Affairs upon reasonable request, with appropriate approval for research use.

Acknowledgements

This study is based on part of the first author's doctoral dissertation.

AI use disclosure

During the preparation of this work, the authors used an AI-assisted language editing tool (Gemini and Paperpal) to refine the phrasing, eliminate grammatical errors, and enhance the overall linguistic quality of the manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Supplementary material

Supplement 1. Variables and measurements.

Supplement 2. Correlations between social desirability, parental ACE domains and child maltreatment.

Supplement 3. Description of factors related to parent-level factors, family/household-level factors, and community-contextual factors.

ORCID and ResearcherID

Mina Jang	https://orcid.org/0000-0003-0852-256X https://researcherid.com/rid/PHN-6542-2026
Sue Kim	https://orcid.org/0000-0003-3785-2445 https://researcherid.com/rid/HOF-5687-2023
Eun Kyoung Choi	https://orcid.org/0000-0003-4622-2437 https://researcherid.com/rid/GPG-0204-2022
Chang Gi Park	https://orcid.org/0000-0003-3366-4279 https://researcherid.com/rid/AEN-4164-2022
Hyejung Lee	https://orcid.org/0000-0001-9357-0640 https://researcherid.com/rid/PHN-7916-2026

REFERENCES

1. Shim WS. New public-centered child protection system in Korea. Clin Exp Pediatr. 2023;66(5):179-181. https://doi.org/10.3345/cep.2023.00150
2. Ma J, Han Y, Kang HR. Physical punishment, physical abuse, and child behavior problems in South Korea. Child Abuse Negl. 2022;123:105385. https://doi.org/10.1016/j.chiabu.2021.105385
3. Ministry of Health and Welfare. Child Abuse & Neglect Korea 2023. Ministry of Health and Welfare; 2024.
4. Lee JY, Ryu JH. The relationship between latent classes of parent's adverse childhood experiences and child maltreatment. J Korean Counc Child Rights. 2021;25(1):107-130. https://doi.org/10.21459/kccr.2021.25.1.107
5. Racine N, Deneault AA, Thiemann R, Turgeon J, Zhu J, Cooke J, et al. Intergenerational transmission of parent adverse childhood experiences to child outcomes: a systematic review and meta-analysis. Child Abuse Negl. 2025;168(Pt 1):106479. https://doi.org/10.1016/j.chiabu.2023.106479
6. Berzenski SR, Yates TM. Revisiting a multidimensional model of intergenerational transmission of child maltreatment. In: Krugman RD, Korbin JE, editors. Handbook of child maltreatment. 2nd ed. Springer; 2022. p. 351-370.
7. Langevin R, Abou Chabake S, Beaudette S. Intergenerational cycles of maltreatment: an updated scoping review of psychosocial risk and protective factors. Trauma Violence Abuse. 2026;27(2):490-505. https://doi.org/10.1177/15248380251316908
8. Marshall C, Langevin R, Cabecinha-Alati S. Victim-to-victim intergenerational cycles of child maltreatment: a systematic scoping review of theoretical frameworks. Int J Child Adolesc Resil. 2022;9(1):95-115. https://doi.org/10.54488/ijcar.2022.283
9. Madigan S, Turgeon J, Racine N, Zhu J, Alink LR, Ereyi-Osas W, et al. Patterns of continuity and discontinuity of childhood maltreatment across generations: a meta-analysis. Dev Psychopathol. 2025 May 19 [Epub]. https://doi.org/10.1017/S0954579425000239
10. Russotti J, Warmingham J, Swerbenski H, Handley ED, Li Z, Cicchetti D. Intergenerational continuity of multidimensional patterns of child maltreatment exposure: a person-centered approach. Dev Psychopathol. 2025 Jul 3 [Epub]. https://doi.org/10.1017/S0954579425100217
11. Knisely MR, Draucker CB. Using a person-oriented approach in nursing research. West J Nurs Res. 2016;38(4):508-520. https://doi.org/10.1177/0193945915602856
12. Buffarini R, Hammerton G, Coll CV, Cruz S, da Silveira MF, Murray J. Maternal adverse childhood experiences (ACEs) and their associations with intimate partner violence and child maltreatment: Results from a Brazilian birth cohort. Prev Med. 2022;155:106928. https://doi.org/10.1016/j.ypmed.2021.106928
13. Rivera PM, Fincham F. Forgiveness as a mediator of the intergenerational transmission of violence. J Interpers Violence. 2015;30(6):895-910. https://doi.org/10.1177/0886260514539765
14. Swenson CC, Schaeffer CM. A multisystemic approach to the prevention and treatment of child abuse and neglect. Int J Child Maltreat. 2018;1(1):97-120. https://doi.org/10.1007/s42448-018-0002-2
15. Belsky J. Child maltreatment: an ecological integration. Am Psychol. 1980;35(4):320-335. https://doi.org/10.1037//0003-066x.35.4.320
16. Ryu JH, Lee SJ, Jeon JA, Park SK, Yeo YJ, Lee JY, et al. Comprehensive Survey on Korean Children. Korea Institute for Health and Social Affairs; 2019.
17. World Health Organization. Adverse Childhood Experiences International Questionnaire (ACE-IQ) [Internet]. World Health Organization; 2018 [cited 2022 Dec 15]. Available from: https://www.who.int/publications/m/item/adverse-childhood-experiences-international-questionnaire-(ace-iq)
18. Chang X, Jiang X, Mkandarwire T, Shen M. Associations between adverse childhood experiences and health outcomes in adults aged 18-59 years. PLoS One. 2019;14(2):e0211850. https://doi.org/10.1371/journal.pone.0211850
19. Lee J, Choi E. Effects of parental experiences of childhood abuse and parenting stress on offspring abuse and depression: the buffering role of children's social support. Health Soc Welf Rev. 2022;42(1):125-145. https://doi.org/10.15709/hswr.2022.42.1.125
20. Straus MA, Hamby SL, Finkelhor D, Moore DW, Runyan D. Identification of child maltreatment with the Parent-Child Conflict Tactics Scales: development and psychometric data for a national sample of American parents. Child Abuse Negl. 1998;22(4):249-270. https://doi.org/10.1016/s0145-2134(97)00174-9
21. Kohout FJ, Berkman LF, Evans DA, Cornoni-Huntley J. Two shorter forms of the CES-D (Center for Epidemiological Studies Depression) depression symptoms index. J Aging Health. 1993;5(2):179-193. https://doi.org/10.1177/089826439300500202
22. Rosenberg M. Conceiving the self. Basic Books; 1979.
23. Kong J. Effect of caring for an abusive parent on mental health: the mediating role of self-esteem. Gerontologist. 2018;58(3):456-466. https://doi.org/10.1093/geront/gnx053
24. Abidin RR. Parenting Stress Index-Short Form. Pediatric Psychology Press; 1990. p 118.
25. Straus MA, Hamby SL, Boney-McCoy SU, Sugarman DB. The revised Conflict Tactics Scales (CTS2) development and preliminary psychometric data. J Fam Issues. 1996;17(3):283-316. https://doi.org/10.1177/019251396017003001
26. Lubben J, Blozik E, Gillmann G, Iliffe S, von Renteln Kruse W, Beck

JC, et al. Performance of an abbreviated version of the Lubben Social Network Scale among three European community-dwelling older adult populations. Gerontologist. 2006;46(4):503-513. https://doi.org/10.1093/geront/46.4.503

27. Lee KW, Kim SY, Chung W, Hwang GS, Hwang YW, Hwang IH. The validity and reliability of Korean version of Lubben Social Network Scale. Korean J Fam Med. 2009;30(5):352-358. https://doi.org/10.4082/kjfm.2009.30.5.352
28. Zhou H, Wang X, Li M. Parental stress, coercive and encouraging parenting among Chinese one-child, two-child and three-child families. Fam Relatsh Soc. 2024;13(4):528-548. https://doi.org/10.1332/20467435Y2024D000000018
29. World Health Organization. Child maltreatment [Internet]. World Health Organization; 2024 [cited 2026 Jan 22]. Available from: https://www.who.int/news-room/fact-sheets/detail/child-maltreatment
30. Beatriz ED, Salhi C, Griffith JL, Molnar BE. Urbanicity matters in self-reported child maltreatment prevalence: Findings from a nationally representative study. Child Abuse Negl. 2018;79:371-383. https://doi.org/10.1016/j.chiabu.2018.02.028

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):274-286
https://doi.org/10.4094/chnr.2026.004

pISSN 2287-9110
eISSN 2287-9129

CHNR

Factors associated with birth weight and birth length among term newborns in Vietnam: a retrospective cross-sectional study

Do Thi Thu Huyen[1,2], Quang Vu Van[3], Hoang Thi Oanh[4], Do Thi Lan Anh[4]

[1]Lecturer, Faculty of Nursing, Hai Phong University of Medicine and Pharmacy, Hai Phong, Vietnam
[2]Doctoral Student, School of Nursing, Chungnam National University, Daejeon, Korea
[3]Associate Professor, Faculty of Nursing, Hai Phong University of Medicine and Pharmacy, Hai Phong, Vietnam
[4]Doctor, Faculty of Nursing, Hai Phong University of Medicine and Pharmacy, Hai Phong, Vietnam

Corresponding author
Do Thi Lan Anh
Faculty of Nursing, Hai Phong University of Medicine and Pharmacy, Hai Phong, Vietnam
Tel: +84-984-819-773 (Landline: +84-2253-731-907)
Fax: +84-2253-733-315
E-mail: dtlanh@hpmu.edu.vn

Received: January 9, 2026
Revised: February 26, 2026
Accepted: April 20, 2026

Purpose: Birth weight and birth length are essential indicators of neonatal health and later development. However, evidence from Vietnam on the multidimensional determinants of these outcomes remains limited. Guided by the biopsychosocial model, this study examined factors associated with birth weight and birth length among term newborns.

Methods: This retrospective cross-sectional study included 198 term singleton live births at Hai Phong Hospital of Obstetrics and Gynecology, Vietnam. Data were extracted from the medical records of newborns born at the hospital between December 2023 and May 2024. Because the variables did not meet parametric assumptions, the Mann-Whitney U test, Kruskal-Wallis H test, and Spearman correlation coefficient were used as nonparametric alternatives to the independent-samples t-test, analysis of variance, and Pearson correlation coefficient, respectively. Two multiple linear regression models were constructed to identify independent predictors of birth weight and birth length, with statistical significance set at $p<.05$.

Results: In the multivariable analysis, gestational age (β=.37, $p<.001$), maternal pre-pregnancy weight (β=.24, $p<.001$), protein supplementation (β=.13, $p=.040$), and infant sex (β=−.16, $p=.008$) were significant predictors of birth weight. Paternal height (β=.47, $p<.001$), gestational age (β=.23, $p<.001$), maternal height (β=.22, $p<.001$), and maternal pre-pregnancy weight (β=.16, $p=.009$) were significant predictors of birth length.

Conclusion: Within the biopsychosocial framework, interrelated biological and behavioral factors were associated with birth weight and birth length among term newborns. Prenatal assessment of maternal and paternal characteristics may help inform strategies to support fetal growth, particularly in resource-limited settings.

Keywords: Biopsychosocial models; Birth weight; Body weight; Newborn

INTRODUCTION

Birth weight and birth length are fundamental indicators of neonatal health, survival, and further well-being [1]. According to the World Health Organization, low birth weight (LBW) is defined as <2,500 g regardless of gestational age [2]. LBW remains one of the strongest predictors of neonatal mortality, being responsible for approximately 60%–80% of deaths in the first month of life [3], and is associated with postnatal growth impairment, neurocognitive developmen-

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

tal delay, and a number of adult noncommunicable diseases, including hypertension and type 2 diabetes [4,5]. Similarly, birth length reflects intrauterine linear growth and skeletal development, with normal full-term length generally ranging from approximately 49 to 50 cm, although values between 47 and 53 cm are also considered within normal limits [6].

Globally, approximately 14.7% of live births, equivalent to nearly 20 million newborns, were classified as LBW in 2020 [7]. Along with weight, birth length provides complementary information on skeletal and linear growth. Departures from gestational age norms may signal intrauterine growth restriction even when the weight is near the threshold [8]. A prospective study in rural Vietnam showed that maternal nutritional status and gestational weight gain were significant determinants of infant growth in the first 2 years of life [9]. Thus, maternal anthropometry and gestational nutrition are the major drivers of neonatal and early childhood growth. Despite this, secular improvements in neonatal size have been evident in northern Vietnam; for example, a greater than 1.3 cm increase in average birth length over 2 decades [10], preterm and LBW infants still contribute to nearly 19% of the national neonatal disease burden. Despite these findings, few Vietnamese studies have examined the joint influence of biological, psychological, and social determinants from both maternal and paternal perspectives on neonatal anthropometric outcomes, especially at the provincial hospital level. Provincial tertiary hospitals, such as the Hai Phong Obstetrics and Gynecology Hospital, Hai Phong serve as regional referral centers for both urban and surrounding rural populations, providing a heterogeneous case mix that better reflects real-world clinical and socioeconomic variations than national surveys or highly specialized central hospitals.

Recent global evidence confirms that the determinants of birth weight and birth length are multifactorial and represent biological, behavioral, psychological, and social dimensions. Guided by Engel's biopsychosocial (BPS) model [11], this study conceptualized these determinants within an integrated analytical framework to systematically represent the biological, behavioral/psychological, and social/environmental domains. However, owing to the retrospective design and reliance on medical records, psychological variables (e.g., maternal stress or anxiety) were not available in this study. In the biological sphere, maternal and paternal anthropometric characteristics, such as pre-pregnancy body mass index (BMI), gestational weight gain, and height, directly influence intrauterine growth and newborn size. Accordingly, this domain comprises gestational age, infant sex, maternal pre-pregnancy weight, gestational weight gain, maternal height, parity, and paternal height [12,13]. The behavioral/psychological domain was operationalized through maternal nutritional practices (e.g., protein/micronutrient supplementation and dietary patterns) and adherence to antenatal care, factors that may affect fetal growth through neuroendocrine or metabolic pathways [14]. The social domain encompasses maternal age, education, occupation, household income, healthcare utilization, and structural determinants that shape maternal health behaviors and well-being, thereby indirectly influencing fetal development [15].

Therefore, this study aims to identify factors associated with birth weight and birth length among term newborns in Vietnam, within the BPS framework. A multidimensional understanding of these factors may inform targeted interventions and health policies to improve maternal and neonatal outcomes in low- and middle-income settings.

METHODS

Ethical statements: This study was approved by the Institutional Review Board of Hai Phong University of Medicine and Pharmacy (approval number: 2550/QD-YDHP-IRB). The need for informed consent was waived due to the retrospective design and anonymized data.

1. Study Design

This study employed a retrospective cross-sectional design to identify factors associated with neonatal anthropometric outcomes. The conduct and reporting of the research adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [16].

2. Conceptual Framework

This study's conceptual framework was guided by Engel's BPS model [11], which conceptualized health outcomes as arising from interacting biological, psychological/behavioral, and social determinants. The model was used to structure variable selection and analysis strategies. The biological domain included neonatal characteristics (gestational age and infant sex), maternal anthropometry (pre-pregnancy weight, gestational weight gain, height, and parity), and paternal an-

thropometry (height and weight). The behavioral/psychological domain comprised maternal nutritional practices, supplement use, smoking exposure, and pregnancy-related health behaviors (psychological factors were not included because of data unavailability). The social domain included maternal age, education, occupation, household income, and healthcare utilization (Figure 1).

3. Data Source and Setting

Data were collected from Hai Phong Hospital of Obstetrics and Gynecology, Hai Phong, a tertiary perinatal referral center in northern Vietnam. The hospital is located in a major urban–industrial province with a mixed urban and peri-urban population, serving both city residents and the surrounding districts. The hospital functions as the primary referral institution for high-risk pregnancies in the region while also providing routine obstetric services. Medical records of deliveries occurring between December 2023 and May 2024 were extracted from the hospital's obstetric and neonatal registries, which included routinely documented maternal, paternal, and neonatal information as part of the standard clinical assessment.

Given their referral role, hospitals manage a substantial proportion of medically complicated pregnancies, limiting the representativeness of the sample relative to the general population. However, the institution maintains standardized clinical protocols and a comprehensive electronic registry system that provides high-quality, systematically recorded perinatal data. Restricting the analysis to term singleton births further reduces the potential bias related to extreme prematurity and severe neonatal complications.

4. Participants and Eligibility Criteria

All deliveries recorded during the study period between December 2023 and May 2024 were screened for eligibility.

The inclusion criteria were as follows: (1) term singleton live births (gestational age, 37–42 weeks), (2) complete records of birth weight and birth length, (3) availability of maternal and paternal sociodemographic and anthropometric data, and (4) delivery at the Hai Phong Hospital of Obstetrics and Gynecology. The exclusion criteria included multiple pregnancies, congenital anomalies, stillbirths, and incomplete or implausible medical records.

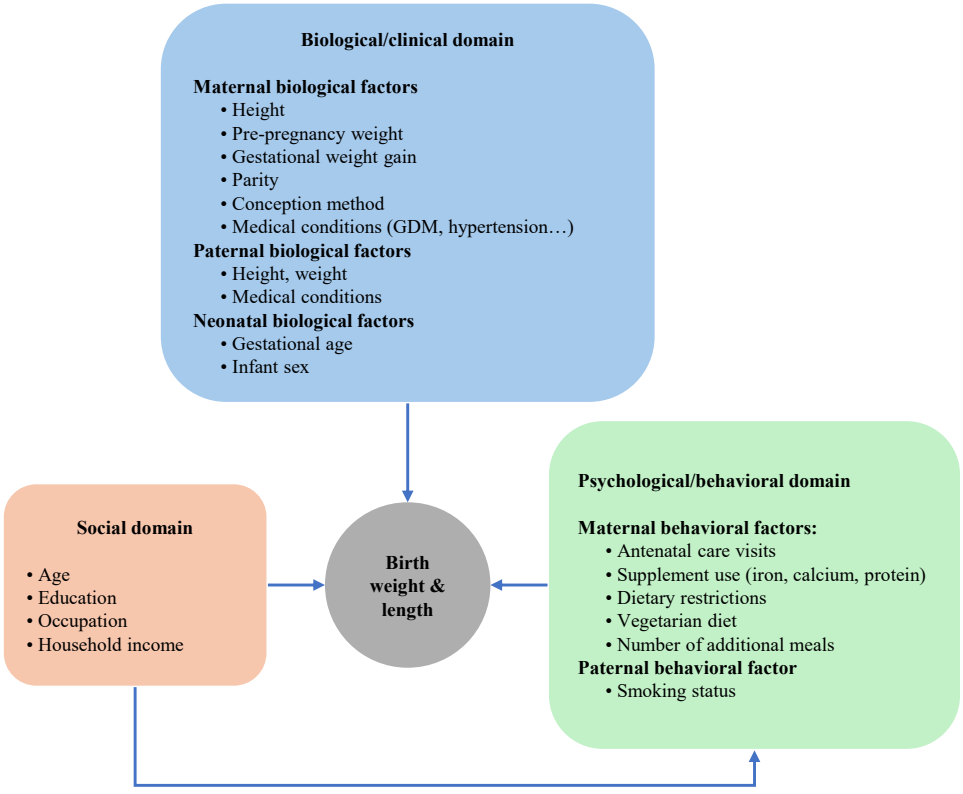

Figure 1. Conceptual framework illustrates determinants of birth weight and length based on the Engel's biopsychosocial model. GDM, gestational diabetes mellitus.

5. Sample

The sample size was calculated a priori using G*Power ver. 3.1.9 (Heinrich-Heine-Universität Düsseldorf), using an F-test for linear multiple regression, assuming a medium effect size ($f^2 = .15$), an alpha level of .05, and up to 8 predictors; a minimum of 160 participants was required to achieve 95% power. Given the retrospective design, all eligible term singleton births during the study period were included in the analysis with no sampling procedure applied. A total of 198 eligible births met the inclusion criteria and were analyzed, exceeding the minimum required sample size. This approach ensured that the study utilized a fully available dataset and minimized the risk of selective inclusion. The selection process is illustrated in Figure 2.

6. Variables and Measurement

1) Outcome variables

(1) Birth weight

Birth weight (g) was measured immediately after delivery using a calibrated digital infant scale, recorded to the nearest 50 g, and analyzed as a continuous variable.

(2) Birth length

Birth length (cm) was measured within 1 hour after delivery as part of routine clinical practice at the hospital using a standardized infantometer, recorded to the nearest 0.1 cm. According to the hospital's standard neonatal protocol, trained maternity staff obtained 2 consecutive measurements, and the recorded value represented the average of the 2 readings to enhance measurement reliability. It was analyzed as a continuous variable.

2) Independent variables

Variables were grouped according to the BPS model framework.

(1) Biological/clinical factors

Maternal attributes: maternal height, pre-pregnancy weight, and total gestational weight gain were measured as continuous variables. Parity (primiparous vs. multiparous), conception method (natural vs. in vitro fertilization), and medical conditions (gestational diabetes mellitus [GDM] and hypertension) were analyzed as categorical variables. Paternal attributes: paternal height, weight (continuous variables), and presence of medical conditions (yes/no). Neonatal characteristics: Gestational age, measured as a continuous variable (weeks) and categorized into 37–38, 38–39, 39–40, and 40–42 weeks [17], and infant sex (male/female).

(2) Psychological/behavioral factors

Maternal behaviors and pregnancy management: number of antenatal care (ANC) visits (<10 vs. ≥10) [18], and use of

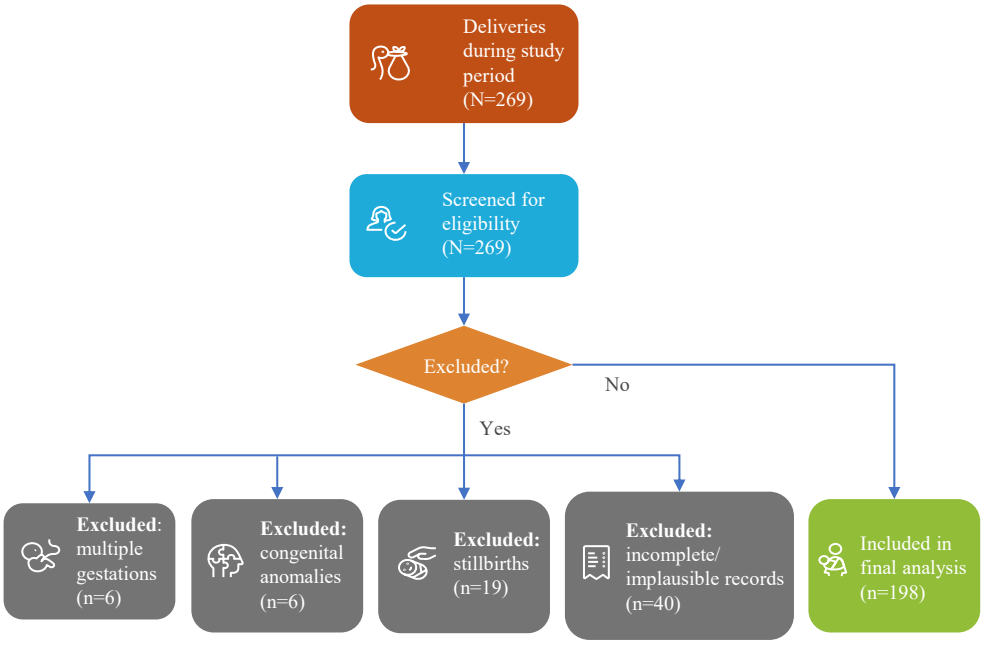

Figure 2. Sampling process of associated factors of birth weight and length among term newborns.

supplements (iron, calcium, protein). Lifestyle and emotional health proxies: dietary restrictions, vegetarian diet, and number of additional meals. Paternal behaviors: smoking status (yes/no).

(3) Social factors

Maternal sociodemographic characteristics: maternal age, although biologically relevant, was categorized as a sociodemographic variable because it reflects life-course and social context factors influencing health behaviors and healthcare access within the BPS framework (<18, 18–35, >35 years) [19], education (high school or below vs. above high school), occupation (government employee, worker, self-employed, housewife), and household income (<20 million Vietnam dong [VND]/mo vs. ≥20 million VND/mo). Categorical cutoffs were based on prior perinatal epidemiology literature and local clinical practice.

7. Data Collection Procedures

Data were extracted using a structured abstraction form. Two trained research assistants independently reviewed delivery registries and medical records. A screening log was used to identify all deliveries and assess eligibility. After verification, eligible records were abstracted and entered into an electronic database. Discrepancies between reviewers were identified through comparison and resolved by consensus after rechecking the original medical records. Unresolved cases were adjudicated by a senior investigator. A 10% random subsample was rechecked by a senior researcher to ensure accuracy. The data were examined for completeness, logical consistency, and validity.

8. Statistical Analysis

All collected data were entered into IBM SPSS Statistics ver. 29.0 (IBM Corp.), with a 2-tailed significance level set at $p<.05$. This study adopted a complete case analysis approach. Continuous variables were summarized as mean±standard deviation or median with interquartile range, as appropriate, while categorical variables were presented as frequencies and percentages. Normality was assessed using the Shapiro-Wilk test and P–P plots. Because several continuous variables violated the assumption of normality, nonparametric tests were applied. Bivariate associations were examined using the Mann-Whitney U test and Kruskal-Wallis H test as alternatives to the independent t-test and analysis of variance (ANOVA), respectively. Spearman's rank correlation coefficient (r_s) as an alternative to Pearson's correlation coefficient were used to assess relationships between continuous variables.

Two multiple linear regression models were constructed to identify independent predictors of birth length and weight. Predictors were selected a priori based on the BPS framework and informed by bivariate analysis ($p<.05$). Predictors were entered simultaneously using the Enter method. Linearity was evaluated using scatter plots and partial regression plots, and homoscedasticity was assessed by visual inspection of the standardized residual plots. Model assumptions and multicollinearity were evaluated using residual diagnostics, tolerance (>0.20), and the variance inflation factor (VIF <5) [20]. Model performance was assessed using the adjusted R^2 and ANOVA F-tests. Results were reported as standardized β coefficients, 95% confidence intervals (CIs), and *p*-values, with effect sizes interpreted as small (β≥.10), moderate (β≥.30), and large (β≥.50).

RESULTS

1. General Characteristics of the Study Population

This study included 198 singleton newborns and their parents (Table 1). In terms of gestational age, 32.3% of the infants were born between 37 and <38 weeks, 47.4% between 38 and <39 weeks, 18.7% between 39 and <40 weeks, and 1.5% between 40 and <42 weeks. Of the newborns, 55.6% were male, and 44.4% were female. The average birth weight was 3,067.3±369.7 g, with weights ranging from 2,000 to 4,600 g. Approximately 83% of the infants fell within the normal birth weight range of 2,500–<3,500 g. The mean birth length was 49.9±1.7 cm, with measurements ranging from 45.60 to 55.10 cm.

2. Associations of Biopsychosocial Factors with Birth Weight and Length

Table 1 shows the associations between biopsychosocial factors and neonatal outcomes (weight and length).

1) Biological/clinical factors

In the group comparison analyses, GDM was significantly associated with birth length (U=2,347.5, $p=.008$) but not

Table 1. Bivariate associations of biopsychosocial characteristics with birth weight and length (N=198)

Domain/factor	No. (%) or mean±SD (range)	Birth weight			Birth length		
		Mean±SD	Test statistic	*p*	Mean±SD	Test statistic	*p*
Group comparison analyses							
Biological/clinical factors							
Parity			4,488.5[a]	.849		4,224.5[a]	.385
Primiparous	73 (36.9)	3,063.5±371.4			50.1±1.9		
Multiparous	125 (63.1)	3,069.4±370.1			49.8±1.6		
Method of conception			997.0[a]	.864		940.0[a]	.632
Natural conception	187 (94.4)	3,068.8±365.8			49.9±1.7		
In vitro fertilization	11 (5.6)	3,040.9±449.9			50.2±2.0		
Hypertension during pregnancy			222.0[a]	.142		303.0[a]	.453
Yes	4 (2.0)	2,875.0±826.1			49.2±4.4		
No	194 (98.0)	3,071.2±357.9			49.9±1.6		
Gestational diabetes mellitus			2,902.0[a]	.331		2,347.5[a]	.008
Yes	41 (20.7)	3,135.3±506.4			50.5±2.0		
No	157 (79.3)	3,049.4±324.4			49.8±1.5		
Paternal medical conditions			495.0[a]	.094		697.0[a]	.691
Yes	8 (4.0)	2,825.0±337.0			49.4±2.7		
No	190 (96.0)	3,077.4±368.3			49.9±1.7		
Infant sex			3,783.5[a]	.008		4,402.5[a]	.275
Male	110 (55.6)	3,127.1±388.9			50.0±1.76		
Female	88 (44.4)	2,992.5±331.2			49.8±1.6		
Gestational age			47.02[b]	<.001		14.72[b]	.002
37w–<38w	64 (32.3)	2,822.8±320.2			49.4±1.8		
38w–<39w	94 (47.4)	3,150.5±311.4			50.0±1.4		
39w–<40w	37 (18.7)	3,233.8±369.5			50.6±1.8		
40w–<42w	3 (1.5)	3,620.0±230.6			52.1±2.0		
Psychological/behavioral factors							
No. of antenatal care visits			3,053.0[a]	.497		3,214.5[a]	.852
<10 visits	42 (21.2)	3,100.2±332.0			49.9±1.6		
≥10 visits	156 (78.8)	3,058.4±379.6			50.0±1.7		
Iron supplementation			725.0[a]	.222		855.5[a]	.632
Yes	188 (94.9)	3,058.3±367.3			49.9±1.7		
No	10 (5.1)	3,235.0±393.0			50.2±2.0		
Calcium supplementation			2,146.0[a]	.054		1,952.0[a]	.010
Yes	165 (83.3)	3,087.9±364.5			50.1±1.7		
No	33 (16.7)	2,963.9±383.4			49.4±1.5		
Protein supplementation			2,489.0[a]	.011		2,949.0[a]	.248
Yes	43 (21.7)	2,933.0±382.5			49.8±2.0		
No	155 (78.3)	3,104.5±358.4			50.0±1.6		
Vegetarian diet during pregnancy			270.0[a]	.819		208.5[a]	.393
Yes	3 (1.5)	3,116.7±525.2			50.3±0.3		
No	195 (98.5)	3,066.5±368.6			49.9±1.7		
Dietary restriction during pregnancy			2,878.0[a]	.902		2,643.5[a]	.381
Yes	36 (18.2)	3,120.3±488.1			50.2±1.9		
No	162 (81.8)	3,055.5±338.6			49.9±1.7		
Paternal smoking status			3,600.0[a]	.032		4,304.5[a]	.763
Yes	68 (34.3)	3,030.0±362.2			49.9±1.6		
No	130 (65.7)	3,138.4±376.0			49.9±1.8		
Social factors							
Maternal age (yr)			0.47[b]	.791		2.14[b]	.343
<18	4 (2.0)	3,050.0±613.7			50.5±2.5		
18–35	160 (80.8)	3,057.6±366.3			50.0±1.7		

(Continued on the next page)

Table 1. Continued

Domain/factor	No. (%) or mean±SD (range)	Birth weight			Birth length		
		Mean±SD	Test statistic	*p*	Mean±SD	Test statistic	*p*
>35	34 (17.2)	3,114±363.8			49.5±1.6		
Maternal education			4,463.0[a]	.906		4,223.0[a]	.460
High school or below	127 (64.1)	3,060.5±359.0			49.9±1.6		
Above high school	71 (35.9)	3,079.3±390.3			50.1±1.9		
Maternal occupation			2.41[b]	.491		6.09[b]	.108
Government employee	46 (23.2)	3,150.4±427.3			50.6±2.1		
Worker	60 (30.3)	3,085.5±277.8			49.9±1.2		
Self-employed	77 (38.9)	3,014.1±402.4			49.7±1.6		
Housewife	15 (7.6)	3,012.0±297.9			49.3±1.9		
Household income			2,845.0[a]	.189		2,829.0[a]	.175
<20 million VND/mo	42 (21.2)	2,976.7±281.3			49.4±1.5		
≥20 million VND/mo	156 (78.8)	3,098.7±391.7			50.1±1.7		
Correlation analyses							
Biological/clinical factors		3,067.3±369.7			49.9±1.7		
Maternal height (cm)	156.9±5.1 (145–170)		0.19[c]	.008		0.36[c]	<.001
Maternal pre-pregnancy weight (kg)	51.6±7.9 (36–92)		0.32[c]	<.001		0.33[c]	<.001
Gestational weight gain	13.0±4.3 (5–27)		0.22[c]	.001		0.23[c]	.001
Paternal height (cm)	169.94±5.58 (157–185)		0.09[c]	.224		0.52[c]	<.001
Paternal weight (kg)	66.07±8.03 (42–85)		0.12[c]	.108		0.27[c]	<.001
Gestational age (wk)	38.32±0.83 (37–41.14)		0.41[c]	<.001		0.20[c]	.004
Psychological/behavioral factors		3,067.3±369.7	–0.12[c]	.108	49.9±1.7	0.05[c]	.504
No. of additional meals per days	2.67±0.90 (0–4)						
Social factors		3,067.3±369.7			49.9±1.7		
Maternal age	29.87±5.9 (16–54)		–0.05[c]	.483		–0.12[c]	.104
Paternal age	32.87±5.96 (19–58)		0.01[c]	.928		–0.12[c]	.108

SD, standard deviation; VND, Vietnam dong.
[a]Mann-Whitney test (U). [b]Kruskal-Wallis test (H). [c]Spearman rank test (r).

birth weight (U=2,902.0, p=.331). Infant sex was significantly associated with birth weight (U=3,783.5, p=.008), with no significant association observed for birth length (p=.275). Gestational age was significantly associated with birth weight (H=47.02, p<.001) and birth length (H=14.72, p=.002). Other biological and clinical factors, including parity, method of conception, hypertension during pregnancy, and paternal medical conditions, were not significantly associated with either outcome (all p>.05).

Correlation analyses further demonstrated significant positive associations between parental anthropometric variables and neonatal outcomes. Maternal height was positively correlated with birth weight (r=.19, p=.008) and length (r=.36, p<.001). Maternal pre-pregnancy weight positively correlated with birth weight (r=.32, p<.001) and birth length (r=.33, p<.001). Gestational weight gain was positively correlated with birth weight (r=.22, p=.001) and birth length (r=.23, p=.001).

Paternal height showed a strong positive correlation with birth length (r=.52, p<.001) but was not correlated with birth weight (p=.224). Paternal weight was positively correlated with birth length (r=.27, p<.001) but not with birth weight (p=.108). Gestational age, which was analyzed as a continuous variable, positively correlated with birth weight (r=.41, p<.001) and birth length (r=.20, p=.004).

In addition, the correlation matrix revealed significant interrelationships among the key predictors (Supplement 1). Maternal height was positively correlated with maternal pre-pregnancy weight (r=.42, p<.001), while paternal height was positively correlated with paternal weight (r=.39, p<.001). Gestational age was also weakly correlated with birth weight (r=.41, p<.001) and length (r=.20, p=.004), reinforcing its role as an important biological factor.

2) Psychological/behavioral factors

In the group comparison analyses, calcium supplementation was significantly associated with birth length (U=1,952.0, p=.010) and showed a marginal association with

birth weight (p=.054). No protein supplementation was significantly associated with higher birth weight (U=2,489.0, p=.011) but not with birth length (p=.248). Paternal smoking status was significantly associated with lower birth weight (U=3,600.0, p=.032) but not with birth length (p=.763). Iron supplementation, a vegetarian diet, and dietary restrictions were not significantly associated with neonatal outcomes.

In the correlation analysis, the number of additional meals per day was not significantly correlated with birth weight (r=−.12, p=.108) or birth length (r=.05, p=.504).

3) Social factors

In the group comparison analyses, none of the sociodemographic factors, including maternal age, maternal education, maternal occupation, household income, number of ANC visits, or paternal age were significantly associated with birth weight or birth length (all p>.05).

Similarly, correlation analyses showed no significant correlations between maternal age (birth weight: r=−.05, p=.483; birth length: r=−.12, p=.104) or paternal age (birth weight: r=.01, p=.928; birth length: r=−.12, p=.108) and neonatal outcomes (Table 1).

Additionally, maternal age showed weak negative correlations with maternal pre-pregnancy weight (r=−.26, p<.001) and gestational weight gain (r=−.22, p=.002), although these were not associated with neonatal outcomes.

3. Multivariable Linear Regression Analysis of Factors Associated with Birth Weight

Multiple regression analysis showed that the model was significant (F(7, 190)=12.81, p<.001), explaining 32.1% of the variance in birth weight (adjusted R^2=.30).

The model diagnostics supported the assumptions of linear regression. Multicollinearity was not detected (tolerance ≥0.82; VIF ≤1.22), and the Durbin-Watson statistic (1.70) indicated independence of residuals. The residual plots showed no evidence of nonlinearity or heteroscedasticity. The histogram and P–P plot indicated the approximate normality of the residuals. Cook's distance values were low (maximum=0.10), suggesting that there were no influential outliers.

Gestational age (B=181.74, p<.001; 95% CI, 121.15 to 242.33; β=.37) and maternal pre-pregnancy weight (B=11.08, p<.001; 95% CI, 5.01 to 17.16; β=.24) were the strongest predictors of birth weight. No protein supplementation was also positively associated with birth weight (B=112.37, p=.040; 95% CI, 5.18 to 219.57; β=0.13). Female infants weighed significantly less than males (B=–120.74, p=.008; 95% CI, –209.93 to –31.55; β=–0.16). Maternal height, gestational weight gain, and paternal smoking status were not significant predictors (all p>.05) (Table 2).

4. Multivariable Linear Regression Analysis of Factors Associated with Birth Length

The regression model for birth length was significant (F(8, 189)=22.58, p<.001), explaining 48.9% of the variance (adjusted R^2=.47). The assumptions of linear regression were satisfied. The residuals were approximately normally distributed, as indicated by the histogram and normal P–P plots. Visual inspection of the standardized residuals against the predicted values demonstrated no obvious patterns, supporting linearity and homoscedasticity. No influential outliers were identified (Cook's distance <0.10, maximum=0.06). Multicollinearity was not observed (tolerance >0.70; VIF <1.40). The Durbin-Watson statistic (1.93) indicated the independence of the residuals.

Paternal height was the strongest predictor of birth length (B=0.15, p<.001; 95% CI, 0.11 to 0.18; β=.47), followed by

Table 2. Multivariable linear regression analysis of factors associated with birth weight (N=198)

Factor	B	β	t	p	95% CI
Maternal height	2.13	.03	0.45	.655	−7.28 to 11.55
Maternal pre-pregnancy weight	11.08	.24	3.60	<.001	5.01 to 17.16
Gestational weight gain	6.48	.08	1.24	.217	−3.83 to 16.79
Gestational age	181.74	.37	5.92	<.001	121.15 to 242.33
Protein supplementation[a]	112.37	.13	2.07	.040	5.18 to 219.57
Paternal smoking status[b]	−47.28	−.06	−1.01	.316	−140.00 to 45.44
Infant sex[c]	−120.74	−.16	−2.67	.008	−209.93 to −31.55
Model fit	R^2=.32, adjusted R^2=.30, F=12.81, p<.001				

B, unstandardized coefficient; β, standardized coefficient; CI, confidence interval.
[a]Dummy variable: reference=Yes. [b]Dummy variable: reference=No. [c]Dummy variable: reference=Male.

gestational age (B = 0.53, $p < .001$; 95% CI, 0.29 to 0.77; β = .23) and maternal height (B = 0.07, $p < .001$; 95% CI, 0.04 to 0.11; β = .22). Maternal pre-pregnancy weight also showed a significant positive association (B = 0.03, $p = .009$; 95% CI, 0.01 to 0.06; β = .16). Gestational weight gain, calcium supplementation, GDM, and paternal weight were not significant predictors of birth length ($p > .05$) (Table 3).

DISCUSSION

This study examined the determinants of birth weight and length in term newborns using a BPS model. Overall, biological factors (e.g., gestational age, infant sex, maternal pre-pregnancy weight, maternal height, and paternal height) influenced neonatal anthropometric outcomes. Behavioral and psychological factors (e.g., protein supplementation) also contributed, whereas social and demographic characteristics were not directly associated with birth size.

In the biological domain, gestational age was independently associated with both birth weight and birth length, whereas infant sex was independently associated only with birth weight. Greater gestational age was associated with greater birth weight and birth length, while male newborns had a higher birth weight than female newborns. These observations are consistent with the international newborn growth standards, which demonstrating clear gestational age- and sex-specific differences in birth weights and length [8]. Recent population-based data have also shown that male infants are consistently heavier and longer at birth across gestational ages, reinforcing the biological influence of fetal sex on neonatal anthropometry [21]. Moreover, both maternal and paternal traits play important roles in determining neonatal size. Maternal pre-pregnancy weight, gestational weight gain, and height were positively associated with birth weight and length. This is in agreement with recent evidence showing that both insufficient and excessive gestational weight gain are strongly associated with adverse neonatal outcomes in diverse settings [22,23]. Similarly, a large-scale analysis conducted by Dola and Valderrama [13] in 2024 also cited maternal height, pre-pregnancy weight, and gestational weight gain as strong and consistent predictors of birth weight. These findings suggest that fetal growth is mediated by maternal body composition before and during pregnancy.

Paternal height in our study also showed a strong association with neonatal length. Although most studies conventionally place great emphasis on maternal factors, recent work underlines the fact that paternal anthropometry independently explains variances in neonatal size [24]. These observations indicate that birth size is influenced not only by the intrauterine environment shaped by the mother, but also by the skeletal growth potential inherited from the father. This may be partly explained by genetic mechanisms; paternal height reflects inherited skeletal growth potential, which is transmitted to the fetus and manifests as greater linear growth at birth. A large Japanese cohort study demonstrated that paternal height was significantly associated with both birth weight and birth length independent of maternal characteristics, suggesting a direct genetic pathway influencing fetal skeletal development [24,25]. Clinically, this underscores the importance of recognizing the physical profiles of both parents when optimizing prenatal care.

Beyond biological factors, neonatal outcomes are further shaped by behavioral and psychosocial conditions. In this study, maternal protein supplementation remained a significant independent predictor of birth weight in the adjusted model, although the magnitude of this effect was modest. Interestingly, infants whose mothers reported protein supplementation had a lower birth weight than those whose moth-

Table 3. Multivariable linear regression analysis of factors associated with birth length (N=198)

Factor	B	β	t	*p*	95% CI
Maternal height	0.07	.22	3.84	< .001	0.04 to 0.11
Maternal pre-pregnancy weight	0.03	.16	2.63	.009	0.01 to 0.06
Gestational weight gain	0.04	.09	1.69	.093	−0.01 to 0.08
Calcium supplementation[a)]	−0.45	−.10	−1.85	.066	−0.92 to 0.03
Gestational diabetes mellitus[b)]	−0.24	−.06	−1.02	.307	−0.70 to 0.22
Paternal height	0.15	.47	8.23	< .001	0.11 to 0.18
Paternal weight	0.00	−.02	−0.32	.752	−0.03 to 0.02
Gestational age	0.53	.23	4.33	< .001	0.29 to 0.77
Model fit	$R^2 = .49$, adjusted $R^2 = .47$, $F = 22.58$, $p < .001$				

B, unstandardized coefficient; β, standardized coefficient; CI, confidence interval.
[a)]Dummy variable: reference=Yes. [b)]Dummy variable: reference=Yes.

ers did not receive supplementation. This finding differs from recent high-quality evidence demonstrating that improved maternal protein energy intake can enhance fetal growth. A recent systematic review and meta-analysis of 24 trials showed that balanced protein–energy supplementation significantly increased birth weight and reduced the risk of low birth weight among pregnant women in diverse settings [26]. However, in the present study, protein supplementation was assessed only as a binary variable (yes/no) without information on dosage, duration, or nutritional composition. Therefore, the associations observed should be interpreted with caution. One possible explanation is that protein supplementation may have been provided more frequently to women at higher nutritional or obstetric risk, resulting in residual confounding rather than a causal effect of protein supplementation itself. While these findings suggest the potential benefits of adequate protein and energy intake during pregnancy, the current data do not allow for precise conclusions regarding the specific effects or optimal characteristics of supplementation. These findings support the broader role of maternal nutrition in fetal growth and highlight the importance of appropriately designed nutritional interventions during pregnancy. However, psychological factors central to the BPS model were not included in this study because of data limitations. This omission may have limited our ability to fully capture the complex pathways that influence neonatal outcomes.

In this study, no significant relationships were observed between social or demographic variables and neonatal size. This may reflect the relatively homogeneous living conditions and healthcare access within the sampled population. However, research from other low- and middle-income countries (LMIC) indicates that socioeconomic inequality remains an important determinant of LBW [15]. Engdaw et al. [14] in 2023 also found that regular antenatal visits greatly reduced the likelihood of LBW in African settings, indicating that healthcare access can offset the disadvantages associated with a lower socioeconomic status. The discrepancy between our findings and those of previous studies likely reflects contextual differences. In our setting, ANC access is relatively uniform, limiting socioeconomic variability. However, in many LMIC contexts, wider disparities in healthcare access and living conditions make social inequalities more evident in neonatal outcomes.

In Vietnam, the low national prevalence of LBW (8.2% [27], probably reflects nationwide improvements in maternal nutrition and healthcare coverage. However, gaps still exist between rural and urban areas. Quyen et al. [9] in 2020 found that mothers from rural areas with lower dietary diversity and suboptimal weight gain tend to have smaller babies. These findings show that, although progress at the national level can reduce inequalities, differences in income, education, and environmental conditions at the local level still matter. There is also a growing body of evidence showing that general social and environmental stressors, such as air pollution, food insecurity, and urban stress, interact with biological processes that influence fetal development [28]. Thus, social factors might not be a direct predictor in statistical models but could shape the environment in which biological and behavioral determinants operate. Therefore, future studies in Vietnam should capture the full context of neonatal health determinants, including environmental exposure, family support, and perceived stress.

The application of the BPS model has helped elaborate on how biological, behavioral, and social factors come together to influence fetal growth. Biological factors provide a physiological basis for growth, while behavioral and psychosocial factors determine how well the biological potential is utilized. These findings have clinical implications for the integration of biological monitoring with behavioral counseling in ANC. Healthy gestational weight gain, balanced diets, micronutrient supplementation, and avoidance of tobacco exposure are essential components of comprehensive prenatal programs. Psychosocial screening and support, including emotional status, family relationships, and partner involvement, are also important. Walsh et al. [29] in 2019 identified maternal stress and lack of family support as contributors to poor perinatal outcomes, emphasizing the importance of counseling and social support systems in maternal healthcare.

Importantly, given the significant association between paternal height and neonatal birth length observed in this study, prenatal care programs should move beyond a maternal-centered approach to incorporate paternal factors. Integrating fathers into antenatal education and counseling programs may help optimize fetal growth by addressing shared health behaviors, lifestyle factors, and genetic influences. For example, programs could include components such as paternal health screening, lifestyle modifications (e.g., smoking cessation and nutrition), and active participation in antenatal visits [30]. Such family-centered approaches are consistent with the BPS model and may enhance both maternal and

neonatal outcomes by leveraging the combined influence of both parents.

From a policy perspective, the BPS framework provides an important guide for designing family-centered maternal health interventions. Strengthening prenatal education, expanding equitable access to supplements, and developing rural healthcare infrastructure remain national priorities. The promotion of paternal involvement in maternal health programs may provide additional opportunities to promote family cohesion and long-term health outcomes for mothers and children. The use of a multidimensional approach congruent with the BPS model ensures that the biological aspects of pregnancy are considered along with the behavioral and social contexts in which health behaviors occur.

This study had several limitations. First, its retrospective cross-sectional design precluded causal inference and limited the ability to capture longitudinal changes during pregnancy. Future prospective cohort studies across multiple centers and regions should provide more robust evidence. Second, psychological factors (e.g., maternal stress, family support, and air pollution exposure) were not measured. Future studies should incorporate psychological assessments to provide a more comprehensive evaluation of the BPS framework regarding birth outcomes. Third, while paternal height and smoking were included, detailed paternal data (BMI, diet, and occupational stress) were lacking. Future studies should broaden paternal profiling in line with emerging evidence of paternal influence [31]. Furthermore, the study was subject to potential selection and participation biases related to the data completeness criteria. The requirement for full maternal and paternal sociodemographic and anthropometric data may have inadvertently skewed the analyzed sample toward certain socioeconomic strata. It is plausible that participants with higher socioeconomic backgrounds were more willing to disclose sensitive personal and physical information for research purposes. Conversely, individuals from lower-income or marginalized groups may harbor reservations or negative perceptions regarding data disclosure, leading to underrepresentation. Consequently, a participation bias may have restricted the generalizability of our findings to a broader population. Finally, advanced analytical techniques such as structural equation modeling or machine learning may help unpack the complex interdomain interactions posited by the BPS model.

CONCLUSION

This study highlights the multifactorial nature of neonatal outcomes within a BPS framework, emphasizing the combined influence of maternal and paternal factors on fetal growth. These findings support the need for more comprehensive prenatal care approaches that extend beyond maternal-focused models to include paternal characteristics and family contexts. Strengthening preconception nutrition, optimizing gestational weight management, and incorporating paternal involvement in routine ANC may enhance risk assessment and contribute to improved birth outcomes, particularly in low- and middle-income settings.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: DTTH, DTLA. Methodology: DTTH, DTLA. Data collection: DTLA. Formal analysis: DTTH, QVV, HTO. Validation: DTTH, DTLA, QVV, HTO. Investigation: DTLA. Writing–original draft: DTTH. Writing–review and editing: DTTH, DTLA, QVV, HTO. Supervision: none. Project administration: none. Final approval of published version: DTTH, DTLA, QVV, HTO.

Conflict of interest

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

Funding

This research was funded by the Hai Phong University of Medicine and Pharmacy.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

AI use disclosure

Generative AI was used solely for grammar and language clarity checks during manuscript preparation. The authors reviewed and approved all suggestions, and are fully responsible for the content of this work.

Supplementary material

Supplement 1. Correlation matrix of Spearman's rho correlation coefficients.

ORCID and ResearcherID

Do Thi Thu Huyen https://orcid.org/0009-0002-0981-0029
https://researcherid.com/rid/JWP-0103-2024
Quang Vu Van https://orcid.org/0000-0002-8434-9052
https://researcherid.com/rid/PYY-6503-2026
Hoang Thi Oanh https://orcid.org/0009-0008-4187-0703
https://researcherid.com/rid/QDO-5335-2026
Do Thi Lan Anh https://orcid.org/0009-0007-4620-1333
https://researcherid.com/rid/PGF-1146-2026

REFERENCES

1. Blencowe H, Krasevec J, de Onis M, Black RE, An X, Stevens GA, et al. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: a systematic analysis. Lancet Glob Health. 2019;7(7):e849-e860. https://doi.org/10.1016/S2214-109X(18)30565-5
2. World Health Organization (WHO). Global nutrition targets 2025: low birth weight policy brief [Internet]. WHO; 2014 [cited 2026 Jan 3]. Available from: https://www.who.int/publications/i/item/WHO-NMH-NHD-14.5
3. UNICEF. 1 in 7 babies worldwide born with a low birthweight: the Lancet Global Health, UNICEF, WHO. UNICEF; 2019.
4. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: consequences for adult health and human capital. Lancet. 2008;371(9609):340-357. https://doi.org/10.1016/S0140-6736(07)61692-4
5. Barker DJ. Fetal origins of coronary heart disease. BMJ. 1995;311(6998):171-174. https://doi.org/10.1136/bmj.311.6998.171
6. Jamshed S, Khan F, Chohan SK, Bano Z, Shahnawaz S, Anwar A, et al. Frequency of normal birth length and its determinants: a cross-sectional study in newborns. Cureus. 2020;12(9):e10556. https://doi.org/10.7759/cureus.10556
7. World Health Organization (WHO). UNICEF/WHO low birthweight estimates: levels and trends 2000-2020. WHO; 2023.
8. Villar J, Cheikh Ismail L, Victora CG, Ohuma EO, Bertino E, Altman DG, et al. International standards for newborn weight, length, and head circumference by gestational age and sex: the Newborn Cross-Sectional Study of the INTERGROWTH-21st Project. Lancet. 2014;384(9946):857-868. https://doi.org/10.1016/S0140-6736(14)60932-6
9. Quyen PN, Nga HT, Chaffee B, Ngu T, King JC. Effect of maternal prenatal food supplementation, gestational weight gain, and breast-feeding on infant growth during the first 24 months of life in rural Vietnam. PLoS One. 2020;15(6):e0233671. https://doi.org/10.1371/journal.pone.0233671
10. Hop le T. Secular trend in size at birth of Vietnamese newborns during the last 2 decades (1980-2000). Asia Pac J Clin Nutr. 2003;12(3):266-270.
11. Engel GL. The need for a new medical model: a challenge for biomedicine. Science. 1977;196(4286):129-136. https://doi.org/10.1126/science.847460
12. Arabzadeh H, Doosti-Irani A, Kamkari S, Farhadian M, Elyasi E, Mohammadi Y. The maternal factors associated with infant low birth weight: an umbrella review. BMC Pregnancy Childbirth. 2024;24(1):316. https://doi.org/10.1186/s12884-024-06487-y
13. Dola SS, Valderrama CE. Exploring parental factors influencing low birth weight on the 2022 CDC natality dataset. BMC Med Inform Decis Mak. 2024;24(1):367. https://doi.org/10.1186/s12911-024-02783-x
14. Engdaw GT, Tesfaye AH, Feleke M, Negash A, Yeshiwas A, Addis W, et al. Effect of antenatal care on low birth weight: a systematic review and meta-analysis in Africa, 2022. Front Public Health. 2023;11:1158809. https://doi.org/10.3389/fpubh.2023.1158809
15. Mare KU, Andarge GG, Sabo KG, Mohammed OA, Mohammed AA, Moloro AH, et al. Regional and sub-regional estimates of low birth weight and its determinants in 44 low- and middle-income countries: evidence from demographic and health survey data. BMC Pediatr. 2025;25(1):342. https://doi.org/10.1186/s12887-025-05691-9
16. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol. 2008;61(4):344-349. https://doi.org/10.1016/j.jclinepi.2007.11.008
17. Dahlen HG, Thornton C, Downe S, de Jonge A, Seijmonsbergen-Schermers A, Tracy S, et al. Intrapartum interventions and outcomes for women and children following induction of labour at term in uncomplicated pregnancies: a 16-year population-based linked data study. BMJ Open. 2021;11(6):e047040. https://doi.org/10.1136/bmjopen-2020-047040
18. Abid MT, Kulsum U, Sultana S, Razia S, Chowdhury AH. Relationship between antenatal care and pregnancy outcome among participants of a Rural Upazilla Health complex in Bangladesh. Age. 2024;20(17):37-38. https://doi.org/10.36348/sijog.2024.v07i09.012
19. Kozuki N, Lee AC, Silveira MF, Sania A, Vogel JP, Adair L, et al. The associations of parity and maternal age with small-for-gestational-age, preterm, and neonatal and infant mortality: a meta-anal-

ysis. BMC Public Health. 2013;13(Suppl 3):S2. https://doi.org/10.1186/1471-2458-13-S3-S2

20. Akinwande MO, Dikko HG, Samson A. Variance inflation factor: as a condition for the inclusion of suppressor variable(s) in regression analysis. Open J Stat. 2015;5(7):754-767. https://doi.org/10.4236/ojs.2015.57075
21. Azcorra H, Dickinson F, Mendez-Dominguez N, Mumm R, Valentín G. Development of birthweight and length for gestational age and sex references in Yucatan, Mexico. Am J Hum Biol. 2022;34(6):e23732. https://doi.org/10.1002/ajhb.23732
22. Perumal N, Wang D, Darling AM, Liu E, Wang M, Ahmed T, et al. Suboptimal gestational weight gain and neonatal outcomes in low and middle income countries: individual participant data meta-analysis. BMJ. 2023;382:e072249. https://doi.org/10.1136/bmj-2022-072249
23. Huang Z, Tan X, Wang J, Zhang A. Maternal pre-pregnancy body mass index and gestational weight gain on adverse birth outcomes in Chinese newborns: a retrospective study. J Health Popul Nutr. 2024;43(1):165. https://doi.org/10.1186/s41043-024-00652-x
24. Deshpande M, Miriam D, Shah N, Kajale N, Angom J, Bhawra J, et al. Influence of parental anthropometry and gestational weight gain on intrauterine growth and neonatal outcomes: findings from the MAI cohort study in rural India. PLOS Glob Public Health. 2023;3(8):e0001858. https://doi.org/10.1371/journal.pgph.0001858
25. Takagi K, Iwama N, Metoki H, Uchikura Y, Matsubara Y, Matsubara K, et al. Paternal height has an impact on birth weight of their offspring in a Japanese population: the Japan Environment and Children's Study. J Dev Orig Health Dis. 2019;10(5):542-554. https://doi.org/10.1017/S2040174418001162
26. Iftikhar A, Azam H, Ahmed M, Asad A, Noorani A, Shabbir M, et al. Effect of balanced protein-energy supplementation given to pregnant women on birth outcomes: a systematic review and meta-analysis. Womens Health (Lond). 2025;21:17455057251335366. https://doi.org/10.1177/17455057251335366
27. Global Nutrition Report. Country nutrition profile: Viet Nam [Internet]. Global Nutrition Report; 2021 [cited 2026 Jan 3]. Available from: https://globalnutritionreport.org/resources/nutrition-profiles/asia/south-eastern-asia/viet-nam/
28. O'Sullivan A, Monk C. Maternal and environmental influences on perinatal and infant development. Future Child. 2020;30(2):11-34. https://doi.org/10.1353/foc.2020.a807759
29. Walsh K, McCormack CA, Webster R, Pinto A, Lee S, Feng T, et al. Maternal prenatal stress phenotypes associate with fetal neurodevelopment and birth outcomes. Proc Natl Acad Sci U S A. 2019;116(48):23996-24005. https://doi.org/10.1073/pnas.1905890116
30. Tokhi M, Comrie-Thomson L, Davis J, Portela A, Chersich M, Luchters S. Involving men to improve maternal and newborn health: a systematic review of the effectiveness of interventions. PLoS One. 2018;13(1):e0191620. https://doi.org/10.1371/journal.pone.0191620
31. Kearns ML, Lahdenperä M, Galante L, Rautava S, Lagström H, Reynolds CM. Association of paternal BMI and diet during pregnancy with offspring birth measures: the STEPS Study. Nutrients. 2025;17(5):866. https://doi.org/10.3390/nu17050866

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):287-296
https://doi.org/10.4094/chnr.2025.040

pISSN 2287-9110
eISSN 2287-9129

CHNR

Associations of asthma with obesity phenotypes and dyslipidemia among Korean adolescents: a secondary data analysis of the Eighth Korea National Health and Nutrition Examination Survey

Heashoon Lee

Professor, School of Nursing, Hannam University, Daejeon, Korea

Corresponding author
Heashoon Lee
School of Nursing, Hannam University, 70 Hannam-ro, Daedeok-gu, Daejeon 34430, Korea
Tel: +82-42-629-8474
Fax: +82-42-629-8883
E-mail: lhs7878@hanmail.net

Received: October 12, 2025
Revised: March 7, 2026
Accepted: May 6, 2026

Purpose: This study investigated the association of asthma with obesity phenotypes and dyslipidemia among Korean adolescents.
Methods: This secondary analysis included 1,723 adolescents aged 10–18 years, using data from the Eighth Korea National Health and Nutrition Examination Survey conducted in 2019–2021. The complex sampling design accounted for stratification, clustering, and sampling weights. Data were analyzed using the t-test, Rao-Scott chi-square test, and binary logistic regression.
Results: Factors associated with asthma included body mass index (BMI), waist circumference (WC), high-density lipoprotein cholesterol (HDL-C), age, sex, and smoking-related variables. The adjusted odds of asthma were 1.21-fold higher per 1-unit increase in BMI and 4.50-fold higher per 1-unit increase in WC. Each 1-unit increase in HDL-C was associated with 0.78-fold lower odds of asthma. Compared with adolescents aged 10–12 years, those aged 13–15 and 16–18 years had 0.38-fold and 0.36-fold lower odds of asthma, respectively. Female adolescents had 0.46-fold lower odds than male adolescents. Adolescents who smoked had 4.40-fold higher odds of asthma than those who did not smoke. The odds of asthma were 10.26-fold higher among adolescents who began smoking before the age of 12 years and 10.20-fold higher among those who smoked more than 11 cigarettes per day.
Conclusion: Clinical programs for preventing and managing asthma in adolescents should include physical activity promotion and dietary management, as well as abdominal muscle-strengthening exercises in cases of abdominal obesity. Regular monitoring of blood lipid levels, particularly HDL-C levels, should also be included.

Keywords: Abdominal obesity; Asthma: Adolescent; Obesity; Dyslipidemias

INTRODUCTION

Asthma is the most common chronic inflammatory airway disease among adolescents [1]. It is characterized by respiratory symptoms such as dyspnea, chest tightness, and cough, accompanied by variable expiratory airflow limitation [2]. The global prevalence of asthma has been steadily increasing, according to the Centers for Disease Control and Prevention, the prevalence of asthma was estimated to be 8.8% in 2022 [3], and, the prevalence of asthma among Korean adolescents has increased from approximately 4% in 2007 to about 6% in 2023 [1]. Despite advances in medical care, insufficient pre-

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

vention and delayed treatment continue to contribute to asthma-related mortality [2].

Although obesity has been associated with an increased risk of asthma, it remains a major global health concern and continues to rise at an alarming rate [4]. In Korea, the prevalence of obesity among adolescents increased from 5.9% in 2006 to 11.7% in 2020 [5]. Obesity often precedes the onset of asthma [6] and represents one of its most significant risk factors [4]. Furthermore, obesity contributes to poor asthma control and more frequent exacerbations, which are often difficult to manage [6]. It also diminishes treatment effectiveness, particularly for inhaled and systemic corticosteroids, and may be associated with reduced therapeutic responsiveness [7].

Obesity phenotype refers to the classification of obesity based on patterns of body fat accumulation and distribution, including general obesity measured by body mass index (BMI) [8] and abdominal obesity (AO) measured by waist circumference (WC) [9]. One of the most widely used tools for assessing obesity is the BMI. However, BMI is an indicator of relative weight and may not accurately represent body fat distribution [8,10]. The health risks associated with obesity are more closely linked to the distribution of body fat than to total body weight [11]. Alternative measures of fat distribution include AO indices such as WC, which are more effective than BMI in predicting obesity-related diseases [9].

Obesity, as defined by BMI, is associated with subcutaneous adipose tissue [2]. In contrast, AO primarily results from visceral fat accumulation, AO-related asthma may result from structural changes in airway diameter and lung volume [12]. Specifically, studies have demonstrated a correlation between AO and asthma [13], with every 10 cm increase in WC associated with a 40% higher likelihood of developing asthma [8]. However, other research has reported no significant association between AO and asthma [14]. Therefore, this study needs to analyze asthma risk among Korean adolescents by including obesity phenotypes defined not only by BMI but also by AO indicators based on WC.

Dyslipidemia is an abnormal blood lipid condition characterized by elevated total cholesterol (TC), triglyceride (TG), and low-density lipoprotein cholesterol (LDL-C), or decreased high-density lipoprotein cholesterol (HDL-C) levels [2,15]. A significant association has been reported between serum lipid levels and asthma [16,17]. In particular, asthmatic adolescents with dyslipidemia have shown a significant correlation with lung function indices [18]. The prevalence of asthma was higher among adolescents with elevated TC and TG levels [17,18], whereas adolescents with asthma exhibited lower HDL-C levels compared with those without asthma [19]. However, elevated TC, TG, and LDL-C levels, as well as low HDL-C levels, were not significantly associated with asthma in other studies [20]. Thus, the association between asthma and dyslipidemia remains inconsistent [17-20], and research among adolescents is still limited [17].

In obesity, hypertrophy and dysfunction of adipocytes lead to elevated serum TG levels, decreased HDL, and increased LDL, in other words, dyslipidemia is a common comorbidity in obese patients, and there is a correlation between the 2 factors [3]. Although obesity and dyslipidemia are independent disease entities, they are closely interrelated and jointly contribute to the development and exacerbation of asthma through systemic inflammation and metabolic dysregulation [15,17]. Previous studies have primarily focused on the association between obesity and asthma [2,13], dyslipidemia and asthma [16,18]. Inflammatory factors associated with asthma include obesity and dyslipidemia [15], and dyslipidemia increases the risk of asthma in obese individuals [17]. Nevertheless, research on the combined association of obesity, dyslipidemia, and asthma in Korean adolescents has been limited.

Previous studies have demonstrated that obesity increases the risk of asthma, most frequently assessed using BMI [3,6]. However, some individuals may have a normal BMI but still exhibit AO [10], and the association between AO and asthma has been more consistent [8,9]. In addition, asthma has been linked to dyslipidemia [16], and risk factors for asthma include elevated TC, TG, and LDL-C levels [17,18] as well as low HDL-C levels [19]. Conversely, other studies have found no significant relationship between these lipid parameters and the development of asthma [20]. So, it is necessary to determine whether specific patterns of dyslipidemia are associated with asthma in Korean adolescents.

Obesity phenotype and dyslipidemia may be differentially associated with asthma. Also, there have been no prior studies that simultaneously examined the relationships between BMI, WC, detailed lipid profile, and asthma in Korean adolescents. Therefore, comprehensive studies are needed to investigate the associations among asthma, obesity phenotype, and dyslipidemia in Korean adolescents.

The objectives of this study were to identify general characteristics, obesity phenotype, and lipid profiles of groups with and without a history of asthma, and to investigate the

association between asthma and body weight, AO, and dyslipidemia in Korean adolescents.

This study will provide evidence applicable to nursing practice. In particular, the findings are expected to serve as foundational data for the early identification of health risk factors and the development of lifestyle intervention strategies in school health. Furthermore, this study will contribute to the importance of nurse-led integrated health management and the need for a family-centered approach.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of the Hannam University (IRB No. 2024-E-03-01-1019). The requirement for informed consent was waived owing to the retrospective nature of the study.

1. Study Design

This study was an observational, cross-sectional secondary data analysis using data from the Eighth Korea National Health and Nutrition Examination Survey (KNHANES VIII, 2019–2021) to examine the relationships among asthma, obesity phenotypes, and dyslipidemia in Korean adolescents. The reporting of this study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [21].

2. Participants and Data Collection

Data for adolescents aged 10–18 years were extracted from KNHANES-VIII. The survey employed a 2-stage cluster sampling design: first, sample areas were selected, followed by the selection of households within those areas. Sampling was stratified by administrative divisions such as cities/provinces and neighborhoods (dongs/eup-myeon), as well as housing types. Implicit stratification factors included the proportions of residential areas and the educational levels of household heads.

The KNHANES-VIII dataset comprises health-related questionnaires, physical measurements, and nutrition surveys, all collected by trained personnel. To protect participant confidentiality, the KNHANES-VIII dataset underwent top-coding, bottom-coding, and variable recategorization. These procedures ensured data anonymity and compliance with ethical standards. Following approval from the Korea Centers for Disease Control and Prevention to use the raw data (approval granted on May 10, 2024), this study accessed the data, with the analysis period spanning from August to December 2024.

Of the total 22,559 participants, 1,723 adolescents aged 10–18 years were included after excluding those younger than 10 or older than 18 years, as well as non-respondents. Among these participants, 112 individuals (6.1%) were classified in the asthma group, and 1,611 (93.9%) were categorized in the non-asthma group.

3. Measurements

In this study, the general characteristics of the participants included age groups (10–12 years, 13–15 years, and 16–18 years), sex, smoking status (non-smoker or smoker), age at smoking onset (≤12 years, 13–15 years, and 16–18 years), and daily cigarette consumption categorized as ≤5, 6–10, or ≥11 cigarettes per day.

1) Asthma-related characteristics

Asthma-related variables in KNHANES-VIII included self-reported physician diagnosis of asthma ("Have you ever been diagnosed with asthma by a doctor?"; yes or no), age at asthma onset (categorized as ≤9 years, 10–12 years, and 13–18 years), and asthma medication usage, which was classified as regular use, irregular use, or no use.

2) Measurements of general obesity and abdominal obesity

In this study, general obesity was assessed using BMI, calculated by dividing body weight in kilograms by height in meters squared (kg/m^2) [22]. Anthropometric measurements were conducted in the morning after an overnight fast, in accordance with the KNHANES-VIII protocol. For height measurement, participants stood barefoot on a flat surface in an upright position with their heels together and feet slightly apart. While maintaining straight knees and relaxed arms at their sides, they faced forward with their line of sight kept level. After taking a deep breath and holding it, height was recorded in centimeters to the nearest 0.1 cm. Before weight measurement, the scale was calibrated and reset to zero. Participants, dressed in light clothing, stood still with arms relaxed and eyes facing forward. Body weight was measured in kilograms and recorded to one decimal place.

AO was determined using WC. According to the KN-

HANES-VIII protocol, WC was measured while participants stood upright and maintained normal, relaxed breathing. A non-stretchable measuring tape was placed horizontally at the midpoint between the lower margin of the last palpable rib and the upper border of the iliac crest, and the measurement was recorded to the nearest 0.1 cm [22].

3) Lipid profile measurements

In KNHANES-VIII, blood samples were collected in the early morning following an overnight fast. Experienced medical personnel performed venipuncture using a sterile vacuum needle inserted into the participant's antecubital vein. Blood was drawn into specialized vacuum tubes designed for component separation. Serum samples were stored under controlled low-temperature conditions and preserved according to standardized handling protocols until analysis. Uniform procedures were consistently applied to all participants to ensure measurement reliability and accuracy.

Serum lipid profiles, including TC, TG, LDL-C, and HDL-C, were analyzed using an enzymatic colorimetric assay. All analyses were conducted with the Hitachi Labospect analyzer (Hitachi) [22].

4. Data Analysis

This study used data from KNHANES-VIII, applying a complex sampling design that accounted for stratification, clustering, and sampling weights. Descriptive statistics of participants' characteristics were presented as unweighted frequencies, weighted percentages, estimated means, and standard errors. Group differences in general characteristics, BMI, WC, and lipid profile parameters between the asthma and non-asthma groups were analyzed using the t-test and Rao-Scott chi-square test. Binary logistic regression analyses were performed to identify factors associated with asthma among adolescents. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were calculated for each variable. All statistical analyses were performed using IBM SPSS ver. 27.0 (IBM Corp.).

RESULTS

1. General Characteristics of Participants

Among the study population, 112 participants (6.1%) were classified in the asthma history group, whereas 1,611 participants (93.9%) were categorized in the non-asthma history group. The distribution of asthma onset age was as follows: 4.1% at ≤9 years, 1.1% at 10–12 years, and 0.8% at 13–18 years. Regarding asthma medication use, 0.6% of participants reported regular use, 1.5% reported irregular use, and 4.0% reported no use of medication.

The mean age of all participants was 14.17 years, with males comprising 53.2% and females 46.8% of the total sample. Smokers accounted for 6.6% of participants, with ages of onset ranging from 16–18 years (3.0%), 13–15 years (2.7%) and ≤12 years (0.9%). Among smokers, the amount of smoking cigarettes per day was 6–10 (2.4%), ≤5 (2.2%), and ≥11 (2.0%). The participants' mean height was 162.02 cm, mean weight was 57.21 kg, mean BMI was 21.54 kg/m^2, and the mean WC was 72.46 cm. The mean lipid profile values were as follows: TC 154.45 mg/dL, TG 72.66 mg/dL, LDL-C 87.97 mg/dL, and HDL-C 59.06 mg/dL (Table 1).

2. General Characteristics, Obesity Phenotypes, and Lipid Profile related Characteristics of the Asthma and Non-asthma Groups

The average age of participants in the asthma group was significantly higher than that of the non-asthma group ($t = 42.22$, $p < .001$). When classified by age group, those aged 16–18 years accounted for 46.9% of the asthma group, followed by those aged 13–15 years (37.6%) and 10–12 years (15.5%). In contrast, the non-asthma group included 35.9% aged 16–18 years, 31.1% aged 13–15 years, and 32.9% aged 10–12 years. The distribution showed a statistically significant difference between groups ($\chi^2 = 14.03$, $p = .047$). With respect to sex, males constituted 74.7% of the asthma group and 51.8% of the non-asthma group, while females accounted for 25.3% and 48.2%, respectively. This difference was statistically significant ($\chi^2 = 20.76$, $p = .003$).

Smoking-related characteristics also significantly differed between groups. The asthma group had a higher proportion of smokers (29.3% vs. 5.1%), an earlier smoking onset (≤12 years: 10.2% vs. 0.3%), and a greater daily cigarette consumption (≥11 cigarettes/day: 11.6% vs. 1.5%) compared with the non-asthma group ($p < .001$ for all).

The asthma group showed significantly higher levels of BMI ($t = 2.25$, $p = .025$) and WC ($t = 2.71$, $p = .007$) compared with the non-asthma group. Regarding lipid profiles, the asthma group had significantly lower HDL-C levels than the non-asthma group ($t = 5.38$, $p < .001$) (Table 2).

Table 1. General characteristics of subjects (N=1,723)

Characteristic	Value
Asthma diagnosis	
No	1,611 (93.9)
Yes	112 (6.1)
Asthma onset age (yr)	
Non-asthma	1,611 (93.9)
≤9	84 (4.1)
10–12	17 (1.1)
13–18	11 (0.8)
Asthma drug administration	
Non-asthma	1,611 (93.9)
Regular drug administration	12 (0.6)
Irregular drug administration	20 (1.5)
No drug administration	80 (4.0)
Age (yr)	14.17±0.07
10–12	639 (31.9)
13–15	560 (31.6)
16–18	524 (36.6)
Sex	
Male	946 (53.2)
Female	777 (46.8)
Smoking status	
Non-smoker	1,628 (93.4)
Smoker	95 (6.6)
Smoking onset age (yr)	
Non-smoker	1,628 (93.4)
≤12	15 (0.9)
13–15	41 (2.7)
16–18	39 (3.0)
Amount of smoking (cigarettes/day)	
Non-smoker	1,628 (93.4)
≤5	30 (2.2)
6–10	39 (2.4)
≥11	26 (2.0)
Height (cm)	162.02±0.35
Weight (kg)	57.21±0.53
Body mass index (kg/m²)	21.54±0.15
Waist circumference (cm)	72.46±0.38
Total cholesterol (mg/dL)	154.45±0.82
Triglyceride (mg/dL)	72.66±0.89
Low-density lipoprotein cholesterol (mg/dL)	87.97±0.91
High-density lipoprotein cholesterol (mg/dL)	59.06±0.45

Values are presented as unweighted frequencies (weighted %) or estimated mean±standard error. All percentages and means are weighted.

3. Factors Affecting Adolescent Asthma

To identify factors associated with asthma in adolescents, binary logistic regression analysis was performed. Variables included in the model were those that showed statistically significant differences between asthma and non-asthma groups (Table 2). In addition, previous studies have reported that elevated serum TC, TG, and LDL-C levels are risk factors for asthma [17,18]. These lipid parameters may promote systemic inflammation, exacerbate airway inflammation, and consequently worsen asthma symptoms [19]. Accordingly, these variables were also included in the analysis. The final model incorporated BMI, WC, lipid profile components, age, sex, smoking status, age at smoking initiation, and daily smoking amount.

In the multicollinearity diagnostics performed in this study, BMI and WC exhibited identical values for the variance inflation factor (VIF) 5.034 and tolerance 0.210. Given that no universally accepted VIF cut-off has been established, these values suggest that multicollinearity is unlikely to be a major concern in the present study [23].

In addition, multicollinearity among smoking-related variables was assessed. The results showed acceptable VIF and tolerance values for smoking status (VIF=1.003, tolerance=0.997), smoking onset age (VIF=1.970, tolerance=0.508), and smoking amount (VIF=1.966, tolerance=0.509), indicating that multicollinearity among these variables was unlikely to be substantial. Model explanatory power was confirmed by Cox & Snell R^2=.402 and Nagelkerke R^2=.750, demonstrating that the selected variables adequately explained variance in asthma risk and confirming the model's robustness.

The AORs indicated that each one-unit increase in BMI and WC was associated with 1.21-fold (95% CI, 1.09–1.34; p<.001) and 4.50-fold (95% CI, 1.94–10.43; p<.001) higher odds of asthma, respectively, while a one-unit increase in HDL-C was related to 0.78-fold (95% CI, 0.65–0.94; p=.011) lower odds of asthma. Compared with adolescents aged 10–12 years, those aged 13–15 and 16–18 years had 0.38-fold (95% CI, 0.18–0.79; p=.012) and 0.36-fold (95% CI, 0.16–0.80; p=.020) lower risks, respectively. Females had a 0.46-fold (95% CI, 0.10–0.92; p=.004) lower risk compared to males.

Smoking was a major risk factor: smokers had 4.40-folds (95% CI, 1.69–11.46; p<.001) higher odds of asthma than non-smokers. The risk was 10.26-fold (95% CI, 6.08–47.36; p=.043) higher among those who began smoking at ≤12 years, 9.13-fold (95% CI, 3.04–27.39; p<.001) higher at 13–15 years, and 4.71-fold (95% CI, 2.21–18.23; p=.030) higher at 16–18 years. Smoking 6–10 cigarettes daily increased asthma risk by 6.07-fold (95% CI, 2.18–16.86; p=.001), while smoking ≥11 cigarettes daily increased it by 10.20-fold (95% CI, 4.08–25.54; p<.001) compared with non-smokers (Table 3).

Table 2. General characteristics, obesity phenotypes, and lipid profile-related characteristics of non-asthma groups and asthma-diagnosis groups (N=1,723)

Characteristic	Non-asthma group	Asthma group	t/χ^2 (p)
Total	1,611 (93.9)	112 (6.1)	
Mean age (yr)	14.10±0.07	15.10±0.35	42.22 (<.001)
Age (yr)			14.03 (.047)
10–12	611 (32.9)	28 (15.5)	
13–15	516 (31.1)	44 (37.6)	
16–18	484 (35.9)	40 (46.9)	
Sex			20.76 (.003)
Male	866 (51.8)	80 (74.7)	
Female	745 (48.2)	32 (25.3)	
Smoking status			94.26 (<.001)
Non-smoker	1,545 (94.9)	83 (70.7)	
Smoker	66 (5.1)	29 (29.3)	
Smoking onset age (yr)			155.61 (<.001)
Non-smoker	1,545 (94.9)	83 (70.7)	
≤12	6 (0.3)	9 (10.2)	
13–15	28 (2.2)	13 (9.9)	
16–18	32 (2.6)	7 (9.3)	
Amount of smoking (cigarettes/day)			105.29 (<.001)
Non-smoker	1,545 (94.9)	83 (70.7)	
≤5	26 (2.1)	4 (6.5)	
6–10	24 (1.5)	15 (11.2)	
≥11	16 (1.5)	10 (11.6)	
Body mass index (kg/m²)	21.36±0.15	23.30±0.84	2.25 (.025)
Waist circumference (cm)	72.12±0.39	75.81±2.04	2.71 (.007)
Total cholesterol (mg/dL)	154.38±5.25	163.91±0.87	1.79 (.073)
Triglyceride (mg/dL)	72.50±9.79	79.29±2.96	0.44 (.506)
LDL-C (mg/dL)	87.12±16.53	96.60±3.81	0.50 (.615)
HDL-C (mg/dL)	59.21±0.47	54.63±1.20	5.38 (<.001)

Values are presented as unweighted frequencies (weighted %) or estimated mean±standard error. All percentages and means are weighted.
LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

Table 3. Factors affecting adolescents asthma (N=1,723)

Variable	AOR (95% CI)	p
Body mass index (kg/m^2)	1.21 (1.09–1.34)	<.001
Waist circumference (cm)	4.50 (1.94–10.43)	<.001
Total cholesterol (mg/dL)	1.01 (0.99–1.02)	.490
Triglyceride (mg/dL)	1.07 (0.98–1.15)	.152
Low-density lipoprotein cholesterol (mg/dL)	1.13 (0.96–1.32)	.116
High-density lipoprotein cholesterol (mg/dL)	0.78 (0.65–0.94)	.011
Age (ref: 10–12 yr)		
13–15	0.38 (0.18–0.79)	.012
16–18	0.36 (0.16–0.80)	.020
Sex (ref: male)		
Female	0.46 (0.10–0.92)	.004
Smoking status (ref: non-smoker)		
Smoker	4.40 (1.69–11.46)	<.001
Smoking onset age (ref: non-smoker)		
≤12	10.26 (6.08–47.36)	.043
13–15	9.13 (3.04–27.39)	<.001
16–18	4.71 (2.21–18.23)	.030
Amount of smoking (cigarettes/day) (ref: non-smoker)		
≤5	3.73 (0.70–19.89)	.458
6–10	6.07 (2.18–16.86)	.001
≥11	10.20 (4.08–25.54)	<.001

AOR, adjusted odds ratio; CI, confidence intervals; ref, reference.

DISCUSSION

Our study explores the relationship between asthma, obesity phenotype, and dyslipidemia among Korean adolescents. Unlike previous research, our investigation takes a comprehensive approach by examining the interconnections between BMI, WC, lipid profiles, and asthma in this specific population.

The significance of this study lies in its potential to contribute to the development of preventive strategies for asthma in adolescents, particularly by considering the combined influence of obesity and lipid imbalances.

In this study, BMI and WC were significantly higher in the asthma group than in the non-asthma group, and, multiple logistic regression analysis showed that asthma risk increased by 1.21-fold with higher BMI and 4.50-fold with higher WC. Among adolescents classified as obese based on BMI, asthma prevalence was significantly higher than among their normal-weight peers [2,3]. Obesity increases asthma risk by approximately 1.28-fold [6] and is also linked to greater disease severity [3]. The systemic, non-atopic inflammation observed in these patients is linked to metabolic abnormalities that may impair lung function [19]. Additionally, obese individuals with asthma exhibit reduced responsiveness to inhaled corticosteroids [2,24].

AO, as reflected by WC, is more strongly associated with asthma risk than overall obesity measured by BMI [8]. This underscores the importance of fat distribution, particularly central adiposity, in the pathogenesis of asthma beyond total body weight [9]. Therefore, the researchers believe that, as a new perspective for preventing adolescent asthma, managing obesity-particularly preventing AO caused by visceral fat accumulation-could play a crucial role in asthma prevention.

BMI and WC serve as indicators of general obesity and AO, respectively [3,6,8,13]. In the current study, both indicators showed significant associations with asthma. In a study examining the association between central obesity and asthma in adolescents, the risk increased 3.55-fold for each unit rise in WC [8]. The association between AO and asthma remained significant even after adjusting for BMI, suggesting that AO may independently influence asthma risk [13]. AO induces low-grade systemic inflammation due to visceral fat accumulation, which alters airway inflammation and immune regulation, thereby increasing asthma susceptibility [8,9]. BMI has limitations in accurately reflecting body fat distribution and may misclassify individuals with high muscle mass as obese, whereas WC directly indicates abdominal visceral fat volume [8], and AO can worsen asthma symptoms by limiting diaphragmatic movement, and decreasing lung volumes [25]. The researchers interpreted the stronger association between WC and asthma observed in this study as suggesting that fat distribution, rather than total body mass, is more closely related to asthma.

In this study, low HDL-C was identified as a significant factor associated with adolescent asthma. HDL-C is an anti-inflammatory lipoprotein that protects against airway inflammation and hyperresponsiveness [19], and HDL-C levels are inversely correlated with C-reactive protein, a biomarker of systemic inflammation [26]. Mechanistically, decreased HDL-C can impair reverse cholesterol transport and increase oxidative stress, thereby activating respiratory inflammatory pathways and elevating asthma susceptibility [19], which supports the findings of our study. However, several studies have reported that TC, TG, and LDL-C are risk factors for asthma [17-19], findings that differ from those of this study. These discrepancies suggest that the relationship between lipid levels and asthma may be influenced by complex, multifactorial mechanisms rather than a single pathway [18]. Future studies should therefore adjust for potential confounding variables such as age, sex, and genetic factors, and employ longitudinal designs to better clarify the causal relationship between lipid metabolism and asthma. The researchers interpreted low HDL-C among lipid profiles as an important factor in assessing asthma risk in adolescents. Therefore, improving HDL-C levels during adolescence may help prevent and manage asthma.

According to the present study, age and sex were significant factors influencing asthma, with asthma prevalence decreasing with age and males exhibiting a higher risk than females. Previous studies have similarly reported that the risk of developing asthma decreases with age [9], and that adolescents aged 16 years or older have a lower risk compared to those aged 12–13 years [27], supporting the current findings. Earlier studies have reported that younger adolescents may be more sensitive to environmental and physiological risk factors, leading to a higher susceptibility to asthma [9,27]. Based on the findings of our study, the researcher interprets that the increased sensitivity in younger adolescents may contribute to a higher risk of developing asthma. Research has also demonstrated a higher prevalence of asthma in males than in females among adolescents [18,27], with one study reporting that the risk of asthma was 1.32 times higher

in males than in females [9]. Generally, asthma is more common and tends to be more severe in prepubescent males than in females of the same age. Before the age of 14, the prevalence of asthma in males is approximately twice that observed in females [2]. This sex-based difference is believed to be influenced by fluctuations in sex hormones, which may affect asthma onset and severity [28].

In this study, smoking status, age at smoking initiation, and amount of smoking were identified as risk factors for asthma. The risk increased with earlier smoking initiation and higher cumulative exposure. Consistent with previous research, asthma was significantly associated with a higher prevalence of smoking among adolescents [29]. In individuals with asthma, smoking accelerates lung function decline through mechanisms involving airway inflammation, oxidative stress, and airway remodeling. These pathophysiological changes heighten airway hyperresponsiveness and mucus hypersecretion, thereby worsening asthma symptoms [2]. Furthermore, smoking reduces the efficacy of both inhaled and systemic corticosteroids by impairing glucocorticoid receptor function and disrupting anti-inflammatory pathways, leading to poorer asthma control [29]. The researcher interprets that early smoking initiation and daily cigarette consumption contribute significantly to the increased risk of asthma. Therefore, the researcher believes that an early smoking prevention education program, particularly targeting adolescents and elementary school students, is crucial. Such educational interventions could effectively raise awareness of risk factors prior to smoking initiation and may play a key role in the prevention of asthma.

This study focused on identifying factors related to asthma in adolescents to support preventive strategies The findings of this study have important implications for nursing practice. The observed associations between BMI, WC, and asthma risk highlight the need for comprehensive obesity assessment, including the evaluation of AO, in school health nursing. Furthermore, the relationship between lipid profiles, such as HDL-C, and asthma underscores the importance of integrated health management through lifestyle modification. In particular, a family-centered nursing approach that takes into account familial influence may play a critical role in improving adolescents' health behaviors and preventing asthma.

A major strength of this study lies in its use of a reliable, nationally representative dataset. Additionally, it examined the relationship between asthma and obesity using both BMI and AO indicators. Another strength is the inclusion of adolescents within a narrow age range and with minimal comorbidities that could affect dyslipidemia status. These features enhance the credibility of the interpretation that obesity type and dyslipidemia may be risk factors for asthma.

Limitations of this study include the fact that the question used to assess asthma diagnosis ("Have you ever been diagnosed with asthma by a doctor?") reflects lifetime prevalence. It was unable to distinguish between active asthma, which reflects current symptoms, and treatment status. Asthma diagnosed in childhood may remit over time during adolescence, which may lead to discrepancies between lifetime asthma prevalence and actual current asthma status. In addition, lifetime asthma prevalence cannot clearly determine the temporal relationship between asthma diagnosis and associated factors, limiting the causal interpretation of the study results. Also, our study is limited in its ability to clearly establish the temporal sequence between metabolic/obesity-related markers and the onset of asthma during adolescence. Future studies should employ longitudinal designs with repeated measurements over time to better elucidate the causal pathways between metabolic factors and asthma development in adolescent populations. Furthermore, because this study analyzed secondary data, it had limitations in considering potential confounding variables such as physical activity, allergic diseases, and secondhand smoke exposure. Therefore, the current study focused on the association between adolescent asthma and obesity phenotypes and dyslipidemia indicators. Finally, potential measurement variability in WC and lipid levels may have introduced random error. WC measurements can vary depending on measurement site, and respiratory phase, while lipid levels may fluctuate due to fasting status, or laboratory procedures. Repeated measurements, standardized protocols, or using averaged values across multiple assessments could help minimize such variability in future research. The use of representative data from KNHANES VIII enhances the generalizability of the present findings to Korean adolescents. However, as the study population was restricted to Korean adolescents, caution is warranted when applying these findings to populations with different ethnic, environmental, and socioeconomic backgrounds.

CONCLUSION

This study identified high body weight, AO, low HDL-C,

age, sex, and smoking as significant risk factors for asthma. In particular, obesity-related indicators and serum lipid levels played crucial roles in asthma development, with an increased risk observed among males and smokers. Comprehensive approaches addressing obesity are essential in adolescent asthma prevention and management clinical practice programs, incorporating multifaceted strategies such as promoting physical activity and dietary control for weight regulation. For AO, interventions should focus on reducing WC through abdominal muscle strengthening exercises and lifestyle modifications that improve fat distribution. In addition, regular monitoring and appropriate management of serum lipid levels especially HDL-C are necessary. Early intervention and smoking cessation education targeting high-risk groups with early smoking initiation and heavy smoking habits are critical components of adolescent asthma prevention.

A comprehensive and personalized prevention and management strategy can help reduce asthma incidence and prevent symptom exacerbation. Considering that effective weight management is crucial for asthma prevention in both males and females, integrated interventions involving exercise, physical activity, behavioral therapy, smoking cessation, and dietary improvement through health education and counseling are recommended.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: HL. Methodology: HL. Data collection: HL. Formal analysis: HL. Writing–original draft: HL. Writing–review and editing: HL. Final approval of published version: HL.

Conflict of interest

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

Funding

This work was supported by 2025 Hannam University Research Fund, and by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2023R1A2C1006271).

Data availability

The data analyzed in this study utilized data from the KNHANES VIII. This data can be downloaded in the official website (https://knhanes.kdca.go.kr/knhanes/rawDataDwnld/rawDataDwnld.do).

Acknowledgements

None.

ORCID and ResearcherID

Heashoon Lee https://orcid.org/0000-0002-2256-3352
https://researcherid.com/rid/QJV-9776-2026

REFERENCES

1. Yon DK, Kim J, Yim Y, Park S, Kim H, Smith L, et al. National trends in asthma prevalence among adolescents in South Korea, 2007-2023: a national representative serial study. Int Arch Allergy Immunol. 2025;186(10):967-983. https://doi.org/10.1159/000544734
2. The Korean Academy of Tuberculosis and Respiratory Diseases. Korean Guideline for Asthma. 5th ed. The Within; 2022.
3. Centers for Disease Control and Prevention. Asthma data: current asthma prevalence by select sociodemographic characteristics [Internet]. Centers for Disease Control and Prevention; 2022 [cited 2026 Jan 30]. Available from: https://www.cdc.gov/asthma-data/about/most-recent-asthma-data.html
4. Reyes-Angel J, Kaviany P, Rastogi D, Forno E. Obesity-related asthma in children and adolescents. Lancet Child Adolesc Health. 2022;6(10):713-724. https://doi.org/10.1016/S2352-4642(22)00185-7
5. Kim E, Lee GB, Yon DK, Kim HC. Trends in socioeconomic inequalities in obesity among Korean adolescents: the Korea Youth Risk Behavior Web-based Survey (KYRBS) 2006 to 2020. Epidemiol Health. 2023;45:e2023033. https://doi.org/10.4178/epih.e2023033
6. Chen YC, Su MW, Brumpton BM, Lee YL. Investigating obesity-related risk factors for childhood asthma. Pediatr Allergy Immunol. 2022;33(1):e13710. https://doi.org/10.1111/pai.13710
7. Forno E, Lescher R, Strunk R, Weiss S, Fuhlbrigge A, Celedón JC, et al. Decreased response to inhaled steroids in overweight and obese asthmatic children. J Allergy Clin Immunol. 2011;127(3):741-749. https://doi.org/10.1016/j.jaci.2010.12.010
8. Papoutsakis C, Chondronikola M, Antonogeorgos G, Papadakou E, Matziou V, Drakouli M, et al. Associations between central obesity and asthma in children and adolescents: a case-control study. J Asthma. 2015;52(2):128-134. https://doi.org/10.3109/02770903.2014.954291
9. Musaad SM, Patterson T, Ericksen M, Lindsey M, Dietrich K, Succop P, et al. Comparison of anthropometric measures of obesity in

childhood allergic asthma: central obesity is most relevant. J Allergy Clin Immunol. 2009;123(6):1321-1327. https://doi.org/10.1016/j.jaci.2009.03.023

10. Wang Y. Epidemiology of childhood obesity: methodological aspects and guidelines: what is new? Int J Obes Relat Metab Disord. 2004;28 Suppl 3:S21-S28. https://doi.org/10.1038/sj.ijo.0802801
11. Ashwell M, Hsieh SD. Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. Int J Food Sci Nutr. 2005;56(5):303-307. https://doi.org/10.1080/09637480500195066
12. Dooley AA, Pillai DK. Paediatric obesity-related asthma: disease burden and effects on pulmonary physiology. Paediatr Respir Rev. 2021;37:15-17. https://doi.org/10.1016/j.prrv.2020.04.002
13. Jiang D, Wang L, Bai C, Chen O. Association between abdominal obesity and asthma: a meta-analysis. Allergy Asthma Clin Immunol. 2019;15:16. https://doi.org/10.1186/s13223-019-0333-6
14. Jobim Benedetti F, Lúcia Bosa V, Mariante Giesta J, Bueno Fischer G. Anthropometric indicators of general and central obesity in the prediction of asthma in adolescents; central obesity in asthma. Nutr Hosp. 2015;32(6):2540-2548. https://doi.org/10.3305/nh.2015.32.6.9851
15. Su X, Ren Y, Li M, Zhao X, Kong L, Kang J. Association between lipid profile and the prevalence of asthma: a meta-analysis and systemic review. Curr Med Res Opin. 2018;34(3):423-433. https://doi.org/10.1080/03007995.2017.1384371
16. Kim EY. Clinical and diagnostic importance of dyslipidemia in children and adolescents during the coronavirus disease 2019 pandemic. Clin Exp Pediatr. 2022;65(3):129-130. https://doi.org/10.3345/cep.2021.01851
17. Lim JE, Kim HM, Kim JH, Baek HS, Han MY. Association between dyslipidemia and asthma in children: a systematic review and multicenter cohort study using a common data model. Clin Exp Pediatr. 2023;66(8):357-365. https://doi.org/10.3345/cep.2023.00290
18. Ko SH, Jeong J, Baeg MK, Han KD, Kim HS, Yoon JS, et al. Lipid profiles in adolescents with and without asthma: Korea National Health and nutrition examination survey data. Lipids Health Dis. 2018;17(1):158. https://doi.org/10.1186/s12944-018-0807-4
19. Rastogi D, Fraser S, Oh J, Huber AM, Schulman Y, Bhagtani RH, et al. Inflammation, metabolic dysregulation, and pulmonary function among obese urban adolescents with asthma. Am J Respir Crit Care Med. 2015;191(2):149-160. https://doi.org/10.1164/rccm.201409-1587OC
20. Lu M, Wu B, Qiao R, Gu H, Din Y, Dong X. No associations between serum lipid levels or HOMA-IR and asthma in children and adolescents: a NHANES analysis. J Clin Res Pediatr Endocrinol. 2019;11(3):270-277. https://doi.org/10.4274/jcrpe.galenos.2019.2018.0098
21. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. BMJ. 2007;335(7624):806-808. https://doi.org/10.1136/bmj.39335.541782.AD
22. Korea Centers for Disease Control and Prevention. The Eighth Korea National Health and Nutrition Examination Survey (KNHANES VIII-3), 2021 [Internet]. Korea Centers for Disease Control and Prevention; 2021 [cited 2024 May 20]. Available from: https://knhanes.kdca.go.kr/knhanes/sub04/sub04_04_01.do
23. O'Brien RM. A caution regarding rules of thumb for variance inflation factors. Qual Quant. 2007;41(5):673-690. https://doi.org/10.1007/s11135-006-9018-6
24. Jung Y, Jean T, Morphew T, Galant SP. Peripheral airway impairment and dysanapsis define risk of uncontrolled asthma in obese asthmatic children. J Allergy Clin Immunol Pract. 2022;10(3):759-767. https://doi.org/10.1016/j.jaip.2021.09.029
25. Lessard A, Alméras N, Turcotte H, Tremblay A, Després JP, Boulet LP. Adiposity and pulmonary function: relationship with body fat distribution and systemic inflammation. Clin Invest Med. 2011;34(2):E64-E70. https://doi.org/10.25011/cim.v34i1.15102
26. Chanachon PN, Jotikasthira W, Kiewngam P, Sawatchai A, Kanchongkittiphon W, Manuyakorn W. Association of dyslipidemia and respiratory resistance assessed by the forced oscillation technique in asthmatic children. Lung. 2022;200(1):73-82. https://doi.org/10.1007/s00408-021-00502-1
27. Han JY, Park HS. Prevalence of allergic diseases and its related factors in Korean adolescents: using data from the 2013 Korea Youth Risk Behavior Web-Based Survey. J Korean Data Inf Sci Soc. 2016;27(1):155-168. https://doi.org/10.7465/jkdi.2016.27.1.155
28. Hohmann C, Keller T, Gehring U, Wijga A, Standl M, Kull I, et al. Sex-specific incidence of asthma, rhinitis and respiratory multimorbidity before and after puberty onset: individual participant meta-analysis of five birth cohorts collaborating in MeDALL. BMJ Open Respir Res. 2019;6(1):e000460. https://doi.org/10.1136/bmjresp-2019-000460
29. Chun YH, Han K, Park YG, Yoon JS, Kim HH, Kim JT, et al. Examining impacts of allergic diseases on psychological problems and tobacco use in Korean adolescents: the 2008-2011 Korean National Health and Nutrition Examination Survey. PLoS One. 2015;10(4):e0125172. https://doi.org/10.1371/journal.pone.0125172

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):297-307
https://doi.org/10.4094/chnr.2026.014

pISSN 2287-9110
eISSN 2287-9129

CHNR

Impact of nurse–parent partnership, social support, and uncertainty on parental efficacy among mothers of children hospitalized in pediatric wards in South Korea: a cross-sectional study

Dan A Kim[1], Mi-Young Choi[2]

[1]Registered Nurse, Nursing Department, Chungbuk National University Hospital, Cheongju, Korea
[2]Professor, Research Institute of Nursing Science, College of Nursing, Chungbuk National University, Cheongju, Korea

Corresponding author
Mi-Young Choi
College of Nursing, Chungbuk National University, 1 Chungdae-ro, Seowon-gu, Cheongju 28644, Korea
Tel: +82-43-249-1798
Fax: +82-43-266-1710
E-mail: myb98@chungbuk.ac.kr

This manuscript is a condensed form of the first author's master's thesis from Chungbuk National University.

Received: February 21, 2026
Revised: April 7, 2026
Accepted: June 1, 2026

Purpose: This study aimed to identify the relationships among nurse–parent partnership, social support, uncertainty, and parental efficacy among mothers of children hospitalized in pediatric wards.
Methods: This descriptive survey study included 149 mothers of children hospitalized in pediatric wards at 5 hospitals in the Chungcheong region from August 12 to September 17, 2025. Data were collected using structured questionnaires and analyzed using descriptive statistics, Pearson correlation analysis, and multiple regression analysis.
Results: Parental efficacy was positively correlated with social support (r=.35, p<.001) and negatively correlated with uncertainty (r=–.36, p<.001). Multiple regression analysis showed that uncertainty (β=–.26, p=.001) and social support (β=.24, p=.003) were significantly associated with parental efficacy and explained 21.0% of the variance.
Conclusion: Uncertainty and social support were key factors associated with parental efficacy among mothers of children hospitalized in pediatric wards. Nursing interventions to enhance parental efficacy should therefore focus on reducing maternal uncertainty by providing specific, repeated information and fostering a supportive nursing environment that helps mothers recognize and use available social support.

Keywords: Hospitals; Parents; Partnership; Social support; Uncertainty

INTRODUCTION

In Korea, previous studies on hospitalized children have consistently identified mothers as the primary caregivers [1], assuming full responsibility for nursing and caregiving during hospitalization. This evidence indicates that they play the central role as primary caregivers in hospital settings, suggesting their critical significance in children's health recovery and adaptation to hospitalization.

A child's hospitalization imposes concurrent physical and psychological burdens on mothers. During this period, maternal coping abilities may be associated not only with their own psychological well-being but also with the child's treatment process and family functioning [2]. In particular, the hospitalization of a child creates significant uncertainty for mothers, leading them to experience negative emotions such as anxiety, helplessness, guilt, and stress [3]. When these negative emotions persist, mothers may lose confidence in caring for their child and experience decreased parental efficacy, which can ultimately have adverse effects on the hospitalized child's recovery process [4].

Parental efficacy refers to a parent's perception of their

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

ability to successfully manage parenting and discipline, including the confidence to resolve challenges that may arise while raising their child [5]. As an essential psychological resource, it empowers caregivers to perform parenting tasks with confidence and is closely linked to children's healthy development and attachment formation [5]. Mothers with high parental efficacy demonstrate positive interactions with their children and actively engage in child-rearing, which is positively associated with child development [6]. Particularly during hospitalization, mothers with high parental efficacy actively participate in medication administration and emergency management, as well as demonstrate proactive and effective coping even in stressful situations [7]. Therefore, parental efficacy is a critical factor in the treatment process and recovery of hospitalized children, and strengthening it among mothers of hospitalized children is essential for achieving positive health outcomes for these children.

Nurse–parent partnerships are collaborative relationships between parents and nurses that are based on shared goals and interactions in the care of hospitalized children [8]. Characterized by reciprocity, professionalism, and collaboration, this study defined the concept specifically as the partnership with nurses as perceived by the mothers of hospitalized children [8]. Collaborative care through these partnerships is associated with enhanced parental understanding of treatment processes and improved nursing care quality [2]. Nurses should alleviate the parental psychological burden and create supportive environments through emotional support and appropriate interventions, while effective communication strengthens parental therapeutic trust, which is related to parental efficacy and treatment outcomes [9]. A collaborative relationship provides mothers with the necessary clinical information and emotional validation, which may bolster their confidence and competence in performing parenting tasks within an unfamiliar hospital environment.

Social support refers to the human resources available within the parenting environment, specifically the assistance available to mothers from their social network, excluding their spouses [10]. It includes emotional and practical assistance from family, friends, and the community, playing a crucial role in promoting emotional stability and alleviating stress among the parents of hospitalized children [10]. Adequate social support is linked to a reduced psychological burden and enhanced parental efficacy [11], whereas insufficient support leads to psychological isolation. This suggests that providing adequate social support can be an important strategy for promoting parental efficacy. By providing practical help and emotional stability, external support systems may help mothers maintain their psychological resilience, thereby sustaining their sense of efficacy in the parenting role even during a child's illness.

Uncertainty refers to a state of being unable to clearly interpret a situation due to unfamiliarity with illness-related events, unpredictability, ambiguity, and a lack of information [12]. This cognitive barrier arises from insufficient disease information and diagnostic complexity, posing a major challenge to effective parental role performance. For parents of hospitalized children, high levels of uncertainty are often triggered by ineffective communication with healthcare providers and unpredictable changes in their child's clinical condition [12,13]. Persistent uncertainty is associated with feelings of helplessness and decreased role performance and confidence, reducing parental efficacy, which in turn impedes parent–child attachment and negatively affects home caregiving after discharge [14]. When mothers cannot clearly interpret their child's health status or the trajectory of treatment, they experience a diminished sense of control, which may undermine their confidence in caring for their child effectively.

Although previous research has identified nurse–parent partnerships, social support, and uncertainty as factors associated with parental efficacy—primarily among mothers of premature infants in neonatal intensive care units (NICUs) and parents of children with chronic or life-threatening conditions—there is a paucity of studies that comprehensively examine the interrelationships among these variables in mothers of children hospitalized in general pediatric wards. Given the contemporary development in healthcare demands and the unique cultural context of South Korean pediatric wards, where mothers provide 24-hour bedside care, it is necessary to re-examine these variables to provide updated, evidence-based nursing strategies.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Chungbuk National University (IRB No. CBNU-2025-A-0093). Informed consent was obtained from all participants.

1. Study Design

This descriptive correlational study examined the relationships among nurse–parent partnerships, social support, uncertainty, and parental efficacy, and identified the factors influencing parental efficacy in mothers of children hospitalized in pediatric wards. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [15].

2. Participants

The participants were the mothers of children hospitalized in pediatric wards at 5 hospitals in Chungcheong region who understood the study's purpose and provided informed consent. The required sample size was estimated using G*Power ver. 3.1 (Heinrich-Heine-Universität Düsseldorf) for multiple regression analysis with 3 predictor variables, a significance level of .05, and a power of .80. The effect size (f^2 = .715) was calculated from a previous study investigating factors associated with parental effectiveness in mothers of hospitalized children [10], which reported an adjusted R^2 of .417. To improve the generalizability and statistical stability of the findings, 153 questionnaires were distributed, accounting for a 10% attrition rate, and 149 questionnaires with complete responses were analyzed.

3. Measurements

1) General characteristics

The assessed maternal characteristics included age, religion, educational level, employment status, perceived economic status, and marital status. The child and hospitalization-related characteristics included the child's sex, birth order, number of hospitalizations (including current hospitalization), current length of hospital stay (days), and primary diagnosis.

2) Nurse–parent partnerships

Nurse–parent partnerships were measured using the Pediatric Nurse Parents Partnership Scale developed by Choi and Bang [8]. The instrument comprises 34 items across 7 domains: reciprocity (9 items), professional knowledge and skill (7 items), sensitivity (6 items), collaboration (3 items), communication (4 items), shared information (3 items), and cautiousness (2 items). Each item is rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with total scores ranging from 34 to 170. Higher scores indicate a higher level nurse–parent partnership. The reliability of the original instrument was Cronbach's α = .96 and, in this study, Cronbach's α = .97.

3) Social support

Social support was measured using the Social Support Scale developed by Park [13] and modified by Kim [16], comprising 10 items on a 5-point Likert scale, with total scores ranging from 10 to 50. Higher scores indicate higher perceived social support. Cronbach's α was .94 in the study by Kim [16] and .93 in this study.

4) Uncertainty

Uncertainty was measured using the Parents' Perception of Uncertainty Scale developed by Mishel [17] and translated and modified by Oh [18]. The instrument comprises 22 items on a 4-point Likert scale, with total scores ranging from 22 to 88. Higher scores indicate higher uncertainty levels. Cronbach's α was .83 in the study by Oh [18] and .77 in this study.

5) Parental efficacy

Parental efficacy was measured using the Parenting Sense of Competence (PSOC) scale originally developed by Gibaud-Wallston and Wandersman [19]. While the original PSOC consists of 2 subscales—parental efficacy (reflecting skills and abilities) and parental satisfaction (reflecting affective dimensions such as motivation and frustration)—this study utilized the Korean version of the PSOC adapted by Shin and Chung [20]. In their factor analysis, Shin and Chung [20] identified 3 distinct factors: parental efficacy (9 items), anxiety as a parent (4 items), and others (3 items). For the purpose of this study, which focuses specifically on the mothers' perceived competence in their parenting role, only the 9-item parental efficacy subscale was employed. Formal approval was obtained to use this specific subscale for research purposes. Each item is rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with total scores ranging from 9 to 45. Higher scores indicate higher levels of parental efficacy. The reliability of the parental efficacy subscale was acceptable, with a Cronbach's α of .78 in the study by Shin and Chung [20], and .79 in this study.

4. Data Collection

Permission to use all measurement instruments was obtained from the original developers, modifiers, and translators by email and text messages. Data collection was conducted from August 12 to September 17, 2025. The researcher contacted the nursing departments of 5 hospitals with pediatric wards in the Chungcheong region, explained the study's purpose and methods, and obtained approval by submitting a data collection application. Subsequently, the researcher visited each pediatric ward to obtain ward consent and posted recruitment announcements. Participants who voluntarily expressed interest in participating after viewing the announcements were approached directly by the researcher and provided with questionnaires that included an information sheet and a consent form. The researcher fully explained to the participants, both verbally and in writing, the study's background and purpose, methods, benefits, compensation for participation, potential side effects or risks and discomfort, personal information protection and confidentiality assurance, and their right to voluntary participation and withdrawal at any time without any disadvantage. All participants received a small token of appreciation for their participation. The time required to complete the questionnaire was approximately 20 to 30 minutes. To protect personal information, each participant was provided with a sealable return envelope for the completed questionnaire, which was then directly collected by the researcher and processed anonymously. All collected data were used solely for research purposes, and all personal information was coded to protect participant privacy. The coded data were stored and password-protected on a computer accessible only to the researcher and analyzed accordingly. All data will be destroyed 3 years after the completion of the study.

5. Data Analysis

Collected data were analyzed using IBM SPSS for Windows ver. 31.0 (IBM Corp.) as follows. First, participants' general characteristics and the levels of nurse–parent partnership, social support, uncertainty, and parental efficacy were analyzed using descriptive statistics, including frequencies, percentages, means, and standard deviations. Second, differences in parental efficacy according to participants' general characteristics were analyzed using independent t-tests and one-way analysis of variance (ANOVA). When the ANOVA results showed significant differences, the Scheffé test was performed for post-hoc comparison. Third, the correlations among nurse–parent partnerships social support, uncertainty, and parental efficacy were analyzed using Pearson's correlation coefficient. Fourth, to identify the factors influencing parental efficacy, multiple regression analysis was conducted using the enter method. Prior to the regression analysis, assumptions were tested by examining multicollinearity, residuals, and outliers.

RESULTS

1. Differences in Parental Efficacy according to Participants' General Characteristics

Differences in parental efficacy according to the general characteristics of the participants are shown in Table 1. Parental efficacy differed significantly by employment status ($t = -2.26$, $p = .025$) and perceived economic status ($F = 4.49$, $p = .013$). The post-hoc analysis revealed that mothers who perceived their economic status as "sufficient" had significantly higher parental efficacy than those who perceived it as "moderate" (Table 1).

2. Descriptive Statistics for the Main Variables

The levels of the main variables are presented in Table 2. The mean score for nurse–parent partnerships was 4.50±0.48 out of 5. Among the subscales, cautiousness showed the highest mean score at 4.71±0.47, followed by collaboration (4.61±0.52), professional knowledge and skill (4.57±0.52), reciprocity (4.55±0.50), shared information (4.43±0.58), sensitivity (4.42±0.57), and communication (4.24±0.62). The mean scores were 4.04±0.78 out of 5 for social support, 1.92±0.31 out of 4 for uncertainty, and 3.72±0.51 out of 5 for parental efficacy.

3. Correlations among the Main Variables

The correlations among the main variables are presented in Table 3. Parental efficacy showed a significant positive correlation with social support ($r = .35$, $p < .001$) and a significant negative correlation with uncertainty ($r = -.36$, $p < .001$). Although there was no statistically significant correlation between parental efficacy and the total score of nurse–parent partnerships, 2 subscales—sensitivity ($r = .17$, $p = .035$) and

Table 1. Differences in parental efficacy according to participants' general characteristics (N=149)

Characteristic	No. (%) or Mean±SD	Parental efficacy	
		Mean±SD	t or F (*p*)
Age (yr)			0.19 (.830)
≤25	11 (7.4)	3.46±0.68	
26–30	95 (63.8)	3.68±0.52	
>30	43 (28.9)	3.72±0.51	
Mean age (yr)	37.03±5.07		
Religion			0.47 (.638)
Yes	47 (31.5)	3.75±0.56	
No	102 (68.5)	3.70±0.48	
Education			1.67 (.192)
High school	28 (18.8)	3.57±0.43	
University	102 (68.5)	3.74±0.51	
≥Master	19 (12.8)	3.81±0.57	
Job			–2.26 (.025)
Yes	103 (69.1)	3.78±0.51	
No	46 (30.9)	3.58±0.47	
Perceived economic status			4.49 (.013) (a>b)
Sufficienta	52 (34.9)	3.87±0.52	
Moderateb	83 (55.7)	3.66±1.44	
Insufficient	14 (9.4)	3.51±0.66	
Marital status			–0.82 (.416)
Married	140 (94.0)	3.71±0.52	
Single	9 (6.0)	3.85±0.22	
Child's sex			1.20 (.232)
Male	77 (51.7)	3.77±0.53	
Female	72 (48.3)	3.67±0.48	
Child's birth order			–0.89 (.375)
1st	91 (61.1)	3.69±0.50	
2nd or higher	58 (38.9)	3.76±0.52	
No. of hospitalizations			–1.16 (.250)
<3	80 (53.7)	3.67±0.48	
≥3	69 (46.3)	3.77±0.54	
Length of hospital stay (day)			–0.12 (.903)
<4	106 (71.1)	3.71±0.51	
≥4	43 (28.9)	3.73±0.51	
Child's diagnosis			0.89 (.472)
Respiratory	67 (45.0)	3.73±0.44	
Gastrointestinal	33 (22.1)	3.77±0.54	
Urinary	9 (6.0)	3.91±0.62	
Neurologic	12 (8.1)	3.67±0.49	
Others (infectious disease, surgery)	28 (18.9)	3.59±0.59	

SD, standard deviation.

shared information (r=.19, p=.023)—showed significant positive correlations with parental efficacy. Meanwhile, nurse–parent partnerships were positively correlated with social support (r=.30, p<.001) and negatively correlated with uncertainty (r=–.26, p=.002).

4. Factors Influencing Parental Efficacy

To identify the factors influencing parental efficacy, multiple regression analysis was conducted with employment status and perceived economic status (i.e., variables showing significant differences in general characteristics) as control variables, and nurse–parent partnerships, social support, and uncertainty as independent variables. Prior to the regression analysis, multicollinearity was examined. The tolerance ranged from 0.30 to 0.92, and the variance inflation factor (VIF) ranged from 1.09 to 3.34, both of which were within the acceptable thresholds (tolerance >.10; VIF <10) [21]. Thus,

Table 2. Descriptive statistics for the main variables (N=149)

Variable	Mean±SD	Min	Max	Range
Nurse–parent partnerships	4.50±0.48	3.00	5.00	1–5
Reciprocity	4.55±0.50	3.11	5.00	1–5
Professional knowledge and skills	4.57±0.52	3.00	5.00	1–5
Sensitivity	4.42±0.57	2.33	5.00	1–5
Collaboration	4.61±0.52	3.00	5.00	1–5
Communication	4.24±0.62	2.50	5.00	1–5
Shared information	4.43±0.58	3.00	5.00	1–5
Cautiousness	4.71±0.47	2.50	5.00	1–5
Social support	4.04±0.78	1.60	5.00	1–5
Uncertainty	1.92±0.31	1.23	2.86	1–4
Parental efficacy	3.72±0.51	2.33	5.00	1–5

SD, standard deviation.

Table 3. Correlations among the main variables (N=149)

Variable	1	1-1	1-2	1-3	1-4	1-5	1-6	1-7	2	3	4
1. Nurse–parent partnerships	1										
1-1. Reciprocity	.91 (<.001)	1									
1-2. Professional knowledge and skills	.91 (<.001)	.74 (<.001)	1								
1-3. Sensitivity	.95 (<.001)	.83 (<.001)	.87 (<.001)	1							
1-4. Collaboration	.80 (<.001)	.71 (<.001)	.65 (<.001)	.72 (<.001)	1						
1-5. Communication	.87 (<.001)	.70 (<.001)	.76 (<.001)	.81 (<.001)	.67 (<.001)	1					
1-6. Shared information	.85 (<.001)	.68 (<.001)	.79 (<.001)	.79 (<.001)	.64 (<.001)	.79 (<.001)	1				
1-7. Cautiousness	.74 (<.001)	.73 (<.001)	.66 (<.001)	.67 (<.001)	.62 (<.001)	.51 (<.001)	.48 (<.001)	1			
2. Social support	.30 (<.001)	.20 (.014)	.34 (<.001)	.30 (<.001)	.24 (.003)	.30 (<.001)	.29 (<.001)	.10 (.207)	1		
3. Uncertainty	–.26 (.002)	–.14 (.084)	–.23 (.005)	–.27 (<.001)	–.31 (<.001)	–.27 (<.001)	–.24 (.003)	–.17 (.040)	–.29 (<.001)	1	
4. Parental efficacy	.14 (.091)	.07 (.424)	.14 (.096)	.17 (.035)	.10 (.222)	.15 (.064)	.19 (.023)	.01 (.865)	.35 (<.001)	–.36 (<.001)	1

Values are presented as r (*p*).

there were no multicollinearity issues. The Durbin-Watson statistic was 2.32, which is close to 2, confirming that the assumption of independent residuals was satisfied. Regarding the normality of residuals, the skewness and kurtosis values were .11 and .11, respectively, while the Kolmogorov-Smirnov (p=.200) and Shapiro-Wilk (p=.162) tests indicated that the residuals did not deviate from a normal distribution. Finally, the assumption of homoscedasticity was also met.

The regression model was statistically significant (F=6.68, p<.001), with an adjusted R^2 of 21.0%. The examination of the factors influencing parental efficacy revealed that uncertainty (β=–.26, p=.001) and social support (β=.24, p=.003) were significant predictors. Specifically, lower uncertainty and higher social support were associated with higher parental efficacy (Table 4).

DISCUSSION

This study investigated the relationships among nurse–parent partnerships, social support, uncertainty, and parental efficacy to identify the factors associated with parental efficacy among mothers of children hospitalized in pediatric wards. The results revealed that uncertainty and social support were significant explanatory variables associated with parental efficacy.

In this study, parental efficacy showed statistically signifi-

Table 4. Factors influencing parental efficacy (N=149)

Variables	B	SE	β	t	*p*
(Constant)	3.76	0.58		6.48	< .001
Job (yes)	0.12	0.08	0.11	1.46	.147
Perceived economic status (sufficient)	0.21	0.14	0.20	1.50	.137
Perceived economic status (moderate)	0.05	0.13	0.05	0.40	.691
Nurse–parent partnership (sensitivity)	–0.04	0.05	–0.06	–0.76	.449
Nurse–parent partnership (shared information)	0.02	0.03	0.07	0.83	.406
Social support	0.16	0.05	0.24	3.00	.003
Uncertainty	–0.42	0.13	–0.26	–3.28	.001
Model fit	R^2 = .25, Adj. R^2 = .21, F = 6.68, p < .001, Durbin-Watson = 2.32				

Adj. R^2, adjusted coefficient of determination; B, unstandardized regression coefficient; β, standardized regression coefficient; R^2, coefficient of determination; SE, standard error.

cant differences according to employment and perceived economic status. Specifically, employed mothers demonstrated higher parental efficacy than unemployed mothers, which is consistent with the findings of Chang and Park [22], who reported that maternal employment is positively related to higher parental efficacy. Separately, our finding that mothers with higher perceived economic status reported greater parental efficacy aligns with the broader understanding that economic resources provide a foundational support for caregiving roles [23]. This suggests that while both variables are influential, employment status may specifically be related to efficacy through professional role fulfillment, whereas economic stability acts as a protective buffer against the costs of treatment and caregiving [24]. These findings suggest that the socioeconomic background of the parents of hospitalized children can be significantly associated with their parental efficacy. Therefore, pediatric nurses should assess the socioeconomic background of the parents of hospitalized children and provide tailored nursing care accordingly. Specifically, for families facing economic difficulties, nurses should provide information about medical cost support systems and community resources, as well as enhance education and emotional support to help parents actively participate in the caregiving process and enhance their parental efficacy.

The analysis of the correlations among nurse–parent partnerships, social support, uncertainty, and parental efficacy revealed that parental efficacy had a significant positive correlation with social support and a significant negative correlation with uncertainty. The positive correlation between social support and parental efficacy is consistent with the findings of Huang et al. [25] who reported that a family-focused parenting support intervention significantly improved both perceived social support and parents' sense of competence among parents of preterm infants. While their study focused on parents of children hospitalized in a NICU where the clinical instability is extreme, our findings confirm that this inverse relationship remains consistent in general pediatric ward settings. These findings suggest that enhancing social support and reducing uncertainty are key factors in improving parental efficacy among the mothers of hospitalized children.

Meanwhile, although parental efficacy showed no significant correlation with the total score of nurse–parent partnerships, the subscale analysis revealed that sensitivity and shared information were significantly positively correlated with parental efficacy. This indicates that nurses' sensitive responses to children's conditions and parents' needs, along with the provision of necessary information through continuous communication, can enhance parents' perception of active participation in the treatment process and their confidence in performing the parental role. These findings echo those of Genna et al. [26], who reported that appropriate responses and interactions from healthcare providers enhance parents' role awareness and caregiving confidence. Notably, while nurse–parent partnerships showed no direct correlation with parental efficacy, they demonstrated significant correlations with social support and uncertainty. This suggests the possibility that nurse–parent partnerships may contribute to enhancing parental efficacy indirectly by strengthening social support and reducing uncertainty, rather than through a direct effect. However, as this mediating effect was not directly examined in this study, future research using mediation analysis is needed to clarify these pathways.

Multiple regression analysis revealed that uncertainty and social support were significant factors associated with parental efficacy, with uncertainty as the primary predictor with the greatest explanatory power. This finding is consistent with Huang et al. [25], who demonstrated that family-cen-

tered support interventions enhanced parental efficacy among parents of preterm infants. The role burden and lack of control experienced by mothers in hospitalization contexts amplify uncertainty, which acts as a major factor inhibiting parental efficacy. Notably, the absolute levels of uncertainty in this study were relatively lower than those typically reported in intensive care settings. This can be attributed to the characteristics of general wards, where disease progression is relatively predictable compared to the NICU. Furthermore, according to the Uncertainty in Illness Theory by Mishel [27], uncertainty is a cognitive state determined by the clarity of clinical cues. In this study, the effective provision of information and sensitive interaction by nurses likely served as sufficient cues, enabling mothers to develop a better understanding of the situation and thus report lower uncertainty. If mothers enhance their understanding of the treatment process and regain a sense of control, uncertainty can be reduced, and parental efficacy can be enhanced. However, Glatz and Lippold [28] cautioned that a unilateral information overload can actually increase parental anxiety and undermine efficacy. Therefore, rather than simply providing abundant information in clinical settings, it is essential to assess parents' psychological readiness and receptive capacity to establish stepwise and individualized information provision strategies.

In this study, social support was identified as the second major factor associated with parental efficacy. This finding is consistent with those of the study by Jung [29] on the parents of hospitalized children, suggesting that social support is a universal and essential factor that strengthens parental efficacy regardless of the clinical context. Furthermore, the importance of social support has been consistently reported in special caregiving situations as well. In their study of mothers of premature infants, Begjani et al. [30] found that education and support from peer mothers significantly enhanced parental efficacy. These findings confirm that support from others acts as a protective factor during hospitalization by providing psychological stability and boosting confidence in parental role performance. Therefore, in clinical settings, a multilayered approach is needed to strengthen parents' social support systems. Specifically, healthcare providers should offer emotional support and encouragement to parents, facilitate peer support groups or online support communities among the parents of hospitalized children, and strengthen linkages with family members and community resources. Through this multifaceted construction of social support networks, parental efficacy can be effectively enhanced [31].

In this study, although the total score of nurse–parent partnerships showed no significant correlation with parental efficacy, 2 subscales—sensitivity and shared information—demonstrated significant positive correlations with parental efficacy. However, nurse–parent partnerships were not identified as an independent predictor of parental efficacy in the regression analysis. This finding may be related to the characteristics of the study participants. Most participants were mothers of children with relatively short hospital stays and generally evaluated nurse–parent partnerships positively. However, there may have been temporal constraints preventing the partnerships formed during short-term hospitalization from developing into a sufficiently deep therapeutic relationship to substantially enhance mothers' parental efficacy. Additionally, considering that nurse–parent partnerships showed significant correlations with social support and uncertainty, partnerships may contribute to parental efficacy indirectly by mediating the pathways of strengthening social support and reducing uncertainty, rather than having a direct effect. The finding that the sensitivity and shared information subscales correlated with parental efficacy is noteworthy. It suggests that parental efficacy is enhanced not simply through the formation of positive partnerships with nurses, but rather through the process of mothers experiencing nurses' sensitive responses, receiving adequate information, directly participating in childcare, and accumulating successful experiences based on the established partnership. Therefore, for children with relatively short hospital stays, a strategic approach that goes beyond simply forming close relationships is needed to enable mothers to substantially participate in childcare and experience a sense of achievement. Specifically, nurses should respond sensitively to mothers' needs and emotions, provide clear and understandable information about the child's condition and treatment, offer opportunities for mothers to participate in daily childcare activities, and reinforce successful experiences through positive feedback. These recommendations are consistent with the systematic review by Hodgson et al. [32], which reported that family-centered interventions for hospitalized children enhance parental participation, knowledge, and overall well-being, and such an approach can serve as a foundation for the substantial enhancement of parental efficacy.

The need for repeated investigation of these relationships is underscored by the shifting dynamics of the contemporary healthcare environment. First, modern advances have altered

how parents manage illness-related information; in the current digital era, an information overload paradoxically increases the demand for clear, professional communication to navigate clinical uncertainty. Second, changes in subject characteristics warrant consideration, as millennial and Gen Z mothers pursue more active participation and autonomous decision-making compared to previous generations. Finally, given the unique cultural context of 24-hour rooming-in in South Korean pediatric wards, validating these variables is essential to provide evidence-based nursing strategies that reflect current parental expectations. Thus, this study provides a critical and timely update to existing theories, confirming their relevance in the present-day clinical setting.

The limitations of this study are as follows. First, this study was conducted only with mothers of children hospitalized in pediatric wards in selected regions, which limits the generalizability of the findings. Additionally, the study only considered mothers as the primary caregivers and did not capture the experiences of fathers or other caregivers. Future research should include diverse regions and a comprehensive range of caregivers. Second, this study included the mothers of children hospitalized in pediatric wards without differentiating by disease or length of stay. This constrained our ability to compare differences in parental efficacy according to disease characteristics or hospitalization duration. Future research should specify target populations by disease groups, acute versus chronic hospitalization, and length of stay. Third, the uncertainty measurement tool may not adequately reflect the changes in caregiver perceptions and current healthcare environments since its development, which may have contributed to lower reliability compared to the original instrument. Future research should revise and validate the instrument to reflect current healthcare contexts and parental perceptions. Furthermore, the parental efficacy instrument was originally developed for general parenting contexts and may not fully assess the specific efficacy required for parents caring for hospitalized children, such as managing a child's illness, participating in treatment processes, and communicating effectively with healthcare professionals. Therefore, future studies should employ or develop a disease-specific parental efficacy scale to better assess the unique obstacles faced by parents in pediatric settings. Fourth, as this study employed a cross-sectional design, clear causal relationships among variables could not be established. In particular, the indirect pathways through which nurse–parent partnerships may influence parental efficacy via social support and uncertainty were not directly examined. Future research using longitudinal designs or structural equation modeling to verify mediating effects is thus needed.

Despite these limitations, this study yields the following implications. By empirically identifying factors associated with parental efficacy among mothers of hospitalized children, this study reaffirms the importance of family-centered nursing practice and contributes to expanding the knowledge base in pediatric nursing. Moreover, the findings can serve as foundational data for developing evidence-based nursing intervention programs for the families of hospitalized children.

CONCLUSION

This study identified the factors associated with parental efficacy among mothers of children hospitalized in pediatric wards, focusing on the roles of nurse–parent partnerships, social support, and uncertainty. The results revealed that uncertainty and social support were significant explanatory variables associated with parental efficacy, suggesting that nurse–parent partnerships may indirectly contribute to parental efficacy through these variables. The importance of this study is supported by the evolving dynamics of the contemporary healthcare environment. First, temporal shifts in information access have transformed how parents manage illness-related data; in the digital era, information overload often necessitates clear, professional communication to alleviate clinical uncertainty. Second, the generational transition among caregivers—specifically millennial and Gen Z mothers in South Korea—reflects an increasing demand for active participation and autonomous decision-making. Finally, considering the unique 24-hour rooming-in culture in Korean pediatric wards, validating these variables provides essential evidence-based insights that reflect current parental expectations. Therefore, this study re-evaluates and confirms the relevance of existing theoretical frameworks within the present-day clinical setting.

Based on these findings, nursing interventions are needed to enhance parental efficacy by reducing maternal uncertainty through the provision of specific, repeated, and tailored information. Furthermore, healthcare providers should create a supportive environment that facilitates the recognition and utilization of social support. Such multifaceted support strategies will ultimately contribute to improving the quality of care and health outcomes for hospitalized children and their families.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: DAK, MC. Methodology: DAK. Investigation: DAK. Formal analysis: DAK. Validation: DAK, MC. Supervision: MC. Writing–original draft: DAK, MC. Writing–review & editing: DAK, MC. Final approval of published version: DAK, MC.

Conflict of interest

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

Funding

None.

Data availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgements

The authors would like to thank the hospitals and the mothers of hospitalized children who participated in this study.

AI use disclosure

The authors declare that no AI-based language model (ChatGPT, OpenAI, GPT-5.3) was used for grammar and language editing. All scientific content, interpretation, and conclusions remain the sole responsibility of the authors. The authors reviewed and approved all content and take full responsibility for the integrity of the manuscript.

ORCID and ResearcherID

Dan A Kim https://orcid.org/0009-0007-1624-6047
https://researcherid.com/rid/PLC-4881-2026
Mi-Young Choi https://orcid.org/0000-0002-9564-4161
https://researcherid.com/rid/AFJ-8732-2022

REFERENCES

1. Kwon IS, Seo YM, Kim JY. Trends in research on caregivers hospitalized children in Korea: focus on knowledge type. J Korean Acad Child Health Nurs. 2012;18(3):101-108. https://doi.org/10.4094/jkachn.2012.18.3.101
2. Kim J, Lee H. The influence of communication competence and self-efficacy of nurses at children's hospitals on partnership with parents. J East West Nurs Res. 2021;27(2):134-142. https://doi.org/10.14370/jewnr.2021.27.2.134
3. Daughtrey HR, Ruiz MO, Felix N, Saynina O, Sanders LM, Anand KJS. Incidence of mental health conditions following pediatric hospital admissions: analysis of a national database. Front Pediatr. 2024;12:1344870. https://doi.org/10.3389/fped.2024.1344870
4. Jeong E, Kwon IS. Nursing needs and nursing performance as perceived by caregivers with hospitalized children. Child Health Nurs Res. 2015;21(3):244-252. https://doi.org/10.4094/chnr.2015.21.3.244
5. Outhwaite LA. App-based support for parental self-efficacy in the first 1,000 days: a randomized control trial. Front Psychol. 2023;13:998170. https://doi.org/10.3389/fpsyg.2022.998170
6. Lee J, Lee K. Structural analysis of creative personality, parenting belief, resilience and parent-child relationship variables that affect parental efficacy. J Future Early Child Educ. 2023;30(3-4):69-92. https://doi.org/10.22155/JFECE.30.3-4.69.92
7. Yazicioğlu T, Yildirim AE, Kumaş ÖA. Family stress and self-efficacy in parents of children with special needs: the regulatory role of perceived social support. Child Youth Serv Rev. 2024;163:107804. https://doi.org/10.1016/j.childyouth.2024.107804
8. Choi MY, Bang KS. Development and testing of a pediatric nurse parent partnership scale. J Korean Acad Nurs. 2013;43(2):194-202. https://doi.org/10.4040/jkan.2013.43.2.194
9. Kim J, Chae H, Kim Y. Spousal support, parent-nurse partnership and caregiver burden among parents of children with chronic diseases: a cross-sectional study. J Clin Nurs. 2024;33(7):2649-2661. https://doi.org/10.1111/jocn.16985
10. Lee YM. The influence of inpatient maternal uncertainty, partnership with nurses, social support, and depression on parental effectiveness [master's thesis]. Korean Bible University; 2019.
11. Li F, Xu M, Wu D, Tang Y, Zhang L, Liu X, et al. From child social impairment to parenting stress in mothers of children with ASD: The role of parental self-efficacy and social support. Front Psychiatry. 2022;13:1005748. https://doi.org/10.3389/fpsyt.2022.1005748
12. Gunter MD, Duke G. Reducing uncertainty in families dealing with childhood cancers: an integrative literature review. Pediatr Nurs. 2018;44(1):21-37.
13. Park JW. A study for the development of a social support scale [dissertation]. Yonsei University; 1985.
14. Kim AR. The influencing factors of perceived uncertainty and social support on attachment in mothers of high-risk newborns [dissertation]. Hanyang University; 2024.
15. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational

Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Ann Intern Med. 2007;147(8):573-577. https://doi.org/10.7326/0003-4819-147-8-200710160-00010

16. Kim EY. A study on the determinants of nurturing behaviors of mothers who are raising preschool children [dissertation]. Daejeon University; 2007.
17. Mishel MH. Parents' perception of uncertainty concerning their hospitalized child. Nurs Res. 1983;32(6):324-330. https://doi.org/10.1097/00006199-198311000-00002
18. Oh JA. A study on perception of uncertainty and coping effort of hospitalized children's mother [dissertation]. Ewha Womans University; 1997.
19. Gibaud-Wallston J, Wandersmann LP. Development and utility of the Parenting Sense of Competence Scale. John F. Kennedy Center for Research on Education and Human Development; 1978.
20. Shin SJ, Chung MJ. Effects of stress, social support and efficacy on mothers' parenting behaviors. Korean J Child Stud. 1998;19(1):27-42.
21. Hair JF. Jr, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. 8th ed. Cengage Learning; 2019.
22. Chang YE, Park SH. The relationships between beliefs about maternal employment and role satisfaction, parenting efficacy, and parenting stress of mothers with toddlers: comparison by employment status. Fam Fam Ther. 2016;24(4):599-619. https://doi.org/10.21479/kaft.2016.24.4.599
23. Sattler KM, Prickett KC, Crosnoe R. Mothers' work conditions, income, and parenting of young children. Fam Relat. 2024;73(2):1159-1177. https://doi.org/10.1111/fare.12917
24. Klawetter S, Weikel B, Roybal K, Cetin N, Uretsky MC, Bourque SL, et al. Social determinants of health and parenting self-efficacy among mothers of preterm infants. J Soc Soc Work Res. 2023;14(2):411-429. https://doi.org/10.1086/716303
25. Huang L, Zhao BY, Li XT, Huang SX, Chen TT, Cheng X, et al. Effects of an online family-focused parenting support intervention on preterm infants' physical development and parents' sense of competence and care ability: a randomized controlled trial. Int J Nurs Stud. 2024;149:104625. https://doi.org/10.1016/j.ijnurstu.2023.104625
26. Genna C, Thekkan KR, Dall'oglio I, Tiozzo E, Raponi M, Cecchetti C, et al. Parent's process of escalation of care for their deteriorating children admitted to paediatric wards: a grounded theory. J Clin Nurs. 2026;35(3):1382-1395. https://doi.org/10.1111/jocn.70090
27. Mishel MH. Reconceptualization of the uncertainty in illness theory. Image J Nurs Sch. 1990;22(4):256-262. https://doi.org/10.1111/j.1547-5069.1990.tb00225.x
28. Glatz T, Lippold MA. Is more information always better?: associations among parents' online information searching, information overload, and self-efficacy. Int J Behav Dev. 2023;47(5):444-453. https://doi.org/10.1177/01650254231190883
29. Jung Y. The relationship between mood state, maternal role confidence and perceived nurse support of the mothers of premature babies [master's thesis]. Seoul National University; 2021.
30. Begjani J, Movahidimoghadam F, Khoshnavay Fomani F, Beiranvand F. The effect of educational and supportive package by peers on the self-efficacy mothers of premature neonates: a quasi-experimental study. J Nurs Adv Clin Sci. 2024;1(2):91-96. https://doi.org/10.32598/jnacs.2405.1029
31. Fu W, Li R, Zhang Y, Huang K. Parenting stress and parenting efficacy of parents having children with disabilities in China: the role of social support. Int J Environ Res Public Health. 2023;20(3):2133. https://doi.org/10.3390/ijerph20032133
32. Hodgson CR, Mehra R, Franck LS. Child and family outcomes and experiences related to family-centered care interventions for hospitalized pediatric patients: a systematic review. Children (Basel). 2024;11(8):949. https://doi.org/10.3390/children11080949

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):308-319
https://doi.org/10.4094/chnr.2025.048

pISSN 2287-9110
eISSN 2287-9129

CHNR

Job stress experiences among Korean pediatric ward nurses: a qualitative content analysis

Hyemi Mun[1], Yonghwan Hyeon[2], Juhyun Jin[3]

[1]Assistant Professor, College of Nursing, Kyungwoon University, Gumi, Korea
[2]Assistant Professor, Department of Nursing, Ulsan College, Ulsan, Korea
[3]Assistant Professor, College of Nursing, Daegu Catholic University, Daegu, Korea

Corresponding author
Juhyun Jin
College of Nursing, Daegu Catholic University, 33 Duryugongwon-ro 17-gil, Nam-gu, Daegu 42472, Korea
Tel: +82-53-650-4826
Fax: +82-2-8765-4321
E-mail: dominicajin@cu.ac.kr

Received: November 5, 2025
Revised: February 2, 2026
Accepted: June 8, 2026

Purpose: This study explored job stress experiences among pediatric ward nurses in Korea and identified the underlying meanings and patterns of these experiences using qualitative content analysis.
Methods: Data were collected through individual in-depth interviews with 9 pediatric ward nurses who had at least 1 year of experience, thereby excluding nurses in the initial adaptation phase of clinical practice. The data were analyzed using qualitative content analysis.
Results: Five categories of job stress experiences were identified: (1) cognitive and emotional burden related to the distinctive characteristics of children, (2) difficulties maintaining positive relationships with caregivers, (3) difficulties arising from job demands and organizational culture, (4) additional stress from caring for children from multicultural families, and (5) growth through overcoming stress. Pediatric nurses experienced heightened emotional labor related to developmentally appropriate care and caregiver interactions, as well as structural stress associated with organizational and interprofessional contexts. Despite these challenges, they described developing professional competence, resilience, and professional identity through accumulated experience and supportive relationships.
Conclusion: Job stress among pediatric ward nurses is a multifaceted experience shaped by clinical, relational, organizational, and sociocultural contexts. Although stress created substantial challenges, nurses also described professional growth and resilience as they accumulated experience. These findings highlight the need for integrated educational and organizational strategies that address emotional labor, strengthen resilience, and promote equitable family-centered pediatric nursing care.

Keywords: Nurses; Occupational health; Pediatric nursing; Psychological stress; Qualitative research

INTRODUCTION

Pediatric nursing involves providing individualized care from birth through adolescence and requires the delivery of "developmentally appropriate nursing care." Understanding children's needs and emotions throughout the developmental continuum is a fundamental component of pediatric nursing [1]. Pediatric nurses serve as healthcare professionals who address the clinical conditions and health problems of children across developmental stages [2]. Hospitalization is a

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

highly stressful experience for both children and their parents [3]. Children experience anxiety and fear in response to unfamiliar environments and medical procedures, often expressing resistance to healthcare providers through crying or restlessness [4]. Parents also experience heightened stress levels, such as depression, anxiety, and emotional instability, during their child's hospitalization [3,5]. Accordingly, supporting parents' emotional responses is considered an essential element in promoting children's recovery and well-being [6]. Pediatric nursing is grounded in the principles of family-centered care, in which caregivers are regarded as active partners as well as recipients of nursing care. While this approach emphasizes partnership and shared decision-making, it may simultaneously impose additional emotional and relational demands on pediatric nurses [1,7]. Pediatric nurses are frequently exposed to high levels of emotional labor because they must respond to children's diverse developmental and healthcare needs and the high expectations of parents [6]. Kim et al. [8] in 2023 reported that parents often demand direct nursing care during hospitalization and expect nurses to understand and support their emotional circumstances. Pediatric nurses operate in a unique environment requiring complex partnerships with both children and their caregivers [1,9]. Recent studies indicate that these relational dynamics, combined with the demands of continuous coordination and communication with multiple healthcare professionals, act as primary stressors that distinguish their experience from that of general ward nurses [8,9].

Job stress is defined as negative emotions arising from the interaction between personal capabilities and the work environment, adversely affecting nurses' physical, psychological, and social health [10]. Given these complexities, pediatric nurses are particularly vulnerable to job stress and emotional labor while providing individualized nursing care. Prolonged exposure to job stress impairs therapeutic relationships and increases the risk of nursing errors, ultimately compromising patient safety and the overall quality of care [10]. These findings underscore the critical need for effective strategies to manage job stress among pediatric nurses. However, most domestic and international studies to date have predominantly employed quantitative designs, focusing primarily on identifying correlations between predefined variables [1,5-9]. Although these studies have contributed to identifying factors associated with job stress, they have limitations in capturing the lived experiences of pediatric nurses and the sociocultural context in which job stress occurs. Consequently, they provide limited insight into the contextual, relational, and experiential dimensions of job stress encountered in daily clinical practice [10].

In particular, the complex interactions among children's developmental characteristics, caregivers' expectations, organizational culture, and emotional labor in pediatric settings are difficult to fully capture through quantitative methods alone [1,5,7].

Qualitative content analysis provides a systematic approach for interpreting both manifest and latent content within participants' narratives, enabling the identification of recurring patterns, categories, and contextual meanings embedded in lived experiences [11]. This method is especially suitable for examining job stress in pediatric nursing, where stress is shaped by multifaceted clinical, relational, and organizational contexts [12]. Therefore, this study aimed to explore pediatric nurses' experiences of job stress using qualitative content analysis, to identify key categories and patterns that characterize these experiences, and to generate contextualized knowledge that may inform the development of educational, organizational, and support strategies tailored to pediatric nursing practice. Ultimately, this study seeks to contribute to improving pediatric nurses' job performance and supporting the provision of high-quality, family-centered pediatric nursing care.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Kyungwoon University (IRB No. KW-2025-A-4). Written informed consent was obtained from all participants prior to data collection.

1. Study Design

This qualitative study employed qualitative content analysis to explore the job stress experiences of pediatric ward nurses through individual in-depth interviews. This research was conducted and reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines [13].

2. Setting and Participants

Participants were pediatric ward nurses working at a tertiary hospital, a general hospital, and a children's hospital lo-

cated in Daegu Metropolitan City. Consistent with the inclusion criteria used in a previous study involving pediatric nurses [14], participants were required to have at least 1 year of clinical experience in a pediatric ward. After obtaining permission from the nursing department, potential participants were approached in person by the researcher and recruited using purposive and snowball sampling methods.

To focus on job stress specific to pediatric nursing practice, nurses in the initial adaptation phase were excluded because their stress primarily reflects general entry-level nursing demands [15]. Head nurses were also included as interview participants because pediatric ward job stress is closely linked not only to direct care situations but also to unit-level operational demands such as staffing management, bed and workload allocation, handling complaints and mediating conflicts, and overseeing safety and quality. As key informants, head nurses were considered able to provide the organizational context in which job stress is generated and managed. Although overall clinical experience was considered during the study design based on the classification by Jang [15], it was not used as a formal inclusion criterion but was reported as part of the participant characteristics. A total of 9 pediatric nurses were recruited. After receiving an explanation of the study purpose and procedures, including the audio recording of interviews and the use of transcribed data, all participants provided written informed consent, and the study was completed without any dropouts (Table 1).

3. Data Collection

To explore job stress experiences among pediatric nurses, individual in-depth interviews were conducted. In-depth interviews are a widely used qualitative data collection method that facilitates the systematic exploration of participants' perceptions, experiences, and meanings related to a specific phenomenon through face-to-face interaction [16]. This approach allows researchers to obtain rich descriptive data relevant to identifying patterns and categories within qualitative content analysis [12]. To enhance the quality of interview data, the researcher contacted the participants in advance and conducted the interviews after establishing rapport through informal conversation. Interviews were conducted from July 3 to August 24, 2025, with each session lasting approximately 60–90 minutes. Interview locations were selected by participants to ensure comfort and privacy, including small conference rooms within hospitals, empty classrooms during academic breaks, quiet nearby cafés, or private meeting rooms where interruptions from others were unlikely.

Interviews began with informal conversation and gradually progressed to the main topics. During interviews, the researcher maintained a neutral stance, noted key concepts, and sought clarification when responses were unclear. All interviews were audio-recorded with consent, transcribed verbatim by the researcher, and reviewed repeatedly to ensure accuracy. Data collection continued until analytic saturation was reached, defined as the point at which no new codes or categories emerged from the data [17]. In this study, no new codes were identified after the seventh interview, and subsequent interviews confirmed data redundancy. Therefore, data collection was concluded after interviewing 9 participants. To ensure consistency in the interviews, all interviews were conducted by the first author. Field notes were used during the interviews to record participants' statements and to document key concepts as they emerged. The participants had no prior relationship or conflicts of interest with the interviewer. Each participant was interviewed once. When responses were unclear or required confirmation, clarification was obtained during or immediately after the interview to ensure accurate recording and interpretation of participants' statements.

Table 1. General characteristics of participants (N=9)

No.	Gender	Age (yr)	Marital status	Pediatric ward career (yr)	Total clinical career (yr)	Position	Hospital type
1	F	46	Married	8.0	13.0	Head nurse	Pediatric hospital
2	F	30	Single	3.4	8.0	Staff nurse	General hospital
3	F	51	Married	26.0	29.0	Head nurse	General hospital
4	F	35	Married	11.0	14.0	Head nurse	Pediatric hospital
5	F	33	Single	11.0	11.0	Staff nurse	Pediatric hospital
6	F	37	Married	7.0	14.0	Staff nurse	General hospital
7	F	49	Married	3.4	28.0	Head nurse	General hospital
8	F	49	Married	9.8	28.1	Charge nurse	Tertiary hospital
9	F	34	Single	9.0	12.0	Charge nurse	General hospital

F, female.

The first author was a female registered nurse (RN), an assistant professor, and a PhD (Doctor of Philosophy) candidate in nursing. She had more than 17 years of pediatric ward experience and extensive clinical expertise in pediatric nursing. She had completed doctoral-level coursework in qualitative methodology and attended additional workshops on qualitative research methods to further strengthen her research competence.

4. Measurement

To explore the job stress experiences of pediatric ward nurses, data were collected using a researcher-developed semi-structured interview guide. The interview guide was developed based on a review of the literature on pediatric nursing stress and qualitative interview methodology [16] and was refined through discussions among 3 researchers. It was subsequently reviewed by 2 experts in qualitative research to ensure clarity and content validity (Table 2). No pilot testing of the interview guide was conducted prior to data collection. The interview questions consisted of open-ended items designed to elicit participants' experiences of job-related stress in pediatric nursing practice. Interviews were conducted flexibly, allowing participants to describe their experiences freely. The interviewer adjusted the wording and depth of questions according to participants' responses and used probing questions when necessary to obtain more detailed information. Examples of the core interview questions included: "What feelings or thoughts have you experienced while caring for hospitalized children?" and "Have you ever experienced emotions such as difficulty, fear, anxiety, tension, or worry (i.e., stress) while working as a pediatric ward nurse?" Examples of probing questions included: "Could you explain that in more detail?", "Could you provide a specific example?", and "How did that situation affect you?"

5. Data Analysis

Data were analyzed using qualitative content analysis as described by Graneheim and Lundman [11] in 2004. This approach is an inductive method in which coding categories are derived directly from the data rather than from preconceived categories or theoretical frameworks. All interviews were audio-recorded and transcribed verbatim. The transcripts were read repeatedly to gain an overall understanding of the data. Words, phrases, and sentences related to the study purpose were highlighted as meaning units. These meaning units were condensed while preserving their core meaning, and appropriate labels representing the underlying concepts were generated to form initial codes. Similar codes were grouped into subcategories and categories based on shared characteristics [11,12].

Coding was performed independently by 3 researchers, including the first author. The first author's clinical background in pediatric nursing enabled interpretation grounded in the practice context, while the co-researchers' formal training

Table 2. Interview guide and questions

	Questions
Introduction	• Before starting, please introduce yourself.
	• We will talk about job stress experienced by pediatric ward nurses.
Opening	• What are your main responsibilities as a pediatric ward nurse?
	• How have you perceived the stress you experienced while working in a pediatric ward?
Transition	• Please describe your personal experiences of job stress in the clinical pediatric ward setting.
Core questions	• What tasks or responsibilities do pediatric ward nurses actually perform in their daily practice?
	• What feelings or thoughts have you experienced while caring for hospitalized children?
	• Have you ever experienced emotions such as difficulty, fear, anxiety, tension, or worry (i.e., stress) while working as a pediatric ward nurse?
	• What effects, either positive or negative, do you think job stress during nursing tasks has on pediatric nursing?
	• What strategies or approaches can be used to effectively manage stress and enhance the nursing competencies of pediatric ward nurses?
	• How have you overcome the difficulties or stress you encountered in pediatric nursing practice?
	• What efforts did you make, and which of these factors did you consider most important?
	• Probing questions: Could you explain that in more detail?, Could you provide a specific example?, How did that situation affect you?
Closing	• To summarize, we have discussed your experiences of job stress as a pediatric ward nurse.
	• Do you have any additional comments to add?

and extensive experience in qualitative research—including multiple publications—enhanced the methodological rigor of the analysis. Discrepancies in coding were resolved through discussion among the researchers until consensus was reached. When necessary, consultation with an external qualitative research expert was sought.

No qualitative data analysis software was used; all coding and data analysis were performed manually.

6. Rigor and Trustworthiness

The rigor of this qualitative study was established in accordance with the criteria by Lincoln and Guba [18] of credibility, transferability, auditability, and confirmability.

Credibility was enhanced by selecting participants relevant to the study purpose and conducting interviews in quiet, private settings where pediatric nurses could speak openly without interruption. Participants had no prior personal or professional relationship and no conflicts of interest with the researchers, minimizing potential bias or power imbalance. Probing questions were used to obtain detailed descriptions when responses were abstract or unclear.

When responses were unclear or required confirmation, clarification was obtained during or immediately after the interview to ensure accurate recording and interpretation of participants' statements. Participants were also asked to confirm the researcher's understanding of their responses, thereby enhancing the accuracy and credibility of the data. Throughout the research process, the researchers reflected on potential preconceptions related to pediatric nursing stress.

To further enhance the quality of data collection, several strategies were implemented throughout the interview process. Prior to the interviews, informed consent was obtained, and participants were encouraged to speak freely. Efforts were made to create a comfortable atmosphere; participants who appeared tense or hesitant were reassured and encouraged to share their experiences openly. During the interviews, the researcher ensured that participants had sufficient opportunity to express their views in detail and used supportive prompts when necessary. To minimize interviewer bias, the researcher acknowledged the possibility of personal preconceptions and emphasized that there were no right or wrong answers and that participants' perspectives could change during the interview. These procedures facilitated open and authentic responses and further strengthened credibility.

Transferability was supported by providing detailed descriptions of participants' clinical characteristics, research context, and analytic procedures. Direct quotations from participants were included to allow readers to assess the applicability of the findings to other settings.

Auditability was ensured by maintaining consistency throughout data collection and analysis. All interviews were conducted by the same researcher using a consistent interview guide. Analytic notes documenting methodological decisions and category development were maintained, enabling the research process to be traced.

Confirmability was strengthened through reflexive practices and ongoing discussions among the research team to minimize the influence of researchers' biases on data interpretation.

All authors reflected on their prior clinical or professional experiences related to pediatric nursing stress and revisited these reflections during data analysis to ensure that interpretations were grounded in participants' accounts rather than researchers' assumptions. Prior assumptions—for example, that stress would primarily arise from relationships with caregivers or from difficulties with intravenous procedures—were discussed among the research team during the early stages of the study. As data collection progressed, these assumptions were revisited and compared with emerging findings. Ongoing discussions among the research team were conducted to minimize the influence of researchers' biases on data interpretation.

RESULTS

As a result of analyzing the participants' interviews, meaningful statements were identified from the interview transcripts and used to generate initial codes. Codes with similar meanings were then grouped into subcategories. Subcategories were further abstracted into higher-level categories based on similar situational and experiential characteristics, as well as shared emotional responses reflected in the data. Through this analytic process, the job stress experiences of 9 pediatric nurses were organized into 5 categories, 14 subcategories, and 32 codes (Table 3).

Table 3. Subcategories and categories of the study

Category	Subcategory
Cognitive and emotional burden due to the uniqueness of "children"	• More delicate and personalized care required for pediatric patients
	• Precision required in medication dosage calculation
	• Family-centered nursing including pediatric patient's parents
Difficulties in maintaining positive relationships with caregivers	• Difficulty establishing positive relationships with parents
	• Excessive expectations and criticism from parents and guardians
Difficulties arising from job demands and organizational culture	• Reduced sense of belonging due to individualism and lack of solidarity
	• Psychological burnout due to authoritarian attitudes of certain physicians
	• Vicious cycle of stress
Additional stress from caring for children from multicultural families	• Difficulties in information gathering, nursing, and stabilization due to language barriers
	• Conflicts between caregiver expectations and nursing practices due to cultural differences
	• Need for institutional support and education
Growth through overcoming stress	• Becoming proficient in pediatric nursing
	• Emotional burden management and resilience building
	• Becoming established as a pediatric nurse

1. Cognitive and Emotional Burden due to the Uniqueness of "Children"

1) More delicate and personalized care required for pediatric patients

Participants stated that pediatric nursing requires close observation of subtle changes in children who are unable to communicate verbally, individualized care tailored to each child's developmental stage, and considerable patience, making it more demanding than adult nursing.

"Adults can express discomfort or pain verbally, but children cannot, so they might cry persistently until very late at night." (Participant 4)

"Even among children of the same chronological age, developmental levels vary, so focusing on these differences is appropriate." (Participant 1)

"Children sometimes suddenly hit or bite, kick hard, or put objects like watches in their mouths. We must endure this as part of care." (Participant 4)

2) Precision required in medication dosage calculation

Participants placed great importance on medication administration. They expressed concerns about patient safety incidents due to incorrect calculations and dosages, and emphasized that for young children, even a small dosage error can be fatal, requiring extra caution.

"For steroids, an adult may receive 1 ampule, but for pediatric patients, the dosage varies based on body weight (like 0.25 or 0.34)." (Participant 1)

"Sometimes the attending physician says 'mL' but we interpret it as 'mg,' causing confusion." (Participant 2)

3) Family-centered nursing including pediatric patient's parents

Participants described pediatric nursing as "whole-family care," noting that both children and their parents experience anxiety in the unfamiliar hospital environment, so care includes not only the child but also the parents.

"Parents need emotional support, as they naturally feel anxious when their child is ill." (Participant 1)

"The child is 1 year old, and the mother is 1 year old too." (Participant 1)

"In pediatrics, parents initiate hospitalization decisions and participate throughout treatment. The parent-child pair is treated as a unit, unlike adult care." (Participant 1)

2. Difficulties in Maintaining Positive Relationships with Caregivers

1) Difficulty establishing positive relationships with parents

Participants described experiencing difficulties when interacting with parents whom they perceived as uncooperative or demanding. This caused stress for the participants and led to feelings of disappointment toward parents they had considered cooperative, making it challenging to build positive relationships.

"'Why make my precious child suffer?' like this… There seems to be little compromise regarding the child's issues." (Participant 3)
"Please warm the milk, heat the food, bring water,' Like this...." (Participant 4)

2) Excessive expectations and criticism from parents and guardians

Participants experienced various negative emotions such as suspicion, hypersensitivity, disappointment, and anger during interactions with parents, which caused them psychological stress and feelings of self-doubt.

"Almost 90% of parental demands 'Please try to insert the IV on my child in one try.'" (Participant 1)
"I feel like I keep causing this child pain... It's kind of a self-reproach. Honestly, after the first or second poke, by the third time, I start to feel scared. It's really hard to try again...." (Participant 4)
"'Is it okay to be this incompetent? In such a big hospital, is there really no one capable of doing this? It feels like everyone's skills are pretty lacking, just not up to the mark?' like this....." (Participant 2)
"Since it's a single room, we have patients with infections. So, we put up all the caution marks. Parents even watch closely to see if nurses wash their hands when moving from the infected patient's room." (Participant 7)

3. Difficulties Arising from Job Demands and Organizational Culture

1) Reduced sense of belonging due to individualism and lack of solidarity

According to the head nurse, recent nurses tend to expect senior nurses or someone else to look after them rather than proactively approaching colleagues to collaborate, and this growing tendency to focus only on their own tasks rather than helping one another is weakening teamwork. As a result, she noted that solidarity is diminishing and the sense of belonging within the ward appears to be gradually declining.

"They don't take the initiative to approach first but expect senior nurses or someone else to look after them." (Participant 3)
"It feels like everyone's just looking after their own patients—'your patient is your responsibility, my patient is mine'—and only doing their own share." (Participant 3)

2) Psychological burnout due to authoritarian attitudes of certain physicians

Participants experience verbal attacks, authoritarianism, insults, and blame-shifting from doctors amid unclear boundaries of responsibility, leading to feelings of anger and helplessness, which can undermine both patient safety and teamwork.

"A child underwent an appendectomy and was admitted to the ward, but the head surgeon prescribed the same antibiotic at a ridiculously high dosage compared to what the pediatrician prescribed. As a nurse, I had to ask for clarification, so I contacted him, and he said, 'Why can't a nurse do that calculation? If that's the case, we don't need nurses. We can just work with assistants. How can we work together if that's all a nurse can do?'... There are a lot of situations like this these days...." (Participant 3)
"Some attending physicians don't answer calls, express irritation, or remain silent when asked questions." (Participant 2)

3) Vicious cycle of stress

Some participants expressed concern about the negative impact of stress on pediatric care. Emotional exhaustion, physical depletion, and decreased motivation reduce direct caregiving quality.

"Stress causes me to explain things perfunctorily or speak tersely, which is apparent through facial expressions and work attitude." (Participant 3)
"Stressful situations lead to more frequent nursing errors." (Participant 1)

4. Additional Stress from Caring for Children from Multicultural Families

1) Difficulties in information gathering, nursing, and stabilization due to language barriers

As the number of foreign children and parents increases, participants experience difficulties and concerns about communication barriers and potential problems in the treatment process.

"Non-verbal communication, like body language, or demonstrating procedures—these tend to be more neces-

sary with parents from other cultures compared to Korean mothers." (Participant 1)
"A parent gave medication incorrectly because they couldn't understand it was not an antipyretic, confusing it by color." (Participant 4)

2) Conflicts between caregiver expectations and nursing practices due to cultural differences

While striving to respect diverse cultures, participants faced difficulties due to differences in hygiene beliefs, lifestyle, and dietary customs among varied cultural backgrounds.

"People from India often wear hijabs. they also wear them inside the hospital. They walk around at night wearing black hijabs...." (Participant 2)
"In Western countries, people wash less often, sometimes only every 2 or 3 days. Even in the summer, the child wasn't bathed despite sweating a lot. The child kept sucking on unwashed hands, causing repeated gastroenteritis. Although the child took enough medicine, they kept getting sick because of sucking dirty hands without washing." (Participant 4)

3) Need for institutional support and education

Participants recognize the need for policy support in nursing care for children from multicultural families. Foreign parents often do not even know how to properly administer fever medication, and communication barriers make explanations and education more difficult.

"The health center provides multilingual maternity handbooks for multicultural mothers, but these lack detailed guidelines on how to manage fever or administer antipyretics, and instead contain a lot of product promotional content." (Participant 4)
"It would be good to gather some multicultural mothers and offer them such lectures." (Participant 4)

5. Growth through Overcoming Stress

1) Becoming proficient in pediatric nursing

Participants strive to acquire professional knowledge about pediatric diseases and nursing interventions, improve their clinical skills, and prioritize understanding and empathy to build positive relationships with the children's parents.

"I often open pediatric nursing books. When I wonder what medicine to use or what we can't do, I find myself looking it up in the book." (Participant 4)
"As a mother of 2, I try my best to understand parents' perspectives." (Participant 1)

2) Emotional burden management and resilience building

Participants found strength through supportive communication with colleagues and family, sharing experiences to cope emotionally and mentally, thereby fostering growth as pediatric nurses.

"You're really good at it. When you encourage them like this, they seem to gain strength from it and keep adding more and more..." (Participant 3)
"...But that process involves getting some criticism. You have to overcome those challenges, and I think it's important to manage and get through them well." (Participant 1)

3) Becoming established as a pediatric nurse

Participants described their role as companions throughout the child's health challenges and developmental growth. Witnessing children's healthy growth and receiving gratitude and recognition from parents were described as sources of emotional satisfaction and professional affirmation.

"I've seen this child since infancy, and now they come as elementary students." (Participant 4)
"When moms say, 'Oh, we really come to this hospital because you, nurse, are here,' that's when my self-esteem really soars." (Participant 4)
"This is painful, but just a quick sting once and it's over. It hurts less than when you pick your nose... (omitted) ... I explain this to the child, and after one shot, they say it didn't hurt at all and bravely face it. Since then, the child has been handling injections well." (Participant 5)

DISCUSSION

Using qualitative content analysis, this study explored the job stress experiences of pediatric ward nurses and identified 5 interrelated categories. The findings suggest that job stress among pediatric ward nurses is a multifaceted phenomenon arising from children's developmental characteristics, interactions with caregivers, organizational culture, increasing

multicultural care demands, and the ongoing process of professional growth. One strength of this study is its focus on pediatric ward nurses as a specific clinical group, rather than treating them as part of a broader nursing population. In addition, the categories were derived directly from field data, allowing stress experiences to be organized in a systematic and practice-based manner. By moving beyond an emphasis on individual coping, the results draw attention to structural and relational factors that shape stress and offer meaningful implications for clinical practice and organizational policy.

The first category reflects the cognitive and emotional burden associated with providing developmentally appropriate care for children. Previous studies have reported that pediatric nursing entails greater cognitive demands than adult nursing, as it requires continuous interpretation of nonverbal cues and close monitoring of behavioral changes [3]. Similarly, participants in this study described persistent tension and emotional regulation while caring for children who were unable to clearly articulate their symptoms. These findings suggest that pediatric nursing extends beyond the performance of technical tasks and is characterized by substantial emotional labor. Although Hochschild [19] first introduced the concept of emotional labor in 1983, subsequent healthcare research has expanded its application to clinical settings by emphasizing its psychological and organizational implications. In pediatric care, emotional labor becomes particularly intensified due to triadic interactions among nurses, children, and caregivers. Emotional labor involves the active regulation and management of emotions in professional practice [9]. Pediatric nurses are particularly vulnerable to these demands because they must navigate complex interpersonal relationships while providing individualized care [6,9]. In addition, weight-based medication calculations and ambiguous medication orders further intensify this burden by reinforcing the high-risk nature of pediatric nursing practice, increasing nurses' sense of responsibility, and amplifying stress because even minor errors may have serious consequences.

The second category highlights job stress arising from relationships with caregivers and reveals a gap between the principles of family-centered care and the realities of clinical practice. Previous studies have shown that parents of hospitalized children often have high expectations regarding nurses' technical competence and timely responses and may express dissatisfaction when these expectations are not met [8]. In Korea, the ultra-low fertility rate of 0.75 in 2024 has further intensified parental protectiveness and reinforced child-centered attitudes [20]. Within this social context, the findings indicate that interactions with caregivers may impose a disproportionate emotional burden on nurses. These findings suggest that implementing family-centered care without sufficient consideration of nurses' emotional labor may inadvertently increase job stress rather than provide support [21]. Accordingly, organizational strategies should move beyond simply endorsing partnership and incorporate concrete structural supports. First, structured communication training tailored to managing interactions with highly anxious or high-conflict caregivers should be incorporated into continuing education programs. Second, clear institutional policies for managing verbal aggression, unreasonable demands, and patient or caregiver complaints should be established to protect nurses from disproportionate emotional burden. Third, formal debriefing mechanisms following emotionally challenging encounters may help reduce accumulated stress. Finally, staffing allocation and workload adjustments should reflect the intensity of caregiver interaction in pediatric units. Therefore, reframing nurse–parent relationships as collaborative caregiving partnerships requires not only conceptual agreement but also explicit organizational support and safeguards. The third category reflects job stress arising from job demands and organizational culture. Participants described a diminished sense of belonging resulting from individualized work practices and limited peer support. They also reported that hierarchical and authoritarian attitudes among some physicians caused psychological distress, including feelings of intimidation and anger. These findings are consistent with previous studies suggesting that problems in collaboration with physicians, conflicts among colleagues, and the quality of teamwork and organizational culture have a substantial impact on stress levels [22]. Such organizational contexts intensified nurses' emotional labor, contributing to a vicious cycle of emotional exhaustion, reduced work engagement, and diminished quality of care. These findings suggest that pediatric nurses' job stress should be understood not merely as an individual vulnerability but as a structurally reinforced experience shaped by organizational culture and power dynamics. This underscores the importance of stress management approaches that extend beyond individual coping strategies to include team-based interventions and the cultivation of collaborative, respectful work environments [23,24]. These findings highlight the central role of organizational culture in shaping pediatric nurses' job stress experiences.

Beyond organizational and interprofessional stressors, the fourth category addresses additional stress associated with caring for children from multicultural families. Participants reported that language barriers complicated information gathering, medication education, and symptom assessment, increasing concerns about the accuracy of care and patient safety. These findings are consistent with previous studies indicating that communication difficulties constrain the delivery of effective nursing care. As multicultural encounters in pediatric settings become increasingly common in Korea [25], multicultural nursing competence should be recognized as essential institutional resources for promoting child health equity [26]. Therefore, professional medical interpreter services, multilingual educational materials, and culturally appropriate clinical guidelines should be regarded not only as mechanisms for reducing nurses' workload and emotional burden but also as essential institutional resources for promoting child health equity [26].

The fifth category, "growth through overcoming stress," highlights the dynamic role of job stress in the professional development of pediatric nurses. Participants described developing pediatric-specific knowledge and clinical skills while cultivating greater empathy for children and their caregivers through repeated exposure to stressful situations. These findings are consistent with previous research suggesting that stress does not inevitably result in negative outcomes, but may facilitate positive adaptation and resilience [27]. In this study, resilience emerged not as an inherent personal trait but as a dynamic process fostered through collegial support, recognition from caregivers, and accumulated clinical experience. This indicates that the integration and reinterpretation of stressful experiences play a crucial role in the formation of professional identity among pediatric nurses.

In summary, job stress among pediatric ward nurses is a multidimensional phenomenon shaped by children's developmental characteristics, emotional labor associated with caregiver interactions, organizational culture, job structure, and increasing multicultural care demands. Therefore, moving beyond approaches that emphasize individual coping strategies, multilevel support is needed that integrates strengthened team-based collaboration, the cultivation of a respectful organizational culture, comprehensive education that includes pediatric and multicultural competencies, and improvements in work structure.

First, because participants were recruited from pediatric wards in a single metropolitan area, the findings may have limited transferability to other settings. Second, although all participants had at least 1 year of experience, differences in clinical experience may have influenced the diversity of reported job stress experiences. To enhance the trustworthiness of the study, efforts such as investigator triangulation, maintaining an audit trail, and ongoing reflexivity were implemented throughout the research process.

CONCLUSION

This study provided an in-depth exploration of job stress among pediatric ward nurses using qualitative content analysis, revealing subjective experiences and emotional responses that are difficult to capture through quantitative research. The findings suggest that pediatric ward nurses' job stress is intensified by complex clinical situations, emotional labor associated with caregiver interactions, organizational culture, and high interpersonal demands, underscoring the need for practical educational and organizational support strategies tailored to pediatric nursing practice. To this end, tailored education should be systematically developed that reflects career stage-specific competencies and learning needs (e.g., communication with guardians, managing emotional labor, and multicultural nursing competencies), and organizational support should be expanded through enhanced team-based communication and appropriate workload allocation. In addition, sustainable work environments for pediatric nurses should be fostered through parallel efforts to implement acuity-based staffing, establish systems for responding to verbal abuse and caregiver complaints, expand multicultural support resources, and provide accessible mental health support programs. Future research should broaden its scope to multiple institutions and regions and compare job stress across different career stages, using mixed-methods and longitudinal designs that incorporate objective stress indicators to better understand the relationship between job stress and the quality of nursing care.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: HM, YH, JJ. Data collection: HM, YH, JJ. Formal analysis: HM, YH, JJ. Writing–original draft: HM, YH, JJ. Writing–review and editing: HM, YH, JJ. Final approval of published version: HM, YH, JJ.

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

Funding
None.

Data availability
Please contact the corresponding author for data availability.

Acknowledgements
None.

AI use disclosure
During the preparation of this work, the authors used ChatGPT (OpenAI, GPT-5.5) to improve the English language, grammar, and academic writing style of the manuscript. After using this tool, the authors carefully reviewed and edited the content as needed and take full responsibility for the content of the published article.

ORCID and ResearcherID
Hyemi Mun https://orcid.org/0000-0002-5018-3568
https://researcherid.com/rid/OJU-4836-2025
Yonghwan Hyeon https://orcid.org/0000-0002-4618-4066
https://researcherid.com/rid/OPO-2924-2025
Juhyun Jin https://orcid.org/0000-0001-8677-8638
https://researcherid.com/rid/OHT-8569-2025

REFERENCES

1. Jin I, Cho HH. Factors influencing the quality of nursing care as perceived by mothers of hospitalized children in South Korea. Child Health Nurs Res. 2021;27(3):266-275. https://doi.org/10.4094/chnr.2021.27.3.266
2. Kim E, Song S, Kim S. Development of pediatric simulation-based education: a systematic review. BMC Nurs. 2023;22(1):291. https://doi.org/10.1186/s12912-023-01458-8
3. Zdun-Ryżewska A, Nadrowska N, Błażek M, Białek K, Zach E, Krywda-Rybska D. Parent's stress predictors during a child's hospitalization. Int J Environ Res Public Health. 2021;18(22):12019. https://doi.org/10.3390/ijerph182212019
4. Barratt M, Bail K, Paterson C. Children living with long-term conditions: a meta-aggregation of parental experiences of partnership nursing. J Clin Nurs. 2021;30(17-18):2611-2633. https://doi.org/10.1111/jocn.15770
5. Seo A, Kim SS. Effects of caregiver burden, anxiety, spirituality and family relationships on depression among caregivers of hospitalized children. J Korean Acad Fundam Nurs. 2021;28(3):353-360. https://doi.org/10.7739/jkafn.2021.28.3.353
6. Hong YJ, Kim HO. Effects of anxiety, parenting efficacy, and partnership with nurses on the caring behaviors of mothers of hospitalized children. J Korean Matern Child Health. 2024;28(3):111-121. https://doi.org/10.21896/jkmch.2024.28.3.111
7. Kaya A, İşler-Dalgıç A. Evaluating the job satisfaction of nurses working in pediatric clinics in terms of eleven dimensions and the influencing factors. Florence Nightingale J Nurs. 2020;28(3):312-320. https://doi.org/10.5152/FNJN.2020.19101
8. Kim Y, Choi A, Jang I. The effects of nurses' communication styles, nurse-mother partnerships, and mothers' anxiety on coping of hospitalized children's mothers. J Korean Acad Soc Nurs Educ. 2023;29(2):170-179. https://doi.org/10.5977/jkasne.2023.29.2.170
9. Lee JE, Choi MY. Impact of pediatric nurses' nursing professionalism on quality of nursing care: double mediating effect of clinical decision making and pediatric nurse-parent partnership. J Korean Acad Nurs Adm. 2024;30(1):55-66. https://doi.org/10.11111/jkana.2024.30.1.55
10. Yun M, Baek H, Kim IA, Sung JM. Occupational stress in Korean hospital nurses: secondary data analysis of the development of a Korean Nurses' Occupational Stress Scale. J Korean Acad Nurs Adm. 2022;28(4):393-405. https://doi.org/10.11111/jkana.2022.28.4.393
11. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Educ Today. 2004;24(2):105-112. https://doi.org/10.1016/j.nedt.2003.10.001
12. Elo S, Kyngäs H. The qualitative content analysis process. J Adv Nurs. 2008;62(1):107-115. https://doi.org/10.1111/j.1365-2648.2007.04569.x
13. Tong A, Sainsbury P, Craig J. Consolidated Criteria for Reporting Qualitative Research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349-357. https://doi.org/10.1093/intqhc/mzm042
14. Kim JH, Jung IS. Factor affecting on recognition and performance of peripheral intravenous infusion management among pediatric nurses. J Converg Inf Technol. 2019;9(12):104-114. https://doi.org/10.22156/CS4SMB.2019.9.12.104
15. Jang KS. A study on establishment of clinical career development model of nurses [dissertation]. Yonsei University; 2000.
16. Patton MQ. Qualitative research & evaluation methods: integrating theory and practice. 4th ed. Sage Publications; 2015.
17. Hennink MM, Kaiser BN, Marconi VC. Code saturation versus

meaning saturation: how many interviews are enough? Qual Health Res. 2017;27(4):591-608. https://doi.org/10.1177/1049732316665344

18. Lincoln YS, Guba EG. Effective evaluation. Jossey-Bass; 1985.
19. Hochschild AR. The managed heart: commercialization of human feeling. University of California Press; 1983.
20. Statistics Korea. Total fertility rate [Internet]. Korean Statistical Information Service; c2025 [cited 2025 Sep 26]. Available from: https://www.index.go.kr/unify/idx-info.do?idxCd=5061
21. Coyne I, O'Neill C, Murphy M, Costello T, O'Shea R. What does family-centred care mean to nurses and how do they think it could be enhanced in practice. J Adv Nurs. 2011;67(12):2561-2573. https://doi.org/10.1111/j.1365-2648.2011.05768.x
22. Hong MS, Lim EJ. Job stress and stress management among nurses in general hospitals: a systematic review. J Korean Public Health Nurs. 2025;39(3):325-339. https://doi.org/10.5932/JKPHN.2025.39.3.325
23. Aiken LH, Cimiotti JP, Sloane DM, Smith HL, Flynn L, Neff DF. Effects of nurse staffing and nurse education on patient deaths in hospitals with different nurse work environments. Med Care. 2011;49(12):1047-1053. https://doi.org/10.1097/MLR.0b013e3182330b6e
24. Lee SJ, Lee YM. A study on impact of nursing work environment, interpersonal skills, and grit on field adaptation of nurses who have experienced department transfers. J Korean Crit Care Nurs. 2024;17(2):71-82. https://doi.org/10.34250/jkccn.2024.17.2.71
25. Ministry of Justice. Introduction to the Ministry of Justice [Internet]. Ministry of Justice; c2025 [cited 2025 Sep 26]. Available from: https://www.moj.go.kr/moj/2412/subview.do
26. Shin MS. Effects of intercultural uncertainty, transcultural self-efficacy, and cultural competency on partnership with multicultural parents among children's hospital nurses [dissertation]. Kongju National University; 2023.
27. Cooper AL, Brown JA, Rees CS, Leslie GD. Nurse resilience: a concept analysis. Int J Ment Health Nurs. 2020;29(4):553-575. https://doi.org/10.1111/inm.12721

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):320-329
https://doi.org/10.4094/chnr.2026.015

pISSN 2287-9110
eISSN 2287-9129

CHNR

Factors related to prenatal depression among hospitalized high-risk pregnant women in South Korea: a cross-sectional study focused on resilience, pregnancy stress, and marital satisfaction

Misun Jin[1], Soonyoung Shon[2]

[1]Registered Nurse, Keimyung University Dongsan Hospital, Daegu, Korea
[2]Assistant Professor, College of Nursing, Keimyung University, Daegu, Korea

Corresponding author
Soonyoung Shon
College of Nursing, Keimyung University, 1095 Dalgubeol-daero, Dalseo-gu, Daegu 42601, Korea
Tel: +82-53-258-7657
Fax: +82-53-258-7616
E-mail: sy.shon@kmu.ac.kr

This article is based on a thesis by Misun Jin, submitted in partial fulfilment of the requirements for a master's degree at Keimyung University.

Received: February 21, 2026
Revised: April 6, 2026
Accepted: June 1, 2026

Purpose: Prenatal depression affects 10%–25% of pregnant women and has important implications for maternal and neonatal health. High-risk pregnant women may be particularly vulnerable to anxiety and depression because of obstetric complications and concerns about fetal health. This study examined factors related to prenatal depression among hospitalized high-risk pregnant women, focusing on resilience, pregnancy stress, and marital satisfaction.

Methods: A descriptive cross-sectional survey was conducted among 169 high-risk pregnant women admitted to a tertiary hospital in South Korea. Data were collected using validated instruments that measured pregnancy stress, marital satisfaction, resilience, and prenatal depression. Hierarchial regression analysis was performed to identify factors associated with prenatal depression.

Results: The mean prenatal depression score was 8.75±5.54, and 43.8% of participants had mild to severe depression. The regression model explained 37.4% of the variance in prenatal depression (F=21.07, p<.001). Resilience showed the strongest protective association (β=−.43, p<.001), followed by pregnancy stress as a significant risk factor (β=.26, p<.001) and desire for pregnancy as a significant predictor (β=−.16, p=.018). Marital satisfaction and experience of infertility treatment were not significant independent predictors.

Conclusion: Resilience and pregnancy stress were key factors related to prenatal depression among hospitalized high-risk pregnant women. Interventions that strengthen resilience and reduce pregnancy-related stress may help prevent and manage prenatal depression in this population.

Keywords: Depression; High-risk pregnancy; Resilience; Psychological stress

INTRODUCTION

High-risk pregnancy refers to conditions during pregnancy or childbirth that may threaten the health and life of the mother, fetus, or newborn [1]. Pregnant women with such high-risk conditions experience higher levels of anxiety than those with normal pregnancies because of concerns about the potential for obstetric complications and fetal health issues during pregnancy and childbirth [2]. Anxiety experienced by pregnant women can lead to depression, which is reported in 10%–25% of all pregnant women [3]. In particular, some studies have suggested that high-risk pregnant women are

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

approximately 3 times more likely to experience prenatal depression than low-risk pregnant women [4].

Prenatal depression is associated with an increase in the risk of preeclampsia, preterm birth, and complications during delivery in pregnant women [5]. Mental health issues may not only lead to increased rates of preterm birth and low birth weight but also elevate the risk of neonatal infections and cognitive developmental disorders [5]. Untreated prenatal depression can lead to maternal nutritional deficiencies, sleep disturbances, poor adherence to medical recommendations, increased exposure to tobacco and substance, and even suicide risk [6]. Furthermore, prenatal depression can progress to postpartum depression, and chronic depressive conditions and may recur in subsequent pregnancies [7]. Given that a substantial proportion of pregnant women experience depressive symptoms, understanding the underlying causes of prenatal depression and developing effective interventions is important. Such efforts can improve the health of not only the pregnant women but also the fetus and the family.

Pregnancy stress is a major factor influencing depression during pregnancy. It reduces placental blood flow and oxygen supply to the fetus, potentially impairing fetal brain development [8]. High levels of pregnancy-related stress are associated with miscarriage and preterm birth, thereby adversely affecting both maternal and fetal outcomes [9]. Compared with women with low-risk pregnancies, high-risk pregnant women are more likely to experience elevated stress levels due to physical complications, frequent hospital visits, and prolonged hospitalization, which may further exacerbate depressive symptoms [10].

Low marital satisfaction has been found to significantly increase the risk of both prenatal and postpartum depression [11]. Conversely, a positive spousal relationship enhances emotional support, boosting marital satisfaction and reducing depressive symptoms [12].

Resilience is another important factor that directly and indirectly influences marital satisfaction as well as prenatal and postpartum depression [13]. Individuals with greater resilience are better able to cope with psychologically threatening situations and maintain emotional stability [14]. High levels of resilience are associated with stronger maternal-fetal attachment [15] and the increased ability to effectively manage stressors by utilizing adaptive coping strategies and social support, even in high-risk conditions [1]. Therefore, examining the relationship between resilience and prenatal depression in high-risk pregnant women is crucial.

Previous studies have identified various factors associated with prenatal depression, including socioeconomic difficulties, low educational attainment, unmarried or divorced status, and unemployment [3]. Additionally, obstetric factors such as high-risk pregnancy, gestational age, and unintended pregnancy, as well as psychological factors including low self-esteem, high anxiety, and stress, have been reported as significant contributors [10,16]. High-risk pregnant women often experience restricted environments due to hospitalization, anxiety about delivering a healthy baby, and feelings of loneliness caused by separation from their families [16].

Despite these findings, most studies have focused on general pregnant populations or examined individual factors in isolation. There is a dearth of studies investigating the combined and interrelated effects of pregnancy stress, marital satisfaction, and resilience on prenatal depression, particularly among hospitalized high-risk pregnant women exposed to more complex clinical and psychosocial stressors.

Therefore, this study aimed to examine the factors related to prenatal depression, including pregnancy stress, marital satisfaction, and resilience.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Keimyung University Dongsan Hospital in South Korea (IRB No. 2025-01-001). Informed consent was obtained from all participants.

1. Study Design

In this study, descriptive cross-sectional surveys were conducted to examine the relationships between pregnancy stress, marital satisfaction, resilience, and prenatal depression in high-risk pregnant women. The reporting of this study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [17].

2. Study Population

Participants included pregnant women who were less than 37 weeks pregnant, diagnosed with high-risk pregnancy, and admitted to the High-Risk Maternal and Fetal Intensive Care Centre at Keimyung University's Tertiary General Hospital in Daegu. In this study, high-risk pregnancy includes conditions such as preterm labor, hypertensive disorders, gestational di-

abetes, placenta-related complications, and other maternal or fetal conditions requiring specialized medical care. The selection criteria were as follows: (1) diagnoses listed among the 19 major high-risk pregnancy conditions specified by the Health Insurance Review and Assessment Service (e.g., preterm labor, premature rupture of membranes, cervical insufficiency, placenta previa, placental abruption, preeclampsia, oligohydramnios and polyhydramnios, multiple pregnancies, fetal abnormalities, uterine malformations, hypertension, diabetes, and other medical conditions), (2) pregnant women who were married to or living with their partners, (3) pregnant women who fully understood the study's purpose and questionnaire content and could respond independently, and (4) pregnant women who voluntarily participated. Foreign pregnant women who were unable to communicate fluently in Korean and pregnant women diagnosed with depression or taking antidepressants were excluded from the study.

The sample size was calculated using G*Power ver. 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf). Based on hierarchical regression analysis, the significance level was set at .05, the effect size at a medium level of .15, and the power at .80.

Sixteen predictor variables were considered, including demographic characteristics (age, highest level of education, employment status, family income level, and duration of marriage) and obstetric characteristics (gestational age, parity, infertility treatment status, desire for pregnancy, premature birth, miscarriage experience, reason for visit, and receipt of prenatal education). A minimum sample size of 143 participants was required for this study. Anticipating a 15% dropout rate, data were collected from a total of 169 participants. All questionnaires were completed without substantial missing data and were included in the final analysis.

3. Instruments

1) Pregnancy stress

The Pregnancy Stress Scale was used to assess stress levels of pregnant women [18]. This scale measures stress caused by various changes during pregnancy. It consists of 26 items divided into 3 subfactors: fetus (9 items), pregnant woman herself (11 items), and spouse (6 items). Scoring is based on a 5-point Likert scale ranging from 1 ('not at all worried') to 5 ('always worried'). The total score ranges from 26 to 130. Higher scores indicate a higher pregnancy stress index. At the time of the scale's development, the reliability value was Cronbach's α=.84. The instrument's reliability in this study was Cronbach's α=.88.

2) Marital satisfaction

Marital satisfaction was measured using the Korean Marital Satisfaction Scale [19], adapted for couples during pregnancy. This tool consists of 31 items: 16 in the affective domain and 15 in the communicative domain. The affective domain comprises 2 subdomains: respect for and consideration of the partner. The communicative domain comprises 2 subdomains: effective communication and conflict resolution, and negative communication. Each item is scored on a 4-point Likert scale ranging from 1 ('not at all true') to 4 ('very true'). Total scores range from 31 to 124. Higher scores indicate greater marital satisfaction. At the time of the tool's development, its reliability was Cronbach's α=.83. The reliability of the tool in this study was Cronbach's α=.96.

3) Resilience

Resilience was measured using the Korean version of the Connor-Davidson Resilience Scale [20]. This scale has proven reliability and validity and consists of 25 items. It is divided into 5 subscales: resilience (items 1, 4, 14–19, 23), persistence (items 5, 10–12, 21, 22, 24, 25), optimism (items 6–9), support (items 2, 13), and spirituality (items 3, 20). All items are scored on a 5-point scale, with total scores ranging from 0 to 100. Higher scores indicate greater resilience. At the time of tool development, its reliability was Cronbach's α=.89; Baek et al. [20] reported a higher reliability (Cronbach's α=.93). The reliability of the tool for this study was Cronbach's α=.93.

4) Prenatal depression

Prenatal depression was assessed using the Korean version of the Edinburgh Postnatal Depression Scale [21]. The scale consists of 10 items covering depression, anxiety, guilt, and suicidal thoughts over the past week and uses a 4-point Likert scale. Each item is scored from 0 ('strongly agree') to 3 ('strongly disagree'). Reverse-coded items (items 3, 5–10) are scored in reverse order. A score of 0–8 indicates normal, 9–12 indicates mild depression, and ≥13 indicates severe depression. The total scores range from 0 to 30, with higher scores indicating more severe prenatal depression. The tool's reliability was Cronbach's α=.89, whereas the study by Han et al. [21] showed Cronbach's α=.85. Its reliability in this study was Cronbach's α=.98.

5) Demographic and obstetric characteristics

Demographic and obstetric characteristics were collected using a self-report questionnaire. Demographic characteristics included age, highest level of education, employment status, household income, and duration of marriage. Obstetric characteristics included gestational age, parity, experience of infertility treatment, desire for pregnancy, history of preterm birth, miscarriage experience, reason for hospital visit, and receipt of prenatal education.

4. Data Collection

Data were collected from January 11, 2025 to April 1, 2025. The study participants were high-risk pregnant women hospitalized in the high-risk maternal and fetal intensive care unit of a tertiary hospital. Participants were identified by reviewing admission records in the high-risk maternal and fetal intensive care unit. Eligible participants were approached after clinical stabilization during hospitalization. After confirming eligibility, the researcher explained the study purpose, procedures, and ethical considerations in a private setting within the hospital ward. Written informed consent was obtained prior to participation. Primary data were collected using self-report questionnaires assessing pregnancy stress, marital satisfaction, resilience, prenatal depression, and clinical and obstetric data. All collected data were reviewed for completeness immediately after collection. The data were anonymized, coded, and securely stored in a password-protected database accessible only to the research team.

5. Data Analysis

The data collected in this study were analyzed using the IBM SPSS for Windows ver. 30.0 (IBM Corp., Armonk, NY, USA). A descriptive statistical analysis, composed of calculations of frequencies, percentages, means, and standard deviations, was performed on the participants' demographic and obstetric characteristics. Pregnancy stress, marital satisfaction, resilience, and prenatal depression levels were analyzed using means and standard deviations. To verify the differences in prenatal depression levels according to demographic and pregnancy-related characteristics, t-tests and one-way analysis of variance were performed with post-hoc analysis using the Scheffé method. Pearson's correlation coefficients were used to assess correlations among pregnancy stress, marital satisfaction, resilience, and prenatal depression. Independent variables were selected based on both theoretical relevance and preliminary analyses. Specifically, variables that showed significant differences in prenatal depression in univariate analyses (infertility treatment and desire for pregnancy) and those significantly correlated with prenatal depression (pregnancy stress, marital satisfaction, and resilience) were included in the regression model. A multiple regression analysis was used to examine the relationships between pregnancy stress, marital satisfaction, resilience, and prenatal depression.

RESULTS

1. Prenatal Depression according to General Characteristics

The levels of prenatal depression based on participants' demographic and obstetric characteristics are presented in Table 1. No statistically significant differences in prenatal depression scores were observed according to age, educational level, employment status, household income, or duration of marriage. Duration of marriage was divided into 2 groups based on a median of 38 months to compare prenatal depression scores; however, no significant differences were found. Significant differences in prenatal depression were observed in some obstetric variables. Participants without infertility treatment had higher prenatal depression scores than those with treatment ($t=2.06$, $p=.041$). Prenatal depression was also higher among women with no desire for pregnancy ($t=3.58$, $p<.001$). Conversely, prenatal depression scores did not show statistically significant differences based on gestational age, parity, history of preterm birth, history of miscarriage, diagnosis, or prenatal education.

2. Pregnancy Stress, Marital Satisfaction, Resilience, and Prenatal Depression

The results related to the measurement of pregnancy stress, marital satisfaction, resilience, and prenatal depression among the participants are shown in Table 2. The mean scores were 61.34±13.40 for pregnancy stress, 100.02±13.18 for marital satisfaction, and 61.96±13.20 for resilience. The mean prenatal depression score was 8.75±5.54. Under depression severity, 56.2% of participants were classified as normal, 20.7% as mildly depressed, and 23.1% as severely depressed.

Table 1. Differences in prenatal depression according to general characteristics of high-risk pregnant women (N=169)

Characteristic	No. (%)	Mean±SD	t or F	*p*
Demographic characteristics				
Age (yr)			1.30	.276
20s	16 (9.5)	7.75±5.40		
30s	129 (76.3)	9.12±5.66		
40s	24 (14.2)	7.38±4.84		
Education			0.22	.879
High school graduate or below	28 (16.6)	8.79±5.30		
College graduate	39 (23.1)	9.00±4.74		
University graduate	91 (53.8)	8.49±5.73		
Graduate degree or higher	11 (6.5)	9.82±7.57		
Occupation			0.77	.445
None	85 (50.3)	9.07±5.37		
Present	84 (49.7)	8.42±5.73		
Household income			2.05	.132
Sufficient	37 (21.9)	8.14±6.03		
Average	106 (62.7)	8.47±5.23		
Insufficient	26 (15.4)	10.73±5.83		
Marriage duration (mo)			0.23	.822
<38	82 (48.5)	8.84±5.79		
≥38	87 (51.5)	8.65±5.29		
Obstetric characteristics				
Gestational age (wk)			1.10	.271
<28	58 (34.3)	9.40±5.61		
≥28	111 (65.7)	8.41±5.50		
Parity			0.37	.709
Primiparous	127 (75.1)	8.65±5.37		
Multiparous	42 (24.9)	9.02±6.10		
Infertility treatment			2.06	.041
No	104 (61.5)	9.43±5.69		
Yes	65 (38.5)	7.65±5.16		
Desire for pregnancy			3.58	<.001
Not desired	16 (9.5)	13.31±6.17		
Desired	153 (90.5)	8.27±5.27		
History of preterm birth			1.31	.191
None	154 (91.1)	8.57±5.43		
Yes	15 (8.9)	10.53±6.57		
Abortion experience			0.68	.498
None	122 (72.2)	8.57±5.45		
Yes	47 (27.8)	9.21±5.81		
Diagnosis			0.65	.665
Preterm labor	86 (50.9)	8.49±5.49		
Other	35 (20.7)	8.71±5.04		
Placenta previa	15 (8.9)	9.53±5.38		
Gestational hypertension	14 (8.3)	10.79±7.71		
Intrauterine growth retardation	11 (6.5)	7.18±6.03		
Oligohydramnios	8 (4.7)	8.75±3.65		
Prenatal education status			0.01	.994
None	123 (72.8)	8.72±5.44		
Irregular	42 (24.8)	8.79±5.90		
Regular	4 (2.4)	9.00±6.32		

SD, standard deviation.

3. Correlation among Pregnancy Stress, Marital Satisfaction, Resilience, and Prenatal Depression

The results of the analysis of the correlations among pregnancy stress, marital satisfaction, resilience, and prenatal depression among the participants are shown in Table 3. Participants' prenatal depression was positively correlated with pregnancy stress (r = .43, p < .001) and negatively correlated with marital satisfaction (r = –.22, p = .004) and resilience (r = –.53, p < .001).

4. Factors Related to Prenatal Depression

Multiple regression analyses were conducted using infertility treatment, desire for pregnancy, pregnancy stress, marital satisfaction, and resilience. Independent variables were selected based on both theoretical relevance and preliminary analyses. Pregnancy stress, marital satisfaction, and resilience were selected based on prior literature. In addition, infertility treatment and desire for pregnancy were included as they caused significant differences in prenatal depression in the univariate analyses. Results of the analyses are summarized in Table 4. All regression assumptions, including normality, linearity, homoscedasticity, and multicollinearity, were satisfied. No multicollinearity was detected (tolerance = .79–.97; variance inflation factor = 1.04–1.27), and the Durbin-Watson statistic (2.13) indicated no autocorrelation. The model was statistically significant (F = 21.07, p < .001) and explained 37.4% of the variance in prenatal depression (R^2 = .393, adjusted R^2 = .374).

Pregnancy stress was positively associated with prenatal depression (β = .26, p < .001), whereas resilience showed the strongest negative association (β = –.43, p < .001). Desire for pregnancy (dummy-coded; not desired = 0) was also a significant predictor (β = –.16, p = .018). In contrast, infertility treatment and marital satisfaction were not significant predictors of prenatal depression.

Table 2. Pregnancy stress, marital satisfaction, resilience, and prenatal depression (N=169)

Variable	No. (%) or Mean ± SD	Score range	Minimum value	Maximum value
Pregnancy stress	61.34 ± 13.40	26 to 130	29	107
Marital satisfaction	100.02 ± 13.18	31 to 124	62	124
Resilience	61.96 ± 13.20	0 to 100	13	100
Prenatal depression	8.75 ± 5.54	0 to 30	0	26
Normal	95 (56.2)	0 to 8		
Mild depression	35 (20.7)	9 to 12		
Severe depression	39 (23.1)	≥ 13		

SD, standard deviation.

Table 3. Correlations among pregnancy stress, marital satisfaction, resilience, and prenatal depression (N=169)

Variable	r (p)			
	1	2	3	4
1. Pregnancy stress	1			
2. Marital satisfaction	–.27 (< .001)	1		
3. Resilience	–.37 (< .001)	.32 (< .001)	1	
4. Prenatal depression	.43 (< .001)	–.22 (.004)	–.53 (< .001)	1

Table 4. Factors influencing prenatal depression (N=169)

Variable	B	SE	β	t	p
Constant	18.02	4.26	-	4.23	< .001
Infertility treatment[a)]	–0.84	0.72	–.07	–1.17	.245
Desire for pregnancy[b)]	–3.02	1.26	–.16	–2.40	.018
Pregnancy stress	0.11	0.03	.26	3.98	< .001
Marital satisfaction	0.03	0.03	.06	0.88	.381
Resilience	–0.18	0.03	–.43	–6.31	< .001
Model fit	R^2 = .393, adjusted R^2 = .374, F = 21.07, p < .001				

SE, standard error.
[a)]Dummy variable: desire for pregnancy, not desired=0. [b)]Dummy variable: infertility treatment, no=0.

DISCUSSION

This study was conducted to assess pregnancy stress, marital satisfaction, and resilience among high-risk pregnant women and investigate the effects of these variables on prenatal depression. Prenatal depression levels observed in this study were higher than those reported in general pregnant populations [22], suggesting that high-risk pregnancy status may be associated with increased psychological vulnerability. Notably, a considerable proportion of participants required counseling or clinical intervention, underscoring the importance of early detection and targeted support for prenatal depression among high-risk pregnant women.

Women without infertility treatments showed higher levels of prenatal depression than those who had undergone infertility treatment. This finding should be interpreted with caution; however, one possible explanation is that women who conceive following an infertility treatment may experience psychological relief after successful conception, given that infertility is often associated with high levels of stress, uncertainty, and emotional burden [23]. In addition, these women may receive more consistent medical attention and emotional support during the treatment process. Conversely, women who have not undergone fertility treatments may be more likely to have unplanned or less psychologically prepared pregnancies, which could contribute to increased depressive symptoms. These findings suggest that psychological preparedness for pregnancy, rather than the infertility treatment experience itself, may play a more important role in prenatal depression, which is consistent with evidence highlighting the impact of pregnancy intention on maternal mental health [24].

Furthermore, prenatal depression differed significantly according to the desire for pregnancy, with women who did not desire the pregnancy reporting higher depression levels. Unintended pregnancy may impose substantial psychological burden, including negative emotions, reduced sense of control, and anxiety regarding future parenting, all of which are known risk factors for prenatal depression [25]. These effects may be further exacerbated in high-risk pregnancies, where psychological vulnerability is compounded by underlying medical risks.

Correlation analysis showed that pregnancy stress was positively associated with prenatal depression, whereas marital satisfaction and resilience were negatively associated. These findings support the role of pregnancy stress as a key psychological factor influencing prenatal depression [26]. Marital satisfaction was negatively correlated with prenatal depression, suggesting that spousal relationships and emotional support may act as protective factors for maternal mental health [27]. However, marital satisfaction was not an independent predictor of prenatal depression in the hierarchical regression model, indicating that its effect may be indirect, possibly through psychological pathways such as pregnancy stress or resilience [28]. This limited explanatory value may also be related to the characteristics of the study population. Participants were high-risk pregnant women hospitalized in a tertiary hospital, a context that is physically restrictive and socially constrained compared with non-hospitalized pregnant women [28,29]. Accordingly, marital satisfaction, as a broad construct, may have reduced sensitivity in explaining prenatal depression in high-risk pregnancy contexts [30]. Therefore, future research should incorporate more specific relational indicators—such as the spouse's actual emotional support, frequency and quality of communication, and caregiving involvement—to better capture the relationship dynamics relevant to prenatal depression.

Resilience was a major protective factor and showed the strongest negative association with prenatal depression. Resilience refers to the capacity to adapt positively and recover from adversity [31]. Our findings indicate that resilience may buffer the detrimental impact of pregnancy-related physical and psychological stress, reducing the likelihood of progression to prenatal depression. This highlights resilience as a clinically meaningful target for assessment and intervention in high-risk pregnancy populations [31,32].

In this model, pregnancy stress was identified as a significant risk factor for prenatal depression, indicating that pregnancy-related concerns and stressors contribute to elevated depressive symptoms during pregnancy. Among the reproductive-context variables, the desire for pregnancy was significantly associated with prenatal depression, whereas infertility treatment experience was not. This suggests that the psychological meaning and acceptance of pregnancy may be more significant than treatment history itself, consistent with previous findings [24,33]. Marital satisfaction was not significantly associated with prenatal depression, after controlling for other predictors, supporting the possibility that its influence is indirect and less prominent in high-risk pregnancy contexts where medical and psychosocial stressors are substantial [28,30].

Overall, this study clarified the relative effects of pregnan-

cy stress, marital satisfaction, and resilience on prenatal depression among high-risk pregnant women using multiple regression analysis. These findings indicate that proximal psychological factors, particularly pregnancy stress and resilience, may exert a more direct influence on prenatal depression than broader contextual factors such as marital satisfaction or infertility treatment experience [34]. These results underscore the importance of systematic screening, continuous assessment of pregnancy-related stress, and resilience-focused interventions to prevent and manage prenatal depression in hospitalized high-risk pregnant women. From a nursing practice perspective, a comprehensive understanding of the interplay among these factors may facilitate early identification of women at risk and support the development of tailored, patient and family-centered interventions.

This study has several limitations. First, the findings may have limited generalizability because participants were recruited from a single tertiary hospital, which may limit the generalizability of the findings to broader populations or different clinical settings. Second, because all variables were assessed using self-reported questionnaires, reporting bias may have occurred. In particular, hospitalized high-risk pregnant women may have underreported depressive symptoms or emotional difficulties because of concerns about stigma or the clinical environment. Third, the cross-sectional design precludes causal inferences.

Despite these limitations, this study makes important clinical and academic contributions. It identifies key modifiable psychological factors—particularly resilience and pregnancy stress—associated with prenatal depression among hospitalized high-risk pregnant women. These findings highlight the need for routine psychological screening and the development of resilience-enhancing and stress management interventions in high-risk pregnancy care settings. Furthermore, by focusing on a clinically vulnerable and underexplored population, this study contributes to the literature on high-risk pregnancy care and offers evidence to inform targeted nursing interventions and future longitudinal research.

CONCLUSION

This study identified factors related to prenatal depression among high-risk pregnant women, including desire for pregnancy, pregnancy stress, marital satisfaction, and resilience. The results showed that resilience had the strongest association with prenatal depression, followed by pregnancy stress and desire for pregnancy. Additionally, 43.8% of the participants experienced mild or higher levels of antenatal depression, with a total explanatory power of 37.4%. These findings suggest the need for tailored nursing interventions centered on resilience, continuous stress assessment from early pregnancy, and establishment of individualized psychological support systems to manage and prevent prenatal depression in high-risk pregnant women. Furthermore, it is recommended to strengthen professional counseling and medical support systems that reflect the psychosocial context of high-risk pregnant women, conduct research validating the effectiveness of resilience enhancement programs, establish a systematic stress assessment system from early pregnancy, and develop personalized psychological support systems through longitudinal studies to confirm the impact of prenatal depression-related factors that extend into the postpartum period.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: MJ, SS. Methodology: MJ, SS. Data collection: MJ. Formal analysis: MJ, SS. Writing–original draft: MJ, SS. Writing–review and editing: MJ, SS. Final approval of published version: all authors.

Conflict of interest

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

Funding

None.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgements

This article is based on a thesis by Misun Jin, submitted in partial fulfillment of the requirements for a master's degree at Keimyung University.

AI use disclosure

During the preparation of this manuscript, the authors used Claude Sonnet 5 to check and correct English grammar

and spelling. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

ORCID and ResearcherID

Misun Jin https://orcid.org/0009-0007-1203-5090
https://researcherid.com/rid/PLD-0450-2026

Soonyoung Shon https://orcid.org/0000-0003-0571-2181
https://researcherid.com/rid/MCI-5983-2025

REFERENCES

1. Holness N. High-risk pregnancy. Nurs Clin North Am. 2018;53(2):241-251. https://doi.org/10.1016/j.cnur.2018.01.010
2. Isaacs NZ, Andipatin MG. A systematic review regarding women's emotional and psychological experiences of high-risk pregnancies. BMC Psychol. 2020;8(1):45. https://doi.org/10.1186/s40359-020-00410-8
3. Field T. Prenatal depression risk factors, developmental effects and interventions: a review. J Pregnancy Child Health. 2017;4(1):301. https://doi.org/10.4172/2376-127X.1000301
4. Thiagayson P, Krishnaswamy G, Lim ML, Sung SC, Haley CL, Fung DS, et al. Depression and anxiety in Singaporean high-risk pregnancies: prevalence and screening. Gen Hosp Psychiatry. 2013;35(2):112-116. https://doi.org/10.1016/j.genhosppsych.2012.11.006
5. Nisar A, Yin J, Waqas A, Bai X, Wang D, Rahman A, et al. Prevalence of perinatal depression and its determinants in Mainland China: a systematic review and meta-analysis. J Affect Disord. 2020;277:1022-1037. https://doi.org/10.1016/j.jad.2020.07.046
6. Jahan N, Went TR, Sultan W, Sapkota A, Khurshid H, Qureshi IA, et al. Untreated depression during pregnancy and its effect on pregnancy outcomes: a systematic review. Cureus. 2021;13(8):e17251. https://doi.org/10.7759/cureus.17251
7. Wolf AW, De Andraca I, Lozoff B. Maternal depression in three Latin American samples. Soc Psychiatry Psychiatr Epidemiol. 2002;37(4):169-176. https://doi.org/10.1007/s001270200011
8. Parcells DA. Women's mental health nursing: depression, anxiety and stress during pregnancy. J Psychiatr Ment Health Nurs. 2010;17(9):813-820. https://doi.org/10.1111/j.1365-2850.2010.01588.x
9. Lima SA, El Dib RP, Rodrigues MR, Ferraz GA, Molina AC, Neto CA, et al. Is the risk of low birth weight or preterm labor greater when maternal stress is experienced during pregnancy?: a systematic review and meta-analysis of cohort studies. PLoS One. 2018;13(7):e0200594. https://doi.org/10.1371/journal.pone.0200594
10. Smorti M, Ginobbi F, Simoncini T, Pancetti F, Carducci A, Mauri G, et al. Anxiety and depression in women hospitalized due to high-risk pregnancy: an integrative quantitative and qualitative study. Curr Psychol. 2023;42(7):5570-5579. https://doi.org/10.1007/s12144-021-01902-5
11. Azad R, Fahmi R, Shrestha S, Joshi H, Hasan M, Khan AN, et al. Prevalence and risk factors of postpartum depression within one year after birth in urban slums of Dhaka, Bangladesh. PLoS One. 2019;14(5):e0215735. https://doi.org/10.1371/journal.pone.0215735
12. Vaezi A, Soojoodi F, Banihashemi AT, Nojomi M. The association between social support and postpartum depression in women: a cross sectional study. Women Birth. 2019;32(2):e238-e242. https://doi.org/10.1016/j.wombi.2018.07.014
13. Kallas KA, Marr K, Moirangthem S, Heude B, Koehl M, van der Waerden J, et al. Maternal mental health care matters: the impact of prenatal depressive and anxious symptoms on child emotional and behavioural trajectories in the French EDEN Cohort. J Clin Med. 2023;12(3):1120. https://doi.org/10.3390/jcm12031120
14. Hajure M, Alemu SS, Abdu Z, Tesfaye GM, Workneh YA, Dule A, et al. Resilience and mental health among perinatal women: a systematic review. Front Psychiatry. 2024;15:1373083. https://doi.org/10.3389/fpsyt.2024.1373083
15. Noroozi M, Gholami M, Mohebbi-Dehnavi Z. The relationship between hope and resilience with promoting maternal attachment to the fetus during pregnancy. J Educ Health Promot. 2020;9:54. https://doi.org/10.4103/jehp.jehp_386_19
16. Smorti M, Gemignani A, Bonassi L, Mauri G, Carducci A, Ionio C. The impact of COVID-19 restrictions on depressive symptoms in low-risk and high-risk pregnant women: a cross-sectional study before and during pandemic. BMC Pregnancy Childbirth. 2022;22(1):191. https://doi.org/10.1186/s12884-022-04515-3
17. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. PLoS Med. 2007;4(10):e296. https://doi.org/10.1371/journal.pmed.0040296
18. Ahn HL. An experimental study of the effects of husband's supportive behavior reinforcement education on stress relief of primigravidas. J Nurs Acad Soc. 1985;15(1):5-16. https://doi.org/10.4040/jnas.1985.15.1.5
19. Chung H. A study of development of the Korean-Marital Satisfaction Scale. J Korean Home Econ Assoc [Internet]. 2001 [cited 2026 Feb 10];39(12):205-224. Available from: https://koreascience.kr/article/JAKO200111921063455.pdf
20. Baek SJ, Yun JA, Nam JA, Seo EY, Kwon SY, Lee CH, et al. Antenatal depressive symptoms and associated risk factors among preg-

nant women. J Korean Neuropsychiatr Assoc. 2019;58(4):346-352. https://doi.org/10.4306/jknpa.2019.58.4.346

21. Han K, Kim M, Park JM. The Edinburgh Postnatal Depression Scale, Korean version: reliability and validity. J Korean Soc Biol Ther Psychiatry [Internet]. 2004 [cited 2026 Feb 10];10(2):201-207. Available from: https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART001177556
22. Lee EJ, Lee JY, Lee SJ, Yu SE. Influence of self-esteem and spouse support on prenatal depression in pregnant women. J Korean Soc Matern Child Health. 2020;24(4):212-220. https://doi.org/10.21896/jksmch.2020.24.4.212
23. Bhat A, Byatt N. Infertility and perinatal loss: when the bough breaks. Curr Psychiatry Rep. 2016;18(3):31. https://doi.org/10.1007/s11920-016-0663-8
24. Bahk J, Yun SC, Kim YM, Khang YH. Impact of unintended pregnancy on maternal mental health: a causal analysis using follow up data of the Panel Study on Korean Children (PSKC). BMC Pregnancy Childbirth. 2015;15:85. https://doi.org/10.1186/s12884-015-0505-4
25. Muskens L, Boekhorst MG, Kop WJ, van den Heuvel MI, Pop VJ, Beerthuizen A. The association of unplanned pregnancy with perinatal depression: a longitudinal cohort study. Arch Womens Ment Health. 2022;25(3):611-620. https://doi.org/10.1007/s00737-022-01225-9
26. Insan N, Weke A, Forrest S, Rankin J. Social determinants of antenatal depression and anxiety among women in South Asia: a systematic review & meta-analysis. PLoS One. 2022;17(2):e0263760. https://doi.org/10.1371/journal.pone.0263760
27. Yoo H, Ahn S, Park S, Kim J, Oh J, Koh M. Factors influencing prenatal and postpartum depression in Korea: a prospective cohort study. Korean J Women Health Nurs. 2021;27(4):326-336. https://doi.org/10.4069/kjwhn.2021.11.17
28. Koh M, Ahn S, Kim J, Park S, Oh J. Pregnant women's antenatal depression and influencing factors. Korean J Women Health Nurs. 2019;25(1):112-123. https://doi.org/10.4069/kjwhn.2019.25.1.112
29. Giurgescu C, Penckofer S, Maurer MC, Bryant FB. Impact of uncertainty, social support, and prenatal coping on the psychological well-being of high-risk pregnant women. Nurs Res. 2006;55(5):356-365. https://doi.org/10.1097/00006199-200609000-00008
30. Olabisi OI, Ogunmodede E, Ojo S, Ilori O, Esan DT. Body image perception and social support as predictors of psychological distress among third trimester pregnant women in Nigeria. BMC Pregnancy Childbirth. 2024;24(1):298. https://doi.org/10.1186/s12884-024-06463-6
31. Goldstein Z, Rosen B, Howlett A, Anderson M, Herman D. Interventions for paternal perinatal depression: a systematic review. J Affect Disord. 2020;265:505-510. https://doi.org/10.1016/j.jad.2019.12.029
32. Wang Y, Gu J, Zhang F, Xu X. Path analysis of influencing factors for maternal antenatal depression in the third trimester. Sci Rep. 2024;14(1):4742. https://doi.org/10.1038/s41598-024-55355-4
33. Capotosto MP, Corcoran E, Burgess AW, Rifas-Shiman SL, Chavarro JE, Oken E. Anxiety and depression symptoms during pregnancy and postpartum among parous women with history of infertility. Fertil Steril. 2023;120(6):1252-1254. https://doi.org/10.1016/j.fertnstert.2023.08.970
34. Ma X, Wang Y, Hu H, Tao XG, Zhang Y, Shi H. The impact of resilience on prenatal anxiety and depression among pregnant women in Shanghai. J Affect Disord. 2019;250:57-64. https://doi.org/10.1016/j.jad.2019.02.058

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):330-343
https://doi.org/10.4094/chnr.2026.016

pISSN 2287-9110
eISSN 2287-9129

CHNR

Development and pilot evaluation of an AI-based pediatric medication safety virtual simulation program for nursing students: a quasi-experimental study in South Korea

In Young Cho[1,2], Soohyeon Cho[3], Min Yeong Im[3], Hui Jung Jeong[4], Jimin Choi[5], In Hyeong Choi[6], Hee Young Kim[7]

[1]Associate Professor, College of Nursing, Chonnam National University, Gwangju, Korea
[2]Associate Professor, Research Institute of Nursing Science, Chonnam National University, Gwangju, Korea
[3]Undergraduate Student, College of Nursing, Chonnam National University, Gwangju, Korea
[4]Undergraduate Student, College of Engineering, Chonnam National University, Gwangju, Korea
[5]Undergraduate Student, College of Philosophy, Chonnam National University, Gwangju, Korea
[6]Registered Nurse, Department of Nursing, Chonnam National University Hospital, Gwangju, Korea
[7]Doctoral Student, Department of Nursing, Chonnam National University, Gwangju, Korea

Corresponding author
Hee Young Kim
Department of Nursing, Chonnam National University, 160 Baekseo-ro, Dong-gu, Gwangju 61469, Korea
Tel: +82-62-530-4947
Fax: +82-62-220-4544
E-mail: hee0xox@naver.com

Received: February 25, 2026
Revised: March 31, 2026
Accepted: June 15, 2026

Purpose: This study aimed to develop an artificial intelligence (AI)-based pediatric medication safety competence (PMSC) virtual simulation program and evaluate its effectiveness among nursing students.

Methods: This quasi-experimental study used a nonequivalent control group pretest-posttest design and was conducted in December 2025. The AI-based PMSC virtual simulation program was developed based on Kolb's experiential learning theory, following its 4-stage cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Participants were 48 third-year nursing students in South Korea who were assigned to either the experimental group (n=24) or the control group (n=24) through a nonrandomized allocation procedure. The experimental group participated in the PMSC virtual simulation program. Outcomes included PMSC, medication calculation confidence (MCC), Simulation Task Load Index (SIM-TLX), and learning immersion (LI). Data were collected before and after the intervention using validated instruments, and statistical tests were used to evaluate program effectiveness.

Results: Compared with the control group, the experimental group showed significant improvement in PMSC (t=2.48, p=.017). No significant between-group differences were observed in MCC (t=−0.87, p=.389) or LI (t=0.97, p=.336). In addition, SIM-TLX scores decreased significantly from pretest to posttest in the experimental group (t=−2.61, p=.016).

Conclusion: The AI-based PMSC virtual simulation program may help strengthen PMSC among nursing students and may be suitable for use in pediatric nursing education. Future research should refine the program to better address individual learning needs and integrate complementary simulation-based strategies into pediatric medication nursing education.

Keywords: Artificial intelligence; Nursing students; Patient safety; Pediatric nursing; Simulation training

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.

© 2026 Korean Academy of Child Health Nursing

INTRODUCTION

Pediatric medication administration is recognized as a complex, multidisciplinary, and multistage process that requires comprehensive professional knowledge, skill, clinical judgement and attitude across the medication process, including a thorough understanding of pharmacological properties [1]. In particular, pediatric patients are more vulnerable to medication errors than adults because of weight-based dose calculations, the need for dilution due to limited standardized pediatric formulations, and communication differences associated with developmental stages [2].

In addition, pediatric patients exhibit considerable pharmacokinetic variability [3]. Their renal and hepatic functions are immature, which makes drug metabolism and excretion different from those of adults, complicating dosage adjustment [2,3]. Due to these characteristics, the incidence of medication errors in pediatric patients has been reported to be approximately 3 times higher than in adults, highlighting medication safety as a particularly critical issue in pediatric care settings [1]. Medication safety competence in pediatric nursing extends beyond medication administration and requires clinical reasoning, critical thinking, and highly proficient technical skills [4]. In particular, weight-based dosage calculation is the area prone to error in pediatric drug administration, and as a single calculation error can lead to a serious adverse drug event, which should be treated as a fundamental core competency [5].

Nursing students develop medication competence through pediatric nursing theory and practice in the undergraduate curriculum. However, pediatric medication management is still perceived as a challenging task [2]. Even when nursing students possess substantial theoretical knowledge, they often find it difficult to directly perform medication management tasks—such as medication preparation and administration—during clinical practicum, and they have limited opportunities to observe how medication administration is handled or reported [5]. As clinical placements in pediatric wards are limited, students may have fewer opportunities to gain sufficient experience in administering medications to pediatric patients [4]. In addition, limited opportunities for active participation may make it difficult for students to translate theoretical learning into practical competence [4,5].

Pediatric medication safety administration involves a complex nursing process that includes confirming prescriptions, calculating doses, preparing and diluting medications, administering drugs, monitoring, and communicating in a manner appropriate to the child's developmental stage [1,4,5]. In pediatric nursing practice, safe medication administration requires not only conceptual understanding but also the ability to apply knowledge in complex clinical situations. Therefore, multifaceted educational strategy with integration of theoretical knowledge and practical skills is needed for nursing students to systematically develop safety competencies in pediatric medication administration.

Medication-focused nursing education programs are increasingly incorporating digital instruction aligned with Generation Z (individuals generally born between the mid-1990s and the early 2010s) to enhance performance capabilities [6]. In particular, programs incorporating virtual reality (VR), augmented reality, and gamification have been shown to promote learners' immersion, motivation, and skill acquisition [7,8]. In pediatric nursing, various approaches—such as VR-based learning for injection skills and simulation of medication dose calculation and injection techniques have been developed and used to enhance clinical performance competence [9,10]. However, previous simulation-based education is often structured around predetermined scenarios, which may limit opportunities for interactive and customized learning that reflect learners' competency levels and characteristics of pediatric patients.

To address these challenges, artificial intelligence (AI)–based education is gaining attention. AI is being applied across various fields, including education, and is introducing new approaches that can transform existing educational methodologies and enhance learning experiences [11]. Recently, AI has been used in education through learning applications, virtual patients, AI chatbots, simulations, and platforms such as Chat Generative Pre-trained Transformer (GPT) [11]. It can support learners by providing customized feedback and opportunities for repeated practice appropriate to their level. By analyzing learners' input in real time, AI can identify patterns of errors in clinical performance and reasoning. It can also promote adaptive learning by providing educational content tailored to students' individual needs and learning styles [12]. Orkaby et al. [13] also suggested that AI could be used as a verification tool to prevent medication errors. Therefore, simulations that incorporate AI tools could be advantageous for strengthening competencies in drug selection, dosage calculation, communication, and technical execution in pediatric medication administration, where the risk of errors is high [12,13].

In particular, AI-based simulations enable repeated practice in a controlled environment, thereby enhancing clinical preparedness and understanding [14]. They can promote learners' critical thinking and evidence-based decision-making by posing clinical questions such as "Why did you choose this medication?" and "Why did you select this route of administration?" [14]. In addition, virtual pediatric scenarios can support personalized learning and provide experiences that approximate real clinical settings while enhancing learner autonomy and immersion without time or space constraints [9,11]. Moreover, interactive communication between the AI system and learners enables repeated practice of medication administration across diverse situations [15].

Thus, integrating AI with simulation-based instruction offers a flexible learning experience in which learners progress at their own pace [16]. This approach enables repeated practice and targeted feedback on the steps in the pediatric medication administration process. In addition, the integration of AI-based simulation with subsequent real-world simulation may support the development of pediatric medication safety competence (PMSC) among nursing students by providing opportunities for both experiential practice and applied skill reinforcement [15].

The experiential learning theory (ELT) by Kolb [17] describes the process through which knowledge is constructed by transforming experience. Experiential learning is frames learning as an ongoing process rather than a fixed outcome, emerging through continuous interaction between the learner and the environment. This theory describes a 4-stage cycle comprising concrete experience, reflective observation, abstract conceptualization, and active experimentation. Learners may enter the cycle at any stage, and individual variation may occur [17].

The effectiveness of pediatric medication safety education could be evaluated by concurrently measuring comprehensive PMSC (from prescription verification to monitoring and communication), medication calculation confidence (MCC) [18], Simulation Task Load Index (SIM-TLX) [19] and process indicators such as learning immersion (LI) [20], which reflects the extent to which learners are cognitively and emotionally engaged with the learning environment. Guided by this framework [17], this study aimed to develop and evaluate its effectiveness of an AI-based PMSC virtual simulation program for nursing students.

1. Research Aim

This study aimed to develop an AI-based PMSC virtual simulation program for nursing students and to evaluate its effectiveness.

2. Research Hypotheses

Hypothesis 1: Nursing students who participate in the AI-based PMSC virtual simulation program will demonstrate greater improvement in PMSC compared to those in the control group.

Hypothesis 2: Nursing students who participate in the AI-based PMSC virtual simulation program will demonstrate greater MCC compared to those in the control group.

Hypothesis 3: Nursing students who participate in the AI-based PMSC virtual simulation program will demonstrate lower SIM-TLX scores compared to preintervention.

Hypothesis 4: Nursing students who participate in the AI-based PMSC virtual simulation program will demonstrate greater LI compared to those in the control group.

3. Conceptual Framework

Grounded in Kolb's ELT [21], the program was organized into 4 sequential stages. In the abstract conceptualization stage, learners attended a lecture covering core theories and principles of pediatric medication safety and dosage calculation, intended to establish foundational knowledge and to cultivate appropriate attitudes toward safe nursing practice. In the concrete experience stage, learners worked through pediatric medication administration scenarios in the AI-based PMSC virtual simulation to apply lecture content within an authentic clinical context. AI-driven learning and real-time feedback were incorporated to promote PMSC, MCC, and LI. In the active experimentation stage, learners practiced the same scenario in an authentic simulation environment to internalize knowledge and strengthen practical confidence. Finally, in the reflective observation stage, learners reviewed their performance to integrate learning experiences and deepen their commitment to safe nursing practice. Given the cyclical linkage among the 4 stages, this study also examined whether the program effectively enhanced LI and lower SIM-

TLX. On this basis, the study developed and evaluated an AI-based PMSC virtual simulation program designed to strengthen nursing students' PMSC, MCC, SIM-TLX, and LI (Figure 1, Supplement 1).

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Chonnam National University (IRB No. 1040198-251124-HR-231-02). Informed consent was obtained from all participants.

1. Study Design

This study used a nonequivalent control group pretest–posttest design to develop and evaluate an AI-based PMSC virtual simulation program grounded in the ELT by Kolb [17]. Reporting followed the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) Statement guidelines [22].

2. Participants

Participants were third-year nursing students recruited from universities located in 2 cities in South Korea who had completed a pediatric nursing theory course. Volunteers were recruited through notices posted in nursing-student community channels and were assigned to the experimental or control group using a nonrandom allocation method after they understood the study purpose and voluntarily agreed to participate. The sample size was calculated using G*Power ver. 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf) with a significance level of $\alpha = .05$ and statistical power of .80. Assuming an effect size of Cohen's $d = 0.85$, the minimum required sample size was 22 participants per group [23]. Allowing for an attrition rate of approximately 10%, 24 participants were recruited and allocated to each group at the outset, for a total of 48 participants.

3. Data Collection

Participants were recruited from December 12 to 14, 2025, through advertisements posted to online community for nursing studies and SNS (Social Network Service); nursing students KakaoTalk open chat rooms. With administrators' permission, an online questionnaire (Google link; Google LLC) that included study information and an electronic consent form was posted to nursing students' online communi-

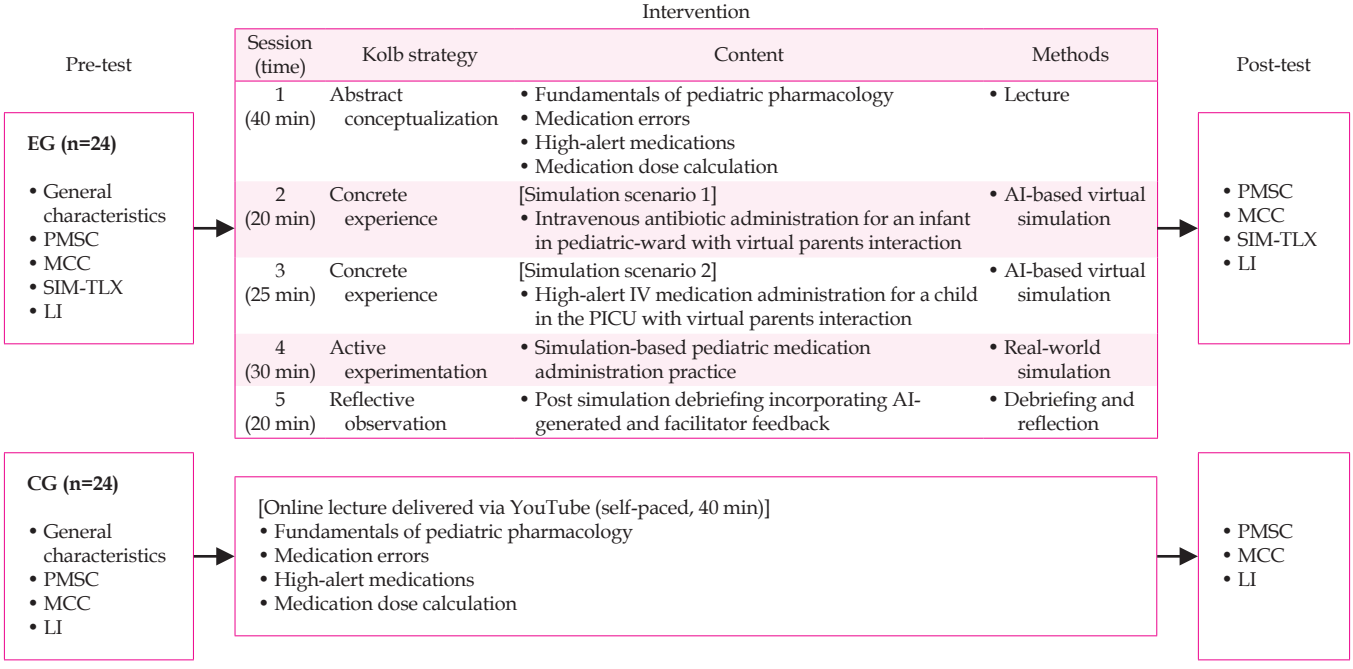

Figure 1. Overview of the study design and the artificial intelligence (AI)-based pediatric medication safety competence (PMSC) virtual simulation program. EG, experimental group; CG, control group; LI, learning immersion; MCC, medication calculation confidence; SIM-TLX, SimulationTask Load Index; IV, intravenous; PICU, pediatric intensive care unit.

ties. Interested students accessed the study summary via the Google link, which described the study purpose, procedures, right to withdraw, and personal information protection policies. Students who provided consent completed a self-administered preintervention questionnaire.

Participants were allocated to groups using a nonrandom convenience method. Following voluntary recruitment, the researcher allocated participants sequentially in the order of enrollment. After allocation, 48 students were assigned to the experimental and control groups (24 per group); no participants withdrew, and all were included in the final analysis. The survey was designed to be completed in approximately 15 minutes (Figure 2).

Both groups completed the preintervention survey before participating in the study. Immediately after completing the AI-based PMSC virtual simulation session, the experimental group completed a follow-up questionnaire. The control group completed a follow-up questionnaire after their online lecture learning experience. Following the completion of data collection for the control group (December 16–17, 2025), data collection for the experimental group (December 18–23, 2025) was subsequently conducted. This sequential approach was adopted to minimize the risk of information contamination between groups. Specifically, by prioritizing data collection for the control group, we reduced the likelihood of participants being exposed to the AI-based PMSC virtual simulation content before receiving their assigned intervention.

4. Intervention Development

The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model of instructional design [24] was followed in this study. The phases were as follows. (1) Analysis phase: A comprehensive literature review was conducted on medication nursing education and medication administration programs and simulation-based learning to guide the development of the program. (2) Design and development phase: The intervention consisted of 5 sequential sessions: a pediatric medication lecture (Session 1), AI-based virtual simulation (Sessions 2 and 3), a real-world simulation (Session 4), and a structured debriefing (Session 5) (Figure 1).

The AI-based PMSC virtual simulation program was developed in 2 stages: (1) development of a scenario-based 3-dimensional virtual environment integrated with generative AI and (2) construction of an AI-driven learning and interaction system. First, pediatric medication focused clinical scenarios (e.g., intravenous antibiotic administration in a general ward and the administration of high-alert intravenous medications; anticonvulsants and vasopressors, in a pediatric intensive care unit [ICU]) was developed. Unity-based virtual environment was created to provide an authentic pediatric clinical setting (a pediatric ward and ICU) to mirror an authentic pediatric-nursing practice environment, which is used in both game development and medical simulation.

The AI-based PMSC virtual simulation program was de-

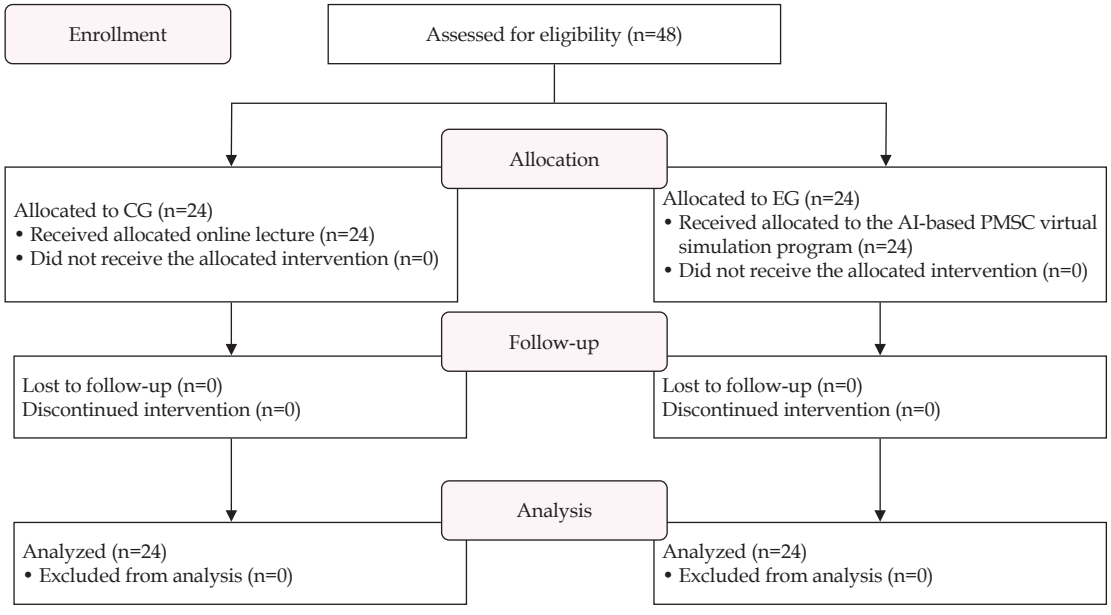

Figure 2. Consort flow diagram. AI, artificial intelligence; CG, control group; EG, experimental group; PMSC, pediatric medication safety competence.

veloped to enable interactive, scenario-based learning through avatar-driven engagement. Within each scenario, learners interacted through an avatar and engaged in step-by-step decision-making process related to medication administration. The program was designed to allow learners to assess the clinical situation, solve medication-related tasks, and make sequential decisions to complete the medication administration process. To support this, children's avatars in the simulation were implemented as Unity-based non-player characters such as "a 3-month-old infant and a 13-month-old infant with an electrocardiogram monitor and oxygen saturation meter attached," using VARCO3D, a generative modeling tool (https://3d.varco.ai/) (Supplement 1).

In addition, an AI-based learning system integrated with a retrieval-augmented generation framework was developed to provide automated evaluation and individualized feedback. Learners could submit responses to clinical questions through the nurse avatar [25]. Based on predefined criteria and provided individualized feedback, learners scoring below 80 received remediation, whereas those scoring 80 or higher progressed to the next stage. Further, an AI-based learner–parent interaction system was established incorporating speech recognition and natural language processing. When learners (the nurse avatar) communicated with parents avatars, the system generated context-appropriate verbal and nonverbal responses through Naver Cloud Platform CLOVA Speech API based on nursing scenarios, supporting pediatric communication practice [26].

1) Implementation phase

The program began with an orientation session explaining its purpose and procedures. Two pediatric nursing professors delivered the intervention; each had more than 10 years of clinical and teaching experience in pediatrics. To minimize potential bias, the instructors did not grade or evaluate participants' academic performance and were not responsible for their regular coursework.

The experimental group consisted of 24 nursing students who participated in both group-based and individual-based learning activities. AI based individual learning activities were completed independently, and for the real-world simulation session, students were organized into small groups of 3.

The intervention (5 sequential sessions) was delivered on the same day. In Session 1, classroom lecture covered pediatric medication administration topics, including fundamentals of pediatric pharmacology, the importance of medication safety, medication errors, high-alert medications, and medication dose calculation. Sessions 2 and 3 involved the AI-based PMSC virtual simulation with 2 sequential modules. Learners completed individually on personal computers in a self-directed learning environment within the classroom. In Session 4, for the real-world simulation, participants completed hands-on practice with a high-fidelity simulator in a clinical skills laboratory. The session was conducted in small groups under instructor supervision and used the same scenarios as the virtual simulation. Finally, Session 5 consisted of a structured debriefing in which participants reflected on pediatric medication administration processes and discussed their communication experiences with parents.

Participants in the control group (n=24) individually completed a 40-minute pre-recorded online lecture that covering the fundamentals of pediatric pharmacology, the importance of medication safety, medication errors, high-alert medications, and medication dose calculation. The lecture was uploaded on YouTube and distributed through a dedicated URL. Participants accessed the lecture independently at their preferred location (e.g., home or self-selected settings) and completed the learning at their own pace without instructor interaction. To ensure participation, students were required to post a comment on the YouTube video after viewing the lecture, and completion was confirmed by the research team.

2) Evaluation phase

Program effectiveness was evaluated by comparing pretest and posttest outcomes between the experimental and control groups A pretest including demographic characteristics and study variables was administered immediately before the intervention, followed by a posttest immediately after the intervention (Figure 1).

5. Measurements

1) PMSC

PMSC was measured using a researcher-developed instrument with 18 items across 5 subdomains: infection prevention and preparation; patient identification and verification; drug preparation and administration; patient communication and cooperation; and documentation and digital competency. The instrument was developed based on a comprehensive review of the literature on pediatric medication safety, clinical practice guidelines [27,28]. Items focused on safety

performance behaviors that may occur in pediatric nursing practice.

Content validity was evaluated by a panel of 3 pediatric nurses with more than 10 years of clinical experience and education expertise in pediatric nursing. Each expert independently rated each item's relevance on a 4-point scale. The item-level content validity index (I-CVI) was calculated as the proportion of experts rating each item as relevant. All items achieved an I-CVI of 1.00, and the scale-level content validity index (S-CVI/Ave) was 1.00, indicating satisfactory content validity. An example item reads: "Medications are administered via the correct route and at the correct rate; if an error occurs, administration can be stopped immediately and reported." In this study, Cronbach's α was .93. Higher scores on the 5-point Likert scale (1=not at all, 5=very much) indicate greater PMSC.

2) MCC

MCC was assessed with the "Confidence in Drug Calculation" subscale of the Medication Calculation Skill Test (MCS test) developed by Grandell-Niemi et al. [18] and subsequently modified and translated by Park et al. [29]. An example of a measurement item is: "I have sufficient skills in medication dosage calculation." This 7-item tool uses a 5-point Likert scale (1=not at all, 5=very much), and higher scores indicate greater confidence in drug calculation. The tool demonstrated good reliability, with Cronbach's α of .89 in the study by Park et al. [29] and .95 in the present study.

3) SIM-TLX

User workload in a simulation environment was evaluated using the SIM-TLX developed by Harris et al. [19] and translated by Jeong et al. [30]. SIM-TLX assesses the multidimensional cognitive and mental workload experienced by users in simulated environments [19]. It comprises 9 items evaluating diverse aspects of task load: mental demand, physical demand, temporal demand, frustration, task complexity, stress, perceptual strain, task control, and presence/immersion. An example of a measurement item is: "How mentally exhausting was this assignment?" Each item was rated on a 7-point Likert scale (1=not at all, 7=very much). Lower scores indicate a lower level of perceived workload during the simulation task. The tool demonstrated good reliability, with Cronbach's α of .94 in the study by Jeong et al. [30] and .94 in the present study.

4) LI

LI was evaluated using the Learning Immersion Scale developed by Kim et al. [20]. The LI Scale consists of 30 items across 9 dimensions: clear goals, immediate feedback, challenge-skill balance, concentration on the task at hand, merging of action and awareness, loss of self-consciousness, altered sense of time, sense of control, and autotelic experience. An example of a measurement item is: "Time passes very quickly while studying." Items were rated on a 5-point Likert scale (1=not at all, 5=very much). Higher scores indicate a greater level of LI. The tool demonstrated good reliability, with Cronbach's α of .93 in the study by Kim et al. [20] and .95 in the present study.

6. Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics for Windows ver. 29.0 (IBM Corp.). All tests used 2-sided p-values with a 5% significance level (α=.05). Descriptive statistics (frequencies, means [M], standard deviations [SD], and percentages) summarized participant demographics and variable distributions. Chi-square tests and independent t-tests were used to assess the homogeneity of participant characteristics and variables. Independent t-tests compared groups on key variables at baseline and postintervention and on preintervention-to-postintervention change scores. Cronbach's α was used to assess the internal consistency of the measurement instruments.

7. Research Ethics

The study adhered to IRB requirements and the Declaration of Helsinki throughout. Participants were assured that personal information would be handled confidentially. To uphold educational equity and ethical principles, control-group participants were informed at the start of the study that they could be eligible to participate in the same AI-based PMSC virtual simulation program as the experimental group after data collection had been completed. To this end, participants received a thorough pre-study explanation, gave their voluntary consent, and were free to withdraw from the study at any time. Participants received a small gift as a token of gratitude.

RESULTS

1. Homogeneity in the Characteristics of the Participants and Study Variables

Homogeneity testing showed no statistically significant between-group differences in general characteristics. Before the intervention, PMSC, MCC, and LI also did not differ significantly between groups (Table 1). Thus, baseline homogeneity was confirmed.

2. Comparative Analysis of the Program Effects between Experimental and Control Groups

Table 2 presents program effects on PMSC, MCC, SIM-TLX, and LI.

1) Hypothesis 1: PMSC

Posttest results showed significant improvement in PMSC in the experimental group ($t=8.66$, $p<.001$) and the control group ($t=4.93$, $p<.001$). Although both groups improved significantly, the experimental group's gain in PMSC was significantly greater than that of the control group ($t=2.48$, $p=.017$). Subdomain analysis revealed that infection prevention and preparation increased significantly only in the experimental group. Significant between-group differences were observed in patient identification and verification ($t=2.10$, $p=.041$), patient communication and collaboration ($t=2.46$, $p=.018$), and documentation and digital competency ($t=2.11$, $p=.040$); the experimental group showed greater increases than the control group across all 3 subdomains. Hypothesis 1 was supported (Table 2, Figure 3).

2) Hypothesis 2: MCC

Pretest-to-posttest analysis revealed significant increases in MCC in both the experimental group ($t=6.15$, $p<.001$) and the control group ($t=9.82$, $p<.001$). However, the magnitude of the increase did not differ significantly between groups ($t=-0.87$, $p=.389$). Hypothesis 2 was therefore rejected (Table 2).

3) Hypothesis 3: SIM-TLX

Scores decreased significantly from pretest to posttest in the experimental group ($t=-2.61$, $p=.016$). Hypothesis 3 was supported (Table 2).

4) Hypothesis 4: LI

LI improved significantly after the intervention in both the experimental group ($t=4.47$, $p<.001$) and the control group ($t=3.87$, $p=.001$). However, the between-group difference was not significant ($t=0.97$, $p=.336$). Hypothesis 4 was therefore rejected (Table 2).

DISCUSSION

This study developed an AI-based PMSC virtual simulation program and evaluated its effectiveness of PMSC, MCC, SIM-TLX, and LI for nursing students.

In this study, the experimental group showed a significantly greater increase in PMSC than the control group. PMSC encompasses competencies including accurate medication calculation, safe administration practices, clinical decision-making, and effective communication with caregivers [1,4,5]. As educational approaches that integrate those elements are essential for competency development, this intervention was designed to integrate these components through AI-based virtual simulation and experiential learning activities [15,31]. This AI-based program may have supported repetitive and adaptive learning in medication administration by delivering in-depth questions and learner-tailored quizzes when participants showed low accuracy on medication-related tasks.

Within the AI-based virtual simulation environment, learners encountered pediatric medication scenarios and made step by step medication-related decisions. This process may have provided opportunities for learners to apply medication-related knowledge in realistic clinical scenarios, while engaging in decision-making within given simulated situations. After the AI-based learning, participants engaged in real-world simulation, which may have facilitated the integration of theoretical knowledge with practical skills and procedural performance. This approach is consistent with prior research [32] showing that simulation-based learning environments enhance the integration of knowledge and clinical skills while promoting medication safety competence. In addition, as in the work of Bayram and Ergün [32], the iterative learning process—characterized by adaptive feedback, repeated attempts, and progression may have supported learners improvements of PMSC.

From a family-centered care perspective, communication with parents; a key subdomain of PMSC is a core competency. Structured communication education can help nursing students communicate more effectively with families, en-

Table 1. Homogeneity tests for participant characteristics and study variables (N=48)

Characteristic	EG (n=24)	CG (n=24)	χ^2 or t	*p*
Sex			0.00	1.000
Female	18 (75.0)	18 (75.0)		
Male	6 (25.0)	6 (25.0)		
Age (yr)			0.08	.773
≤21	11 (45.8)	12 (50.0)		
≥22	13 (54.2)	12 (50.0)		
Region			0.00	1.000
Gwang-ju	23 (95.8)	23 (95.8)		
Chonnam	1 (4.2)	1 (4.2)		
Religion			0.12	.989
Christian	1 (4.2)	1 (4.2)		
Catholic	5 (20.8)	6 (25.0)		
Buddhism	2 (8.3)	2 (8.3)		
None	16 (66.7)	15 (62.5)		
Satisfaction with nursing studies			1.30	.862
Very dissatisfied	1 (4.2)	0 (0.0)		
Dissatisfied	1 (4.2)	1 (4.2)		
Moderate	7 (29.2)	9 (37.5)		
Satisfied	11 (45.8)	10 (41.7)		
Very satisfied	4 (16.7)	4 (16.7)		
Interpersonal relationships			2.95	.228
Difficult	2 (8.3)	0 (0.0)		
Average	8 (33.3)	12 (50.0)		
Good	14 (58.3)	12 (50.0)		
Experience with medication administration education			0.40	.525
Yes	6 (25.0)	8 (33.3)		
No	18 (75.0)	16 (66.7)		
Perceived usefulness of school-based pediatric medication training[a)]			1.56	.457
Helpful	1 (16.7)	1 (12.5)		
Unsure	4 (66.7)	7 (87.5)		
Not helpful	1 (16.7)	0 (0.0)		
Experience with AI-based education			2.09	.149
Yes	14 (58.3)	9 (37.5)		
No	10 (41.7)	15 (62.5)		
Courses in which AI education was provided[a)]			2.85	.723
Fundamentals of nursing	1 (7.1)	1 (11.1)		
Adult nursing	2 (14.3)	2 (22.2)		
Pediatric nursing	2 (14.3)	0 (0.0)		
Women's health nursing	4 (28.6)	1 (11.1)		
Nursing and AI	3 (21.4)	3 (33.3)		
Other	2 (14.3)	2 (22.2)		
Pediatric medication safety competence	3.84±0.62	4.08±0.57	–1.35	.183
Infection prevention and preparation	4.55±0.50	4.57±0.52	–0.14	.889
Patient identification and verification	4.03±0.64	4.33±0.54	–1.71	.095
Medication preparation and administration	3.33±0.75	3.55±0.81	–0.97	.336
Patient communication and collaboration	3.78±0.78	4.11±0.71	–1.55	.129
Documentation and digital competency	3.08±1.11	3.46±1.03	–1.21	.231
Medication calculation confidence	2.59±0.79	2.38±0.91	0.87	.390
Learning immersion	3.32±0.74	3.22±0.55	0.53	.597

Values are presented as number (%) or mean±standard deviation.

AI, artificial intelligence; EG, experimental group; CG, control group.

[a)]Asked only for participants who responded "yes" to the corresponding question; the denominator therefore differs from the full-sample (N=48).

Table 2. Comparison of dependent variables between the experimental and control groups (N=48)

Variable	EG (n=24)			CG (n=24)			t (*p*)	ES(*d*)
	Pretest	Posttest	Pre–post t (*p*)	Pretest	Posttest	Pre–post t (*p*)		
Pediatric medication safety competence	3.84±0.62	4.64±0.29	8.66 (<.001)	4.08±0.57	4.55±0.47	4.93 (<.001)	2.48 (.017)	0.72
Infection prevention and preparation	4.55±0.50	4.83±0.29	2.63 (.015)	4.57±0.52	4.71±0.45	1.33 (.197)	0.99 (.329)	0.29
Patient identification and verification	4.03±0.64	4.68±0.30	5.08 (<.001)	4.33±0.54	4.64±0.39	3.55 (.002)	2.10 (.041)	0.61
Medication preparation and administration	3.33±0.75	4.55±0.39	9.33 (<.001)	3.55±0.81	4.47±0.52	6.43 (<.001)	1.56 (.125)	0.45
Patient communication and collaboration	3.78±0.78	4.60±0.45	6.63 (<.001)	4.11±0.71	4.47±0.64	2.60 (.016)	2.46 (.018)	0.71
Documentation and digital competency	3.08±1.11	4.44±0.66	7.66 (<.001)	3.46±1.03	4.25±0.72	3.97 (.001)	2.11 (.040)	0.61
Medication calculation confidence	2.59±0.79	3.81±0.91	6.15 (<.001)	2.38±0.91	3.81±0.77	9.82 (<.001)	−0.87 (.389)	0.25
SIM-TLX	2.94±0.94	2.45±0.97	–2.61 (.016)	-	-	-	-	0.53
Learning immersion	3.32±0.74	3.82±0.66	4.47 (<.001)	3.22±0.55	3.58±0.59	3.87 (.001)	0.97 (.336)	0.28

Values are presented as number (%) or mean±standard deviation.
EG, experimental group; CG, control group; ES, effect size; SIM-TLX, Simulation Task Load Index.

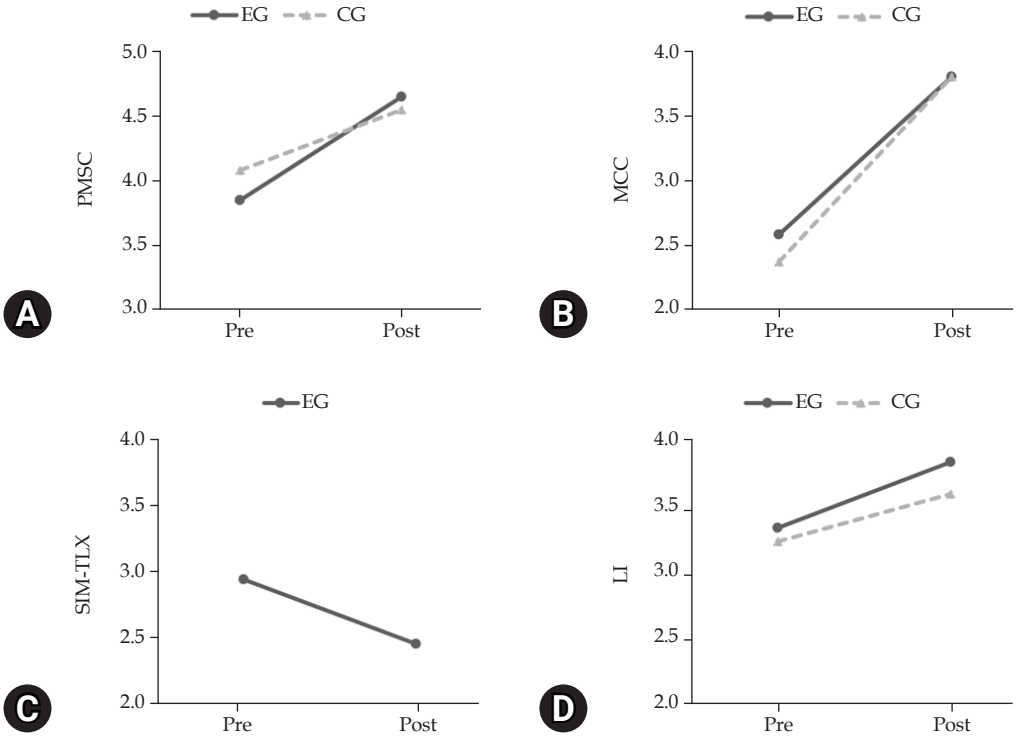

Figure 3. (A–D) Differences in outcome variables between the groups. CG, control group; EG, experimental group; LI, learning immersion; MCC, medication calculation confidence; PMSC, pediatric medication safety competence; SIM-TLX, Simulation Task Load Index.

abling them to better understand and participate in their child's care. Previous studies also have suggested that patient-oriented simulation education could be associated with improvements in communication with patients and families [33]. In this context, the AI-based PMSC virtual simulation program provided nursing students with opportunities to engage in medication-related question-and-answer interactions and communication with parents avatars. These interactions may have enhanced the quality of communication experiences by allowing learners to practice explaining medication-related information, responding to caregivers' concerns, and engaging in family-centered communication.

Although MCC increased in both groups, no significant between-group difference was demonstrated. Although previous studies have reported improvements in medication confidence [32], this study findings did not demonstrate an effect of the intervention on MCC. From the perspective of experiential learning, repeated engagement in the 4-step learning cycle may enhance learning by promoting reflection, internalization, and application [18,31].

Previous research has reported that satisfaction and confidence in medication could be increased when learners are provided with enough opportunities to adjust their learning pace and engage in repeated practice [32]. In this study, the AI-based PMSC virtual simulation embedded medication calculation tasks within time-limited clinical scenarios. Although this program may have supported task engagement, it may not have provided sufficient opportunities for repeated practice, reflection, and error correction due to time-limited structure of the program. Furthermore, the single-day intervention may have limited learners' opportunities to fully engage in the experiential learning cycle. Thus, future studies should examine whether extended intervention periods and flexible learnings could enhance medication confidence among nursing students.

SIM-TLX scores in the experimental group decreased significantly from pretest to posttest. This finding is consistent with Gohman et al. [34], which suggests that VR-based simulations could provide a manageable learning environment without excessive cognitive load, and that repeated exposure to simulation may further reduce perceived workload during task performance. As SIM-TLX reflects perceived task load during simulation rather than comparative index of learning outcome, these findings may indicate that learners experienced a acceptable level of cognitive workload while participating in the simulation.

LI increased significantly in both groups; however, the between-group difference was not significant. This result may reflect the influence of multiple interacting factors including learners' individual characteristics, adaptation to the learning environment, and contextual factors rather than a single determinant [35]. Although AI technology can provide new opportunities for participation, learners' immersion may be influenced by their familiarity with digital technologies and characteristics of the learning environment [15]. Furthermore, in this study, the limited interactivity of non-immersive virtual simulations may have been insufficient to elicit the high level of immersion typically expected in immersive environments [36].

Therefore, educational interventions aimed at enhancing nursing students' LI should consider both the degree and quality of immersion. In addition, learning objectives and task difficulty should be tailored to learners' competencies, and sufficient time and support should be provided to facilitate adaptation to AI-based learning environments [15]. Future studies should examine how factors such as digital proficiency, familiarity with AI-based learning environments, and intervention duration influence learners' immersion. Further future studies should explore how different types and levels of immersion influence learning outcomes in AI-based simulation environments.

This study is meaningful in that it highlights the potential of AI-based simulation as an educational approach for supporting PMSC among nursing students. However, the present study had several limitations. First, because the sample included nursing students from only 2 cities, the findings may have limited generalizability to nursing students across South Korea; nation-wide multi-center studies are needed to strengthen external validity in future study. In addition, although participants were recruited from multiple cities, information regarding their institutional affiliations was not collected. Consequently, the number and characteristics of participating universities could not be identified, limiting the assessment of sample representativeness across institutions, future studies should consider collecting institution- and region-level information, with appropriate ethical approval, to enhance the sample representativeness and generalizability of the findings. Second, data collection in the control and experimental groups was sequential rather than concurrent. The sequential design was adopted to minimize the risk of information contamination, given the nature of the AI-based simulation intervention. Despite this precaution, the sequential approach may have introduced temporal bias and uncontrolled external influences. These findings should therefore be interpreted with caution. Third, the study design may raise concerns regarding internal validity because of differential exposure between groups. The experimental group received a multi-component intervention, whereas the control group received only a lecture-based intervention. This difference in instructional intensity and modality may have introduced confounding. Although this design was intended to evaluate the added value of the AI-based simulation beyond conventional lecture-based instruction, the observed effects may have been influenced by differences in instructional exposure. Future studies should therefore consider more controlled comparisons with equivalent instructional intensity. Fourth, the primary outcome variable, PMSC, was measured using a researcher-developed instrument. Although content validity was assessed, construct validity was not formally analyzed and the use of a small number of experts may limit the rigor of the content validity evaluation. More rigorous validation procedures (such as exploratory or confirmatory

factor analysis) are needed to strengthen the validity of the instrument. Fifth, participants were assigned using a nonrandom convenience method, which may have introduced selection bias and limited the internal validity of the study. Although baseline homogeneity was confirmed, unmeasured between-group differences cannot be excluded, and the findings should be interpreted with caution. Future studies should therefore employ randomized controlled designs. Finally, follow-up research is needed to evaluate longitudinal and broader competencies—such as communication with parents and multidisciplinary collaboration—in addition to the PMSC components administered in the present study.

CONCLUSION

This study developed and evaluated an AI-based PMSC virtual simulation program for pediatric medication safety among nursing students in South Korea. The results showed that the program improved nursing students' PMSC, with significant reductions in SIM-TLX. The program can serve as an educational intervention in pediatric nursing education to strengthen medication safety competence, including communication with pediatric patients and their caregivers. Future research should refine the program to address individual learning needs and should evaluate its application across a wider range of nursing education settings.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors. Methodology: all authors. Data collection: all authors. Formal analysis: IYC, HYK. Writing–original draft: all authors. Writing–review & editing: IYC, HYK. Final approval of published version: all authors.

Conflict of interest

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

Funding

This study was financially supported by Chonnam National University (Grant number: 2025-1017-01).

Data availability

Please contact the corresponding author for data availability.

Acknowledgments

None.

AI use disclosure

The authors declare that an AI-based language model (ChatGPT) was used solely for grammar and spelling check. All scientific content, interpretation, and conclusions remain the sole responsibility of the authors. The authors reviewed and approved all content and take full responsibility for the integrity of the manuscript.

Supplementary material

Supplement 1. Screenshots of the artificial intelligence-based pediatric medication safety competence virtual simulation program.

ORCID and ResearcherID

In Young Cho	https://orcid.org/0000-0002-6265-6342 https://researcherid.com/rid/MGT-6277-2025
Soohyeon Cho	https://orcid.org/0009-0008-0943-256X https://researcherid.com/rid/PJB-4762-2026
Min Yeong Im	https://orcid.org/0009-0000-4617-4346 https://researcherid.com/rid/PJB-5522-2026
Hui Jung Jeong	https://orcid.org/0009-0005-4759-9529 https://researcherid.com/rid/PJB-8995-2026
Jimin Choi	https://orcid.org/0009-0000-4539-3264 https://researcherid.com/rid/PJB-9134-2026
In Hyeong Choi	https://orcid.org/0009-0001-5501-2805 https://researcherid.com/rid/PJB-4851-2026
Hee Young Kim	https://orcid.org/0009-0002-4506-4158 https://researcherid.com/rid/PJS-1971-2026

REFERENCES

1. D'Errico S, Zanon M, Radaelli D, Padovano M, Santurro A, Scopetti M, et al. Medication errors in pediatrics: proposals to improve the quality and safety of care through clinical risk management. Front Med (Lausanne). 2022;8:814100. https://doi.org/10.3389/fmed.2021.814100
2. Öztürk Şahin Ö, Aközlü Z, Taşdelen Y. Pediatric nursing students' self-efficacy regarding medication administration and clinical comfort and worry: a pre-posttest comparative study of nurse mentoring versus peer mentoring. Nurse Educ Pract. 2023;71:103712. https://doi.org/10.1016/j.nepr.2023.103712
3. Lu H, Rosenbaum S. Developmental pharmacokinetics in pediatric populations. J Pediatr Pharmacol Ther. 2014;19(4):262-276. https://

doi.org/10.5863/1551-6776-19.4.262
4. Özgüven Öztornaci B, Karakul A, Ardahan Akgül E, Doğan P, Yildirim Sari H, Başbakkal Z. The effect of web-based double-eye control program on the prevention of pediatric medication errors of nursing students: a quasi-experimental study. Medicine (Baltimore). 2025;104(49):e46222. https://doi.org/10.1097/MD.0000000000046222
5. Lin FY, Wu WW, Lin HR, Lee TY. The learning experiences of student nurses in pediatric medication management: a qualitative study. Nurse Educ Today. 2014;34(5):744-748. https://doi.org/10.1016/j.nedt.2013.08.004
6. Dodson TM, Thompson-Hairston K. A scoping review of gen z nursing students: learning preferences and educator strategies. Teach Learn Nurs. 2025;20(1):85-90. https://doi.org/10.1016/j.teln.2024.11.007
7. Chang YY, Chao LF, Chang W, Lin CM, Lee YH, Latimer A, et al. Impact of an immersive virtual reality simulator education program on nursing students' intravenous injection administration: a mixed methods study. Nurse Educ Today. 2024;132:106002. https://doi.org/10.1016/j.nedt.2023.106002
8. Gokalp MG, Yucel SC, Yilmaz O. The effect of game-based learning on the acquisition of intramuscular injection skills. Nurse Educ Pract. 2025;82:104172. https://doi.org/10.1016/j.nepr.2024.104172
9. Mahmoud F, Abdel-Salam A. The effect of interactively virtual reality eyeglasses on the of pediatric nursing students performance. IOSR J Nurs Health Sci. 2018;7(4):58-67. https://doi.org/10.9790/1959-0704095867
10. Marchi NM, Zimmermann E, Kelling CS, Wong S, Juniper KM. A medication dosage simulation strategy to improve patient safety. Am Nurse Today. 2019;14(9):1.
11. Ma J, Wen J, Qiu Y, Wang Y, Xiao Q, Liu T, et al. The role of artificial intelligence in shaping nursing education: a comprehensive systematic review. Nurse Educ Pract. 2025;84:104345. https://doi.org/10.1016/j.nepr.2025.104345
12. Lin CC, Huang AY, Lu OH. Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review. Smart Learn Environ. 2023;10(1):41. https://doi.org/10.1186/s40561-023-00260-y
13. Orkaby B, Kerner E, Saban M, Levin C. Bridging generational gaps in medication safety: insights from nurses, students, and generative AI models. BMC Nurs. 2025;24(1):382. https://doi.org/10.1186/s12912-025-03034-8
14. Park SA, Kim HY. Development and effects of a scenario-based labor nursing simulation education program using an artificial intelligence tutor: a quasi-experimental study. Womens Health Nurs. 2025;31(2):143-154. https://doi.org/10.4069/whn.2025.06.18
15. Sengul T, Sarıköse S. Enhancing learning outcomes through AI-driven simulation in nursing education: a systematic review. Clin Simul Nurs. 2025;106:101797. https://doi.org/10.1016/j.ecns.2025.101797
16. Atkins R, Brown KM, Mudd SS, Ghobadi K, Baker DJ, Szanton S. Reimagining nursing education: leveraging competency-based education, artificial intelligence, and simulation for a diverse and practice-ready workforce. Nurs Outlook. 2025;73(6):102582. https://doi.org/10.1016/j.outlook.2025.102582
17. Kolb DA. Experiential learning: experience as the source of learning and development. FT Press; 2014.
18. Grandell-Niemi H, Hupli M, Leino-Kilpi H, Puukka P. Medication calculation skills of nurses in Finland. J Clin Nurs. 2003;12(4):519-528. https://doi.org/10.1046/j.1365-2702.2003.00742.x
19. Harris D, Wilson M, Vine S. Development and validation of a simulation workload measure: the simulation task load index (SIM-TLX). Virtual Real. 2020;24(4):557-566. https://doi.org/10.1007/s10055-019-00422-9
20. Kim YY, Kim SW, Koo KH. Development and validation of the learning flow scale for high school students. J Curric Eval. 2017;20(4):95-119. https://doi.org/10.29221/jce.2017.20.4.95
21. Alruwaili AN, Alshammari AM, Alhaiti A, Elsharkawy NB, Ali SI, Ramadan OME. Virtual reality simulation for high-risk neonatal emergency nursing training: a mixed-methods study on nurse competency and outcomes. BMC Nurs. 2025;24(1):367. https://doi.org/10.1186/s12912-025-03038-4
22. Des Jarlais DC, Lyles C, Crepaz N, TREND Group. Improving the reporting quality of nonrandomized evaluations of behavioral and public health interventions: the TREND statement. Am J Public Health. 2004;94(3):361-366. https://doi.org/10.2105/ajph.94.3.361
23. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175-191. https://doi.org/10.3758/bf03193146
24. Molenda M, Pershing JA, Reigeluth CM. Designing instructional systems. In: Craig RL, editor. ASTD training and development handbook. 4th ed. McGraw-Hill; 1996.
25. Lewis P, Perez E, Piktus A, Petroni F, Karpukhin V, Goyal N, et al. Retrieval-augmented generation for knowledge-intensive NLP tasks. Adv Neural Inf Process Syst. 2020;33:9459-9474.
26. Yang HJ, Oh EB, Kim JM. Comparison of automatic speech recognition system for school-aged children's narratives: Naver Clova Speech and Google Speech-to-Text. Commun Sci Disord. 2023;28(1):30-38. https://doi.org/10.12963/csd.23952
27. World Health Organization. Medication without harm [Internet]. World Health Organization; c2026 [cited 2026 Feb 10]. Available from: https://www.who.int/initiatives/medication-without-harm

28. The Joint Commission. Home—The Joint Commission [Internet]. The Joint Commission; c2026 [cited 2026 Feb 10]. Available from: https://www.jointcommission.org/en/
29. Park HS, Cho GY, Kim DH, Kim SH, Kim MS. The mediating effect of drug calculation confidence in the relationship between interest in medication and drug calculation competency. J Korean Biol Nurs Sci. 2013;15(4):155-163. https://doi.org/10.7586/jkbns.2013.15.4.155
30. Jeong Y, Kim K, Ryu J. The impact of cognitive, affective, and psychomotor learning perception on learning outcomes in the extended reality-based nursing simulation. In: Auer ME, Tsiatsos T, editors. Immersive learning research network conference proceedings. Springer Nature Switzerland; 2024. p. 446-459. https://doi.org/10.1007/978-3-031-80475-5
31. Uppor W, Klunklin A, Viseskul N, Skulphan S. Effects of experiential learning simulation-based learning program on clinical judgment among obstetric nursing students. Clin Simul Nurs. 2024;92:101553. https://doi.org/10.1016/j.ecns.2024.101553
32. Bayram HÇ, Ergün S. Effect of screen-based simulation on pediatric drug administration among nursing students: a randomized controlled trial. Rev Esc Enferm USP. 2025;59:e20250249. https://doi.org/10.1590/1980-220X-REEUSP-2025-0249en
33. Asuncion AM, Quintos-Alagheband ML, Leavens-Maurer J, Akerman M, Janicke P, Cavanaugh S. Utilization of family as faculty: a patient directed simulation education to improve patient and family communication during Patient-Family Centered Rounds (PFCR). Pediatr Qual Saf. 2022;7(3):e551. https://doi.org/10.1097/pq9.0000000000000551
34. Gohman T, Nisar H, Gupta A, Javed MJ, Rau N. Development and usability of a virtual reality umbilical venous catheter placement simulator. Int J Comput Assist Radiol Surg. 2024;19(5):881-889. https://doi.org/10.1007/s11548-024-03072-8
35. Kim YS, Lee KS. Factors influencing learning flow of Korean nursing students: a systematic review and meta-analysis. J Korea Acad Ind Coop Soc. 2022;23(6):151-162. https://doi.org/10.5762/KAIS.2022.23.6.151
36. Choi HI. Nursing students' learning immersion, learning self-efficacy, and learning satisfaction for web-based virtual clinical simulation and clinical case seminars [dissertation]. Seoul National University; 2025.

ORIGINAL ARTICLE

Child Health Nurs Res Vol.32, No.3, July 2026;32(3):344-354
https://doi.org/10.4094/chnr.2026.017

pISSN 2287-9110
eISSN 2287-9129

CHNR

Factors associated with the health-related quality of life of adolescents with atopic dermatitis in South Korea: a cross-sectional study

Youna Lee[1], Anna Lee[2], Yoon Jung Shin[3], Eun Kyoung Choi[2]

[1]Graduate Student, Graduate School of Nursing, Yonsei University, Seoul, Korea
[2]Assistant Professor, Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, Seoul, Korea
[3]Team Leader, Division of Nursing, Yonsei University Health System, Seoul, Korea

Corresponding author
Eun Kyoung Choi
College of Nursing, Yonsei University,
50-1 Yonsei-ro, Seodaemun-gu, Seoul
03722, Korea
Tel: +82-2-2228-3340
Fax: +82-2-2227-8303
E-mail: ekchoi@yuhs.ac

Received: February 26, 2026
Revised: April 11, 2026
Accepted: June 8, 2026

Purpose: Atopic dermatitis (AD) in adolescents has received less attention than AD in infants and children. However, AD can persist or worsen after school age and affect health-related quality of life (HRQoL) beyond adolescence. This study aimed to examine HRQoL and its associated factors among adolescents with AD, guided by Roy's Adaptation Model.

Methods: This cross-sectional study was conducted between May and August 2023 and included adolescents aged 13–18 years with AD. Data on symptom experience, body image, peer relationships, self-management, HRQoL, and general and disease-related characteristics were collected using self-report questionnaires and electronic medical records. Data were analyzed using descriptive statistics, the independent t-test, analysis of variance, Pearson correlation analysis, and multiple regression analysis.

Results: A total of 97 adolescents with AD participated in the study, including 60 males (61.9%) and 37 females (38.1%). Participants were aged 13–18 years, with a mean age of 15.8±1.7 years. HRQoL was negatively correlated with symptom experience and positively correlated with body image, peer relationships, and self-management. Multiple regression analysis showed that allergen sensitization, symptom experience, and self-management were significantly associated with HRQoL, explaining approximately 40.0% of the variance.

Conclusion: Symptom experience and self-management were identified as key factors associated with HRQoL among adolescents with AD. Interventions aimed at reducing symptom burden and promoting active self-management are essential for improving HRQoL. These findings highlight the need to support adolescents' independence and underscore the importance of personalized education and effective self-management programs.

Keywords: Adolescent; Atopic dermatitis; Quality of life; Self-management

INTRODUCTION

Atopic dermatitis (AD) is a chronic and relapsing skin condition characterized by severe itching [1]. It generally occurs before school age and may improve with age [2]. However, AD can persist or worsen after school age [3], and adolescents with AD therefore require continuous attention and appropriate management strategies.

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.
© 2026 Korean Academy of Child Health Nursing

The symptoms of AD include itchiness, rashes, and dryness that become increasingly chronic, with skin thickening, lichenification, and sleep disturbances [4]. Adolescents with AD often experience a chronic and relapsing disease course characterized by repeated remission and exacerbation of symptoms, making sustained remission difficult [5]. In this context, they are likely to experience a range of physical, psychological, and social problems [4,6].

Adolescents with AD often have visible skin lesions on the face and neck [7]. Such visible symptoms may negatively affect body image during adolescence, a developmental period marked by increased concern about appearance, and may consequently interfere with the formation of self-concept [7,8]. In addition, AD may restrict daily activities, and adolescents may feel embarrassed about their skin condition, which can negatively influence peer relationships—an important aspect of social development during adolescence [9,10]. Furthermore, adolescents with AD are required to engage in long-term daily management, including avoidance of environmental triggers, skin care, and medication adherence [11]. As adolescents spend more time at school than at home, self-management plays a particularly important role in their daily lives.

However, despite the significant impact of AD on adolescents' HRQoL, research focusing specifically on adolescents remains limited compared to studies on children (or their caregivers) and adults [12,13]. Previous studies on adolescents with AD have primarily focused on treatment effects [14,15] or have relied on general dermatology-specific quality of life measures [2,16], with limited attention to the broader psychosocial and self-management factors influencing HRQoL. Moreover, there is a lack of studies that comprehensively examine these factors, particularly from a conceptual perspective that considers adolescents' adaptation to chronic conditions. Addressing these gaps is essential to better understand the multidimensional needs of adolescents and to develop effective nursing interventions.

Previous studies have identified several factors associated with HRQoL in adolescents with AD, including symptom experience, body image, peer relationships, self-management [17-20]. Therefore, these variables were selected as key factors potentially influencing HRQoL in adolescents with AD. These factors can be conceptually understood using the Adaptation Model by Roy [21], which offers a useful framework for explaining adaptation to chronic health conditions.

This study aimed to examine HRQoL and its associated factors among adolescents with AD, based on the Adaptation Model by Roy [21]. In addition, this study sought to explore these factors from a conceptual perspective informed by the Adaptation Model by Roy [21]. The findings may provide foundational data for developing nursing interventions to support positive adaptation in adolescents with AD.

The Adaptation Model by Roy [21] has been widely used to understand how individuals adapt to chronic health conditions and maintain quality of life. In this study, the model was used as a conceptual framework to guide the identification and organization of factors potentially associated with HRQoL in adolescents with AD. In the model by Roy [21], the regulator subsystem processes physiological stimuli through automatic neuroimmune responses-manifesting as symptom experience-while the cognator subsystem appraises these disruptions cognitively and emotionally, shaping adaptive responses across the self-concept (body image), role function (peer relationships), and interdependence (self-management) modes, which collectively determine HRQoL as an indicator of adaptation. Variables such as symptom experience, body image, peer relationships, and self-management were considered in relation to different aspects of adaptation. However, this study focused on examining the associations between these variables and HRQoL rather than testing the theoretical structure of the model.

The conceptual framework of the study is illustrated in Supplement 1.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Ajou University Hospital (IRB No. AJOUIRB-SB-2023-215). Written informed consent was obtained from the participants as well as their legal guardians.

1. Study Design and Participants

This cross-sectional study was conducted at the allergy department of a university hospital in South Korea from May 17 to August 31, 2023. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. Participants were adolescents aged 13–18 years diagnosed with AD who were able to communicate in Korean. Written informed consent was obtained from both the adolescents and one of their parents. First-time visitors were excluded.

The required sample size was calculated using G*Power ver. 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf) for multiple linear regression analysis (test family: F tests, statistical test: linear multiple regression: fixed model, R^2 deviation from zero). Based on an effect size (Cohen's f^2) of .30, and a significance level (α) of .05, a statistical power of .95, and 6 planned predictors, the minimum required sample size was 77. Considering a potential dropout rate of 20%, a total of 97 participants were recruited.

Data were collected using self-report questionnaires, complemented by electronic medical records. Participants were referred by their allergists and completed the questionnaire in the presence of the researcher, who provided assistance if needed. Completion took approximately 20 minutes, and questionnaires were returned in sealed envelopes. Participants received a small gift in appreciation of their participation.

2. Participants' Characteristics

Participants' characteristics included general characteristics and disease-related characteristics. General characteristics were collected using a basic data sheet and included sex, age, height, weight, comorbid allergic diseases, family history of AD, and main sources of information about AD. Body mass index (BMI) was calculated based on age- and sex-specific pediatric growth charts.

Disease-related characteristics were obtained from electronic medical records, including the date of first visit, outpatient visit cycle, allergen sensitization, and main treatment. Allergen sensitization was assessed using serum-specific immunoglobulin E tests for common allergens or a skin prick test.

3. Measures

HRQoL was measured using the Korean version of the Pediatric Quality of Life Inventory (PedsQL) 4.0 Generic Core Scale, originally developed by Varni et al. [22] and validated by Kook and Varni [23]. The instrument includes 23 items across 4 subscales: physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). All items are rated on a 5-point Likert scale (0=never, 1=rarely, 2=sometimes, 3=often, and 4=almost always). The items are reverse-scored and linearly transformed to a 0–100 scale (0=100, 1=75, 2=50, 3=25, and 4=0). The total HRQoL score is calculated as the mean of the transformed item scores, resulting in a final score ranging from 0 to 100, with higher scores indicating better HRQoL. Cronbach's α of the PedsQL 4.0 Generic Core Scale was .89 in the original study [22] and .90 in the Korean validation study [23]. In this study, Cronbach's α was .91.

Symptom experience was measured using the Korean version of the Patient Oriented Eczema Measure (POEM), originally developed by Charman et al. [24]. This tool consists of 7 questions that measure the number of days one experienced the following symptoms of AD in the past week: dry skin, itchy skin, flaking skin, cracking skin, sleep disturbances, bleeding, and weeping. The questions are rated on a 5-point Likert scale (0=none, 1=1–2 days, 2=3–4 days, 3=5–6 days, and 4=every day). The total score ranges from 0 to 28, and higher scores indicate more frequent experience of symptoms. A total score of 0–2, 3–7, 8–16, 17–24, and 25–28 denotes clear/almost clear, mild, moderate, severe, and very severe AD, respectively, according to the tool developer's classification criteria. Cronbach's α was .88 when the POEM was developed [24] and .88 in this study.

Body image was measured using the Body-Esteem Scale for Adolescents and Adults developed by Mendelson et al. [25] and translated into Korean by Park [8]. The instrument consists of 23 questions across 3 subscales: weight satisfaction, general feelings about appearance, and evaluations attributed to others about one's body and appearance. All questions are answered on a 5-point Likert scale (5=very much, 4=somewhat, 3=moderately, 2=not very much, and 1=not at all). Nine questions (Items 4, 7, 9, 11, 13, 17, 18, 19, and 21) are reverse coded. The total scores range from 23 to 115, with higher scores indicating more positive perceptions of and respect for one's body. Cronbach's α ranged from .75 to .96 when this tool was developed [25] and .90 for the total scale in the study by Park [8]. In this study, Cronbach's α was .93.

Peer relationships were measured using a scale developed and validated by Bae et al. [26]. Eight items measure positive peer relationships and 5 measure negative peer relationships. All items are rated on a 5-point Likert scale, ranging from 5 (strongly agree) to 1 (strongly disagree). The 5 items measuring negative peer relationships (Items 9, 10, 11, 12, and 13) are reverse scored. The total score ranges from 13 to 65, with higher scores indicating better peer relationships. The Cronbach's α at the time of its development was .84, and .84 in this study.

Self-management in adolescents with AD was measured using a modified and adapted version of the treatment adherence tool originally developed by Kim and Choi [12] for caregivers of infants and toddlers with AD. The original tool consisted of 21 items; the modified tool comprised 15 items. Permission to use and adapt the tool was obtained from the original developers. To ensure its applicability to adolescents, content validity was assessed by 5 experts [27], including an allergist, a pediatrician, an allergy coordinator, and 2 educational nurses from the Gyeonggi-do Atopic Asthma Education and Information Center. Items with a content validity index of 0.80 or higher were retained. In addition, items were revised based on expert feedback and relevant guidelines for the preventive management of allergic diseases published by the Korea Centers for Disease Control and Prevention in 2022. The final instrument included 4 domains: outpatient visits, skin care, medication adherence, and daily life management. All items are scored on a 5-point Likert scale (1=never, 2=rarely, 3=fairly, 4=fairly well, and 5=very well), with total scores ranging from 15 to 75. Higher scores indicate better self-management. Cronbach's α was .88 when the tool was developed and .81 in this study. However, the construct validity and factor structure of the modified instrument were not examined in this study. Despite being adapted from a caregiver-reported instrument, the modified self-management tool demonstrated acceptable internal consistency in this adolescent sample.

4. Data Analysis

The data were analyzed using descriptive statistics, independent t-tests, analysis of variance, Pearson correlation coefficients, and multiple regression analysis. All statistical analyses were performed using IBM SPSS Statistics ver. 27.0 (IBM Corp.).

No missing data were observed. Prior to conducting the regression analysis, assumptions including normality, linearity, homoscedasticity, and multicollinearity were examined. Linearity and homoscedasticity were assessed using scatterplots of standardized residuals versus standardized predicted values, and normality was evaluated using normal P–P plots of standardized residuals. Multicollinearity was assessed using variance inflation factors (VIF) and tolerance values. All diagnostic criteria were satisfied.

RESULTS

1. Characteristics of the Participants

Table 1 presents the general and disease-related characteristics of the participants. A total of 97 adolescents with AD (60 male and 37 female) aged 13–18 years (mean±standard deviation=15.8±1.7) participated in the study. Of these, 77 participants reported having comorbid allergic diseases (allergic rhinitis, allergic conjunctivitis, asthma, and food allergies). A family history of AD was reported by 46 participants (47.4%). The main source of information about AD was hospitals (healthcare organizations), with 65 participants (67%) receiving the information from hospitals. Furthermore, most participants (94.8%) reported having an allergen, and the most common allergen was house dust mites (91.8%)

2. Levels of Symptom Experience, Body Image, Peer Relationships, Self-management, and HRQoL

Table 2 presents the descriptive statistics of the study variables. The mean score for symptom experience was 9.33±7.27 on a scale of 0 to 28. Regarding symptom severity, 53 participants (54.6%) reported having moderate or more severe symptoms. Dry skin was the most common symptom, followed by itchy skin, flaky skin, cracking skin, sleep disturbances, bleeding skin, and weeping skin.

The scores for body image ranged from 37 to 108 with a mean score of 73.61±15.42. Regarding the subscales, the mean score was 33.22±7.49 for general feelings about appearance, 25.00±6.34 for weight self-esteem, and 15.39±3.89 for evaluations attributed to others about one's body and appearance, with the mean score being the highest for general feelings about appearance and the lowest for evaluations attributed to others about one's body and appearance.

The mean score for peer relationships was 51.87±7.16 on a scale from 13 to 65 and 55.31±8.63 for self-management on a scale from 15 to 75. The mean score for the overall HRQoL was 83.45±13.34. Regarding the subscales, the mean score was the highest for the social functioning (92.68±10.97), followed by the physical functioning (82.80±15.82), school functioning (80.00±17.31), and emotional functioning (78.71±20.93).

Table 1. Socio-demographic and clinical characteristics of participants (N=97)

Characteristic	Value
Sex	
Male	60 (61.9)
Female	37 (38.1)
Age (yr)	15.8±1.7
13–14	25 (25.8)
15–16	37 (38.1)
17–18	35 (36.1)
Education level	
Middle school	34 (35.1)
≥High school	63 (64.9)
Body mass index (kg/m^2)	22.27±4.05
Underweight	5 (5.1)
Normal	61 (62.9)
Overweight	12 (12.4)
Obesity	19 (19.6)
Comorbid allergic diseases[a)]	
0	20 (20.6)
1	40 (41.2)
≥2	37 (38.2)
Allergic rhinitis	68 (70.1)
Allergic conjunctivitis	11 (11.3)
Asthma	19 (19.6)
Food allergy	32 (33.0)
Family history of AD[a)]	
No	51 (52.6)
Yes	46 (47.4)
Parents	25 (25.8)
Siblings	23 (23.7)
Other relatives	6 (6.2)
Information sources	
Hospital	65 (67.0)
Internet/media	24 (24.8)
Family	8 (8.2)
Treatment period (yr)	2.0 (0.7–3.8)
<1	29 (29.9)
1–2	36 (37.1)
≥3	32 (33.0)
Outpatient visit cycle (mo)	1.5 (1.1–2.3)
<1	15 (15.4)
1	51 (52.6)
≥2	31 (32.0)
Allergen sensitization	
No	5 (5.2)
Yes	92 (94.8)
Treatment	
Basic care/topical medication	22 (22.6)
Systemic immunosuppressants	6 (6.2)
Immunotherapy	54 (55.7)
Biologics	15 (15.5)

Values are presented as number (%), mean±standard deviation, or median (IQR).
AD, atopic dermatitis.
[a)]Multiple response.

3. Differences in Symptom Experience, Body Image, Peer Relationships, Self-management, and HRQoL Based on Participants' Characteristics

As shown in Table 3, there was a statistically significant difference in symptom experience depending on age ($F=3.255$, $p=.043$), and the 17–18 age group experienced more symptoms than the 15–16 age group. Symptom experience also differed significantly depending on the source of information ($F=3.662$, $p=.029$). Body image differed significantly depending on BMI ($t=2.979$, $p=.004$), and participants with underweight and normal BMI had more favorable perceptions of their body image than those with overweight and obese BMI.

Regarding peer relationships, women scored higher than men on peer relationships ($t=-2.139$, $p=.035$). Peer relationships also differed significantly depending on the source of information ($F=3.118$, $p=.049$). Self-management scores were higher among the participants who had a family history of allergy diseases ($t=-2.410$, $p=.018$). Finally, the HRQoL differed significantly depending on allergen sensitization, with the HRQoL being greater among participants who did not have allergens than among those who had allergens ($t=3.223$, $p=.012$).

4. Correlations of Symptom Experience, Body Image, Peer Relationships, and Self-management with HRQoL

As shown in Table 4, HRQoL was negatively correlated with symptom experience ($r=-.488$, $p<.001$) and positively correlated with body image ($r=.413$, $p<.001$), peer relationships ($r=.259$, $p=.011$), and self-management ($r=.324$, $p=.001$). When symptom experience scores were classified based on severity and the resulting differences in HRQoL were further analyzed, participants with "mild" symptom severity had the highest scores for HRQoL, while those with "very severe" symptom severity had the lowest scores ($F=6.932$, $p<.001$).

5. Factors Influencing HRQoL

Before conducting the multiple regression analysis, assumptions were examined. Multicollinearity was assessed using VIF and tolerance values. All VIF values were below 10 and tolerance values exceeded 0.1, indicating no signifi-

Table 2. Levels of symptom experience, body image, peer relationships, self-management, and health-related quality of life (N=97)

Variable	Value	Possible range	Actual range
Symptom experience	9.33±7.27	0–28	0–28
Clear/almost clear	25 (25.8)		
Mild	19 (19.6)		
Moderate	37 (38.1)		
Severe	14 (14.4)		
Very severe	2 (2.1)		
Body image	73.61±15.42	23–115	37–108
Weight satisfaction	25.00±6.34	8–40	11–40
General feelings about appearance	33.22±7.49	10–50	18–49
Evaluations attributed to others about one's body and appearance	15.39±3.89	5–25	7–25
Peer relationships	51.87±7.16	13–65	31–65
Self-management	55.31±8.63	15–75	31–74
Health-related quality of life	83.45±13.34	0–100	44–100
Physical health	82.80±15.82	0–100	18–100
Emotional health	78.71±20.93	0–100	10–100
Social functioning	92.68±10.97	0–100	55–100
School functioning	80.00±17.31	0–100	10–100

Values are presented as number (%), mean±standard deviation, or range unless otherwise stated.

cant multicollinearity. Other assumptions of regression, including normality, linearity, and homoscedasticity, were also satisfied.

As shown in Table 5, a multiple linear regression analysis was performed to determine the factors affecting the HRQoL of adolescents with AD. Allergen sensitization ($\beta = -.190$, $p = .022$), symptom experience ($\beta = -.454$, $p < .001$), and self-management ($\beta = .248$, $p = .004$) were statistically significant, explaining approximately 40.0% of the variance.

A post-hoc power analysis was conducted using G*Power ver. 3.1.9.7. Based on the observed effect size ($R^2 = .400$), significance level ($\alpha = .05$), sample size (N=97), and 6 predictors, the statistical power ($1-\beta$) was calculated to be .999, indicating sufficient statistical power.

DISCUSSION

This study identified symptom experience, self-management, and allergen sensitization as significant factors influencing the HRQoL of adolescents with AD.

Symptom experience was the most influential factor associated with HRQoL, indicating that the severity and frequency of symptoms are key determinants of adolescents' quality of life. Adolescents with AD often experience a vicious cycle in which skin barrier damage triggers inflammatory responses, further impairing skin barrier function and leading to persistent symptoms. In this study, 54.6% of participants had moderate to severe AD, and more than half reported experiencing dry skin and pruritus for at least 3–4 days per week. These symptoms are known to have the greatest impact on quality of life in individuals with AD [4,28]. Effective management of these symptoms is essential to prevent disease progression and chronicity [29]. Therefore, nursing interventions should focus on early symptom recognition and continuous symptom monitoring, as well as individualized strategies to manage fluctuation in symptom severity. In addition, practical education is needed to help adolescents manage common symptoms such as pruritus and dry skin in their daily lives.

Self-management was also identified as a significant factor influencing HRQoL. In this study, adherence to outpatient visits and medication was relatively high, whereas scores for skin care and daily life management—including indoor temperature and humidity control, dietary management, and bathing habits-were relatively low. This indicates that caregiver-led management is well established, while adolescents' active self-management remains insufficient. Although symptom experience showed the strongest association with HRQoL, self-management also demonstrated a meaningful and independent effect, indicating that adolescents who actively engage in managing their condition tend to report better HRQoL. Self-management has been shown to improve quality of life in adolescents with chronic disease [30]. The European Academy of Allergy and Clinical Immunology also emphasizes that strengthening self-management in adolescents with allergic diseases can help reduce dependence on caregivers. Given that AD is a chronic condition that often

Table 3. Differences in symptom experience, body image, peer relationships, self-management, health-related quality of life by characteristics of the participants (N=97)

Variable	Symptom experience		Body image		Peer relationships		Self-management		HRQoL	
	Mean±SD	F/t (*p*)	Mean±SD	F/t (*p*)	Mean±SD	F/t (*p*)	Mean±SD	F/t (*p*)	Mean±SD	F/t (*p*)
Gender		–0.827 (.411)		0.805 (.423)		–2.139 (.035*)		0.980 (.330)		1.626 (.107)
Male	8.85±6.94		74.60±15.11		50.67±7.08		55.98±7.94		85.16±12.83	
Female	10.11±7.80		72.00±15.99		53.81±6.96		54.22±9.65		80.66±13.84	
Age (yr)		3.255 (.043*)		0.239 (.788)		0.318 (.728)		0.087 (.917)		1.663 (.195)
13–14[a]	9.00±7.23	b<c	71.80±16.63		52.84±7.82		54.80±9.88		85.17±14.21	
15–16[b]	7.38±6.34		73.97±16.41		51.41±6.24		55.24±8.37		85.37±12.83	
17–18[c]	11.63±7.75		74.51±13.70		51.66±7.72		55.74±8.17		80.19±12.97	
Education level		–0.825 (.412)		–1.059 (.292)		0.877 (.383)		–1.024 (.308)		1.318 (.191)
Middle school	8.50±6.90		71.35±16.30		52.74±6.99		54.09±9.19		85.87±13.44	
≥High school	9.78±7.48		74.83±14.91		51.40±7.26		55.97±8.30		82.14±13.20	
Comorbid allergic diseases		2.754 (.069)		0.322 (.725)		0.611 (.545)		1.038 (.358)		0.186 (.830)
0	12.65±7.05		73.90±18.36		53.20±5.77		56.85±6.62		83.64±11.08	
1	8.27±6.87		72.18±14.08		51.05±6.97		55.97±8.88		84.29±15.50	
≥2	8.68±7.47		75.00±15.40		52.03±8.05		53.76±9.24		82.43±12.13	
Family history of AD		–1.201 (.233)		–1.056 (.294)		0.618 (.538)		–2.410 (.018*)		0.108 (.914)
No	8.49±7.17		72.04±15.90		52.29±7.17		53.35±8.57		83.58±12.85	
Yes	10.26±7.33		75.35±14.86		51.39±7.20		57.48±8.25		83.29±13.99	
Information source		3.662 (.029*)		1.754 (.179)		3.118 (.049*)		0.510 (.602)		1.607 (.206)
Hospital	10.69±7.35		73.23±15.92		52.78±6.85		55.49±8.44		82.90±12.67	
Internet/media	6.67±6.23		71.50±12.54		48.79±7.14		55.79±8.68		82.24±14.82	
Family	6.25±7.13		83.00±17.58		53.63±7.96		52.38±10.48		91.44±12.91	
Allergen sensitization		0.933 (.379)		1.011 (.314)		–0.853 (.396)		–1.311 (.193)		3.223 (.012*)
No	10.60±2.70		80.40±11.67		49.20±7.05		50.40±6.50		91.30±4.80	
Yes	9.26±7.43		73.24±15.56		52.01±7.17		55.58±8.68		83.02±13.53	
Treatment		2.375 (.075)		1.847 (.144)		0.123 (.946)		0.102 (.959)		1.907 (.134)
Basic care/topical medication	11.45±7.75		76.32±17.76		51.64±5.93		55.64±8.29		81.32±12.72	
Systemic immunosuppressants	11.17±5.67		64.67±11.04		50.33±6.31		54.50±4.23		81.88±10.84	
Immunotherapy	7.61±7.04		75.13±15.04		52.00±7.32		55.54±9.08		86.09±12.50	
Biologics	11.67±6.89		67.73±12.89		52.33±8.97		54.33±9.32		77.68±16.51	
Body mass index		–0.620 (.537)		2.979 (.004*)		–0.065 (.948)		1.573 (.120)		0.035 (.972)
Underweight/normal	9.02±6.91		76.68±15.73		51.83±7.11		56.17±9.18		83.48±12.79	
Overweight/obesity	10.00±8.05		67.06±12.64		51.94±7.37		53.48±7.11		83.38±14.66	
Treatment period (yr)		1.214 (.302)		0.966 (.384)		0.571 (.567)		2.805 (.066)		0.536 (.587)
<1	10.56±7.31		77.07±15.83		53.00±6.96		58.33±6.11		83.70±13.20	
1–2	10.09±8.03		71.63±14.19		51.06±7.57		53.17±9.97		81.80±15.06	
≥3	7.84±6.43		73.34±16.40		51.62±6.97		55.09±8.57		85.19±11.60	
Outpatient visit cycle (mo)		1.591 (.209)		1.144 (.323)		0.329 (.720)		2.892 (.060)		0.857 (.428)
<1	9.27±9.56		77.60±18.91		52.20±8.19		59.00±9.46		80.15±13.32	
1	10.45±6.80		71.49±13.68		52.29±7.00		55.76±8.66		83.14±14.71	
≥2	7.52±6.62		75.16±16.24		51.00±7.06		52.77±7.57		85.55±10.76	

AD, atopic dermatitis; HRQoL, health-related quality of life; SD, standard deviation.
*p<.05.

Table 4. Correlation matrix of variables and health-related quality of life (N=97)

Variable	V1	V2	V3	V4	V5
V1. HRQoL	1				
V2. Symptom experience	–.488*** (< .001)	1			
V3. Body image	.413*** (< .001)	–.212* (.037)	1		
V4. Peer relationships	.259* (.011)	.011 (.914)	.443*** (< .001)	1	
V5. Self-management	.324** (.001)	–.054 (.597)	.318** (.001)	.180 (.078)	1

Values are presented as r (*p*).
HRQoL, health-related quality of life.
*p<.05. **p<.01. ***p<.001.

Table 5. Factors influencing health-related quality of life (N=97)

Variable	Multiple linear regression (enter method)						
	B	SE	β	t	*p*	Tolerance	VIF
(Constant)	55.111	10.239		5.382	< .001		
Allergen sensitization	–11.410	4.914	–.190	–2.322	.022	.932	1.073
Symptom experience	–0.832	0.150	–.454	–5.547	< .001	.934	1.071
Body image	0.122	0.083	.142	1.467	.146	.671	1.491
Peer relationships	0.321	0.168	.173	1.917	.058	.772	1.296
Self-management	0.384	0.131	.248	2.932	.004	.870	1.150
Model fit	R^2 = .431, adjusted R^2 = .400, F = 13.797, p < .001						

SE, standard error; VIF, variance inflation factor.

persists from childhood into adulthood, it is important to support adolescents in gradually taking responsibility for their own care.

Although self-management programs for adolescents with AD are still limited, similar programs have been widely implemented in other chronic conditions, such as asthma and type 1 diabetes [31,32]. Previous studies have shown that educational interventions, including those delivered by nurses, can improve disease knowledge and self-management behaviors in adolescents with chronic conditions [31,33]. Therefore, nursing interventions should not only focus on symptom reduction but also support adolescents in developing practical self-management skills in their daily lives. For example, nurses can provide individualized education on skin care routines, itch management strategies, and environmental control, while also encouraging adolescents to monitor their symptoms and treatment adherence. Supporting adolescents' active engagement in daily self-management may help improve HRQoL.

Allergen sensitization was also found to be associated with HRQoL. This may reflect the burden and fatigue associated with long-term avoidance of triggering factors. However, this finding should be interpreted with caution, as the number of participants without identified allergens was relatively small. In addition, allergen sensitization was assessed based on medical records, and it was not confirmed whether adolescents were aware of their own triggers. Future studies should examine adolescents' awareness of allergen triggers, their coping strategies, and their impact on HRQoL.

In this study, HRQoL was measured using the PedsQL 4.0 Generic Core Scale. While many previous studies in patients with AD have used dermatology-specific instruments such as the Children's Dermatology Life Quality Index [2,16,17], limiting direct comparisons, the use of a generic HRQoL measure allowed comparison with adolescents with other chronic conditions. The HRQoL of adolescents with AD in this study was found to be comparable to that of adolescents with other chronic conditions reported in previous studies [34,35]. These findings suggest that although AD is not a life-threatening condition, its chronic and relapsing nature can have a substantial impact on multiple aspects of adolescents' lives [19]. Therefore, it is important to assess and address not only dermatological symptoms but also overall HRQoL in adolescents with AD.

Overall, the findings of this study emphasize the importance of a comprehensive approach to improving HRQoL in adolescents with AD, including effective symptom management, enhancement of adolescents' self-management capacity, and consideration of environmental factors. These results provide important implications for the development of nursing interventions aimed at supporting adolescents' adaptation to chronic conditions.

This study has several limitations. First, the relatively small sample size and the use of convenience sampling from a single university hospital may limit the generalizability of the findings and introduce potential regional bias. Second, although the self-management instrument was adapted for adolescents, its psychometric properties were not fully validated in this population. While content validity was established, construct validity and factor structure were not examined, which may limit the interpretation of the findings. Therefore, the results related to self-management should be interpreted with caution. Third, data were collected using self-reported questionnaires, which may have introduced response bias. In addition, allergen sensitization was assessed based on medical records, and participants' awareness of their own allergen triggers was not evaluated.

Future studies should include larger, multi-center samples with adolescents with AD from diverse regions, clinical settings, and varying levels of disease severity to enhance the generalizability of the findings. In addition, longitudinal study designs are needed to better understand changes in HRQoL over time. Further research is also required to validate the psychometric properties of the self-management instrument for adolescents with AD, including construct validity and factor structure assessment. Moreover, future studies should explore adolescents' awareness of allergen triggers and their coping strategies in relation to HRQoL.

CONCLUSION

This study identified symptom experience, self-management, and allergen sensitization as key determinants of HRQoL in adolescents with AD. Pediatric nurses play an important role in supporting adolescents to develop the knowledge and skills necessary for proactive symptom management. Nursing interventions should consider strategies to reduce symptom experience, particularly itchiness and dry skin, and provide individualized education tailored to adolescents' needs. In addition, appropriate self-management programs, including guidance on skin care, lifestyle management, and allergen avoidance, may help adolescents actively manage their condition. Such approaches may contribute to improvements in HRQoL and support better long-term health outcomes.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: YL, AL, YJS, EKC. Methodology: AL, YJS. Data collection: YL. Formal analysis: YL. Investigation: YL. Project administration: EKC. Supervision: EKC. Writing–original draft: YL. Writing–review & editing: YL, AL, YJS, EKC. Final approval of published version: all authors.

Conflict of interest

This manuscript is derived from a master's thesis conducted at the Graduate School of Nursing, Yonsei University. No other existing or potential conflict of interest relevant to this article was reported.

Funding

None.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

We would like to thank the professionals of the Allergy department at Ajou University Hospital for their help in recruiting participants. In addition, we thank the adolescents who participated in this study.

AI use disclosure

During the preparation of this work, the authors used ChatGPT (OpenAI) to improve the English language and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Supplementary material

Supplement 1. Conceptual framework of the study.

ORCID and ResearcherID

Youna Lee	https://orcid.org/0009-0003-7022-7032
	https://researcherid.com/rid/QQZ-7179-2026
Anna Lee	https://orcid.org/0000-0001-9277-8204
	https://researcherid.com/rid/LMP-5091-2024
Yoon Jung Shin	https://orcid.org/0000-0002-0423-0925
	https://researcherid.com/rid/QQZ-8103-2026
Eun Kyoung Choi	https://orcid.org/0000-0003-4622-2437
	https://researcherid.com/rid/GPG-0204-2022

REFERENCES

1. Frazier W, Bhardwaj N. Atopic dermatitis: diagnosis and treatment. Am Fam Physician. 2020;101(10):590-598.
2. Jeon YH, Ahn K, Kim J, Shin M, Hong SJ, Lee SY, et al. Clinical characteristics of atopic dermatitis in Korean school-aged children and adolescents according to onset age and severity. J Korean Med Sci. 2022;37(4):e30. https://doi.org/10.3346/jkms.2022.37.e30
3. Silverberg NB, Durán-McKinster C. Special considerations for therapy of pediatric atopic dermatitis. Dermatol Clin. 2017;35(3):351-363. https://doi.org/10.1016/j.det.2017.02.008
4. Grant L, Seiding Larsen L, Trennery C, Silverberg JI, Abramovits W, Simpson EL, et al. Conceptual model to illustrate the symptom experience and humanistic burden associated with atopic dermatitis in adults and adolescents. Dermatitis. 2019;30(4):247-254. https://doi.org/10.1097/DER.0000000000000486
5. Abuabara K, Margolis DJ, Langan SM. The long-term course of atopic dermatitis. Dermatol Clin. 2017;35(3):291-297. https://doi.org/10.1016/j.det.2017.02.003
6. Lifschitz C. The impact of atopic dermatitis on quality of life. Ann Nutr Metab. 2015;66 Suppl 1:34-40. https://doi.org/10.1159/000370226
7. Mikołajczyk J, Rzepa T, Król J, Żaba R. Body image assessment and quality of life in patients with atopic dermatitis. Dermatol Rev. 2017;104(2):92-102. https://doi.org/10.5114/dr.2017.67383
8. Park W. The effects of adolescents' body mass index, self-esteem, family criticism and media exposure on their body image [master's thesis]. Seoul: Yonsei University; 2009.
9. Brenninkmeijer EE, Legierse CM, Sillevis Smitt JH, Last BF, Grootenhuis MA, Bos JD. The course of life of patients with childhood atopic dermatitis. Pediatr Dermatol. 2009;26(1):14-22. https://doi.org/10.1111/j.1525-1470.2008.00745.x
10. Cho SI, Kim JH, Chung BY, Ahn IS, Kim HO, Park CW, et al. Quality of life in children and adolescents with atopic dermatitis. Korean J Dermatol. 2011;49(5):415-421.
11. Jee HM, Han MY. Therapeutic approach to atopic dermatitis in children. J Korean Med Assoc. 2022;65(10):675-680. https://doi.org/10.5124/jkma.2022.65.10.675
12. Kim MJ, Choi MH. Knowledge, compliance and quality of life of mothers of children with atopic dermatitis. J Korean Acad Child Health Nurs. 2011;17(4):272-280. https://doi.org/10.4094/jkachn.2011.17.4.272
13. Kwak Y, Kim Y. Health-related quality of life and mental health of adults with atopic dermatitis. Arch Psychiatr Nurs. 2017;31(5):516-521. https://doi.org/10.1016/j.apnu.2017.06.001
14. Cork MJ, McMichael A, Teng J, Valdez H, Rojo R, Chan G, et al. Impact of oral abrocitinib on signs, symptoms and quality of life among adolescents with moderate-to-severe atopic dermatitis: an analysis of patient-reported outcomes. J Eur Acad Dermatol Venereol. 2022;36(3):422-433. https://doi.org/10.1111/jdv.17792
15. Silverberg JI, Thyssen JP, Simpson EL, Yosipovitch G, Ständer S, Valdez H, et al. Impact of oral abrocitinib monotherapy on patient-reported symptoms and quality of life in adolescents and adults with moderate-to-severe atopic dermatitis: a pooled analysis of patient-reported outcomes. Am J Clin Dermatol. 2021;22(4):541-554. https://doi.org/10.1007/s40257-021-00604-9
16. Ng MS, Tan S, Chan NH, Foong AY, Koh MJ. Effect of atopic dermatitis on quality of life and its psychosocial impact in Asian adolescents. Australas J Dermatol. 2018;59(2):e114-e117. https://doi.org/10.1111/ajd.12632
17. Ezzedine K, Shourick J, Merhand S, Sampogna F, Taïeb C. Impact of atopic dermatitis in adolescents and their parents: a French study. Acta Derm Venereol. 2020;100(17):adv00294. https://doi.org/10.2340/00015555-3653
18. Kelly KA, Balogh EA, Kaplan SG, Feldman SR. Skin disease in children: effects on quality of life, stigmatization, bullying, and suicide risk in pediatric acne, atopic dermatitis, and psoriasis patients. Children (Basel). 2021;8(11):1057. https://doi.org/10.3390/children8111057
19. Ricci G, Bellini F, Dondi A, Patrizi A, Pession A. Atopic dermatitis in adolescence. Dermatol Reports. 2011;4(1):e1. https://doi.org/10.4081/dr.2012.e1
20. Lundin S, Jonsson M, Wahlgren CF, Johansson E, Bergstrom A, Kull I. Young adults' perceptions of living with atopic dermatitis in relation to the concept of self-management: a qualitative study. BMJ Open. 2021;11(6):e044777. https://doi.org/10.1136/bmjopen-2020-044777
21. Roy SC. The Roy adaptation model. 3rd ed. Pearson Education; 2009.
22. Varni JW, Seid M, Rode CA. The PedsQL: measurement model for the pediatric quality of life inventory. Med Care. 1999;37(2):126-139. https://doi.org/10.1097/00005650-199902000-00003
23. 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 Qual Life Outcomes. 2008;6:41. https://doi.org/10.1186/1477-7525-6-41
24. Charman CR, Venn AJ, Williams HC. The patient-oriented eczema measure: development and initial validation of a new tool for measuring atopic eczema severity from the patients' perspective. Arch Dermatol. 2004;140(12):1513-1519. https://doi.org/10.1001/archderm.140.12.1513
25. Mendelson BK, Mendelson MJ, White DR. Body-esteem scale for

adolescents and adults. J Pers Assess. 2001;76(1):90-106. https://doi.org/10.1207/S15327752JPA7601_6

26. Bae SM, Hong JY, Hyun MH. A validation study of the peer relationship quality scale for adolescents. Korean J Youth Stud [Internet]. 2015 [cited 2026 Feb 10];22(5):325-344. Available from: https://kiss.kstudy.com/Detail/Ar?key=3332003
27. Lynn MR. Determination and quantification of content validity. Nurs Res. 1986;35(6):382-385.
28. Silverberg JI, Gelfand JM, Margolis DJ, Boguniewicz M, Fonacier L, Grayson MH, et al. Patient burden and quality of life in atopic dermatitis in US adults: a population-based cross-sectional study. Ann Allergy Asthma Immunol. 2018;121(3):340-347. https://doi.org/10.1016/j.anai.2018.07.006
29. Li K. Itch in atopic dermatitis: from pathogenesis to treatment. Allergy Asthma Respir Dis. 2014;2(1):8-15. https://doi.org/10.4168/aard.2014.2.1.8
30. Gauci J, Bloomfield J, Lawn S, Towns S, Steinbeck K. Effectiveness of self-management programmes for adolescents with a chronic illness: a systematic review. J Adv Nurs. 2021;77(9):3585-3599. https://doi.org/10.1111/jan.14801
31. Alquran A, Lambert KA, Farouque A, Holland A, Davies J, Lampugnani ER, et al. Smartphone applications for encouraging asthma self-management in adolescents: a systematic review. Int J Environ Res Public Health. 2018;15(11):2403. https://doi.org/10.3390/ijerph15112403
32. Orpin J, Rodriguez A, Harrop D, Mills E, Campbell F, Martin-Kerry J, et al. Supportive use of digital technologies during transition to adult healthcare for young people with long-term conditions, focusing on Type 1 diabetes mellitus: a scoping review. J Child Health Care. 2025;29(1):204-221. https://doi.org/10.1177/13674935231184919
33. Choi EK, Jung E, Ji Y, Bae E. A 2-step integrative education program and mHealth for self-management in Korean children with spina bifida: feasibility study. J Pediatr Nurs. 2019;49:e54-e62. https://doi.org/10.1016/j.pedn.2019.09.002
34. Jin EJ. Factors affecting health-related quality of life in adolescents with congenital heart disease after open-heart surgery [master's thesis]. Seoul: Yonsei University Graduate School of Nursing; 2015.
35. Park MN. Associations among ego identity, resilience, and health-related quality of life in adolescent survivors of childhood cancer [master's thesis]. Seoul: Yonsei University Graduate School of Nursing; 2016.

Instructions to Authors

CHNR
Child Health Nursing Research

Child Health Nursing Research
Enacted in April 2006 | Most recently revised in May 2026 (applied from Vol. 32, No. 3, July 2026)

I. General Information

Child Health Nursing Research (CHNR) is the official, open-access, double-blind, peer-reviewed journal of the Korean Academy of Child Health Nursing (KACHN). As an international English-language journal, CHNR adheres to high global standards of research integrity.

CHNR is dedicated to advancing scientific knowledge and clinical practice in child health nursing. The journal promotes the health, development, and well-being of infants, children, adolescents, and their families worldwide by disseminating rigorous research on evidence-based practices.

CHNR is indexed in major international databases, including Scopus, PubMed Central (PMC), Korea Citation Index (KCI), CINAHL, KoreaMed, KoMCI, the Directory of Open Access Journals (DOAJ), ScienceCentral, and Google Scholar. All articles are assigned a Digital Object Identifier (DOI) through Crossref and are made available online immediately upon publication.

The scope of CHNR includes recent clinically and academically relevant topics in healthcare and nursing from the beginning of life to young adulthood, with attention to both children and their families. The journal publishes original research, reviews, and methodological papers that address theory, research, and practice in child health nursing, including but not limited to the following areas:

- Evidence-based child health nursing in clinical settings
- Health promotion, disease prevention, and community care
- Acute, critical, and chronic illness management in children
- Neonatal nursing and early childhood development
- Family-centered care and psychosocial support
- Cross-cultural issues, health disparities, and global health policies affecting child health

The primary readership of CHNR includes academic researchers, pediatric nurses, advanced practice registered nurses, healthcare administrators, educators, and policymakers dedicated to pediatric care. CHNR aims to build a robust body of knowledge that translates into improved clinical practice and better global health outcomes for children and their families.

CHNR is published quarterly in January, April, July, and October. The journal is open access, and all articles are freely available online immediately upon publication.

For policies on research and publication ethics not addressed in these Instructions, authors should follow the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals of the International Committee of Medical Journal Editors (ICMJE; https://www.icmje.org/icmje-recommendations.pdf) or the COPE Guidelines (https://publicationethics.org/retraction-guidelines). All processes for handling research and publication misconduct will follow the applicable COPE flowcharts (https://publicationethics.org/resources/flowcharts).

II. Research and Publication Ethics

1. Bioethics and Protection of Human/Animal Rights

Research Involving Human Participants

Clinical research involving human participants is required to be conducted in strict compliance with international standards of ethical practice, particularly the principles outlined in the Declaration of Helsinki (https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/) and relevant local regulations, including the Bioethics and Biosafety Act of Korea (https://elaw.klri.re.kr/). Clinical studies that do not meet these ethical standards will not be considered for publication. To protect participant privacy, identifiable information, such as patients' names, initials, hospital numbers, dates of birth, or other protected health information, must not be disclosed in the manuscript.

Research Involving Animals

When animals are used as research subjects, the study must be conducted in accordance with institutional and national guidelines, including those of the Institutional Animal Care and Use Committees (IACUCs; https://olaw.nih.gov/) or the 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). The ethical treatment of all experimental animals must be maintained throughout the study.

2. Informed Consent and Institutional Review Board (IRB) Approval

IRB Approval

For all clinical studies involving human participants, researchers must obtain formal approval, an agreement, or a certificate of exemption from the Institutional Review Board (IRB) of the author's affiliated institution before commencing the study.

Informed Consent and Vulnerable Populations

Researchers must obtain and securely retain written, voluntary informed consent from all study participants or their legally authorized representatives, such as parents or guardians. If the research involves children or other vulnerable populations, strict safeguards must be implemented to ensure safety and protect human rights. In addition to parental consent, researchers are strongly encouraged to obtain the child's assent in a manner appropriate to the child's developmental age and understanding.

Document Verification

The CHNR Editorial Board or peer reviewers may request copies of informed consent forms and official proof of IRB approval at any point during the review process. Authors conducting secondary data analyses may be asked to provide IRB documentation, including approval or exemption, appropriate to the data type, such as public, institutional, or special-purpose datasets.

3. Authorship and Acknowledgements

Criteria for Authorship

Authorship is limited to individuals who have made substantial contributions to the manuscript, and every designated author must meet all four ICMJE criteria (https://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html) There criteria require the following:

- Substantial contributions to the conception or design of the work, or to the acquisition, analysis, or interpretation of data;
- Drafting the work or reviewing it critically for important intellectual content;
- Final approval of the version to be published; and
- Agreement to be accountable for all aspects of the work by ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

At the time of submission, all authors, including the order of their names, must be confirmed. All authors must provide their ORCID ID (https://orcid.org). Artificial intelligence (AI) tools or other AI-assisted technologies cannot be listed as authors.

Corresponding Author and First Author

CHNR does not allow multiple first authors or co-corresponding authors for a single article. Only one author per article should communicate with the editorial office and reviewers. The corresponding author is primarily responsible for addressing all issues raised by the editor and readers and must confirm that all appropriate persons are listed as authors and that all authors have approved the final manuscript.

- When a master's thesis or doctoral dissertation is submitted for publication, the first author should be the degree recipient and must declare that the content is derived from the thesis or dissertation.

Authorship Taxonomy (CRediT)

Each author's contribution must be described using the CRediT taxonomy (https://credit.niso.org/) during the submission process. This information will appear above the references section of the published paper.

Term	Definition
Conceptualization	Ideas; formulation or development of overarching research goals and aims
Methodology	Development or design of methodology; creation of models
Software	Programming, software development; designing computer programs; testing of existing code components
Validation	Verification 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 experiments or data/evidence collection
Resources	Provision of study materials, reagents, patients, laboratory samples, animals, instrumentation, or other analysis tools
Data curation	Management activities to annotate, clean data, and maintain research data for initial use and later reuse
Writing – original draft	Preparation, creation, and/or presentation of the published work, specifically writing the initial draft
Writing – review & editing	Critical review, commentary, or revision of the published work by the original research group
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
Project administration	Management and coordination responsibility for the research activity planning and execution
Funding acquisition	Acquisition of financial support for the project leading to the publication

Changes to Authorship

Before Publication

Requests for authorship changes, including the addition, removal, or reordering of authors, must be submitted before manuscript acceptance. Such requests must be accompanied by a formal letter to the Editor, signed by all authors, including those being added or removed, that provides a clear justification for the change. The Editorial Board reserves the right to conduct a formal review and may request further clarification before reaching a decision. All processes will strictly follow COPE guidelines (https://publicationethics.org/guidance/Flowcharts).

After Publication

Authorship changes after publication are generally not permitted in order to maintain the integrity of the scholarly record. However, if a genuine error is identified, such as an editorial mistake or the justifiable omission of a contributor, the Editorial Board may consider a request for a correction. Such requests must be accompanied by a detailed explanation and written consent from all original and prospective authors. All cases will be handled in accordance with COPE guidelines.

Acknowledgements for Non-author Contributors

Contributors who do not meet all four ICMJE criteria for authorship should be listed in the Acknowledgements section. Roles such as funding acquisition, data collection, general supervision, writing assistance, and technical or language editing do not, by themselves, justify authorship.

4. Conflict of Interest Statement

A conflict of interest exists when professional judgment concerning a primary interest, such as research validity or patient welfare, may be influenced by a secondary interest, such as financial gain. All authors must transparently disclose any financial or personal relationships, including employment, consultancies, stock ownership, honoraria, or academic competition, that could potentially bias their work, even if the authors believe their judgment was not influenced.

Authors must complete and submit the ICMJE Disclosure Form (https://www.icmje.org/disclosure-of-interest/) and declare any potential conflicts on the manuscript title page and in a dedicated Conflict of Interest section at the end of the main text. If no conflicts exist, the following statement must be included: "*The authors declare no conflict of interest*."

Authors must explicitly identify all sources of financial support and describe the exact role of each funding sponsor in study design, data collection, analysis, interpretation, and the decision to submit the manuscript for publication.

Both reviewers and editors must disclose any potential conflicts of interest. If a conflict exists, the individual must immediately notify the editorial office and recuse themselves from the review or decision-making process. Manuscripts submitted by editors or Editorial Board members are handled as standard unsolicited submissions, and those individuals are strictly excluded from reviewer selection, evaluation, and final decision-making for their own manuscripts. Any such conflict of interest must be explicitly declared in the dedicated Conflict of Interest section of the manuscript.

5. Originality and Misconduct

Reporting Standards and Originality

Authors must report their research accurately and objectively. Methods and procedures should be described in sufficient detail to allow replication. Authors must never produce, record, or report nonexistent data (fabrication) or change or omit data (falsification). Manuscripts must be original works and must properly cite all sources. Plagiarism, including self-plagiarism, is strictly prohibited. All submissions are screened using the Crossref Similarity Check tool powered by iThenticate (https://www.crossref.org/services/similarity-check/); manuscripts with a high similarity index will be rejected. Manuscripts with substantial unattributed overlap may be rejected following editorial assessment.

Duplicate Publication and Salami Slicing

Multiple, simultaneous, or duplicate submissions are strictly prohibited in accordance with ICMJE recommendations. Authors must not divide one substantial manuscript into multiple smaller publications ("salami slicing"). Secondary publication in a different language requires explicit approval from the Editors-in-Chief of both the primary and secondary journals. If duplicate submission is detected, sanctions may be imposed in accordance with COPE guidelines, including temporary suspension of submission privileges and notification of the authors' institutions.

6. Image Integrity Policy

The integrity of all images submitted to CHNR must be maintained. Manipulating images in a manner that misrepresents the original data or findings constitutes research misconduct and may result in rejection or retraction of the manuscript. The following standards apply:

- Global adjustments, such as brightness, contrast, and color balance, are permitted only when applied equally and uniformly to the entire image and when they do not obscure or eliminate any information present in the original.
- Enhancements, erasures, splicing, cloning, or other manipulations of specific image regions are strictly prohibited.
- Any image processing performed, including the software used and adjustments made, must be described in the Methods section.
- Original, unprocessed image files must be retained by the authors and provided to the editorial office upon request.

7. Research Data Sharing Policy

CHNR encourages authors to share the research data supporting their publications, where appropriate, and to link these data to their published articles. To facilitate reproducibility and data reuse, the journal also encourages the sharing of software, code, models, algorithms, protocols, methods, and other useful materials.

Authors must include a Data Availability Statement in the manuscript describing how readers can access the data, code, and other resources supporting the research findings.

Example 1 (Data available upon request):
The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.
Example 2 (Data included in the article):
All data generated or analyzed during this study are included in this published article and its supplementary information files.
Example 3 (Data in a public repository):
The data that support the findings of this study are available in [Name of Repository] at https://dx.doi.org/[DOI].

8. Management of Research Misconduct and Corrections

CHNR is committed to maintaining the integrity of the scientific record. When research misconduct is suspected or errors are identified, the journal follows a systematic process for investigation and resolution.

Process for Handling Misconduct

If reviewers, editors, or readers suspect any form of publication malpractice, including data fabrication or falsification, salami slicing, plagiarism, simultaneous or duplicate submission, inappropriate authorship changes, undisclosed conflicts of interest, ethical violations involving research participants or animals, or a reviewer's appropriation of an author's data, a formal resolution process will be initiated in accordance with the COPE (Committee on Publication Ethics) flowcharts (https://publicationethics.org/guidance/Flowcharts).

The journal's ethics committee and Editorial Board are responsible for adjudicating all suspected cases. If authors discover a fundamental error in their published manuscript, they must immediately inform the editor and cooperate fully to correct or retract the manuscript.

Post-Publication Mechanisms

To address identified errors or confirmed misconduct, CHNR uses the following mechanisms in accordance with the COPE Retraction Guidelines (https://publicationethics.org/retraction-guidelines). All correction requests must be submitted to the Editorial Office with a detailed explanation.

- **Expression of Concern:** Issued when the Editorial Board becomes aware of evidence regarding the unreliability of a study or potential misconduct, but a final determination has not yet been reached.
- **Retraction:** Issued when serious errors or misconduct, such as data fabrication, falsification, or plagiarism, invalidate the findings of a study. Retracted articles remain accessible online to preserve the scholarly record but are clearly and permanently marked as "RETRACTED."
- **Corrigendum:** A correction issued for significant errors identified by the author(s) that do not undermine the scientific integrity or conclusions of the article.
- **Erratum:** A correction for production errors made by the publisher, such as typesetting or figure-placement errors, that materially affect the content or metadata.

III. Manuscript Preparation

1. Types of Manuscripts

CHNR publishes the following article types:

Article Type	Abstract (words)	Main Text (words)	References	Tables & Figures
Original article	250	6,000	30	5
Review article	250	8,000	No limit	5
Editorial	N/A	2,500	10	5

Note: No strict reference limit applies to systematic reviews and meta-analyses. For original articles, the recommended number of references is 30 or fewer, although exceptions may be considered for certain study types, such as structural equation modeling studies. The total word count for the main text excludes the abstract, references, tables, and figure legends.

- **Original Articles:** Comprehensive papers presenting novel research findings from empirical studies relevant to child health nursing and healthcare for people from the beginning of life to young adulthood, as well as their families. Methodologies include mixed-methods designs, observational, quasi-experimental, and experimental investigations, qualitative methods, and instrument development or evaluation studies.
- **Review Articles:** Critical presentations on themes of interest and importance to child health nursing theory, practice, and education. This category includes comprehensive literature reviews, systematic reviews, scoping reviews, and discussion papers. All review articles must include a critical evaluation of a significant body of research or scholarship.
- **Editorials:** Editorials are published by invitation only and feature remarks by institutional representatives or individuals on topics of current interest. Authors with suggestions for editorials may contact the editorial office.

2. General Information

- **Language and format:** All manuscripts must be written in English and submitted in Microsoft Word format (.doc or .docx) to facilitate international peer review. The document should be prepared on A4 paper with standard margins of at least 25 mm on all sides. Use a 12-point standard font, such as Times New Roman, and double-space the entire text, including the abstract and references.
- **Abbreviations:** Use the complete term at first mention, followed by the abbreviation in parentheses. Abbreviations must not be used in the title.
- **Numbers:** All numbers should be written as Arabic numerals, except at the beginning of a sentence.
- **Survey tools:** Authors must obtain permission from the copyright holder to use any psychosocial questionnaire.
- **Equipment**: When identifying machinery or equipment, include the model and manufacturer in parentheses. Brand names (™, ®) should be used only when necessary.
- **Inclusive language:** Authors are encouraged to use language that acknowledges diversity and respects all individuals. Writing should be free of bias, stereotypes, and cultural assumptions. Gender neutrality is encouraged, such as by using plural nouns (e.g., "patients") rather than gendered pronouns.
- **Reference style:** References and citations must follow National Library of Medicine (NLM) style. Authors are responsible for ensuring adherence to NLM guidelines.
- **Statistical reporting:** Authors must report appropriate effect-size measures, such as Cohen's d, odds ratios, relative risks, and η^2, and 95% confidence intervals (CIs)

alongside p-values wherever applicable. Reporting p-values alone is insufficient. The statistical software and version used must be specified in the Methods section (e.g., IBM SPSS Statistics 29.0, R 4.3.0, SAS 9.4). All statistical tests must be two-tailed unless otherwise justified.

- **English-language quality:** To maintain high standards of linguistic quality and international readability, the Editorial Board may require authors of accepted manuscripts to submit a certificate of professional English editing. Alternatively, if generative AI tools were used for linguistic refinement, authors must provide a detailed disclosure of the tools and processes used, as specified in the "Policies on the Use of Generative AI" section. The Editorial Board reserves the right to request these documents before final publication.
- **Sex and gender equity:** CHNR adheres to the SAGER (Sex and Gender Equity in Research) guidelines to promote gender-sensitive research and systematic reporting of sex and gender. Authors should use the terms "sex" (a biological attribute) and "gender" (an attribute shaped by social and cultural contexts) carefully and distinguish between them. The sex and gender of study participants should be clearly specified in the title or abstract so that the applicability of the findings is transparent from the outset. In the Methods section, authors should describe how sex or gender was determined and justify its relevance to the study design. In the Results section, authors are encouraged to provide data disaggregated by sex or gender, where appropriate. If no such analysis was conducted, the Discussion section must include a rationale for the omission and address how it may affect interpretation and generalizability. For more information, please refer to the SAGER guidelines (https://doi.org/10.1186/s41073-016-0007-6).

3. Reporting Guidelines for Specific Study Designs

Authors are encouraged to adhere to the relevant reporting guidelines for their study design. The EQUATOR Network (https://www.equator-network.org/) provides a comprehensive list.

Study Design	Reporting Guideline
Observational studies (cohort, case-control, cross-sectional)	STROBE
Qualitative studies	COREQ, SRQR
Quasi-experimental / non-randomized trials	TREND
Randomized controlled trials	CONSORT
Diagnostic accuracy / assessment scale	STARD
Systematic review and meta-analysis	PRISMA, MOOSE
Scoping review	PRISMA-ScR
Quality improvement studies	SQUIRE
Animal studies	ARRIVE 2.0
Clinical trial protocol	SPIRIT
Mixed-methods research	GRAMMS

4. Sequence of Headings in an Original Article

The manuscript should be organized as follows, with each section clearly delineated.

Section	Components
Beginning section	Cover letter / Title page / Abstract and keywords
Middle section (main text)	Introduction / Methods / Results / Discussion / Conclusion
Ending section	ORCID and ResearcherID / Authors' contributions / Conflict of interest / Funding resource / Data availability / Acknowledgements / Declaration of generative AI and AI-assisted technologies in the writing / Supplementary materials / References
Other elements	Tables and Figures

1) Beginning Section

(1) **Cover Letter**

Authors must include a cover letter to the editor that summarizes the main components of the manuscript and explains what makes its contribution original and relevant to the aims and scope of CHNR. The author(s) should also address any authorship or publication matters they wish the editors to consider. Disclosure of AI tool use must also be included in the cover letter.

(2) **Title Page**

- The title page should include the following items in this order: title, running title, manuscript type, author(s), corresponding author, conflict of interest, IRB approval, Medical Subject Headings (MeSH; https://www.ncbi.nlm.nih.gov/mesh/) keywords, number of references, and word count of the English abstract.

- Manuscript type: One of the following should be noted: original article, review article, editorial, or invited paper.
- Author(s): This section should list the names of all authors, with each author's position and affiliation, including title, department, and the location of the institution to which the work should be attributed. It should also include each author's ORCID number and ResearcherID and describe each author's role in the study.
- Corresponding author: The corresponding author should be identified by full address, including zip code, email address, telephone number, fax number, and ORCID number or ResearcherID.
- Conflict of interest: Any matter relevant to the research should be noted here, such as sources of research funding, conflicts of interest, or an indication that the manuscript is derived from a dissertation or thesis for an academic degree program.
- IRB approval: The author should provide information about the institution that granted IRB approval, including the approval number and informed consent process. If the study did not involve humans or animals, a statement regarding IRB exemption should be included.
- MeSH keywords: Keywords must be drawn from the MeSH list, include no more than five terms, and be listed in alphabetical order.
- Number of references: Original articles should include no more than 30 references. However, for articles with no reference restriction, such as meta-analyses, systematic reviews, or structural equation modeling studies, authors may provide more references.
- Number of words in the abstract: The abstract word count should be noted and should not exceed 250 words.

(3) **Abstract and Keywords**

An abstract of up to 250 words, including for review articles, should appear on a separate page. It should state the main factual points, including the purpose, methods, results, and conclusions. The abstract should be accompanied by three to five MeSH keywords for indexing, listed in alphabetical order. The abstract must not include abbreviations, references, or diagrams.

2) Middle Section (Main Text)

The main text should be organized in the following order: Introduction, Methods, Results, Discussion, and Conclusion.

(1) **Introduction:** Clearly state the study rationale and the main research question or hypothesis, and provide a relevant literature review or background summary.

(2) **Methods:** Describe the study design, setting and sample, ethical considerations, measurements or instruments, data collection procedures, and data analysis. For qualitative studies, the research instrument may be omitted. An Ethics Statement must be provided immediately after the Methods heading in a text-box format.

> **Example 1:**
> *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 (or their parents/legal guardians).*
> **Example 2:**
> *Ethics statement: This study is a literature review of previously published studies and was therefore exempt from Institutional Review Board approval.*

- Example 1: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 or their parents/legal guardians.
- Example 2:Ethics statement: This study is a literature review of previously published studies and was therefore exempt from Institutional Review Board approval.
- Statistical analysis: Authors must specify the statistical software and version used (e.g., IBM SPSS Statistics 29.0, R 4.3.0, SAS 9.4). Effect sizes and 95% confidence intervals (CIs) must be reported alongside p-values. The alpha level for statistical significance must be stated explicitly, typically as $\alpha = .05$. For complex models, such as multilevel modeling or structural equation modeling, model fit indices must be provided.
- For systematic reviews and meta-analyses, authors must provide a PROSPERO registration number (https://www.crd.york.ac.uk/prospero/) in both the abstract and the Methods section to ensure transparency and reproducibility. For randomized controlled trials (RCTs), registration in an ICMJE-recognized clinical trial registry is mandatory, and the registration number must be clearly cited in the manuscript. In exceptional cases in which registration was not possible, a compelling justification must be submitted in the cover letter for evaluation by the Editorial Board.

(3) **Results:** Describe the main results logically and concise-

ly. Report levels of statistical significance and confidence intervals where appropriate. Do not duplicate data presented in tables or figures.

(4) **Discussion:** Base the Discussion only on the reported results. Compare and contrast the findings with relevant prior studies. Describe advances in nursing practice and knowledge development. Discuss limitations and future research directions.

(5) **Conclusion:** State the conclusions and recommendations for further study. Do not summarize the study results again.

3) Final Section

(1) **ORCID and ResearcherID:** Authors should provide their ORCID number and ResearcherID.

(2) **Authors' contributions:** Authors' contributions should be described according to the CRediT authorship taxonomy.

(3) **Conflict of interest:** Authors must disclose commercial or similar relationships with products or companies mentioned in, or related to the subject matter of, the submitted article. If there are no conflicts of interest, the following statement must be included: "*The authors declare no conflict of interest*."

(4) **Funding:** Acknowledge all sources of funding for the manuscript. If there was no funding, state: "None."

(5) **Data sharing and availability:** Authors should include a Data Availability Statement specifying how readers can access the data and resources supporting the findings. In accordance with the data-sharing plan, authors are required to deposit de-identified data in a recognized repository and provide the DOI and registered site information. For data that are not publicly deposited, the corresponding author shall be the primary point of contact for verifying and facilitating data availability. For guidance on preparing the Data Sharing Plan, authors should consult the Research Data Sharing Policy (Section II.7), which contains example statements and policy requirements.

(6) **Acknowledgements:** Persons who contributed to the study or manuscript but did not meet the authorship requirements may be listed here. Written permission should be obtained from any person or organization mentioned in this section.

(7) **Declaration of generative AI and AI-assisted technologies in the writing:** Authors must disclose the use of generative AI and AI-assisted technologies in the writing process in a new section headed "Declaration of Generative AI and AI-assisted Technologies in the Writing Process," placed before the References list. This declaration excludes the use of basic tools for checking grammar, spelling, references, and similar items. No statement is required if there is no information to disclose.

> Example:
> *During the preparation of this work, the author(s) used [NAME TOOL/SERVICE] in order to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.*

(8) **Supplementary materials:** Supplementary materials that aid readers' understanding or contain data too extensive for the main text may be presented as supplementary data.

(9) **References:** See Section III.5 for formatting details. Authors are responsible for the accuracy of the references. The use of DOIs is strongly encouraged.

(10) **Tables and figures:** The total number of tables and figures in a manuscript must not exceed five. See Section III.6 for formatting details.

5. Reference Format

References must follow NLM citation style (Citing Medicine: The NLM Style Guide for Authors, Editors, and Publishers, 2nd ed.; https://www.ncbi.nlm.nih.gov/books/NBK7256/). References should be numbered consecutively in the order in which they appear in the text, with numbers in brackets [ ]. Use the original reference number if a reference is cited more than once. If a work has seven or more authors, list the first six followed by "et al." The use of DOIs is strongly encouraged. The recommended number of references is 30 or fewer for an original article, with no limit for meta-analyses, systematic reviews, or structural equation modeling studies.

1) **Journals**

Journal names should be abbreviated according to the NLM Catalog. For six or fewer authors, list all authors. For more than six authors, list the first six followed by "et al."

· *Park IT, Oh WO. Evaluation of a child abuse prevention program for unmarried mothers in South Korea: a single-case ex-*

perimental design. Child Health Nurs Res. 2024;30(3):187-198. https://doi.org/10.4094/chnr.2024.018

- *Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, et al. Epidemiology of COVID-19 among children in China. Pediatrics. 2020;145(5):e20200702. https://doi.org/10.1542/peds.2020-0702*
- *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 Nurs Res. 2014;20(3):205-214. https://doi.org/10.4094/chnr.2014.20.3.205*
- *Cesare M, Cocchieri A. Can an increase in nursing care complexity raise the risk of intra-hospital and intensive care unit transfers in children? A retrospective observational study. J Pediatr Nurs. 2024 Nov 28 [Epub]. https://doi.org/10.1016/j.pedn.2024.11.005*

2) **Books and Book Chapters**

- *Book: Harding MM, Kwong J, Roberts D, Hagler D, Reinisch C. Lewis's medical-surgical nursing: assessment and management of clinical problems. 12th ed. St. Louis (MO): Elsevier; 2023.*
- *Book chapter: Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. In: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York (NY): McGraw-Hill; 2002. p. 93-113.*

3) **Scientific and Technical Reports**

- *World Health Organization. World health statistics 2023: monitoring health for the SDGs, sustainable development goals. Geneva (Switzerland): World Health Organization; 2023.*
- *Korean Women's Development Institute. 2015 National multicultural family survey report. Seoul (Korea): Ministry of Gender Equality & Family; 2016. Report No.: MOGEF2016-3.*

4) **Unpublished Theses or Dissertations**

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

5) **Conference Proceedings**

- *Chu H, Rosenthal M. Search engines for the World Wide Web: a comparative study and evaluation methodology. Proceedings of the 59th Annual Meeting of the American Society for Information Science; 1996 Oct 21-24; Baltimore (MD). Medford (NJ): Information Today; 1996. p. 127-135.*

6) **Web**

- *World Health Organization. Coronavirus disease (COVID-19) pandemic [Internet]. Geneva (Switzerland): World Health Organization; 2020 [cited 2024 Jan 15]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019*
- *Statistics Korea. Cause of death statistics in 2023 [Internet]. Daejeon (Korea): Statistics Korea; 2024 [cited 2024 Dec 10]. Available from: https://kostat.go.kr/*

7) **Datasets**

- *Kraemer MU, Sinka ME, Duda KA, Mylne A, Shearer FM, Brady OJ, et al. The global compendium of Aedes aegypti and Ae. albopictus occurrence [dataset]. Dryad Digital Repository; 2015 [cited 2024 Dec 10]. Available from: https://doi.org/10.5061/dryad.47v3c*

8) **Software**

- *R Core Team. R: a language and environment for statistical computing, version 4.4.0 [software]. Vienna (Austria): R Foundation for Statistical Computing; 2024. Available from: https://www.r-project.org/*

6. Table and Figure Format

The total number of tables and figures in a manuscript must not exceed five. All tables and figures should be understandable when presented separately from the rest of the manuscript and should present information relevant to the study.

1) **Table Formatting**

- Use single horizontal lines only. Do not use vertical lines.
- The title of a table should appear above the table. Use sentence case for table titles. Example: Table 1. Responses to question types
- Tables should be numbered consecutively, such as Table 1, Table 2, and so on.
- Abbreviations, symbols, and explanatory notes should be provided in table footnotes. All abbreviations used in a table should be defined in the footnotes of every table in which they appear. Example: HR, heart rate; T, temperature.
- In a table, use superscript lowercase letters to indicate

footnotes. Example: a) Surviving case; b) Deceased case.

- For statistics that can exceed 1, include a leading zero before the decimal point; for statistics that cannot exceed 1, omit the leading zero. Examples: t = 0.26, F = 0.92; p < .001, r = .01, R^2 = .61.
- Statistical significance (p-values) should be presented without a footnote and rounded to three decimal places. Example: p = .003. If p = 0.000, report p < .001. If p = 1.000, report p > .999.

2) **Illustration and Photograph Format Rules**

- The title should appear below an image. Use sentence case for figure titles. Example: Figure 1. Mean responses to questions by student grade categories.
- Acceptable figure file formats are BMP, JPG, PSD, TIF, AI, EMF, EPS, WMF, DOC, XLS, PPT, and PDF.
- The image size should be 102 × 152 mm (4 × 6 inches). Larger images may be permitted; however, each image must not exceed 203 × 254 mm (8 × 10 inches).
- If one figure contains two or more images, consecutive alphabetical letters should be used to distinguish the images. Examples: Figure 1A, Figure 1B.
- For photomicrographs, identify the region from which the tissue was extracted and the staining method. A magnification scale must be included.

3) **Quotations from Other Sources**

- Citations for illustrations and tables reproduced from other sources may follow any recognized style, such as NLM or APA. Written permission must be obtained from the original publisher if the source is not open access.

4) **Image Manipulation Policy**

- All submitted figures must accurately represent the original data. Digital image processing must comply with the journal's Image Integrity Policy (Section II.6). Authors must confirm in the Methods section that no image manipulation beyond acceptable global adjustments has been performed. Color figures should be designed with accessibility in mind; authors are encouraged to use color-blind-friendly palettes and ensure that figures remain interpretable in grayscale.

IV. Manuscript Submission and Peer Review

1. Submission

All manuscripts must be submitted online through the CHNR submission system (http://www.chnr-submission.org/) or the CHNR website (https://www.e-chnr.org/). Authors should review the submission guidelines and complete the author checklist before submission.

During submission, all authors must provide their ORCID and ResearcherID. All required forms are available on the CHNR website (https://www.e-chnr.org/) and the Korean Academy of Child Health Nursing website (https://www.childnursing.or.kr).

2. Peer Review Process

1) Initial Screening (Desk Review)

Upon submission, the editorial office and Editor-in-Chief conduct an initial triage. All submissions are screened for plagiarism using the Crossref Similarity Check tool powered by iThenticate. Manuscripts may be returned without peer review (desk rejection) if they fall outside the journal's aims and scope, fail to follow formatting guidelines, demonstrate insufficient English proficiency, or have a high similarity index.

2) Double-Blind Peer Review

CHNR operates a strict double-blind peer review process in which the identities of both authors and reviewers are kept confidential. To ensure a fair evaluation, authors must remove all identifying information, including names, affiliations, and acknowledgements, from the main manuscript file. The title page, which contains author details, must be submitted as a separate file. At least two independent expert reviewers are assigned by the Editorial Board based on academic expertise and publication history.

3) Review Outcomes and Author Revisions

Reviewers are asked to complete their evaluations within two to three weeks. Authors can generally expect an initial decision within 6 to 8 weeks of submission. The Editorial Board will issue one of the following decisions: Accept, Minor Revision, Major Revision, or Reject.

If revisions are requested, authors must submit the revised

manuscript with a detailed point-by-point response letter. Revisions must be completed within 15 days for minor revisions and 30 days for major revisions. If the revised manuscript is not submitted by the deadline, it will be considered a new submission. Authors who require an extension must contact the Editorial Board in advance. A manuscript may undergo up to two rounds of peer review before a final decision is made.

4) Statistical and Methodological Review

If a manuscript involves complex statistical analyses or advanced research methodologies, the Editorial Board may request an additional review by a specialized statistical editor to ensure rigor, reproducibility, and accuracy.

5) Final Decision

The Editor-in-Chief retains final authority to accept or reject a manuscript based on reviewers' feedback, associate editors' recommendations, and the scientific merit of the study. Information regarding the internal review process or editorial discussions will not be shared publicly.

6) Submission by Editors

Manuscripts authored by the Editor-in-Chief, associate editors, or Editorial Board members are subject to the same rigorous, blinded peer review process as all other submissions. The submitting editor is strictly prohibited from accessing the peer review system for their own manuscript and is completely excluded from reviewer selection and final decision-making.

7) Reviewer Responsibilities

Peer reviewers play a critical role in maintaining the quality and integrity of research published in CHNR. All reviewers are expected to adhere to the following responsibilities: (a) notify the editor promptly if a conflict of interest exists and recuse themselves if necessary; (b) maintain strict confidentiality of all submitted materials and not share or discuss manuscripts with third parties; (c) complete evaluations within the agreed timeframe and notify the editor in advance if unable to do so; (d) provide constructive, evidence-based, and unbiased feedback focused on the scientific merit of the manuscript; (e) comply with the journal's policies on the use of AI tools (see Section V.7), particularly the prohibition against uploading any part of a submitted manuscript into a non-confidential AI system; and (f) refrain from any unauthorized use of submitted manuscripts for personal purposes, including citing, using data from, or appropriating ideas from a manuscript before its publication. Such conduct constitutes research misconduct and will be reported to the relevant institution.

8) Appeals and Complaints

Authors may appeal an editorial decision within two weeks of receiving the decision letter. Appeals must be submitted in writing to the Editor-in-Chief with detailed, evidence-based scientific justifications. The appeal will be reviewed by the Editor-in-Chief and at least one independent associate editor who was not involved in the original review. The process adheres strictly to COPE guidelines for handling appeals (https://publicationethics.org/appeals). The decision reached after the appeal is final, and second appeals are not considered.

V. Publishing and Editorial Policy

1. Copyright

The copyright of all published manuscripts, including rights to digital content, is owned by the Korean Academy of Child Health Nursing. All authors must agree to the transfer of copyright during the submission process. Upon acceptance of the manuscript, the corresponding author must submit a signed Copyright Transfer Agreement on behalf of all contributing authors.

2. Open Access Policy

CHNR is an open-access journal. Articles are distributed under the terms of the Creative Commons Attribution-Non-Commercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0; https://creativecommons.org/licenses/by-nc-nd/4.0/), which permits copying and redistribution of the material in any medium or format, in unadapted form only, for non-commercial purposes, provided that appropriate credit is given to CHNR.

All articles are freely available to read and download from the CHNR website (https://www.e-chnr.org/) immediately and permanently after publication, in accordance with the Budapest Open Access Initiative definition of open access and the open access policy of PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/).

3. Article Processing Charge

Upon acceptance, authors must pay an article processing charge (APC). The standard fee is 600,000 KRW for a manuscript of up to 10 pages. For manuscripts exceeding this limit, an additional charge of 60,000 KRW per page applies. This fee covers publication costs, including typesetting, XML conversion, and DOI registration.

Authors from least developed countries (https://www.un-.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf) may be eligible for a fee reduction after consultation with the Editorial Board.

4. Clinical Trials Registration

All clinical trials, as defined by the ICMJE, must be registered in a publicly accessible trial registry at or before the time of first participant enrollment. For all other study types, including systematic reviews, prospective registration is strongly encouraged. If a study has been registered, the registration number must be cited in both the abstract and the main body of the manuscript.

Acceptable registries include the following:

- WHO International Clinical Trials Registry Platform (ICTRP; https://www.who.int/ictrp/en/)
- ClinicalTrials.gov (https://clinicaltrials.gov/)
- International Standard Randomized Controlled Trial Number Registry (ISRCTN; https://www.isrctn.org)
- Clinical Research Information Service, Korea (CRIS; https://cris.nih.go.kr)

Note: Registration may be waived for studies involving purely educational interventions that do not measure health-related outcomes. Authors should discuss this waiver with the Editorial Board before submission.

5. Preprint Policy

CHNR allows authors to submit manuscripts that have been posted as preprints. Preprints are not treated as duplicate submissions or duplicate publications. Authors are advised to disclose preprint status, including the DOI, in the cover letter during submission; otherwise, the submission may be flagged by the similarity check tool.

Preprint submissions are processed through the same peer-review process as all other submissions. If the manuscript is accepted for publication, authors are advised to update the preprint record with a link to the published article in CHNR, including the DOI. Authors are strongly encouraged to cite the final published article rather than the preprint in subsequent submissions.

6. Archiving Policy

To ensure permanent accessibility and long-term preservation of the scholarly record, CHNR maintains a comprehensive digital archiving and backup strategy. All published content is deposited in multiple stable repositories to ensure that metadata and full-text articles remain available even if the journal is no longer published. The archives and backup databases include the following:

- National Library of Korea (http://nl.go.kr)
- PubMed Central (PMC) (https://www.ncbi.nlm.nih.gov/pmc/journals/4129/)
- ScienceCentral (https://www.e-sciencecentral.org/journals/169/)

7. Policies on the Use of Generative AI

CHNR adheres to the AI-assisted technology guidelines established by the ICMJE (https://www.icmje.org/icmje-recommendations.pdf) and follows updated international standards as of 2026.

Responsibilities of Authors

- AI tools cannot be listed as authors. Human authors bear full responsibility for the accuracy, integrity, and originality of the entire manuscript.
- Disclosure is mandatory. Authors must explicitly disclose the use of any generative AI or AI-assisted technologies, such as large language models (LLMs), chatbots, or image generators, in the cover letter and in the relevant section of the manuscript. The specific tools used and the reason for their use must be stated. Writing assistance should be noted in the Acknowledgements section; use in data collection, analysis, or figure generation must be described in the Methods section.
- AI-generated outputs cannot be cited as primary sources.

- Nondisclosure may constitute research misconduct. Failure to disclose AI use may be treated as a violation of publication ethics.
- Image, figure, and artwork restrictions: The use of generative AI or AI-assisted tools to create or alter images is strictly prohibited, except when such use is integral to the research design or methodology, such as in biomedical imaging. In such cases, authors must transparently describe the process in the Methods section, specifying the model name, version, and manufacturer to ensure reproducibility. The journal reserves the right to request raw, pre-adjusted images for editorial assessment.
- Basic tools are exempt. Grammar-checking, spell-checking, and literature-search tools do not require disclosure.

Required declaration format, to appear before the References list:
"*During the preparation of this work, the author(s) used [NAME OF TOOL/SERVICE] to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.*"

Responsibilities of Peer Reviewers

- Submitted manuscripts are strictly confidential. Reviewers are prohibited from uploading any part of a submitted manuscript into AI systems that do not guarantee confidentiality.
- Reviewers may use closed-system AI, defined as AI that does not save inputs for training, solely to refine the language of their reviews. This use must be declared to the journal, and all AI-generated content must be independently verified.
- Reviewers must comply with the journal's AI policy and obtain prior permission from the journal before using any AI tools in the review process.

Responsibilities of Editors

- Editors must ask authors about AI use and ensure proper disclosure.
- The use of AI for language correction is generally permitted. The use of AI for content generation must be critically reviewed.
- Uploading manuscripts into AI systems without the authors' explicit permission is strictly prohibited.

VI. Indexing and Abstracting

Child Health Nursing Research is indexed and abstracted in the following databases:

- Scopus
- PubMed / PubMed Central (PMC)
- CINAHL (Cumulative Index to Nursing and Allied Health Literature)
- Korea Citation Index (KCI)
- DOAJ (Directory of Open Access Journals)
- KoreaMed / KoMCI
- ScienceCentral
- Crossref (DOI registration)
- Google Scholar

Contact Information

Editorial Office

Child Health Nursing Research (CHNR) website: https://www.e-chnr.org/

(The current list of Editorial Board members is available on the journal website.)

- E-submission: http://www.chnr-submission.org/
- Email: office@e-chnr.org

Korean Academy of Child Health Nursing (KACHN) Website: https://www.childnursing.or.kr/

Journal Information

- eISSN: 2287-9129 | pISSN: 2287-9110
- Published quarterly: January, April, July, October

Author Checklist

CHNR
Child Health Nursing Research

Title of the Manuscript : _____

Please check the items below (if indicated) before submission of the manuscript:

1. GENERAL CONSIDERATION

□ This article has not been published elsewhere and will not be published elsewhere.
□ The manuscript is typewritten and double-spaced in a file formatted for A4-sized paper.
□ The number of pages including tables and figures is no more than 20.
□ The parts of the manuscript are presented in the following order: title page, English abstract, introduction, methods, results, discussion, conclusions, conflicts of interest, acknowledgments, references, tables, and figures.
□ Page numbers appear at the bottom of each page.

2. TITLE PAGE

□ The title, a separate running title (if the main title exceeds 40 characters in English), author names, their affiliations, research design type, number of words in the English abstract and number of references, keywords (English), and any relevant statements of related funding or conflicts of interest, or mention of an associated graduate thesis are all presented.
□ At the bottom of the title page, the email address, telephone, fax, and ORCID number, ResearcherID, plus the full postal address of the corresponding author, are provided.

3. ENGLISH ABSTRACT

□ The abstract contains no more than 250 words with 5 or fewer keywords at the bottom.
□ The abstract section contains the following in this order: title, author names with affiliations, body of abstract (Purpose, Methods, Results, and Conclusion), and keywords.
□ The keywords are drawn from the MeSH list.
□ The abstract does not include abbreviations, references, or diagrams.

4. MAIN TEXT

□ The main text consists of an introduction, methods, results, discussion, conclusions, conflicts of interest, and acknowledgments.
□ This article has not been published elsewhere and will not be published elsewhere.

5. REFERENCES

□ Every article in the reference list has been cited in the proper location(s) within the main text.
□ References and citations may follow any style, for example, NLM, APA, etc. However, after the manuscript is accepted, all references and citations must follow Citing Medicine: The NLM Style Guide for Authors, Editors, and Publishers, 2nd Edition (2007).
□ The number of references is recommended to be 30 or fewer for an article.

6. TABLES AND FIGURES

□ The titles should be placed above tables and below figures.
□ Non-standard abbreviations should be defined below tables and figures.
□ When using numbers, the units should be specified.

7. RESEARCH AND PUBLICATION ETHICS

□ Research involving humans that is submitted to CHNR should comply with 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/DoHOct2013-JAMA.pdf).
□ The publication and research ethics of CHNR strictly follow the ICMJE guidelines (http://www.icmje.org), which

state that authorship requires "substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND drafting the work or revising it critically for important intellectual content; AND final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All other contributors should be credited in the acknowledgments."

□ Duplicate publication or duplicate submission is prohibited. Manuscripts that have been published or are being submitted to other journal(s) must not be submitted to CHNR. Manuscripts that have been published or are currently under consideration for publication in CHNR must not be submitted to other journals.

□ Manuscripts that do not follow international ethical standards of research and publication (i.e., those involving 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.

□ Institutional Review Board (IRB) approval
- Approved by an IRB ( )
- Non-human or animal research ( )

• The authors of this article understand and confirm the abovei nstructions.

• Name of corresponding author: _____ Date: _____/_____/_____ Signature: _____

Copyright Transfer Agreement and Disclosure of Conflict of Interest

CHNR
Child Health Nursing Research

• Manuscript Number: _____

• Title of the Manuscript: _____

COPYRIGHT TRANSFER AGREEMENT

We the undersigned authors have all made significant contributions to this manuscript and agree to its submission to *Child Health Nursing Research* and, if accepted, to its publication in this journal. We warrant that this article is original, does not infringe on any copyright or other proprietary right of any third party, is not under consideration by another journal, and has not been previously published.

DISCLOSURE OF CONFLICT OF INTEREST

Each author is responsible for disclosing to the publisher all potential conflicts of interest regarding this manuscript (any financial support or benefits that have been received by the author(s) that could affect the work reported in the article) and whether the author regards them to be actual conflicts of interest.

List any potential conflicts of interests of this manuscript or indicate "None"

_____

_____

Please sign below to indicate that the necessary copyright transfer and disclosure of conflicts of interest have been completed.

Date :

Name	Signature	Name	Signature