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

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

Aims and Scope

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

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REVIEW ARTICLE

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Trends in e-cigarette research in Korea: a comparative analysis of adult and adolescent studies

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Purpose: This study aimed to analyze the characteristics and trends of domestic research on electronic cigarettes published in Korean academic journals between 2017 and September 2025, with a comparative focus on studies involving adults and adolescents.
Methods: The study employed a descriptive literature analysis design. A total of 87 articles were identified through searches of major Korean academic databases (RISS, ScienceON, and DBpia) and selected based on predefined inclusion and exclusion criteria. The studies were classified by research population (adults vs. adolescents) and analyzed according to publication year, study design, data sources, and research themes.
Results: A greater number of studies focused on adults than on adolescents, and quantitative research predominated in both groups. Most quantitative studies relied on secondary data; notably, 88.0% of adolescent studies used data from the Korea Youth Risk Behavior Survey (KYRBS). Among adult studies, the most common research themes were health effects and associated factors, whereas adolescent studies most frequently addressed smoking cessation and health effects.
Conclusion: Although domestic research on electronic cigarettes has steadily increased, it remains concentrated mainly on cross-sectional quantitative designs, with limited use of longitudinal or qualitative approaches. In particular, the excessive reliance on secondary data in adolescent research limits the ability to capture emerging patterns of e-cigarette use and evolving risk perceptions. Therefore, future studies should apply diverse research designs to gain an in-depth understanding of the social and psychological contexts of adolescent e-cigarette use.

Keywords: Adolescent; Adult; Electronic nicotine delivery system; Trends

INTRODUCTION

Over the past decade, tobacco products have evolved rapidly. Moving beyond an earlier pattern in which most smokers used only conventional cigarettes, the use of a variety of tobacco products has become increasingly widespread [1]. Central to this shift is the e-cigarette, which has emerged as a significant new form of tobacco product.

According to the Korea Disease Control and Prevention Agency, e-cigarette use is increasing among both adults and adolescents in Korea. Data from the Korea National Health and Nutrition Examination Survey (KNHANES) show that the prevalence of current conventional cigarette smoking among adults declined from 20.6% in 2020 to 19.6% in 2023. In contrast, the prevalence of current liquid e-cigarette use and current heated tobacco product (HTP) use increased over the same period, from 3.2% to 4.5% and from 5.1% to 6.1%, respectively [2]. The Korea Youth Risk Behavior Survey

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(KYRBS) shows similar trends among adolescents. Among adolescents, the prevalence of current conventional cigarette smoking decreased from 4.4% in 2020 to 3.6% in 2024. In contrast, the prevalence of current liquid e-cigarette use and current HTP use increased from 1.9% to 3.0% and from 1.1% to 1.9%, respectively, during the same period. These findings suggest that smoking patterns are shifting from conventional cigarette-centered use toward e-cigarette-centered use [3].

E-cigarettes have gained popularity through aggressive tobacco industry marketing strategies. Marketing messages promoted by the tobacco industry, such as "less harmful," "harm reduction," "better health," and "smoking cessation aid," have drawn smokers' attention to e-cigarettes [4]. In practice, some smokers use e-cigarettes to reduce cigarette consumption, for smoking cessation, or as substitutes for conventional cigarettes in smoke-free environments. Moreover, e-cigarettes have evolved into forms that are difficult to recognize as tobacco products, such as USB (universal serial bus) drives, watches, and car keys, making it difficult even for teachers and parents to detect adolescents' use [1]. Whereas adults may regard e-cigarettes primarily as cessation aids or substitutes for conventional cigarettes, adolescents may be drawn to them for different reasons, including novel designs, cultural appeal, and ease of concealment [5].

Research on e-cigarettes has expanded globally. According to an analysis by Li et al. [6], research on e-cigarettes was conducted in 94 countries between 2000 and 2021, with the United States leading the field, accounting for 59.0% of all publications (n=4,709). This was followed by the United Kingdom (10.4%), Canada (4.4%), and Australia (4.3%), while Korea contributed 121 publications, representing 1.5% of the total. Building on this growing body of evidence, international research has produced numerous systematic reviews examining, among adults, the health effects of e-cigarettes, differences by tobacco industry funding, and overall research trends [7-9]. Systematic reviews focusing on adolescents have also analyzed health effects, associations with smoking initiation, and patterns of use [10,11]. In Korea, several systematic reviews have been conducted among adults regarding the health effects of HTPs [12] and liquid e-cigarettes [13]. However, comprehensive syntheses of domestic research trends remain limited, and systematic reviews or trend analyses focusing on adolescents have rarely been conducted.

E-cigarette regulations vary internationally. In the United States, following legislative amendments in 2022, federal authorities regulate the manufacture, distribution, and marketing of e-cigarette products, including those containing synthetic nicotine, and require a premarket authorization process for products to be sold commercially [14]. In contrast, the United Kingdom has pursued strong legislation aimed at achieving a "smoke-free generation," including measures to prohibit the sale of tobacco to individuals born in or after 2009 [15], while also informing adult smokers that e-cigarettes may be used as a smoking cessation support tool from a harm-reduction perspective [16]. These cross-national differences in regulations and social contexts influence users' exposure and motivations, making it challenging to apply international findings directly to the Korean context.

Despite these differences, few domestic studies have directly compared e-cigarette use between adults and adolescents, even though their motivations and usage contexts differ substantially. Adults often use e-cigarettes for quit attempts or consumption reduction; however, their effectiveness remains limited, and e-cigarettes have been reported to contribute to dual use with conventional cigarettes [17]. In contrast, adolescents often initiate e-cigarette use due to psychosocial factors such as curiosity, peer pressure, and marketing exposure, which increases the risk of long-term nicotine addiction and progression to conventional cigarette smoking [18]. Comparative research is therefore essential for developing targeted regulatory policies and prevention strategies.

Accordingly, this study aims to identify trends in e-cigarette–related research on adults and adolescents published in Korean academic journals from 2017, when HTPs were introduced in Korea, to September 2025. Through this analysis, the study seeks to suggest directions for future research and, by comparing findings from adult and adolescent studies, to provide foundational evidence for the development of population-specific tobacco control policies and e-cigarette use prevention strategies.

METHODS

Ethical statements: The study was approved by the institutional Review Board (IRB) of Jeonbuk National University (IRB No. 2025-12-038). The Board determined that this study was exempt from review.

1. Study Design

This study employed a descriptive literature analysis to

identify trends in e-cigarette–related research in Korea, focusing on adult and adolescent populations, and was conducted in accordance with reporting guidelines informed by the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) framework.

2. Search Strategy

The publications analyzed in this study were identified through the electronic databases Research Information Sharing Service (RISS), ScienceON, and DBpia, and the search was conducted in consultation with a professional librarian. The literature search covered studies published from 2017, when HTPs began to emerge in the Korean market, through September 2025. Search terms were used in combination, including "전자담배," "궐련형 전자담배," "액상형 전자담배," "electronic cigarette," and "heated tobacco products."

The target population was restricted to studies involving adolescents and adults. Because the adult study populations were heterogeneous (e.g., women, men, military personnel, university students, office workers, middle-aged adults, and older adults), the researchers manually reviewed all retrieved articles and classified the participants as adolescents or adults.

The exclusion criteria were as follows: (1) studies involving participants other than adolescents or adults; (2) studies in which e-cigarettes were not the primary variable; (3) conference abstracts or presentation materials; and (4) studies for which the full text was unavailable.

3. Search Outcomes

The literature selection process is illustrated in Figure 1. A total of 570 records were identified through database searching (RISS, n=234; DBpia, n=183; ScienceON, n=150) and manual searches (n=3). Prior to screening, 254 duplicate records were removed, leaving 316 records for title and abstract screening. During screening, 216 records were excluded for the following reasons: duplicate records (n=60), not targeting adolescents or adults (n=129), not related to e-cigarettes (n=17), and conference abstracts or presentation materials (n=10). As a result, 100 full-text articles were assessed for eligibility. After full-text review, 13 articles were excluded because they were not directly relevant to e-cigarette use among adolescents and adults, and 87 studies were ultimately included in the analysis (Supplements 1, 2).

4. Criteria for Literature Analysis

Data extraction for the 87 included studies was conducted

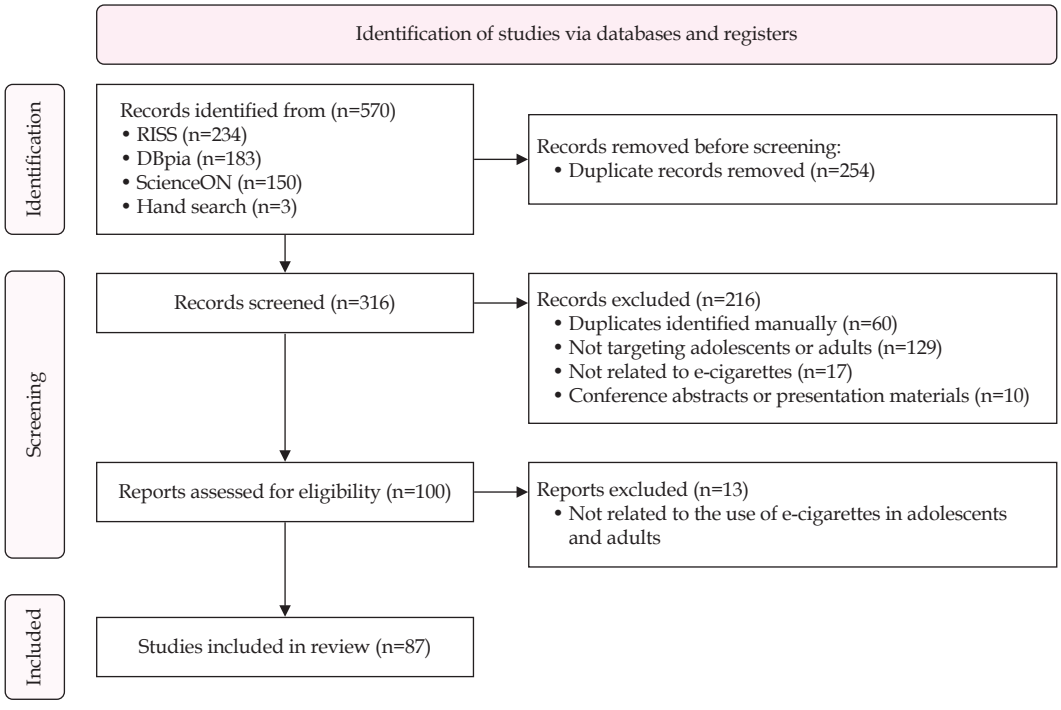

Figure 1. Flow chart of study selection.

by a single researcher based on predefined inclusion, exclusion, and analysis criteria established prior to coding. The screening process was performed twice at different time points to ensure consistency in study selection. Any discrepancies between the two rounds were reviewed and resolved through discussion with another researcher.

1) Year of publication

Studies were categorized by year of publication.

2) Study population

Participants were classified as adolescents or adults. Adolescents were defined as middle and high school students enrolled in formal education. Adults were defined as participants aged 19 years or older, or as participants in adult groups such as university students, office workers, military personnel, and older adults.

3) Study design

Study designs were classified into four types: (1) Quantitative studies: Studies using quantitative data and applying descriptive and/or inferential statistical analyses. (2) Qualitative studies: Studies exploring qualitative aspects, such as participants' experiences or perceptions, and interpreting their meanings. (3) Mixed-methods studies: Studies combining quantitative and qualitative data. (4) Systematic reviews: Studies that systematically collected, appraised, and synthesized prior research on a specific topic using objective procedures.

4) Data source

Studies were classified according to the data source used. (1) Primary data: Data collected using survey instruments developed by the researchers for the study purpose. (2) Secondary data: Data obtained from pre-existing datasets, such as panel data or national surveys.

5) Research theme

Research themes were classified using the six-category framework proposed by Cheon and Hwang [12], which modified the classification criteria from the e-cigarette systematic review protocol suggested by Glasser et al. [19]. The categories were as follows: (1) Health effects: Associations with physical and cognitive outcomes, adverse effects, health impacts of secondhand exposure, and cytotoxicity. (2) Associated factors: Determinants and levels of factors influencing e-cigarette use. (3) Smoking cessation: Cessation rates, extent of use as a means to quit conventional cigarettes, intention to quit, and reasons for quitting. (4) Patterns of use: Ever-use prevalence, current-use prevalence, and frequency of use. (5) Dependence and suicide: Differences in nicotine delivery by product type, differences by individual puffing behavior, degree of addiction, and symptoms related to smoking cessation. (6) Consumer perceptions: Levels of awareness, perceptions, and attitudes toward e-cigarettes, interest, and reasons for use.

RESULTS

1. Trends by Year of Publication

A total of 87 e-cigarette–related studies were published between 2017 and September 2025. The number of publications peaked in 2020, with 15 studies, and then declined gradually thereafter (Figure 2).

By study population, research involving adults increased steadily from five studies in 2017 to a peak of 11 studies in 2021, then showed a gradual downward trend. Research involving adolescents peaked in 2020 with five studies. Throughout the entire period, the number of adolescent-focused studies was consistently lower than that of adult-focused studies, and only one adolescent-focused study had been published as of September 2025.

2. Trends in Study Design and Data Sources

Among the 87 papers analyzed, quantitative studies were most common (n=72; 82.8%), followed by qualitative studies

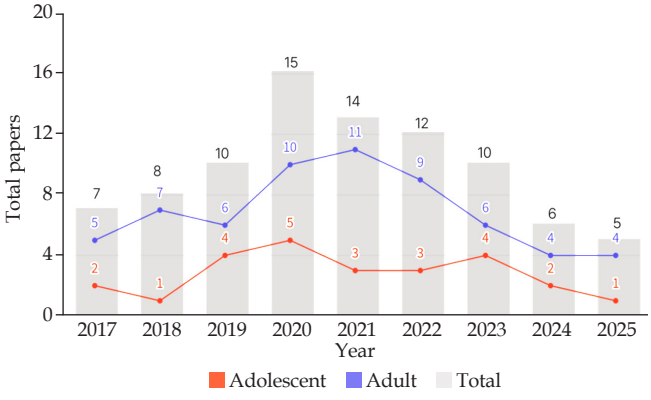

Figure 2. Trends in e-cigarette research publications by study population (2017–2025).

(n=10; 11.5%), mixed-methods studies (n=2; 2.3%), and systematic reviews (n=3; 3.4%) (Table 1). Adolescent-focused studies (n=25) were almost entirely quantitative (n=24; 96.0%) with only one mixed-methods study (n=1; 4.0%), while no qualitative studies or systematic reviews were identified. In comparison, adult-focused studies (n=62) showed greater methodological diversity: quantitative (n=48; 77.4%), qualitative (n=10; 16.2%), systematic reviews (n=3; 4.8%), and mixed-methods (n=1; 1.6%).

To examine data sources used in the included research, a total of 74 studies were analyzed, comprising 72 quantitative studies and two mixed-methods studies (Table 2). Overall, studies using secondary data sources accounted for 51 (68.9%), a higher proportion than studies using primary data sources collected directly by the researchers (n=23; 31.1%). Adolescent research (n=25) relied predominantly on secondary data (n=23; 92.0%), mainly the KYRBS (n=22; 88.0%) and one regional office of education survey (n=1; 4.0%), with 2 studies (8.0%) using primary data. Adult research (n=49) showed more balanced distribution, with 28 studies (57.1%) using secondary data—primarily KNHANES (n=16; 32.7%), Korea Community Health Survey (n=9; 18.4%), and International Tobacco Control Korea Survey (n=2; 4.0%), and the Korean Fiscal Panel Survey (n=1; 2.0%),—and 21 studies (42.9%) using primary data collected via researcher-administered surveys.

Table 1. Numbers of study design (N=87)

Study design	Adolescent	Adult	Sum
Quantitative studies	24 (96.0)	48 (77.4)	72 (82.8)
Qualitative studies	-	10 (16.2)	10 (11.5)
Mixed-methods studies	1 (4.0)	1 (1.6)	2 (2.3)
Systematic review	-	3 (4.8)	3 (3.4)
Sum	25 (100.0)	62 (100.0)	87 (100.0)

Values are presented as number (%).

3. Trends in Research Themes

In this study, research themes were analyzed using the classification criteria proposed by Cheon and Hwang [12]. After excluding three systematic reviews covering multiple themes, leaving 84 studies for analysis (Table 3).

Across all studies, the most frequent themes were "health effects" (n=28; 33.3%), "association factors" (n=17; 20.2%), "smoking cessation" (n=14; 16.7%), "patterns of use" (n=10; 12.0%), "dependence & Suicide" (n=8; 9.5%), and "consumer perceptions" (n=7; 8.3%).

Within the "health effects" theme, adult-focused studies (n=21) outnumbered adolescent-focused studies (n=7). Adolescent-focused studies primarily examined mental health (A8, A67) and allergic diseases (A14, A81), with single studies on sleep health (A45), oral health (A1), and health behavior and status (A75). In contrast, adult-focused studies addressed a broader topic, including mental health (A7, A34, A50, A71), airway and lung injury (A29, A36, A63, A84), allergic diseases (A22, A78), sleep health (A26, A40), oral health (A20, A87), and blood biomarkers (A25, A52). Additional topics, each represented by a single study, included carcinogens (A51), inflammation and oxidative stress (A77), myocardial infarction and angina (A31), cardiac autonomic nerve responses (A30), and self-rated health (A82), demonstrating greater thematic diversity than adolescent-focused research.

When the distribution of themes was examined by study population, in adolescent-focused studies (n=25), "health effects" and "smoking cessation" were most common (each n=7; 28.0%), followed by "association factors" (n=6; 24.0%), "patterns of use" (n=3; 12.0%), and "dependence & Suicide" and "consumer perceptions" (each n=1; 4.0%). Adult-fo-

Table 2. Distribution of data sources in quantitative studies (N=74[a])

Category	Primary data	Secondary data			Sum
		No. (%)	Data source	No. (%)	
Adolescent	2 (8.0)	23 (92.0)	KYRBS	22 (88.0)	25 (100.0)
			Office of Education survey data	1 (4.0)	
Adult	21 (42.9)	28 (57.1)	KNHANES	16 (32.7)	49 (100.0)
			Korea Community Health Survey	9 (18.4)	
			International Tobacco Control Korea Survey	2 (4.0)	
			Korea Fiscal Panel Survey	1 (2.0)	
Sum	23 (31.1)	51 (68.9)			74 (100.0)

Values are presented as number (%).
KYRBS, Korea Youth Risk Behavior Web-based Survey; KNHANES, Korea National Health and Nutrition Examination Survey.
[a]A total of 74 studies (out of 87) were analyzed, including 72 quantitative and two mixed-methods studies, excluding three systematic reviews and 10 qualitative studies.

Table 3. Number of studies by research themes (N=84[a])

Themes	Adolescent (%)	Adult (%)	Sum (%)
Health effects	7 (28.0)	21 (35.6)	28 (33.3)
Allergic diseases	A14, A81	A22, A78	
Sleep health	A45	A26, A40	
Oral health	A1	A20, A87	
Health behavior and status	A75		
Airway & lung injury		A29, A36, A63, A84	
Blood biomarkers		A25, A52	
Carcinogen		A51	
Inflammation & oxidative stress		A77	
Myocardial infarction & angina		A31	
Cardiac autonomic nerve responses		A30	
Self-rated health		A82	
Association factors	6 (24.0)	11 (18.5)	17 (20.2)
Smoking cessation	7 (28.0)	7 (11.9)	14 (16.7)
Patterns of use	3 (12.0)	7 (11.9)	10 (12.0)
Dependence & suicide	1 (4.0)	7 (11.9)	8 (9.5)
Consumer perceptions	1 (4.0)	6 (10.2)	7 (8.3)
Sum	25 (100.0)	59 (100.0)	84 (100.0)

[a]A total of 84 studies (out of 87) were analyzed, excluding three systematic reviews.

cused research showed "health effects" as dominant (n=21; 35.6%), followed by "association factors" (n=11; 18.5%), "patterns of use" (n=7; 11.9%), "dependence & suicide" (n=7; 11.9%), "smoking cessation" (n=7; 11.9%), and "consumer perceptions" (n=6; 10.2%).

Notably, adolescent research placed greater emphasis "smoking cessation" compared with adult research (28.0% vs. 11.9%), while adult research more frequently focused on "health effects" (35.6%) and "association factors" (18.5%).

DISCUSSION

In this study, 87 papers published between 2017 and September 2025 were reviewed to examine research trends on e-cigarettes among adolescents and adults in Korea. The studies were analyzed by year of publication, study design, data source, and research theme. Based on these findings, the main results are discussed below.

Since liquid e-cigarettes were introduced into the Korean tobacco market in 2017, research on e-cigarettes has generally increased, with the largest number of studies published in 2020. This increase is likely related to the coronavirus disease 2019 (COVID-19) pandemic. During this period, greater attention was given to the possible links between e-cigarette use and health issues such as infection risk, respiratory health, and immune function [20]. As a result, studies focusing on adults and the health effects of e-cigarette use may have been conducted more actively. In addition, non-face-to-face research methods, such as online surveys, were relatively easy to use during the pandemic, even when in-person contact was limited. This may explain why adult-focused research continued to be active in 2021 as well as in 2020. In contrast, research on e-cigarettes among adolescents decreased after 2021. This decrease may be related to the strong dependence on secondary data sources, especially the KYRBS, which was used in 88.0% of adolescent-focused studies. Because the KYRBS questionnaire changes little from year to year, it may have been difficult to examine social and environmental changes related to the pandemic or new risk behaviors among adolescents. In addition, access to schools was restricted during the pandemic, and conducting in-person surveys was challenging. These factors may have made it more difficult to collect primary data from adolescent populations. In the future, it will be important to develop more diverse methods for collecting primary data, use qualitative or mixed-methods research designs, and improve survey tools better to reflect rapid social changes in adolescent e-cigarette use.

Quantitative designs were the most common in both adolescent- and adult-focused studies. Among adolescent-focused research, all but one study used a quantitative design, with only one mixed-methods study and no qualitative stud-

ies or systematic reviews. Adult-focused studies also showed a strong preference for quantitative methods, while other study designs accounted for only a small proportion.

Overall, e-cigarette research in Korea targeting both adolescents and adults has been largely based on quantitative cross-sectional designs. This finding aligns with international trends, where cross-sectional designs also predominate [6,21]. However, while 14.1% of international adolescent and young adult studies employed longitudinal designs [21], such approaches remain scarce in Korean research, indicating a notable gap in the domestic literature.

In contrast, international studies involving adolescents and young adults, although still mainly cross-sectional (n=69; 81.2%), have used a wider range of study designs, including longitudinal studies (n=12; 14.1%), repeated cross-sectional studies (n=2; 2.4%), and studies combining cross-sectional and longitudinal approaches (n=2; 2.4%) [21]. Compared with these international trends, longitudinal research on e-cigarette use in Korea is very limited.

Cross-sectional studies have limited ability to examine time order or suggest causal relationships, and they are not well suited to tracking changes in behavior from initiation to cessation or assessing long-term health effects [22]. This limitation is significant in adolescent populations, as ongoing physical and psychological development may influence long-term health outcomes differently than in adults. Therefore, future research in Korea would benefit from expanding prospective cohort studies, conducting repeated cross-sectional surveys with consistent indicators, and adopting longitudinal study designs. In particular, longitudinal studies among adolescents are needed to better understand patterns of e-cigarette and conventional cigarette use over time and their long-term health effects, which can help inform evidence-based policies to protect adolescent health.

Regarding data sources, researcher-administered surveys were far less common in adolescent-focused research than in adult-focused research. Among the 49 adult-focused studies, 21 (42.9%) collected data directly through researcher-administered surveys, whereas among the 25 adolescent-focused studies, only 2 (8.0%) used a researcher-administered survey. Internationally, adult-focused research also frequently relies on surveys or panel studies led by researchers or research institutions and examines a broad range of variables, including product type, nicotine concentration, dual use, cessation outcomes, and biomarkers [23]. These differences likely reflect the practical and ethical barriers to collecting primary data from adolescents (e.g., parental consent, school access approval, privacy procedures, and logistical constraints), which have led to heavy reliance on secondary data sources such as KYRBS. Although KYRBS provides strong representativeness and generalizability, it is limited in capturing emerging use patterns and nuanced determinants, and adolescent self-reports may be affected by social desirability bias, leading to underreporting [24]. Therefore, future research should establish collaborative survey infrastructures among offices of education, schools, and research institutions, refine key variables to enable linkage analyses with KYRBS, strengthen continuity through repeated measurements, and enhance anonymity safeguards and indirect indicators to improve response accuracy.

When examined by research themes, "health effects" accounted for the most significant proportion overall. Within this theme, adult-focused studies addressed a broad range of outcomes, extending to clinical and physiological indicators such as respiratory and cardiovascular measures, inflammation, and autonomic function. In contrast, adolescent-focused studies tended to concentrate on relatively limited areas, primarily mental health and allergic diseases. This contrasts with the international systematic review by Jankowski et al. [7], which comprehensively examined the chemical composition, toxicity, and health effects of HTPs. Accordingly, future adolescent-focused research should broaden this theme by incorporating objective, noninvasive biomarkers (e.g., salivary or urinary cotinine), simple pulmonary function tests, and more robust designs such as longitudinal and repeated cross-sectional studies.

In addition, the second most frequently examined theme was "association factors," and the correlates of e-cigarette use differed markedly between adults and adolescents. Among adults, greater health concerns (A65) and more negative self-rated health (A27) were associated with a higher likelihood of e-cigarette use, possibly reflecting the perception of e-cigarettes as a less harmful alternative. In contrast, adolescent-focused research reported higher use among those who perceived themselves as very healthy (A13), suggesting overconfidence and limited risk awareness. Moreover, adolescents may be more influenced by flavors, aromas, and sleek designs, perceiving e-cigarettes as trendy and self-expressive as well as less harmful [1]. Accordingly, policies and education for both groups should prioritize correcting misconceptions, and adolescent education should foster critical awareness that these attractive features reflect tobacco companies'

marketing strategies.

Within the "association factors" theme, smoking experience showed a clear population difference. Among adults, e-cigarette use was strongly associated with personal smoking history, with higher use among current or former smokers (A35, A62, A69). In contrast, adolescent e-cigarette use appeared to be driven more by social and environmental influences, particularly friends' smoking status (A13, A33) and exposure to secondhand smoke (A18, A33, A59, A73). Accordingly, prevention strategies should be tailored: individualized approaches that incorporate smoking history and quit motivation for adults, and multifaceted interventions addressing peers, family, and school environments for adolescents.

In contrast, within the "association factors" theme, alcohol use showed a similar pattern across adults and adolescents, being strongly associated with e-cigarette use in both groups (A13, A27, A59, A62, A66, A83). However, the implications of alcohol use differ for adolescents because the sale and provision of alcohol to minors is legally prohibited [25]. Thus, adolescent drinking may indicate reduced protection and supervision and greater exposure to high-risk peers and environments [26]. Therefore, preventing adolescent e-cigarette use requires integrated, multidimensional interventions that address alcohol use and other risk behaviors beyond e-cigarettes alone.

By study population, and excluding "health effects," adult-focused studies primarily concentrated on "association factors," whereas adolescent-focused studies more often emphasized "smoking cessation." This pattern suggests that adult research has actively examined personal and socioeconomic determinants that influence diverse tobacco-use behaviors, such as dual or multiple use of conventional cigarettes and e-cigarettes. In contrast, a relatively large proportion of adolescent-focused studies addressed smoking cessation. This pattern differs from international trends, where adolescent e-cigarette research has increasingly focused on pathways to conventional cigarette smoking and gateway effects [11], as well as marketing exposure and flavor preferences [10,18]. The emphasis on smoking cessation in Korean adolescent studies appears to reflect the structure of KYRBS questionnaire items rather than actual research priorities. Most adolescent studies were secondary analyses using the KYRBS. Because the KYRBS includes items such as smoking-cessation education, exposure to cessation campaigns, and attempts to quit, repeated use of this dataset likely contributed to the observed focus on smoking-cessation–related topics. Future research should examine psychosocial factors influencing continuation and discontinuation of e-cigarette use among adults, and, for adolescents, move beyond simple cessation indicators to more precisely assess e-cigarette perceptions, specific triggers for use, and product-specific interests to inform tailored prevention strategies. Such evidence will be critical for developing effective prevention strategies tailored to each population's characteristics.

This study has several limitations. First, the literature search was limited to Korean-language journals indexed in three domestic databases, and studies on Korean adolescents published in international journals were not included. Second, the literature screening and coding were conducted by a single researcher, which may limit reproducibility due to the absence of independent dual coding. Third, because many studies collected data through self-reported questionnaires, the possibility of social desirability bias and recall bias cannot be ruled out, particularly in research involving adolescent smoking behaviors. Future research should consider expanding the search scope, incorporating longitudinal designs and objective measurement methods, and adopting strategies to enhance data reliability, such as anonymous surveys and secure data collection procedures.

CONCLUSION

This study aimed to examine trends and characteristics of e-cigarette–related research published in Korean academic journals between 2017 and September 2025, focusing on studies involving adults and adolescents. A total of 87 studies met the inclusion criteria and were analyzed by year of publication, study design, data source, and research themes.

The results of this study indicate that research involving adolescents has largely depended on secondary datasets, particularly the KYRBS, which restricts a comprehensive understanding of adolescents' experiences and contextual factors related to e-cigarette use. Expanding studies based on primary data is therefore necessary to more clearly examine adolescents' motivations, usage patterns, and perceptions of e-cigarettes. School-based data collection conducted in cooperation with school health teachers, who regularly interact with students, may provide meaningful opportunities to obtain such data. In addition, findings from these primary data sources could support the design and application of tailored smoking cessation interventions that reflect adolescents' spe-

cific characteristics and needs. Community health nurses may play a key role in planning, implementing, and evaluating these interventions in both school and community settings.

Compared with adults, the included studies indicated that adolescents' e-cigarette use was more frequently associated with social and environmental influences, as well as with perceptions of reduced harm and attractive product features such as flavors and design elements. These features have been widely recognized as components of tobacco industry marketing strategies. Taken together, these findings suggest that adolescents' e-cigarette use is closely linked to reduced harm perceptions and exposure to commercial marketing influences. Accordingly, strengthening school-based prevention education alongside regulatory efforts addressing online marketing environments is essential. The development of prevention education programs tailored to adolescents' developmental and psychosocial characteristics represents an important area for child health nursing practice and research.

In adult populations, primary and secondary data sources were used relatively evenly, and many studies focused on factors associated with e-cigarette use. These findings highlight the need for evidence-informed policy approaches, including workplace-based health promotion education, strengthened smoking cessation services for e-cigarette users in public health centers, and accurate communication regarding the effectiveness of e-cigarettes as smoking cessation aids.

Finally, most domestic e-cigarette studies have used cross-sectional designs, limiting understanding of behavioral changes and long-term health outcomes. Longitudinal research involving both adolescents and adults is needed to examine transitions from initiation to continued use and cessation of e-cigarettes and to better clarify potential causal relationships.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: SS, EJL. Methodology: SS, EJL. Data collection: SS. Formal analysis: SS, EJL. Validation: SS, EJL. Investigation: SS, EJL. Visualization: SS, EJL. Project administration: SS, EJL. Writing–original draft: SS. Writing–review and editing: SS, EJL. Final approval published version: SS, EJL.

Conflict of interest

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

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Data availability

Please contact the corresponding author for data availability.

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AI use disclosure

The authors declare that an AI-based language editing tool (Grammarly) was used solely 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.

Supplementary material

Supplement 1. List of the 87 studies included in the analysis.
Supplement 2. Bibliographic information of the included studies.

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REFERENCES

1. Lee S, Kim J. Evolution of tobacco products. J Korean Med Assoc. 2020;63(2):88-95. https://doi.org/10.5124/jkma.2020.63.2.88
2. Korea Disease Control and Prevention Agency (KDCA). Korea National Health and Nutrition Examination Survey (KNHANES), 2020-2023 [Internet]. KDCA; 2020-2023 [cited 2026 Jan 7]. Available from: https://knhanes.kdca.go.kr/knhanes/main.do
3. Korea Disease Control and Prevention Agency (KDCA). Korea Youth Risk Behavior Web-based Survey (KYRBS) statistics, 2020-2024 [Internet]. KDCA; 2020-2024 [cited 2026 Jan 7]. Available from: https://www.kdca.go.kr/yhs/home.jsp
4. Pepper JK, Emery SL, Ribisl KM, Southwell BG, Brewer NT. Effects of advertisements on smokers' interest in trying e-cigarettes: the

roles of product comparison and visual cues. Tob Control. 2014;23(Suppl 3):iii31-iii36. https://doi.org/10.1136/tobaccocontrol-2014-051718
5. Cho JH, Shin E, Moon SS. Electronic-cigarette smoking experience among adolescents. J Adolesc Health. 2011;49(5):542-546. https://doi.org/10.1016/j.jadohealth.2011.08.001
6. Li X, Zhang T, Zhao L, Liu Q, Shi C, Zhang R. Mapping of global research on electronic cigarettes: a bibliometric analysis. Front Public Health. 2022;10:856257. https://doi.org/10.3389/fpubh.2022.856257
7. Jankowski M, Brożek GM, Lawson J, Skoczyński S, Majek P, Zejda JE. New ideas, old problems?: heated tobacco products: a systematic review. Int J Occup Med Environ Health. 2019;32(5):595-634. https://doi.org/10.13075/ijomeh.1896.01433
8. Ratajczak A, Jankowski P, Strus P, Feleszko W. Heat not burn tobacco product: a new global trend: impact of heat-not-burn tobacco products on public health, a systematic review. Int J Environ Res Public Health. 2020;17(2):409. https://doi.org/10.3390/ijerph17020409
9. Simonavicius E, McNeill A, Shahab L, Brose LS. Heat-not-burn tobacco products: a systematic literature review. Tob Control. 2019;28(5):582-594. https://doi.org/10.1136/tobaccocontrol-2018-054419
10. Lee SJ, Rees VW, Yossefy N, Emmons KM, Tan AS. Youth and young adult use of pod-based electronic cigarettes from 2015 to 2019: a systematic review. JAMA Pediatr. 2020;174(7):714-720. https://doi.org/10.1001/jamapediatrics.2020.0259
11. O'Brien D, Long J, Quigley J, Lee C, McCarthy A, Kavanagh P. Association between electronic cigarette use and tobacco cigarette smoking initiation in adolescents: a systematic review and meta-analysis. BMC Public Health. 2021;21(1):954. https://doi.org/10.1186/s12889-021-10935-1
12. Cheon E, Hwang JE. A systematic review of research on heated tobacco products in South Korea. Korean Public Health Res. 2020;46(3):15-29. https://doi.org/10.22900/kphr.2020.46.3.002
13. Cheon E, Kim H, Kang N, Park S, Cho SI, Hwang J. A systematic review on health impact of electronic cigarettes in South Korea. J Korean Soc Res Nicotine and Tob. 2024;15(2):29-41. https://doi.org/10.25055/JKSRNT.2024.15.2.29
14. Consolidated Appropriations Act 2022, Public Law No. 117-103 (Mar 15, 2022).
15. Tobacco and Vapes Bill [Internet]. UK Parliament; 2026 [cited 2026 Jan 15]. Available from: https://bills.parliament.uk/bills/3879
16. National Health Service (NHS). Using e-cigarettes to stop smoking [Internet]. NHS; 2023 [cited 2026 Jan 15]. Available from: https://www.nhs.uk/live-well/quit-smoking/using-e-cigarettes-to-stop-smoking/
17. Lee JA, Kim SH, Cho HJ. Electronic cigarette use among Korean adults. Int J Public Health. 2016;61(2):151-157. https://doi.org/10.1007/s00038-015-0763-y
18. Huang J, Duan Z, Kwok J, Binns S, Vera LE, Kim Y, et al. Vaping versus JUULing: how the extraordinary growth and marketing of JUUL transformed the US retail e-cigarette market. Tob Control. 2019;28(2):146-151. https://doi.org/10.1136/tobaccocontrol-2018-054382
19. Glasser AM, Cobb CO, Teplitskaya L, Ganz O, Katz L, Rose SW, et al. Electronic nicotine delivery devices, and their impact on health and patterns of tobacco use: a systematic review protocol. BMJ Open. 2015;5(4):e007688. https://doi.org/10.1136/bmjopen-2015-007688
20. Bennett M, Speer J, Taylor N, Alexander T. Changes in e-cigarette use among youth and young adults during the COVID-19 pandemic: insights into risk perceptions and reasons for changing use behavior. Nicotine Tob Res. 2023;25(2):350-355. https://doi.org/10.1093/ntr/ntac136
21. Han G, Son H. A systematic review of socio-ecological factors influencing current e-cigarette use among adolescents and young adults. Addict Behav. 2022;135:107425. https://doi.org/10.1016/j.addbeh.2022.107425
22. Wang X, Cheng Z. Cross-sectional studies: strengths, weaknesses, and recommendations. Chest. 2020;158(1S):S65-S71. https://doi.org/10.1016/j.chest.2020.03.012
23. Lee S, Xu SS, Yan M, Gravely S, Quah ACK, Seo HG, et al. Patterns of cigarette, heated tobacco product, and nicotine vaping product use among Korean adults: findings from the 2020 ITC Korea Survey. Tob Induc Dis. 2024;22:10.18332/tid/186273. https://doi.org/10.18332/tid/186273
24. Hwang JH, Kim JY, Lee DH, Jung HG, Park SW. Underestimation of self-reported smoking prevalence in Korean adolescents: evidence from gold standard by combined method. Int J Environ Res Public Health. 2018;15(4):689. https://doi.org/10.3390/ijerph15040689
25. Youth Protection Act, Law No. 21065 (Oct 1, 2025) [Internet]. Ministry of Government Legislation; 2025 [cited 2026 Jan 10]. Available from: https://www.law.go.kr/LSW//lsLawLinkInfo.do?chrClsCd=010202&lsId=000815&lsJoLnkSeq=1000062027&print=print
26. Ju HJ. Effects of adolescents' parental intimacy, parental supervision, peer pressure, and TV alcohol advertising on drinking. J Digit Converg. 2020;18(12):363-375. https://doi.org/10.14400/JDC.2020.18.12.363

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Development and effectiveness of a digital health literacy improvement program (DHL-Up) for multicultural children and adolescents in South Korea: a quasi-experimental study

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Purpose: Digital health literacy is essential for health management among children and adolescents, with multicultural youth being particularly vulnerable to challenges in accessing, appraising, and using digital health information. This study aimed to develop a digital health literacy improvement program (DHL-Up) tailored to multicultural children and adolescents and evaluate its effectiveness.

Methods: Guided by the Transactional Model of eHealth Literacy and the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model, a five-session program was developed to strengthen functional, communicative, critical, and translational digital health literacy. A non-equivalent control group pretest–posttest design was used. The participants included 31 multicultural children and adolescents aged 10–15 years (experimental group: 14; control group: 17). The experimental group participated in a 5-week online program (60 minutes per session) delivered to small groups via Zoom. Data were collected before and after the intervention and analyzed using descriptive statistics, independent t-tests, Mann-Whitney U tests, chi-square tests, and Fisher's exact tests.

Results: The experimental group showed significantly greater improvements in digital health literacy (t=2.73, p=.011) and the usefulness of Internet health information (t=3.11, p=.004) than the control group. No significant difference was found for information overload (t=-0.17, p=.854).

Conclusion: This study developed and validated a tailored digital health literacy intervention for multicultural children and adolescents, demonstrating its applicability in schools, public health centers, and community settings. These findings provide foundational evidence to support the institutionalization of digital health literacy education and highlight its potential to mitigate digital health information disparities among vulnerable populations.

Keywords: Adolescent; Child; Cultural diversity; Health equity; Health literacy

INTRODUCTION

In 2023, the number of children and adolescents from multicultural families in South Korea reached 308,402, a 61.2% increase from 2013, accounting for 4.1% of the total child and adolescent population [1]. As the age distribution of this population shifts, the proportion of those enrolled in elementary, middle, and high schools increases, highlighting the need to

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strengthen health-related support for school-aged multicultural children and adolescents [2].

Children and adolescents from multicultural families are at greater risk of adverse health outcomes than those from monocultural families because of socioeconomic disadvantages, limited access to health information, low parental health literacy, and cultural differences in health beliefs [3,4]. When parents have limited proficiency in the host country's language, children often serve as language brokers within the family, which can hinder accurate interpretation and use of health information [3,5]. Furthermore, the rapid digitalization of health information environments has increased not only the volume but also the complexity of available health information, contributing to a cognitive burden and information overload among users [6]. Given that health information requires medical and contextual understanding, even digitally proficient individuals may find it challenging to critically appraise and apply such information [7]. These difficulties can lead to the avoidance or passive acceptance of health information, diminishing its perceived usefulness and weakening the motivation to engage with it [8,9].

Digital health literacy, defined as the ability to seek, understand, evaluate, and apply health information in digital contexts [9], has become a core competency for effective health management as healthcare digitalization accelerates [10]. Higher levels of digital health literacy support informed decision-making, alleviate information overload, strengthen self-management, and promote health equity [11,12]. Moreover, digital health literacy fosters an intrinsic motivation to perceive such information as a meaningful resource for health management and its application in daily life [9,13]. Conversely, low digital health literacy increases vulnerability to misinformation and irrational health behaviors, which contribute to health disparities among socioeconomically disadvantaged populations [3,14].

Digital environments have become key channels for multicultural children and adolescents to access and utilize health information [12]. Previous studies have shown that multicultural children and adolescents actively use digital technology to search for, understand, and share health information with themselves and their families [15]. Such experiences may facilitate the integrated development of digital and health literacy, thereby contributing to better health management and decision-making. In addition, online networks play a critical role in enabling multicultural youths to identify trustworthy health information and develop a shared understanding of health management [15]. Despite this active engagement with digital health information, there remains a lack of digital health literacy interventions specifically designed for multicultural children and adolescents, as most existing programs target adults or older adults [10,16]. As youths are growing up in technology-rich environments, they increasingly access and navigate health information in digital settings. As such, developmentally tailored interventions are essential to promote healthy behaviors and reduce health inequities in this population [11].

The Transactional Model of eHealth Literacy (TMeHL) conceptualizes digital health literacy as a dynamic, interaction-driven, and context-dependent competency that evolves through engagement with digital health environments. It comprises the functional, communicative, critical, and translational dimensions that develop in a hierarchical and interdependent manner [9]. This model provides a useful theoretical foundation for designing interventions tailored to the developmental needs and contextual realities of multicultural adolescents living in increasingly digitalized environments. Therefore, this study aimed to develop a digital health literacy improvement program (DHL-Up) for multicultural children and adolescents based on TMeHL and evaluate its effects on digital health literacy, information overload, and the usefulness of Internet health information. The study hypotheses are as follows:

Hypothesis 1. Changes in digital health literacy from pre- to post-intervention differ between the experimental and control groups.

Hypothesis 1-1. Changes in functional digital health literacy differ between groups.

Hypothesis 1-2. Changes in communicative digital health literacy differ between groups.

Hypothesis 1-3. Changes in critical digital health literacy differ between groups.

Hypothesis 2. Changes in information overload differ between groups.

Hypothesis 3. Changes in the usefulness of Internet health information differ between groups.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Seoul National University (IRB No. 2502/002-008). Informed consent was obtained from all participants.

1. Research Design

This quasi-experimental study employed a non-equivalent control group pretest–posttest design to evaluate the effectiveness of a digital health literacy improvement program for multicultural children and adolescents. The study was registered with the Clinical Research Information Service (Register No. KCT0010329) and was conducted in accordance with the Transparent Reporting of Evaluations with Nonrandomized Designs guidelines [17].

2. Participants

The participants in this study were multicultural children and adolescents aged 10–15 years, who understood the purpose of the study and voluntarily agreed to participate. Considering that the study procedures were conducted in Korean, only those able to adequately comprehend and participate in the study were included. The inclusion criteria were: (1) children and adolescents with at least one foreign-born parent; (2) currently enrolled in elementary or middle school in South Korea, with no difficulties in basic communication in Korean (reading, writing, and speaking); and (3) no physical impairments or disabilities that would interfere with the use of digital devices.

The sample size was calculated using G*Power ver. 3.1 (Heinrich-Heine-Universität Düsseldorf), with reference to a previous study that developed and evaluated a web-based program to improve digital literacy among elementary school students [18]. Assuming that the pre–post change in the control group was zero, the anticipated effect size for the between-group difference was set at 1.07. Based on an independent t-test, a minimum of 15 participants per group was required, assuming a significance level (α) of .05 and a power (1–β) of .80. Due to recruitment challenges related to the accessibility and availability of the target population, the experimental group did not reach the target sample size. Consequently, 31 participants were included in the final analysis, with 14 in the experimental group and 17 in the control group.

3. Theoretical Framework for the Development of DHL-Up

The conceptual framework of this study is grounded in the TMeHL proposed by Paige et al. [9] (Figure 1). TMeHL conceptualizes digital health literacy as a cyclical process that is

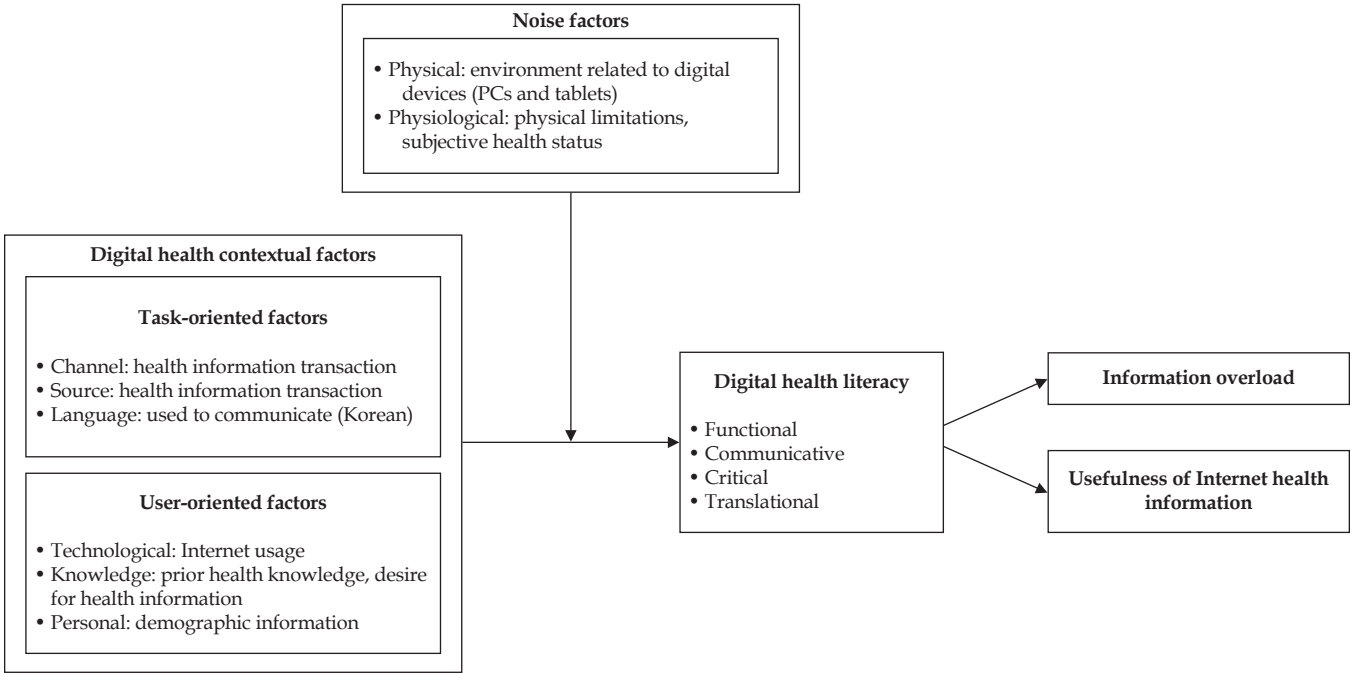

Figure 1. Theoretical framework of the study.

continuously shaped and expanded through individuals' digital health experiences and contextual factors, reflecting the dynamic, bidirectional, and interactive nature of an evolving digital environment. In this study, the contextual factors influencing digital health literacy were classified into task-oriented factors (i.e., channels and sources of digital health information) and user-oriented factors (i.e., daily Internet usage, prior health knowledge, desire for health information, and demographic characteristics). To minimize linguistic heterogeneity among participants, Korean was used as the primary language throughout the intervention. In addition, the noise factors identified by Paige et al. [9] were considered in the program design, specifically physical noise (e.g., restricting intervention participation to PCs and tablets) and physiological noise (e.g., physical limitations and subjective health status).

DHL-Up was structured around the four dimensions of the TMeHL: functional, communicative, critical, and translational digital health literacy. Functional digital health literacy refers to the basic skills required to search for and comprehend digital health information. Communicative digital health literacy refers to the ability to exchange health information effectively in digital environments and adapt communication strategies accordingly. Critical digital health literacy involves evaluating the credibility, relevance, and potential risks of digital health information. Translational digital health literacy encompasses the ability to apply digital health information across multiple ecological contexts, representing a higher-order competency that develops cumulatively from the preceding dimensions. Given the complexity and developmental nature of the translational dimension, full mastery was not expected within a short-term intervention; thus, this study focused on promoting initial application through practice-based activities, and this dimension was excluded from the outcome measurement.

Based on this theoretical framework, the present study identified digital health literacy, information overload, and the usefulness of Internet health information as the primary outcome variables. Information overload is regarded as a representative noise factor that hinders the effective use of digital health information, and its negative influence is presumed to be moderated by one's level of digital health literacy. That is, digital health literacy may function as a buffering mechanism that mitigates the disruptive influences inherent in digital information environments. In contrast, perceived usefulness denotes the extent to which individuals regard digital health information as a valuable resource for managing their health in daily life, reflecting the process through which digital health literacy is internalized and translated into a personal capacity for health management. Taken together, this study hypothesized that DHL-Up would result in significant between-group differences in changes in digital health literacy, information overload, and the usefulness of Internet health information among multicultural children and adolescents.

4. Measurements

1) General and digital health-related characteristics

Items were developed to reflect variables that may influence digital health literacy among multicultural children and adolescents. The key variables included age, sex, grade, academic performance, parents' country of origin and educational level, economic status, average daily Internet usage, channels and sources of health information transactions, prior health knowledge, desire for health information, subjective health status, and physical limitations.

2) Digital health literacy

Digital health literacy was measured using the eHealth Literacy Scale developed and validated by Lee [19]. The scale consists of 31 items across three subdomains (functional, communicative, and critical eHealth literacy) rated on a 5-point Likert scale (1=strongly disagree, 5=strongly agree). The total scores range from 31 to 155, with higher scores indicating higher levels of digital health literacy. Cronbach's α reported by Lee [19] ranged from .90 to .93 across subdomains. In this study, Cronbach's α was .91 for functional, .93 for communicative, .95 for critical, and .96 for the total scale.

3) Information overload

Information overload is the cognitive burden that occurs when the amount of information to be processed exceeds an individual's processing capacity [20]. This study used the information overload subscale of the Technology Overload Scale developed by Karr-Wisniewski and Lu [20]. Based on the Korean-translated and validated version of Lee et al. [21], the selected terminology was modified with the authors' permission to align it with the purpose of this study. The subscale consists of three items rated on a 7-point Likert scale (–3=strongly disagree, 3=strongly agree). The total scores range from –9 to 9, with higher scores indicating a greater

level of information overload. Cronbach's α was .87 in Lee et al. [21] and .78 in this study.

4) Usefulness of Internet health information

Usefulness of Internet health information refers to the extent to which individuals believe that online health information is helpful for improving and managing their health status [22]. The construct was measured using the scale developed by Noh et al. [22], which consists of three items rated on a 5-point Likert scale (1=strongly disagree, 5=strongly agree). The total scores range from 3 to 15, with higher scores indicating greater perceived usefulness of Internet health information. Cronbach's α was .82 in the original study and .80 in this study.

5) Program satisfaction

Program satisfaction was measured using a 10-item questionnaire developed by the researcher based on the training program reaction evaluation criteria proposed by Lee and Pershing [23]. The items assess satisfaction with program expectations; clarity, usefulness, and engagement; effectiveness of materials and instructional strategies; clarity of explanations; appropriateness of structure and learning environment; applicability to daily life; and overall satisfaction. Responses are rated on a 5-point Likert scale (1=strongly disagree, 5=strongly agree).

5. Data Collection

The participants were multicultural children and adolescents aged 10–15 years, enrolled in elementary or middle schools in South Korea, and used Korean as their primary language of instruction. Convenience sampling was used to recruit an accessible population. With IRB approval, recruitment notices detailing the eligibility criteria were posted at two community child centers in Gwangju and Jeonnam. Data were collected by the researcher from January to March 2025 through a self-administered online survey via Google Forms (Google LLC).

Participants were allocated to the experimental or control group at the time of recruitment based on their ability to attend scheduled intervention sessions rather than participant preference to minimize potential self-selection bias. Once the required sample size for each group was secured, the pre- and posttest survey links were distributed concurrently, prior to the intervention and immediately upon its completion. The experimental group received the intervention, whereas the control group did not receive any intervention. A small incentive was provided to participants for survey completion and intervention participation. No participants withdrew during the data collection, resulting in a final sample of 14 in the experimental group and 17 in the control group (Figure 2).

6. Procedure

1) Development of DHL-Up

The program was developed using the ADDIE instructional design (Figure 3). In the analysis phase, a literature review was conducted to identify the four dimensions of digital health literacy and core competencies (knowledge, skills, and

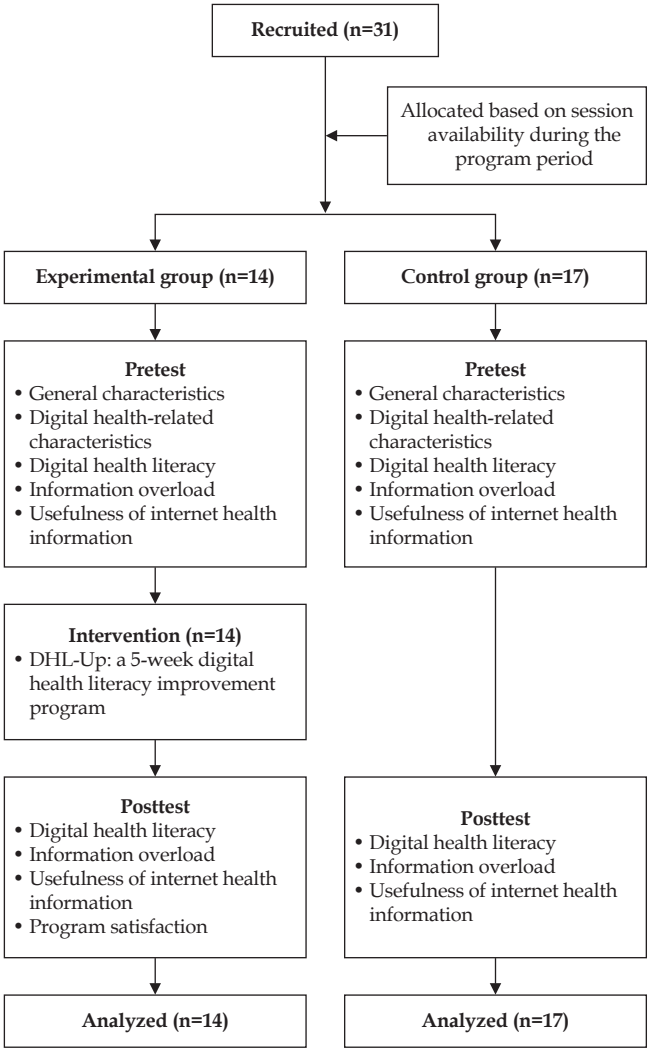

Figure 2. Flowchart of the study. DHL-Up, digital health literacy improvement program.

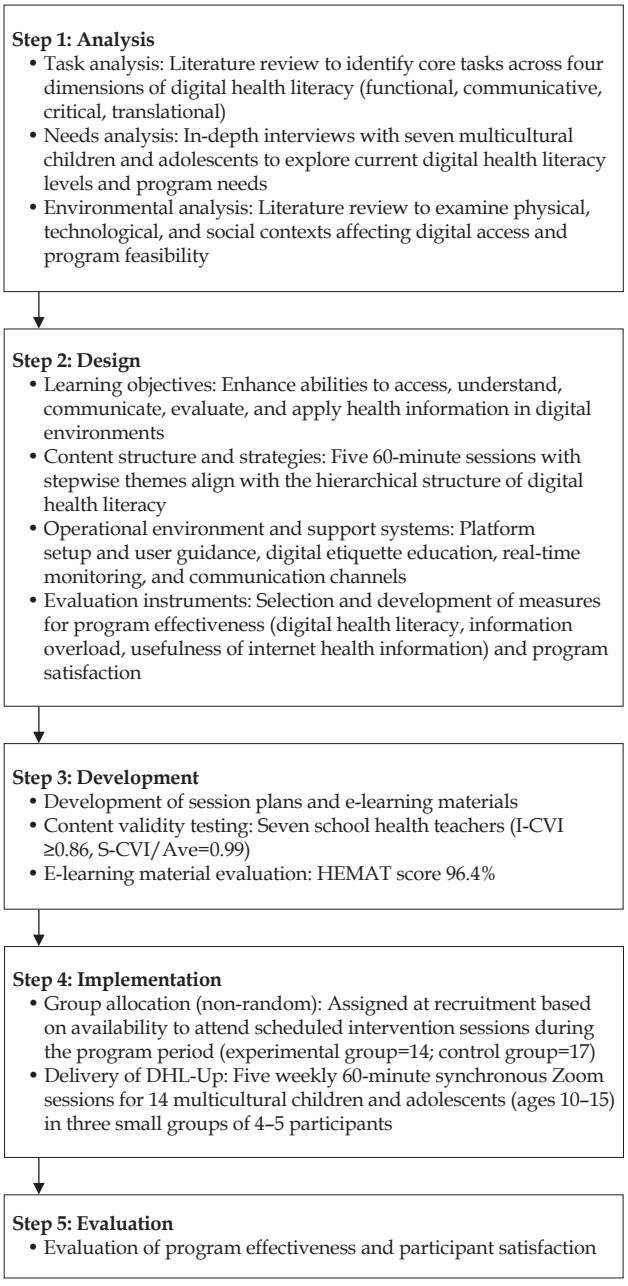

Figure 3. Digital health literacy improvement program (DHL-Up) development process based on the ADDIE model. HEMAT, health education materials assessment tool; I-CVI, item-level content validity index; S-CVI, scale-level content validity index.

attitudes). In-depth interviews were conducted with seven multicultural children and adolescents to explore their digital health literacy levels and program requirements. Furthermore, the feasibility of implementation was examined by analyzing physical, technological, and social environmental factors. In the design phase, the overall program structure was formulated based on the analysis results. The program comprised five weekly 60-minute sessions, structured in alignment with the hierarchical domains of digital health literacy. Specific learning objectives were established for each session based on the conceptual attributes of the respective literacy components. Appropriate instruments for measuring the program outcomes and participant satisfaction were either selected or developed. Support strategies were established to ensure the fidelity of the online implementation, including platform preparation, user guidance, digital etiquette training, and real-time attendance monitoring. Detailed session plans and e-learning materials were produced during the development phase. Content validity was assessed by seven school health teachers, yielding an item-level content validity index (I-CVI ≥0.86) and a scale-level content validity index (S-CVI/Ave=0.99). The suitability of the e-learning materials was further evaluated using the Health Education Materials Assessment Tool, with a total score of 96.4% indicating high clarity, comprehensibility, and appropriateness.

The final program consisted of educational and practice-based activities designed to enhance the functional, communicative, critical, and translational dimensions of digital health literacy among multicultural children and adolescents (Table 1).

2) Intervention

DHL-Up was delivered by the researcher to 14 multicultural children and adolescents aged 10–15 years through five weekly 60-minute synchronous online sessions conducted via Zoom (Zoom Video Communications Inc.). The participants were organized into three small groups (four to five participants each) to accommodate their schedules (Groups 1–3), and the same intervention procedures were applied across all groups. Each session followed a standardized structure consisting of an introduction, core activities, and wrap-up. The sessions began with a brief review of the content and an overview of the session objectives, followed by lectures, guided practice, and group discussions. Practice-based activities were conducted in real time using digital materials and tools (e.g., digital worksheets and web-based resources), with immediate verbal feedback provided to guide task performance and confirm understanding. The sessions concluded with a summary of key points and guidance for applying the acquired skills to health-related contexts.

To mitigate the potential limitations of online delivery (e.g., reduced engagement and constrained interaction), the program incorporated strategies designed to strengthen social, cognitive, and teaching presence. Multimodal materials (e.g.,

Table 1. Contents of the digital health literacy improvement program (DHL-Up) for multicultural children and adolescents

Session	Duration (min)	Contents	Teaching methods
1	60	Overview of digital health literacy • Introduction to the digital health literacy improvement program • Creating a digital passport • Digital etiquette • Definition and importance of digital health literacy • Establishing my SMART health management plan	Individual practice; lecture; self-assessment; presentation; feedback
2	60	Functional digital health literacy • Concepts, types, and functions of digital health resources • Basic Internet terminology • Tips for searching online health information: website scanning techniques, effective search terms • Choosing healthy snacks: searching, comparing, and analyzing nutrition information online • Creating a healthy snack box for my family (assignment) • Managing search and browsing history for privacy protection (supplement)	Lecture; individual practice; discussion
3	60	Communicative digital health literacy • Characteristics of online and offline communication • Sharing health information online: benefits, risks, SHARE strategy • Ask Me 3® health communication support tool • Evaluation of online health communication (supplement)	Lecture; individual practice
4	60	Critical digital health literacy • Definition of misinformation and the risks of false health information • 5W's criteria for evaluating online health information • Analysis and evaluation of online health information using the 5W's framework • Domestic and international guidelines for countering (health) misinformation (supplement) • Evaluation methods by source type (supplement) • List of trusted digital health resources (supplement)	Lecture; individual practice; discussion
5	60	Translational digital health literacy • Reorganizing health information using digital tools: creating a card news (slide-type infographic) • Reviewing progress on my SMART health management plan • Completion ceremony for the digital health literacy improvement program	Lecture; individual practice; presentation; feedback; ceremony; reward; debriefing

SMART, specific, measurable, achievable, relevant, and time-bound.

videos and images) and interactive elements (e.g., live polls and quizzes) were used to sustain attention and promote active involvement, whereas case-based activities were incorporated to facilitate critical thinking and applications in daily life. Collaborative activities (e.g., Q&As, presentations, and discussions) were included to support interactions between participants and the instructor, and a point-based incentive system was used to encourage motivation and a sense of accomplishment. Points were awarded based on in-session engagement, completion of assigned tasks, and collaborative interactions. At the beginning of each session, cumulative points were briefly shared to promote the self-monitoring of engagement. Prior to implementation, Zoom readiness was verified, and participants received a brief orientation on platform use and session procedures, along with digital etiquette guidance. Real-time monitoring and individual communication channels were used throughout the program to address questions and technical issues promptly.

A preliminary assessment of digital device ownership and Internet access indicated that some participants lacked appropriate equipment; therefore, laptop computers were loaned to nine participants for the duration of the program, along with prior instructions on device use. The attendance rates were 88.0% (Group 1), 90.0% (Group 2), and 88.0% (Group 3), with absence due to personal circumstances (e.g., illness or visiting a parent's country of origin). To support the continuity of learning, participants who missed a session received session materials, including worksheets, key summaries, and comprehension quizzes. Intervention fidelity was ensured through adherence to standardized session manuals

and platform operation guidelines, and was monitored using session records documenting attendance, task completion, and participant engagement.

7. Data Analysis

Data were analyzed using IBM SPSS/WIN ver. 25.0 (IBM Corp.). A two-tailed significance level of $p < .05$ was applied for all statistical tests. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to analyze the participants' general and digital health-related characteristics. Homogeneity between the experimental and control groups at baseline was examined using the Mann-Whitney U test, independent t-test, Fisher's exact test, and chi-square test. Differences in the pre- and post-change scores between the groups were analyzed using independent t-tests, and effect sizes were calculated using Cohen's d. Program satisfaction was analyzed using mean and standard deviation.

RESULTS

1. General and Digital Health-Related Characteristics of Participants and Baseline Homogeneity of Outcome Variables between Groups

The homogeneity of general characteristics, digital health-related characteristics, and baseline outcome variables was examined, and no significant between-group differences were observed (Supplement 1). A total of 31 participants took part in the study, with 14 in the experimental group and 17 in the control group. The mean age of the participants was 11.06±1.00 years. Most participants were in the 4th to 6th grades of elementary school (n=29; 93.6%). Regarding parents' countries of origin, 15 fathers (48.4%) were from Korea and 19 mothers (61.3%) were from Southeast Asian countries. Sixteen participants (51.6%) had parents from non-Korean countries of origin. The most common source of health information was parents (n=14; 45.2%), and the most frequently used channels for health information were social networking services (SNS) and messaging apps (38.7%), followed by online video platforms (35.5%).

2. Effects of DHL-Up

1) Hypothesis testing

Table 2 presents the results of the hypothesis testing for differences in pre- and post-change scores between the experimental and control groups. Digital health literacy increased by 20.64 points in the experimental group, whereas it decreased by 0.71 points in the control group. The difference in the change scores between the two groups was statistically significant (t=2.73, $p=.011$), supporting Hypothesis 1. Infor-

Table 2. Comparison of the outcome variables between the two groups

Variable	Mean±SD			t (*p*)	ES (d)
	Pretest	Posttest	Difference (post–pre)		
Digital health literacy				2.73 (.011)	0.99
Exp. (n=14)	93.36±25.20	114.00±19.32	20.64±23.50		
Con. (n=17)	97.12±18.58	96.41±17.12	–0.71±20.02		
Functional				2.13 (.042)	0.77
Exp. (n=14)	26.36±6.80	32.29±5.78	5.93±8.47		
Con. (n=17)	28.71±6.14	27.94±5.45	–0.76±8.91		
Communicative				4.16 (<.001)	1.50
Exp. (n=14)	31.00±10.23	36.29±8.61	5.29±4.46		
Con. (n=17)	31.71±8.52	31.11±8.54	–0.59±3.41		
Critical				1.80 (.082)	0.65
Exp. (n=14)	36.00±9.48	45.43±11.49	9.43±13.56		
Con. (n=17)	36.71±7.14	37.35±10.61	0.65±13.43		
Information overload				–0.17 (.854)	–0.06
Exp. (n=14)	0.86±3.37	–1.50±4.94	–2.36±5.93		
Con. (n=17)	1.18±5.19	–0.82±3.78	–2.00±5.57		
Usefulness of Internet health information				3.11 (.004)	1.12
Exp. (n=14)	9.71±2.81	12.57±1.83	2.86±3.37		
Con. (n=17)	10.06±2.02	9.35±1.87	–0.71±3.02		

Values are presented as mean±standard deviation unless otherwise stated.
Con., control group; ES, effect size; Exp., experimental group.

mation overload decreased by 2.36 points in the experimental group and by 2.00 points in the control group; however, the difference in change scores between the two groups was not statistically significant (t=–0.17, p=.854). Thus, Hypothesis 2 is not supported. Usefulness of Internet health information increased by 2.86 points in the experimental group, whereas it decreased by 0.71 points in the control group. The difference in the change scores between the groups was statistically significant (t=3.11, p=.004), supporting Hypothesis 3. No adverse events or unintended effects related to the intervention were observed or reported during the study period.

2) Program satisfaction

Program satisfaction was assessed among 14 participants in the experimental group using a 10-item questionnaire rated on a 5-point Likert scale. The mean score was 44.07±4.46 out of a possible 50 points, indicating a high level of satisfaction with DHL-Up (Supplement 2).

DISCUSSION

This study developed and evaluated DHL-Up for multicultural children and adolescents, grounded in TMeHL and systematically designed using the ADDIE model. The five-session program operationalized the hierarchical dimensions of digital health literacy—functional, communicative, critical, and translational—providing a structured progression of competencies necessary for accessing, understanding, exchanging, evaluating, and applying digital health information to support health management in daily life.

The needs assessment findings indicated that multicultural children and adolescents did not differ substantially from their non-multicultural peers in terms of health interests or perceived health-related needs. Their primary areas of interest were developmentally normative and daily life–relevant topics, including dietary habits, weight management, pubertal changes, emergency response, and common health issues. Rather than assuming cultural uniformity, the program intentionally incorporated cultural heterogeneity and individual lived experiences that shaped engagement with digital health information. Accordingly, the content emphasized culturally neutral and universally relevant health themes, while learning activities were designed to facilitate culturally grounded meaning-making and personalized knowledge application. For example, in the healthy eating session, participants compared the nutritional attributes of culturally familiar foods and identified feasible modifications that aligned with their practices and goals. This culturally responsive approach aligns with the TMeHL premise that digital health literacy is context-dependent and develops through dynamic interactions between individuals and their environment. By integrating individual and contextual differences and flexibly refining the intervention based on participant feedback and emerging needs, the program demonstrated inclusive adaptability to children and adolescents from diverse cultural backgrounds.

Importantly, this study adopted a strength-based perspective by viewing multicultural children and adolescents as active agents capable of interpreting and using health information, rather than passive recipients. Socioculturally responsive strategies enabled participants to discern and apply personally relevant and contextually appropriate health information, positioning DHL-Up as a culturally sensitive and inclusive nursing intervention that advances equity in health education for culturally diverse youths.

The experimental group showed a significant improvement in overall digital health literacy compared to the control group. Prior studies among general school-aged children in South Korea reported mean eHealth literacy scores of approximately 28–29 out of 40 on the eHEALS [24,25]. In contrast, the mean baseline score in this study was 93.36 out of 155. Although direct comparisons are limited because of differences in measurement tools, these findings indicate that multicultural children and adolescents may have relatively lower levels of digital health literacy than their non-multicultural peers. Following the intervention, the mean score of the experimental group increased to 118.64, approaching the levels previously reported in general school-aged populations. These findings suggest that DHL-Up may enhance digital health literacy among multicultural children and adolescents and has the potential to serve as a practical nursing intervention to reduce disparities in access to and use of digital health information.

Although functional and communicative digital health literacy increased significantly in the experimental group compared with the control group, no significant between-group differences were observed in critical digital health literacy. This finding aligns with the assertion by Paige et al. [9] that higher-order literacy skills develop progressively based on lower-order skills. Critical health literacy involves the ability to consider social determinants of health, engage in problem-solving, and take informed action [26]. Given their reli-

ance on advanced cognitive processes, short-term interventions may be insufficient to generate substantial improvement, underscoring the need for sustained and repeated educational efforts. Although translational digital health literacy was included as a component of the intervention, it was not assessed as an outcome in this study. Translational digital health literacy is a higher-order competence that builds upon functional, communicative, and critical skills and develops cumulatively over time [9]. Accordingly, rather than attempting to detect mastery-level changes within a short-term intervention, the present study adopted a process-oriented approach, emphasizing the initial application through guided practice in this domain (e.g., synthesizing information from credible sources and creating brief digital health messages). Given its developmental nature, detecting meaningful changes in translational digital health literacy may require interventions of sufficient duration and intensity to support repeated and sustained practice along with a longitudinal design capable of capturing translation into practice in real-world contexts. Future research should include follow-up assessments and behavioral indicators to examine how competencies acquired through interventions are applied to health-related behaviors and decision-making in everyday life.

Information overload decreased in both groups, although between-group differences were not statistically significant. Baseline levels of information overload were generally low and comparable to those in previous studies, including those among Korean university students [21]. This pattern may reflect the characteristics of digital natives, as children and adolescents are continuously exposed to digital environments from an early age. In South Korea, Internet usage among teenagers reached 99.4% in 2023 [27], and the routinization of digital platform use has been suggested to reduce cognitive sensitivity to information stimuli [28]. Additionally, prolonged exposure to information-rich digital environments may lead to cognitive adaptation or habituation, making short-term changes in perceived information overload less apparent. Since information overload reflects subjective cognitive appraisal, self-report measures may be less sensitive to such subtle changes, particularly among digitally experienced youths. Moreover, excessive Internet use and digital multitasking have been reported to exacerbate the cognitive burden when navigating complex health information environments [29]. In digital contexts, information overload is influenced not only by information volume, but also by complexity, urgency, ambiguity, and modes of delivery [21]. Overall, these findings suggest that information overload among multicultural children and adolescents is shaped by individual information processing abilities, as well as broader contextual and psychosocial factors. Accordingly, future interventions should consider patterns of digital exposure and psychosocial contexts to reduce cognitive burden and promote the meaningful use of health information.

The usefulness of Internet health information increased significantly in the experimental group. Perceived usefulness is a key predictor of individuals' behavioral intentions and actual behavior in digital health environments [13]. Prior research has identified the credibility of health information, previous information-use experiences, and level of artificial intelligence literacy as determinants of perceived usefulness [13,22,30]. Among youth, successful experiences in locating credible and personally relevant health information have been shown to positively shape subsequent information use [8]. From this perspective, DHL-Up may have contributed to increased perceived usefulness by providing participants with opportunities to search for reliable digital health information and apply it to real-life contexts, thereby reinforcing their perception of Internet-based health information as a valuable resource for health management.

This study had several limitations. First, because the group assignment was determined by participant availability at the time of program implementation, baseline equivalence between the groups could not be fully ensured. Second, voluntary participation may have introduced a self-selection bias, with children and adolescents who were more interested in health information or familiar with digital environments being more likely to participate, limiting sample representativeness. Third, as only multicultural children and adolescents with sufficient Korean proficiency were included, the generalizability of the findings to those with lower proficiency, who may be at a greater risk of digital health inequities, is limited. Finally, although short-term effects were identified through pre–post comparisons, the absence of follow-up assessments prevented the examination of long-term effects and actual behavioral changes.

Nevertheless, this study is meaningful in that it highlights the digital health literacy gap and related health inequities from a nursing perspective and suggests directions for future research to address these issues. Furthermore, the findings provide foundational evidence to inform the development of digital health education and curriculum improvements for

children and adolescents, and may support the integration of such interventions into community-based health promotion and prevention strategies.

CONCLUSION

This study developed and evaluated a digital health improvement program (DHL-Up) for multicultural children and adolescents. Guided by the TMeHL and structured using the ADDIE instructional design model, a five-session program was tailored to reflect the needs and characteristics of the target population. The intervention resulted in significant improvements in digital health literacy and the usefulness of Internet health information among participants, supporting its potential as a nursing intervention for youths with limited ability to navigate digital health information. DHL-Up can be delivered by school and public health nurses as part of prevention-oriented health education using structured, activity-based sessions to build children's and adolescents' skills in accessing, communicating, evaluating, and applying digital health information in daily contexts. These findings offer a basis for educational initiatives to strengthen nurses' digital healthcare competencies for person-centered care in digital health environments and may inform policy and implementation strategies to reduce inequalities in access to health information and promote health equity.

Given that digital health literacy is a multifaceted construct shaped not only by individual skills but also by broader social determinants of health, interventions for digitally disadvantaged populations should move beyond one-time hardware-focused assistance toward software-based approaches that support ongoing capacity building. To ensure systematic and sustained implementation, digital health literacy education should be embedded within the community infrastructure, such as schools, public health centers, community childcare centers, and multicultural family support centers. Ultimately, enhancing digital health literacy should be viewed as a shared societal responsibility that requires institutional commitment and policy action, rather than as an outcome achievable through individual efforts alone.

Based on these findings, we propose several recommendations for future research. First, studies with larger and more diverse samples employing randomized controlled trial designs are needed to further validate the program's effectiveness. Second, the program development should incorporate multilingual components to accommodate the diverse linguistic backgrounds of multicultural children and adolescents. Third, longitudinal studies are required to examine the long-term effectiveness and sustainability of interventions. Finally, future research should empirically investigate whether improvements in digital health literacy lead to lasting changes in health-related behaviors.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors. Methodology: all authors. Investigation: SC. Data curation: SC. Formal analysis: SC. Writing–original draft: SC. Writing–review & editing: all authors. Final approval of published version: all authors.

Conflict of interest

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

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Data availability

Please contact the corresponding author for data availability.

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Supplementary material

Supplement 1. Homogeneity test of general and digital health-related characteristics at baseline.

Supplement 2. Participant satisfaction with the DHL-Up.

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REFERENCES

1. Ministry of the Interior and Safety. Status of foreign residents in local government in 2023 [Internet]. Ministry of the Interior and Safety; 2024 [cited 2025 Mar 9]. Available from: https://www.mois.go.kr/frt/bbs/type001/commonSelectBoardArticle.do?bbsId=BBSMSTR_000000000014&nttId=113261
2. Ministry of Gender Equality and Family. The 4th basic plan for multicultural family support policy [Internet]. Ministry of Gender Equality and Family; 2023 [cited 2025 Mar 19]. Available from: https://www.mogef.go.kr/mp/pcd/mp_pcd_s001d.do?mid=plc503&bbtSn=704956
3. Seidl K, Stauch L, Affengruber L, Sommer I, Wahl A, Rojatz D, et al. Conceptualization of health literacy from the perspective of children and adolescents: a meta-ethnography. Sci Rep. 2025;15(1):5697. https://doi.org/10.1038/s41598-025-89371-9
4. Kim J. Health disparities of multicultural adolescents in South Korea: an exploratory study. Chorogusan Childfund; 2019.
5. Orellana MF, Dorner L, Pulido L. Accessing assets: immigrant youth's work as family translators or "para-phrasers". Soc Probl. 2003;50(4):505-524. https://doi.org/10.1525/sp.2003.50.4.505
6. Jia C, Li P. Generation Z's health information avoidance behavior: insights from focus group discussions. J Med Internet Res. 2024;26:e54107. https://doi.org/10.2196/54107
7. Lee H, Oh S. Health consciousness and health information orientation on health information searching behaviors of middle-aged adults. J Korean Soc Inf Manag. 2021;38(3):73-99. https://doi.org/10.3743/KOSIM.2021.38.3.073
8. Freeman JL, Caldwell PH, Bennett PA, Scott KM. How adolescents search for and appraise online health information: a systematic review. J Pediatr. 2018;195:244-255. https://doi.org/10.1016/j.jpeds.2017.11.031
9. Paige SR, Stellefson M, Krieger JL, Anderson-Lewis C, Cheong J, Stopka C. Proposing a transactional model of eHealth literacy: concept analysis. J Med Internet Res. 2018;20(10):e10175. https://doi.org/10.2196/10175
10. Choi SK, Chun H, Choi EJ. Review of recent digital health literacy programs in Europe and the United States. Korean J Health Educ Promot. 2022;39(4):15-28. https://doi.org/10.14367/kjhep.2022.39.4.15
11. Kim J, Livingston MA, Jin B, Watts M, Hwang J. Fundamentals of digital health literacy: a scoping review of identifying core competencies to use in practice. Adult Learn. 2024;35(3):131-142. https://doi.org/10.1177/10451595231178298
12. Yameogo AR, Délétroz C, Sasseville M, Amil S, Da SM, Bodenmann P, et al. Effectiveness of interventions to improve digital health literacy in forced migrant populations: protocol for a mixed methods systematic review. JMIR Res Protoc. 2023;12:e50798. https://doi.org/10.2196/50798
13. Choi H, Jin M. Determinants of health-promoting behavior among eHealth consumers in South Korea: a longitudinal path analysis. J Korean Biol Nurs Sci. 2024;26(3):206-217. https://doi.org/10.7586/jkbns.24.017
14. Taba M, Allen TB, Caldwell PH, Skinner SR, Kang M, McCaffery K, et al. Adolescents' self-efficacy and digital health literacy: a cross-sectional mixed methods study. BMC Public Health. 2022;22(1):1223. https://doi.org/10.1186/s12889-022-13599-7
15. Santos MG, Gorukanti AL, Jurkunas LM, Handley MA. The health literacy of U.S. immigrant adolescents: a neglected research priority in a changing world. Int J Environ Res Public Health. 2018;15(10):2108. https://doi.org/10.3390/ijerph15102108
16. Barbati C, Maranesi E, Giammarchi C, Lenge M, Bonciani M, Barbi E, et al. Effectiveness of eHealth literacy interventions: a systematic review and meta-analysis of experimental studies. BMC Public Health. 2025;25(1):288. https://doi.org/10.1186/s12889-025-21354-x
17. Des Jarlais DC, Lyles C, Crepaz N. 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
18. Lee E. The development and effect of web-based program for improving elementary student's digital literacy attitude [master's thesis]. Seoul: Ewha Womans University; 2018.
19. Lee SR. A study for developing eHealth literacy scale [dissertation]. Seoul: Hanyang University; 2018.
20. Karr-Wisniewski P, Lu Y. When more is too much: operationalizing technology overload and exploring its impact on knowledge worker productivity. Comput Human Behav. 2010;26(5):1061-1072. https://doi.org/10.1016/j.chb.2010.03.008
21. Lee AR, Son S, Kim KK. Information and communication technology overload and social networking service fatigue: a stress perspective. Comput Hum Behav. 2016;55:51-61. https://doi.org/10.1016/j.chb.2015.08.011
22. Noh GY, Choi J, Kwon MS. A test of extended technology acceptance model on health information seeking on the internet. Korea J Broadcast Telecommun Stud. 2013;27(5):49-85.
23. Lee SH, Pershing JA. Dimensions and design criteria for developing training reaction evaluations. Hum Resour Dev Int. 2002;5(2):175-197. https://doi.org/10.1080/13678860110053678
24. Choi S, Bang KS, Shin DA. eHealth literacy, awareness of pandemic infectious diseases, and healthy lifestyle in middle school students. Children (Basel). 2021;8(8):699. https://doi.org/10.3390/chil-

dren8080699
25. Park BK. Factors influencing eHealth literacy of middle school students in Korea: a descriptive cross-sectional study. Healthc Inform Res. 2019;25(3):221-229. https://doi.org/10.4258/hir.2019.25.3.221
26. Nutbeam D. The evolving concept of health literacy. Soc Sci Med. 2008;67(12):2072-2078. https://doi.org/10.1016/j.socscimed.2008.09.050
27. Ministry of Science and ICT. Survey on the Internet usage [Internet]. Korean Statistical Information Service; 2024 [cited 2025 Mar 19]. Available from: https://kosis.kr/statHtml/statHtml.do?orgId=127&tblId=DT_MH001_MI002&conn_path=I2
28. Baumgartner SE. The effects of digital media and media multitasking on attention problems and sleep In: Nesi J, Telzer EH, Prinstein MJ, editors. Handbook of adolescent digital media use and mental health. Cambridge University Press; 2022. p. 317-337. https://doi.org/10.1017/9781108976237.017
29. Yang CC, Ariati J, Pham T, Smith C. Motives for digital social multitasking (DSMT) and problematic phone use among adolescents. J Adolesc. 2023;95(4):811-823. https://doi.org/10.1002/jad.12155
30. Lee J, Oh HJ. Determinants of continuous use of generative AI: focusing on the extended technology acceptance model (ETAM) and AI literacy. Korean J Advert Public Relat. 2024;26(3):96-140. https://doi.org/10.16914/kjapr.2024.26.3.96

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Maternal experiences of home care for young children with tracheostomies in South Korea: a qualitative descriptive study

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Purpose: This study explored the maternal experiences of providing home care for infants and toddlers with tracheostomies in South Korea.
Methods: Using a qualitative descriptive design, the study examined the experiences of 10 mothers with children under 36 months who had at least 3 months of home care experience. Semi-structured interviews were conducted between April and August 2024, lasting from 72 to 138 minutes. All interviews were audio-recorded, transcribed verbatim, and analyzed by employing thematic analysis.
Results: Four main themes were identified: (1) navigating the demands of home care, (2) bearing witness to a constrained childhood, (3) drifting apart through caregiving strain, and (4) learning to carry the weight alone and together. These reflected the mothers' struggles with inadequate preparation, limited support, financial and emotional strain, along with the gradual development of caregiving expertise through lived experience and peer support, particularly via online.
Conclusion: Mothers caring for young children with tracheostomies in South Korea faced interrelated systemic, economic, developmental, and psychosocial challenges, while developing a sense of competence and resilience. The findings highlight the need for context-responsive strategies in South Korea, including standardized caregiver education and transitional support, equitable access to essential resources, inclusive childcare opportunities, and integrated psychosocial services. Collectively, these efforts are essential to ensuring safer and more sustainable pediatric tracheostomy care at home.

Keywords: Caregivers; Children with disabilities; Infant; Qualitative research; Tracheostomy

INTRODUCTION

Tracheostomy is a life-sustaining intervention for individuals who require prolonged mechanical ventilation or have conditions that compromise normal breathing [1]. With advances in pediatric medicine, tracheostomy has become an integral component of long-term respiratory management, particularly for children under 1 year of age who have complex medical conditions [2-4]. However, decannulation is uncommon in early childhood, as less than half of these children are decannulated after an average duration of approximately 2 years [5]. As a result, these children are discharged from hospitals with tracheostomies, leaving parents responsible for providing prolonged and complex tracheostomy care at home over an extended period.

In this study, young children with tracheostomies refers to

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infants and toddlers who require ongoing tracheostomy care at home, often in the context of chronic or complex medical conditions. While the presence of tracheostomy alone does not indicate severity of illness, it signifies caregiving demands related to airway management, continuous monitoring, and emergency preparedness. Existing qualitative studies on this population include children with diverse diagnoses, reflecting the clinical heterogeneity of this group. In these literatures, caregiving is commonly described in relation to the demands and challenges inherent to tracheostomy status, rather than around differences in underlying diagnoses. Consistently, this study focuses on parents' experiences of providing tracheostomy care at home across varied medical conditions.

Caregiving for infants and toddlers with tracheostomy involves potentially life-threatening risks, including accidental decannulation, airway obstruction, bleeding, and infection. Because of their smaller airways, young children are particularly vulnerable to such complications [6]. Although proper caregiver education can prevent many of these adverse outcomes, tracheostomy care remains highly complex and demanding. Parents must learn critical procedures such as suctioning, stoma care, tube replacement, and emergency response techniques [7]. However, many parents report that the training provided before hospital discharge is inadequate [8]. Even when comprehensive instruction is provided, parents struggle with gaps in knowledge, lack of confidence, and difficulties in applying learned skills in real-life situations [9].

In addition to immediate medical risks, tracheostomy in early childhood is associated with developmental challenges. Developmental delays—particularly in gross motor skills—are often evident in young children with tracheostomies. A recent study has found that infants with tracheostomies have significantly lower scores in head control and rolling than their peers without tracheostomies [10]. Neurodevelopmental impacts have also been reported. For example, children with severe bronchopulmonary dysplasia who underwent tracheostomy demonstrated greater cognitive and motor delays before 24 months of age, with persistent cognitive impairments beyond that period [11]. Furthermore, the presence of a tracheostomy tube interferes with vocalization and oral communication, potentially impeding speech and language development [12].

The cumulative demands of prolonged tracheostomy care place a significant burden on parents. In comparison to caregivers of children with other chronic illnesses, such as diabetes or cancer, parents of children with tracheostomies report lower quality of life [13]. Caregiving responsibilities affect multiple aspects of daily life, including sleep, emotional well-being, interpersonal relationships, and overall family dynamics. Social isolation is also common, as the intensity of ongoing care leaves little time for interaction with others [14]. High levels of anxiety, depression, and post-traumatic stress have been reported due to the constant vigilance needed to maintain the child's airway and respond to emergencies [15]. Nighttime monitoring leads to chronic sleep deprivation and physical exhaustion, while financial strain is intensified by medical expenses and loss of income due to reduced work hours or unemployment for commitment to caregiving [15].

Although existing studies have examined parental experiences related to pediatric tracheostomy, most were conducted in Western countries. Therefore, less is known about how parents navigate caregiving in different sociocultural and healthcare settings. In South Korea, caregiving for young children with complex medical needs is shaped by cultural norms that may differentiate parents' experiences from those reported in other countries. Although both mothers and fathers are increasingly involved in childrearing, societal norms continue to assign different roles to each parent, influencing how caregiving responsibilities are assumed within families [16]. The gendered expectations intersect with a healthcare system that remains hospital-centered, offering limited community-based support for long-term home care. In addition, social perceptions on disability and visible medical devices may contribute to experiences of stigma and constrained interaction [17]. Collectively, the sociocultural and systemic dimensions influence how pediatric tracheostomy care is provided at home in South Korea and highlight the need for a context-specific investigation.

A qualitative design is therefore appropriate for addressing these gaps, as it allows in-depth examination of how parents manage and interpret caregiving demands within specific sociocultural and healthcare contexts. Accordingly, this study explores the lived experiences and perceived support needs of parents providing home care for infants and toddlers with tracheostomies in South Korea, with the aim of offering insights that can inform family-centered practice and the development of support strategies responsive to caregiving realities.

The research questions of this study are as follows: (1) What challenges and responsibilities do parents of infants

and toddlers with tracheostomies encounter in home care? (2) How do parents perceive, navigate, and identify areas of support within the healthcare and social context of South Korea?

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Seoul National University (IRB No. 2403/004-006). Informed consent was obtained from all participants.

1. Study Design

This study adopts a qualitative descriptive design with thematic analysis to examine the home care experiences of mothers with young children who have tracheostomies [18]. To ensure comprehensive and standardized reporting, we followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines [19].

2. Sampling

Participants were recruited between March and August 2024, through an online community for parents of children with chronic illnesses and disabilities. The same recruitment post was sent directly to parents who publicly shared their experiences of tracheostomy care at home on social media. Individuals interested in the study were asked to contact the first author, who then assessed their qualifications based on the study's inclusion criteria. Eligible participants were parents of children under the age of 36 months with at least 3 months of home care experience. Infancy and toddlerhood represent an intensive and developmentally sensitive caregiving period [20], and the 3-month minimum ensured that participants had moved beyond the immediate post-discharge state and could meaningfully reflect on their caregiving experience at home [21]. Parents were excluded if their child had received 6 months or more of hospital or facility-based care within the past year, as this would disrupt the continuity of home-based caregiving. Although the study was open to both mothers and fathers, all individuals who expressed interest in participation were mothers. As a result, the final sample consisted of 10 mothers (Table 1).

3. Data Collection

Individual interviews were conducted from April to August 2024, lasting 72 to 138 minutes, with an average duration of approximately 90 minutes. Each participant was interviewed once at a time and location of their preference. During recruitment, attention was paid to variation in participant characteristics—such as the child's age and duration of tracheostomy care at home—to represent diverse caregiving experiences. Among the 10 participants, eight mothers opted for in-person interviews, while two participated via video calls due to geographic constraints. For in-person interviews, private and secure settings—such as participants' homes or reserved conference rooms—were selected to ensure confidentiality. Participants received verbal and written explana-

Table 1. General characteristics of the participants (N=10)

ID	Mothers				Children			
	Age (yr)	Employment status	Duration of tracheostomy care at home (mo)	Primary support resources	Age (mo)	Underlying condition	Method of respiratory support	Time since tracheostomy placement (mo)
1	25	Leave of absence	4.5	Extended family	9	Airway anomaly	HMV	5
2	35	No	9	None	36	Neurological condition	HMV	10
3	33	No	5	Extended family	11	Airway anomaly	HME	6
4	31	Yes	20	Extended family	24	Airway anomaly	HME	20
5	27	Yes	28	None	36	Airway anomaly	HME	30
6	38	Leave of absence	5	None	8	Neurological condition	OC	6
7	36	Leave of absence	3	Extended family	12	Airway anomaly	HME	6
8	34	Leave of absence	5	None	8	Airway anomaly	HME	5
9	30	Yes	19	Extended family	24	Airway anomaly	HME	20
10	35	Leave of absence	18	None	21	Airway anomaly	HME	20

HME, heat moisture exchanger; HMV, home mechanical ventilation; OC, oxygen concentrator.

tions of the study and their right to withdraw at any time, and provided voluntary informed consent prior to participation. Given the emotional sensitivity of caregiving experience, participants were allowed to pause, skip questions, or take breaks as needed during the interview, with the interviewer attentive to participants' response. No interviews were terminated due to emotional distress. Interviews were audio-recorded with participants' consent, and non-verbal cues (e.g., facial expressions and body language) were documented in detailed field notes. Collected data were stored on a secure device accessible only to the research team.

Semi-structured, open-ended questions were used as a flexible guide to facilitate in-depth exploration of participants' caregiving experiences (Table 2), which were followed by more specific discussions [22]. The interview guide was developed in alignment with the study's research questions and the clinical context of tracheostomy care at home for infants and toddlers, with domains designed to address practical, emotional, and contextual aspects of caregiving. Data collection and preliminary analysis occurred concurrently, and data saturation was determined after the tenth interview, when no new themes emerged across participants with differing caregiving and clinical characteristics. All interviews were conducted by the first author, a female nurse with several years of clinical experience in a neonatal intensive care unit and formal training in qualitative research, under the supervision of the second author, a professor with expertise in qualitative research. To minimize potential bias related to the first author's clinical background, reflective notes were maintained during interviews and initial data analysis, and the analytic interpretations were reviewed through regular team discussions.

4. Data Analysis

Each interview was transcribed verbatim immediately after completion, and all personally identifiable information was moved to anonymize transcripts and ensure confidentiality during data analysis. The transcripts were reviewed repeatedly to allow deep immersion and reflection of the data. Thematic analysis was conducted according to the six steps outlined by Braun and Clarke [23]. During transcription and subsequent review, initial impressions were noted, and meaningful phrases and recurring ideas were identified and labeled with preliminary codes. The first author conducted initial coding of the transcripts, and drafted preliminary themes. The second author reviewed the coded data and thematic interpretations, and theme validation was achieved through iterative discussion and consensus between the two authors. These codes were then organized into overarching themes and sub-themes through discussion to ensure accuracy. Themes were examined, refined, and mapped to represent the dataset, and each was defined and named collaboratively to capture the essence of the data. Finally, a comprehensive report was produced, which integrated the thematic findings with relevant literature to provide context and support the analysis.

5. Rigor

The rigor of this study was grounded in the criteria by Sandelowski [24]. Credibility was established with semi-structured interviews using open-ended questions, immediate transcription by the first author, and continuous team discussions to reduce interpretive bias. Fittingness was enhanced via purposive sampling of participants with diverse caregiv-

Table 2. Semi-structured interview guide for caregivers of tracheostomized infants and toddlers

Category	Key questions
Background and daily life	• Could you describe your typical day of caregiving at home? • What was your experience like before and after your child's tracheostomy, especially during the transition from hospital to home?
Challenges and concerns	• Since your child's tracheostomy, what challenges have you encountered in caring for them at home? • Looking ahead, what concerns do you have about continuing care in the future?
Education and professional support	• What education or training did you receive on tracheostomy care before your child was discharged from the hospital? • After discharge, have you received any professional support at home? (e.g., home visits from nurses or other healthcare providers)
Family and social support	• What kinds of support have you received from family, community, or other social resources in terms of caregiving? • How do you usually go about seeking or asking for help when it is needed?
Coping and motivation	• What has been the most difficult part about adapting to tracheostomy care at home, and how did you handle it? • What has helped or motivated you in continuing your caregiving role?

ing backgrounds, and findings were validated by participant confirmation. To ensure auditability, each research step was thoroughly documented, and participant quotes were included to illustrate the theme development. During translation from Korean to English, careful attention was given to preserve meaning and nuance, with final texts reviewed against the originals for accuracy. Confirmability was reinforced through adherence to the principles of credibility, fittingness, and auditability.

RESULTS

Initial coding of the data yielded 74 descriptive codes. These codes were iteratively reviewed and refined through repeated discussions between the first and second authors, with closely related codes merged into higher-order categories. As a result, four themes and nine corresponding subthemes were identified: (1) navigating the demands of home care, (2) bearing witness to a constrained childhood, (3) drifting apart through caregiving strain, and (4) learning to carry the weight alone and together (Table 3).

1. Navigating the Demands of Home Care

1) Entering home care without adequate preparation

Participants faced significant gaps in the education provided before hospital discharge, particularly in preparing them for the realities of tracheostomy care at home. Many described the education process as rushed, fragmented, and lacking in practical depth. In some cases, critical information—such as details about necessary medical supplies—were not communicated promptly, exacerbating the caregiver's stress during an already overwhelming transition.

"Caregiver education just seemed like a formality. I wasn't confident enough, and if something went wrong, it could cost my child's life. Most parents leave the hospital unprepared, and the whole process feels rushed and disorganized. I didn't even learn about the necessary supplies until 2 days before discharge." (Participant 5)

The quality and content of caregiver education also varied across healthcare institutions, with notable differences between urban and rural settings. These inconsistencies led to heightened anxiety and uncertainty, especially around managing emergencies such as accidental decannulation. While some urban hospitals provided hands-on training for tracheostomy tube replacement, those in rural areas often offered minimal or no practical instruction.

"Hospitals in rural areas offer little to no caregiver education. They gave a brief demonstration on how to suction using hospital equipment, but provided no guidance on which machines to use at home, how to care for tracheostomy site, or how to handle emergencies, except to call 911. It felt like they were saying, 'It's your child, so figure it out yourself.'" (Participant 4)

2) Feeling overwhelmed amid insufficient support

The transition from hospital to home was described as overwhelming and disorienting, particularly in the absence of sufficient post-discharge support. While some participants believed they had a basic understanding of the tasks involved, the reality of independently practicing tracheostomy care exposed significant gaps and challenges.

"I thought I understood everything. But once we got home, I felt completely lost. I ended up calling the hospital multiple times asking for help." (Participant 7)

Table 3. Themes and sub-themes from the interviews

Themes	Sub-themes
1. Navigating the demands of home care	1.1 Entering home care without adequate preparation
	1.2 Feeling overwhelmed amid insufficient support
	1.3 Ongoing challenges with securing the essentials
2. Bearing witness to a constrained childhood	2.1 Balancing developmental needs and safety
	2.2 Tracheostomy as a barrier to accessing inclusive childcare
3. Drifting apart through caregiving strain	3.1 Enduring social and emotional toll of caregiving
	3.2 Heightened family tensions under caregiving stress
4. Learning to carry the weight alone and together	4.1 Building competence through trial and error
	4.2 Finding strength in online companionship

Although home nursing is critical for supporting families with complex medical needs especially during the transition period, participants frequently reported receiving little or no guidance on how to access such support. In several cases, mothers were informed that they were ineligible for home nursing without further guidance, leaving them to navigate care options on their own.

"We were simply told our home was outside the service area, so we weren't eligible for home nursing. It wasn't until later that I learned we might have been able to apply for home nursing at a nearby hospital with the right documents." (Participant 1)

In the absence of adequate systemic support, caregivers found themselves taking on the role of advocate to secure necessary services for their child. Several participants noted that, in order to receive timely or appropriate support, they felt compelled to speak up repeatedly and be assertive—sometimes to the point of being labeled as "difficult" by healthcare professionals.

"Some parents feel that they have to be seen as 'difficult' or 'demanding' just to make sure their child gets proper care. If they don't speak up and push for what's needed, it's the child who ends up suffering the consequences." (Participant 5)

3) Ongoing challenges with securing the essentials

Basic tracheostomy supplies—such as suction catheters and normal saline—were described as the essentials for daily home care. Despite their necessity, participants reported that a lot of these supplies were not covered by insurance, intensifying the cost-related stress.

"The tracheostomy keeps my son alive, but most essential supplies aren't covered by insurance. … They're meant for single use, but I have to reuse them because of the cost. I know it's unsafe, but I don't have any other option." (Participant 3)

In addition to supply costs, participants faced greater economic challenges due to inconsistent insurance coverage and a lack of proactive guidance from professionals. Many of them were unaware of more affordable options or available resources until after making out-of-pocket payments. This lack of timely information, combined with pricing variability across providers, left mothers feeling unsupported and financially strained.

"We had been paying out of pocket for an oxygen concentrator—only to later find out that, with a prescription, we could have received financial support. No one informed us, so we ended up spending the money we didn't have to." (Participant 1)

"Some equipment aren't covered by insurance, so rental costs vary widely. Some companies offer them for free, while others charge extensive amount per month. It all depends on the provider." (Participant 6)

Caregivers also expressed heightened anxiety about the unpredictable availability of essential supplies, particularly during sudden crises. In these moments, the concern shifted from monetary burden to fear of complete inaccessibility. For many participants, the fear of being unable to obtain life-sustaining products was a source of deep emotional distress.

"During unanticipated events like the coronavirus disease 2019 (COVID-19) pandemic, essential supplies can suddenly become scarce. … Some providers seemed to take advantage of this situation—raising prices or stopping sales altogether, knowing how desperate caregivers and children are." (Participant 5)

"What worries me most are the things beyond my control—like not being able to get the supplies we need. The cost is one thing, but the thought of not getting them at all is terrifying." (Participant 1)

2. Bearing Witness to a Constrained Childhood

1) Balancing developmental needs and safety

As children with tracheostomies grow and begin to reach developmental milestones—such as rolling over, crawling, or attempting to sit—participants described entering a new dimension of emotional struggle. Although mothers expressed concerns across all areas of development, including cognitive and linguistic abilities, they were particularly worried about the dangers associated with their children becoming physically active. The increased mobility posed greater risk to the stability and safety of tracheostomy, requiring constant su-

pervision and responses to unexpected situations. Participants reported feeling increasingly anxious and needing to stay constantly alert as their children gained more independence in movement while relying on life-sustaining equipment.

"When he started rolling onto his belly, he couldn't always hold up his head and would drop forward. The filter attached to tracheostomy tube could hit the surface below and get stuck, making it hard to remove quickly in an emergency. I was constantly on edge, worried something would go wrong." (Participant 4)

Balancing developmental needs with safety was a persistent concern. Mothers also struggled with the tension between allowing their children to explore and maintaining safety. Because of the risk of injury or accidental decannulation, participants had to limit activities that would otherwise promote play, social interaction, and age-appropriate development. This need for vigilance restricted the children's participation in peer engagements and natural learning experiences.

"We stop him from playing with toys that could block the tracheostomy tube. Even when he wants to play with other kids, we hold him back because they don't know how to interact safely with him." (Participant 8)

2) Tracheostomy as a barrier to accessing inclusive childcare

Participants described how regulatory restrictions limited access to childcare for infants and toddlers with tracheostomies. Although some children with tracheostomies were cognitively ready to benefit from group learning, they were excluded from such experience due to medical needs. Mothers expressed particular frustration that routine caregiving tasks they performed daily at home were classified as medical acts within institutional settings, restricting childcare enrollment.

"It's frustrating that I can't send my son to childcare. Suctioning is considered as a medical procedure, so the staffs at daycare aren't allowed to do it. Even though he is cognitively capable, they won't allow him to attend." (Participant 4)

A similar lack of accommodation was also observed in home-based childcare. Some mothers expressed deep frustration with systems that failed to recognize how caregiving and medical procedures are intertwined for young children with tracheostomies. Existing services often excluded essential tasks, leaving families without adequate support.

"We were matched with a sitter for children with disabilities by the local welfare center. However, it was made clear that we couldn't ask her to perform activities like suctioning as they were classified as medical procedures. But for our son, daily caregiving is inseparable from medical care. It was incredibly frustrating." (Participant 2)

Several participants also brought attention to the possible developmental consequences of being excluded from group learning. Even when they recognized the value of peer interaction for cognitive and social growth, mothers were unable to secure suitable environments due to medical and logistical constraints.

"We have a play teacher who visits our home, and she says group lessons would be really beneficial to my son—he could learn a lot more by watching and imitating others. … I agree, but making it happen is impossible." (Participant 9)

3. Drifting Apart through Caregiving Strain

1) Enduring social and emotional toll of caregiving

At home, many participants described a profound sense of emotional isolation. This was often fueled by a perceived inability to relate to other parents whose caregiving responsibilities were far less demanding. For some, efforts to connect with people around them only deepened feelings of alienation, as differences in daily lives became too difficult to bridge.

"I've become increasingly isolated because I can't relate to other moms with kids the same age. I've tried reaching out, but our situations are so different that it just adds stress. … Even my close friends don't really understand, so I distance myself." (Participant 4)

Over time, caring for a young child with tracheostomy—especially under public scrutiny in a society that values conformity and stigmatizes visible illness—began to affect the

mothers' emotional well-being. Several participants described heightened sensitivity to public attention and social judgment, particularly in everyday settings, which often led them to withdraw from social interactions.

"The way others reacted was so overwhelming it changed me—I became overly sensitive and constantly on edge. It felt like everyone was staring whenever the ventilator alarm went off or my child made coughing noise through tracheostomy tube in public. I'd irritably cover the stroller trying to hide my son, and lash out at others." (Participant 5)

In response to the psychological burden, participants emphasized the importance of interpersonal support and opportunities to speak freely and feel truly understood. For many, the rare moments of open conversation with others played a crucial role in helping them cope with the emotional demands of caregiving.

"When they suspected something was wrong with my baby, we were referred to the palliative care team. … At first, I didn't quite understand the purpose, but now I feel like they're there to support parents emotionally. I can talk to them in ways that I can't with anyone else, and it made a huge difference." (Participant 10)

2) Heightened family tensions under caregiving stress

Participants explained that tracheostomy care at home required the coordinated efforts of multiple family members, especially in the absence of consistent professional support. As a result, the burden of caregiving extended beyond the primary caregiver, affecting the entire family.

"In the beginning, my mom, mother-in-law, and I took turns caring for the baby around the clock. I couldn't take extended leave … so now they come over every day to care for my child while I'm at work." (Participant 4)

Even when family members contributed, mothers often assumed primary responsibility for both hands-on care and the coordination of medical and daily needs. Despite increasing flexibility in gender roles in South Korea, traditional patriarchal norms continue to frame caregiving as a maternal duty. Participants described that this unequal division of labor, reinforced by cultural expectations of maternal sacrifice, led their caregiving efforts to be taken for granted. For some mothers, the resulting strain also weighed on their marriages, as exhaustion and loss of emotional intimacy created distance and tension between spouses.

"I ended up taking on most of the responsibilities and it's not just the hands-on caregiving. I'm also the one researching hospitals, figuring out where to buy supplies at a better price… a lot of things fall just on me." (Participant 1)

"Cooperation between spouses is crucial, but stress and exhaustion often trigger hurtful arguments. I've seriously thought about leaving my husband and sometimes wonder if we'd even be fighting like this if our child weren't ill." (Participant 6)

Participants also expressed profound guilt over how the intense demands of caregiving impacted their other children. Because so much time and attention were devoted to the child with tracheostomy, siblings often received less parental care and support. Mothers described this imbalance as a painful source of conflict, worrying that siblings might feel neglected or less valued within the family. The concerns were not limited to personal guilt, as mothers also felt the weight of external and societal expectations that pressure siblings to act more mature than their actual age.

"I feel a deep sense of guilt toward my other child because he inevitably gets less attention, no matter how hard I try. People also expect him to act more mature because of our situation—although I don't ask that of him, it still troubles me." (Participant 5)

4. Learning to Carry the Weight Alone and Together

1) Building competence through trial and error

Participants shared that confidence in tracheostomy care at home rarely came from caregiver education alone. Instead, it developed through lived experiences—particularly after managing high-stress, life-threatening situations. These moments, while deeply stressful, served as turning points in their caregiving journey.

"I started to feel more confident after facing intense situations—like when my child turned blue during tracheosto-

my tube change or struggled to breathe during sleep. Going through those moments helped me feel more capable in caregiving." (Participant 3)

Beyond responding to crises, mothers described how their confidence was built through everyday caregiving—repetition, persistence, and learning from trial and error. Gradually, mothers tailored care at home to the specific needs of their child, refining caregiving abilities in ways that formal guidance could not.

"Over time, I've learned what works best for my child. A thinner suction catheter is more comfortable for him, so I still use it when there's less mucus, even with a larger tracheostomy tube. It's been a process of trial and error." (Participant 4)

As their caregiving experience deepened, many mothers came to see themselves as experts in their child's care. This growing sense of competence was reinforced when healthcare professionals acknowledged their comprehensive knowledge and familiarity with their child's unique needs.

"Eventually, moms really do become the experts. During hospital stays, nurses rarely need to step in for tracheostomy care with moms at the bedside—they usually just ask what we need because they know we've got it handled." (Participant 10)

2) Finding strength in online companionship

Participants underscored the essential role of peer support as a key resource in navigating daily challenges of tracheostomy care at home. With formal guidance limited or lacking in practical detail, many caregivers turned to online platforms and social media to seek advice from others with the same experience.

"Searching online and reading about how others manage tracheostomy care at home has been really helpful. … These parents share information with such care and detail, because they understand how overwhelming the situation can be." (Participant 6)

Several participants described how online platforms provided immediate access to real-life insights that were difficult to find through professionals. Guidance from other parents—whether related to equipment, supplies, or daily caregiving routines—was valued for being both practical and empathetic, as it was grounded in lived experience.

"Now I can search social media and connect with other parents caring for a child with tracheostomy. I've asked about care routines, supplies, and where to buy them, and they've responded with detailed, thoughtful advice." (Participant 4)

The peer-led online platforms played a critical role in bridging the gap between clinical knowledge and real-world caregiving. Beyond serving as channels for information exchange, these communities functioned as virtual spaces that fostered a sense of solidarity rooted in shared experience. Experienced caregivers took on mentoring roles, offering hands-on direction and emotional reassurance to those just beginning their journey of tracheostomy care.

"There's an online community for parents of children with tracheostomies where we share information … We also rely on similar platforms for support, since we've all been through a same situation. Experienced parents are especially helpful, offering practical advice to those just starting." (Participant 3)

DISCUSSION

The findings of this study offer valuable insights into the lived realities of mothers caring for infants and toddlers with tracheostomies at home in South Korea. Caregiving extended beyond the execution of routine medical tasks and was shaped by intersecting structural, developmental, and relational factors that influenced how mothers adapted over time. Mothers navigated caregiving within a healthcare and social support context marked by ongoing constraints, while simultaneously responding to their children's evolving needs and their own roles as primary caregivers. By examining these experiences in the context of South Korea, this study illustrates how mothers perceive and confront ongoing challenges while developing practical and emotionally responsive coping strategies to manage the complexities of tracheostomy care at home.

A key issue identified in this study was the inadequacy of transitional care, which imposed a dual burden of insufficient caregiver education and fragmented post-discharge

support. Participants described the discharge preparation as rushed, inconsistent, and lacking in meaningful hands-on training—challenges that were particularly pronounced in rural hospitals where resources and training opportunities were limited. These shortcomings left mothers feeling anxious and uncertain, undermining their confidence and increasing the risk of rehospitalization. Such finding is consistent with previous studies demonstrating the adverse effects of deficient caregiver education and discharge preparation [9]. Once at home, mothers found themselves navigating poorly coordinated healthcare and social service systems, having to advocate persistently for even the most basic forms of support. Collectively, these circumstances reveal critical systemic gaps in preparing and supporting caregivers of young children with tracheostomies, and underscore the need for standardized, competency-based discharge education with supervised hands-on practice and structured hospital-to-community care pathways to support safer transitions from hospital to home [25].

The realities of daily caregiving after discharge were further intensified by economic pressure, which emerged as one of the most persistent and overwhelming difficulties. The high costs of complex care, combined with the lack of structured financial guidance, left mothers feeling particularly vulnerable. Participants reported substantial out-of-pocket spending on equipment, supplies, and frequent hospital visits, learning about cost-saving options or partial coverage only after significant expenses had already been incurred. Many attributed this to inadequate communication and limited guidance from healthcare professionals. The ongoing need to secure life-sustaining items—such as suction catheters, humidification devices, and replacement tubes—added a continual layer of stress. These pressures were magnified in situations like COVID-19, where supplies became unavailable, leaving mothers deeply anxious about the survival of their children. These findings reinforce international evidence that financial strain and supply shortages are not merely material burdens but also profound sources of emotional distress [15].

Beyond financial concerns within the households, participants also encountered systemic and policy-level barriers that further restricted their ability to secure appropriate care. Limited insurance coverage, insufficient information, and fragmented service structures forced mothers to assume the role of care coordinators. Most of them were left to independently locate suppliers, negotiate costs, and apply repeatedly for economic support. These difficulties reflect patterns observed in other high-cost home care contexts [26]. Based on these findings, relevant forms of support may include coordinated case management to assist families with service navigation, clearer financial guidance, and standardized insurance coverage for essential supplies. Assigning case managers at the point of discharge could provide caregivers with clear and timely guidance on accessing home nursing services, securing financial assistance, and obtaining necessary equipment [27]. In addition, regulatory changes to classify tracheostomy-related supplies as essential and to standardize insurance coverage and pricing, would help reduce inequities and caregiver burden [10].

Furthermore, the impact of systemic barriers extended beyond practical caregiving challenges to affect mothers' emotional and relational well-being. Participants described profound feelings of isolation—both from society at large and from other parents who could not fully relate to the demands of tracheostomy care—reflecting patterns documented in previous research [15]. Within the sociocultural context of South Korea, the visibility of medical devices often drew unwanted attention, reinforcing stigma and leaving mothers feeling exposed and contributing to social withdrawal. Cultural expectations of maternal devotion further intensified these experiences, as mothers' primary caregiver role and responsibilities were often legitimized rather than acknowledged. In line with earlier findings, the unequal division of labor within families placed a significant burden on mothers, leading to marital strain and feelings of guilt toward siblings who received less attention [28]. This imbalance suggests the importance of developing shared caregiving frameworks and integrated psychosocial supports such as counseling, family-based interventions, and structured peer-support, to better address caregivers' vulnerabilities while promoting healthier family relationships [29].

While mothers faced multiple challenges in caregiving, infants and toddlers with tracheostomies also encountered developmental and social barriers. Aside from the commonly reported delays in development, participants shared the emotional toll of constantly weighing developmental opportunities against safety risks as their children became more active. The relentless supervision often restricted play, peer interaction, and age-appropriate exploration. The difficulties were not confined to the home environment, as children were excluded from childcare services regardless of their cognitive readiness. Such exclusion is consistent with inter-

national findings that young children with special healthcare needs are frequently denied access to inclusive childcare [30]. In the systemic context of South Korea, mothers attributed these barriers to regulatory distinction between medical and caregiving roles. Participants reported that childcare staff are legally prohibited from performing routine tracheostomy-related tasks such as suctioning, which are classified as medical procedures restricted to healthcare professionals. Additionally, mothers voiced concern that exclusion from childcare would exacerbate developmental delays and social isolation in their children. Addressing these barriers may require adjustments that allow trained staff or on-site nurses to safely perform necessary tracheostomy care, thereby promoting developmental and social growth in young children with tracheostomies [31].

In response to these challenges, mothers sought ways to strengthen their caregiving competence through lived experience and peer support. With formal caregiver education limited or lacking in practical detail, many participants explained that their confidence developed not through formal instruction but via experiential learning—managing emergencies, navigating daily routines, and refining essential techniques through trial and error. Peer networks, particularly online communities, played a complementary role by providing practical guidance and mentorship. Within these interactions, mothers gradually expanded their caregiving knowledge and skills, tailoring home care to meet their child's specific needs. Participants also noted the importance of online peer connections as a source of emotional reassurance, empowering them to cope with the ongoing demands of tracheostomy care. This finding supports prior studies that demonstrated the role of peer networks in fostering emotional resilience among caregivers [25,28]. The combination of embodied knowledge and shared support enhanced mothers' adaptability and resilience in navigating caregiving challenges. Although these coping strategies did not completely eliminate perceived caregiving burden, they mitigated the impact by fostering a sense of solidarity and caregivers' confidence. Integrating experiential learning opportunities and structured peer-support into formal caregiver education, discharge planning, and follow-up services may further improve caregivers' capacity to adapt and sustain caregiving over time.

Although this study provides valuable insights into the realities of home care for infants and toddlers with tracheostomies in South Korea, several limitations should be considered when interpreting the findings. First, the small sample size (N=10) and the participation of only mothers may limit the range of captured caregiving experiences and the transferability of the findings, as the results primarily reflect maternal perspectives. Second, recruitment through online communities and social media may have introduced selection bias, favoring those with greater digital access or a higher willingness to share their experiences publicly. Third, detailed information on participants' residential area and socioeconomic status were not collected, limiting contextual interpretation. Finally, the potential influence of differences in respiratory support methods as well as underlying medical conditions on caregiving experiences were not systematically examined. Future studies should include larger and more diverse samples, including fathers and other caregivers, to reflect a broader range of caregiving experiences. Using varied recruitment strategies beyond online platforms may help reduce selection bias. Furthermore, collecting detailed contextual information and examining possible differences in caregiving experiences across different respiratory support methods and medical conditions would further strengthen the understanding of home caregiving for infants and toddlers with tracheostomies.

CONCLUSION

This study explores the complex realities of home care for young children with tracheostomies in South Korea, revealing how caregiving experiences are shaped by the interaction of overall demands with sociocultural and systemic contexts. Mothers described persistent challenges, including insufficient discharge preparation, fragmented support systems, inequitable financial resources, restricted developmental opportunities, and psychosocial isolation. While many of these challenges have been noted in prior research, our findings suggest that their impacts were experienced in contextually distinct ways within South Korea. In particular, cultural expectations of maternal role placed primary caregiving and care-coordination responsibilities on mothers, whose efforts were often overlooked or underappreciated within families. Social stigma associated with visible illness contributed to withdrawal and isolation, while rigid systemic boundaries enforcing a strict division between medical and caregiving tasks limited access to inclusive childcare. Despite these constraints, mothers demonstrated resilience by developing caregiving competence through lived experience and online

peer networks, compensating for gaps in formal support systems. This reliance on informal coping strategies points to the need for practice and policy-level responses attuned to South Korea's sociocultural and healthcare context. Continued efforts should focus on reducing caregiving burden through standardized discharge education, coordinated transitional care, equitable coverage of essential supplies, inclusive childcare with trained staff or on-site nurses, and integrated psychosocial support.

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Authors' contribution

Conceptualization: all authors. Data collection: SL. Formal analysis: all authors. Writing–original draft: SL. Writing–review & editing: all authors. Supervision: SMC. Final approval of published version: all authors.

Conflict of interest

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

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Data availability

Please contact the corresponding author for data availability.

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An AI-assisted language editing tool (ChatGPT, OpenAI) was used to improve spelling, grammar, clarity, and readability of the manuscript. The authors subsequently reviewed and revised the manuscript and take full responsibility for the final content.

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REFERENCES

1. Fuller C, Wineland AM, Richter GT. Update on pediatric tracheostomy: indications, technique, education, and decannulation. Curr Otorhinolaryngol Rep. 2021;9(2):188-199. https://doi.org/10.1007/s40136-021-00340-y
2. Watters KF. Tracheostomy in infants and children. Respir Care. 2017;62(6):799-825. https://doi.org/10.4187/respcare.05366
3. Muller RG, Mamidala MP, Smith SH, Smith A, Sheyn A. Incidence, epidemiology, and outcomes of pediatric tracheostomy in the United States from 2000 to 2012. Otolaryngol Head Neck Surg. 2019;160(2):332-338. https://doi.org/10.1177/0194599818803598
4. Kang KT, Lee CH, Lin CY, Hsu WC. Trend of pediatric tracheostomy in Taiwan: a population-based survey from 2000 to 2019. J Otolaryngol Head Neck Surg. 2024;53:19160216241293069. https://doi.org/10.1177/19160216241293069
5. Pérez-Ruiz E, Caro P, Pérez-Frías J, Cols M, Barrio I, Torrent A, et al. Paediatric patients with a tracheostomy: a multicentre epidemiological study. Eur Respir J. 2012;40(6):1502-1507. https://doi.org/10.1183/09031936.00164611
6. Lubianca Neto JF, Castagno OC, Schuster AK. Complications of tracheostomy in children: a systematic review. Braz J Otorhinolaryngol. 2022;88(6):882-890. https://doi.org/10.1016/j.bjorl.2020.12.006
7. Antoniou I, Wray J, Kenny M, Hewitt R, Hall A, Cooke J. Hospital training and preparedness of parents and carers in paediatric tracheostomy care: a mixed methods study. Int J Pediatr Otorhinolaryngol. 2022;154:111058. https://doi.org/10.1016/j.ijporl.2022.111058
8. Gong S, Wang X, Wang Y, Qu Y, Tang C, Yu Q, et al. A descriptive qualitative study of home care experiences in parents of children with tracheostomies. J Pediatr Nurs. 2019;45:7-12. https://doi.org/10.1016/j.pedn.2018.12.005
9. Mai K, Davis RK, Hamilton S, Robertson-James C, Calaman S, Turchi RM. Identifying caregiver needs for children with a tracheostomy living at home. Clin Pediatr (Phila). 2020;59(13):1169-1181. https://doi.org/10.1177/0009922820941209
10. Shin HI, Shin HI. Delayed development of head control and rolling in infants with tracheostomies. Front Pediatr. 2020;8:571573. https://doi.org/10.3389/fped.2020.571573
11. Annesi CA, Levin JC, Litt JS, Sheils CA, Hayden LP. Long-term respiratory and developmental outcomes in children with bronchopulmonary dysplasia and history of tracheostomy. J Perinatol. 2021;41(11):2645-2650. https://doi.org/10.1038/s41372-021-01144-0

12. Lugo-Machado JA, Cárdenas AZ. The impact of tracheostomy on spoken language in children: a narrative review. Rom J Rhinol. 2024;14(54):49-52. https://doi.org/10.2478/rjr-2024-0009
13. Westwood EL, Hutchins JV, Thevasagayam R. Quality of life in paediatric tracheostomy patients and their caregivers: a cross-sectional study. Int J Pediatr Otorhinolaryngol. 2019;127:109606. https://doi.org/10.1016/j.ijporl.2019.109606
14. Flynn AP, Carter B, Bray L, Donne AJ. Parents' experiences and views of caring for a child with a tracheostomy: a literature review. Int J Pediatr Otorhinolaryngol. 2013;77(10):1630-1634. https://doi.org/10.1016/j.ijporl.2013.07.020
15. Aung WT, Ong NY, Yeo SQ, Juhari NS, Kong G, Lim NA, et al. Impact of pediatric tracheostomy on family caregivers' burden and quality of life: a systematic review and meta-analysis. Front Public Health. 2024;12:1485544. https://doi.org/10.3389/fpubh.2024.1485544
16. Lee YE. Childcare sharing and family happiness: analyzing parental and child well-being in the actor-partner interdependence model. Front Public Health. 2024;12:1361998. https://doi.org/10.3389/fpubh.2024.1361998
17. An JY, Kwon SH, Choi HR. Experiences of South Korean mothers of children with medical complexity under long-term hospitalization. Nurs Open. 2023;10(3):1840-1851. https://doi.org/10.1002/nop2.1446
18. Sandelowski M. Whatever happened to qualitative description? Res Nurs Health. 2000;23(4):334-340. https://doi.org/10.1002/1098-240x(200008)23:4<334::aid-nur9>3.0.co;2-g
19. 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
20. Gee DG, Cohodes EM. Caregiving influences on development: a sensitive period for biological embedding of predictability and safety cues. Curr Dir Psychol Sci. 2021;30(5):376-383. https://doi.org/10.1177/09637214211015673
21. Tarfa RA, Morris J, Melder KL, McCoy JL, Tobey AB. Readmissions and mortality in pediatric tracheostomy patients: are we doing enough? Int J Pediatr Otorhinolaryngol. 2021;145:110704. https://doi.org/10.1016/j.ijporl.2021.110704
22. DeJonckheere M, Vaughn LM. Semistructured interviewing in primary care research: a balance of relationship and rigour. Fam Med Community Health. 2019;7(2):e000057. https://doi.org/10.1136/fmch-2018-000057
23. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77-101. https://doi.org/10.1191/1478088706qp063oa
24. Sandelowski M. The problem of rigor in qualitative research. ANS Adv Nurs Sci. 1986;8(3):27-37. https://doi.org/10.1097/00012272-198604000-00005
25. Acorda DE, Jackson A, Lam AK, Molchen W. Overwhelmed to ownership: the lived experience of parents learning to become caregivers of children with tracheostomies. Int J Pediatr Otorhinolaryngol. 2022;163:111364. https://doi.org/10.1016/j.ijporl.2022.111364
26. Teggart K, Neil-Sztramko SE, Nadarajah A, Wang A, Moore C, Carter N, et al. Effectiveness of system navigation programs linking primary care with community-based health and social services: a systematic review. BMC Health Serv Res. 2023;23(1):450. https://doi.org/10.1186/s12913-023-09424-5
27. Breneol S, Belliveau J, Cassidy C, Curran JA. Strategies to support transitions from hospital to home for children with medical complexity: a scoping review. Int J Nurs Stud. 2017;72:91-104. https://doi.org/10.1016/j.ijnurstu.2017.04.011
28. Castro-Codesal M, Ofosu DB, Mack C, Majaesic C, van Manen M. Parents' experiences of their children's medical journeys with tracheostomies: a focus group study. Paediatr Child Health. 2024;29(1):36-42. https://doi.org/10.1093/pch/pxad042
29. Sherman J, Bower KL, Eskandanian K. "100 Things I wish someone would have told me": everyday challenges parents face while caring for their children with a tracheostomy. Qual Health Res. 2024;34(11):1108-1118. https://doi.org/10.1177/10497323231217387
30. Whitmore KE, Johnson NL, Park J, Salama S, Sobiesk RJ. Improving inclusion for children with special health care needs in childcare settings: results from a Statewide Survey of Childcare Professionals. J Pediatr Health Care. 2023;37(2):e1-e10. https://doi.org/10.1016/j.pedhc.2022.11.012
31. Caicedo C. Health and functioning of families of children with special health care needs cared for in home care, long-term care, and medical day care settings. J Dev Behav Pediatr. 2015;36(5):352-361. https://doi.org/10.1097/DBP.0000000000000167

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A theory of planned behavior–based analysis of factors associated with human papillomavirus vaccination intentions among high school students in South Korea: a cross-sectional study

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Purpose: This descriptive study identified factors influencing high school students' intentions to receive human papillomavirus (HPV) vaccination using Ajzen's theory of planned behavior as the guiding framework.
Methods: Participants were 192 male and female high school seniors aged 18 years or older who could express their opinions independently. In April 2023, participants completed structured, self-administered questionnaires assessing HPV vaccination intention, HPV knowledge, attitudes toward HPV vaccination, subjective norms, and perceived behavioral control. Data were analyzed using independent t-tests, one-way analysis of variance with the Scheffé post hoc test, Pearson correlation coefficients, and hierarchical multiple regression.
Results: Intention to receive HPV vaccination was significantly predicted by subjective norms (β=.31, p<.001), perceived behavioral control (β=.31, p<.001), attitudes (β=.22, p<.001), and school gender composition (β=.19, p=.005). Subjective norms and perceived behavioral control exerted the greatest influence and together explained 54% of the variance in intention (adjusted R^2=.54).
Conclusion: These findings provide fundamental evidence for developing effective interventions to enhance high school students' intentions to receive HPV vaccination. Efforts should focus on fostering positive perceptions of HPV vaccination by providing accurate information about its benefits and potential adverse effects, supported by credible public messaging.

Keywords: Attitudes; Intentions; Knowledge; Norms; Students

INTRODUCTION

1. Background

Human papillomavirus (HPV) is a prevalent sexually transmitted infection. Although most HPV infections resolve spontaneously, persistent infection with high-risk types 16 and 18 markedly increases the likelihood of progression to cervical cancer [1]. HPV is also implicated in vulvar, penile, anal, oropharyngeal, and head-and-neck cancers, as well as genital warts [1].

Globally, HPV accounted for approximately 7.5% of all cancer cases in 2022, with about 1,505,394 HPV-associated cancer cases newly diagnosed worldwide [2]. In South Korea,

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16.7% of women were infected with HPV in 2021 [3]. Additionally, surveillance data identified HPV infection in 107 men and 12,862 women in 2022; in 2025, a total of 13,193 HPV cases were reported through the sentinel surveillance system [4]. These findings underscore HPV's detrimental impact on quality of life for both men and women and highlight HPV as a pervasive health threat.

In particular, HPV infection in men is frequently asymptomatic, increasing the risk of inadvertent transmission [1]. The most common route of HPV infection is direct contact during sexual intercourse, with incidence peaking immediately after sexual debut [1]. In South Korea, 7.6% of male and 4.7% of female middle and high school students report having had sexual experience, and this proportion rises sharply to 53.8% among individuals in their 20s [5,6].

To prevent HPV infection, the US Food and Drug Administration approved the first HPV vaccine in 2006 to curb HPV-related diseases associated with increasing sexual activity [7]. The vaccine is now also recommended for preventing penile, oropharyngeal, and anal cancers [8]. Currently, the National Immunization Program provides free HPV vaccination to females aged 12–26 for the prevention of cervical and oropharyngeal cancers. For the first time, the program is being extended to include 12-year-old boys [9]. Administering the vaccine before the rapid rise in sexual activity maximizes coverage and cost-effectiveness. Moreover, the overall incidence of HPV-related diseases decreases when men are vaccinated compared with vaccinating only women [10].

However, HPV vaccination rates among adolescent girls remain suboptimal, and rates among adolescent boys are extremely low (approximately 1% or less), which is insufficient to achieve herd immunity [3]. Therefore, achieving herd immunity requires vaccinating students of both sexes, particularly during late adolescence—just before the sharp rise in HPV exposure associated with increased sexual experience. In addition, because HPV is increasingly recognized as a major cause of various cancers affecting both men and women—including cervical, anal, oral, and penile cancers—expanding national support for HPV vaccination to male adolescents is under active policy discussion [11].

Ajzen [12] identified behavioral intention as the most proximate determinant of action in the theory of planned behavior (TPB). According to the TPB, intention is shaped by attitudes toward the behavior, subjective norms, and perceived behavioral control. Furthermore, behavior manifests only when it is under voluntary control [12]. Thus, understanding high school students' intention to receive HPV vaccination—and the attitudes, subjective norms, and perceived behavioral control that shape it—through the TPB framework is essential.

Ajzen [12] also noted that researchers may modify the model or introduce additional variables to better predict behavioral intentions or behaviors. HPV knowledge is an important predictor of HPV vaccination intentions; greater knowledge is associated with a higher likelihood of vaccination [13]. Previous studies have demonstrated that greater HPV knowledge is associated with more favorable attitudes toward HPV vaccination and stronger intentions to vaccinate, thereby influencing behavioral intention. Notably, research involving parents of adolescent girls has reported that higher levels of HPV-related knowledge significantly increase the likelihood of HPV vaccine acceptance and uptake [13]. Thus, this study conceptualized HPV-related knowledge not as a core extension of the TPB, but as a supplementary contextual variable that may influence vaccination intention through its association with TPB constructs.

Previous research on HPV vaccination intention has focused mainly on female populations, including female students and mothers [14,15]. Because HPV also poses serious risks to men, vaccinating both sexes can further reduce infection rates and related diseases [10]. Therefore, enhancing HPV vaccination intention among high school students—who can make independent health decisions and are on the brink of increased sexual activity—is critical to safeguarding late-adolescent health.

High school students are in a developmental period during which sexual activity and the risk of HPV exposure increase rapidly, making this a critical window for prevention. Building on prior research, this study integrated HPV knowledge into a TPB-based framework and examined its influence on HPV vaccination intention among high school students. These findings may inform policy in South Korea, where legislators are actively discussing expanding free HPV vaccination to male adolescents under the National Immunization Program. Accordingly, this study investigated how HPV-related knowledge, attitudes toward HPV vaccination, subjective norms, and perceived behavioral control influenced high school students' intention to receive HPV vaccination (Figure 1).

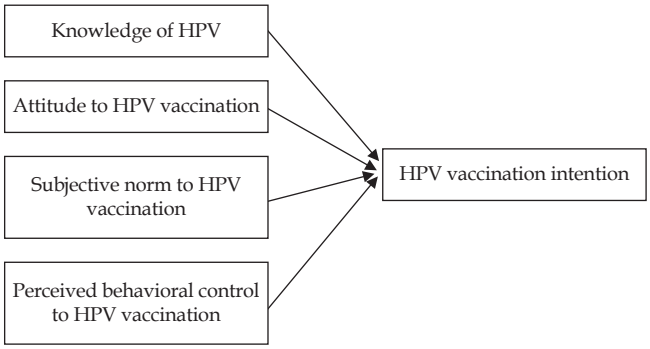

Figure 1. Conceptual framework of the study.
HPV, human papillomavirus.

2. Research Purpose

This study examined relationships between high school students' HPV vaccination intention and HPV knowledge, attitudes toward HPV vaccination, subjective norms, and perceived behavioral control. It also determined how these TPB constructs influenced vaccination intention.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Chonnam National University in South Korea (IRB No. 1040198-221116-HR-136-02). Informed consent was obtained from all participants.

1. Study Design

This cross-sectional study aimed to identify factors influencing high school students' intention to receive HPV vaccination. Reporting followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines [16].

2. Participants

Students from two general high schools in residential areas of Kwang ju Metropolitan City—one boys' school and one girls' school—participated in this study. Eligible participants were at least 18 years old and able to provide informed consent independently. Using multivariate power analysis (α=.05, power=.80, medium effect size=.15) and accounting for the required number of predictor variables, the minimum sample size was calculated as 163. To account for a potential dropout rate of approximately 20%, a total of 210 participants were recruited. Ultimately, after excluding incomplete responses, 192 datasets were included in the analysis, exceeding the minimum sample size by approximately 20%.

3. Measurement

1) Demographic characteristics and HPV-related variables

Variables included age, school gender composition, religious affiliation, smoking history, drinking history, contraceptive experience, awareness of cervical cancer, family history of cervical cancer, awareness of HPV, awareness of HPV vaccination, awareness of the expanded national support for HPV vaccination, vaccination status, and reasons for non-vaccination.

2) HPV-related knowledge

HPV knowledge was measured using a 20-item instrument developed by Kim and Ahn [17] for female college students. The scale covers HPV types, related diseases, symptoms, incubation period, prognosis, immunity, transmission routes, testing and diagnosis, prevention and treatment, fetal infection, and the age of peak prevalence. Each item is answered with "yes," "no," or "I don't know," yielding a total score of 0–20. Correct responses are scored as 1, whereas incorrect or "I don't know" responses are scored as 0; higher scores indicate greater knowledge. The KR-20 (Kuder–Richardson 20) reliability coefficient in this study was .62.

3) Attitude toward HPV vaccination

Attitude was measured using an instrument developed by Ajzen [18] and subsequently modified by Lee [19] based on a scale developed by Lee [20]. The final instrument comprises eight pairs of bipolar adjectives on a semantic differential scale, scored from +3 to −3 (total possible range, −24 to +24), with higher scores reflecting a more favorable attitude toward vaccination. Cronbach's α was .96.

4) Subjective norms for HPV vaccination

Subjective norms were assessed using an instrument developed by Ajzen [18] and modified by Lee [19] based on the scale developed by Lee [20]. The instrument comprises three items rated on a 7-point Likert scale (1=not at all, 7=very much), yielding total scores ranging from 3 to 21. Higher scores indicate stronger perceived social pressure to be vaccinated. Cronbach's α was .68.

5) Perceived behavioral control regarding HPV vaccination

Perceived behavioral control was measured with a four-item instrument adapted by Lee [19] from Ajzen [18], based on the scale developed by Lee [20]. Items were rated on the same 7-point Likert scale (1=not at all, 7=very much), yielding scores ranging from 4 to 28. Negatively worded items were reverse-coded; higher scores represent greater perceived ease of receiving the vaccine. Cronbach's α was .68.

6) Intention to receive HPV vaccination

Intention was evaluated using an instrument originally developed by Ajzen [18] and, with permission, adapted by Lee [19] from Lee [20]. The instrument comprises three items rated on a 7-point Likert scale, yielding a total score ranging from 3 to 21; higher scores denote stronger vaccination intention. Cronbach's α was .94.

4. Data Collection

Data were collected in April 2023 after approval from the university IRB and permission from the principals of two high schools in Gwangju City, South Korea. The study purpose and procedures were explained to students who volunteered to participate. Participants then received anonymous questionnaires and consent forms describing the study aims, their participation rights (including the freedom to withdraw at any time), the estimated time required, and data management procedures. Participation offered no benefits and posed no harm to school life, and personal identification was not possible. Participants were instructed to respond honestly. Data were coded with identification numbers to support anonymity. Of the 210 questionnaires collected, 18 were excluded because of incomplete responses or substantial missing data. The final analysis included 192 complete cases.

5. Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows ver. 27.0 (IBM Corp.). Means and standard deviations were calculated for all general and HPV-related characteristics. Relationships among variables were examined using t-tests and Pearson correlation coefficients. Hierarchical regression analysis was conducted to identify factors associated with high school students' intention to receive HPV vaccination. Before hierarchical regression analysis, assumptions of normality, linearity, homoscedasticity, and multicollinearity were examined. Missing data were handled using a complete-case approach, as the proportion of excluded cases was small and did not materially affect the overall sample size.

6. Research Ethics

All procedures involving human participants followed ethical standards established by the institutional and/or national research committee in accordance with the 1964 Helsinki Declaration and its amendments. Participants received a brochure detailing the study's objectives, methods, confidentiality, voluntary participation, and risks and benefits. Informed consent was obtained from all participants, who completed a 15-minute self-report questionnaire only after voluntarily signing the consent form.

RESULTS

1. HPV Vaccination Intention by Demographic and HPV-Related Characteristics

A total of 210 high school students were initially recruited. Eighteen questionnaires were excluded because of incomplete or missing responses; therefore, 192 participants were included in the final statistical analysis.

The participants' mean age was 18.04±0.19 years; 185 participants (96.4%) were 18 years old, and 7 (3.6%) were 19 years old. Regarding health-related behaviors, 30 participants (15.6%) reported smoking, 99 (51.6%) reported drinking alcohol, and 19 (9.9%) reported contraceptive use. Cervical cancer awareness was reported by 155 participants (80.7%). With multiple responses permitted, the main sources of information were school (n=77; 49.7%), television, the Internet, or radio (n=52; 33.5%), medical institutions (n=40; 25.8%), and family (n=39; 25.2%). Most participants (n=184; 95.8%) reported no family history of cervical cancer.

Overall, 136 participants (70.8%) were unaware of HPV. Among those who knew about HPV, the most common sources of information were television, the Internet, and radio (n=25; 44.6%), followed by school (n=24; 42.9%) and medical institutions (n=11; 19.6%). Similarly, 128 participants (66.7%) were unaware of the HPV vaccine. Among those who were aware, the main sources were school (n=30; 46.9%) and television, the Internet, and radio (n=23; 35.9%). Most participants (n=154; 80.2%) were unaware of the expanded national support for HPV vaccination. Forty-one

participants (21.3%) had received at least one HPV vaccine dose, whereas 151 (78.6%) had not been vaccinated.

For vaccinated students, the most frequent sources of recommendation were family members (n=22; 53.7%), followed by teachers (n=16; 39.0%). The primary reasons for not receiving the HPV vaccine were lack of awareness of the vaccine (n=97; 64.2%) and perceived low risk of infection (n=36; 23.8%).

HPV vaccination intention differed significantly according to school gender composition (t=6.69, $p<.001$), awareness of cervical cancer (t=3.91, $p<.001$), awareness of HPV infection (t=2.80, $p=.006$), awareness of HPV vaccination (t=3.34, $p=.001$), awareness of the expansion of national support for HPV vaccination (t=2.91, $p=.004$), and HPV vaccination status (F=5.82, $p=.004$). Participants reported higher vaccination intention if they were female; if they were aware of cervical cancer, HPV, or HPV vaccination; or if they were aware of the expanded national support for the vaccine. Post hoc analyses indicated that intention was highest among individuals who had received a second or subsequent HPV vaccine dose (4.96±1.63) (Table 1).

Table 1. Demographic characteristics and HPV-related variables (N=192)

Characteristic	No. (%)	Mean±SD	t/F (*p*) Scheffé post hoc test
Mean age (yr)		18.04±0.19	
Age (yr)			−0.13 (.899)
18	185 (96.4)	4.07±1.55	
19	7 (3.6)	4.14±1.51	
School gender composition			6.69 (<.001)
Girls' school	96 (50.0)	4.74±1.37	
Boys' school	96 (50.0)	3.40±1.42	
Religious affiliation			1.00 (.341)
Yes	49 (25.5)	4.25±1.47	
No	143 (74.5)	4.01±1.57	
History of smoking			−1.82 (.070)
Yes	30 (15.6)	3.60±1.47	
No	162 (84.4)	4.16±1.55	
History of alcohol use			1.64 (.103)
Yes	99 (51.6)	4.25±1.54	
No	93 (48.4)	3.88±1.54	
History of contraceptive use			0.11 (.916)
Yes	19 (9.9)	4.11±1.84	
No	173 (90.1)	4.07±1.52	
Awareness of cervical cancer			3.91 (<.001)
Yes	155 (80.7)	4.28±1.53	
No	37 (19.3)	3.21±1.32	
Family history of cervical cancer			−0.67 (.502)
Yes	8 (4.2)	3.71±1.95	
No	184 (95.8)	4.09±1.53	
Awareness of HPV infection			2.80 (.006)
Yes	56 (29.2)	4.55±1.74	
No	136 (70.8)	3.87±1.42	
Awareness of HPV vaccination			3.34 (.001)
Yes	64 (33.3)	4.58±1.71	
No	128 (66.7)	3.81±1.40	
Awareness of expanded national HPV vaccination support			2.91 (.004)
Yes	38 (19.8)	4.71±1.92	
No	154 (80.2)	3.91±1.40	
HPV vaccination status[a]			5.82 (.004)
First dose only[a]	16 (8.3)	4.40±1.69	b>c
Second dose or higher[b]	25 (13.1)	4.96±1.63	
Not vaccinated[c]	151 (78.6)	3.89±1.47	

Normality and homogeneity of variance were assessed using the Shapiro-Wilk test and Levene's test before conducting t-tests and analysis of variance. All variables satisfied the assumptions for parametric testing.
HPV, human papillomavirus; SD, standard deviation.

2. Correct Response Rates for HPV Knowledge Items

Item-level correct-answer rates for HPV knowledge are presented in Supplement 1. The statement "HPV vaccination can prevent HPV infection" had the highest correct response rate (75.5%), followed by "HPV is a sexually transmitted infection" (67.7%), "HPV is a common infection transmitted through sexual contact" (59.9%), and "HPV is associated with the development of cervical cancer" (57.3%). In contrast, the lowest correct response rate (3.6%) was observed for the following statements: "low-risk viruses do not cause cervical cancer," "high-risk viruses cause warts around the genitals," and "sexually active women should undergo an annual HPV test" (Supplement 1).

3. HPV Knowledge, Vaccination Attitude, Subjective Norms, Perceived Behavioral Control, and Vaccination Intention

The mean HPV knowledge score was 5.06±2.53 out of a possible 20 points. The mean attitude score toward vaccination was 1.78±1.10 on a −3 to +3 scale. Mean subjective norm and perceived behavioral control scores were 4.31±1.24 and 4.82±1.06, respectively, on a 7-point scale. The mean intention to receive HPV vaccination was 4.07±1.55 on the same 7-point scale (Table 2).

4. Correlations between HPV Vaccination Intention, TPB Variables, and HPV Knowledge

Intention to receive HPV vaccination was positively correlated with attitude toward vaccination (r=.51, p<.001), subjective norm (r=.59, p<.001), and perceived behavioral control (r=.61, p<.001). In contrast, HPV knowledge was not significantly associated with vaccination intention (r=−.04, p=.551) (Table 3).

5. Factors Influencing HPV Vaccination Intention

Diagnostic statistics indicated no multicollinearity (variance inflation factors ranged from 1.34 to 2.09) and no autocorrelation (Durbin–Watson statistic=1.92). Tolerance values were ≥0.1, and variance inflation factors were <10 in both models. Examination of residual distributions indicated that the assumptions of normality and homoscedasticity were satisfied.

A two-stage hierarchical multiple regression analysis was conducted to identify factors associated with intention to receive HPV vaccination. In Model 1, which included only general and HPV-related characteristics, sex was a significant predictor (β=.42, p<.001) and explained 22% of the variance (adjusted R^2). The overall model fit was significant (F=10.09, p<.001).

In Model 2, after the psychosocial variables were added, subjective norm (β=.31, p<.001), perceived behavioral con-

Table 2. Descriptive statistics for HPV knowledge, attitudes, subjective norms, perceived behavioral control, and vaccination intention (N=192)

Variable	Mean±SD	Min	Max	Scale range
HPV knowledge	5.06±2.53	0	11	0 to 20
Attitude toward HPV vaccination	1.78±1.10	−3	3	−3 to 3
Subjective norm toward HPV vaccination	4.31±1.24	1	7	1 to 7
Perceived behavioral control toward HPV vaccination	4.82±1.06	2.25	7	1 to 7
HPV vaccination intention	4.07±1.55	1	7	1 to 7

HPV, human papillomavirus; SD, standard deviation.

Table 3. Correlations among HPV knowledge, theory of planned behavior variables, and HPV vaccination intention (N=192)

Variable	1	2	3	4	5
1. HPV knowledge	1	−.01 (.903)	−.02 (.798)	.01 (.936)	−.04 (.551)
2. Attitude toward HPV vaccination		1	.35 (<.001)	.43 (<.001)	.51 (<.001)
3. Subjective norm regarding HPV vaccination			1	.48 (<.001)	.59 (<.001)
4. Perceived behavioral control over HPV vaccination				1	.61 (<.001)
5. HPV vaccination intention					1

Values are presented as r (p).
HPV, human papillomavirus.

trol (β=.31, $p<.001$), attitude toward vaccination (β=.22, $p<.001$), and school gender composition (β=.19, $p=.005$) remained significant predictors. This model accounted for 54% of the variance (adjusted R^2) and showed good overall fit ($F=26.15$, $p<.001$) (Table 4).

DISCUSSION

This study examined factors influencing high school students' intention to receive the HPV vaccine by adding HPV knowledge variables to the TPB. Participants' HPV knowledge was very low, averaging 5.06 out of 20 points. This average is comparable to previously reported scores for female college students (5.49 points) [21] and health and non-health-related male undergraduate students (5.16 and 4.71 points, respectively) [22].

HPV knowledge was relatively high for items on vaccine preventability, its classification as a sexually transmitted disease, transmission routes, and its link to cervical cancer. In contrast, knowledge of HPV genotypes, related diseases, testing methods and intervals, and treatment options was low. Accordingly, topics with low correct-response rates should be reinforced through mass media, school curricula, or extracurricular sessions using proven educational tools, such as PowerPoint lectures, talk concerts, videos, webtoons, and booklets to enhance HPV knowledge [23,24]. Schools can also support learning by providing educational materials, inviting expert instructors, and strengthening teachers' expertise through targeted training for health educators.

The mean intention-to-vaccinate score was 4.07 on a 7-point scale, exceeding the score reported for female college students (3.88 on a 7-point scale) [19] but lower than that reported for college students overall (5.20 on a 7-point scale) [25]. Significant differences in vaccination intention were associated with gender, cervical cancer awareness, HPV awareness, HPV vaccination awareness, awareness of the expansion of national HPV vaccination support, and prior HPV vaccination status. These results partially align with prior findings showing higher intention among female and older college students [25] and among adult males with sexual experience and vaccine awareness [26].

In a previous study, mothers of upper-grade elementary school boys exhibited high intention to have their sons vaccinated against HPV when health insurance coverage was available [27]. Parents of female adolescents also argued that boys should be included in the national free vaccination program [15]. Together, these findings underscore the need to extend government support for HPV vaccination to males. Furthermore, systematic health education focusing on HPV-related cancers, routes and rates of infection, symptoms, and preventive measures is essential because intention to receive the vaccine varied by awareness of cervical cancer, HPV, and HPV vaccination. More active promotion of the current national HPV vaccination program is likewise war-

Table 4. Hierarchical regression analysis of factors predicting HPV vaccination intention

Variable	Model 1				Model 2			
	B	SE	β	t (*p*)	B	SE	β	t (*p*)
Constant	2.99	0.23		13.11 (<.001)	−0.50	0.40		−1.26 (.209)
School gender composition	1.29	0.25	.420	5.22 (<.001)	0.57	0.20	.19	2.84 (.005)
Awareness of cervical cancer	0.26	0.28	.067	0.93 (.353)	−0.27	0.22	−.07	−1.19 (.234)
Awareness of HPV	0.30	0.29	.089	1.03 (.305)	0.18	0.23	.05	0.81 (.418)
Awareness of HPV vaccination	0.37	0.30	.113	1.24 (.215)	0.33	0.23	.10	1.41 (.160)
Awareness of expanded national HPV vaccination support	0.32	0.28	.083	1.15 (.251)	−0.08	0.22	−.02	−0.36 (.723)
Received HPV vaccination	−0.27	0.30	−.073	−0.93 (.356)	−0.19	0.23	−.05	−0.81 (.419)
Attitude toward HPV vaccination					0.31	0.08	.22	3.86 (<.001)
Subjective norm toward HPV vaccination					0.38	0.08	.31	5.12 (<.001)
Perceived behavioral control toward HPV vaccination					0.45	0.09	.31	5.12 (<.001)
R^2	.25				.56			
Adjusted R^2	.22				.54			
F (*p*)	10.09 (<.001)				26.15 (<.001)			

Dummy variables: school type (girls' school=1), awareness of cervical cancer (yes=1), awareness of HPV (yes=1), awareness of HPV vaccination (yes=1), awareness of expanded national HPV vaccination support (yes=1), and received HPV vaccination (yes=1).
HPV, human papillomavirus; SE, standard error.

ranted.

Subjective norms, perceived behavioral control, attitude, and school gender composition significantly influenced intention to receive the HPV vaccine and explained 54% of the variance. Among these variables, subjective norms and perceived behavioral control were the strongest predictors. These results concur with findings for female college students [19], in which subjective norms were the most influential, as well as studies of female high school students [28] and parents of female adolescents [15], in which perceived behavioral control was paramount.

When making health-related decisions, individuals often rely heavily on advice from family members, peers, or healthcare providers [29]. Accordingly, interventions should elicit support and encouragement from family members and teachers, who were the primary recommenders of HPV vaccination in this study. Barriers such as the vaccine's cost and lack of time, both cited as reasons for non-vaccination, must be addressed to enhance perceived behavioral control. Additional research to identify obstacles preventing high school students from receiving the vaccine, as well as factors facilitating vaccination, will likely further strengthen their intention to be vaccinated.

Attitude toward HPV vaccination also influenced vaccination intention, consistent with findings among high school girls [28] and parents of upper-grade elementary school students [30]. In previous studies, male students had a low awareness of the need for HPV vaccination, while female students showed a low awareness of safety factors, Thus, active promotion and education will be necessary to alleviate concerns related to HPV vaccine side effects [31]. Because the Korea Disease Control and Prevention Agency [32] has confirmed the vaccine's safety, accurate information about both safety and the importance of HPV vaccination should be disseminated.

School gender composition was also identified as a factor affecting the intention to receive HPV vaccination. Extending free HPV vaccination to boys would increase male students' willingness to be vaccinated. Hence, these findings underscore the need for national support for HPV vaccination regardless of sex. Education explaining HPV transmission routes and HPV-related diseases in males is also required to increase vaccination intention among male students.

However, HPV knowledge did not significantly influence vaccination intention. This finding is consistent with prior research indicating that parents of elementary school boys' HPV knowledge does not predict their intention to receive the HPV vaccine [30]. Although moderate correct-response rates were observed for basic HPV-related questions, overall knowledge was low; several questions had extremely low correct-response rates, suggesting limited response variability and possible floor effects. Together, these findings indicate that factual knowledge alone cannot sufficiently explain adolescents' intentions to receive HPV vaccination and may be unevenly distributed across adolescents, limiting its utility as a direct predictor of intention.

In addition, among adolescents, behavioral intention may be shaped more directly by attitude, perceived social norms, and perceived behavioral control than by knowledge. Social influence and perceptions of vaccination accessibility are therefore expected to function as stronger determinants. Future research should systematically examine how HPV knowledge influences vaccination intentions through educational delivery methods that are understandable and accessible and that account for high school students' cognitive levels.

This study employed a convenience sample from two high schools in a single metropolitan area in South Korea, which limits the generalizability of its findings and may have introduced selection bias. In addition, this study focused on personal factors; variables related to parental support, parental attitudes, or parental recommendations regarding HPV vaccination were not included. Future studies should incorporate these familial determinants to provide a more comprehensive understanding of HPV vaccination intention.

Nevertheless, this study meaningfully identified factors related to HPV vaccination intention among both male and female high school students before the recent rapid increase in HPV infections. At a time when the inclusion of male adolescents in HPV vaccination policies is being discussed, these results provide timely evidence for analyzing factors related to vaccination intentions across the adolescent population. Within this evolving policy context of free vaccination for male students, this study can furnish timely, policy-relevant empirical evidence to inform future decisions on program expansion. This study is particularly timely given recent epidemiological trends showing that, despite long-term use of HPV vaccines with proven safety and efficacy, vaccination rates among adolescents—especially male students—remain low. Furthermore, the significant explanatory power of key TPB components supports the applicability of the TPB framework for understanding HPV vaccination intentions among high

school students. Therefore, this study has important implications because it can contribute to future evidence-based vaccination programs by systematically analyzing adolescents' behavioral factors related to HPV vaccination. The results could serve as a basis for developing effective intervention strategies to enhance HPV vaccination intention in this population.

CONCLUSION

Grounded in the TPB, this study examined associations among HPV vaccination intention, HPV knowledge, attitude toward HPV vaccination, subjective norm, and perceived behavioral control. The main predictors of intention were subjective norm, perceived behavioral control, attitude toward HPV vaccination, and sex; subjective norm and perceived behavioral control showed the strongest effects. These findings provide a foundation for developing and implementing interventions to increase HPV vaccination intention among high school students. To strengthen high school students' intention to receive HPV vaccination, trusted public information campaigns should disseminate accurate information about benefits and potential adverse effects. Ongoing, targeted HPV-related health education from families, teachers, and the mass media—key influences on adolescents—should also be expanded. Policy measures should support gender-appropriate interventions, expand health insurance coverage, provide free vaccination, and improve access to vaccination services. At the family level, public health authorities should equip parents and caregivers with accessible educational materials and guidance so they can hold informed discussions about HPV vaccination with adolescents.

ARTICLE INFORMATION

Authors' contribution

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

Conflict of interest

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

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Data availability

Data are available from the corresponding author upon reasonable request.

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Supplementary material

Supplement 1. Correct response rates for HPV knowledge items (N=192).

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REFERENCES

1. Centers for Disease Control and Prevention (CDC). Human papillomavirus (HPV) [Internet]. CDC; 2025 [cited 2026 Feb 9]. Available from: https://www.cdc.gov/hpv/index.html
2. Meng X, Yang B, Yin H, Chen J, Ma W, Xu Z, Shen Y. Global burden and incidence trends in cancers associated with human papillomavirus infection: a population-based systematic study. Pathogens. 2025;14(9):880. https://doi.org/10.3390/pathogens14090880
3. National Center for Medical Information and Knowledge (NCMIK). Cost-effectiveness analysis for expanding national vaccination of the HPV vaccine [Internet]. NCMIK; 2023 [cited 2026 Feb 9]. Available from: https://library.nih.go.kr/ncmiklib/synap/skin/doc.html?fn=a1e48fe7b7d8320b1a619daa812d0241acdd13717ec5382d37f04afa122f8bf7&rs=/roms/ncmik/st1/synap/202602&fileKey=211212&pn=1
4. Korea Disease Control and Prevention Agency (KDCA). Sentinel surveillance of infectious diseases: sexually transmitted infections [Internet]. KDCA; 2025 [cited 2026 Feb 9]. Available from: https://dportal.kdca.go.kr/pot/is/st/stis.do
5. Korean Statistical Information Service (KOSIS). 2021-2022 Youth Health Behavior Survey: sexual behavior [Internet]. Statistics Korea; 2024 [cited 2026 Feb 9]. Available from: https://kosis.kr/statHtml/statHtml.do?orgId=177&tblId=DT_117_12_Y056
6. Kim KM, Joo KS, Lee JP. Predictors associated with of intention to HPV vaccination in undergraduate students: focusing on HPV related knowledge, attitude and health beliefs related to HPV vacci-

nation. JALCI. 2020;20(2):993-1006. https://doi.org/10.22251/jlcci.2020.20.2.993
7. Markowitz LE, Dunne EF, Saraiya M, Lawson HW, Chesson H, Unger ER, et al. Quadrivalent human papillomavirus vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep. 2007;56(RP-2):1-24.
8. Centers for Disease Control and Prevention (CDC). Preventing HPV-associated cancers [Internet]. CDC; 2024 [cited 2026 Feb 9]. Available from: https://www.cdc.gov/cancer/hpv/preventing-hpv-associated-cancers.html
9. Korea Disease Control and Prevention Agency (KDCA). KDCA confirms 2026 budget of KRW 1,335.9 billion (December 3) [Internet]. KDCA; 2025 [cited 2026 Feb 9]. Available from: https://www.kdca.go.kr/kdca/2848/subview.do
10. Bianco A, Pileggi C, Iozzo F, Nobile CG, Pavia M. Vaccination against human papilloma virus infection in male adolescents: knowledge, attitudes, and acceptability among parents in Italy. Hum Vaccin Immunother. 2014;10(9):2536-2542. https://doi.org/10.4161/21645515.2014.969614
11. Min KJ, Ouh YT, Bae S, Ji YB, Lee JK, Kim JW, et al. Position statement about gender-neutral HPV vaccination in Korea. Vaccines (Basel). 2024;12(10):1110. https://doi.org/10.3390/vaccines12101110
12. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991;50(2):179-211. https://doi.org/10.1016/0749-5978(91)90020-T
13. Mansfield LN, Onsomu EO, Merwin E, Hall NM, Harper-Harrison A. Association between parental HPV knowledge and intentions to have their daughters vaccinated. West J Nurs Res. 2018;40(4):481-501. https://doi.org/10.1177/0193945916682953
14. Ko JO, Moon IB, Kwak JG. Relationship between human papillomavirus knowledge and health beliefs, and immunization of female university students. J Radiat Ind. 2019;13(3):215-222. https://doi.org/10.23042/radin.2019.13.3.215
15. Park HS. Factors associated with parental intention to vaccinate adolescent daughters against HPV [master's thesis]. Seoul: Seoul National University; 2018.
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. Kim HW, Ahn HY. Study on the knowledge of human papillomavirus in female university students. Korean J Women Health Nurs. 2007;13(1):13-20. https://doi.org/10.4069/kjwhn.2007.13.1.13
18. Ajzen I. Constructing a theory of planned behavior questionnaire: brief description of the theory of planned behavior [Internet]. University of Massachusetts; 2006 [cited 2026 Feb 9]. Available from: https://www.researchgate.net/publication/235913732_Constructing_a_Theory_of_Planned_Behavior_Questionnaire
19. Lee KE. Factors associated with intention to receive human papillomavirus vaccine in undergraduate women: an application of the theory of planned behavior. J Basic Nurs. 2014;21(4):457-465. https://doi.org/10.7739/jkafn.2014.21.4.457
20. Lee SH. Undergraduate students' sexual behavior and influencing factors: an analysis based on the theory of planned behavior [master's thesis]. Seoul: Konkuk University; 2005.
21. Kim SH. Factors predicting HPV vaccination practices among female college students. Korean Parent Child Health J. 2017;20(1):39-47.
22. Son YW, Park JY, Min JW, Lee WH, Lee HS, Kong HJ, et al. The comparison of sexual knowledge, HPV knowledge, and HPV vaccine acceptance between health and non-health-related male undergraduate students. Glob Creat Leaders Educ Learn. 2022;12(4):103-121. https://doi.org/10.34226/gcl.2022.12.4.103
23. Kim SY, Choi JH, Kim SY. An increase in HPV-related knowledge and vaccination beliefs among parents of adolescent sons in Dongdaemon-gu, Seoul, Korea. J Korean Soc Sch Community Health Educ. 2021;22(1):37-53. https://doi.org/10.35133/kssche.20210228.04
24. Cho YH. Development and effectiveness of a human papillomavirus infection prevention education program for mothers of elementary school boys [dissertation]. Daejeon: Daejeon University; 2023.
25. Kim SY. Factors influencing human papillomavirus vaccination among college students using the theory of planned behavior [master's thesis]. Seoul: Chung-Ang University; 2018.
26. Cao Y. Factors affecting the intention to vaccinate human papillomavirus (HPV) by applying the theory of planned behavior for adult males [master's thesis]. Seoul: Kyung Hee University; 2023.
27. Park EY. Intention to receive human papillomavirus vaccine and related factors among mothers of elementary school boys [master's thesis]. Daejeon: Daejeon University; 2019.
28. Sung MH, Sung MH. Factors influencing human papillomavirus vaccination intention in female high school students: application of planned behavior theory. Korean J Women Health Nurs. 2018;24(1):71-79. https://doi.org/10.4069/kjwhn.2018.24.1.71
29. Gerend MA, Shepherd JE. Predicting human papillomavirus vaccine uptake in young adult women: comparing the health belief model and theory of planned behavior. Ann Behav Med. 2012;44(2):171-180. https://doi.org/10.1007/s12160-012-9366-5
30. Kang EH. Factors influencing the intention of parents of elementary school boys to receive human papillomavirus (HPV) vaccination: application of the theory of planned behavior [master's thesis]. Su-

won: Ajou University; 2019.
31. Jang I. Comparison of factors associated with intention to HPV vaccination between male and female high school students: focusing on HPV knowledge, attitude and health beliefs related to HPV. J Korean Soc Sch Health. 2018;31(2):59-69. https://doi.org/10.15434/kssh.2018.31.2.59
32. Korea Disease Control and Prevention Agency (KDCA). Vaccination expert: reconfirmation of the safety of cervical cancer vaccination [Internet]. KDCA; 2016 [cited 2026 Feb 9]. Available from: https://www.kdca.go.kr/kdca/2848/subview.do

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Latent class analysis of sexual behavior patterns and multidimensional health characteristics among Korean adolescents: a cross-sectional study

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Purpose: Adolescents with same-sex or both-sex sexual experience face disproportionate health risks, yet research has predominantly examined single health problems rather than their multidimensional patterns. This study employed latent class analysis (LCA) to identify distinct health typological classes among Korean adolescents and characterize the distribution of sexual behavior patterns across these classes.
Methods: We analyzed 278,066 middle- and high-school students in the 2013–2016 Korea Youth Risk Behavior Survey. The LCA used 17 indicators encompassing sexual behavior patterns, health behaviors, health perceptions, and mental health. Complex-sample weighted analyses examined associations between latent classes and sociodemographic characteristics, sexual behaviors, and diseases.
Results: Four distinct classes were identified: mental health high-risk group (10.1%), substance use high-risk group (6.5%), average group (36.3%), and healthy group (47.1%). Adolescents with same-sex or both-sex sexual experience were disproportionately concentrated in the two high-risk classes, comprising 3.3% of the mental health high-risk group and 4.1% of the substance use high-risk group, compared with only 0.3% and 0.5% of the average group and the healthy group. The mental health high-risk group exhibited extremely elevated prevalence rates of suicidal ideation (96.2%), depressive symptoms (88.5%), and suicide attempts (27.5%), while the substance use high-risk group showed high rates of smoking (82.4%) and alcohol use (84.6%) but better mental health.
Conclusion: Adolescents with same-sex or both-sex sexual experience demonstrate health inequality through disproportionate classification in the mental health high-risk group and the substance use high-risk group. The findings underscore the need for integrated interventions combining mental health support and substance use prevention.

Keywords: Adolescent; Health behavior: Latent class analysis; Mental health; Sexual behavior

INTRODUCTION

The proportion of sexual minorities in the global population has been steadily increasing [1,2]. A global survey of 18,515 individuals across 26 countries in 2024 found that approximately 11% of respondents identified as lesbian, gay, bisexual, transgender, or other sexual minorities, while the proportion was markedly lower in South Korea, at 5% [2]. This large discrepancy may reflect underreporting, since South Korea lacks a nationwide survey system for sexual orientation and gender identity, and social prejudice makes such disclosures difficult, limiting accurate population estimation [3].

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Adolescence is a period of rapid physical, mental, and sexual changes, representing a critical developmental stage when sexual orientation emerges and identity formation begins [4]. During this process, sexual-minority adolescents often navigate significant identity confusion and psychological uncertainty while exploring their sexual orientation [5]. Coupled with these developmental vulnerabilities, this group encounters a dual burden of minority stress: (1) distal (external) stressors, such as bullying and family rejection, and (2) proximal (internalized) stressors, including identity concealment and internalized stigma [6]. This situation results in sexual-minority adolescents experiencing substantial health inequalities. Research has consistently shown that the vulnerability across various health risk indicators is higher among sexual-minority adolescents than among their heterosexual peers. Specifically, sexual-minority adolescents demonstrate elevated risks of smoking [7,8], alcohol use [7,8], drug use [7-9], risky sexual behaviors [10], sleep disorders [11], depressive symptoms [5,7], and suicidal ideation and suicide attempts [5,7,8]. Large-scale analyses of US adolescent survey data found that sexual-minority youth had significantly elevated odds of hopelessness (adjusted odds ratio [aOR], 4.6), suicidal ideation (aOR, 3.2), and suicide planning (aOR, 2.0) compared with their heterosexual peers, along with higher prevalence rates of cigarette use (15% vs. 7.8%), marijuana use (31.2% vs. 20.2%), and cocaine use (8.4% vs. 3.9%) [8].

Recent research has also produced evidence of serious disparities in physical health between sexual-minority and heterosexual adolescents, with the former exhibiting greater physical health problems such as chronic pain [12,13] and elevated inflammatory markers [14]. These patterns persist into adulthood, with sexual-minority adults showing higher prevalence rates of diabetes [15], hypertension [16], cardiovascular disease [17], and cancer [18,19] than their heterosexual peers.

International research has increasingly employed latent class analysis (LCA) to examine multidimensional health patterns among sexual-minority adolescents. An LCA study of sexual-minority youth seeking crisis services identified four distinct classes of co-occurring behavioral health risks, with gender-nonconforming youth showing significantly higher odds of membership in high-risk classes [20]. An analysis of over 119,000 US adolescents similarly found that gay, lesbian, and bisexual youth were disproportionately represented in polysubstance use classes compared with their heterosexual peers [21]. These patterns extend to the co-occurrence of sexual violence, substance use, and mental health problems, with sexual-minority youth demonstrating elevated risk across multiple domains [22]. In contrast, Korean research remains predominantly limited to single-variable approaches [5,7]. Accordingly, in this study we employed LCA as a person-centered method optimized for uncovering hidden group structures within categorical data. Unlike variable-centered approaches such as regression analysis that estimate relationships between variables across the entire population, LCA can capture within-group diversity, thereby providing essential information for identifying vulnerable groups where health risks are concentrated among adolescents and for facilitating the development of tailored intervention strategies [23]. This approach is particularly relevant to nursing practice, since school and community health nurses—who maintain ongoing contact with adolescents—can utilize latent class profiles to identify high-risk individuals requiring integrated interventions rather than using fragmented approaches targeting isolated health problems.

The studies reviewed above assessed the sexual-minority status based on self-reported sexual identity or orientation, whereas South Korea lacks nationally representative surveys that have directly measured adolescent sexual orientation [3]. Instead, the Korea Youth Risk Behavior Survey (KYRBS) conducted during 2013–2016 included questions about sexual-intercourse partners, and so enables the classification of sexual behavior patterns. Given that a same-sex or both-sex sexual experience does not necessarily equate to a sexual-minority identity [24], the present study examined health patterns associated with sexual behavior patterns rather than sexual identity. However, it should be noted that the KYRBS partner-sex response options were modified after 2017, and so the 2013–2016 data remain the most-recent nationally representative data available for such an analysis.

This study aimed to systematically classify types of sexual behavior patterns among adolescents and their multidimensional health characteristics, and to identify the features and associated factors of each latent class. This information would support the development of practical policies and programs for improving the health status of adolescents.

METHODS

Ethical statements: This study obtained an exemption from the Institutional Review Board (IRB) at Daejeon University (IRB No. 1040647-202509-HR-003-03) as it involves the utilization of secondary data with anonymity.

1. Study Design

This study applied secondary data analyses to raw data obtained in the KYRBS performed from 2013 to 2016, which represented the 9th to 12th implementations of this survey. A cross-sectional descriptive design was used to systematically analyze the relationships between adolescents' sexual behavior patterns and multidimensional health behaviors through LCA. The reporting of this study followed the guidelines outlined in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [25].

2. Study Setting and Data Collection

The KYRBS is a nationwide anonymous self-administered online survey jointly conducted annually by the Ministry of Education and the Korea Disease Control and Prevention Agency that since 2005 has assessed adolescent health behaviors and provided foundational data for the development of relevant policies. The 2013–2016 surveys targeted middle- and high-school students nationwide, with approximately 800 schools and 68,000–75,000 students across 17 provinces and metropolitan cities selected through stratification, sample allocation, and sampling processes. The KYRBS data are publicly available for academic research purposes, with all individual identifiers removed prior to public release. The final analysis involved 278,066 survey participants.

3. Measures and Variable Definitions

This study analyzed the responses to questions regarding sexual behavior patterns, sociodemographic characteristics, health behaviors, health perceptions, mental health, sexual behaviors, and diseases. Variable values were defined based on the KYRBS indicator definitions and variable classifications in previous research [5,7].

1) Sexual behavior patterns

Sexual behavior patterns were assessed based on questions about sexual-intercourse partners among those with sexual experience. Participants were categorized into four groups: no sexual experience, opposite-sex experience only, same-sex experience only, and experience with both sexes.

2) Sociodemographic characteristics

The analyzed sociodemographic variables included sex (male or female), school grade (middle-school grades 1–3 or high-school grades 1–3), city size (metropolitan, small-to-medium city, or rural area), and living arrangements (with family, with relatives, boarding/self-boarding, dormitory, or welfare facility). Parental education levels were categorized into middle-school graduation or below, high-school graduation, college graduation or above, or unknown. A multicultural family status was determined by the parents' birthplaces. Subjective academic performance and economic status were each classified into five levels: high, upper-middle, middle, lower-middle, and low. Weekly allowance, part-time employment, and hospital treatment due to violence victimization were also assessed.

3) Health behaviors

Current smoking was defined as smoking at least once during the past 30 days, and current alcohol use was defined as consuming at least one alcoholic drink during the past 30 days. Breakfast skipping was defined as being present when it occurred at least 5 days per week. The consumption of fast food and vegetables was assessed based on weekly frequency. Physical activity was defined as engaging in activity intense enough to increase the heart rate for at least 60 minutes daily on at least 5 days per week. The body-weight-control effort was categorized into no effort, weight loss, weight gain, or weight maintenance.

4) Health perceptions

Subjective health perception and body-image perception were assessed on 5-point scales and recategorized into three levels for the analysis: healthy, average, and unhealthy for health perception; and thin, average, and overweight for body image.

5) Mental health

Subjective happiness and perceived stress were assessed on 5-point scales and recategorized into three levels: happy, average, and unhappy for happiness; and high, moderate, and low for stress. Subjective sleep sufficiency was assessed

according to whether the sleep duration was sufficient for fatigue recovery, and categorized into sufficient, average, or insufficient. Depressive symptoms were defined as feeling sad or hopeless enough to stop performing daily activities for at least 14 days consecutively during the past 12 months. Suicidal ideation, suicide planning, and suicide attempts during the past 12 months were classified into yes or no.

6) Sexual behaviors

Age at first sexual intercourse was categorized into elementary school or earlier, middle school, or high school. Sexual intercourse after consuming alcohol and the use of contraceptives were assessed among students with sexual experience, with contraceptive use categorized into always, sometimes, rarely, or never. Pregnancy experience was assessed among female students with sexual experience, and sexually transmitted infection (STI) experience was assessed among all sexually experienced students, with both classified into yes or no.

7) Diseases

Since asthma, allergic rhinitis, and atopic dermatitis were the only chronic conditions assessed in the survey, they were the only diseases included in this analysis. Participants were classified into yes or no based on the history of physician-confirmed diagnosis for these specific conditions.

4. Data Analyses

Data analyses were performed using R software ver. 4.3.0 (The R Foundation for Statistical Computing) considering the complex sample design characteristics of the KYRBS. LCA was conducted using the poLCA package. Because this package does not support sampling weights when estimating latent classes [26], the class structure was derived from unweighted data. Although unweighted estimations may affect class solutions when the sampling design is informative [27], the survey design features of stratification, clustering, and sampling weights were incorporated in all subsequent analyses of class prevalence, characteristics, and associations using the R survey package. In all analyses, statistical significance was considered to be present when $p < .05$.

The data analyses involved four main steps. First, analyses of complex-sample descriptive statistics were conducted to determine the distributions of the participants' characteristics. Second, LCA was conducted to derive latent patterns of adolescents' sexual behavior patterns and health characteristics (health behaviors, health perceptions, and mental health variables) using 17 variables (Supplement 1). The poLCA package was used to fit models with two to six latent classes, and the optimal model was selected by considering the Bayesian information criterion (BIC), Akaike information criterion (AIC), and entropy index [23]. Third, complex-sample weighted analyses were used to characterize the derived latent classes. Class-specific distributions were calculated as weighted proportions. Fourth, Rao-Scott χ^2 tests were used to examine relationships between latent classes and exogenous variables including sociodemographic characteristics, sexual behaviors, and diseases.

RESULTS

1. Participant Characteristics

The sociodemographic characteristics, sexual behavior patterns, health behaviors, health perceptions, mental health, sexual behaviors, and diseases of the 278,066 study participants are presented in Table 1. All percentages are weighted percentages that reflect the complex sample design.

The sample included 52.2% males. The distribution by school grade was relatively even across all grades. Most students (95.8%) lived with their families. Regarding sexual behavior patterns, 94.9% had no sexual experience, 4.1% had opposite-sex experience only, 0.6% had same-sex experience only, and 0.4% had experience with both sexes.

2. Selection of Optimal Latent Class Model

Models with two to six latent classes were fitted (Table 2). Although both the AIC and BIC decreased as more classes were added, the four-class solution was selected based on this providing an adequate entropy index (0.855), conceptually distinct class profiles, and consistency with previous LCA studies that similarly identified four-class solutions for adolescent emotional and behavioral problems [28-30].

3. Comparison of Characteristics between Latent Classes

There were distinct differences in sexual behavior patterns, health behaviors, health perceptions, and mental health among the four derived latent classes (Table 3).

Table 1. General characteristics of study participants (N=278,066)

Characteristic	Category	No. (%)	Weighted %
Sociodemographic characteristics			
Sex	Male	142,132 (51.1)	52.2
	Female	135,934 (48.9)	47.8
Grade	Middle school 1st	45,129 (16.2)	14.9
	Middle school 2nd	46,347 (16.7)	15.8
	Middle school 3rd	47,728 (17.2)	16.8
	High school 1st	46,329 (16.7)	17.5
	High school 2nd	46,200 (16.6)	17.4
	High school 3rd	46,333 (16.7)	17.6
City size	Rural area	25,247 (9.1)	6.4
	Metropolitan area	123,617 (44.4)	43.7
	Small-to-medium city	129,202 (46.5)	49.9
Living arrangements	With family	264,906 (95.3)	95.8
	With relatives	2,524 (0.9)	0.8
	Dormitory/boarding/self-boarding	9,207 (3.3)	2.9
	Welfare facility	1,429 (0.5)	0.5
Father's education[a)]	≤Middle school	8,060 (3.0)	2.8
	High school	82,798 (31.0)	30.3
	≥College	129,784 (48.6)	50.7
	Unknown	45,599 (17.1)	16.2
	Missing	11,825	-
Mother's education[a)]	≤Middle school	7,114 (2.7)	2.5
	High school	103,754 (39.0)	38.6
	≥College	112,087 (42.1)	43.2
	Unknown	43,965 (16.5)	15.6
	Missing	11,146	-
Multicultural family[a)]	No	255,495 (98.9)	99.1
	Yes	2,873 (1.1)	0.9
	Missing	19,698	-
Subjective academic performance	High	34,095 (12.3)	12.1
	Upper-middle	68,552 (24.7)	24.6
	Middle	77,888 (28.0)	28.1
	Lower-middle	66,481 (23.9)	24.0
	Low	31,050 (11.2)	11.1
Subjective economic status	High	23,295 (8.4)	8.5
	Upper-middle	72,171 (25.9)	26.3
	Middle	132,552 (47.7)	47.4
	Lower-middle	39,813 (14.3)	14.1
	Low	10,235 (3.7)	3.6
Weekly allowance (KRW)	0–9,999	89,494 (32.2)	31.8
	10,000–19,999	76,255 (27.4)	27.2
	20,000–29,999	36,844 (13.2)	13.3
	≥30,000	75,473 (27.1)	27.7
Part-time work experience	No	240,347 (86.4)	86.4
	Yes	37,719 (13.6)	13.6
Hospital treatment due to violence	No	270,635 (97.3)	97.3
	Yes	7,431 (2.7)	2.7
Sexual behavior patterns	No sexual experience	264,439 (95.1)	94.9
	Opposite-sex experience only	11,042 (4.0)	4.1
	Same-sex experience only	1,470 (0.5)	0.6
	Experience with both sexes	1,115 (0.4)	0.4
Health behaviors			
Current smoking	No	255,530 (91.9)	91.7
	Yes	22,536 (8.1)	8.3

(Continued on the next page)

Table 1. Continued

Characteristic	Category	No. (%)	Weighted %
Current alcohol use	No	234,038 (84.2)	83.8
	Yes	44,028 (15.8)	16.2
Breakfast skipping (≥5 day/wk)	No	200,629 (72.2)	72.3
	Yes	77,437 (27.8)	27.7
Fast food consumption (≥3 times/wk)	No	237,032 (85.2)	85.0
	Yes	41,034 (14.8)	15.0
Vegetable consumption (≥3 times/day)	No	234,270 (84.3)	84.5
	Yes	43,796 (15.7)	15.5
Physical activity (60 min/day, ≥5 day/wk)	No	239,910 (86.3)	86.6
	Yes	38,156 (13.7)	13.4
Weight control efforts	No effort	138,845 (49.9)	50.4
	Weight loss effort	91,621 (32.9)	32.6
	Weight gain effort	16,902 (6.1)	6.1
	Weight maintenance effort	30,698 (11.0)	10.9
Health perceptions			
Subjective health perception	Healthy	198,094 (71.2)	71.2
	Average	62,842 (22.6)	22.6
	Unhealthy	17,130 (6.2)	6.2
Subjective body image perception	Thin	73,626 (26.5)	26.8
	Average	96,505 (34.7)	34.6
	Overweight	107,935 (38.8)	38.6
Mental health			
Subjective happiness	Happy	176,628 (63.5)	63.2
	Average	76,516 (27.5)	27.7
	Unhappy	24,922 (9.0)	9.1
Stress perception	High	105,200 (37.8)	37.9
	Moderate	118,692 (42.7)	42.8
	Low	54,174 (19.5)	19.3
Subjective sleep sufficiency	Sufficient	74,689 (26.9)	26.4
	Average	89,959 (32.3)	32.4
	Insufficient	113,418 (40.8)	41.2
Depressive symptoms	No	204,033 (73.4)	73.2
	Yes	74,033 (26.6)	26.8
Suicidal ideation	No	240,851 (86.6)	86.6
	Yes	37,215 (13.4)	13.4
Suicide planning	No	265,466 (95.5)	95.5
	Yes	12,600 (4.5)	4.5
Suicide attempt	No	269,749 (97.0)	97.0
	Yes	8,317 (3.0)	3.0
Sexual behaviors[b]			
Age at first sexual intercourse	≤Elementary school	4,042 (30.5)	30.4
	Middle school	4,993 (37.7)	37.4
	High school	4,208 (31.8)	32.2
	Missing	384	-
Sexual intercourse after drinking	No	9,152 (67.2)	67.0
	Yes	4,475 (32.8)	33.0
Contraception use	Always	4,081 (29.9)	30.3
	Sometimes	1,619 (11.9)	12.2
	Rarely	1,384 (10.2)	10.3
	Never	6,543 (48.0)	47.2
Pregnancy experience (female)[c]	No	3,468 (92.1)	91.3
	Yes	298 (7.9)	8.7
STI experience	No	12,381 (90.9)	90.5
	Yes	1,246 (9.1)	9.5

(Continued on the next page)

Table 1. Continued

Characteristic	Category	No. (%)	Weighted %
Diseases			
Asthma	No	252,771 (90.9)	90.9
	Yes	25,295 (9.1)	9.1
Allergic rhinitis	No	187,899 (67.6)	66.8
	Yes	90,167 (32.4)	33.2
Atopic dermatitis	No	211,321 (76.0)	75.8
	Yes	66,745 (24.0)	24.2

Percentages may not sum to exactly 100% due to rounding.
KRW, Korean won; STI, sexually transmitted infection.
[a]Missing values exist (only responded when parent is a family member). [b]Among those who reported sexual experience (n=13,627). [c]Among females who reported sexual experience (n=3,766).

Table 2. Model fit indices for latent class analysis

No. of classes	Log-likelihood	AIC	BIC	Entropy
2	–2,670,187	5,340,481	5,341,039	0.924
3	–2,641,249	5,282,658	5,283,501	0.865
4	–2,621,889	5,243,992	5,245,119	0.855
5	–2,605,025	5,210,319	5,211,730	0.806
6	–2,596,838	5,193,998	5,195,694	0.772

AIC, Akaike information criterion; BIC, Bayesian information criterion.

1) Class 1: mental health high-risk group (10.1%)

Class 1 showed the most-vulnerable mental health indicators, with markedly higher rates of depressive symptoms (88.5%), suicidal ideation (96.2%), suicide planning (39.9%), and suicide attempts (27.5%) than for the other classes. High stress (85.0%), insufficient sleep (63.2%), and unhappiness (40.7%) were also prominent. Among those with sexual experience, 8.0% had opposite-sex experience only, 1.9% had same-sex experience only, and 1.4% had experience with both sexes. Health behaviors showed moderate risk levels, with smoking at 15.7% and alcohol use at 27.1%.

2) Class 2: substance use high-risk group (6.5%)

Class 2 exhibited the most-severe substance use behaviors, with markedly higher rates of current smoking (82.4%) and alcohol use (84.6%) than for the other classes. The sexual experience rate was 33.1%, with the rates of same-sex (2.3%) and both-sex (1.8%) experience being the highest among all classes. However, mental health indicators were more favorable for this class, with 57.0% feeling happy and low rates of suicide-related indicators: 6.0% for suicidal ideation, 1.4% for suicide planning, and 0.9% for suicide attempts. A positive subjective health perception was present in 72.4% of the participants.

3) Class 3: average group (36.3%)

Class 3 showed average characteristics across most indicators. This class had a very high rate of no sexual experience (98.4%), and the lowest rate of same-sex or both-sex experience (0.3%). Smoking (1.2%) and alcohol use (11.4%) rates were also low, but notable rates of high stress (65.3%) and insufficient sleep (57.8%) were present.

4) Class 4: healthy group (47.1%)

Class 4 was the largest group and showed the most-favorable health indicators. Feeling happy (93.4%) and good subjective health perception (88.9%) were prominent. Mental health indicators were the most favorable, with rates of depressive symptoms and suicidal ideation of 5.5% and 0.8%, respectively. This class also had a very high rate of no sexual experience (97.7%), and a rate of same-sex or both-sex experience (0.5%) that was similarly low to that for Class 3. Smoking (1.8%) and alcohol use (7.7%) rates were also low.

4. Associations between Latent Classes and Exogenous Variables

Significant differences were found across all sociodemographic variables, sexual behaviors, and diseases ($p < .001$). The detailed distributions are presented in Tables 4 and 5. Class 2 had markedly high proportions of males (81.5%) and high-school students (81.6%). Class 4 had the highest proportions of upper-level academic performance (42.5%) and economic status (41.5%). The rate of part-time employment was highest in Class 2 (49.5%) and lowest in Class 4 (8.3%). The rate of violence victimization requiring hospital treatment was highest in Class 1 (9.5%) and lowest in Class 4 (1.3%). Among sexually experienced adolescents, those in Class 2 had the highest proportion of first sexual intercourse during

Table 3. Profiles of four latent classes (N=278,066)

Variable	Class 1: mental health high-risk group	Class 2: substance use high-risk group	Class 3: average group	Class 4: healthy group
Sexual behavior patterns				
No sexual experience	88.8	66.9	98.4	97.7
Opposite-sex experience only	8.0	29.0	1.3	1.8
Same-sex experience only	1.9	2.3	0.2	0.3
Experience with both sexes	1.4	1.8	0.1	0.2
Health behaviors				
Current smoking (yes)	15.7	82.4	1.2	1.8
Current drinking (yes)	27.1	84.6	11.4	7.7
Breakfast skipping (≥5 day)	34.5	39.9	30.6	22.7
Fast food (≥3 times/wk)	22.0	30.6	14.6	11.2
Vegetables (≥3 times/day)	16.6	13.0	12.0	18.8
Physical activity (60 min/day, ≥5 day/wk)	15.2	20.6	8.4	16.6
Weight control efforts				
No effort	39.9	48.7	49.1	52.9
Weight loss effort	42.5	24.6	38.7	27.7
Weight gain effort	6.5	18.3	3.1	6.7
Weight maintenance effort	11.2	8.4	9.2	12.8
Health perceptions				
Subjective health perception				
Healthy	49.8	72.4	53.8	88.9
Average	31.9	21.1	36.6	10.2
Unhealthy	18.3	6.5	9.6	0.9
Subjective body image perception				
Thin	25.1	38.4	21.3	29.1
Average	28.0	32.9	31.5	38.8
Overweight	46.9	28.7	47.2	32.0
Mental health				
Subjective happiness				
Happy	26.4	57.0	35.8	93.4
Average	33.0	34.3	52.3	6.6
Unhappy	40.7	8.7	11.9	0.0
Stress perception				
High	85.0	40.9	65.3	6.5
Moderate	11.3	43.2	34.5	55.5
Low	3.7	15.9	0.2	38.0
Subjective sleep sufficiency				
Sufficient	14.3	16.7	11.0	43.0
Average	22.6	30.6	31.3	35.5
Insufficient	63.2	52.6	57.8	21.5
Depression (yes)	88.5	34.3	35.8	5.5
Suicidal ideation (yes)	96.2	6.0	8.1	0.8
Suicide planning (yes)	39.9	1.4	0.4	0.6
Suicide attempt (yes)	27.5	0.9	0.3	0.1

Values are presented as weighted %. Percentages may not sum to exactly 100% due to rounding.

high school (58.4%), while Classes 1 and 4 had high proportions during elementary school (33.6% and 35.3%, respectively). The rate of STI experience was highest in Class 1 (16.4%); this class also showed the highest prevalence rates of asthma (12.1%), allergic rhinitis (37.2%), and atopic dermatitis (27.6%).

DISCUSSION

This study applied LCA to a large representative sample (N=278,066) from the 2013–2016 KYRBS to identify associations between sexual behavior patterns and multidimensional health characteristics. Four distinct classes were identified: mental health high-risk group (10.1%), substance use high-

Table 4. Sociodemographic characteristics by latent class (N=278,066)

Variable	Class 1: mental health high-risk group	Class 2: substance use high-risk group	Class 3: average group	Class 4: healthy group	χ^2	*p*
Sex					14,880.39	<.001
Male	41.4	81.5	41.1	58.9		
Female	58.6	18.5	58.9	41.1		
School level					11,088.16	<.001
Middle school	48.0	18.4	41.9	55.8		
High school	52.0	81.6	58.1	44.2		
City size					114.51	<.001
Rural	6.5	7.5	6.2	6.4		
Small-medium city	49.7	51.6	50.5	49.3		
Metropolitan	43.8	40.9	43.3	44.4		
Living arrangement					1,019.98	<.001
With family	93.5	92.8	95.9	96.7		
Others	6.5	7.2	4.1	3.3		
Father's education[a)]					1,808.17	<.001
≤Middle school	3.9	4.6	3.0	2.2		
High school	30.7	39.8	31.6	28.0		
≥College	50.1	41.7	49.5	52.9		
Unknown	15.3	13.8	15.9	16.9		
Mother's education[a)]					1,884.58	<.001
≤Middle school	3.7	4.0	2.7	1.9		
High school	39.0	47.4	40.7	35.9		
≥College	42.9	34.8	41.5	45.8		
Unknown	14.3	13.8	15.1	16.5		
Subjective academic performance					7,208.36	<.001
High (high & upper-middle)	30.5	24.4	33.4	42.5		
Middle	23.7	23.8	28.7	29.2		
Low (lower-middle & low)	45.7	51.9	37.9	28.3		
Subjective economic status					9,994.49	<.001
High (high & upper-middle)	30.3	30.6	28.1	41.5		
Middle	40.7	43.2	50.7	47.0		
Low (lower-middle & low)	29.0	26.2	21.2	11.6		
Part-time job experience					24,839.18	<.001
No	79.0	50.5	88.2	91.7		
Yes	21.0	49.5	11.8	8.3		
Hospital treatment due to violence					7,630.46	<.001
No	90.5	92.7	98.3	98.7		
Yes	9.5	7.3	1.7	1.3		

Values are presented as weighted % unless otherwise stated. Percentages may not sum to exactly 100% due to rounding.
[a)]Missing values exist (only responded when parent is a family member).

risk group (6.5%), average group (36.3%), and healthy group (47.1%). This four-class structure is broadly consistent with previous LCA research identifying four subgroups of adolescent emotional and behavioral problems, typically distinguishing between internalizing, externalizing, low-risk, and comorbid or maladjusted patterns [28-30]. The mental health high-risk group shares features with internalizing classes, the substance use high-risk group with externalizing classes, and the healthy group with low-problem classes. The average group, characterized by moderate stress and sleep insufficiency, did not correspond to the comorbid classes reported elsewhere but may represent a subclinical risk group specific to the indicators used in this study.

The rates of suicidal ideation (96.2%), depressive symptoms (88.5%), and suicide attempts (27.5%) in the mental health high-risk group were substantially higher than those in the overall sample. The extremely high prevalence rates of these indicators reflect the methodology of LCA clustering individuals with similar response patterns onto specific indicator variables. Similar methodological patterns have been reported elsewhere, with an LCA of undergraduate students finding that the high-risk class showed rates of suicidal ide-

Table 5. Sexual behavior characteristics and disease prevalence by latent class (N=278,066)

Variable	Class 1: mental health high-risk group	Class 2: substance use high-risk group	Class 3: average group	Class 4: healthy group	χ^2	*p*
Sexual behavior[a]						
Age at first sexual experience					1,277.93	<.001
Elementary school	33.6	16.6	27.4	35.3		
Middle school	28.3	25.0	30.7	33.4		
High school	38.1	58.4	41.9	31.3		
Sexual intercourse after drinking					1,305.48	<.001
No	61.2	54.4	85.8	87.6		
Yes	38.8	45.6	14.2	12.4		
Contraceptive use					607.53	<.001
Always	28.6	30.6	31.9	30.6		
Sometimes	13.8	15.6	7.3	6.4		
Rarely	10.9	14.4	5.8	4.1		
Never	46.6	39.4	55.1	58.9		
Pregnancy experience (female)[b]					84.44	<.001
No	87.8	88.5	96.5	97.1		
Yes	12.2	11.5	3.5	2.9		
STI experience					307.38	<.001
No	83.6	90.2	95.5	95.5		
Yes	16.4	9.8	4.5	4.5		
Disease						
Asthma					453.97	<.001
No	87.9	89.9	90.6	91.8		
Yes	12.1	10.1	9.4	8.2		
Allergic rhinitis					899.94	<.001
No	62.8	69.5	64.2	69.2		
Yes	37.2	30.5	35.8	30.8		
Atopic dermatitis					877.6	<.001
No	72.4	79.7	73.5	77.7		
Yes	27.6	20.3	26.5	22.3		

Values are presented as weighted % unless otherwise stated. Percentages may not sum to exactly 100% due to rounding.
STI, sexually transmitted infection.
[a]Among those who reported sexual experience (n=13,627). [b]Among females who reported sexual experience (n=3,766).

ation, prior suicide attempts, and depressive symptoms of 66.0%, 22.5%, and 97.6%, respectively [31], illustrating that LCA typically yields extreme prevalence rates within identified risk classes. However, the possibility of overreporting in anonymous adolescent surveys cannot be excluded [32]. These findings should be interpreted as identifying a subgroup where mental health vulnerabilities are concentrated, rather than as population-level prevalence estimates. Adolescents with same-sex or both-sex sexual experience comprised 3.3% of this group, which was markedly higher than their prevalence rates in the average group (0.3%) and the healthy group (0.5%). These findings are broadly consistent with international research indicating that adolescents with same-sex attraction are 5 to 7 times more likely to experience suicidal ideation and mental health problems than their heterosexual peers [33], although that study assessed sexual orientation through self-reported attraction rather than sexual behavior patterns.

The mental health high-risk group demonstrated co-occurring vulnerabilities beyond mental health, including high rates of violence victimization (9.5%), STI experience (16.4%), and disease prevalence (12.1%, 37.2%, and 27.6% for asthma, allergic rhinitis, and atopic dermatitis, respectively). The elevated prevalence of these allergic conditions may be partly explained by the well-documented pathway through which chronic psychosocial stress dysregulates immune function, shifting the balance toward allergic inflammatory responses associated with asthma, allergic rhinitis, and atopic dermatitis [34]. These findings underscore the need for integrated interventions that address mental health, physical health, and prevention of violence victimization simultaneously, particularly for those in this high-risk group who report same-sex or

both-sex partners.

The substance use high-risk group was characterized by prominent smoking (82.4%) and alcohol use (84.6%) and had the highest proportion of those with same-sex or both-sex sexual experience (4.1%). The demographic profile of this group (81.5% males, 81.6% high-school students, and 49.5% in part-time employment) suggests greater developmental autonomy and economic resources that could facilitate substance access. The high rate of sexual intercourse after consuming alcohol (45.6%) indicates that substance use and risky sexual behaviors were tightly linked in the behavior patterns in this group. Despite these risk behaviors, this group exhibited relatively preserved mental health (57.0% feeling happy and 6.0% with suicidal ideation); however, this apparent well-being may be misleading since heavy substance use during adolescence is associated with increased risks of addiction, school dropout, chronic disease, and delayed-onset mental health problems in young adulthood. These findings suggest that substance use and mental health problems may represent temporally distinct pathways of health risk that do not necessarily co-occur during adolescence but may converge over time. Therefore, approaches to support early identification and interventions for this group should focus on substance use reduction and associated risky sexual behaviors, while recognizing that these adolescents might not present with the visible psychological distress typically targeted by mental health screening.

The average group (36.3%) showed moderate characteristics, but the elevated rates of stress (65.3%) and sleep insufficiency (57.8%) indicated latent risks. The very low proportion of adolescents with same-sex or both-sex sexual experience (0.3%) suggests that these individuals are concentrated in higher-risk classes.

The healthy group (47.1%) demonstrated the most-favorable indicators, with a high rate of feeling happy (93.4%), a low rate of depressive symptoms (5.5%), and minimal suicidal ideation (0.8%). However, adolescents with same-sex or both-sex sexual experience were markedly underrepresented, at 0.5%, compared with 5.1% of the overall sample. Notably, 35.3% of the sexually experienced adolescents in this class reported that their first sexual intercourse occurred during elementary school, which was the highest rate across all classes and is implausibly high for consensual activity. This pattern, shared with the mental health high-risk group (33.6%), raises concerns about either mischievous responding in anonymous surveys [32] or early experience of sexual abuse. These findings illustrate that the "healthy" label reflects a favorable current health status based on the measured indicators rather than the absence of all developmental risks.

The disproportionate representation of adolescents with same-sex or both-sex sexual experience in the high-risk groups may be partly understood within the Korean sociocultural context. Conservative attitudes toward adolescent sexuality are reinforced by Confucian values emphasizing family conformity and traditional social norms [35], and they may reduce access to comprehensive sexual health education and services for all sexually active adolescents, which would potentially have a greater impact on those whose sexual behaviors deviate from heteronormative expectations. In such an environment, adolescents with same-sex or both-sex sexual experience may face additional barriers to seeking health-related support, which could contribute to the clustering of health risks observed in this study.

Given this clustering of health risks, the clinical and nursing significance of these findings warrants consideration despite their modest absolute proportions (3.3% and 4.1% in the high-risk classes). These values represent overrepresentation rates of 6 to 8 times compared with the healthy group (0.5%), indicating that sexual behavior patterns serve as a meaningful marker for risk identification. These findings have several implications for nursing practice and policy. First, school and community health nurses—who maintain ongoing contact with adolescents—should include the making of sensitive inquiries about sexual experiences in routine health assessments and create safe environments for such disclosures. Second, given the co-occurrence of mental health vulnerabilities and substance use risks within distinct subgroups, integrated interventions combining mental health support and substance use prevention are necessary, rather than fragmented approaches targeting isolated health problems. Third, both schools and community organizations should establish support systems that enable adolescents with same-sex or both-sex sexual experience to access protective factors observed in the healthy group, such as supportive environments and mental health resources. Fourth, questions about sexual behavior patterns should be reintroduced into the KYRBS, since the modifications after 2017 eliminated the only nationally representative data source for monitoring health patterns according to sexual behaviors among Korean adolescents.

This study had several limitations. First, sexual behavior patterns were assessed only among the 5.1% of adolescents

with sexual experience, thereby precluding classification of the 94.9% without sexual experience who may include adolescents with minority sexual orientations who are not yet sexually active. This would introduce selection bias, since our findings represent health patterns among sexually active adolescents categorized by the sex of their sexual partners, rather than all adolescents who may identify as sexual minorities. Therefore, the term "sexual behavior patterns" used throughout this study should be interpreted as referring specifically to the sex of sexual partners, and not as equivalent to a sexual-minority identity or sexual orientation. Second, the latent class structure was derived from unweighted data due to software constraints of the poLCA package. When sampling weights are informative, unweighted estimations may yield biased parameter estimates with smaller variances that do not fully reflect sampling variability [27]. However, the excellent classification accuracy (entropy index = 0.855) supports the reliability of the class solution. Nevertheless, future studies using software capable of integrating survey weights into LCA estimations (e.g., Mplus) could further validate these findings. Third, the use of 2013–2016 data meant that recent attitudinal changes were not included in the analyses. Although these data are the most-recent nationally representative data available, the behavioral and social environments of Korean adolescents have changed considerably since that period. For example, the increasing use of e-cigarettes, increased exposure to digital media, and deteriorations in mental health observed following the COVID-19 (coronavirus disease 2019) pandemic may have altered the composition and prevalence of the latent classes identified in this study. Accordingly, the present findings should be interpreted as providing a historical baseline rather than a direct representation of the current adolescent health landscape.

CONCLUSION

The application of LCA to a large representative sample (N = 278,066) from the 2013–2016 KYRBS in this study has identified four distinct health classes. Adolescents with same-sex or both-sex sexual experience were disproportionately classified into the mental health and substance use high-risk groups, demonstrating their exposure to complex and severe health risks. These findings underscore the urgent need for integrated interventions and the reinstatement of assessments of sexual behaviors in national surveys. As the first large-scale multidimensional analysis of adolescent health patterns according to sexual behaviors in South Korea, this study has provided foundational data for developing evidence-based policies to address health inequalities.

ARTICLE INFORMATION

Authors' contribution

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

Conflict of interest

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

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Data availability

The data analyzed in this study were taken from 2013–2016 KYRBS which is available to the public for academic research purpose. The data can be downloaded in the official website (https://www.kdca.go.kr/yhs/; accessed on 7 July 2025).

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Supplementary material

Variables used in latent class analysis.

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REFERENCES

1. Phillips GL, Curtis MG, Kelsey SW, Floresca YB, Davoudpour S, Quiballo K, et al. Changes to sexual identity response options in the Youth Risk Behavior Survey. JAMA Pediatr. 2024;178(5):506-508. https://doi.org/10.1001/jamapediatrics.2024.0024
2. LGBT+ Pride 2024 Global Survey: a 26-country Ipsos global advisor survey [Internet]. Ipsos; 2024 [cited 2025 Aug 1]. Available from: https://www.ipsos.com/sites/default/files/ct/news/documents/2024-05/Pride%20Report%20FINAL_0.pdf

3. Lee HR, Lee HM, Joo SS, Kim RY, Um YJ, Kim SS. Importance of collecting sexual orientation and gender identity information in nationally representative surveys of South Korea: a review of current status and measurement development. J Crit Soc Welf. 2022(74):175-208. https://doi.org/10.47042/ACSW.2022.2.74.175
4. Saewyc EM. Research on adolescent sexual orientation: development, health disparities, stigma and resilience. J Res Adolesc. 2011;21(1):256-272. https://doi.org/10.1111/j.1532-7795.2010.00727.x
5. Kwak Y, Kim JS. Associations between Korean adolescents' sexual orientation and suicidal ideation, plans, attempts, and medically serious attempts. Iran J Public Health. 2017;46(4):475-484.
6. Frost DM, Meyer IH. Minority stress theory: application, critique, and continued relevance. Curr Opin Psychol. 2023;51:101579. https://doi.org/10.1016/j.copsyc.2023.101579
7. Lee DY, Kim SH, Woo SY, Yoon BK, Choi D. Associations of health-risk behaviors and health cognition with sexual orientation among adolescents in school: analysis of pooled data from Korean nationwide survey from 2008 to 2012. Medicine (Baltimore). 2016;95(21):e3746. https://doi.org/10.1097/MD.0000000000003746
8. Depa N, Desai S, Patel S, Silvi S, Hanif S, Rizvi S, et al. Mental health disparities amongst sexual-minority adolescents of the US: a national survey study of YRBSS-CDC. Psychiatry Res. 2022;314:114635. https://doi.org/10.1016/j.psychres.2022.114635
9. Duong J, Kelly D, Sciolla AF. Illicit drug use and associated health risk behaviors among sexual minority youth. Addict Behav. 2025;169:108397. https://doi.org/10.1016/j.addbeh.2025.108397
10. Rasberry CN, Lowry R, Johns M, Robin L, Dunville R, Pampati S, et al. Sexual risk behavior differences among sexual minority high school students: United States, 2015 and 2017. MMWR Morb Mortal Wkly Rep. 2018;67(36):1007-1011. https://doi.org/10.15585/mmwr.mm6736a3
11. Nagata JM, Lee CM, Yang JH, Kiss O, Ganson KT, Testa A, et al. Sexual orientation disparities in early adolescent sleep: findings from the Adolescent Brain Cognitive Development Study. LGBT Health. 2023;10(5):355-362. https://doi.org/10.1089/lgbt.2022.0268
12. Weiss KE, Li R, Chen D, Palermo TM, Scheurich JA, Groenewald CB. Sexual orientation/gender identity discrimination and chronic pain in children: a national study. Am J Prev Med. 2024;67(2):175-183. https://doi.org/10.1016/j.amepre.2024.03.010
13. Katz-Wise SL, Everett B, Scherer EA, Gooding H, Milliren CE, Austin SB. Factors associated with sexual orientation and gender disparities in chronic pain among U.S. adolescents and young adults. Prev Med Rep. 2015;2:765-772. https://doi.org/10.1016/j.pmedr.2015.09.011
14. McQuillan MT, Kuhns LM, Miller AA, McDade T, Garofalo R. Gender minority stress, support, and inflammation in transgender and gender-nonconforming youth. Transgend Health. 2021;6(2):91-100. https://doi.org/10.1089/trgh.2020.0019
15. Beach LB, Elasy TA, Gonzales G. Prevalence of self-reported diabetes by sexual orientation: results from the 2014 Behavioral Risk Factor Surveillance System. LGBT Health. 2018;5(2):121-130. https://doi.org/10.1089/lgbt.2017.0091
16. Caceres BA, Sharma Y, Doan D. Hypertension risk in sexual and gender minority individuals. Expert Rev Cardiovasc Ther. 2022;20(5):339-341. https://doi.org/10.1080/14779072.2022.2075345
17. Sherman J, Dyar C, McDaniel J, Funderburg NT, Rose KM, Gorr M, et al. Sexual minorities are at elevated risk of cardiovascular disease from a younger age than heterosexuals. J Behav Med. 2022;45(4):571-579. https://doi.org/10.1007/s10865-021-00269-z
18. Huang AK, Hoatson T, Chakraborty P, McKetta S, Soled KR, Reynolds CA, et al. Disparities in cancer incidence by sexual orientation. Cancer. 2024;130(24):4306-4314. https://doi.org/10.1002/cncr.35356
19. Rypka KJ, Wendland ZD, Steele MV, Wehner MR, Yeung H, Mansh MD. Sexual orientation and lifetime prevalence of skin cancer across racial and ethnic groups. JAMA Dermatol. 2024;160(9):977-983. https://doi.org/10.1001/jamadermatol.2024.2097
20. Srivastava A, Davis JP, Goldbach JT. Gender and sexual identities predicting patterns of co-occurring health risks among sexual minority youth: a latent class analysis approach. Prev Sci. 2020;21(7):908-916. https://doi.org/10.1007/s11121-020-01137-z
21. Coulter RW, Ware D, Fish JN, Plankey MW. Latent classes of polysubstance use among adolescents in the United States: intersections of sexual identity with sex, age, and race/ethnicity. LGBT Health. 2019;6(3):116-125. https://doi.org/10.1089/lgbt.2018.0149
22. Nelon JL, De Pedro KT, Gilreath TD, Patterson MS, Holden CB, Esquivel CH. A latent class analysis of the co-occurrence of sexual violence, substance use, and mental health in youth. Subst Use Misuse. 2019;54(12):1938-1944. https://doi.org/10.1080/10826084.2019.1618337
23. Lanza ST. Latent class analysis for developmental research. Child Dev Perspect. 2016;10(1):59-64. https://doi.org/10.1111/cdep.12163
24. Institute of Medicine (US) Committee on Lesbian, Gay, Bisexual, and Transgender Health Issues and Research Gaps and Opportunities. The health of lesbian, gay, bisexual, and transgender people: building a foundation for better understanding. National Academies Press (US); 2011. https://doi.org/10.17226/13128
25. 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. PLoS Med. 2007;4(10):e296. https://

doi.org/10.1371/journal.pmed.0040296
26. Linzer DA, Lewis JB. poLCA: an R package for polytomous variable latent class analysis. J Stat Softw. 2011;42(10):1-29. https://doi.org/10.18637/jss.v042.i10
27. Patterson BH, Dayton CM, Graubard BI. Latent class analysis of complex sample survey data: application to dietary data. J Am Stat Assoc. 2002;97(459):721-741. https://doi.org/10.1198/016214502388618465
28. Fine SL, Blum RW, Bass JK, Lulebo AM, Pinandari AW, Stones W, et al. A latent class approach to understanding patterns of emotional and behavioral problems among early adolescents across four low- and middle-income countries. Dev Psychopathol. 2023;35(4):1684-1700. https://doi.org/10.1017/S0954579422000384
29. Bianchi V, Brambilla P, Garzitto M, Colombo P, Fornasari L, Bellina M, et al. Latent classes of emotional and behavioural problems in epidemiological and referred samples and their relations to DSM-IV diagnoses. Eur Child Adolesc Psychiatry. 2017;26(5):549-557. https://doi.org/10.1007/s00787-016-0918-2
30. Kretschmer T, Barker ED, Dijkstra JK, Oldehinkel AJ, Veenstra R. Multifinality of peer victimization: maladjustment patterns and transitions from early to mid-adolescence. Eur Child Adolesc Psychiatry. 2015;24(10):1169-1179. https://doi.org/10.1007/s00787-014-0667-z
31. Bernanke J, Galfalvy HC, Mortali MG, Hoffman LA, Moutier C, Nemeroff CB, et al. Suicidal ideation and behavior in institutions of higher learning: a latent class analysis. J Psychiatr Res. 2017;95:253-259. https://doi.org/10.1016/j.jpsychires.2017.09.003
32. Robinson-Cimpian JP. Inaccurate estimation of disparities due to mischievous responders: several suggestions to assess conclusions. Educ Res. 2014;43(4):171-185. https://doi.org/10.3102/0013189X14534297
33. Kingsbury M, Hammond NG, Johnstone F, Colman I. Suicidality among sexual minority and transgender adolescents: a nationally representative population-based study of youth in Canada. CMAJ. 2022;194(22):E767-E774. https://doi.org/10.1503/cmaj.212054
34. Elenkov IJ, Chrousos GP. Stress hormones, Th1/Th2 patterns, pro/anti-inflammatory cytokines and susceptibility to disease. Trends Endocrinol Metab. 1999;10(9):359-368. https://doi.org/10.1016/s1043-2760(99)00188-5
35. Yang S. Young generation's perceptions of same-sex sexuality and attitudes toward same-sex marriage in South Korea. SAGE Open. 2021;11(3):21582440211031886. https://doi.org/10.1177/21582440211031886

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Challenges and strategic directions in pediatric nursing clinical practicum in South Korea: a descriptive study

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Purpose: This study aimed to examine the current status and key challenges of pediatric nursing clinical education in South Korea and to provide strategic directions for quality improvement based on competency-based learning outcomes.
Methods: A cross-sectional survey was conducted among 89 pediatric nursing faculty members working at various universities nationwide between February and July 2024. Quantitative data were analyzed using descriptive statistics, and qualitative responses were analyzed using inductive content analysis.
Results: Practicum objectives primarily focused on inpatient care (98.9%) and core nursing skills (83.1%), while communication and problem-solving (22.4%) and ethics (21.3%) were underrepresented. Although high-fidelity simulation use reached 33.7%, interactive tools such as virtual reality (17.9%) and nursing process evaluations (7.8%) remained underutilized. Six themes emerged from the analysis of faculty perspectives on enhancing clinical practicum education: structural barriers in securing sites, inconsistent learning environments, overcrowding, limitations of observation-only learning, regulatory constraints, and excessive faculty burden.
Conclusion: This study proposes establishing standardized clinical protocols, expanding hybrid simulation-based models to compensate for shrinking clinical sites, and institutionalizing industry-academic cooperative frameworks to ensure the quality and equity of pediatric nursing education. These approaches are essential to enhancing the quality and equity of pediatric clinical nursing education in Korea.

Keywords: Competency-based education; Nursing education research; Nursing faculty; Pediatric nursing; Simulation training

INTRODUCTION

Recently, the significance of clinical practicums in nursing education has grown substantially in response to evolving healthcare needs, increasing demands for patient safety, and the call for competent and compassionate nurses [1]. Pediatric nursing plays a critical role in fostering the specialized knowledge and skills required to provide high-quality care for infants, children, and their families [2].

In South Korea, the pediatric nursing education landscape is currently navigating a critical transitional stage [3]. Transitioning beyond traditional training models, the field faces an urgent need to adapt to rapid demographic shifts and structural constraints [2]. The nation's total fertility rate fell to 0.75 in 2024, the lowest in the Organization for Economic Cooperation and Development [4], which has resulted in a steep de-

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cline in pediatric hospital admissions and, consequently, a reduction in accessible clinical training opportunities. Compounded by stringent infection control policies during the COVID-19 (coronavirus disease) pandemic, nursing students have experienced significantly reduced direct patient interactions, particularly in high-risk units such as the neonatal intensive care unit (NICU) and pediatric intensive care units [2]. Furthermore, while the number of nursing colleges and graduates continues to rise [4], clinical site availability and diversity have not kept pace, leading to overcrowded practicum environments and inconsistent educational quality [5].

These structural limitations are further exacerbated by a lack of standardized clinical learning objectives, evaluation tools, and competency-based teaching frameworks [5]. Although efforts have been made to integrate simulation-based education and alternative modalities, these have not been systematically embedded into pediatric nursing curricula [6].

The challenges in pediatric nursing clinical education are particularly acute compared to other nursing specialties due to several unique factors. First, pediatric patients represent a vulnerable population requiring specialized developmental considerations, family-centered care approaches, and age-specific communication skills that cannot be adequately learned through observation alone [7]. Second, the ethical complexities of pediatric care, including consent processes involving minors and family dynamics, create additional learning challenges that require structured educational approaches [8]. Third, the emotional intensity and psychological demands of caring for sick children and distressed families necessitate specific competency development in therapeutic communication and coping strategies [9]. Moreover, the technical skills required in pediatric nursing, such as age-appropriate medication calculations, developmental assessments, and specialized procedures for different age groups, demand hands-on practice opportunities that are increasingly difficult to secure [5].

If these limitations are not effectively addressed during this transitional period, the consequences may be profound. Educationally, the lack of direct clinical exposure risks widening the gap between theoretical knowledge and practical application, preventing students from internalizing essential clinical reasoning skills [9,10]. Practically, this deficiency can lead to significant "reality shock" upon employment, resulting in increased burnout and turnover rates among new nurses [10]. Most critically, the inability to guarantee clinical competency poses a direct threat to patient safety and the quality of care provided to the vulnerable pediatric population [11].

Previous research has addressed general trends in clinical nursing education [12], and some studies have examined specific aspects of pediatric nursing education, including simulation-based learning approaches [13] and competency assessment tools [5,11]. However, few comprehensive studies have systematically examined pediatric-specific practicum challenges or developed evidence-based strategies for improving the structure and outcomes of pediatric nursing clinical education in Korea [14-16]. Recent studies have highlighted the need for standardized competency frameworks and innovative educational approaches in pediatric nursing education, but implementation strategies remain limited [5].

Given the critical role pediatric nurses play in ensuring the health and development of the nation's children, and considering the unique educational challenges posed by the declining pediatric patient population and evolving healthcare delivery systems, it is imperative to strengthen the clinical education framework. This study seeks to investigate the status of pediatric nursing clinical practicums in South Korea and systematically identify the key challenges encountered in clinical education. Specifically, it analyzes the barriers within the current system and proposes strategic directions to improve its quality and outcomes. By providing empirical insights into the unique difficulties of pediatric nursing education, this study serves as a foundation for future research and policy development. Ultimately, it aims to establish a more effective, equitable, and competency-based nursing education system that prepares nursing graduates to meet the complex needs of pediatric patients and families in contemporary healthcare settings.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Konkuk University (IRB No. 202509-E-119). The requirement for informed consent was waived due to the retrospective nature of the study and the use of de-identified data.

1. Study Design

This is a descriptive study utilizing existing data on child health nursing clinical practicums. The original dataset was compiled from survey responses provided by nursing faculty members for the Conference of the Korean Academy of Child

Health Nursing. The reporting of this study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [17].

2. Data Collection

For data search and selection, information presented at the Korean Academy of Child Health Nursing 2024 summer conference regarding the status of pediatric nursing clinical education in South Korea was accessed and reviewed. The data were obtained from materials presented at the conference, which reported the results of a nationwide survey on clinical practice education in pediatric nursing. The original survey was conducted between February and July 2024 and investigated pediatric nursing practicum operations across 200 nursing departments and colleges nationwide. The final sample consisted of 89 institutions that provided complete responses. To ensure data accuracy, the unit of response was limited to one representative pediatric nursing faculty member per institution responsible for the clinical practicum curriculum. The survey instrument, comprising 18 items derived from previous studies [8,9] and aligned with national nursing education accreditation outcomes, provided data on practicum goals, credit hours, areas, student numbers, instructional methods, personnel, and evaluation methods, along with responses to open-ended questions regarding improvement needs [18]. Although the study primarily involved the analysis of official educational information, measures were taken to ensure voluntary participation and data confidentiality. To maintain ethical integrity, all data were accessed and analyzed in an anonymized format, and no personal identifiable information was included in the dataset.

3. Data Analysis

The data were analyzed using IBM SPSS/WIN ver. 26.0 (IBM Corp.). The practicum objectives, program outcome, clinical practicum settings, contractual arrangements, instructor types, pedagogical roles, teaching and evaluation methods, feedback sources, and student assessments were analyzed using frequencies and percentages. Qualitative responses were examined through content analysis. Two researchers independently coded the data, compared themes, and resolved discrepancies through discussion to ensure reliability.

RESULTS

1. Quantitative Analysis

1) Practicum objectives and program outcome alignment

Among the reported practicum domains, the most frequent objectives were inpatient pediatric care (98.9%), core nursing skills (83.1%) and high-risk pediatric care (80.9%), whereas competencies in teamwork & collaboration (28.1%), communication & problem-solving (22.4%), ethical practice (21.3%), and population health & community care (14.6%) were relatively lower.

Alignment with national nursing program outcomes (PO) showed a heavy focus on PO2 (provides nursing care appropriate to the situation through clinical reasoning, 98.9%) and PO1 (apply knowledge from nursing and other disciplines, 73.8%), while PO6 (collaborate with health care teams to promote health and address health issues, 50.0%), PO4 (perform nursing in accordance with law and ethics, 21.3%), PO3 (manage the health of the population within the public health care system, 14.6%) and PO5 (applying the principles of safety and quality improvement, 10.8%) were less emphasized.

2) Clinical practicum settings and contractual arrangements

Practicum institutions were primarily university hospitals (74.2%) and general hospitals (64.0%), while non-traditional community settings showed very low utilization. Regarding cooperation, 74.2% of institutions relied on the "personal requests of professors" to secure sites, and 60% utilized school-attached foundation hospitals (Table 1).

Table 1. Characteristics of clinical practicum settings and cooperation methods (N=89)

Variable	Category	No. (%)
Provider types	University hospital	66 (74.2)
	General hospital	57 (64.0)
	Specialist hospitals	47 (52.8)
	Health community centers	10 (11.2)
	Kindergarten/child-care center	6 (6.7)
Cooperation/contract methods	Personal request by professor	66 (74.2)
	School-attached (foundation) hospital	53 (60.0)
	Department/practice chair led	26 (29.2)
	University headquarters support	12 (13.5)

Multiple responses possible.

3) Instructor types and pedagogical roles

Full-time faculty (98.9%), head nurses (84.3%), and visiting instructors (71.9%) were the primary leaders in practicum education. Full-time faculty were most involved in meeting and case studies (93.2%), whereas head nurses focused on orientation (58.0%) and patient assignments (49.4%). A significant number of support staff (44.9% of assistants) had no direct training role (Table 2).

4) Teaching and evaluation methods

Demonstration-based teaching was the most common instructional method (73.0%). Interactive tools like virtual reality (VR) (17.9%) and quizzes (5.6%) remain underutilized. Evaluation relied heavily on reports (100%) and attendance (97.8%), while nursing process evaluation (7.8%) and simulation performance assessment (20.2%) were rare (Table 3).

Assessments of student performance were mainly conducted through direct faculty feedback (47.1%) and clinical instructor evaluations (44.9%), supplemented by peer appraisals (23.6%) and self-satisfaction (4.5%). Student self-assessment included decision-making skills (38.2%), nursing professional intuition (25.8%), and learning achievement (11.0%), although some institutions reported an absence of formal self-assessment (14.3%).

2. Qualitative Analysis

The qualitative analysis identified six main themes and 12 subcategories that illustrate the structural barriers and pedagogical gaps in pediatric nursing education (Table 4). To ensure the validity of these findings, representative participant quotations are provided for each subcategory.

1) Structural barriers in securing practicum sites

(1) Reduction of pediatric-specific beds

The continuous decrease in pediatric wards complicates the stability of clinical placements.

"Due to the low birth rate, pediatric wards are closing one after another. We are constantly searching for new hospitals every semester just to maintain the minimum required hours." (Participant 12)

(2) Restricted practice in integrated care units

Many institutions now operate mixed-age wards, diluting the pediatric focus.

"Pediatric patients are often scattered across integrated internal medicine wards, making it difficult for students to focus solely on developmental-specific nursing care." (Participant 45)

Table 3. Integration of teaching methods and evaluation metrics (N=89)

Variable	Category	No. (%)
Teaching methods	Demonstration	65 (73.0)
	Lecture	44 (49.4)
	Media usage	36 (40.4)
	High-fidelity simulation	30 (33.7)
	Low-fidelity simulation	19 (21.3)
	VR simulation	16 (17.9)
	Role-play	8 (9.0)
	Quizzes/medical term	5 (5.6)
Evaluation metrics	Written reports	89 (100.0)
	Attendance	87 (97.8)
	Attitude	84 (94.4)
	Core nursing skills	83 (93.3)
	Knowledge (quizzes)	81 (91.0)
	Reflective diary	66 (74.1)
	Simulation performance	18 (20.2)
	Nursing process	7 (7.8)

Multiple responses possible.
VR, virtual reality.

Table 2. Distribution of instructor types and their roles (N=89)

Role	Instructor type				
	Full-time faculty	Head nurse	Preceptor nurse	Visiting instructor	Assistant
Instructor presence	88 (98.9)	75 (84.3)	17 (19.1)	64 (71.9)	12 (13.5)
Assigning students	65 (73.0)	10 (11.2)	2 (2.2)	5 (5.6)	33 (37.0)
Orientation	41 (46.0)	52 (58.0)	20 (22.4)	13 (14.6)	1 (1.1)
Meetings/cases studies	83 (93.2)	4 (4.5)	2 (2.2)	49 (55.0)	0 (0.0)
Core nursing skill evaluation	67 (75.2)	8 (8.9)	5 (5.6)	50 (56.1)	4 (4.5)
Patient assignment	6 (6.7)	44 (49.4)	17 (19.1)	1 (1.1)	0 (0.0)
No training	0 (0.0)	10 (11.2)	33 (37.0)	17 (19.1)	40 (44.9)

Values are presented as number (%). Multiple responses possible.

Table 4. Qualitative analysis of improvement need in pediatric nursing education

Themes	Sub-category
Structural barriers in securing practicum sites	• Reduction of pediatric-specific beds • Restricted practice in integrated care units
Inconsistency in clinical learning experiences	• Gaps in high-risk area exposure • Regional disparities in training resources
Overcrowding and inefficient learning environments	• Multi-school placement overlaps • Diminished student engagement
Limitation of "observational only" learning	• Restrictions on direct care • Competency development gaps
Institutional and regulatory constraints	• Supply-demand mismatch • Passive attitudes from healthcare providers
Instructor burden and field capacity	• Supervisory scope limits • Variability in field leader capacity

2) Inconsistency in clinical learning experiences

(1) Gaps in high-risk area exposure

Access to specialized units like the NICU is increasingly restricted.

"Students only get to see the NICU through a window. They graduate without ever assessing a high-risk neonate in person." (Participant 23)

(2) Regional disparities in training resources

Institutions outside the capital area face a severe lack of specialized pediatric centers.

"In our province, there isn't a single children's specialized hospital. Our students have to travel for hours to other cities for a 2-week practicum." (Participant 67)

3) Overcrowding and inefficient learning environments

(1) Multi-school placement overlaps

Multiple universities competing for the same clinical space leads to overcrowding.

"There are times when students from three different nursing schools are on the same small ward. It's so crowded that students just end up standing in the corners." (Participant 8)

(2) Diminished student engagement

Overcrowded environments prevent students from taking an active role.

"When there are more students than patients, the clinical nurses view our students as a hindrance rather than learners, which kills the students' motivation." (Participant 31)

4) Limitation of "observational only" learning

(1) Restrictions on direct care

Safety and parental concerns often limit students to passive observation.

"Parents are very sensitive. Students aren't even allowed to take vital signs for some children, leaving them to only watch from a distance." (Participant 55)

(2) Competency development gaps

Lack of hands-on experience leads to low confidence in pediatric-specific skills.

"Students spend 80 hours in the hospital but never once perform a physical assessment on a child. This isn't 'practice'; it's 'watching'." (Participant 19)

5) Institutional and regulatory constraints

(1) Supply-demand mismatch

The increase in nursing student quotas is not matched by an increase in clinical sites.

"The government increases the number of students, but hospitals are closing pediatric units. Math simply doesn't work anymore." (Participant 72)

(2) Passive attitudes from healthcare providers

Hospitals often see student education as an administrative burden.

"Hospitals are reluctant to sign memorandum of understanding (MOU)s because they don't see any benefit in hosting students, only the risk of complaints from parents." (Participant 40)

6) Instructor burden and field capacity

(1) Supervisory scope limits

Faculty must manage multiple, distant sites simultaneously.

"I have students at 3–4 different hospitals at once. I spend more time driving between sites than actually teaching students at the bedside." (Participant 5)

(2) Variability in field leader capacity

The quality of guidance depends heavily on the individual nurse's willingness to teach.

"Some head nurses are wonderful mentors, but others treat students as 'invisible' because they are too busy with their own clinical duties." (Participant 88)

In summary, the qualitative findings highlight a profound structural crisis in pediatric nursing education, characterized by an acute shortage of clinical sites due to the closure of pediatric wards and a consequent imbalance in practicum opportunities. The learning environment is often inefficient and overcrowded, frequently resulting in passive, observation-only experiences that fail to provide students with essential direct nursing care competencies. Furthermore, the administrative and supervisory burdens are disproportionately concentrated on faculty members who must navigate shrinking institutional cooperation and regional disparities. Ultimately, the quality of clinical education remains highly inconsistent, as student experiences are dictated by the unpredictable autonomy of practice institutions, the varying pedagogical capacity of field leaders, and a significant disconnect between standardized educational goals and the restricted clinical reality.

DISCUSSION

This study aims to identify the structural and pedagogical challenges facing clinical practice education in pediatric nursing in Korea and to discuss the way forward based on these findings.

First, practice objectives were skewed toward specific domains. Most practicum learning objectives focused on clinical care and technical proficiency for pediatric inpatients, while also incorporating essential interpersonal skills such as communication, problem-solving skills, and teamwork. This significantly deviates from the holistic nursing competency frameworks emphasized by the World Health Organization [19] and the International Council of Nurses [20], suggesting an educational reality biased toward procedural competencies. There is an urgent need to redefine and diversify the educational objectives of pediatric nursing practice to develop a balanced set of core competencies for students as future professional nurses [1,2].

Second, simulation-based learning was underutilized. Simulation training can be a highly effective alternative to overcome the limitations of "observational learning" identified in qualitative studies and to prepare students for the high emotional sensitivity and risk involved in pediatric nursing [21,22]. As pediatric wards are shrinking due to declining birth rates and tightening infection control, which makes securing training sites increasingly difficult, there is a critical need to actively integrate simulation and VR tools into structured curricula to complement the quality of education [2,10]. To this end, it is essential not only to develop and share pediatric nursing simulation scenarios but also to establish a comprehensive support system, including administrative and financial resources, dedicated physical spaces, and specialized personnel, to facilitate simulation-based education in clinical and academic settings.

Third, staffing was overly concentrated on full-time professors. In many schools, clinical nurses participate in practical training, but their roles are limited, and they are unable to utilize diverse teaching methods. The qualitative research also pointed to the physical limitations of professors managing multiple practicum sites ("it's too much for professors to supervise students") and the lack of capacity among site leaders. While the leading role of full-time faculty has the positive aspect of strengthening the theory-practice link, it can place an undue burden on the individual faculty member and hinder the diversity of the preceptor workforce [23,24]. There is a need to introduce a collaborative leadership team model that includes a competent child nurse practitioner or site preceptor and a clinical leader, benchmarking international models that support continuous feedback and capacity development [25].

Fourth, structural weaknesses in securing practicum sites and assigning students were revealed. Many practicum sites

were secured through the professors' personal networks (74.2%) rather than through formal agreements, leading to instability and regional imbalances in securing practicum sites [23]. In the qualitative study, the response "there are no pediatric training sites at all in the provinces" clearly illustrates this problem. There was also concern that some sites were overcrowded, with "more trainees than patients," which could compromise student engagement and the quality of learning [26]. Moving forward, there is a need for the standardization of placement criteria, such as institutionalizing formal agreements between institutions and schools and specifying a maximum capacity for each training unit. [5,16,23].

Finally, the evaluation approach is more outcome-oriented and summative than process-oriented and formative. The lack of assessment regarding clinical practice skills, field judgment, and collaboration skills conflicts with the goals of performance-based education [26,27]. Multidimensional assessment systems, such as objective structured clinical examinations (OSCEs) and portfolios, should be introduced to comprehensively assess student growth [13,28].

In conclusion, this study shows that clinical practice education in pediatric nursing in Korea needs systematic improvement in terms of competency balance, diversification of practice settings, collaborative teaching, and multidimensional assessment. Addressing these challenges is essential not only to improve the quality of education but also to ensure that future generations grow into competent professional nurses capable of providing safe, ethical, and family-centered pediatric care.

Furthermore, as this study analyzed data from 89 out of 200 nursing schools, the potential for non-response bias must be acknowledged, as the perspectives of non-participating faculty members may differ from the results presented. Another limitation is that this study relied solely on faculty responses, omitting the viewpoints of other key stakeholders such as nursing students and clinical preceptors. Additionally, the findings may not fully reflect the inter-institutional variations in pediatric nursing curricula and simulation-based learning resources across different universities. Future studies should adopt a multi-center approach involving diverse participants and standardized assessments of institutional curricula to provide a more comprehensive and validated understanding of pediatric nursing education.

CONCLUSION

This study highlighted critical gaps in pediatric nursing clinical practicums in South Korea, particularly in the areas of learning objectives, site accessibility, teaching diversity, and competency evaluation. To advance clinical nursing education for pediatric populations, it is essential to develop national guidelines that standardize clinical practicum goals in alignment with core nursing competencies, while also increasing support for simulation-based and blended learning that integrates VR. Strengthening multi-institutional collaborations, including formal partnerships with community health centers and kindergartens, can broaden the scope and accessibility of training opportunities. In addition, promoting team-based instruction involving preceptors, adjunct faculty, and clinical mentors can enrich the learning experience and provide diverse perspectives. Comprehensive evaluation frameworks, incorporating OSCEs, peer assessments, and reflective portfolios, should be implemented to ensure a robust assessment of student competencies. Collectively, these reforms will contribute to building a future-oriented clinical education system that equips nursing graduates to meet the complex needs of pediatric patients and their families in a rapidly changing healthcare landscape.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: KKS, ESJ. Methodology: ESJ. Investigation: KKS. Formal analysis: KKS. Data curation: KKS. Writing–original draft: KKS. Writing–review and editing: KKS, ESJ. Final approval of published version: KKS, ESJ.

Conflict of interest

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

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Data availability

Please contact the corresponding author for data availability.

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AI use disclosure

The authors declare that an AI-based language model (Gemini 3.0) was used solely for grammar and language editing. All scientific content, interpretation, and conclusions remain the sole responsibility of the authors. The author reviewed and approved all content and take full responsibility for the integrity of the manuscript.

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REFERENCES

1. Benner P, Sutphen M, Leonard V, Day L. Educating nurses: a call for radical transformation. Jossey-Bass; 2010.
2. Koo HY, Lee BR. Development and evaluation of a pediatric nursing competency-building program for nursing students in South Korea: a quasi-experimental study. Child Health Nurs Res. 2022;28(3):167-175. https://doi.org/10.4094/chnr.2022.28.3.167
3. Kang DH, Yang J. Clinical practice experience of nursing students during the COVID-19 pandemic. Korean J Adult Nurs. 2021;33(5):509-521. https://doi.org/10.7475/kjan.2021.33.5.509
4. Statistics Korea. 2024 birth and death statistics (provisional) [Internet]. Statistics Korea; 2025 [cited 2026 Apr 7]. Available from: https://kostat.go.kr/
5. Koo HY, Lee BR. Development of a protocol for guidance in the pediatric nursing practicum in South Korea: a methodology study. Child Health Nurs Res. 2022;28(1):51-61. https://doi.org/10.4094/chnr.2022.28.1.51
6. Jeon B, Kim M, Tae H, Eom S, Jeong Y. Effects of an education program using SBAR on communication clarity, communication confidence, and clinical performance in pediatric nurses. Nurs Health Sci. 2025;24(1):11-22. https://doi.org/10.12972/nhs.2025.24.1.2
7. Abdel Razeq NM, Arabiat DH, Shields L. Nurses' perceptions and attitudes toward family-centered care in acute pediatric care settings in Jordan. J Pediatr Nurs. 2021;61:207-212. https://doi.org/10.1016/j.pedn.2021.05.018
8. Committee on Hospital Care and Institute for Patient- and Family-Centered Care. Patient- and family-centered care and the pediatrician's role. Pediatrics. 2012;129(2):394-404. https://doi.org/10.1542/peds.2011-3084
9. deSante-Bertkau J, Herbst LA. Ethics of pediatric and young adult medical decision-making: case-based discussions exploring consent, capacity, and surrogate decision-making. MedEdPORTAL. 2021;17:11094. https://doi.org/10.15766/mep_2374-8265.11094
10. Kim S, Nam H, Kim M. Critical thinking disposition, problem solving process, and simulation-based assessment of clinical competence of nursing students in pediatric nursing. Child Health Nurs Res. 2014;20(4):294-303. https://doi.org/10.4094/chnr.2014.20.4.294
11. Oh EY, Yu JH. Effects of problem-based learning on the metacognition, problem solving, professional self-concept and self-directed learning of nursing students. J Ind Converg. 2023;21(9):89-102. https://doi.org/10.22678/JIC.2023.21.9.089
12. Yeo JY, Nam H, Park JI, Han SY. Multidisciplinary design-based multimodal virtual reality simulation in nursing education: mixed methods study. JMIR Med Educ. 2024;10:e53106. https://doi.org/10.2196/53106
13. Kwon IS. An analysis on clinical education of pediatric nursing. Child Health Nurs Res. 2002;8(3):344-356.
14. Song CE, Kim WG, Lim YJ. An analysis of evidence-based practice courses in Korean nursing education systems. Heliyon. 2019;5(10):e02650. https://doi.org/10.1016/j.heliyon.2019.e02650
15. Jung YM, Yoo IY. Career education needs of Korean nursing students and professionals: a cross-sectional survey. Nurse Educ Today. 2022;108:105209. https://doi.org/10.1016/j.nedt.2021.105209
16. World Health Organization. State of the world's nursing 2020: investing in education, jobs and leadership. WHO Press; 2020.
17. 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. Lancet. 2007;370(9596):1453-1457. https://doi.org/10.1016/S0140-6736(07)61602-X
18. Korean Accreditation Board of Nursing Education. Accreditation standards for nursing education (2022-2026) [Internet]. Korean Accreditation Board of Nursing Education; 2024 [cited 2025 Aug 12]. Available from: http://www.kabone.or.kr/index.do
19. International Council of Nurses. International Nurses Day 2017: nurses: a voice to lead: achieving the Sustainable Development Goals [Internet]. International Council of Nurses; 2017 [cited 2025 Aug 12]. Available from: https://www.icn.ch/international-nurses-day-2017
20. Hanshaw SL, Dickerson SS. High fidelity simulation evaluation studies in nursing education: a review of the literature. Nurse Educ Pract. 2020;46:102818. https://doi.org/10.1016/j.nepr.2020.102818
21. Lasater K, Nielsen A. The Lasater Clinical Judgment Rubric: 17 years later. J Nurs Educ. 2024;63(3):149-155. https://doi.org/

10.3928/01484834-20240108-05
22. Ju HO, Lee JH. Nursing students' satisfaction and clinical competence by type of pediatric nursing practicum during the COVID-19 pandemic. J Korean Acad Soc Nurs Educ. 2024;30(1):29-38. https://doi.org/10.5977/jkasne.2024.30.1.29
23. Park KO, Kim JK, Yu M. Experience of role adaptation from nurse to member of the nursing faculty. J Korean Acad Nurs. 2016;46(2):168-182. https://doi.org/10.4040/jkan.2016.46.2.168
24. Murad A, Mater E. Evaluating the effectiveness of competency-based didactic approach (CBDA) in pediatric nursing education: a mixed-method study. Nurs Res Pract. 2025;2025:6613710. https://doi.org/10.1155/nrp/6613710
25. Hong KJ, Yoon HJ. Effect of nurses' preceptorship experience in educating new graduate nurses and preceptor training courses on clinical teaching behavior. Int J Environ Res Public Health. 2021;18(3):975. https://doi.org/10.3390/ijerph18030975
26. Kwak E, Oh H. Development and psychometric testing of the Clinical Nursing Competency Scale for Clinical Preceptor Use (CNCS-CP). J Korean Acad Nurs. 2018;48(4):419-431. https://doi.org/10.4040/jkan.2018.48.4.419
27. Kang IH, Lee EJ, Lee K, Chang CJ, Yi YJ. Development of evaluation tool for clinical nursing practice competency of nursing students. J Korean Acad Nurs Adm [Internet]. 2005 [cited 2025 Aug 12];11(3):323-333. Available from: https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART001179408
28. Rushforth HE. Objective structured clinical examination (OSCE): review of literature and implications for nursing education. Nurse Educ Today. 2007;27(5):481-490. https://doi.org/10.1016/j.nedt.2006.08.009

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Impact of stress, loneliness, and emotional dysregulation on drug use potential among middle school students in South Korea: a cross-sectional study

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Purpose: This study is a descriptive survey examining the effects of stress, loneliness, and emotional dysregulation on adolescents' potential for drug use.
Methods: Data were collected through face-to-face surveys conducted between August 28 and September 11, 2023, with a sample of 118 second-year students from a middle school in South Korea. The survey questionnaire included items on general characteristics, substance-related characteristics, adolescent stress, loneliness, emotional dysregulation, and drug use potential.
Results: The analysis revealed significant differences in drug use potential based on academic achievement, school satisfaction, family relationship satisfaction, economic status, smoking experience, and substance use history. Furthermore, drug use potential showed a significant positive correlation with stress, loneliness, and emotional dysregulation. The key predictors of drug use potential were loneliness in family relationships, emotional dysregulation, and school satisfaction with a total explanatory power of 33.8%.
Conclusion: To prevent adolescent drug use potential, it is essential to develop and implement nursing intervention programs that reduce family-related loneliness, provide support for emotional regulation difficulties, and promote smoking prevention.

Keywords: Adolescent; Emotional regulation; Loneliness; Substance abuse

INTRODUCTION

Drugs are substances that affect the human central nervous system by either excessively stimulating or suppressing its function, and they have the potential for both physical and psychological dependency. In South Korea, drugs—including narcotics, psychotropic substances, cannabis, and other emerging psychoactive substances—are regulated under various laws including the Narcotics Control Act, Act on Special Cases Concerning the Prevention of Illegal Trafficking in Narcotics, Act on Aggravating Certain Crimes, and Criminal Act [1].

South Korea has recently experienced a dramatic surge in drug offenses among adolescents, tripling within a year, with the age of drug offenders trending downward. Individuals aged under 20 years now account for 17.7% of all drug users [1]. The expansion of online drug distribution during the COVID-19 (coronavirus disease 2019) pandemic has made it easier for adolescents to access narcotics through social media and search engines [2]. A key trend highlighted in the 2019–2023 Drug Crime Report is the accelerating rise in drug offenses among minors. Over a period of 4 years, cases surged 518.6% from 239 to 1,477, with a particularly sharp 417.2% increase in the past year alone (from 481 in 2022) [3].

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Although it is commonly believed that adolescents find it harder to obtain illicit drugs than adults, concerns about the misuse of painkillers are growing. Many adolescents are gaining easier access to drugs than before through the practice of obtaining painkillers on a doctor's prescription and then reselling them to their peers. This trend is alarming because many adolescents perceive that while substances like cannabis and methamphetamine are illegal, obtaining drugs with a doctor's prescription is not [2].

Various factors contribute to adolescent substance abuse, including personal, environmental, psychological, sociocultural, and regional influences. Adolescence is a transitional developmental stage characterized by rapid physical growth and the establishment of self-identity. In South Korea, adolescents experience intense academic stress due to an exam-focused education system and excessive academic competition, which often leads to identity confusion [4]. If they lack effective coping skills for managing stress or fail to appropriately manage or regulate their desires and conflicts, they may turn to substance use as a means of relaxation, rebellion, or escape from reality [5].

Adolescence is a developmental stage where relationships with parents and peers play a crucial role, and feelings of loneliness peak when adolescents feel neglected by their parents. Loneliness among this group can manifest as anger, delinquency, social media addiction, school maladjustment, or suicidal thoughts, making early intervention essential. Studies have also identified loneliness as a key factor influencing adolescent substance use, emphasizing its importance as a mental health issue that should not be overlooked [6-8].

Emotional regulation refers to the internal and external processes through which individuals monitor, evaluate, and modify their emotional responses to achieve goals. Effective emotional regulation is essential for social adaptation and psychological well-being. Adolescents who develop strong emotional regulation skills exhibit greater prosocial behavior and maintain better peer relationships. However, difficulties in emotional regulation have been linked to depression, anxiety, suicidal ideation, eating disorders, and alcohol use [9].

The accumulation of stress among adolescents exacerbates difficulties in emotional regulation, and those experiencing loneliness due to a lack of appropriate support resources are more likely to pursue undesirable health behaviors such as substance abuse [10,11].

In the context of adolescent drug abuse, early intervention is crucial, because it not only hinders personal growth and development, but also serves as a gateway to delinquency, criminal activity, and addiction to other substances [12]. From a preventive perspective, adolescents' potential for drug use must be assessed and influencing factors identified to enable early prevention and effective management.

Screening for drug use potential can help identify at-risk adolescents early on, allowing for timely referrals to appropriate support services [13]. While adolescents may be drawn to drug use under peer pressure or out of curiosity, various personal and social factors determine whether substance use persists or remains an isolated incident. Therefore, assessing drug use potential is a critical preventive measure in adolescent addiction management.

With the age at which adolescents begin experimenting with drugs decreasing, it is imperative to identify drug use behaviors and risk factors among middle school students, who are in the early stages of adolescence. While previous research has identified stress and loneliness as factors influencing middle school students' drug use [6-8,14], studies examining the impact of emotional dysregulation on drug use potential remain limited.

To address this research gap, this study aims to investigate the effects of stress, loneliness, and emotional dysregulation on drug use potential in early adolescents. As such, it provides foundational data for the development of nursing intervention programs for drug prevention. The objectives of this study are to: (1) examine the general characteristics, stress levels, loneliness, emotional dysregulation, and drug use potential of participants; (2) identify differences in drug use potential based on general and substance-related characteristics; (3) analyze the correlations between stress, loneliness, emotional dysregulation, and drug use potential; and (4) determine the factors influencing adolescent drug use potential. Based on the results of this study, we hope to provide the basic data necessary for the development of intervention programs to prevent drug use among adolescents.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Seoul Women's College of Nursing (IRB No. SWCN-202308-HR-001-03). Informed consent was obtained from all participants.

1. Study Design

This is a descriptive study to determine the impact of stress, loneliness, and emotional dysregulation on the likelihood of drug use among early adolescents. The reporting of this study is based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [15].

2. Participants

The research participants were selected through convenience sampling from a second-year group at a middle school in Gunsan city, South Korea, where a census survey was feasible. All second-year students were informed about the study's purpose, procedures, voluntary participation, and anonymity, and they submitted a consent form before participating in the survey. Parental consent was then obtained before administering the questionnaire.

The sample size was determined using G*Power ver. 3.1 (Heinrich-Heine-Universität Düsseldorf) based on a significance level of .05, power of .90, and medium effect size of .15. A minimum of 116 participants was required for multiple regression analysis with five independent variables. From the total of 140 respondents, data from 118 respondents, excluding 22 incomplete responses, were ultimately included in the final analysis.

3. Measures

1) General and substance-related characteristics

The questionnaire on general characteristics included seven items: gender, age, academic achievement, school life satisfaction, friendship satisfaction, family relationship satisfaction, and economic status. The substance-related characteristics included nine items: experience with smoking, drinking, and substance use prevention education; history of smoking, drinking, and substance use; awareness of the risks and severity of substance use; and sources of information about substance use risks.

2) Stress

Adolescents' stress levels were measured using the Youth Stress Scale developed by Yoon and Jo [16]. This 25-item scale consists of five subscales: school, family, friends, living environment, and self. Each item is rated on a 5-point Likert scale, with higher scores indicating greater stress levels. The scale had a Cronbach's α of .88 at the time of development [16] and .92 in this study.

3) Loneliness

Adolescents' loneliness was measured using the Loneliness Scale for Adolescents developed by Hur and Kim [17]. This 24-item scale consists of three subscales: family relationships, friendships, and community relationships. Each item is rated on a 4-point Likert scale, with higher scores indicating greater loneliness. The original scale had an overall Cronbach's α of .93, with subscale values ranging from .81 to .92 [17]. In this study, the overall Cronbach's α was .91, with subscale values of .90 (family), .89 (friends), and .80 (community).

4) Emotional dysregulation

Emotional dysregulation was assessed using K-DERS, the Korean version of the Difficulties in Emotion Regulation Scale (DERS) originally developed by Gratz and Roemer [18] and adapted and validated for Korean middle and high school students by Park [9]. The 34-item scale consists of six dimensions: (1) nonacceptance of emotional responses, (2) difficulty engaging in goal-directed behavior, (3) difficulty controlling impulsive behavior, (4) lack of emotional awareness, (5) limited access to emotion regulation strategies, and (6) lack of emotional clarity or identification. Each item is rated on a 5-point Likert scale (0=almost never, 4=almost always), with higher scores indicating greater difficulty in emotional regulation. The scale demonstrated high reliability, with a Cronbach's α of .94 at the time of development [9] and .93 in this study.

5) Potential drug-use

Adolescents' potential for drug use was assessed using the Screening Scale for Potential Drug-Use Adolescents developed by Lee et al. [12]. This 39-item scale measures various risk factors including personal traits, problem behaviors, parental issues and substance use history, parent-child relationships, drinking environment and attitudes, smoking environment and attitudes, and substance use environment and attitudes. Each item is rated on a 4-point Likert scale, with higher scores indicating greater potential for drug use. The original scale had a Cronbach's α of .91 [12], and in this study, it was .93.

4. Data Collection

Data were collected in August and September 2023 after receiving the approval of the IRB of the institution. The researcher first obtained verbal consent from the school principal and homeroom teachers after explaining the study's purpose, methods, and procedures. A student representative then informed the participants about the study, emphasizing that participation was voluntary, anonymous, and confidential, and that non-participation would not result in any disadvantages. An information sheet and consent form were distributed. Students were asked to take the documents home, explain them to their parents or caregivers, and obtain their signatures before returning them. Only students who submitted signed parental consent forms were given the questionnaire. Participants completed the survey independently and placed their responses in a locked collection box to ensure anonymity. The survey took approximately 20 minutes to complete, and all participants received a small token of appreciation upon completion.

5. Data Analysis

The collected data were analyzed using IBM SPSS Statistics ver. 27.0 (IBM Corp.). General and substance-related characteristics were analyzed using frequencies, percentages, means, and standard deviations. Stress, loneliness, emotional dysregulation, and drug use potential were summarized using means and standard deviations. Following normality testing, differences in drug use potential based on general characteristics were analyzed using t-tests, Mann-Whitney U tests, an analysis of variance with Dunnett T3 post-hoc tests, and Kruskal-Wallis tests. Correlations among stress, loneliness, emotional dysregulation, and drug use potential were examined using Pearson's correlation coefficients. Factors influencing adolescent drug use potential were analyzed using stepwise multiple regression analysis.

RESULTS

1. Differences in Potential Drug-Use by General and Substance-Related Characteristics

The average age of the participants was 13.31±0.46 years, and 54.7% were female. Regarding academic achievement, 36.4% selected 'high,' 32.2% selected 'medium,' and 31% selected 'low.' Regarding satisfaction with school life, 44.9% of participants reported being 'satisfied,' 37.3% reported 'neutral,' and 17.8% reported 'dissatisfied.' Regarding satisfaction with friendships, 65.3% reported being satisfied, whilst 73.7% reported being satisfied with family relationships and 10.2% were dissatisfied. Regarding household economic status, 18.1% of participants reported it as high, whilst 46.6% perceived it as low. Analysis of differences in potential drug use according to general characteristics revealed that participants with high academic achievement ($F=9.22$, $p<.001$) and high satisfaction with school life ($F=9.39$, $p<.001$) had significantly lower potential drug use scores compared to other groups. Furthermore, participants with high satisfaction with family relationships ($F=13.87$, $p=.001$) and those who perceived their economic status to be high ($F=4.27$, $p=.016$) had significantly lower potential drug use scores compared to those with low satisfaction and low perceptions, respectively. This is shown in Table 1.

Over the past year, 94.1% of participants received education on smoking prevention, 90.7% on alcohol prevention, and 89.0% on drug prevention. Regarding drinking and smoking status over the past month, 1.8% reported smoking and 2.9% reported alcohol use. In terms of substance use, 1.8% reported the habitual or intentional use of substances including sedatives, stimulants, appetite suppressants, opioid painkillers, cold medicine, hallucinogens, cannabis, cocaine, or inhalants such as glue and butane gas. Regarding awareness of the risks associated with substance use, 62.4% of participants reported that they were aware of these risks to a moderate degree or higher, whilst 37.6% stated that they were not aware of them. 81.2% perceived the seriousness of substance use to be moderate or higher, whilst 18.8% believed it was not serious. In terms of sources of information on drug use risks, 33.3% received information through school education, and 66.7% cited other sources including broadcast media, the internet, movies, personal experiences, and peers. Among these, broadcast media such as TV and radio were the most frequently indicated sources.

An analysis of substance-related characteristics revealed that, although they constituted a minority, participants who had smoked in the past month ($Z=2.59$, $p=.003$) or had prior substance use experience ($Z=2.14$, $p=.017$) had significantly higher potential drug-use scores compared to other groups, for a while, other variables showed no significant differences. As shown in Table 2.

Table 1. Differences in potential drug-use by general characteristics (N=118)

Characteristic	No. (%)	Mean±SD	t/F	*p*
Age (yr)	-	13.31±0.46	-	-
Gender			0.18	.860
Male	53 (45.3)	1.58±0.41		
Female	64 (54.7)	1.57±0.41		
Academic achievement			9.22	<.001
High[a]	43 (36.4)	1.38±0.28		a<b<c
Medium[b]	38 (32.2)	1.61±0.43		
Low[c]	37 (31.4)	1.74±0.42		
Satisfaction with school			9.39	<.001
Satisfied[a]	53 (44.9)	1.40±0.31		a<b<c
Neutral[b]	44 (37.3)	1.69±0.46		
Dissatisfied[c]	21 (17.8)	1.75±0.34		
Friendship satisfaction			5.84	.054
Satisfied	77 (65.3)	1.52±0.41		
Neutral	30 (25.4)	1.65±0.37		
Dissatisfied	11 (9.3)	1.72±0.46		
Family relationship satisfaction			13.87	.001[a)]
Satisfied[a]	87 (73.7)	1.49±0.35		a-c
Neutral[b]	19 (16.1)	1.70±0.51		
Dissatisfied[c]	12 (10.2)	1.96±0.39		
Economic status			4.27	.016[a)]
High[a]	21 (18.1)	1.36±0.35		a-c
Middle[b]	41 (35.3)	1.55±0.38		
Low[c]	54 (46.6)	1.66±0.42		

Missing data is not included in the values.
SD, standard deviation.
[a)]By Kruskal-Wallis test; a, b, c: Dunnett T3 test/Bonferroni calibration.

2. Scores for Stress, Loneliness, Emotional Dysregulation, and Potential Drug-Use

Participants' mean scores were 2.65±0.71 out of 5 for stress, and 1.95±0.45 out of 4 for loneliness. Among the dimensions of loneliness, loneliness in community relationships had the highest score (2.32±0.58), and loneliness in family relationships the lowest (1.65±0.54). The mean score for difficulties in emotion regulation was 1.39±0.70 out of 4 and for potential drug-use it was 1.57±0.41 out of 4 (Table 3).

3. Correlations among Stress, Loneliness, Emotional Dysregulation, and Potential Drug-Use

Potential drug-use showed significant positive correlations with stress (r=.38, p<.001), loneliness (r=.39, p<.001), and difficulties in emotion regulation (r=.46, p<.001) (Table 4). An analysis of the correlations between potential drug-use and the dimensions of loneliness revealed that loneliness in family relationships (r=.46, p<.001), friendships (r=.24, p=.011), and community relationships (r=.24, p=.011) exhibited significant positive correlations with potential drug-use. Stress was positively correlated with loneliness (r=.47, p<.001), loneliness in family relationships (r=.45, p<.001), loneliness in friendships (r=.45, p<.001), and loneliness in community relationships (r=.19, p=.042) (Table 4). Difficulties in emotion regulation was also positively correlated with stress (r=.62, p<.001), loneliness (r=.52, p<.001), loneliness in family relationships (r=.49, p<.001), loneliness in friendships (r=.43, p<.001), and loneliness in community relationships (r=.30, p=.001) (Table 4).

4. Factors Influencing Potential Drug-Use

Factors affecting adolescents' potential drug-use were analyzed using stepwise multiple regression analysis. Variables that influenced potential drug-use scores, including participants' general and substance-related characteristics, stress, loneliness, and difficulties in emotion regulation, were identified and set as independent variables. Participants' general and substance-related characteristics were treated as dummy variables for the analysis. However, smoking experience ex-

Table 2. Differences in potential drug-use by substance-related characteristics (N=118)

Characteristic	No. (%)	Mean±SD	t/Z/F	*p*
Smoking prevention education within the last year			1.26	.208
Yes	111 (94.1)	1.56±0.41		
None	7 (5.9)	1.69±0.36		
Drinking prevention education within the last year			0.48	.633
Yes	107 (90.7)	1.57±0.41		
None	11 (9.3)	1.57±0.35		
Substance use prevention education within the last year			1.65	.100
Yes	105 (89.0)	1.55±0.41		
None	13 (11.0)	1.70±0.40		
Alcohol within the last month			1.08	.319
Yes	2 (1.8)	1.83±0.53		
None	110 (98.2)	1.55±0.39		
Smoking within the last month			2.59	.003[a)]
Yes	3 (2.9)	2.30±0.10		
None	99 (97.1)	1.55±0.40		
Substance use history			2.14	.017[a)]
Yes	2 (1.8)	2.32±0.05		
None	107 (98.2)	1.56±0.41		
Awareness of the risks of substance use			1.94	.149
High	27 (23.1)	1.46±0.37		
Medium	46 (39.3)	1.57±0.38		
Low	44 (37.6)	1.65±0.45		
Awareness of the seriousness of substance use			0.57	.569
High	30 (25.6)	1.50±0.46		
Medium	65 (55.6)	1.60±0.38		
Low	22 (18.8)	1.59±0.43		
Paths to obtaining information about substance use risks			0.03	.977
School education	39 (33.3)	1.57±0.38		
Others	78 (66.7)	1.57±0.42		

Missing data is not included in the values.
SD, standard deviation.
[a)]By Mann-Whitney U test.

Table 3. Scores for stress, loneliness, emotional dysregulation, and potential drug-use

Variable	Mean±SD	Range
Stress	2.65±0.71	1.00–5.00
Loneliness	1.95±0.45	1.04–3.21
In family relationships	1.65±0.54	1.00–3.63
In friendships	1.87±0.63	1.00–3.75
In community relationships	2.32±0.58	1.13–4.00
Emotional dysregulation	1.39±0.70	0.00–3.26
Potential drug-use	1.57±0.41	1.00–2.82

SD, standard deviation.

ceeding Cook's distance was excluded from the analysis.

To identify multicollinearity among the independent variables, the tolerance values before the regression analysis was conducted was .50 to .99, which was greater than 0.1 and less than 10. The variance inflation factor ranged from 1.00 to 1.39, lower than 10, indicating no issues of multicollinearity for any variables. Analysis of the residuals confirmed the normality of the error terms, homogeneity of variance, and linearity of the model. In the autocorrelation test, the Durbin-Watson statistic was 1.97, indicating the absence of autocorrelation. Consequently, the regression model was found to be statistically significant ($F=20.58$, $p<.001$), with an explanatory power of 33.8%. The most important factor influencing potential drug-use was family-related loneliness ($\beta=.28$, $p=0.003$) and school satisfaction (satisfied) ($\beta=.27$, $p=0.001$), followed by difficulties in emotion regulation ($\beta=.26$, $p=0.005$) (Table 5).

DISCUSSION

Adolescent substance abuse is not only an individual issue, but also a deviant behavior that negatively impacts families and society. Adolescents are most vulnerable to drinking, smoking, and drug abuse during their late teens to early adulthood, a period characterized by significant psychological and social changes as well as adaptive challenges. Impul-

Table 4. Correlations among stress, loneliness, emotional dysregulation, and potential drug-use (N=118)

Variable	Stress	Loneliness	L-1	L-2	L-3	Emotional dysregulation
Loneliness	.47 (<.001)					
L-1	.45 (<.001)					
L-2	.45 (<.001)					
L-3	.19 (.042)					
Emotional dysregulation	.62 (<.001)	.52 (<.001)	.49 (<.001)	.43 (<.001)	.30 (.001)	
Potential drug-use	.38 (<.001)	.39 (<.001)	.46 (<.001)	.24 (.011)	.24 (.011)	.46 (<.001)

Values are presented as r (*p*).
L-1, loneliness in family relationships; L-2, loneliness in friendships; L-3, loneliness in community relationships.

Table 5. Factors influencing potential drug-use (N=118)

	B	SE	β	t	*p*
Constant	.97	.11		8.99	<.001
Loneliness in family relationships	.21	.07	.28	3.09	.003
School satisfaction: satisfied[a)]	.22	.06	.27	3.44	.001
Emotional dysregulation	.15	.05	.26	2.89	.005
Adjusted R^2	.338				
F (*p*)	20.58 (<.001)				

SE, standard error.
[a)]Dummy variable had the following referent group: school satisfaction (neutral=0, dissatisfied=0).

sivity and curiosity are often cited as primary reasons for initial exposure to various substances during this stage [19]. In particular, adolescent substance abuse can lead to lifelong addiction if not addressed early. Given the increasing trend of substance abuse among younger adolescents in South Korea, this study focused on middle school students, who are in early adolescence, to identify factors influencing their drug use potential.

An analysis of differences in potential drug-use based on participants' general characteristics revealed that lower self-rated academic achievement and economic status were associated with higher drug use potential. This finding aligns with previous research indicating that lower academic performance and poorer household economic conditions are directly linked to a greater likelihood of smoking experience [5]. South Korean adolescents face an intensely competitive, exam-oriented education system from an early age, resulting in high levels of academic stress and frequent frustration with their academic performance. Anxiety stemming from this pressure may lead some students to use substances as a coping mechanism. Furthermore, students who perceive their family's economic situation as disadvantaged have a greater likelihood of drug use, suggesting a strong correlation between substance use and socioeconomic background.

Consistent with prior research showing a correlation between lower school engagement and increased drinking and smoking experience among adolescents [5], this study also found an association between lower school life satisfaction and a greater likelihood of drug use. Since middle school students spend the majority of their time at school, various school-related factors significantly influence their exposure to and perceptions of substance use. Under the current focus on university entrance exams and the standardized education framework, the marginalization of a significant portion of students is inevitable. Given that these marginalized students are at a higher risk of being exposed to substance use, it is essential to foster a school climate where students can develop interest in and satisfaction with their school life.

Over the past year, more than 90% of adolescents received smoking and alcohol prevention education, and 89% received drug prevention education. Despite this consistent level of education in schools, 37.6% of students still exhibited a low level of awareness regarding the risks of substance use. Although substance use education is in place, further efforts are needed to enhance its effectiveness, particularly in preventing the misuse of narcotics and other substances. Given the rapid rise in adolescent substance abuse, it is essential to reassess both the content and delivery methods of drug prevention education. A previous study found that adolescents prefer online education formats [20], highlighting the need for diverse educational approaches tailored to their learning preferences. In addition, 66.7% of students reported obtaining information on substance use risks from sources outside of school, such as the media, internet, movies, personal expe-

riences, and peers. This underscores the need for policy measures that ensure both students and the public have access to accurate and reliable drug-related information.

Beyond the academic stress associated with university entrance exams, adolescents face a range of psychological challenges during this critical developmental stage, including emotional distress and conflicts in peer relationships. These psychological stressors often drive them to seek relief through substance use [21,22]. This study found moderate to strong positive correlations between potential drug-use and adolescent stress, loneliness, and difficulties in emotion regulation. Furthermore, research comparing substance users and non-users has also shown that substance users tend to experience higher levels of loneliness [8]. In addition, among opioid users, those who had recently used opioids reported feeling lonelier than past users or those with no history of use [23]. Local studies in Korea have similarly identified significant correlations between loneliness and habitual substance use [7], reinforcing the finding of this study that loneliness increases the risk of drug use. The issue of potential drug use is a sensitive area that young people are reluctant to disclose, and it is associated with stigma. Therefore, school nurses must acknowledge the serious impact of loneliness on adolescent well-being and offer discreet and empathetic interventions to help students articulate their feelings of loneliness, related challenges, and emotional distress.

Analysis of the factors influencing adolescents' potential for drug use revealed that those experiencing loneliness in family relationships and difficulties with emotion regulation were more likely to use substances. Research has demonstrated that individuals who feel lonely are more prone to substance abuse [14], and that adolescents with a history of alcohol and/or tobacco use tend to receive less family support [5]. These findings underscore the crucial role of family in substance use prevention. Families function as supportive resources for adolescents, providing not only appropriate education regarding risky behaviors such as substance use but also psychological stability. Numerous domestic and international studies have consistently identified an association between loneliness and substance abuse [6-8], and the findings of this study were also consistent with this. Therefore, fostering a supportive family atmosphere that encourages open communication and information-sharing about drug use is essential. Parents should actively provide emotional support, express care and affection, and cultivate a sense of belonging to prevent their children from feeling isolated within the family.

A study on adolescent smokers found that difficulties in emotion regulation have a potential effect on nicotine dependence, with low arousal states such as boredom and relaxation identified as triggers for smoking behaviors [24]. This suggests that adolescents who feel isolated and lonely at home may turn to substances to alleviate boredom and seek new stimuli. Furthermore, smoking experience was identified as a factor influencing substance use potential, which is consistent with previous research indicating that habitual smoking contributes to nicotine dependence [24]. In other words, continuous smoking can develop into habitual behavior, and tobacco, as a gateway drug, may act as a catalyst for seeking stronger stimuli, thereby increasing the likelihood of dependence on various substances. However, whilst this study found differences in the likelihood of substance use depending on smoking status and prior substance use, the number of students who reported actually smoking or having prior experience with substances was very small. Although the school from which the data was collected is known to run an excellent smoking cessation program within the region, caution must be exercised when interpreting the results, given the possibility that adolescents may not have provided honest answers in the survey.

To date, in South Korea, research has focused on adolescent delinquency and school violence, while adolescent substance abuse is often overlooked. However, substance abuse among Korean adolescents has now reached a critical level, making it impossible to dismiss the problem as less severe than in Western countries or as an issue confined to a small subset of students. Therefore, even without conducting actual drug use surveys, identifying factors influencing the likelihood of adolescent drug use can help implement effective preventive measures and reduce drug-related crime.

Prevention education should go beyond addressing impulsive behavior; it should also equip adolescents with the ability to recognize their emotional states and develop emotion regulation skills to enhance their coping strategies. Programs centered on social skills training, anger management, conflict resolution, and interpersonal skills should be developed and actively integrated into prevention efforts. Furthermore, families must take a proactive role in providing consistent care and support for at-risk adolescents, fostering an environment that aids in their emotional well-being and recovery.

An increasing number of young people are being exposed to drugs at an early age, and their potential for drug use may

also rise. Therefore, controlling and preventing young people's potential for drug use cannot be achieved through individual efforts alone. Thus, it is crucial to examine the underlying causes of weakened primary social safety nets such as families and schools and develop effective strategies to strengthen them.

While this study provides valuable insights into the factors influencing adolescent drug use potential, its limitations should be acknowledged, along with suggestions for addressing them.

First, the study participants were selected through convenience sampling from a single middle school in South Korea, which limits the generalizability of the findings. Although this study collected data from a single grade level where a census was feasible, this study is a regional exploratory investigation, meaning limitations exist in interpreting the results. Future research should expand data collection to a nationwide sample of middle school students to obtain more representative and reliable results.

Second, the study relied entirely on self-reported questionnaires, which may have introduced variability in individual interpretations of survey items. In addition, since the survey was conducted in a school setting, concerns about confidentiality might have led participants to underreport their drug use behaviors. The results of this study should be interpreted with caution, bearing in mind the possibility of response bias. To minimize response bias, this study was conducted for all second-year students in participating middle school, and the autonomy and confidentiality of participation in the study were emphasized. Future studies should consider incorporating teacher, parent, or peer assessments, as well as qualitative research methods such as observations, interviews, or case studies to enhance validity.

Third, this study was conducted with a general sample of adolescents rather than high-risk groups. The school where the data were collected is known to have a very low reported rate of smoking among students, as it regularly runs a smoking cessation program led by the school nurse. Consequently, the study may have inadvertently excluded clinical groups actively engaged in substance use, potentially underestimating the overall drug use potential among this age group. Future research should target high-dependency groups to provide a more comprehensive understanding of adolescent substance use.

CONCLUSION

Reducing adolescent drug use potential requires fostering positive family interactions and creating a safe and supportive environment. This can be achieved through family education programs aimed at strengthening families' problem-solving abilities. Adolescents who use drugs are often impulsive and vulnerable to stress, requiring careful guidance and education in both home and school environments. To reduce the likelihood of adolescent drug use, interventions should focus on reducing feelings of loneliness in family relationships, equipping adolescents with emotional regulation skills, and creating environments that minimize exposure to smoking. In this context, the significance of this study lies in identifying key factors influencing adolescent drug use potential, providing foundational data for the development of targeted prevention strategies.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: SNP, JL. Methodology: SNP, JL. Data curation: SNP, JL. Formal analysis: SNP, JL. Investigation: EK. Resource: SNP, EK. Software: SNP, JL. Validation: SNP, JL, EK. Visualization: JL. Funding acquisition: SNP, JL. Project administration: SNP. Writing–original draft preparation: SNP, JL, EK. Writing–review and editing: SNP, JL. Supervision: JL. Final approval of published version: all authors.

Conflict of interest

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

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Data availability

Please contact the corresponding author for data availability.

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REFERENCES

1. Lee HK. The survey of drug users in Korea [Internet]. Ministry of Health and Welfare; 2021 [cited 2024 Nov 18]. Available from: https://www.riss.kr/search/detail/DetailView.do?p_mat_type=6b4a196b69d9bee2&control_no=ea96fa770779cfb4&keyword=%EB%A7%88%EC%95%BD%EB%A5%98%20%EC%82%AC%EC%9A%A9%20%EC%8B%A4%ED%83%9C
2. Lee MS. A study on the actual conditions and countermeasures of adolescents' new drug addiction. Korean Assoc Addict Crime Rev. 2022;12(2):35-53. https://doi.org/10.26606/kaac.2022.12.2.3
3. Supreme Prosecutor's Office. Drug control in Korea [Internet]. Supreme Prosecutor's Office; 2023 [cited 2025 Feb 3]. Available from: https://www.spo.go.kr/site/spo/ex/board/View.do?cbIdx=1204&bcIdx=1047162
4. An J. The Effect of stress management program on stress coping and self-efficacy in middle school students [master's thesis]. Daejeon: Hannam University; 2023.
5. Han WJ. A study on ecological factors affecting middle school girls' drug abuse [master's thesis]. Cheonan: Baekseok University; 2010.
6. Nam E, Lee J, Kwon M. Associations between habitual drug use and loneliness in Korean adolescents: secondary data analysis of the 2020 Youth Health Risk Behavior Web-Based Survey. J Korean Soc Sch Health. 2021;34(3):161-169. https://doi.org/10.15434/kssh.2021.34.3.161
7. Kwon YS. Influencing factors for generalized anxiety and loneliness in adolescents: focusing on experience of violence and habitual drug use. Asia Pac J Converg Res Interchang. 2023;9(1):459-471. https://doi.org/10.47116/apjcri.2023.01.38
8. Turhan Gürbüz P, Çoban ÖG, Erdoğan A, Kopuz HY, Adanir AS, Önder A. Evaluation of internet gaming disorder, social media addiction, and levels of loneliness in adolescents and youth with substance use. Subst Use Misuse. 2021;56(12):1874-1879. https://doi.org/10.1080/10826084.2021.1958856
9. Park J. Measurement of emotion dysregulation in Korean adolescents: psychometric properties of the Emotion Dysregulation Scale. Korean J Health Psychol. 2013;18(4):727-746. https://doi.org/10.17315/kjhp.2013.18.4.008
10. Kim H. The mediating effect of depression on the relationship between loneliness and substance use in Korean adolescents. Behav Sci (Basel). 2024;14(3):241. https://doi.org/10.3390/bs14030241
11. De Berardis D, Fornaro M, Orsolini L, Ventriglio A, Vellante F, Di Giannantonio M. Emotional dysregulation in adolescents: implications for the development of severe psychiatric disorders, substance abuse, and suicidal ideation and behaviors. Brain Sci. 2020;10(9):591. https://doi.org/10.3390/brainsci10090591
12. Lee KY, Kim Y, Im H, Park MJ, Park SH. A validation study for the practical use of Screening Scale for Potential Drug-use Adolescents (SPDA). Korean J Soc Welf. 2005;57(3):305-335.
13. Lee CS, Kim SJ, Kweon YR. A study on adolescents' drug abuse and the influence factors of the potential drug use in a city: middle and high school students in Gwangju city. J Korean Acad Psychiatr Ment Health Nurs. 2006;15(1):76-88. https://doi.org/10.12934/jkpmhn.2006.15.1.76
14. Choe Y, Shin S. A study on the effect of juvenile's strain on drug abuse. J Humanit Soc Sci 21. 2022;13(6):1839-1849. https://doi.org/10.22143/HSS21.13.6.126
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. Yoon M, Jo JS. A study on middle school students' addicted degree to the internet by stressor and stress coping method. Korean J Educ Methodol Stud. 2005;17(1):57-80.
17. Hur JH, Kim J. Development and validation of the Loneliness Scale for Adolescents (LSA). Korean J Couns. 2014;15(4):1549-1570. https://doi.org/10.15703/kjc.15.4.201408.1549
18. Gratz KL, Roemer L. Multidimensional assessment of emotion regulation and dysregulation: development, factor structure, and initial validation of the difficulties in emotion regulation scale. J Psychopathol Behav Assess. 2004;26:41-54. https://doi.org/10.1023/B:JOBA.0000007455.08539.94
19. Lee HK, Kim SJ, Yoon SC, Bong SY, Ahn HJ, Park SY. A survey of adolescent substance uses in a small city. J Korean Neuropsychiatr Assoc. 2001;40(1):23-36.
20. Jeong HJ, Park JS. Current status and perception of abused drugs by gender among young people. J Ind Converg. 2023;21(2):79-84. https://doi.org/10.22678/JIC.2023.21.2.079
21. Deep PD, Ghosh N, Gaither C, Rahaman MS. The factors affecting substance use and the most effective mental health interventions in adolescents and young adults. Psychoactives. 2024;3(4):461-475. https://doi.org/10.3390/psychoactives3040028
22. Connolly S, Govoni TD, Jiang X, Terranella A, Guy GP, Green JL, et al. Characteristics of alcohol, marijuana, and other drug use among persons aged 13-18 years being assessed for substance use disorder treatment: United States, 2014-2022. MMWR Morb Mortal Wkly

Rep. 2024;73(5):93-98. https://doi.org/10.15585/mmwr.mm7305a1
23. Pedrero-Pérez EJ, Morales-Alonso S, Álvarez-Crespo B, Benítez-Robredo MT. Opiate drug use in the city of Madrid: associated health and sociodemographic factors. Adicciones. 2021;33(3):235-244. https://doi.org/10.20882/adicciones.1335
24. Lim GY, Jung JB. Effect of difficulties in emotional regulation on nicotine dependence and smoking motivation: focused on adolescent smokers. Clin Psychol Korea Res Pract. 2019;5(2):117-133. https://doi.org/10.15842/CPKJOURNAL.PUB.5.2.117

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Longitudinal changes and predictors of happiness in South Korean early adolescents: a panel study using latent growth modeling

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Purpose: Early adolescence is a pivotal developmental stage characterized by rapid physical, emotional, and social changes. Happiness during this period is crucial as it influences later life outcomes. This study examined 4-year changes in happiness and identified predictors among Korean early adolescents.
Methods: A secondary analysis of longitudinal panel data was conducted using latent growth modeling to assess changes in happiness over 4 years, utilizing data from the Panel Study on Korean Children (11th–14th waves) with a total of 1,177 participants. Descriptive statistics were computed using IBM SPSS ver. 29.0, and latent growth modeling, including unconditional and conditional models with associated factors variables, was conducted using IBM AMOS ver. 29.0.
Results: A nonlinear trajectory was identified with a sharp decline in happiness, particularly between the ages of 11 and 12 years. Self-esteem, peer attachment, and a creative school environment emerged as protective factors mitigating this decline, whereas parental attachment influenced baseline happiness but not its trajectory. Higher self-esteem, stronger peer attachment, and supportive school environments were associated with a slower decline in happiness.
Conclusions: Our findings highlight the importance of early interventions beginning around the age of 11 years, a critical period when happiness decreases more steeply. Practical implications include developing school-based and psychosocial programs that strengthen self-esteem and positive peer relationships, and fostering autonomy-supportive, creative educational environments. Coordinated efforts between schools and families are essential to promote adolescents' emotional well-being and ensure balanced development in academic and socio-emotional domains.

Keywords: Adolescent; Happiness; Latent class analysis; Longitudinal studies

INTRODUCTION

Adolescence is a transitional period between childhood and adulthood, characterized by rapid physical and emotional development, as well as considerable social changes [1]. Early adolescence, generally considered to encompass the ages of 10–13 years, is marked by substantial changes across physical, cognitive, and social domains. During this period, individuals begin to form identities and explore values and social roles that can influence their adult lives [2]. The onset of early adolescence, typically beginning by the fourth grade of primary school, introduces challenges related to secondary

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sexual characteristics [3] and increased psychological stress and anxiety resulting from expanding relationships with peers, teachers, and others outside the family [4,5].

Happiness refers to a subjective experience that reflects an individual's cognitive appraisal and evaluation of their own life, resulting in positive emotions [6]. Happiness is more than a positive emotional state; it plays a fundamental role in psychological and physical development [7]. Unhappiness or a decline in happiness during early adolescence can lead to various difficulties during middle school. Difficulties in peer relationships, feelings of social exclusion, and emotional instability at home can exacerbate mental health problems such as depression and anxiety [8]. In particular, Korean adolescents have been reported to exhibit the lowest levels of happiness among 22 Organization for Economic Cooperation and Development countries [9]. Such low levels of happiness represent a serious concern, as they are closely associated with adverse mental health outcomes [4], including an increased risk of suicidal ideation and behaviors [8]. Notably, suicide rates among adolescents in the Asia-Pacific region, including Korea, have shown a continuous upward trend [10]. Therefore, supporting the happiness of early adolescents in Korea may serve as a preventive measure against suicidal ideation and attempts, ultimately contributing to better mental health [11].

Happiness during early adolescence exerts a significant influence on physical, mental, and social well-being [6]. It is directly linked to mental health and serves as a foundation for overall development into adulthood [1]. Therefore, efforts to promote happiness during this critical period are essential for enhancing population health and social well-being [8]. Happier adolescents are more likely to engage in community activities and contribute positively to society [1]. In terms of physical health, happiness influences health behaviors such as physical activity. Unhappy adolescents are less likely to engage in physical activity [12]. Moreover, happiness is closely related to a reduction in problematic behaviors such as alcohol consumption, smoking, and school violence [13]. For instance, adolescents who consume alcohol are 68% more likely to report unhappiness, whereas smokers are 61% more likely to report lower happiness than that among their non-smoking peers [12]. Consequently, promoting happiness from late primary school years may provide a protective buffer against the physical and mental health challenges of adolescence and serve as a fundamental strategy for fostering social adaptation while reducing risk behaviors [14].

Despite its importance, happiness among adolescents has shown a global decline [15]. The Health Behavior in School-Aged Children study, conducted across 43 countries with adolescents aged 10–16 years, reported a noticeable decrease in happiness levels [15]. In Korea, cross-sectional research comparing happiness levels between fourth graders in primary school and first-year middle school students found that the younger group reported higher happiness and better teacher–student relationships than did their older peers [7]. Similarly, primary school students showed relatively higher levels of happiness, whereas middle school students reported markedly lower levels [16]. Although some studies reported temporary improvements in happiness between certain grades [17], recent longitudinal evidence indicates a consistent decline during the transition from late primary to early middle school [7]. However, systematic longitudinal studies on happiness changes during this transition remain scarce, highlighting the need for further research.

Guided by an ecological systems perspective and informed by prior research, we selected predictors representing multiple developmental contexts that have been linked to happiness in early adolescence [2,12,17-21]. At the individual level, personal characteristics, such as self-identity formation and emotional experiences, contribute to self-esteem, which is strongly associated with higher happiness levels, effective stress management, and better mental health outcomes [2,12,14,22]. Within the family context, parental attachment has been shown to provide emotional security and positively affect adolescents' happiness [17,18]. In the peer domain, positive peer attachment and supportive friendships are important predictors of happiness [19,20]. At the school level, a creative and supportive educational environment fosters school adaptation and further enhances happiness [21]. Collectively, these findings suggest that self-esteem, parental attachment, peer attachment, and a creative school environment are critical protective factors that shape happiness during early adolescence.

This study aimed to examine the changes in happiness among early adolescents in South Korea using data from the Panel Study on Korean Children (PSKC). Specifically, the objective was to investigate how happiness in early adolescence is influenced by individual-, family-, and school-related factors. By capturing individual changes in happiness over time and conducting a multidimensional analysis of the effects of various predictors on these changes, this study sought to provide foundational evidence for developing programs and

public health interventions aimed at enhancing early adolescent happiness. Furthermore, it aimed to improve the effectiveness of such interventions and contribute to promoting mental well-being during this critical developmental period.

METHODS

Ethical statements: This study was deemed exempt from review by the Institutional Review Board (IRB) of Pusan National University (IRB No. PNU IRB/2024-98-HR) because it was a secondary analysis of existing data. The original Panel Study on Korean Children (PSKC) received annual IRB approval from the internal IRB of the Korea Institute of Child Care and Education (KICCE), and informed consent was obtained from participants and their legal guardians for each wave of data collection.

1. Study Design and Data Source

In this study, we conducted a secondary analysis of longitudinal data from the PSKC, with the aim of examining changes in happiness among early adolescents from the age of 10 years over a 4-year period and identifying predictors of these changes, focusing on individual-, family-, and school-related factors.

The PSKC data used in this study were de-identified secondary data; therefore, no direct contact with participants occurred in the present study. The original PSKC data collection procedures were conducted in accordance with the principles of the Declaration of Helsinki. The PSKC investigates the developmental pathways of children and adolescents in South Korea, assessing factors that contribute to their emotional, social, and academic well-being. The dataset captures multidimensional influences, such as family relationships, peer interactions, and school environments, which are essential for understanding adolescent flourishing. Its longitudinal structure provides a robust basis for examining positive developmental outcomes, such as happiness, with a focus on individual-, family-, and school-related factors. For this study, data from the 11th to 14th waves (2018–2021) of the PSKC were analyzed, targeting adolescents aged 10–13 years. These periods represent a critical developmental period characterized by rapid physical, emotional, and social changes. By leveraging the longitudinal nature of the PSKC, this study examined how self-esteem, parental attachment, peer attachment, and creative school environment contribute to happiness changes, offering insights into interventions that promote adolescent well-being. The reporting of this study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [23].

2. Participants

The study sample included adolescents who participated in all four waves of the PSKC from the 11th to 14th year and met the following criteria: (1) enrollment in regular middle schools and (2) provision of complete responses to the variables of interest. Adolescents attending specialized schools (such as arts or sports-focused middle schools) or alternative educational institutions were excluded to ensure comparability of school environments. The initial eligible sample included children who participated in the 11th PSKC wave (age 10 years; N=1,428). Among them, participants who missed at least one follow-up assessment between Waves 12 and 14 were excluded (n=100), resulting in n=1,328 participants with data available across the target waves. We further excluded cases with missing values in study variables (n=132), those not enrolled in middle school (n=3), and those enrolled in special middle schools (n=16). After applying these criteria, the final sample comprised 1,177 participants, allowing for robust analyses of happiness changes and related protective factors.

3. Measures

Each measure was selected to capture critical components of adolescent flourishing, emphasizing personal strengths and supportive environments:

1) General characteristics

General characteristics included participants' sex and subjective socioeconomic status (SES). SES was assessed at baseline (age 10 years; Wave 11) using the corresponding item from the PSKC. Participants were asked a single question: "Where do you think your family's living standard (economic status) falls on the following ladder?" Responses were recorded on a ladder scale ranging from 1 ("very poor") to 10 ("very well"), yielding scores from 1 to 10.

2) Self-esteem

Self-esteem, a foundational component of resilience and positive self-concept, was assessed at baseline (age 10 years; Wave 11) using a validated five-item adaptation of Rosen-

berg's Self-Esteem Scale, tailored for adolescents [22]. Items were rated on a 4-point Likert scale, with higher scores indicating greater self-esteem. The internal consistency of the scale in this study was Cronbach's α = .84.

3) Parental attachment

Parental attachment, reflecting emotional security and relational support, was measured at baseline (age 11 years; Wave 12) using a modified version of the Inventory of Parent and Peer Attachment [19]. The tool included 12 items assessing communication, trust, and alienation, with separate evaluations for mothers and fathers. Scores were averaged, with higher scores indicating stronger parental attachment. Cronbach's α values were .79 and .81 for father and mother attachments, respectively.

4) Peer attachment

Peer attachment, a key resource for social integration and emotional well-being, was evaluated at baseline (age 10 years; Wave 11) using nine items from the same inventory [24]. The scale assessed communication, trust, and alienation, with negatively worded items reverse-coded. Responses were scored on a 5-point Likert scale, with higher scores indicating stronger peer attachment. Cronbach's α for this scale was .80.

5) Creative school environment

A creative school environment, which fosters autonomy, intrinsic motivation, and self-expression, was measured at baseline (age 10 years; Wave 11) using a 10-item instrument adapted by the Korea Institute of Child Care and Education (KICCE). This instrument was revised by KICCE based on the 37-item "Characteristics of My Surrounding Environment Questionnaire" originally developed by Kim [25] in 2012. The scale included four reverse-coded items reflecting restrictive environments [25]. Higher scores indicated a more creative and supportive school environment. The internal reliability was Cronbach's α = .81.

6) Happiness

Happiness, a core construct of subjective well-being and flourishing, was measured from Waves 11–14 (ages 10–13 years) using the Subjective Happiness Scale [26], adapted for the PSKC. The four-item scale was rated on a 4-point Likert scale, with higher scores reflecting greater subjective happiness. Cronbach's α for this measure was .77 at Wave 11, .75 at Wave 12, .78 at Wave 13, and .75 at Wave 14.

4. Statistical Analysis

To analyze the developmental changes in happiness and identify their predictors, data were processed using IBM SPSS/WIN ver. 29.0 (IBM Corp.) and IBM AMOS ver. 29.0 (IBM Corp.). Descriptive statistics, including means, standard deviation (SD), skewness, and kurtosis, were calculated to summarize participant characteristics and normality. All variables met the criteria for normal distribution, supporting subsequent modeling.

Latent growth curve modeling (LGCM) was applied to examine changes in happiness over time, offering a robust framework for estimating initial levels (intercept) and rates of change (slope) across the study period [27]. An unconditional model was first established to investigate the overall changes in happiness and assess individual differences in initial status and growth rates. Based on prior research and theoretical considerations, predictors such as self-esteem, parental attachment, peer attachment, and creative school environment were then included in a conditional model to examine their influence on happiness changes. Covariates were selected to reflect environmental and psychological significance in adolescent development.

Model fit was evaluated using standard indices, including χ^2/degrees of freedom (df), comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). For model adequacy, RMSEA values below .08 and CFI/TLI values above .90 were indicative of good fit. Maximum likelihood estimation was employed to estimate parameters, and significant pathways within the conditional model provided insights into the relative contribution of each predictor to changes in happiness over time. Comparative evaluations of the models revealed the most suitable framework for understanding the developmental dynamics of happiness in early adolescence.

RESULTS

1. Baseline Characteristics of Participants and Variables

In total, 1,177 participants completed all four waves of the PSKC. Table 1 presents demographic and baseline characteristics of participants. Among the participants, 51.1% were

male, and all were 10 years of age. Participants' SES was 7.18 (SD=1.82), indicating a moderately high level. The mean scores for self-esteem, father attachment, mother attachment, peer attachment, and creative school environment were 17.5 (SD=2.29), 43.2 (SD=6.94), 46.6 (SD=6.58), 31.3 (SD=4.21), and 38.2 (SD=5.95), respectively. Happiness, the primary outcome, declined over time, with mean scores decreasing from 19.9 (SD=2.76) at the age of 10 years (Wave 11) to 17.6 (SD=2.68) at the age of 13 years (Wave 14). Notably, the largest decline was observed between ages of 11 (Wave 12) and 12 (Wave 13) years (Figure 1). These patterns suggest a substantial decline in happiness during early adolescence. Correlation analysis of the main variables revealed that all variables were significantly correlated. First, happiness at the age of 10 years (Wave 11) was significantly and positively correlated with all predictors. The strongest correlation was observed with self-esteem (r=.68, p<.01), followed by creative school environment (r=.55, p<.01) . Second, regarding inter-correlations among the predictors, the strongest association was found between creative school environment and peer attachment (r=.60, p<.01) (Table 1).

2. Changes in Happiness: Model Fit and Growth Patterns

LGCM was employed to examine the changes in happi-

Table 1. Correlations and descriptive statistics of variables (N=1,177)

	Self-esteem	Father-attachment	Mother-attachment	Peer-attachment	Creative school environment	Happiness 11th	Happiness 12th	Happiness 13th	Happiness 14th
Mean±SD	17.50±2.29	43.19±6.94	46.55±6.58	31.32±4.21	38.17±5.95	19.85±2.76	19.47±2.65	17.78±2.90	17.60±2.68
Range	5–20	15–59	21–60	12–39	14–50	6–24	10–24	6–24	7–24
Skewness	–1.31	–0.30	–0.38	–0.49	–0.25	0.07	–0.44	–0.31	–0.06
Kurtosis	2.57	0.02	–0.12	0.64	–0.24	0.14	0.06	0.37	0.41
Self-esteem	1.00								
Father-attachment	.27*	1.00							
Mother-attachment	.27*	.54*	1.00						
Peer-attachment	.45*	.20*	.18*	1.00					
Creative school environment	.43*	.23*	.22*	.60*	1.00				
Happiness 11th	.68*	.28*	.27*	.52*	.55*	1.00			
Happiness 12th	.42*	.39*	.41*	.34*	.33*	.53*	1.00		
Happiness 13th	.35*	.31*	.28*	.25*	.26*	.41*	.52*	1.00	
Happiness 14th	.28*	.23*	.27*	.22*	.24*	.35*	.41*	.45*	1.00

SD, standard deviation.
*p<.01 (assessed through Pearson correlation analysis).

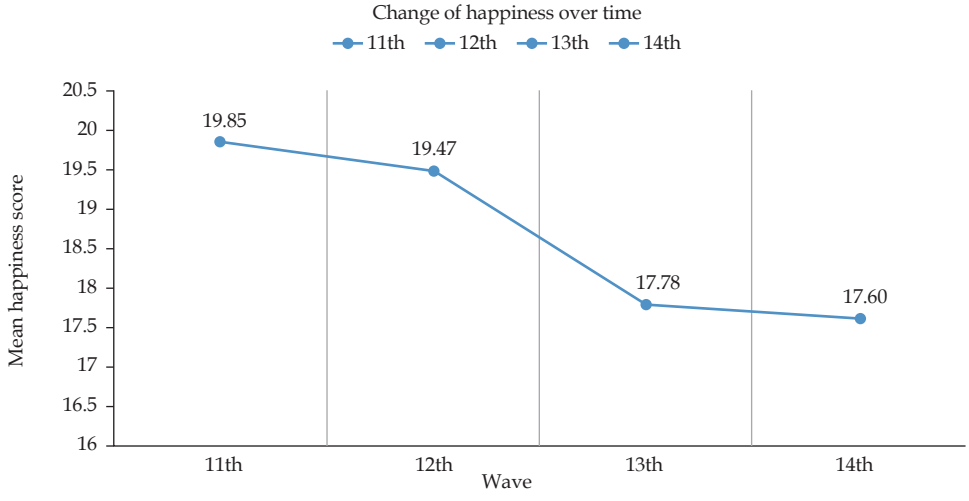

Figure 1. Change of happiness.

ness over the four waves. In the linear LGCM, slope weights were fixed to 3, 2, 1, and 0 for Waves 11–14. In the nonlinear LGCM, the slope weights were fixed to 3 (Wave 11) and 0 (Wave 14), while the intermediate loadings (Waves 12 and 13) were freely estimated to capture nonlinear change. A negative slope indicates a decline in happiness over time. Compared with the no-change and linear models, the nonlinear model demonstrated superior fit (χ^2/df = 3.4, p < .001; CFI = .99; TLI = .99; RMSEA = .04). The model revealed significant variance in the intercept (baseline happiness) and slope (rate of change over time), indicating individual differences in initial happiness levels and decline rate (Table 2).

The estimated intercept of happiness was 17.59 (p < .001), indicating a high initial level of happiness. However, the slope was estimated at 0.76 (p < .001), reflecting a steady decline in happiness. The decline was most pronounced between Waves 12 and 13, coinciding with the transition to adolescence. Variance in the intercept and slope were significant (p < .01), and the covariance between them was negative (–0.22, p = .006), suggesting that higher initial happiness levels were associated with slower declines (Figure 2, Table 3).

Table 2. Fit indices of the unconditional models of happiness (N=1,177)

	χ^2/df (p)	TLI	CFI	RMSEA
No-change model	142.6 (< .001)	.25	.13	.35
Linear model	31.5 (< .001)	.84	.89	.16
Nonlinear model	3.4 (< .001)	.99	.99	.04

df, degrees of freedom; TLI, Tucker-Lewis index; CFI, comparative fit index; RMSEA, root mean square error of approximation.

3. Predictors of Happiness Changes

The conditional LGCM, which incorporated predictors such as self-esteem, peer attachment, parental attachment and creative school environment demonstrated a good fit (χ^2/df = 7.90, p < .001; CFI = .98; TLI = .93; RMSEA = .07). The results revealed that self-esteem (β = .55, p < .001), father attachment (β = .11, p < .001), mother attachment (β = .15, p < .001), peer attachment (β = .17, p < .001), and creative school environment (β = .24, p < .001) were significant positive predictors of the baseline level of happiness.

Regarding slope, self-esteem (β = .47, p < .001), peer attachment (β = .15, p = .018), and creative school environment (β = .23, p < .001) were associated with slower declines in happiness, indicating that these factors serve as protective resources. In contrast, father attachment and mother attachment were insignificant (Figure 2, Table 4).

DISCUSSION

This study systematically analyzed the developmental changes in happiness during early adolescence using LGCM

Table 3. Parameter estimates of the nonlinear growth models of happiness (N=1,177)

	Estimate	SE	CR	p
Intercept	17.59	0.08	223.16	< .001
Slope	.76	0.03	25.66	< .001
Intercept-slope covariate	–.22	0.08	–2.74	.006

SE, standard error; CR, critical ratio.

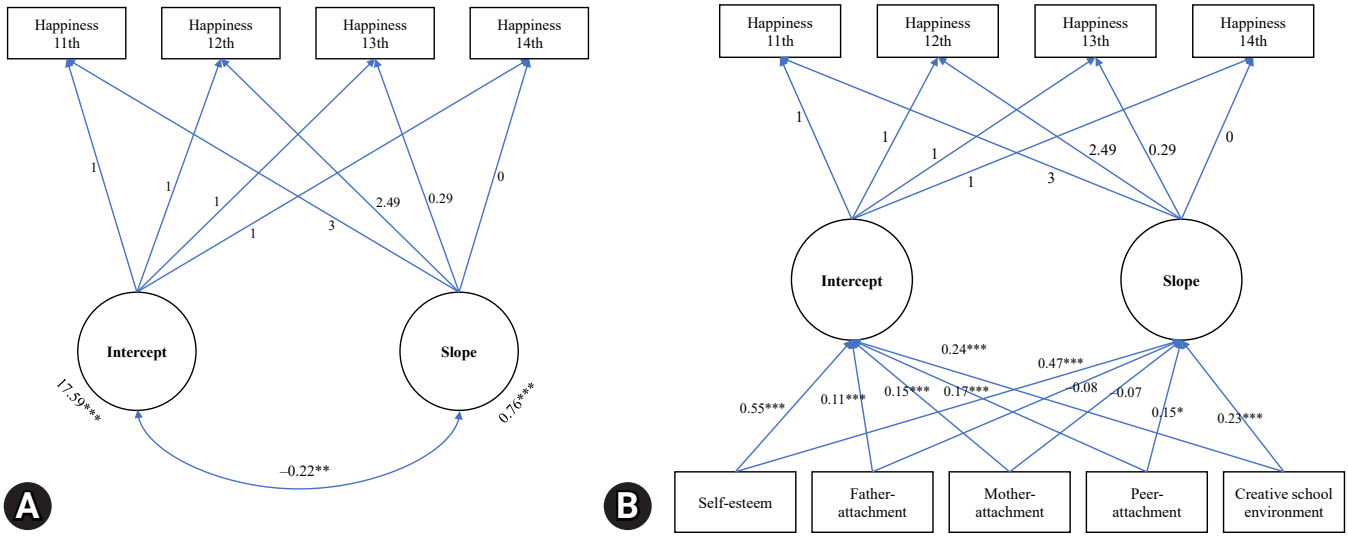

Figure 2. (A) Standardized estimates of the unconditional latent growth model. (B) Standardized estimates of the final conditional growth model. *p<.05. **p<.01. ***p<.001.

Table 4. Factors influencing the trajectory of happiness (N=1,177)

Variable	Intercept				Slope			
	Estimates	SE	CR	*p*	Estimates	SE	CR	*p*
Self-esteem	.55	0.03	20.47	<.001	.47	0.12	8.39	<.001
Father-attachment	.11	0.01	3.80	<.001	–.08	0.01	–1.31	.189
Mother-attachment	.15	0.01	5.44	<.001	–.07	0.01	–1.28	.199
Peer-attachment	.17	0.02	5.84	<.001	.15	0.07	2.38	.018
Creative school environment	.24	0.01	8.10	<.001	.23	0.05	3.82	<.001
Model fit	χ^2 (*p*): 7.90 (<.001), TLI=.93, CFI=.98, RMSEA=.07							

SE, standard error; CR, critical ratio; TLI, Tucker-Lewis index; CFI, comparative fit index; RMSEA, root mean square error of approximation.

and examined the effects of personal and environmental factors, including self-esteem, parental attachment, peer attachment, a creative school environment.

The findings of this study indicated that happiness declined over time, consistent with that of previous research. Prior studies have demonstrated a downward trend in happiness during early adolescence, linked to psychological development, stress factors, and changes in peer relationships [28]. The slope of happiness gradually decreases with age, with the sharpest decline occurring between the ages of 12 and 15 years [29]. Similarly, this study revealed a decline in happiness over time during early adolescence, with a nonlinear change indicating a sharp decrease between the ages of 11 and 12 years. This finding reflects the significant social and psychological changes characteristic of early adolescence. Such changes are associated with reduced happiness and increased complexity in peer relationships, academic burden, and challenges in identity formation [3]. The pronounced nonlinear decline in happiness observed between the ages of 11 and 12 years may also be closely related to the educational structure in Korea [28]. Korean adolescents report relatively low levels of happiness, and this pattern is associated with the stark differences in academic intensity and evaluation methods between elementary and middle school. Upon entering middle school, they experience a sudden increase in academic pressure and competition, which is associated with the sharp nonlinear decline in happiness observed before middle school entry [11]. Therefore, implementing programs that foster happiness before the age of 11 years is crucial to enhancing the well-being of early adolescents in Korea.

The predictors of happiness changes identified in this study include self-esteem, creative school environment, and peer attachment; parental attachment was not found to be significant. First, self-esteem was confirmed as a key predictor of changes in happiness during early adolescence. The results showed that self-esteem was highly correlated with happiness across all waves from the ages of 11 to 14 years. Higher self-esteem was associated with higher initial levels of happiness and a slower decline over time, indicating that it acts as a protective factor against the decline in happiness as adolescents' progress through school grades. This finding aligns with that of previous research, highlighting self-esteem as a critical psychological factor for enhancing happiness after entering middle school [17,30]. Adolescents with high self-esteem are more likely to maintain a positive self-concept and demonstrate emotional resilience in stressful situations [5,7,30]. Therefore, fostering self-esteem during early adolescence is essential, and systematic programs should be actively integrated into both school education and public health policies.

Second, creative school environment were identified as a protective factor against the decline in happiness as adolescents progress through grades. The study also revealed a strong association between creative school environment and peer attachment, highlighting the importance of supportive school settings in fostering positive peer relationships and sustaining adolescent happiness. Well-established creative school environments provide students with opportunities to explore their interests and exercise autonomy, which enhances self-esteem and intrinsic motivation, ultimately improving happiness [21]. Therefore, creating educational environments that focus on academic achievement as well as fostering creativity and student-centered learning is important [28]. In the highly competitive educational environment in Korea, providing creative educational activities and opportunities for autonomous learning could have a positive impact on enhancing early adolescent happiness. Additionally, fostering a creative school environment requires positive teacher-student relationships and a cooperative classroom atmosphere, necessitating efforts from the government, schools, and teachers [21].

Third, peer attachment significantly influenced both the initial levels and the rate of change in happiness. Peer attachment impacts adolescents' life and school satisfaction. This finding supports the notion that positive peer relationships play a crucial role in maintaining happiness by promoting emotional stability and providing social support during early adolescence [30]. Particularly during the transition from upper elementary school to middle school, peer relationships become more important than parental relationships [31]. As students spend more time at school, peer interactions become an essential component of their school life [28]. Therefore, implementing school-based programs that promote positive peer interactions and prevent negative peer influences before student's transition to middle school is necessary [31].

In contrast, parental attachment was not a significant predictor of changes in happiness. This finding may reflect developmental characteristics of early adolescence, during which rapid biological and psychosocial changes and expanding social contexts can influence happiness trajectories [3]. Beyond parental influences, changes in adolescents' happiness during this period may be increasingly linked to other salient factors, including peer relationships and school-related experiences [20]. These results align with those of previous research indicating that peer relationships and self-esteem are closely associated with adolescent well-being and life satisfaction [18,20], and that family-related factors may be more strongly related to overall levels of happiness than to short-term changes during the transition to adolescence [17]. As adolescents transition from late childhood to early adolescence, the formation of self-identity and increased independence diminish parental influence, whereas peer relationships and school environment gain prominence [17]. Although parental attachment did not predict changes in happiness, it may still contribute indirectly by shaping adolescents' self-esteem and peer attachment, which were associated with changes in happiness [18,20]. Consequently, parental roles may be limited to providing basic emotional stability [21]. However, positive parenting during adolescence can potentially influence peer attachment and self-esteem [18], and stable attachment to parents during early childhood may mitigate declines in happiness during early adolescence [18]. Further research is needed to verify the relevance of parental attachment by investigating its impact on happiness from early childhood through early adolescence.

Based on these findings, several practical strategies are proposed to enhance the happiness of early adolescents. First, school-based mental health promotion programs aimed at improving self-esteem should be actively implemented from the age of 11 years [7,30]. Universal self-esteem enhancement programs should be provided for all students to prevent the decline in happiness after transitioning to middle school, whereas targeted interventions should be designed for students with low self-esteem by considering family and school environments. Second, peer attachment, identified as a significant predictor, should be strengthened through activities such as group-based social skills training [31]. These programs promote peer attachment and enhance students' sense of belonging and self-esteem, ultimately improving their overall happiness. Third, educational environments emphasizing creativity and autonomy, such as project-based learning and arts education, can provide early adolescents with opportunities for self-expression and stress relief [21]. In the educational system of Korea, where academic achievement is highly emphasized, academic pressure significantly associated with decline in happiness [28]. Therefore, to promote healthy adolescent development and ensure sustainable improvements in happiness, programs that enhance self-esteem are needed, along with efforts that take into account peer relationships and environmental factors within the school setting. Accordingly, schools and communities should develop programs that support happiness in early adolescents, specifically focusing on fostering self-esteem and peer attachment.

This study had some limitations. First, although variable selection was informed by an ecological systems perspective, the present study did not formally test ecological systems theory as a theory-driven framework. Future studies are needed to evaluate theory-based pathways among multi-level determinants (individual, family, peer, and school factors) and their associations with happiness trajectories. Second, the reliance on self-reported measures introduces the potential for response bias, particularly for constructs such as happiness and self-esteem. In addition, missing data were handled using complete-case analysis, which may have introduced selection bias by excluding participants with incomplete responses or follow-up data. Therefore, the findings should be interpreted with caution. Third, subgroup analyses, such as differences based on sex or SES, were not conducted. These factors likely influence happiness changes and their predictors and should be explored in future research.

Furthermore, future research should investigate the long-term effect of resilience-building interventions on adolescent

happiness. Longitudinal studies should explore how cultural contexts moderate the effects of self-esteem, peer attachment, and creative school environment on well-being changes. Additionally, testing adaptive interventions, including social-emotional learning programs and digital tools such as augmented reality games, across diverse educational and cultural settings could provide new insights into sustaining adolescent happiness.

CONCLUSION

This study identified a nonlinear change in happiness, with a significant decline observed between the ages of 11 and 12 years. Notably, this was likely related to the academic burdens faced by Korean early adolescents during the transition to middle school. Furthermore, this study highlights the critical predictors of self-esteem, peer attachment, and creative school environment in shaping the developmental changes of happiness in early adolescence. By providing insights into the dynamic interplay of these predictors, this research provides a foundation for early, targeted strategies to promote and sustain well-being, offering a foundation for practical applications and future investigations into adolescent happiness.

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Authors' contribution

Conceptualization: HSJ, YJL, MAY. Methodology: HSJ, YJL, MAY. Data curation, Formal analysis: HSJ. Validation: HSJ, YJL, MAY. Writing–original draft: HSJ, YJL. Writing–review and editing: HSJ, YJL, MAY. Supervision: YJL, MAY. Project administration: YJL. Final approval of published version: all authors.

Conflict of interest

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Data availability

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REFERENCES

1. Kansky J, Allen JP, Diener E. Early adolescent affect predicts later life outcomes. Appl Psychol Health Well Being. 2016;8(2):192-212. https://doi.org/10.1111/aphw.12068
2. Kapadia F. Adolescent mental health and well-being: a public health of consequence, February 2024. Am J Public Health. 2024;114(2):158-160. https://doi.org/10.2105/AJPH.2023.307543
3. Crockett LJ, Petersen AC. Pubertal status and psychosocial development: findings from the early adolescence study In: Lerner RM, Foch TT, editors. Biological-psychosocial interactions in early adolescence. Routledge; 2021. p. 173-188.
4. Spithoven AW, Lodder GM, Goossens L, Bijttebier P, Bastin M, Verhagen M, et al. Adolescents' loneliness and depression associated with friendship experiences and well-being: a person-centered approach. J Youth Adolesc. 2017;46(2):429-441. https://doi.org/10.1007/s10964-016-0478-2
5. Zapata-Lamana R, Sanhueza-Campos C, Stuardo-Álvarez M, Ibarra-Mora J, Mardones-Contreras M, Reyes-Molina D, et al. Anxiety, low self-esteem and a low happiness index are associated with poor school performance in Chilean adolescents: a cross-sectional analysis. Int J Environ Res Public Health. 2021;18(21):11685. https://doi.org/10.3390/ijerph182111685
6. Steptoe A. Happiness and health. Annu Rev Public Health. 2019;40:339-359. https://doi.org/10.1146/annurev-publhealth-040218-044150
7. Kwon SW, Lee AH, Song IH. A study on adolescent happiness: application of the adolescent resilience model. Stud Korean Youth. 2012;23(2):39-72.
8. Gentzler AL, Palmer CA, Ford BQ, Moran KM, Mauss IB. Valuing happiness in youth: associations with depressive symptoms and well-being. J Appl Dev Psychol. 2019;62:220-230. https://doi.org/10.1016/j.appdev.2019.03.001
9. Yeom YS, Sung KH. International comparative study on happiness index of Korean children and adolescents: survey report [Internet].

Korea Bang Jeong Hwan Foundation; 2021 [cited 2025 Oct 5]. Available from: https://kossda.snu.ac.kr/bitstream/20.500.12236/25322/4/kor_report_20210010.pdf
10. Yan N, Luo Y, Mackay LE, Wang Y, Wang Y, Wang Y, et al. Global patterns and trends of suicide mortality and years of life lost among adolescents and young adults from 1990 to 2021: a systematic analysis for the Global Burden of Disease Study 2021. Epidemiol Psychiatr Sci. 2024;33:e52. https://doi.org/10.1017/S2045796024000532
11. Sung Y, Choi E. The reciprocal longitudinal relationship between executive dysfunction and happiness in Korean children. Int J Environ Res Public Health. 2021;18(15):7764. https://doi.org/10.3390/ijerph18157764
12. Chen J, Ho SY, Leung LT, Wang MP, Lam TH. Associations of unhappiness with sociodemographic factors and unhealthy behaviours in Chinese adolescents. Eur J Public Health. 2017;27(3):518-524. https://doi.org/10.1093/eurpub/ckx015
13. Soleimani MA, Pahlevan Sharif S, Bahrami N, Yaghoobzadeh A, Allen KA, Mohammadi S. The relationship between anxiety, depression and risk behaviors in adolescents. Int J Adolesc Med Health. 2017;31(2):2016014. https://doi.org/10.1515/ijamh-2016-0148
14. Beyk H, Dehaghan H, Farahmand S, Bahador E. Prediction of adolescent happiness based on spiritual lifestyle with the mediation of mental health. J Adolesc Youth Psychol Stud. 2023;4(5):95-102. https://doi.org/10.61838/kman.jayps.4.5.9
15. Daly M. Cross-national and longitudinal evidence for a rapid decline in life satisfaction in adolescence. J Adolesc. 2022;94(3):422-434. https://doi.org/10.1002/jad.12037
16. Kim WS. A study on children's rights and happiness for building child friendly cities: comparative study between elementary and middle school students. J Digit Converg. 2017;15(2):485-491. https://doi.org/10.14400/JDC.2017.15.2.485
17. Jin BK, Ahn HY. Factors influencing the happiness of late school-aged children: a focus on family strength and self-control. Child Health Nurs Res. 2019;25(3):245-254. https://doi.org/10.4094/chnr.2019.25.3.245
18. Aziz M, Khan W, Amin F, Khan MF. Influence of parenting styles and peer attachment on life satisfaction among adolescents: mediating role of self-esteem. Fam J. 2021 Aug 15 [Epub]. https://doi.org/10.1177/10664807211009807
19. Armsden GC, Greenberg MT. The inventory of parent and peer attachment: individual differences and their relationship to psychological well-being in adolescence. J Youth Adolesc. 1987;16(5):427-454. https://doi.org/10.1007/BF02202939
20. McMahon G, Creaven AM, Gallagher S. Stressful life events and adolescent well-being: the role of parent and peer relationships. Stress Health. 2020;36(3):299-310. https://doi.org/10.1002/smi.2923
21. Kwon Y, Lim J. The mediating effect of school adjustment on the relationship between a creative school environment and children's happiness. Hum Ecol Res. 2024;62(1):47-58. https://doi.org/10.6115/her.2024.004
22. Laurens KR, Tzoumakis S, Dean K, Brinkman SA, Bore M, Lenroot RK, et al. The 2015 Middle Childhood Survey (MCS) of mental health and well-being at age 11 years in an Australian population cohort. BMJ Open. 2017;7(6):e016244. https://doi.org/10.1136/bmjopen-2017-016244
23. 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. PLoS Med. 2007;4(10):e296. https://doi.org/10.1371/journal.pmed.0040296
24. Lee JR, Kim JH, Lee GR, Cho HJ, Lim JH. Development and validation of a cohort model for the growth and development of Korean children. Korea Institute of Child Care and Education; 2017.
25. Kim MS. A study on the development of measurement indicators and tools for creative competency. Korean Educational Development Institute; 2012.
26. Lyubomirsky S, Lepper HS. A measure of subjective happiness: preliminary reliability and construct validation. Soc Indic Res. 1999;46(2):137-155. https://doi.org/10.1023/A:1006824100041
27. Duncan TE, Duncan SC. An introduction to latent growth curve modeling. Behav Ther. 2004;35(2):333-363. https://doi.org/10.1016/S0005-7894(04)80042-X
28. Rudolf R, Lee J. School climate, academic performance, and adolescent well-being in Korea: the roles of competition and cooperation. Child Indic Res. 2023;16(3):917-940. https://doi.org/10.1007/s12187-022-10005-x
29. González-Carrasco M, Sáez M, Casas F. Subjective well-being in early adolescence: observations from a five-year longitudinal study. Int J Environ Res Public Health. 2020;17(21):8249. https://doi.org/10.3390/ijerph17218249
30. Yap CC, Mohamad Som RB, Sum XY, Tan SA, Yee KW. Association between self-esteem and happiness among adolescents in Malaysia: the mediating role of motivation. Psychol Rep. 2022;125(3):1348-1362. https://doi.org/10.1177/00332941211005124
31. Helder EJ, Rigterink T, Hoeksema S, Cush R, Mettler C, Guffie L. Use of the program for the education and enrichment of relational skills (PEERS) intervention to improve social skills and peer relationships among adolescent adoptees. Adopt Q. 2023;26(2):221-249. https://doi.org/10.1080/10926755.2022.2156014

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Factors associated with weight loss behaviors among Korean female adolescents: a bio-psycho-social model approach

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Purpose: Weight loss behaviors are common among Korean female adolescents and are often influenced by distorted body image and sociocultural pressures, leading some to unhealthy practices. This study examined biological, psychological, and social factors associated with weight loss behaviors using Engel's biopsychosocial model.
Methods: This secondary analysis utilized data from the 19th Korea Youth Risk Behavior Survey (2023), focusing on 21,632 female middle and high school students. Logistic regression was conducted to analyze associations between weight loss behaviors and biopsychosocial variables such as body mass index (BMI), grade level, stress, anxiety, body image distortion, smoking, and nutrition education experience.
Results: Among female adolescents, 46.5% reported having attempted weight loss. In logistic regression analysis, biological factors (grade level and BMI percentile), psychological factors (perceived stress, distorted body image, generalized anxiety disorder risk, and smoking), and social factors (nutrition education) were significantly associated with weight loss behaviors. Key predictors included being in middle school (odds ratio [OR], 1.22), higher BMI, elevated stress, distorted body image (OR, 1.90), generalized anxiety, smoking (OR, 1.53), and lack of nutrition education (OR, 1.10). Psychological factors, especially body image distortion and emotional distress, emerged as major contributors to weight loss behaviors.
Conclusion: Weight loss behaviors among Korean female adolescents are influenced by complex biopsychosocial factors beyond physical health concerns. Nursing interventions should incorporate emotional regulation, body image education, and school-based health literacy programs. Early identification through multidimensional assessment is crucial for effective prevention.

Keywords: Adolescent health; Biopsychosocial models; Body image; Female; Weight loss

INTRODUCTION

1. Background

Adolescence is a transitional period from childhood to adulthood, characterized by secondary sexual maturation, physical growth, and psychological development [1]. During this period, female adolescents experience increased secretion of estrogen and progesterone, leading to greater fat accumulation in the hips and thighs [2]. Despite being underweight or having a normal weight, many adolescents tend to overestimate their body size, leading to distorted body image perceptions [3].

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In modern society, where thinness is idealized, such distorted perceptions can lead to dissatisfaction with one's body shape and trigger weight-loss behaviors [4]. Among Korean adolescents, female students were more likely to perceive their weight as overweight (56.4%) compared to male students (43.6%). Among these, 68.7% of female students reported engaging in weight loss behaviors using inappropriate methods [5].

Given the prevalence of diet-related content, these adolescents are more likely to attempt harmful weight-control practices, which may lead to health issues [6]. Such practices include extreme fasting, mono diets (e. g., eating only one type of food), unprescribed diet pills, and self-induced vomiting. These methods are often associated with caloric restriction and nutritional imbalances, resulting in anemia, osteoporosis, and menstrual irregularities [7].

Thus, identifying female adolescents at risk of engaging in inappropriate weight control behaviors and investigating the factors influencing these behaviors is essential to prevent potential health problems and enable early interventions.

Engel [8] proposed the biopsychosocial model, which conceptualizes health behavior as a result of multidimensional interactions among biological, psychological, and social factors. Based on the model by Engel [8], prior research has identified that the likelihood of engaging in weight-loss behaviors increases with higher grade levels [5] and greater levels of obesity [9]. Psychologically, female adolescents experiencing higher stress levels [10], negative body image [9], or frequent anxiety [11] are more likely to engage in weight control behaviors. Additionally, smoking adolescents were more likely to engage in weight loss behaviors compared to non-smokers [12].

From a social perspective, adolescents who have not received nutrition education [13], who report high academic performance, or who come from higher socioeconomic backgrounds [14] were more likely to engage in weight control attempts.

However, previous studies have several limitations: many do not distinguish between genders [5], or focus solely on a specific grade level [3], resulting in insufficient research specifically targeting female adolescents. Thus, there is a pressing need for multidimensional research on female adolescents' weight control behaviors, especially considering the importance of this life stage in developing lifelong health trajectories.

Accordingly, this study aims to explore the factors influencing weight-loss behaviors in female adolescents using the biopsychosocial model by Engel [8], thereby identifying multidimensional determinants of such behaviors.

2. Purpose of the Study

The purpose of this study is to examine the influencing factors related to weight-loss behaviors among female adolescents. The specific objectives are as follows: (1) to identify the presence or absence of weight-loss behaviors among female adolescents; (2) to determine the biological, psychological, and social characteristics associated with weight-loss behaviors; and (3) to analyze the relevant influencing factors on weight-loss behaviors based on the biopsychosocial characteristics of female adolescents.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Pai Chai University (IRB No. 2-1040766-AB-N-01-R-2024-12). The requirement for informed consent was waived owing to the retrospective nature of the study.

1. Study Design

This study is a secondary data analysis using raw data from the 19th Korea Youth Risk Behavior Survey (KYRBS) conducted in 2023. The reporting of this study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [15].

2. Participants

The KYRBS is an anonymous, self-administered online survey conducted to assess the health behaviors of Korean adolescents enrolled in grades 7 to 12. The 19th KYRBS surveyed 52,880 students from 399 middle schools and 400 high schools. For the purpose of this study, data from 21,632 female students who responded to items related to weight-loss behavior were analyzed.

3. Measures

The 2023 KYRBS questionnaire included items related to weight-loss behaviors in female adolescents. Variables were classified into biological factors (grade, BMI), psychological

factors (stress level, body image distortion, anxiety, smoking), and sociological factors (nutrition education, academic achievement level, and household economic status).

1) Dependent variable: weight loss behavior status among female adolescents

Weight loss behavior status among female adolescents was assessed based on their response to the question: "Have you made any effort to control your weight in the past 30 days?" Participants who reported having made efforts to reduce their weight during this period were classified as exhibiting "weight loss behavior." Conversely, those who reported making no effort to control their weight, attempting to gain weight, or attempting to maintain their current weight were classified as "not engaging in weight loss behavior."

2) Independent variables

(1) Biological factors

Biological factors influencing weight loss behavior among female adolescents included school grade and body mass index (BMI) percentile. School grade was categorized as either middle school or high school. BMI percentile was calculated based on self-reported height (cm) and weight (kg), and assessed using the 2017 Korean National Growth Charts for children and adolescents. According to the BMI percentile classification, individuals were categorized as underweight (<5th percentile), normal weight (5th to <85th percentile), overweight (85th to <95th percentile), or obese (≥95th percentile) [16].

(2) Psychological factors

Psychological factors associated with weight loss behaviors among female adolescents included perceived stress, body image distortion, anxiety, and current smoking status. Perceived stress was assessed using a single-item question asking about the usual level of stress perceived, and responses were categorized as high, moderate, or low.

Body image distortion was identified by comparing adolescents' actual BMI classification with their responses to the question, "How do you perceive your body shape?" Participants were classified as having distorted body image if they were underweight however perceived themselves as average, slightly overweight, or very overweight, or if they were of normal weight however perceived themselves as slightly overweight or very overweight. Those whose body perception matched their actual BMI category were categorized as having a normal body image.

Anxiety was measured using the Generalized Anxiety Disorder-7 (GAD-7) screening tool. The GAD-7 includes seven items rated on a 4-point Likert scale (0 to 3), yielding a total score ranging from 0 to 21. Participants scoring ≥10 were classified as the high-risk group for generalized anxiety disorder (GAD), while those scoring <10 were considered the low-risk group [17].

Current smoking status was determined based on responses to the question, "In the past 30 days, on how many days did you smoke at least one cigarette?" Participants who reported no smoking days were classified as "non-smokers," while those who reported smoking on one or more days were categorized as "current smokers."

(3) Social factors

Social factors influencing weight loss behaviors among female adolescents included nutrition education, academic achievement, and perceived household economic status. Nutrition education was assessed with a single item asking whether the respondent had received any education on nutrition and eating habits during the past 12 months. This included education received during school classes, through broadcast programs, or in school-wide lectures. Participants who reported receiving such education were categorized as "received," while those who had not were categorized as "not received."

Academic achievement level and perceived household economic status were each categorized into three groups: high, medium, and low.

4. Data Analysis

The raw data from the 19th KYRBS were collected using a stratified multistage cluster sampling method. Accordingly, analyses were conducted using a complex sample analysis module that accounted for stratification variables, clustering, and sampling weights. All statistical analyses were performed using IBM SPSS Statistics ver. 25.0 (IBM Corp.).

Descriptive statistics were used to analyze the prevalence of weight loss behaviors among female adolescents and their associations with biological, psychological, and social variables. To examine the factors associated with weight loss behaviors, logistic regression analysis was performed. A two-tailed significance level of .05 was considered statistically significant.

RESULTS

1. Prevalence of Weight Loss Behaviors and Characteristics of Associated Biological, Psychological, and Social Factors

Among the 21,632 Korean female adolescents included in this study, 46.5% (n=10,143) reported having attempted weight loss. The characteristics of biological, psychological, and social factors associated with weight loss behaviors are presented in Table 1.

Biological factors showed that 47.4% (n=10,250) of participants were high school students, while 52.6% (n=11,382) were middle school students. Approximately 67.5% (n=14,546) of the participants were categorized as having a normal body weight.

In terms of psychological factors, 44.1% (n=9,538) of participants reported experiencing high levels of stress, 25.4% (n=5,527) exhibited distorted perceptions by overestimating their body weight, and 16.3% (n=3,493) were classified as being at high risk for GAD. Additionally, 2.7% (n=606) of participants reported currently smoking.

Regarding social factors, 48.7% (n=10,416) of the participants reported not having received any form of nutrition education. Furthermore, 80.8% (n=17,428) reported a moderate level of academic achievement, and 87.6% (n=19,014) indicated a moderate level of household economic status.

2. Factors Associated with Weight Loss Behaviors by Biological, Psychological, and Social Variables among Female Adolescents

Regarding biological factors, adolescents in middle school were 1.22 times more likely to attempt weight loss compared

Table 1. Characteristics of weight loss behaviors and associated biological, psychological, and social factors among Korean female adolescents (N=21,632)

Characteristic	Category	No. (%)[a]
Dependent variable		
Weight loss efforts (in the past 30 days)	Yes	10,143 (46.5)
	No	11,489 (53.5)
Independent variable		
Biological factors		
Grade	High school	10,250 (47.4)
	Middle school	11,382 (52.6)
Adiposity	Obese	2,301 (10.2)
	Overweight	2,071 (9.5)
	Normal weight	14,546 (67.5)
	Underweight	2,714 (12.8)
Psychological factors		
Perceived stress	High	9,538 (44.1)
	Middle	9,484 (44.0)
	Low	2,610 (11.9)
Body image distortion	Yes	5,527 (25.4)
	No	16,105 (74.6)
Generalized anxiety disorder	High risk	3,493 (16.3)
	Low risk	18,139 (83.7)
Current smoking (in the past 30 days)	Yes	606 (2.7)
	No	21,026 (97.3)
Social factors		
Nutrition education (in the past year)	No	10,416 (48.7)
	Yes	11,216 (51.3)
Perceived academic achievement	High	2,367 (10.9)
	Middle	17,428 (80.8)
	Low	1,837 (8.3)
Perceived family socioeconomic status	High	2,211 (10.6)
	Middle	19,014 (87.6)
	Low	407 (1.8)

[a]Unweighted frequency and weighted percentage.

to those in high school (adjusted odds ratio [aOR], 1.22; 95% confidence interval [CI], 1.13–1.32; $p < .001$) (Table 2).

With respect to body weight status, compared with underweight adolescents, those who were obese were 14.48 times more likely to engage in weight loss behaviors (aOR, 14.48; 95% CI, 12.45–16.85; $p < .001$), those who were overweight were 12.15 times more likely (aOR, 12.15; 95% CI, 10.45–14.12; $p < .001$), and those of normal weight were 5.49 times more likely (aOR, 5.49; 95% CI, 4.86–6.20; $p < .001$) to attempt weight loss.

Regarding psychological factors, adolescents reporting high levels of perceived stress were 1.43 times more likely to attempt weight loss (aOR, 1.43; 95% CI, 1.31–1.62; $p < .001$) than those with low stress levels, and those with moderate levels of stress were 1.22 times more likely (aOR, 1.22; 95% CI, 1.27–1.60; $p < .001$).

Adolescents with distorted body image were 1.90 times more likely to attempt weight loss compared to those without distortion (aOR, 1.90; 95% CI, 1.76–2.05; $p < .001$). Those classified as being at high risk for GAD showed a higher likelihood of weight loss attempts (aOR, 1.15; 95% CI, 1.03–1.27; $p = .011$). Additionally, adolescents who reported current smoking had 1.53 times higher odds of weight loss behavior (aOR, 1.53; 95% CI, 1.25–1.86; $p < .001$) compared to nonsmokers.

With regard to social factors, adolescents who had not received nutrition education in the past year were 1.10 times more likely to attempt weight loss than those who had (aOR, 1.10; 95% CI, 1.04–1.17; $p = .002$). No statistically significant associations were found between weight loss behaviors and perceived academic achievement or family socioeconomic status ($p > .050$).

DISCUSSION

This study analyzed biological, psychological, and social factors associated with weight loss behaviors among Korean female adolescents using data from the 19th KYRBS (2023). A total of 46.5% of participants reported having attempted weight loss, a substantially higher rate than that reported by male adolescents, reaffirming the existence of gender-specific patterns in adolescent weight control behaviors [18]. The findings highlight a multidimensional phenomenon in which developmental stage, psychological vulnerability, and sociocultural environment interact to influence weight loss behaviors.

First, biological factors showed that middle school students were 1.22 times more likely to attempt weight loss compared to high school students. This difference extends beyond chronological age, reflecting the combined influence of physiological changes and social responses occurring during early to mid-puberty. In this stage, increased estrogen secretion leads to a rapid rise in body fat percentage, with notable fat accumulation in the hips and abdomen. Although these

Table 2. Factors associated with weight loss behaviors according to biological, psychological, and social variables among Korean female adolescents (N=21,632)

Variable	Category	aOR (95% CI)	*p*
Biological factors			
Grade (ref: high school)	Middle school	1.22 (1.13–1.32)	< .001
Adiposity (ref: underweight)	Obese	14.48 (12.45–16.85)	< .001
	Over weight	12.15 (10.45–14.12)	< .001
	Normal weight	5.49 (4.86–6.20)	< .001
Psychological factors			
Perceived stress (ref: low)	High	1.43 (1.31–1.62)	< .001
	Moderate	1.22 (1.27–1.60)	< .001
Body image distortion (ref: no)	Yes	1.90 (1.76–2.05)	< .001
Generalized anxiety disorder (ref: low risk)	High risk	1.15 (1.03–1.27)	.011
Current smoking (in the past 30 days) (ref: no)	Yes	1.53 (1.25–1.86)	< .001
Social factors			
Nutrition education (in the past year) (ref: yes)	No	1.10 (1.04–1.17)	.002
Perceived academic achievement (ref: low)	High	0.88 (0.76–1.02)	.097
	Middle	1.06 (0.94–1.19)	.346
Perceived family socioeconomic status (ref: low)	High	0.95 (0.73–1.23)	.701
	Middle	0.86 (0.68–1.09)	.204

aOR, adjusted odds ratio; CI, confidence interval; Ref, reference group.

changes are part of normal biological development, they are often socially interpreted as "gaining weight," contributing to negative self-evaluations [19]. Moreover, Korean middle school girls are frequently exposed to appearance-based comparisons and evaluations—through peers, social media, and popular culture—rather than receiving accurate education about bodily changes [20,21]. This heightened perception of discrepancy between their developing bodies and the "ideal figure" portrayed in the media may trigger early engagement in dieting behaviors. These findings suggest that early adolescence is a critical period for the initiation of weight loss attempts. During this stage, normal pubertal changes may be perceived as weight gain, leading to early engagement in weight control behaviors. In addition, appearance-based evaluations from peers and media may further reinforce such behaviors.

Therefore, future research should examine developmental differences in weight control behaviors across adolescence and identify factors associated with early initiation. In practice, it is important to provide early adolescents with education on normal pubertal changes and healthy weight management, with an emphasis on promoting healthy lifestyle behaviors rather than weight reduction.

A higher BMI percentile increased the likelihood of weight loss attempts more than fourteenfold. This association appears to be driven not only by the health risks of overweight and obesity but also by the psychosocial consequences of weight stigma and discrimination [22,23]. Adolescents with higher BMI are more likely to experience appearance-based teasing and social exclusion from peers, which can lead to diminished self-esteem and appearance-focused self-control behaviors [22,23]. Furthermore, weight-related comments from family members or teachers may function as additional sources of pressure to change behavior [24]. Notably, previous research has indicated that adolescents in the overweight/obese category are more likely to adopt unhealthy weight control methods such as severe dietary restriction, fasting, excessive exercise, or the use of diet pills [25]. Therefore, nurses should assess not only BMI but also the underlying motivations, methods, and psychological states associated with weight control attempts, and design tailored interventions that address the developmental sensitivities of this population. For middle school girls in particular, reframing weight control in terms of "health promotion" rather than "appearance management" is critical.

Second, psychological factors emerged as the most multifaceted domain in this study. Perceived stress was a significant predictor of weight loss behavior, suggesting that adolescents may use dieting as a coping mechanism to regain a sense of control amid the triple pressures of academic competition, peer relationships, and appearance evaluation [25]. In the Korean context, where educational systems emphasize high-stakes examinations, girls often face the dual burden of excelling academically while meeting societal expectations for appearance [21]. While dieting may offer immediate gratification, it can also perpetuate a cycle of disordered eating, depression, and body dissatisfaction over time [26].

Distorted body image was associated with nearly double the odds of attempting weight loss. Consistent with prior findings, subjective perceptions of body shape were more influential than objective BMI in determining weight control behavior [20,21]. The Korean media environment reinforces the narrative that "slimness equals success and self-discipline," leading many adolescents with a healthy weight to perceive themselves as overweight [20,21]. This misperception may result in unnecessary dieting and nutritional imbalance. In nursing practice, early identification of body image distortion and the promotion of critical media literacy are essential preventive strategies.

High risk for GAD was also significantly related to weight loss attempts. Anxiety can heighten self-surveillance and strict control over appearance, which in turn may lead to restrictive eating and excessive exercise [27,28]. Adolescents with higher social anxiety may attempt more rigid body control to avoid negative peer evaluation. School nurses should utilize standardized screening tools such as the GAD-7 for early detection and implement integrated interventions that combine psychological counseling with body positivity education.

Smoking was associated with a 1.53-fold increase in the likelihood of weight loss attempts, suggesting that adolescents may internalize the misconception that smoking functions as an appetite suppressant or may hold maladaptive health beliefs linking smoking with appearance control [29]. This tendency was particularly pronounced among adolescents with higher BMI, suggesting that smoking may function as a psychologically motivated weight control strategy rather than merely a risk-taking behavior [29]. Although smoking involves biological addiction, prior studies grounded in the biopsychosocial model suggest that adolescent smoking is strongly motivated by psychological factors such as stress coping and weight control concerns; therefore,

smoking was classified as a psychological factor in the present study [8,29]. Accordingly, effective nursing interventions should integrate smoking cessation programs with counseling aimed at dismantling these harmful beliefs and reframing weight control behaviors toward health-oriented approaches.

Taken together, psychological factors did not operate in isolation; rather, stress, body image distortion, anxiety, and smoking interacted synergistically to reinforce weight loss behaviors. This underscores the need for nursing interventions that target clusters of psychological variables, rather than addressing each factor in isolation.

Third, social factors indicated that the absence of school-based nutrition education within the past 12 months increased the likelihood of weight loss attempts. Nutrition education extends beyond delivering dietary knowledge; it plays a crucial role in redefining healthy weight management standards and correcting misinformation about dieting (e.g., extreme calorie restriction, single-food diets) [13]. In Korea, however, nutrition education remains limited in frequency, participation, and content diversity [30]. Given that social media platforms such as YouTube and Instagram are often the primary sources of dieting information for adolescents [31], integrating media literacy and self-reflection into nutrition education is essential. School nurses are well-positioned to lead the design and delivery of such programs, and peer-led education models may further enhance their reach and effectiveness.

In conclusion, this study demonstrates that weight loss behaviors among female adolescents are shaped by the interplay of biological, psychological, and social factors. For school nursing practice, these findings highlight the need for comprehensive, developmentally tailored interventions that integrate physical, psychological, and sociocultural components of health promotion.

This study has several limitations. First, due to its cross-sectional design, causal relationships between biopsychosocial factors and weight loss behaviors cannot be determined. Second, because data were obtained from self-reported questionnaires, recall and social desirability bias may have influenced the responses. Third, specific weight control methods such as fasting or use of diet pills were not analyzed, limiting differentiation between healthy and unhealthy behaviors. Fourth, sociocultural influences unique to Korean adolescents, such as media exposure and peer comparison, were not quantitatively measured. Finally, although the KYRBS employs a nationally representative stratified multistage sampling design with appropriate weighting, the findings may not be generalizable to adolescents who are not enrolled in school, such as out-of-school youth.

Despite these limitations, the findings carry significant clinical and social implications for school health and nursing interventions. School nurses are in a key position to identify adolescents at risk of unhealthy weight control behaviors through early screening for stress, anxiety, and body image distortion. Integrating psychosocial counseling with body positivity education can help prevent maladaptive dieting and foster emotional resilience. Furthermore, incorporating nutrition education, media literacy, and peer-support programs into school-based health initiatives can empower adolescents to develop realistic body perceptions and sustain healthy lifestyle habits. These findings emphasize the need for interdisciplinary collaboration among nurses, teachers, and families to build a supportive school environment that nurtures both physical and psychological well-being among female adolescents.

CONCLUSION

This study examined factors influencing weight loss behaviors among Korean female adolescents using data from the 19th KYRBS (2023) within the framework of the biopsychosocial model. A total of 46.5% of the study participants reported attempting weight loss in the past 30 days, underscoring that these behaviors are driven by complex psychosocial dynamics rather than solely by health management goals.

Biologically, being a middle school student and having a higher BMI markedly increased the likelihood of engaging in weight loss behaviors. Psychologically, high perceived stress, distorted body image, elevated anxiety, and current smoking status were strongly associated with such behaviors, with body image distortion and emotional instability emerging as maladaptive drivers of weight control. Socially, participation in nutrition education functioned as a protective factor, highlighting the critical role of structured, accurate health information in shaping healthy weight management practices.

These findings suggest that adolescent weight loss behaviors should be understood within an integrated developmental and psychosocial framework. For nursing practice, this calls for multidimensional assessment systems that evaluate not only the occurrence but also the underlying motivations and methods of weight control. School nurse-led interventions that enhance emotional resilience, promote body posi-

tivity, and strengthen health literacy are essential to mitigating unhealthy weight control patterns. Future research should employ longitudinal and qualitative approaches to elucidate the developmental trajectories and contextual influences on adolescent weight management, thereby informing the design of tailored, evidence-based nursing interventions.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: SOK, YHJ. Methodology: SOK. Data collection: SOK. Formal analysis: SOK. Validation: SOK, YHJ. Investigation: SOK. Supervision: YHJ. Project administration: SOK. Writing–original draft: SOK, YHJ. Writing–review and editing: SOK, YHJ. Final approval of published version: SOK, YHJ.

Conflict of interest

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

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Data availability

Please contact the corresponding author for data availability.

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AI use disclosure

The authors declare that an AI-based language model (ChatGPT, OpenAI; GPT-5.3) was used solely 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.

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REFERENCES

1. Cheuiche AV, da Silveira LG, de Paula LC, Lucena IR, Silveiro SP. Diagnosis and management of precocious sexual maturation: an updated review. Eur J Pediatr. 2021;180(10):3073-3087. https://doi.org/10.1007/s00431-021-04022-1
2. Ortega MT, McGrath JA, Carlson L, Flores Poccia V, Larson G, Douglas C, et al. Longitudinal investigation of pubertal milestones and hormones as a function of body fat in girls. J Clin Endocrinol Metab. 2021;106(6):1668-1683. https://doi.org/10.1210/clinem/dgab092
3. Fan M, Jin Y, Khubchandani J. Overweight misperception among adolescents in the United States. J Pediatr Nurs. 2014;29(6):536-546. https://doi.org/10.1016/j.pedn.2014.07.009
4. Rodgers RF, McLean SA, Paxton SJ. Longitudinal relationships among internalization of the media ideal, peer social comparison, and body dissatisfaction: implications for the tripartite influence model. Dev Psychol. 2015;51(5):706-713. https://doi.org/10.1037/dev0000013
5. Kim JS, Seo Y. Associations between weight perception, unhealthy weight control behavior, and suicidal ideation and planning among Korean adolescents: a national cross-sectional secondary analysis. J Pediatr Nurs. 2021;56:e62-e69. https://doi.org/10.1016/j.pedn.2020.07.019
6. Stewart TM, Martin CK, Williamson DA. The complicated relationship between dieting, dietary restraint, caloric restriction, and eating disorders: is a shift in public health messaging warranted? Int J Environ Res Public Health. 2022;19(1):491. https://doi.org/10.3390/ijerph19010491
7. Sagar R, Gupta T. Psychological aspects of obesity in children and adolescents. Indian J Pediatr. 2018;85(7):554-559. https://doi.org/10.1007/s12098-017-2539-2
8. Engel GL. The need for a new medical model: a challenge for biomedicine. Psychodyn Psychiatry. 2012;40(3):377-396. https://doi.org/10.1521/pdps.2012.40.3.377
9. Gaylis JB, Levy SS, Hong MY. Relationships between body weight perception, body mass index, physical activity, and food choices in Southern California male and female adolescents. Int J Adolesc Youth. 2020;25(1):264-275. https://doi.org/10.1080/02673843.2019.1614465
10. Ajibewa TA, Zhou M, Barry MR, Miller AL, Sonneville KR, Leung CW, et al. Adolescent stress: a predictor of dieting behaviors in youth with overweight/obesity. Appetite. 2020;147:104560. https://doi.org/10.1016/j.appet.2019.104560
11. Jhone J, Lee S. The mediating effect of anxiety on the relationship between body image distortion and habitual substance use among female adolescents. Forum Youth Cult. 2023;(76):83-106. https://doi.org/10.17854/ffyc.2023.10.76.83
12. Sim WY, Cho YG, Kang JH, Park HA, Kim KW, Hur YI, et al. The

relationship between smoking and unhealthy weight control behaviors among Korean adolescents: the Tenth Korea Youth Risk Behavior Web-Based Survey, 2014. Korean J Fam Med. 2017;38(1):28-33. https://doi.org/10.4082/kjfm.2017.38.1.28
13. Choi MJ, Jo HJ, Kim MK. Biochemical index, nutrition label use, and weight control behavior in female adolescents: using the 2010 and 2011 Korea National Health and Nutrition Examination Survey. Clin Nutr Res. 2020;9(1):32-42. https://doi.org/10.7762/cnr.2020.9.1.32
14. Kim Y, Austin SB, Subramanian SV, Thomas JJ, Eddy KT, Franko DL, et al. Risk factors for disordered weight control behaviors among Korean adolescents: multilevel analysis of the Korea Youth Risk Behavior Survey. Int J Eat Disord. 2018;51(2):124-138. https://doi.org/10.1002/eat.22820
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. Lancet. 2007;370(9596):1453-1457. https://doi.org/10.1016/S0140-6736(07)61602-X
16. Kim JH, Yun S, Hwang SS, Shim JO, Chae HW, Lee YJ, et al. The 2017 Korean National Growth Charts for children and adolescents: development, improvement, and prospects. Korean J Pediatr. 2018;61(5):135-149. https://doi.org/10.3345/kjp.2018.61.5.135
17. Lee M, Yi Y. Predictive factors for adolescent with generalized anxiety disorder during the COVID-19 pandemic: a secondary data analysis of 2020-2022 KYRBS. J Korean Acad Psychiatr Ment Health Nurs. 2025;34(3):297-307. https://doi.org/10.12934/jkpmhn.2025.34.3.297
18. Neumark-Sztainer D, Story M, Hannan PJ, Perry CL, Irving LM. Weight-related concerns and behaviors among overweight and nonoverweight adolescents: implications for preventing weight-related disorders. Arch Pediatr Adolesc Med. 2002;156(2):171-178. https://doi.org/10.1001/archpedi.156.2.171
19. Mendle J, Turkheimer E, Emery RE. Detrimental psychological outcomes associated with early pubertal timing in adolescent girls. Dev Rev. 2007;27(2):151-171. https://doi.org/10.1016/j.dr.2006.11.001
20. Vandenbosch L, Fardouly J, Tiggemann M. Social media and body image: recent trends and future directions. Curr Opin Psychol. 2022;45:101289. https://doi.org/10.1016/j.copsyc.2021.12.002
21. Chyung YJ. The mediating effects of body comparison on the relationship between internalization of sociocultural attitudes toward appearance and body dissatisfaction among adolescent girls. Korean J Child Stud. 2013;34(2):27-42. https://doi.org/10.5723/KJCS.2013.34.2.27
22. Puhl RM, Lessard LM. Weight stigma in youth: prevalence, consequences, and considerations for clinical practice. Curr Obes Rep. 2020;9(4):402-411. https://doi.org/10.1007/s13679-020-00408-8
23. Puhl RM, Latner JD. Stigma, obesity, and the health of the nation's children. Psychol Bull. 2007;133(4):557-580. https://doi.org/10.1037/0033-2909.133.4.557
24. Lessard LM, Puhl RM. Adolescents' exposure to and experiences of weight stigma during the COVID-19 pandemic. J Pediatr Psychol. 2021;46(8):950-959. https://doi.org/10.1093/jpepsy/jsab071
25. Lacroix E, Smith AJ, Husain IA, Orth U, von Ranson KM. Normative body image development: a longitudinal meta-analysis of mean-level change. Body Image. 2023;45:238-264. https://doi.org/10.1016/j.bodyim.2023.03.003
26. Puccio F, Fuller-Tyszkiewicz M, Youssef G, Mitchell S, Byrne M, Allen N, et al. Longitudinal bi-directional effects of disordered eating, depression and anxiety. Eur Eat Disord Rev. 2017;25(5):351-358. https://doi.org/10.1002/erv.2525
27. Trompeter N, Dârvariu Ş, Brieva-Toloza AV, Opitz MC, Rabelo-da-Ponte FD, Sharpe H, et al. The prospective relationship between anxiety symptoms and eating disorder symptoms among adolescents: a systematic review and meta-analysis of a bi-directional relationship. Eur Child Adolesc Psychiatry. 2025;34(6):1691-1718. https://doi.org/10.1007/s00787-024-02601-9
28. Keel PK, Forney KJ. Psychosocial risk factors for eating disorders. Int J Eat Disord. 2013;46(5):433-439. https://doi.org/10.1002/eat.22094
29. Bong AR, Cho YG, Park HA, Kim KW. Unhealthy weight control behaviors according to the status of combustible cigarette and noncombustible nicotine or tobacco product use among Korean adolescents with experience attempting to reduce or maintain their body weight: the 15th Korea Youth Risk Behavior Survey, 2019. Korean J Fam Med. 2024;45(4):223-230. https://doi.org/10.4082/kjfm.21.0170
30. Lee Y, Kim O, Kwon S, Jang J, Kang B, Goo D, et al. Current status of food-related educational activities in school lunch programs in South Korea. J Nutr Educ Behav. 2016;48(7 Suppl):S84. https://doi.org/10.1016/j.jneb.2016.04.198
31. Fardouly J, Vartanian LR. Social media and body image concerns: current research and future directions. Curr Opin Psychol. 2016;9:1-5. https://doi.org/10.1016/j.copsyc.2015.09.005

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CHNR

Effect of upright nesting position with swaddling on physiological status, sleep duration, and feeding tolerance in preterm infants in Indonesia: a quasi-experimental study

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Purpose: This study examined the effects of upright nesting compared with swaddling on physiological status, sleep duration, and feeding tolerance in preterm infants in the neonatal intensive care unit.
Methods: A total of 48 preterm infants, 24 per group, with gestational ages of 31 to 36 weeks, were enrolled. During the study, all infants were fed every 2 hours and did not receive sedation. Those requiring respiratory support or presenting with congenital abnormalities were excluded. At the unit level, participants were assigned to the "upright nesting" or the "swaddling" group. Physiological parameters, such as body temperature, oxygen saturation, heart rate, and respiratory rate, as well as sleep duration and feeding tolerance, were measured over 3 consecutive days. To examine group effects, time effects, and group-by-time interactions, linear mixed models were applied.
Results: Baseline characteristics, including sex, birth weight, and gestational age, were comparable between groups. Infants receiving upright nesting showed higher mean body temperature and oxygen saturation, lower heart rate, longer sleep duration, and improved feeding tolerance. Linear mixed models presented significant main effects of time for temperature, oxygen saturation, and heart rate, while significant group effects were presented for sleep duration and feeding tolerance. Group by time interactions were not statistically significant, suggesting favorable trends without differential change over time.
Conclusion: Upright nesting supports physiological stability, promotes longer sleep duration, and enhances feeding tolerance in preterm infants. Furthermore, it is a promising supportive strategy in neonatal intensive care, but larger studies are needed to confirm the results.

Keywords: Feeding behavior; Physiological processes; Posture; Preterm infant; Sleep

INTRODUCTION

The neonatal period, defined as the first 28 days of life, is the most critical phase for a child's survival [1]. Globally, approximately 2.3 million neonates died within the first month of 2022, with the majority occurring in low- and middle-income countries [2,3]. In Indonesia, the neonatal mortality rate in 2017 was 15 per 1,000 live births [4].

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Preterm birth which is defined as delivery before 37 weeks of gestation, is a leading cause of neonatal mortality. In 2019, its complications accounted for about 35% of global neonatal deaths, with 60,000 cases recorded in Indonesia [5,6].

Physiological instability in preterm infants arises from underdeveloped organs. This is because immature lungs may lack surfactant, increasing the risk of respiratory distress syndrome and requiring interventions such as mechanical ventilation or surfactant therapy [7–9]. Furthermore, cardiovascular immaturity can cause unstable blood pressure and suboptimal perfusion [10]. Feeding intolerance is common, due to underdeveloped gastrointestinal systems, poor sucking, and swallowing reflexes, as well as delayed gastric emptying [11,12].

Proper positioning plays a key role in supporting physiological stability, feeding tolerance, and sleep quality [13]. Upright nesting with swaddling places the infant in a supported semi-upright position within a nest, maintaining optimal posture and promoting neuromuscular development [14–16]. This intervention may enhance respiratory efficiency, improve circulation, and positively influence feeding and sleep [17–19].

From a theoretical perspective, upright nesting with swaddling aligns with the theory of basic human needs by Henderson [20], emphasizing support for breathing, nutrition, and sleep. By facilitating physiological stability, improving sleep quality, and supporting feeding tolerance, the intervention helps meet these fundamental needs.

Although previous studies suggest benefits of upright nesting, evidence remains limited regarding its effects on physiological parameters, sleep duration, and feeding tolerance [21–23]. Assessing these outcomes is critical for optimizing care and developing evidence-based protocols to improve preterm infant health and reduce long-term complications. This study hypothesizes that upright nesting with swaddling will result in better physiological stability, longer sleep duration, and improved feeding tolerance compared to standard swaddling.

METHODS

Ethical statements: This study was approved by the Institutional Health Research Ethics Committee, Faculty of Medicine, Universitas Indonesia–Cipto Mangunkusumo Hospital (Protocol No. 24101504-KET.01/UN2.F1/ETIK/PPM.00.02/2025). Written informed consent was obtained from the parents or legal guardians of all participants.

1. Study Design

This study adopted a quantitative research method with a quasi-experimental design. Participants were assigned to either the intervention or control group, which allowed for a comparison of outcomes. Due to the nature of the intervention (upright nesting with swaddling), blinding of participants and care providers was not feasible, as the positioning procedures were visibly different. In this study, outcome assessors were blinded to group allocation to minimize bias. Although random assignment was not adopted, the design enabled examination of intervention effects and maintained a practical and ethical method. This provided valuable insights and reduced potential bias in outcome comparison. This study was reported in accordance with the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) guidelines.

2. Population and Sample

The study population consisted of infants admitted to the neonatal intensive care unit (NICU) at Cipto Mangunkusumo Hospital (RSCM), Jakarta, with a gestational age of 31 to 36 weeks. In the process, data collection was conducted from November to December 2024.

Using consecutive sampling, all eligible infants admitted during the study period were assessed based on predefined inclusion criteria. The required sample size was calculated using G*Power software ver. 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf), assuming a medium effect size (F = 0.25) based on previous studies examining positioning interventions in preterm infants, with repeated measures across three time points, and a statistical power of .80. A total of 48 infants were included in the study to account for a potential attrition rate of 10%.

Group allocation was conducted using a quasi-random method based on odd–even admission numbers. This led to 48 neonates divided equally into the "upright nesting" and the "swaddling" groups. To minimize potential selection bias associated with non-random assignment, baseline characteristics of both groups were assessed and confirmed to be comparable. Standardized inclusion criteria and consistent clinical protocols were applied across to ensure homogeneity and reduce confounding effects, thereby supporting the internal validity of the study within the NICU clinical setting.

3. Participants

Eligibility criteria included infants admitted to the NICU at Cipto Mangunkusumo Hospital (RSCM), Jakarta, with a gestational age of 31–36 weeks, on a 2-hour feeding schedule, and not receiving sedation. Exclusion criteria comprised infants requiring respiratory support or presenting congenital abnormalities. Prior to data collection, parents or legal guardians received detailed explanations regarding study procedures, potential risks, and benefits. Participation was voluntary, and confidentiality of all collected data was strictly maintained. Participants were allocated to either the "upright nesting (intervention)" or "swaddling (control)" group. This was conducted based on the admission sequence and using a quasi-random method, with infants assigned according to odd or even numbers. Baseline measurements were collected before the intervention, and the assessment was repeated every 20 minutes for a total of 160 minutes. Follow-up assessments continued for 3 consecutive days to monitor physiological parameters, sleep duration, and feeding tolerance.

4. Measurements

1) Physiological outcomes

Physiological outcomes included body temperature, heart rate, respiratory rate, and oxygen saturation. All parameters were measured with continuous bedside monitoring systems routinely used in the NICU. Body temperature was determined using a skin temperature probe connected to the bedside monitor and recorded in degrees Celsius (°C). Heart and respiratory rates were continuously monitored through cardiorespiratory monitoring electrodes and recorded in beats per minute (bpm) and breaths per minute, respectively. Oxygen saturation (SpO_2) was measured using pulse oximetry with an appropriately sized neonatal sensor attached to the infant's foot or hand and expressed as a percentage (%). All parameters were continuously monitored during each 160-minute session over 3 consecutive days. Values were recorded according to standardized NICU monitoring protocols to ensure measurement consistency across participants.

2) Behavioral outcomes

In this study, behavioral outcomes included sleep duration and feeding tolerance. Sleep duration was assessed through continuous direct observation by trained neonatal nurses during each 160-minute observation session. Onset of sleep was defined as the absence of spontaneous motor activity with closed eyes and regular breathing patterns. Awakening was defined as eye-opening, accompanied by body movement or crying. Total sleep duration was calculated in minutes per session to ensure consistency and accuracy across observations. Furthermore, feeding tolerance was evaluated by monitoring vomiting frequency during the 3-day observation period. Episodes of vomiting were documented in the medical record immediately after occurrence, while feeding intolerance was operationally defined as the presence of one or more vomiting episodes during the observation period. To ensure fidelity, both the intervention (upright nesting group) and control (swaddling group) positions were supported using comfortable elastic cloths. Medical personnel and family members receive standardized training to ensure correct and consistent positioning throughout the study period.

5. Intervention

The intervention group received a standardized upright nesting position combined with swaddling. Neonatal nurses were trained on the positioning technique, safety criteria, and monitoring procedures prior to implementation.

Infants were placed in a semi-upright position at approximately 30° to 45° relative to the horizontal plane. This was visually in line with the incubator backrest and positioning aids to support respiratory function and gastrointestinal activity while maintaining physiological stability. Nesting support was constructed using rolled towels and soft foam arranged in a U-shape to promote midline orientation, flexion, and postural containment. The head and trunk were maintained in a neutral position, with slight neck flexion to ensure airway patency.

Swaddling was applied using a soft elastic cotton cloth around the shoulders, trunk, and lower extremities. Tension was snug but non-restrictive, with sufficient chest expansion verified by allowing the insertion of two fingers between the chest and cloth.

The intervention was administered once daily for 3 consecutive days and 160 minutes per session following routine feeding. Physiological parameters were continuously monitored, while position integrity, infant comfort, and stability were assessed every 20 minutes by trained nurses. The intervention was immediately discontinued when signs of distress, desaturation, or physiological instability occurred.

The control group received standard care consisting of a

supine position combined with swaddling. Infants were positioned flat on their backs in the incubator, with the head maintained in a neutral midline position without elevation. Swaddling was applied using the same type of soft elastic cotton cloth and technique as in the intervention group to ensure consistency, with non-restrictive tension allowing adequate chest expansion. The duration and frequency of care were equivalent to the intervention group, with infants observed for 160 minutes per session over 3 consecutive days following feeding. Routine monitoring of physiological parameters and infant comfort was conducted at regular intervals by neonatal nurses in accordance with NICU protocols.

6. Statistical Analysis

All quantitative data were analyzed using IBM SPSS Statistics for Windows ver. 26.0 (IBM Corp.). Data normality was assessed through visual inspection of histograms and Q–Q plots, complemented by Shapiro-Wilk and Kolmogorov-Smirnov tests. To address the study questions on differences between the "upright nesting" and "swaddling" groups over the 3-day observation period, separate linear mixed models (LMMs) were applied to each dependent variable. Specifically, individual LMMs were applied to body temperature, heart rate, respiratory rate, oxygen saturation, sleep duration, and feeding tolerance (measured by vomiting frequency). This method allowed each outcome to be analyzed independently while accounting for repeated measurements within subjects. LMMs were selected because the models account for repeated measures within individuals, accommodate missing observations, and provide greater flexibility than traditional two-way analysis of variance for longitudinal NICU data. For each model, fixed effects included group (upright nesting group vs. swaddling group), time (Day 1, Day 2, Day 3), and the group × time interaction, while a random intercept was specified to account for individual variability among infants. A two-sided significance level of .05 was applied, and partial eta squared (η^2) was reported as a measure of effect size. No missing data were observed in this study; hence, no imputation or data handling procedures were required.

RESULTS

1. Demographic and Baseline Characteristics

Participant progression throughout the study is presented in Figure 1. The demographic and baseline characteristics of

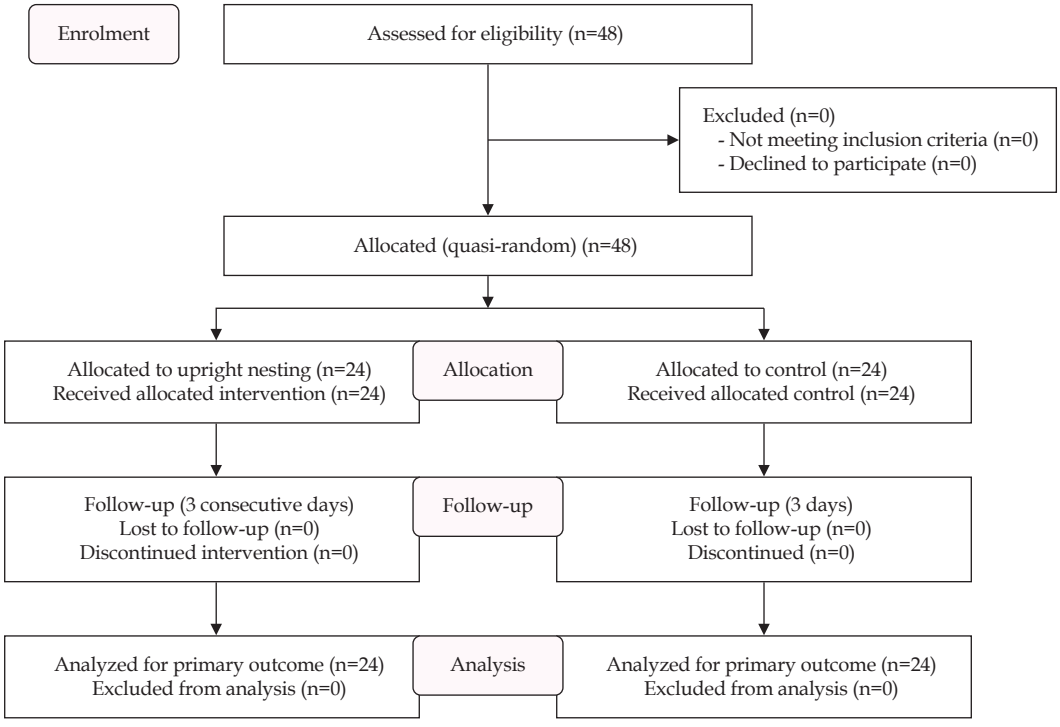

Figure 1. Flow diagram of participant progression through the study phases, including enrollment, group allocation, follow-up, and data analysis.

the "upright nesting (intervention)" and "swaddling (control)" groups were comparable (Table 1). In the upright nesting group, 12 infants (50.0%) were male, and 12 (50.0%) were female, while in the swaddling group, 13 (54.2%) were male and 11 (45.8%) were female, with no significant difference between groups (p=.999). The mean birth weight was 1,710.83±454.8 g in the upright nesting group and 1,774.58±407.5 g in the swaddling group (p=.611). The mean gestational age was 32.29±0.999 weeks and 32.21±1.318 weeks, respectively (p=.806). These results showed that both groups were homogeneous at baseline.

2. Physiological Outcomes

Descriptive statistics for physiological outcomes across the 3-day observation period are presented in Table 2, while the results of the LMMs are summarized in Table 3.

1) Body temperature

Infants in the "upright nesting" group demonstrated consistent increases in body temperature over the 3 days of observation. Body temperature had a significant effect of time (F=4.87, p=.009, partial η^2=0.077), reflecting changes across the 3 days in both groups. However, there was no significant group effect (F=1.52, p=.223) or group×time interaction (F=0.92, p=.402).

This suggested that "upright nesting" group did not differ significantly from "swaddling" group in influencing temperature regulation. Although these decreases were not statistically significant, "swaddling" group may have a mild cooling effect that warrants attention in infants susceptible to temperature instability.

2) Oxygen saturation

Oxygen saturation showed a significant effect of time (F=3.21, p=.043, partial η^2=0.052). No significant differences were observed between groups (F=0.56, p=.457) or in the group×time interaction (F=0.67, p=.513). This signified the similar patterns of oxygenation changes in both groups over time.

3) Heart rate

The "upright nesting" intervention group led to notable reductions in heart rate, suggesting improved cardiovascular stability. Heart rate showed a significant time effect (F=5.34, p=.006, partial η^2=0.084), reflecting variation across the observation period. However, neither the group effect (F=2.18, p=.145) nor the group×time interaction (F=1.03, p=.361) was statistically significant.

4) Respiratory rate

For respiratory rate, no statistically significant effects were observed for group (F=0.72, p=.399), time (F=2.88, p=.060),

Table 1. Comparison of demographic and pretest variables between upright nesting and swaddling groups (N=48)

Characteristic	Upright nesting (n=24)	Swaddling (n=24)	p
Sex			1.00
Male	12 (25.0)	13 (27.1)	
Female	12 (25.0)	11 (22.9)	
Weight (g)	1,710.83±454.8	1,774.58±407.5	.611
Gestational age (wk)	32.29±0.999	32.21±1.318	.806

Values are presented as number (%) or mean±standard deviation. p-values were calculated using chi-square for categorical variables and independent t-tests for continuous variables. No significant differences were found between groups at baseline.

Table 2. Descriptive statistics of physiological and behavioral outcomes for upright nesting and swaddling groups across 3 days

Outcome	Group	Day 1	Day 2	Day 3
Temperature (°C)	Upright nesting	36.71±0.21	36.73±0.20	36.77±0.22
	Swaddling	36.67±0.25	36.66±0.24	36.70±0.23
Oxygen saturation (%)	Upright nesting	96.43±1.55	96.71±1.87	96.57±1.58
	Swaddling	96.10±1.28	95.70±1.73	95.67±2.16
Heart rate (bpm)	Upright nesting	166.79±11.75	152.14±10.90	156.21±9.75
	Swaddling	161.00±10.89	158.29±11.77	156.86±11.90
Respiratory rate (breaths/min)	Upright nesting	53.14±6.13	48.14±5.53	48.36±6.53
	Swaddling	51.24±6.29	50.14±6.31	49.71±6.48
Sleep duration (min)	Upright nesting	129.29±22.97	145.71±21.87	157.14±14.96
	Swaddling	86.90±20.76	88.57±21.15	86.90±21.78
Feeding tolerance (score)	Upright nesting	0.14±0.38	0.29±0.49	0.07±0.26
	Swaddling	0.83±0.74	0.57±0.62	0.69±0.67

Values are presented as mean±standard deviation.

Table 3. Mixed model results for physiological and behavioral outcomes: upright nesting vs. swaddling

Outcome	Source	F	df	*p*	Partial η^2
Temperature (°C)	Group	1.52	(1, 58)	.223	0.026
	Time	4.87	(2, 116)	.009	0.077
	Group × time	0.92	(2, 116)	.402	0.016
Oxygen saturation (%)	Group	0.56	(1, 58)	.457	0.010
	Time	3.21	(2, 116)	.043	0.052
	Group × time	0.67	(2, 116)	.513	0.011
Heart rate (bpm)	Group	2.18	(1, 58)	.145	0.036
	Time	5.34	(2, 116)	.006	0.084
	Group × time	1.03	(2, 116)	.361	0.018
Respiratory rate	Group	0.72	(1, 58)	.399	0.012
	Time	2.88	(2, 116)	.060	0.047
	Group × time	0.49	(2, 116)	.615	0.008
Sleep duration	Group	13.67	(1, 58)	< .001	0.191
	Time	2.41	(2, 116)	.093	0.040
	Group × time	0.53	(2, 116)	.589	0.009
Feeding tolerance	Group	4.28	(1, 58)	.043	0.069
	Time	1.06	(2, 116)	.349	0.018
	Group × time	0.32	(2, 116)	.725	0.006

df shown as numerator, denominator (e.g., 1, 58). Partial η^2 is included as the effect size.
df, degrees of freedom.

or group × time interaction (F = 0.49, p = .615). This signified no meaningful differences between "upright nesting" group and "swaddling" group in respiratory patterns.

3. Behavioral Outcomes

1) Sleep duration

A significant group effect was observed for sleep duration (F = 13.67, p < .001, partial η^2 = 0.191). This suggested that infants in the "upright nesting" group had longer sleep duration. However, the time effect (F = 2.41, p = .093) and group × time interaction (F = 0.53, p = .589) were not statistically significant, suggesting a consistent difference between groups across the 3 days.

2) Feeding tolerance

Feeding tolerance showed a significant group effect (F = 4.28, p = .043, partial η^2 = 0.069). This suggested a better tolerance in the "upright nesting" group compared to the "swaddling" group. No significant time effect (F = 1.06, p = .349) or group × time interaction (F = 0.32, p = .725) was observed.

DISCUSSION

The present study examined the effects of upright nesting compared with traditional swaddling on physiological and behavioral outcomes in preterm infants. Upright nesting was associated with improved thermal stability, reductions in heart rate, modest improvements in oxygen saturation, longer sleep duration, and better feeding tolerance over the 3-day observation period. These results suggest that developmentally supportive positioning may positively influence multiple domains of physiological and behavioral regulation in preterm infants receiving care in the NICU. Recent studies have similarly emphasized the growing role of structured developmental positioning strategies in optimizing physiological stability [24-26].

From a theoretical perspective, the results are interpreted using the theory of basic human needs by Henderson [20]. This emphasizes the nurse's role in assisting individuals in maintaining physiological balance until independence is achieved [27]. Based on observation, preterm infants have limited capacity to regulate essential needs such as breathing, thermoregulation, sleep, and nutrition due to physiological immaturity [7]. Upright nesting, as a developmentally supportive positioning strategy, may facilitate optimal body orientation, support respiratory mechanics, enhance thermal stability, promote restorative sleep, and improve feeding tolerance. As a result, contemporary neonatal care frameworks increasingly recommend individualized positioning as part of developmental care models in the NICU [24].

In terms of thermoregulation, infants in the upright nesting group had more stable body temperature patterns over the

observation period. This result is clinically relevant, as preterm infants are highly vulnerable to heat loss due to immature thermoregulatory mechanisms [28]. Studies emphasizing developmentally supportive positioning have reported that appropriate postural orientation can contribute to improved physiological stability and reduced energy expenditure [25]. More recent investigations have further underscored the role of nesting and supportive positioning in minimizing stress-related thermal fluctuations in preterm infants [27,29].

Regarding respiratory outcomes, upright nesting was associated with modest improvements in oxygen saturation and more stable respiratory rate patterns. Semi-upright positioning has been shown to promote better airway patency, improved thoracoabdominal synchrony, and enhanced lung expansion [30]. Recent clinical observations suggest that structured positioning protocols may enhance short-term respiratory efficiency in medically stable preterm infants [26]. Although the magnitude of oxygen saturation changes in this study was modest, even small improvements in oxygenation can reduce cumulative physiological stress in vulnerable infants.

Based on observation, cardiovascular stability appeared to be influenced by positioning. Infants in the upright nesting group showed greater reductions in heart rate, suggesting improved autonomic regulation and physiological calming [28]. Although swaddling is often used to promote soothing and containment, it did not present comparable changes in heart rate. This result shows that postural orientation and semi-upright positioning contribute meaningfully to autonomic stabilization in preterm infants.

In this study, respiratory rate responses varied across the observation period. Upright nesting appeared to support short-term stabilization of breathing patterns, while effects in the swaddling group were inconsistent. Similar results have been reported in recent studies examining positioning-related modulation of respiratory stability in preterm infants [28]. However, longer-term investigations are required to determine sustained clinical impact.

Behavioral outcomes further support the potential benefits of upright nesting. Infants positioned upright showed longer sleep duration across all observation days. Improved sleep may be related to enhanced physiological stability and reduced discomfort, including decreased risk of gastroesophageal reflux. Recent neonatal sleep studies also suggest that developmentally suitable positioning may enhance sleep continuity and reduce arousal frequency in preterm infants [16,22,23]. Although swaddling mimics the intrauterine environment and may support sleep initiation, it appeared less effective in promoting sustained sleep duration and continuity in this study [23].

In this study, feeding tolerance was more favorable in the upright nesting group. Semi-upright positioning may support coordinated swallowing and digestion, thereby reducing regurgitation and improving feeding efficiency [8,10,15]. A recent study has further shown that positioning during and after feeding may significantly influence reflux-related symptoms and feeding stability in preterm infants [29]. Although feeding tolerance is multifactorial and influenced by gestational age, gastrointestinal maturity, and feeding protocols, positioning represents a modifiable and clinically feasible factor.

From a clinical practice perspective, these results have several implications. Upright nesting appears to be a low-cost, non-invasive intervention that can be implemented using standard NICU materials with appropriate staff training. Recent high-quality evidence, including a Cochrane systematic review, has emphasized the potential role of infant positioning in promoting developmental outcomes and reducing morbidity in preterm infants [30]. However, translation of this evidence into routine clinical practice requires standardized positioning protocols, structured staff education, and continuous safety monitoring to ensure consistent and appropriate application. Ongoing monitoring of crucial signs remains essential, particularly for infants requiring respiratory support or experiencing clinical instability. Furthermore, all positioning strategies should comply with established airway safety and safe sleep principles to minimize the risk of unintended adverse events.

In this study, there are several limitations that need to be acknowledged. The sample size was relatively small and recruited from a single NICU, which may limit the generalizability of the results to other clinical settings or populations. The observation period was restricted to 3 consecutive days, preventing conclusions regarding longer-term outcomes such as growth trajectories, neurodevelopmental progress, or sustained physiological regulation. Feeding tolerance was assessed solely based on vomiting frequency, without inclusion of additional clinically relevant indicators such as gastric residual volume, abdominal distention, or feeding volume tolerance. Furthermore, caregiver and staff perceptions regarding the feasibility, workload, and practical acceptability of

the intervention were not evaluated.

There are no serious adverse events observed during the study period. No infants required permanent discontinuation of the intervention due to physiological instability. Temporary interruptions were performed when signs of mild instability (e.g., brief desaturation or discomfort) were observed. Infants were stabilized according to NICU protocols before resuming standard care. The frequency of these kinds of events was minimal and comparable between groups. Considering these limitations, the observed changes in oxygen saturation and respiratory rate should be interpreted cautiously as supportive trends rather than definitive evidence of sustained clinical benefit.

Despite the limitations, the results suggest that upright nesting may be a feasible and supportive positioning strategy for preterm infants in the NICU. Rather than implying superiority over existing practices, it can be considered an adjunctive intervention tailored to the individual needs and clinical conditions of preterm infants. Nurses should continue to apply comprehensive clinical assessment when selecting positioning strategies, taking into account each infant's tolerance, medical stability, and safety considerations. Further study with larger, multicenter samples and longer follow-up periods is required to confirm the results and clarify the role of upright nesting in neonatal care.

CONCLUSION

In conclusion, upright nesting represented a feasible and supportive positioning method for preterm infants in the NICU. The intervention was associated with patterns of improved physiological stability, including thermoregulation, heart rate regulation, sleep duration, and feeding tolerance. It played a role in developmentally supportive nursing care when applied with appropriate clinical monitoring.

Upright nesting needs to be considered as an adjunctive positioning strategy rather than a replacement for established neonatal care practices. Clinical decisions should continually be guided by comprehensive nursing assessment, with careful consideration of each infant's tolerance, medical condition, and safety. Further study with larger samples, randomized designs, and extended follow-up is needed before definitive clinical recommendations can be established.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: NHP, AA. Methodology: DAY, NHP, DN. Data curation: DAY. Formal analysis: DAY, DN. Investigation: DAY, NHP, AA. Resources: AA. Project administration: NHP. Validation: DN. Visualization: DAY, DN. Supervision: NHP. Writing–original draft: NHP. Writing–review & editing: DAY, NHP, DN. Final approval of published version: all authors.

Conflict of interest

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

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Data availability

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

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Generative AI was used solely for grammar and language clarity checks during manuscript preparation. The authors reviewed and approved all suggestions, and are fully respon-

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REFERENCES

1. Wake GE, Chernet K, Aklilu A, Yenealem F, Wogie Fitie G, Amera Tizazu M, et al. Determinants of neonatal mortality among neonates admitted to neonatal intensive care unit of Dessie comprehensive and specialized hospital, Northeast Ethiopia: an unmatched case-control study. Front Public Health. 2022;10:979402. https://doi.org/10.3389/fpubh.2022.979402
2. Kamity R, Kapavarapu PK, Chandel A. Feeding problems and long-term outcomes in preterm infants: a systematic approach to evaluation and management. Children (Basel). 2021;8(12):1158. https://doi.org/10.3390/children8121158
3. World Health Organization (WHO). Newborn mortality. WHO; 2024.
4. Belizán JM, McClure EM, Goudar SS, Pasha O, Esamai F, Patel A, et al. Neonatal death in low- to middle-income countries: a global network study. Am J Perinatol. 2012;29(8):649-656. https://doi.org/10.1055/s-0032-1314885
5. Ikawati B, Ramadhani T. Achievement of neonatal mortality reduction targets in maternal and child health programs in Indonesia. J Kebijak Kesehat Indones. 2022;11(1):68-78. https://doi.org/10.22146/jkki.68782
6. Sampurna MT, Handayani KD, Utomo MT, Angelika D, Etika R, Harianto A, et al. Determinants of neonatal deaths in Indonesia: a national survey data analysis of 10,838 newborns. Heliyon. 2023;9(1):e12980. https://doi.org/10.1016/j.heliyon.2023.e12980
7. Erickson G, Dobson NR, Hunt CE. Immature control of breathing and apnea of prematurity: the known and unknown. J Perinatol. 2021;41(9):2111-2123. https://doi.org/10.1038/s41372-021-01010-z
8. Avital A, Donchin M, Springer C, Cohen S, Danino E. Feeding young infants with their head in upright position reduces respiratory and ear morbidity. Sci Rep. 2018;8(1):6588. https://doi.org/10.1038/s41598-018-24636-0
9. Albraik RK, Shatla E, Abdulla YM, Ahmed EH. Neonatal feeding intolerance and its characteristics: a descriptive study. Cureus. 2022;14(9):e29291. https://doi.org/10.7759/cureus.29291
10. Salas AA, Travers CP. The practice of enteral nutrition: clinical evidence for feeding protocols. Clin Perinatol. 2023;50(3):607-623. https://doi.org/10.1016/j.clp.2023.04.005
11. Séassau A, Munos P, Gire C, Tosello B, Carchon I. Neonatal care unit interventions on preterm development. Children (Basel). 2023;10(6):999. https://doi.org/10.3390/children10060999
12. El Sayed H, Hassan GA. Nesting technique: its effect on physiological parameters and neurobehavioral organization in preterm infants. Int J Nov Res Healthc Nurs. 2020;7(1):133-147.
13. Ahmed NM, Sabry YY, Khamis GM. Effect of nesting and swaddled position on behavioral readiness and feeding progression of preterm neonates. Alexandria Sci Nurs J. 2024;26(3):13-24.
14. Bennet L, Walker DW, Horne RS. Waking up too early: the consequences of preterm birth on sleep development. J Physiol. 2018;596(23):5687-5708. https://doi.org/10.1113/JP274950
15. Ahmed Mahmoud H, Hamdy Abdelhafeiz S. Effect of right position during and after feeding on gastric residual volume and regurgitation episodes among preterm infants. Egypt J Health Care. 2021;12(3):891-904. https://doi.org/10.21608/ejhc.2021.195513
16. Vadakkan AJ, Prabakaran V. Comparison of the effect of nesting and swaddling on sleep duration and arousal frequency among preterm neonates: a randomized clinical trial. J Caring Sci. 2022;11(3):126-131. https://doi.org/10.34172/JCS.2022.17
17. Bohnhorst B, Lutz E, Pirr S, Peter C, Böhne C. Prone positioning was associated with less hypoxemic events and improved feeding tolerance in preterm infants. Acta Paediatr. 2025;114(10):2643-2650. https://doi.org/10.1111/apa.70153
18. Ar I, Balcı S. The effect of the use of positioning materials and hand-face maneuvers on physiologic parameters and stress symptoms in preterm newborns. Ital J Pediatr. 2025;51(1):239. https://doi.org/10.1186/s13052-025-02070-z
19. Efendi D, Sari D, Riyantini Y, Novardian N, Anggur D, Lestari P. Positioning and nesting in premature infants: evaluation of implementation in the neonatal intensive care unit (NICU). J Keperawatan Indones. 2019;22(3):169-181. https://doi.org/10.7454/jki.v22i3.619
20. Henderson V. Basic principles of nursing care. International Council of Nurses; 2024.
21. Griffiths N, Spence K, Loughran-Fowlds A, Westrup B. Individualised developmental care for babies and parents in the NICU: evidence-based best practice guideline recommendations. Early Hum Dev. 2019;139:104840. https://doi.org/10.1016/j.earlhumdev.

2019.104840
22. Skelton H, Psaila K, Schmied V, Foster J. Systematic review of the effects of positioning on nonautonomic outcomes in preterm infants. J Obstet Gynecol Neonatal Nurs. 2023;52(1):9-20. https://doi.org/10.1016/j.jogn.2022.09.007
23. Dixley A, Ball HL. The effect of swaddling on infant sleep and arousal: a systematic review and narrative synthesis. Front Pediatr. 2022;10:1000180. https://doi.org/10.3389/fped.2022.1000180
24. Prawesti A, Emaliyawati E, Mirwanti R, Nuraeni A. The effectiveness of prone and supine nesting positions on changes of oxygen saturation and weight in premature babies. J Ners. 2019;14(2):137-143. https://doi.org/10.20473/jn.v14i2.7755
25. Castro ES, Bacil LF, de Almeida FD, Andreazza MG, Alves Pedrão RA, Valderramas SR. Premature newborn positionings and physiologic parameters: a randomized clinical study. Fisioter Mov. 2023;36:e36102. https://doi.org/10.1590/fm.2023.36102
26. Prescott MG, Geist M, Olsson E, Fiander M, Soll RF, Bruschettini M. Infant positioning for promoting development and preventing morbidity in preterm infants. Cochrane Database Syst Rev. 2024;12(12):CD016029. https://doi.org/10.1002/14651858.CD016029
27. Agussafutri WD, Ariyani I, Putriningrum R. Effect of swaddling on neonatal sleep quality. Kosala J Ilmu Kesehat. 2023;11(2):183-191. https://doi.org/10.37831/kjik.v11i2.298
28. Fadhillah R, Sari DK. The Kangaroo method and cloth swaddling to increase the body temperature of newborns and prevent hypothermia. Midwifery J. 2022;2(4):201-208. https://doi.org/10.33024/mj.v2i4.8699
29. Mohamed Arafa N, Reda El-Sheshtawy O, Mohamed Thabet A, Maher Khamis G. Effect of developmentally supportive post feeding positions on gastrointestinal feeding tolerance among preterm neonates. Egypt J Health Care. 2022;13(1):1475-1486. https://doi.org/10.21608/ejhc.2022.228204
30. Kamal Abozied BR, Ismail MS, Yonis Mahrous ES. Effect of nesting on bio-physiological parameters and suckling response among low-birth-weight infants. Damanhour Sci Nurs J. 2025;3(5):65-78. https://doi.org/10.21608/dsnj.2025.363813.1059

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Sudden pertussis outbreaks in Guro-gu, Seoul: epidemiological characteristics and contributing factors in 2024

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Purpose: Although pertussis is a vaccine-preventable disease, its incidence increased rapidly in Guro-gu, Seoul, since May 2024. This study aimed to investigate the epidemiological characteristics of pertussis cases and outbreaks during this period.
Methods: Data from epidemiologic investigations of 355 laboratory-confirmed pertussis cases reported in 2024 in Guro-gu, Seoul, were analyzed using national surveillance records. Demographics, vaccination status, outbreak-associated educational settings, and symptom-to-test intervals were analyzed using descriptive statistics and non-parametric tests.
Results: Between May and December 2024, 355 cases were reported, 85.4% of which occurred among school-aged children and adolescents, representing a marked increase compared with previous years. Outbreaks were identified in two elementary schools, three middle schools, and four private academies, indicating clustered transmission in educational settings, with school-based attack rates ranging from 3.2% to 6.3%. Among 146 outbreak-associated school cases, 95.4% had completed age-appropriate vaccination on time. The symptom-to-test interval showed a right-skewed distribution (median, 6 days; interquartile range, 3–11), with longer delays observed in high school students.
Conclusion: The sharp increase in pertussis cases among school-aged children underscores the need for strengthened surveillance in educational settings and improved timeliness of testing to reduce transmission. Delays in symptom-to-test intervals and the occurrence of cases despite age-appropriate vaccination suggest possible waning immunity, highlighting the importance of evaluating booster vaccination strategies and targeted age-specific public health interventions.

Keywords: Epidemiology; Disease outbreaks; Vaccination; Whooping cough

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INTRODUCTION

Pertussis is a highly contagious bacterial respiratory disease caused by *Bordetella pertussis*, characterized by paroxysmal cough and the characteristic "whooping" sound. It is primarily transmitted via respiratory aerosols and droplets, with a basic reproduction number (R_0) estimated at 12 to 17 [1,2]. Although most individuals recover fully from pertussis, it can be fatal to infants, especially those younger than 3 months [3].

In pediatric populations, pertussis may impose a substantial clinical and public health burden, while infants remain particularly vulnerable to severe outcomes [2,3]. Transmission can be amplified in school-related settings due to frequent close-contact interactions, and recent reports from Korea have documented outbreaks affecting school-aged children in educational environments [4-6]. Therefore, timely recognition and testing among children and adolescents are important for early control and prevention of onward spread.

In Korea, pertussis is designated as a nationally notifiable infectious disease (Class 2), meaning that all cases must be reported through a system managed by the Korea Disease Control and Prevention Agency (KDCA). Following the development and widespread use of vaccines, pertussis incidence declined substantially in many high-income countries. In Korea, the incidence rate steadily decreased through the 1990s after the introduction of diphtheria-tetanus-pertussis (DTaP) vaccination [7].

The pertussis vaccination schedule is designed to provide lifelong protection. Infants receive a primary series of DTaP vaccinations at 2, 4, and 6 months of age, followed by booster doses at 15–18 months and 4–6 years. Adolescents are recommended to receive a tetanus-diphtheria-acellular pertussis (Tdap) booster at 11–12 years of age, while adults are advised to receive a Tdap dose if not previously vaccinated, followed by tetanus-diphtheria (Td) or Tdap boosters every 10 years. Moreover, KDCA recently emphasized the need for pertussis vaccination to protect infants under 1 year old who are at high risk, including pregnant women, cohabiting family members, and caregivers [8,9].

Pertussis has resurged since the 2000s, with a notable increase among adolescents [7]. This resurgence has been attributed to multiple factors reported in prior literature, including waning immunity after vaccination, changes in awareness and diagnostic testing, and potential pathogen adaptation over time [2,7]. In Korea, reported cases rose markedly during 2016–2018 across multiple age groups [10] and subsequently declined during 2018–2022, decreasing from 980 cases in 2018 to 31 cases in 2022 [11]. Since October 2023, transmission and outbreaks have particularly affected school-aged children, initially reported in Gyeongsangnam-do and later spreading nationwide [4,5]. The KDCA also reported an infant death due to pertussis, underscoring the need to protect high-risk young infants [12]. In the first half of 2024, 5,497 pertussis cases were reported, compared with 4,603 cases in the first half of 2025 (as of June 30), indicating a decline but a sustained burden requiring continued public health responses [12].

Between 2016 and 2023, pertussis cases reported in Guro-gu were sporadic and occurred primarily among adults and older individuals. Only one case was identified among school-aged children during this period, and no cases were reported among adolescents or preschool-aged children (Supplement 1). In contrast to the preceding years, beginning in May 2024, a marked increase in pertussis cases was observed in this district, particularly among school-aged children.

Accordingly, this study aimed to describe the epidemiologic and clinical characteristics of pertussis cases reported in Guro-gu in 2024 and to characterize exposure sites and commonly frequented locations, focusing on educational institutions (schools and private academies). We also assessed patterns of symptom-to-test intervals across key groups (e.g., age and occupation/affiliation) to inform evidence-based measures for preventing further outbreaks.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Yonsei University Health System, Severance Hospital (IRB No. 4-2024-1373). The requirement for informed consent was waived owing to the retrospective nature of the study.

1. Study Design

This was a retrospective cohort study using routinely collected surveillance and epidemiological investigation data from January 1 to December 31, 2024 in Guro-gu, Seoul, Republic of Korea. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2. Data Sources and Samples

The study population comprised laboratory-confirmed pertussis cases reported to the KDCA surveillance system and investigated by the Guro District Public Health Center between January 1 and December 31, 2024. Pertussis is a nationally notifiable infectious disease, and all case reports and investigation records are registered in the KDCA's Integrated Disease Control Information System. Among 375 reported pertussis cases during the study period, 355 laboratory-confirmed cases were included in the analysis (Supplement 2).

This study used data routinely collected through national public health surveillance and epidemiologic investigations conducted by KDCA and the local public health center. Data were extracted from the KDCA system and epidemiological investigation records, including demographic characteristics, clinical symptoms, and affiliation/occupation and institution information. Investigations were conducted via telephone interviews as part of routine public health practice during the outbreak period. All records were assigned unique identifiers and de-identified prior to analysis.

Vaccination status was verified using both the Integrated Disease Control Information System and the Vaccination Registration System. Among the 355 laboratory-confirmed cases, vaccination status could not be confirmed for 35 cases. These cases were excluded from vaccination-related analyses but retained in all other analyses.

3. Variables

Key variables included sex, age, affiliation/occupation (with institution information when available), and clinical symptoms (respiratory and non-respiratory). Asymptomatic cases were defined as having no symptoms recorded in the investigation form. Vaccination status was categorized based on the national schedule and timing (Supplement 3).

Vaccination status was categorized as: (1) vaccinated (including delayed), (2) incomplete or unvaccinated, and (3) unknown. "Vaccinated" was defined as having received all age-appropriate doses up to the time of diagnosis, regardless of adherence to the recommended schedule. Among vaccinated cases, adherence to the recommended schedule was further classified as on-time or delayed according to whether doses were administered within the recommended age window. Vaccination status was considered unknown when no record was available in the investigation form or registry linkage. In vaccination-related analyses, cases with unknown vaccination status were excluded.

The symptom-to-test interval was calculated as the number of days between symptom onset and the specimen collection (test) date recorded in the investigation form. Symptom onset date was defined as the date of symptom onset recorded in the epidemiological investigation form; test date as the specimen collection (laboratory test) date; and diagnosis date as the date of confirmed pertussis case reporting in the KDCA surveillance system. Because the diagnosis date reflects case reporting/registration in the KDCA surveillance system and may lag behind testing, delay analyses in this study used the symptom-to-test interval (symptom onset to test date) as the primary measure of timeliness.

Attack rate was calculated for each school as the number of laboratory-confirmed cases divided by the total number of students enrolled in that school during the outbreak period.

4. Data Analysis

Descriptive statistics were used to summarize demographic characteristics, vaccination status, symptoms, and outbreak-associated institutions.

For analyses involving diagnostic delay, normality was assessed using the Shapiro-Wilk test. The distribution significantly deviated from normality ($W = 0.744$, $p < .001$), with substantial positive skewness (3.42) and high kurtosis (22.90). Therefore, non-parametric tests were applied for comparisons of this variable.

Group comparisons were performed using the chi-square test, independent t-test, Mann-Whitney U test, or Kruskal-Wallis test, depending on variable type and distribution. When the Kruskal-Wallis test indicated significant differences across groups, post-hoc pairwise comparisons were conducted using the Dwass-Steel-Critchlow-Fligner (DSCF) method to account for multiple comparisons. Analyses were conducted using SAS ver. 9.4 (SAS Institute Inc.), and a two-sided $p < .050$. was considered statistically significant.

RESULTS

1. Epidemiologic Characteristics of Pertussis in Guro-gu

Based on the week of report recorded in the KDCA surveillance system, the epidemic curve indicates that weekly

pertussis case counts began to increase in the last week of May 2024 and reached a peak in the first week of July (65 cases) (Figure 1). After early July, weekly counts declined, but cases continued to occur through December. Overall, the resurgence persisted for approximately 7 months (late May–December), with 355 cases reported during this period.

Elementary and middle school students accounted for approximately 75.5% of all pertussis cases. Including high school students, students accounted for approximately 85.4% of all pertussis cases in 2024. Approximately 96.6% of patients exhibited a cough, and respiratory symptoms were common. Non-respiratory symptoms, such as headache, dizziness, and diarrhea, were rare, affecting fewer than 2.0% of the patients (Table 1).

2. Characteristics of Pertussis Outbreaks in Schools and Private Academies

According to the epidemiological investigation records, the primary locations frequented by outbreak-associated cases included a total of nine sites: two elementary schools, three middle schools, and four private academies. Among these, two schools and four academies were located within the same administrative district (Supplement 4).

In the five schools with identified clusters, the attack rate ranged from 3.2% to 6.3%. Among 146 outbreak-associated patients in these school settings, 139 (95.4%) had completed age-appropriate vaccination on time (Table 2). No clear pattern was observed between school-level attack rates and the proportion of patients who had completed vaccination on time.

3. Vaccination Status

Of 355 cases, 305 (85.9%) were vaccinated (including delayed vaccination), 15 (4.2%) were incomplete or unvaccinated, and 35 (9.9%) had unknown vaccination status (Table 1). The distribution of vaccination status by dose number and adherence to the recommended schedule is presented in Supplement 5.

Analysis of vaccine types by dose number showed that DTaP was the predominant vaccine type for the initial fifth doses, accounting for 71.3% of cases. Smaller proportions received DTaP-IPV or DTaP-IPV/Hib combination vaccines.

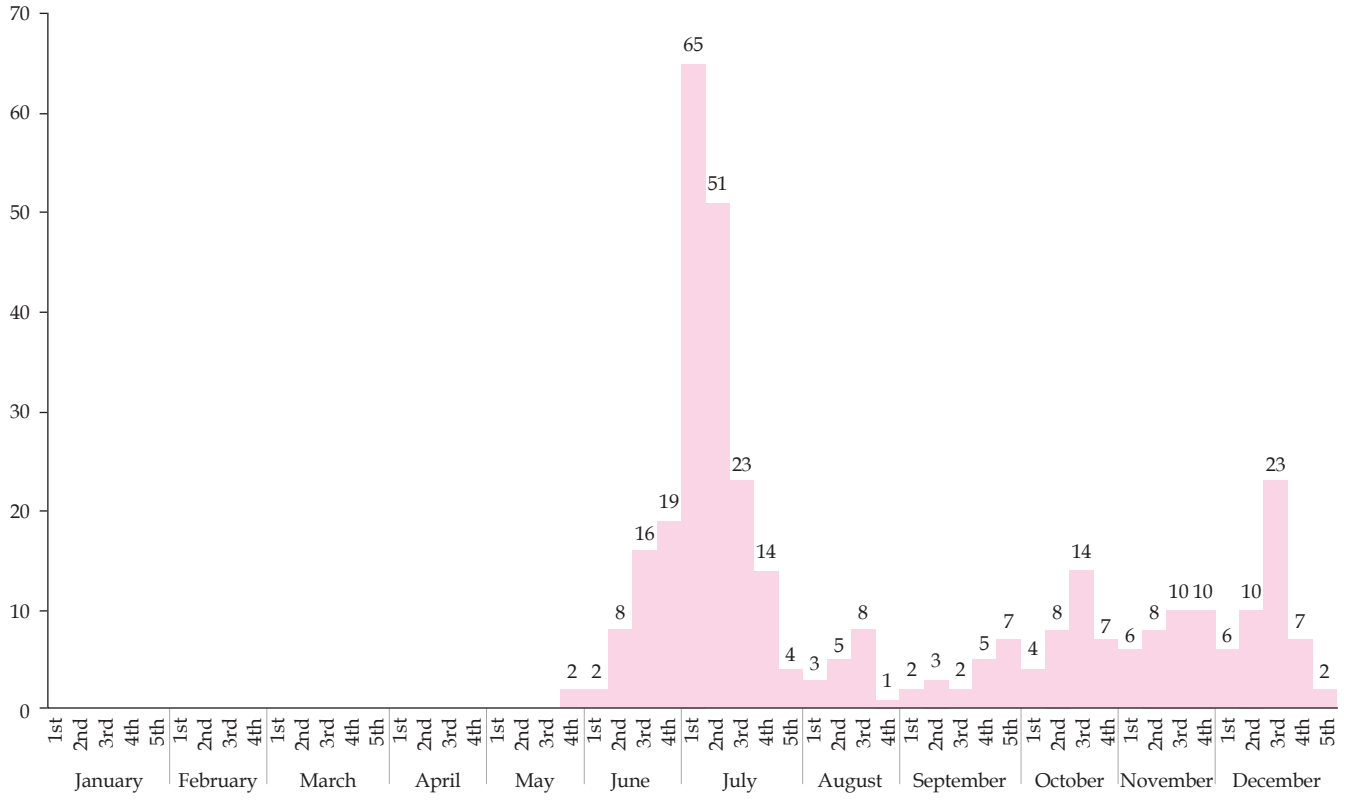

Figure 1. Epidemic curve of pertussis cases in Guro-gu, 2024. The epidemic curve is based on the week of report recorded in the Korea Disease Control and Prevention Agency surveillance system.

Table 1. Characteristics of pertussis patients in Guro-gu, Seoul, 2024 (N=355)

Characteristic	Category	No. (%)
Sex	Male	184 (51.8)
	Female	171 (48.2)
Age group and institution		
Children under school age	Childcare center	8 (2.3)
	Kindergarten	3 (0.8)
School-age children and adolescents	Elementary school	156 (43.9)
	Middle school	112 (31.5)
	High school	34 (9.6)
Adults	Workers	18 (5.1)
	Unemployed	24 (6.8)
Clinical manifestations	Asymptomatic	6 (1.7)
	Fever	34 (9.6)
Respiratory symptoms	Cough	343 (96.6)
	Sputum	42 (11.8)
	Sore throat	26 (7.3)
	Rhinorrhea	27 (7.6)
	Dyspnea	7 (2.0)
Non-respiratory symptoms	Headache	6 (1.7)
	Dizziness	4 (1.1)
	Diarrhea	4 (1.1)
	Nausea	3 (0.8)
Vaccination	Vaccinated (including delayed)	305 (85.9)
	Incomplete/unvaccinated	15 (4.2)
	Unknown	35 (9.9)

Respiratory and non-respiratory symptoms were calculated as multiple responses; percentages may exceed 100%.

For the sixth dose, 81.8% of vaccinated patients received Tdap, whereas 18.2% received Td (Supplement 6).

Among preschool-aged children, all cases were vaccinated on time. In elementary school students, 7.1% had delayed vaccination and 3.2% were incomplete or unvaccinated. Among adolescents, delayed vaccination was observed in 36.6% of middle school students and 20.6% of high school students, while incomplete or unvaccinated status accounted for 5.4% and 11.8%, respectively. Vaccination status was largely unknown among adults (Table 3).

Additional analysis comparing vaccination types and the interval from the sixth dose to diagnosis showed that the median interval was longer among Tdap recipients than among Td recipients; however, this difference was not statistically significant (Supplement 7).

4. Symptom-to-Test Intervals by School Level and Occupation

The symptom-to-test interval showed a right-skewed distribution, with a median of 6 days (interquartile range [IQR], 3–11) and a range of 0–84 days. Figure 2 displays the median values with IQRs among cases with available symptom onset and test dates across school levels and occupation groups. Median (IQR) symptom-to-test days were 12 (9.5–15.5) in childcare center children (n=8), 4 (0–21) in kindergarten chil-

Table 2. Characteristics of schools with pertussis outbreaks in Guro-gu, Seoul, 2024

Schools with pertussis outbreaks	No. of enrolled students	No. of pertussis patients	Attack rate (%)	No. of patients vaccinated on time (%)
A elementary school	1,009	58	5.7	55 (94.8)
B middle school	526	17	3.2	16 (94.1)
G middle school	490	25	5.1	23 (92.0)
H middle school	596	26	4.4	25 (96.2)
I elementary school	315	20	6.3	20 (100.0)
Sum	2,936	146	5.0	139 (95.4)

Table 3. Vaccination status of pertussis patients by age group (N=355)

Age group	School level/occupation	Total	On-time	Delayed	Incomplete/unvaccinated	Unknown
Children under school age	Childcare center	8 (2.3)	7 (87.5)	1 (12.5)	0 (0.0)	0 (0.0)
	Kindergarten	3 (0.8)	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)
School-age children and adolescents	Elementary school	156 (43.9)	140 (89.7)	11 (7.1)	5 (3.2)	0 (0.0)
	Middle school	112 (31.5)	64 (57.1)	41 (36.6)	6 (5.4)	1 (0.9)
	High school	34 (9.6)	22 (64.7)	7 (20.6)	4 (11.8)	1 (2.9)
Adults	Workers	18 (5.1)	3 (16.7)	1 (5.6)	0 (0.0)	14 (77.8)
	Unemployed	24 (6.8)	1 (4.2)	4 (16.7)	0 (0.0)	19 (79.2)

Values are presented as number (%).

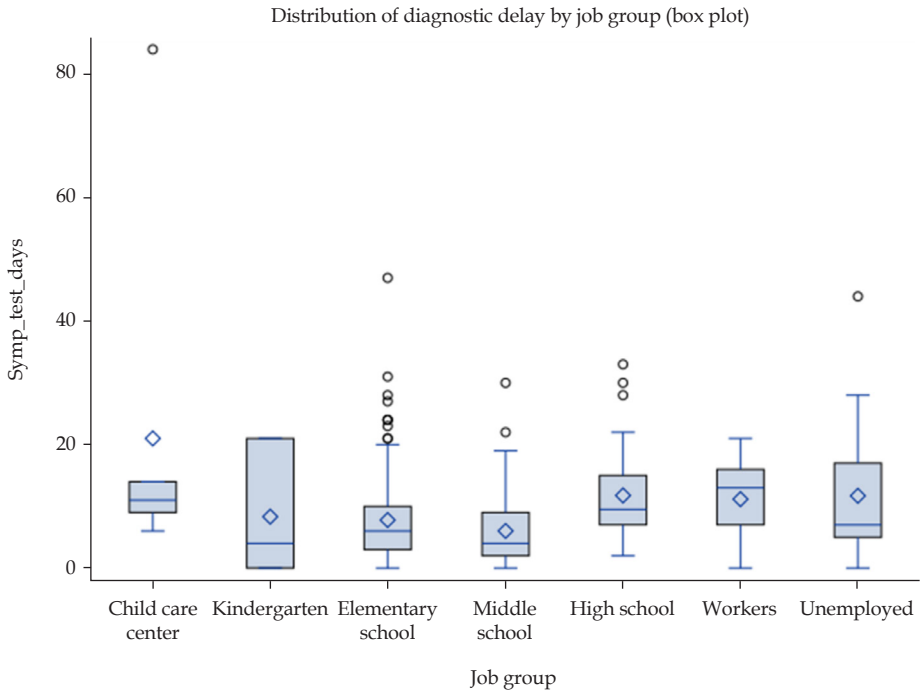

Figure 2. Symptom-to-test interval by school level and occupation. The symptom-to-test interval was defined as the number of days between symptom onset and the test date. The figure presents median values with interquartile ranges among cases with available symptom onset and test dates.

dren (n=3), 6 (3–10) in elementary school students (n=156), 4 (2–9) in middle school students (n=112), 9.5 (7–15) in high school students (n=34), 13 (7–16) in workers (n=18), and 7 (5–17) in unemployed individuals (n=24).

Distributions differed significantly across groups (Kruskal-Wallis $\chi^2=37.117$, degrees of freedom=6, $p<.001$). Detailed Kruskal-Wallis test results are presented in Supplement 8. In DSCF post-hoc comparisons, symptom-to-test delays were longer in high school students than in elementary school students ($p=.015$) and middle school students ($p<.001$), and longer in workers than in middle school students ($p=.011$); childcare center children also showed longer delays than middle school students ($p=.014$), although subgroup sample sizes were small.

DISCUSSION

This study examined the epidemiologic characteristics of the 2024 pertussis resurgence in Guro-gu, Seoul, with a particular focus on transmission patterns in educational settings and delays in testing following symptom onset. The findings indicate that the outbreak was concentrated among school-aged children and adolescents and that clusters were primarily associated with schools and nearby private academies. In addition, symptom-to-test intervals differed across school levels and occupation groups, with longer delays observed among high school students and working adults. These findings provide district-level insights into transmission dynamics and highlight the importance of timely testing and targeted prevention strategies in high-contact educational environments.

Pertussis clusters in this district were primarily identified in educational institutions, including schools and nearby private academies, suggesting that repeated close-contact interactions in these settings may facilitate transmission. Similar school-centered pertussis outbreaks have been documented elsewhere, including outbreaks occurring despite high vaccination coverage, where contact intensity and classroom mixing patterns were considered important contributors [13,14]. A distinguishing feature in our setting was the geographical clustering of schools and private academies within overlapping areas, which may have facilitated repeated exposures across multiple institutions. Enclosed spaces such as classrooms and study rooms may have promoted close contact, and attack rates ranged from 3.2% to 6.3% in affected schools. Although these descriptive findings cannot establish causal determinants, they are compatible with prior outbreak investigations indicating that dense, high-contact educational en-

vironments can amplify transmission once pertussis is introduced [13,14]. This highlights the importance of implementing preventive measures tailored to high-density educational environments to mitigate transmission risks.

Symptom-to-test intervals differed across levels and occupation groups in our analysis. High school students experienced longer delays than elementary and middle school students, and workers also showed prolonged delays. Prior studies have reported that missed opportunities to diagnose pertussis can vary by age and may be more frequent and prolonged among older adolescents and adults, supporting the plausibility of longer delays in these groups [15]. Recent Korean outbreak analyses have also emphasized challenges in promptly identifying and controlling transmission among school-aged populations in 2024 [16]. Together, these findings underscore the importance of timely referral and clear guidance on when and where to obtain pertussis testing for students and working adults in schools, private academies, and workplaces. However, the effectiveness of such approaches in reducing infectious periods or secondary transmission could not be assessed in this study and should be evaluated in future work.

Since October 2023, pertussis activity has re-emerged in Korea, with outbreaks initially reported in Gyeongsangnam-do often involving school-aged children and subsequently spreading nationwide [4,12]. In our district-level investigation, school-aged children and adolescents showed the highest incidence rates, whereas only one case occurred among infants in Guro-gu. This age distribution is consistent with recent reports from the Seoul metropolitan area and national surveillance summaries during the 2023–2024 resurgence [6,12,16]. In contrast to national-level descriptions that necessarily summarize broad patterns, our district data indicate that the 2024 burden was concentrated in interconnected educational settings with high contact intensity, reinforcing the need for timely recognition and control measures focused on schools and nearby private academies.

A high proportion of pertussis cases in our district occurred among vaccinated school-aged individuals. National data indicate that 96.9% of children entering elementary school had received a fifth DTaP vaccination, and 88.2% of children entering middle school had received a sixth Tdap or Td vaccination in 2024. Our findings provide supportive local evidence that many cases occurred despite high coverage; however, because vaccination status among non-cases was unavailable, vaccine effectiveness could not be directly estimated. The high proportion of vaccinated cases raises the possibility that protection against infection may decrease over time in some adolescents and school-aged children, consistent with waning immunity described in prior studies [14,17-19]. These findings highlight the need for continued evaluation of booster timing and vaccine performance in older children and adolescents, particularly in high-contact settings.

We further compared the interval from the sixth booster dose to diagnosis between Tdap and Td recipients and found no significant difference. While this comparison does not permit causal inference regarding comparative effectiveness, it suggests that the current booster strategy and timing may warrant careful re-evaluation, especially given growing evidence that protection may wane over time and vary between individuals [17-19].

Implications for pediatric nursing and school health practice emerge clearly from the school-centered transmission pattern observed in Guro-gu. The epidemic curve showed a term-vacation pattern, with case counts increasing during the school term and decreasing during vacation periods, suggesting that school-based contacts may play an important role in transmission. School health teachers, who maintain routine contact with students, are well positioned to recognize early warning signs during community resurgence. Because pertussis in older children and adolescents may present atypically or as persistent cough, recognition and testing can be delayed. Early and timely referral to clinics capable of pertussis testing may facilitate earlier diagnosis and reduce onward transmission within schools.

School health teachers also play a central role in implementing on-site infection control. Advising symptomatic students to wear masks, reinforcing respiratory etiquette, and coordinating exclusion from school during the recommended isolation period after initiation of appropriate antibiotics are practical measures to reduce exposure opportunities in group settings. In addition, verifying students' immunization histories and counseling families regarding catch-up vaccination or booster recommendations, particularly for students with incomplete vaccination or close contact exposure-may help reduce susceptibility in high-contact environments. Coordinated communication between school health personnel and public health authorities, including early reporting of suspected clusters and cooperation with contact monitoring, can further strengthen timely containment.

The modest increase in incidence among toddlers entering

group settings such as childcare centers and the first pertussis-related infant death reported in November 2024 underscore the vulnerability of young infants and the importance of maintaining protective strategies for high-risk groups [12]. The easing of coronavirus disease 2019 (COVID-19) restrictions in 2024 likely increased social interactions in schools and private academies, potentially creating more opportunities for pertussis transmission. Non-pharmaceutical interventions implemented during the pandemic, such as masking and respiratory hygiene, were associated with reduced transmission of respiratory infections in Korea [20] and may inform practical measures for pertussis control in educational settings. In particular, encouraging symptomatic students to wear masks and strengthening school-based hygiene practices may help mitigate transmission risk [20,21].

Our findings may suggest potential waning protection between booster doses, warranting further evaluation of optimal booster timing in school-aged populations. Whether shorter intervals or optimized booster schedules would improve vaccine effectiveness and reduce transmission requires careful assessment in future studies. The currently recommended interval between the fifth and sixth doses is approximately 5–8 years, and subsequent boosters are recommended every 10 years in Korea [22].

Pertussis epidemics continue to occur worldwide, and waning immunity after vaccination has been proposed as a major contributor to resurgence [17,18]. Our findings, including relatively short intervals between the most recent vaccination and diagnosis among vaccinated cases, are consistent with the need to re-examine booster timing in school-aged children and adolescents [17-19]. Shorter intervals or optimized booster schedules may improve protection in high-contact settings, but such changes require careful evaluation of safety, feasibility, and population-level impact.

Efforts to improve vaccination compliance in adolescents are also important. In our data, compliance decreased beginning in middle school, suggesting that school-based strategies potentially involving collaboration between school health personnel and public health centers could improve booster uptake. Ongoing monitoring of vaccine performance against circulating *B. pertussis strains* and variants remains essential to guide future immunization strategies [23-25].

This study has several limitations. First, although epidemiologic investigation was conducted during outbreaks, we could not estimate the basic reproduction number (R_0). Second, we could not obtain the vaccination status of uninfected students. Therefore, we could not calculate relative risk. Consequently, the ability to evaluate vaccine effectiveness was limited. Third, because this study was based on routinely collected surveillance and epidemiological investigation data, some pertussis cases may have been underreported, particularly those with mild or atypical symptoms. Access to diagnostic testing may also have varied across age groups and occupations, which could have influenced the observed symptom-to-test intervals. In addition, information from epidemiological investigations relied on patient recall and available records and may be incomplete or subject to misclassification. Finally, as this was an observational study, the findings should be interpreted as associations rather than causal relationships.

Moreover, we could not identify the specific mechanisms underlying breakthrough infections. Recent studies have reported circulating *B. pertussis strains* with polymorphisms in the pertussis toxin gene and variants in the pertactin (PRN) gene [23-25]. Continued molecular surveillance and evaluation of vaccine effectiveness against currently circulating strains in Korea are warranted.

Additionally, the marked decrease in pertussis cases during the COVID-19 pandemic suggests that preventive measures designed for COVID-19 could inform strategies for pertussis control. Research focusing on optimizing booster dose schedules and addressing delays in testing (symptom onset-to-test interval) to improve overall disease management is also necessary.

CONCLUSION

The findings from pertussis cases in Guro-gu, Seoul highlight the need for strengthened vaccination strategies and public health measures. Shortening booster intervals, enhancing vaccination adherence, and addressing delays in testing (symptom onset-to-test interval) may contribute to reducing the risk of further outbreaks. Strengthening community education and proactive preventive measures may also help control pertussis and similar infectious diseases. These findings provide practical insights for vaccination strategies and underscores the importance of coordinated public health responses.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: WSH, ECS, HJK. Methodology: all authors. Validation: all authors. Formal analysis: all authors. Investigation: WSH, ECS. Data curation: WSH. Writing–original draft: all authors. Writing–review & editing: WSH, ECS, HJK. Visualization: WSH, ECS. Supervision: ECS, HJK. Project administration: ECS, HJK. Final approval of published version: all authors.

Conflict of interest

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

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Data availability

Please contact the corresponding author (Euncheol Son) for data availability.

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Supplementary material

Supplement 1. Characteristics of pertussis cases by age group in Guro-gu, Seoul, 2016–2024 (N = 369).
Supplement 2. Study cases.
Supplement 3. Pertussis vaccination schedule and vaccine types.
Supplement 4. Pertussis outbreaks from January to September in 2024 in Guro-gu.
Supplement 5. Pertussis vaccination status by dose number (N = 355).
Supplement 6. Frequency of vaccine types by dose number among pertussis patients.
Supplement 7. Comparison of the interval from 6th-dose vaccination to diagnosis by vaccine type (Td vs. Tdap).
Supplement 8. Symptom-to-test days by occupation group (Kruskal-Wallis test results) (N = 355).

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REFERENCES

1. Belcher T, Dubois V, Rivera-Millot A, Locht C, Jacob-Dubuisson F. Pathogenicity and virulence of Bordetella pertussis and its adaptation to its strictly human host. Virulence. 2021;12(1):2608-2632. https://doi.org/10.1080/21505594.2021.1980987
2. Kilgore PE, Salim AM, Zervos MJ, Schmitt HJ. Pertussis: microbiology, disease, treatment, and prevention. Clin Microbiol Rev. 2016;29(3):449-486. https://doi.org/10.1128/CMR.00083-15
3. Kandeil W, van den Ende C, Bunge EM, Jenkins VA, Ceregido MA, Guignard A. A systematic review of the burden of pertussis disease in infants and the effectiveness of maternal immunization against pertussis. Expert Rev Vaccines. 2020;19(7):621-638. https://doi.org/10.1080/14760584.2020.1791092
4. Cho UJ, Kim AR, Park HR, An DH, Yang SG, Kim Y. Report on the Epidemic Investigation of the Pertussis Outbreak in Gyeongsangnam-do, 2023-2024. Public Health Wkly Rep. 2024;17(26):1143-1157. https://doi.org/10.56786/PHWR.2024.17.26.2
5. Kim SH, Lee H, Wi YM, Cho UJ, Lee SE, Ma SH. Transmission dynamics and risk factors for pertussis during the 2023-2024 outbreak in Korea. Vaccine. 2025;64:127726. https://doi.org/10.1016/j.vaccine.2025.127726
6. Lee E, Park B, Kim Y, Kim S, Hwang K. Analysis of pertussis cases in the Seoul Metropolitan area in 2024. Public Health Wkly Rep. 2025;18(41):1495-1509. https://doi.org/10.56786/PHWR.2025.18.41.1
7. Choe YJ, Park YJ, Jung C, Bae GR, Lee DH. National pertussis surveillance in South Korea 1955-2011: epidemiological and clinical trends. Int J Infect Dis. 2012;16(12):e850-e854. https://doi.

org/10.1016/j.ijid.2012.07.012
8. Ko HS, Jo YS, Kim YH, Park YG, Wie JH, Cheon J, et al. Knowledge and acceptability about adult pertussis immunization in Korean women of childbearing age. Yonsei Med J. 2015;56(4):1071-1078. https://doi.org/10.3349/ymj.2015.56.4.1071
9. Kim C, Pae J, Kim WJ, Jang Y, Wie JH, Park IY, et al. Current status of pertussis vaccination during pregnancy and influencing factors in Korea. Taiwan J Obstet Gynecol. 2021;60(2):273-280. https://doi.org/10.1016/j.tjog.2020.12.007
10. Kim C, Yi S, Cho SI. Recent increase in pertussis incidence in Korea: an age-period-cohort analysis. Epidemiol Health. 2021;43:e2021053. https://doi.org/10.4178/epih.e2021053
11. Cho S, Kim DW, Achangwa C, Oh J, Ryu S. Pertussis in the elderly: plausible amplifiers of persistent community transmission of pertussis in South Korea. J Infect. 2024;89(3):106232. https://doi.org/10.1016/j.jinf.2024.106232
12. Kim HJ, Park YJ, Kim D, Lee J, Kim YK, Seo S, et al. Pertussis surveillance and occurrence report in the Republic of Korea: from 2024 to the first half of 2025. Public Health Wkly Rep. 2025;18(43):1631-1651. https://doi.org/10.56786/PHWR.2025.18.43.1
13. Ryu S, Kim JJ, Chen MY, Jin H, Lee HK, Chun BC. Outbreak investigation of pertussis in an elementary school: a case-control study among vaccinated students. Clin Exp Vaccine Res. 2018;7(1):70-75. https://doi.org/10.7774/cevr.2018.7.1.70
14. Huang H, Gao P, Gao Z, Wang L, Hao B, Liu Y, et al. A big pertussis outbreak in a primary school with high vaccination coverage in northern China: an evidence of the emerging of the disease in China. Vaccine. 2018;36(52):7950-7955. https://doi.org/10.1016/j.vaccine.2018.11.009
15. Evans NJ, Arakkal AT, Cavanaugh JE, Newland JG, Polgreen PM, Miller AC. The incidence, duration, risk factors, and age-based variation of missed opportunities to diagnose pertussis: a population-based cohort study. Infect Control Hosp Epidemiol. 2023;44(10):1629-1636. https://doi.org/10.1017/ice.2023.31
16. Chang YH, Chang K, Ju YJ. Epidemiological features of the 2024 pertussis outbreak in Gyeonggi Province, Korea. Epidemiol Health. 2025;47:e2025072. https://doi.org/10.4178/epih.e2025072
17. Domenech de Cellès M, Rohani P. Pertussis vaccines, epidemiology and evolution. Nat Rev Microbiol. 2024;22(11):722-735. https://doi.org/10.1038/s41579-024-01064-8
18. Liu Y, Yu D, Wang K, Ye Q. Global resurgence of pertussis: a perspective from China. J Infect. 2024;89(5):106289. https://doi.org/10.1016/j.jinf.2024.106289
19. Domenech de Cellès M, Magpantay FM, King AA, Rohani P. The impact of past vaccination coverage and immunity on pertussis resurgence. Sci Transl Med. 2018;10(434):eaaj1748. https://doi.org/10.1126/scitranslmed.aaj1748
20. Sim J, Son E, Kwon M, Hwang EJ, Lee YH, Choe YJ. Risk of severe acute respiratory syndrome coronavirus 2 transmission in Seoul, Korea. Infect Chemother. 2024;56(2):204-212. https://doi.org/10.3947/ic.2022.0167
21. Son E, Kim YH. Significant reduction in norovirus outbreaks and secondary transmission of acute gastroenteritis in Seoul schools following the COVID-19 pandemic: a retrospective epidemiological study. J Yeungnam Med Sci. 2025;42:65. https://doi.org/10.12701/jyms.2025.42.65
22. Korea Disease Control and Prevention Agency. Pertussis (DTaP/Tdap/Td): vaccination schedule and method [Internet]. Korea Disease Control and Prevention Agency; 2026 [cited 2026 Jan 23]. https://nip.kdca.go.kr/irhp/infm/goVcntInfo.do?menuCd=1120&menuLv=1
23. Rodrigues C, Bouchez V, Soares A, Trombert-Paolantoni S, Aït El Belghiti F, Cohen JF, et al. Resurgence of Bordetella pertussis, including one macrolide-resistant isolate, France, 2024. Euro Surveill. 2024;29(31):2400459. https://doi.org/10.2807/1560-7917.ES.2024.29.31.2400459
24. de Paula VG, de Sousa RS, da Silva RC, Alves EG, Caetano AR, Ianella P, et al. Fim3-24/ptxP-3 genotype is associated to whooping cough outbreak in Brazilian Midwest: the selection of Bordetella pertussis strains driven by vaccine immunization. Infect Genet Evol. 2024;121:105599. https://doi.org/10.1016/j.meegid.2024.105599
25. Williams MM, Sen K, Weigand MR, Skoff TH, Cunningham VA, Halse TA, et al. Bordetella pertussis strain lacking pertactin and pertussis toxin. Emerg Infect Dis. 2016;22(2):319-322. https://doi.org/10.3201/eid2202.151332

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Rejection parenting style is a key factor associated with child maltreatment during COVID-19 in Indonesia: a cross-sectional study

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Purpose: To investigate the factors contributing to child maltreatment in Indonesia during the COVID-19 (coronavirus disease 2019) pandemic, highlighting the overlooked impact of parenting practices on various maltreatment forms during this unprecedented period.

Methods: Using a cross-sectional design, the research used the ICAST-C (Indonesian version of Child Abuse Screening Tools for Children) tool to assess instances of child maltreatment. The study consisted of 219 high school students from Bekasi and Bandung City in West Java, Indonesia, selected through a stratified proportionate random sampling approach, followed by recruitment and consent procedures. An online questionnaire facilitated data collection, which was analyzed using multivariate logistic regression.

Results: Children experiencing parental rejection were significantly more likely to face violence (adjusted odds ratio [AOR], 2.99; p<.001). Rejection-based parenting was identified as a significant causal factor contributing to psychological maltreatment (AOR, 3.59; p<.001), whereas higher parental education levels directly contributed to increased psychological maltreatment (AOR, 1.99; p=.024). Additionally, rejection significantly influenced physical maltreatment (AOR, 5.17; p<.001) and neglect (AOR, 3.29; p<.001). Interestingly, emotional warmth is also linked to heightened neglect (AOR, 2.29; p=.017). These findings highlight rejection as a critical factor influencing overall child maltreatment (AOR, 6.99; p<.001).

Conclusion: This study establishes a significant causal relationship between parental rejection and various forms of child maltreatment, excluding sexual violence. It emphasizes the need for targeted interventions, such as parenting education and community support, to address parental rejection and promote healthier parenting practices. Longitudinal studies are essential for further exploring these dynamics.

Keywords: Child abuse; Child neglect; COVID-19; Cross-sectional; Parenting

INTRODUCTION

In early 2020, the coronavirus disease 2019 (COVID-19) pandemic fundamentally altered global dynamics, prompting the implementation of social distancing and lockdown measures that effectively curtailed virus transmission [1]. However, these necessary precautions inadvertently heightened the risk of child maltreatment, exposing millions of children to violence and neglect [2]. According to the World Health Organization (WHO), child maltreatment is violent

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and neglecting behavior that occurs against children under the age of 18 years [3]. WHO categorizes violence against children into four main types: physical, emotional or psychological, sexual, and neglect. This categorization is recognized as a standard and has long-term implications for child development. The Indonesian version of Child Abuse Screening Tools for Children (ICAST-C) instrument developed by the International Society for the Prevention of Child Abuse and Neglect adheres to these categories while adding the dimension of exposure to family violence, making it a more comprehensive tool for surveying children's experiences of violence [4]. An estimated 300 million children worldwide experienced various forms of maltreatment during this period, with prevalence rates for physical abuse ranging from 0.1% to 71.2%, psychological abuse from 4.9% to 61.8%, neglect from 7.3% to 40%, and sexual abuse from 1.4% to 19.5% [3,5]. Notably, reports have indicated a significant 94% increase in incidents of child violence during lockdowns [2], leading to profound social and economic consequences. These repercussions include escalating mental health issues and an estimated economic burden of 428 billion US dollars (USD), encompassing both direct and indirect costs [6]. This alarming trend underscores the urgent need for targeted interventions and support systems for affected children and their families.

In Indonesia, reports of child maltreatment surged from 11.055 cases in 2019 to 16.106 cases in 2022, underscoring a critical issue intensified by the constraints of lockdown measures [7]. The increase in child maltreatment during the COVID-19 pandemic aligns with the implementation of stay-at-home measures in March 2020. Prior research in Indonesia has primarily focused on emotional abuse and emotional neglect during the COVID-19 pandemic [8]. While these studies provide essential insights, they often examine these types of maltreatment in isolation and rarely integrate the dimensions of parenting as crucial explanatory factors.

Research conducted in Indonesia during the pandemic has predominantly focused on indirect risk factors, such as economic stress, parental mental health, family dynamics, and mobility restrictions, rather than on child maltreatment itself [8]. As a result, empirical evidence specifically examining child maltreatment within this context remains limited. Parenting practices serve as a vital yet underexplored mechanism that connects pandemic-related stressors to incidents of maltreatment [9]. In addition, parental emotional support has been widely recognized as a key protective factor influencing adolescents' psychological and behavioral outcomes [10]. However, its role in child maltreatment, particularly under pandemic-related stress, remains insufficiently explored. Existing Indonesian studies have primarily contrasted supportive versus hindered parenting or authoritative versus authoritarian styles, illustrating their relationships with parental stress and the children's emotional and behavioral challenges. Notably, Indonesian parents tend to exhibit a stronger inclination toward authoritarian parenting than their Western counterparts, a trend associated with higher levels of parenting stress and poorer outcomes for children [11].

Authoritarian parenting is strict and hindered parenting is constrained, whereas rejection parenting is marked by emotional withdrawal, hostility, and a lack of warmth and may be more directly related to child maltreatment. However, it remains underexplored as a distinct construct, particularly in crisis contexts such as the COVID-19 pandemic. To fill this gap, the present study aims to simultaneously examine multiple types of child maltreatment among adolescents aged 10–19 while investigating rejection parenting as a significant associated factor in the Indonesian context during the pandemic. By employing validated instruments and focusing on culturally specific parenting practices, this study endeavors to provide new empirical evidence that enriches the existing body of Indonesian research on child maltreatment and parenting.

METHODS

Ethical statements: This study was approved by the Ethics Committee of the Universitas Indonesia (approval number: SK-60/UN2.F12.D1.2.1/ETIK2021). All participants provided informed consent.

1. Research Design

A cross-sectional descriptive-analytic study was conducted to explore the factors associated with child maltreatment during the COVID-19 pandemic. This research seeks to shed light on the complexities of child welfare in these challenging times. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2. Population and Samples

This study population consisted of high school adolescents

in Bandung and Bekasi, West Java, Indonesia. The sample included 219 students selected using stratified proportionate random sampling to enhance representativeness and minimize selection bias. Participants were deemed eligible based on several criteria: they must be registered high school students aged 10–19 years, possess a device for completing online forms, provide informed consent for participation, and demonstrate adequate literacy skills. The exclusion criteria included individuals who started but did not complete the questionnaire, as well as those who had interacted with their parents or caregivers for less than six months. This careful selection process ensured a representative sample for the study.

The sample size was determined using G*Power ver. 3.1.9.7 (Z test for logistic regression; Heinrich-Heine-Universität Düsseldorf) based on an expected odds ratio of 2.06 for recent parental violence and outcome prevalence of 40% derived from prior research [12]. We set the significance level (α) at .05 and the desired power (1–β) at .95, and the minimum sample was 199 participants. After adding 10% to account for potential non-response or incomplete data, the final target sample size was 219 participants to ensure the validity of the analysis conducted.

3. Measurements

1) Demographic and health characteristics

The researchers developed a structured digital questionnaire to collect demographic information, including the characteristics of parents, children, and the environment. Child characteristics include age, gender, education level, and disability status. Parent characteristics included age, education level, parenting style, and parental emotional support. Additionally, environmental characteristics covered residence and ethnicity.

2) Emotional support

Emotional support was evaluated through eight statements modified from existing studies, prompting participants to express their perceptions using a code system of "almost always" (2), "sometimes" (1), and "almost never" (0). Higher scores correspond to greater perceived parental emotional support [10,13]. Scores are categorized to enhance interpretation, being labeled as "good" if they meet or exceed the mean value and "poor" if they fall below this threshold. This classification aids in understanding performance levels more clearly. This tool was examined for legibility by two experts in the field of pediatric nursing and was tested at one of the senior high schools in Bandung City. The Cronbach's alpha was .78, meaning that the reliable value of this tool was strong.

3) Parenting style

The Short Egna Minnen Beträffande Uppfostran (s-EMBU) consists of 23 items aimed at assessing adolescents' perceptions of different parental styles, focusing on rejection, warmth, and overprotection, using a 4-point Likert scale for ratings. The s-EMBU, a shortened version of the original EMBU, consists of 23 items focusing on three dimensions: rejection (items 1, 4, 7, 13, 15, 16, 21), warmth (items 2, 6, 12, 14, 19, 23), and overprotection (remaining items) [14]. The predominant parenting style was determined by assessing whether the average score met or exceeded the mean ("yes") or fell below it ("no"), thereby facilitating interpretation. In this study, Cronbach's alpha was .74.

4) Child maltreatment

Child maltreatment was assessed using the ICAST-C, developed by the International Society for the Prevention of Child Abuse and Neglect (ISPCAN). The Indonesian version includes 59 items covering five domains: exposure to violence (seven items), physical violence (18 items), psychological violence (19 items), neglect (11 items), and sexual violence (four items), with responses measured on a 5-point Likert scale and categorized using median cutoffs. This instrument has already been translated into Indonesian and has been validity tested. The results had a Spearman score of >0.30, which indicates that they are valid. A reliability test using Cronbach's alpha formula with an alpha score resulted in >.70, which is considered reliable. Notably, the exposure to violence domain captures indirect experiences of interpersonal and community violence, offering a broader ecological perspective [15].

Before data collection, the researcher translated all English instruments into Indonesian with the original author's permission. To minimize information bias, tested questionnaires were used. Reliability testing was performed in April 2021 at a senior high school in Bandung City (no part of the study sample). The link to the instrument(s) used in this study is provided below: https://bit.ly/kuesionerfaktorCM-Covid19.

4. Data Collection

The data was collected between May and June 2021 from eight secondary schools located in Bandung and Bekasi, West Java, areas identified as having relatively high reported rates of child maltreatment in late 2020 and early 2021 [16]. School selection was initially conducted using a stratified random sampling approach based on city-level distribution, drawing on official records from The Ministry of Education [17]. Among the 112 eligible junior and senior high schools identified across both cities, 17 schools were proportionally selected (four schools in Bandung and 13 in Bekasi) using a computer-assisted randomization procedure (https://spinthewheel.io/) (Figure 1). However, during the recruitment and consent process, several schools declined participation or were unreachable, resulting in a final sample of eight schools (three schools in Bandung and five in Bekasi). Consequently, the analyzed sample did not fully retain the original proportional allocation. Despite this, the final sample included both public and private schools, ensuring variation in institutional characteristics. This process highlights both the structured sampling strategy employed and the practical challenges of institutional recruitment in real-world settings. The potential impact of differential attrition, particularly in Bekasi, was considered during data interpretation and is acknowledged as a limitation of the study.

Following approval from school officials, the principal investigator randomly selected classes and developed communication messages using electronic media that provided a brief explanation of the study, the inclusion criteria, a link to a video tutorial for completing the questionnaire, and a link to the digital Google Forms questionnaire (Google LLC). With the support of selected class teachers, the investigator distributed the questionnaire to students with odd-numbered attendance, who were identified by marking a yellow dot next to their names. Students were provided with a clear explanation of the study purpose, procedures, and their rights prior to participation. The questionnaire was completed during school recess in a supportive environment to minimize potential discomfort, requiring approximately 30 minutes. A total of 266 responses were received, with 239 participants agreeing to take part. After excluding seven respondents who did not meet the inclusion criteria, seven with incomplete questionnaires, and six duplicate submissions, 219 valid responses were included in the final analysis. Sensitivity analyses confirmed that the missing data did not significantly impact the estimates.

5. Data Analysis

Descriptive statistics summarized the participant characteristics, while chi-square tests and Fisher's exact test assessed the associations in the categorical data. Bivariate analyses were conducted to inform covariate selection for the multivariate logistic regression model. Variables showing relevant bivariate associations with *p*-values less than .25 and possessing theoretical relevance (including parenting style and emotional support) were included to control for confounding factors [18]. These variables were selected based on prior literature demonstrating their influences on child maltreatment outcomes [10,19]. This selection aimed to prevent the premature exclusion of potentially meaningful predictors in the multivariate modeling process. An assessment of multicollinearity was conducted using variance inflation factor and tolerance values, resulting in the exclusion of variables exceeding the specified thresholds. Sexual violence was omit-

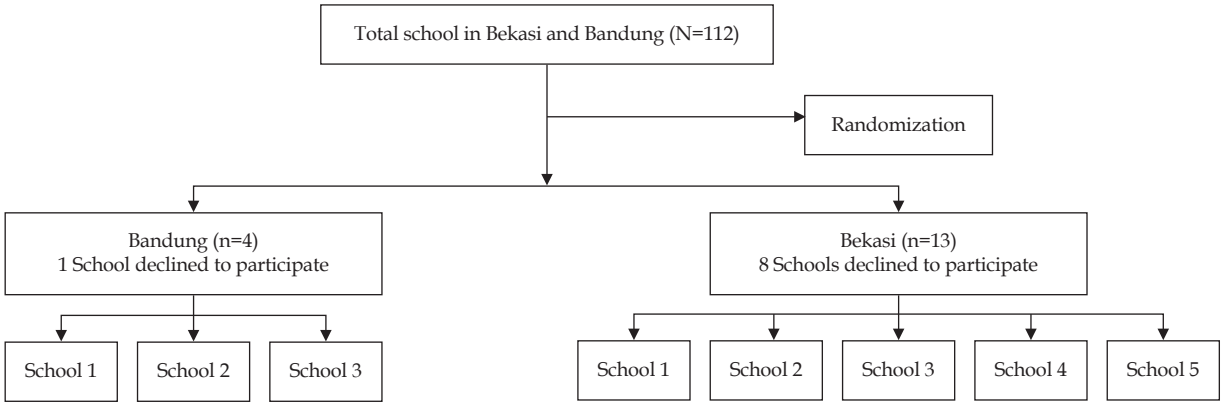

Figure 1. The randomization process for the schools.

ted from multivariate analysis due to a lack of statistically significant associations in the bivariate analysis, thereby failing to meet the inclusion criteria. The finalized variables associated with each outcome are presented in Table 1.

Multivariate logistic regression analyses were conducted to examine the effects of demographic, health, emotional support, and parenting style factors on child maltreatment. Distinct models were specified for each type of maltreatment, with covariates selected according to their relevance to the specific outcome. As a result, adjusted odds ratios (AORs) are not directly comparable across outcomes. Model results are presented as B coefficients, AOR, and 95% confidence intervals (CI) while controlling for confounders like parental education. The AOR indicates model strength and suitability, refining the results after adjusting for various factors. All analyses were conducted using IBM SPSS ver. 23.0 (IBM Corp.). Ethical clearance for this study was obtained from the university ethics committee. All participants received written information about the study and provided informed consent before participation. Relevant local site authorities granted additional approval to meet institutional research governance requirements.

6. Ethical Considerations

In conducting this research, several ethical considerations were prioritized to ensure the integrity and welfare of the participants. Participants were assured of the confidentiality and anonymity of their responses and had the option to withdraw from the study at any time without any repercussions. To acknowledge their time and effort, participants received a mobile data allowance as a token of appreciation.

RESULTS

1. Demographic Characteristics of the Participants

A total of 219 students participated in the study, with a mean age of 15.0 years. The participants were relatively balanced in terms of age, gender, and education level. Most parents were aged 44.88 years or older, and over half had a low level of education. The majority of participants were primarily from Bekasi and non-Sundanese ethnic groups. The demographic and participant characteristics are detailed in Supplement 1.

Table 1. Most dominant factors associated with child maltreatment during the COVID-19 pandemic

Variable: independent	Variable: dependent	
	AOR (95% CI for OR)	*p*
Exposure to violence		
Parents' emotional support (ref: no)	1.60 (0.87–2.95)	.130
Parenting style: rejection (ref: no)	2.99 (1.65–5.44)	< .001***
Parenting style: emotional warmth (ref: no)	1.60 (0.89–2.89)	.119
Constant	0.28	< .001
Psychological maltreatment		
Parents' education level (ref: low)	1.99 (1.09–3.65)	.024*
Parents' emotional support (ref: no)	1.62 (0.89–2.96)	.118
Parenting style: rejection (ref: no)	3.59 (1.97–6.58)	< .001***
Constant	0.22	< .001
Physical maltreatment		
Parents' emotional support (ref: no)	1.46 (0.79–2.71)	.228
Parenting style: rejection (ref: no)	5.17 (2.75–9.72)	< .001***
Constant	0.23	< .001
Neglect		
Parenting style: rejection (ref: no)	3.29 (1.65–6.59)	< .001***
Parenting style: emotional warmth (ref: no)	2.29 (1.16–4.51)	.017*
Constant	0.12	< .001
Child maltreatment		
Parenting style: rejection (ref: no)	6.99 (3.74–13.07)	< .001***
Parenting style: emotional warmth (ref: no)	1.42 (0.76–2.66)	.270
Constant	0.31	< .001

COVID-19, coronavirus disease 2019; AOR, adjusted odds ratio; CI, confidence interval; OR, odds ratio; Ref, reference.
*p<.05. ***p<.001.

2. Descriptive Statistics of Emotional Support, Parenting Style, and Child Maltreatment

Parental emotional support was generally supported as inadequate. Emotional warmth was the most commonly perceived parenting style, followed by rejection and overprotection. Approximately half of the participants reported experiencing some form of child maltreatment, with varying prevalence across types (Supplement 1).

3. Differences in Child Maltreatment Events by Child and Parent Characteristics during COVID-19

Overall, most child and parent demographic characteristics were not significantly associated with child maltreatment outcomes. By contrast, parental emotional support and parenting style exhibited consistent associations with multiple maltreatment outcomes. Children with poor emotional support were significantly more likely to experience violence exposure, psychological maltreatment, physical maltreatment, and neglect than those reporting adequate support ($p = .002$, $p = .002$, $p = .004$, $p < .001$).

Rejection-based parenting emerged as the strongest correlate of violence exposure, psychological maltreatment, physical maltreatment, and neglect. Children exposed to rejection-based parenting had markedly higher rates of violence exposure, psychological maltreatment, physical maltreatment, and neglect than those not exposed (all $p < .001$).

Conversely, emotional warmth appeared protective. Children raised with emotional warmth experienced significantly lower levels of violence exposure, neglect, and overall maltreatment ($p = .009$, $p = .002$, $p = .002$). Higher parental education was associated with reduced psychological maltreatment ($p = .004$). No significant associations were observed between any child or parental characteristic and sexual maltreatment. Detailed statistical results are presented in Supplements 1 and 2.

4. Factors Associated with Child Maltreatment during the COVID-19 Pandemic

To account for outcome-specific determinants, each type of child maltreatment was analyzed using a separate multivariate logistic regression model that included independent variables relevant to that specific outcome. Consequently, adjusted AOR are not directly comparable across outcomes, and differences in effect sizes across models should be interpreted with caution.

The analysis revealed a significant causal relationship between rejection-based parenting and an increased likelihood of violence exposure among children, with an AOR of 2.99 (95% CI, 1.65–5.44; $p < .001$). In contrast, emotional support and warmth did not exert a significant effect on exposure to violence during the pandemic (AOR, 1.60; 95% CI for OR, 0.87–2.95; $p = .130$ and AOR, 1.60; 95% CI for OR, 0.89–2.89; $p = .119$), respectively, indicating their limited influence on violence exposure. Moreover, psychological maltreatment identified rejection-based parenting as a key influence. Children experiencing rejection were much more likely to face psychological maltreatment during the pandemic (AOR, 3.59; 95% CI for OR, 1.97–6.58; $p < .001$). The educational level of parents also emerged as a significant factor influencing psychological maltreatment (AOR, 1.99; 95% CI, 1.09–3.65; $p = .024$), whereas emotional support did not show a significant effect (AOR, 1.62; 95% CI, 0.89–2.96; $p = .118$).

Furthermore, rejection-based parenting was linked to an increased risk of physical maltreatment, with children facing rejection having nearly 5 times higher adjusted odds (AOR, 5.17; 95% CI for OR, 2.75–9.72; $p < .001$). Emotional warmth did not significantly influence physical maltreatment (AOR, 1.46; 95% CI for OR, 0.79–2.71; $p = .228$). Regarding neglect, rejection parenting also showed a significant association, with children experiencing rejection being approximately 3 times more likely to face neglect (AOR, 3.29; 95% CI for OR, 1.65–6.59; $p < .001$). Emotional warmth was similarly associated with neglect (AOR, 2.29; 95% CI for OR, 1.16–4.51; $p = .017$), consistent with the findings for rejection-based parenting.

The analysis underscored the strong causal link between rejection-based parenting and a heightened risk of overall child maltreatment, with children subjected to rejection exhibiting nearly 7 times higher adjusted odds (AOR, 6.99; 95% CI, 3.74–13.07; $p < .001$). In contrast, emotional warmth did not demonstrate a significant influence on maltreatment (AOR, 1.42; 95% CI, 0.76–2.66; $p = .270$), suggesting that its independent impact was negligible in this context (as shown in Table 1).

DISCUSSION

The pandemic has substantially reshaped parenting practices, intensifying both nurturing behaviors and psychologi-

cal strain among caregivers. While some parents demonstrated increased emotional responsiveness, heightened stress and anxiety undermined adaptive parenting in others. Negative parenting characterized by emotional disengagement and rejection has been consistently associated with impaired psychological development and poorer mental health outcomes in children, manifesting in coldness and unaffectionate behavior, hostility and aggression, indifference and neglect, and undifferentiated rejection [20]. Each of these forms can have harmful effects on a child's emotional well-being. Research indicates that parental exhaustion and fear regarding COVID-19 exposure contribute to significant stress, potentially disrupting adaptive changes in the maternal brain. This impairment can hinder stress regulation and diminish maternal motivation [21]. Parents with adverse childhood experiences are more likely to exhibit rejecting behaviors due to heightened stress levels [22]. This cyclical pattern of stress and rejection can create an environment in which children are at risk of exposure to violence and psychological maltreatment. Mothers with a history of childhood emotional abuse tend to experience elevated perceived stress that fully mediates the increase in parental load, which in turn places additional emotional strain on the child and contributes to poorer mental health outcomes, forming a unidirectional chain of association [23].

Parental rejection is also linked to maladaptive coping mechanisms, which significantly impact the children's psychological adjustment, particularly when such rejection is perceived as a form of violence [24]. High rates of maternal and paternal rejection correlate with increased internalizing problems in children, and the COVID-19 pandemic has exacerbated these existing issues, increasing the risks of abuse due to limited oversight, heightened stress, and parental fatigue [25]. Consistent with these broader changes, this study found a significant association between parental rejection and physical abuse, highlighting a cyclical pattern where emotional outbursts lead to physical discipline as a maladaptive coping mechanism. This cycle can perpetuate a cycle of violence, where children learn that aggression is an acceptable response to stress or frustration.

This study reveals a significant association between parental education levels and psychological maltreatment during the pandemic. Notably, higher education was correlated with an increase in psychological maltreatment. Highly educated parents often maintain demanding jobs and hold elevated expectations regarding their children's academic and behavioral performance. The transition to homeschooling heightened these pressures, leading to increased parental stress when children struggled to meet these demands [26]. As stress accumulates, parents may exhibit maladaptive behaviors, such as verbal hostility or emotional neglect. The compounded lack of social support and prolonged isolation during this period intensified these challenges, highlighting the complex interplay between parental education, occupational demands, and psychological maltreatment in crisis contexts [27].

This study found a counterintuitive association between emotional warmth and child neglect, indicating that children receiving higher levels of emotional warmth were associated with higher odds of experiencing neglect. Typically viewed as a protective parenting dimension, the concept of emotional warmth can vary culturally [28]. This counterintuitive finding may be interpreted through several contextual lenses. This aligns with the theory by Baumrind et al. [29], which categorizes parenting styles into three types for neurotypical children: passive (high warmth and low control), authoritarian (low warmth and high control), and authoritative (high warmth and high control). The parenting style selected by caregivers is closely linked to various aspects of child development, highlighting the intricate balance needed in parenting dynamics [29].

Another explanation is that emotional warmth, when lacking adequate parental monitoring and structure, can result in permissive parenting. Parents who express warmth while adopting an indulgent style may inadvertently foster negative outcomes, including emotional and behavioral problems, as well as increased vulnerability to risky behaviors in children and adolescents. This association highlights that high scores in emotional warmth may co-exist with unmet physical and supervisory needs, emphasizing the necessity of structure and monitoring alongside warmth to prevent neglect [30].

This study identified parental rejection as a key factor associated with overall child maltreatment during the COVID-19 pandemic in Indonesia. Increasing stressors, such as social isolation, financial difficulties, health concerns, and the challenges associated with homeschooling, indicate potential risks for maltreatment [31]. These stressors can contribute to maladaptive coping strategies among parents, leading to physical or psychological aggression against their children [26]. The pandemic has inevitably shifted family dynamics, amplifying abusive parenting, particularly in households facing marital discord or financial strife.

Cultural and contextual factors significantly contribute to the differences observed in parenting styles. Societal norms and expectations surrounding child-rearing practices may influence rejective parenting, characterized by emotional neglect and hostility. In some cultures, strict parenting styles may be perceived as acceptable or even necessary for child discipline [32], which can further complicate the dynamics of parental rejection and maltreatment.

Several limitations of this study include the absence of a pre-pandemic comparison, highlighting the need for future longitudinal research to investigate temporal differences. Additionally, the limited number of significant factors for neglect and sexual maltreatment must be interpreted with caution. Underreporting is a likely factor, particularly in self-reported surveys on sensitive topics. Sexual maltreatment is often less disclosed due to fear, stigma, and social desirability bias. In Eastern cultural contexts, strong norms surrounding taboos and shame can further inhibit open discussion, especially when such experiences are seen as dishonorable. These cultural influences may alter the understanding of neglect, leading individuals to normalize or downplay experiences that would typically qualify as maltreatment. In addition, measurement limitations, such as brief screening tools and reliance on retrospective accounts, can diminish variability and weaken associations in the analysis. Collectively, these factors likely explain the weaker correlations for neglect and sexual maltreatment compared to other forms, underscoring the necessity of culturally sensitive measurement techniques and mixed-method approaches in future studies. Furthermore, differential attrition of schools during recruitment may have introduced selection bias, as the final sample did not fully retain the initial proportional distribution.

During the COVID-19 pandemic, evidence-based programs for preventing child maltreatment were transitioned to digital formats. Home-visiting initiatives like SafeCare (National SafeCare Training and Research Center, Georgia State University) and Family Connects (Center for Child and Family Policy, Duke University) managed to maintain engagement through telehealth, achieving results similar to those of traditional methods [33]. To minimize parental resistance, it is essential to enhance parental efficacy, customize interventions, culturally adapt content, and promote supportive communication [34].

In Indonesia, these strategies can be implemented through existing systems. School-based counseling, health units such as UKS (Usaha Kesehatan Sekolah), and school nurses or teachers can identify and assist parents who exhibit high levels of rejection parenting. Parenting education programs delivered through schools, models of school-family collaboration, and community or school-based interventions are practical solutions for improving parenting practices. Indonesian child protection services, such as KPAI (Komisi Perlindungan Anak Indonesia), provide a policy framework to bolster these initiatives. Local research indicates that parenting education and family-centered interventions effectively lower the risk of child maltreatment and enhance parental self-efficacy [35]. Collectively, these approaches offer accessible and culturally relevant pathways to reduce rejection parenting and improve child well-being in Indonesia.

CONCLUSION

This study found a significant causal effect of parental rejection on various forms of child maltreatment, excluding sexual violence. Additionally, higher levels of parental education were associated with an increase in psychological maltreatment, whereas greater emotional warmth contributed to elevated neglect.

These findings emphasize the urgent need for context-specific interventions, such as parenting education, school-family collaboration, and community support programs, to reduce parental rejection and foster healthy parenting practices. Future research using longitudinal designs is necessary to explore the long-term dynamics between parental rejection and child maltreatment. Examining socioeconomic factors related to negative parenting behaviors will be crucial in developing effective prevention strategies and policy initiatives to enhance child well-being in Indonesia. Incorporating mixed-method research will also yield deeper insights into the complexities surrounding sexual violence.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: RA, NN. Methodology: RA, NN, NA. Data collection: RA. Formal analysis: RA, MHH. Investigation: RA, MHH. Validation: RA, MHH. Funding acquisition: NN, RA. Project administration: RA. Supervision: NN, NA, FTW. Writing–original draft: RA. Writing–review and editing: all authors. Final approval of the published version: all authors.

Conflict of interest

There are no potential conflicts of interest regarding this research. This research is based on the results of a graduate thesis titled "Analysis of factors associated with child maltreatment during the COVID-19 pandemic" submitted to Universitas Indonesia. The author used Poe in the writing process to improve readability and remove grammatical errors. However, we took full responsibility for the content.

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Data availability

The data generated from this research will be made available upon reasonable request to ensure transparency and facilitate further academic inquiry. The underlying datasets, including the responses collected via the digital questionnaire, will be securely stored and maintained in accordance with ethical guidelines. Access to the data will be granted to qualified researchers who seek to replicate the study or explore related areas of inquiry, provided that appropriate measures are taken to safeguard participant confidentiality and anonymity.

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AI use disclosure

The authors declare that AI-based language models (Trinka AI dan Poe) were used solely for grammar and language editing. The manuscript also underwent human proofreading. All scientific content, interpretation, and conclusion 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. Participant characteristics and differences in exposure to violence, psychological and physical maltreatment according to child and parent characteristics during the COVID-19 pandemic (N = 219).

Supplement 2. Differences in neglect, sexual and child maltreatment according to child and parent characteristics during the COVID-19 pandemic (N = 219).

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REFERENCES

1. Li L, Taeihagh A, Tan SY. A scoping review of the impacts of COVID-19 physical distancing measures on vulnerable population groups. Nat Commun. 2023;14(1):599. https://doi.org/10.1038/s41467-023-36267-9
2. Babvey P, Capela F, Cappa C, Lipizzi C, Petrowski N, Ramirez-Marquez J. Using social media data for assessing children's exposure to violence during the COVID-19 pandemic. Child Abuse Negl. 2021;116(Pt 2):104747. https://doi.org/10.1016/j.chiabu.2020.104747
3. World Health Organization. Child maltreatment [Internet]. WHO; 2022 [cited 2025 Aug 20]. Available from: https://www.who.int/news-room/fact-sheets/detail/child-maltreatment
4. International Society for the Prevention of Child Abuse and Neglect (ISPCAN). ICAST-C tool: a child instrument for children over 11 years of age [Internet]. ISPCAN; 2022 [cited 2025 Aug 20]. Available from: https://ispcan.org/ispcan-resources/library/icast/
5. Zhang X, Wekerle C, Mathews B, Gonzalez A. Child maltreatment. In: Howard S, Markey CH, editors. Encyclopedia of mental health. 3rd ed. Elsevier; 2023. p. 355-364.
6. Afifi TO, Taillieu T, Salmon S, Davila IG, Stewart-Tufescu A, Fortier J, et al. Adverse childhood experiences (ACEs), peer victimization, and substance use among adolescents. Child Abuse Negl. 2020;106:104504. https://doi.org/10.1016/j.chiabu.2020.104504
7. Ministry of Women's Empowerment and Child Protection of the

Republic of Indonesia. Basis & period [Internet]. KEMENPPPA; 2022 [cited 2025 Aug 20]. Available from: https://kekerasan.kemenpppa.go.id/ringkasan

8. Ramaiya A, Li M, Muluve E, Zuo X, Stones W, Mafuta E, et al. Understanding whether economic instability and food insecurity during COVID-19 moderate the change in emotional abuse and emotional neglect over time: a longitudinal pre- and during COVID-19 analysis from China, Democratic Republic of Congo, Indonesia, and Malawi. J Adolesc Health. 2024;75(6S):S14-S23. https://doi.org/10.1016/j.jadohealth.2024.09.002
9. El-Khani A, Yassine A, Haar K, Narotama N, Pramitasari L, Rosilawati M, et al. Caring for your child during COVID-19: utilizing a light-touch parenting resource during lockdown in Indonesia. Int J Environ Res Public Health. 2022;19(7):4046. https://doi.org/10.3390/ijerph19074046
10. Grunin L, Yu G, Cohen SS. The relationship between youth cyberbullying behaviors and their perceptions of parental emotional support. Int J Bullying Prev. 2021;3(3):227-239. https://doi.org/10.1007/s42380-020-00080-5
11. Riany YE, Haslam DM, Sanders M. Parental mood, parenting style and child emotional and behavioural adjustment: Australia-Indonesia cross-cultural study. J Child Fam Stud. 2022;31(9):2331-2343. https://doi.org/10.1007/s10826-021-02137-5
12. Calvano C, Engelke L, Holl-Etten AK, Renneberg B, Winter SM. Almost 2 years into the COVID-19 pandemic: an update on parental stress, parent mental health, and the occurrence of child maltreatment. Eur Child Adolesc Psychiatry. 2023;32(12):2593-2609. https://doi.org/10.1007/s00787-023-02147-2
13. Iannotti RJ. Health Behavior in School-Aged Children (HBSC), 2009-2010. Inter-university Consortium for Political and Social Research; 2013. https://doi.org/10.3886/ICPSR34792.v1
14. Arrindell WA, Akkerman A, Bagés N, Feldman L, Caballo VE, Oei TP, et al. The short-EMBU in Australia, Spain, and Venezuela. Eur J Psychol Assess. 2005;21(1):56-66. https://doi.org/10.1027/1015-5759.21.1.56
15. Dhamayanti M, Rachmawati AD, Noviandhari A. Validity and reliability update of the Indonesian version of International Society for Prevention of Child Abuse and Neglect-Child Abuse Screening Tool (ICAST-C). Paediatr Indones. 2020;60(4):218-223. https://doi.org/10.14238/pi60.4.2020.218-23
16. Bekasi City Office for Women's Empowerment and Child Protection (DPPPA). Data on the Bekasi Children's Forum 2021 [Internet]. DPPPA; 2021 [cited 2025 Aug 20]. Available from: https://dpppa.bekasikota.go.id/id/forum
17. Ministry of Education Culture, Research and Technology-Republic Indonesia. Data Pokok Pendidikan (DAPODIK): Direktorat Jenderal Pendidikan Anak Usia Dini, Pendidikan Dasar dan Pendidikan Menengah [Basic Education Data (DAPODIK): Directorate General of Early Childhood Education, Primary Education, and Secondary Education] [Internet]. Ministry of Primary and Secondary Education; 2021 [cited 2025 Aug 20]. Available from: https://dapo.kemendikdasmen.go.id/
18. Plichta SB, Kelvin EA. Munro's statistical methods for health care research. Wolters Kluwer Health/Lippincott Williams & Wilkins; 2013.
19. Zephyr L, Cyr C, Monette S, Langlois V, Cyr-Desautels L, Archambault M. Disinhibited social engagement behaviors in young maltreated children: dysfunctional behavior of biological parents and child attachment. Child Abuse Negl. 2021;111:104791. https://doi.org/10.1016/j.chiabu.2020.104791
20. Putnick DL, Bornstein MH, Lansford JE, Malone PS, Pastorelli C, Skinner AT, et al. Perceived mother and father acceptance-rejection predict four unique aspects of child adjustment across nine countries. J Child Psychol Psychiatry. 2015;56(8):923-932. https://doi.org/10.1111/jcpp.12366
21. Kim P. How stress can influence brain adaptations to motherhood. Front Neuroendocrinol. 2021;60:100875. https://doi.org/10.1016/j.yfrne.2020.100875
22. Narayan AJ, Lieberman AF, Masten AS. Intergenerational transmission and prevention of adverse childhood experiences (ACEs). Clin Psychol Rev. 2021;85:101997. https://doi.org/10.1016/j.cpr.2021.101997
23. Rost K, Gossmann E, Fegert JM, Ziegenhain U, Köhler-Dauner F. Long-term consequences of childhood emotional abuse in mothers on parental load and child mental health. Acta Psychol (Amst). 2024;244:104169. https://doi.org/10.1016/j.actpsy.2024.104169
24. Chen C, Qin J. Emotional abuse and adolescents' social anxiety: the roles of self-esteem and loneliness. J Fam Violence. 2020;35(5):497-507. https://doi.org/10.1007/s10896-019-00099-3
25. Katz I, Katz C, Andresen S, Bérubé A, Collin-Vezina D, Fallon B, et al. Child maltreatment reports and Child Protection Service responses during COVID-19: knowledge exchange among Australia, Brazil, Canada, Colombia, Germany, Israel, and South Africa. Child Abuse Negl. 2021;116(Pt 2):105078. https://doi.org/10.1016/j.chiabu.2021.105078
26. Wu Q, Xu Y. Parenting stress and risk of child maltreatment during the COVID-19 pandemic: a family stress theory-informed perspective. Dev Child Welf. 2020;2(3):180-196. https://doi.org/10.1177/2516103220967937
27. Calvano C, Engelke L, Di Bella J, Kindermann J, Renneberg B, Winter SM. Families in the COVID-19 pandemic: parental stress, parent mental health and the occurrence of adverse childhood experienc-

es-results of a representative survey in Germany. Eur Child Adolesc Psychiatry. 2022;31(7):1-13. https://doi.org/10.1007/s00787-021-01739-0

28. Rothenberg WA, Lansford JE, Bornstein MH, Chang L, Deater-Deckard K, Di Giunta L, et al. Effects of parental warmth and behavioral control on adolescent externalizing and internalizing trajectories across cultures. J Res Adolesc. 2020;30(4):835-855. https://doi.org/10.1111/jora.12566
29. Baumrind D, Larzelere RE, Owens EB. Effects of preschool parents'power assertive patterns and practices on adolescent development. Parenting. 2010;10(3):157-201. https://doi.org/10.1080/15295190903290790
30. Cui M, Graber JA, Metz A, Darling CA. Parental indulgence, self-regulation, and young adults' behavioral and emotional problems. J Fam Stud. 2019;25(3):233-249. https://doi.org/10.1080/13229400.2016.1237884
31. Lee SJ, Ward KP, Lee JY, Rodriguez CM. Parental social isolation and child maltreatment risk during the COVID-19 pandemic. J Fam Violence. 2022;37(5):813-824. https://doi.org/10.1007/s10896-020-00244-3
32. Haslam D, Poniman C, Filus A, Sumargi A, Boediman L. Parenting style, child emotion regulation and behavioral problems: the moderating role of cultural values in Australia and Indonesia. Marriage Fam Rev. 2020;56(4):320-342. https://doi.org/10.1080/01494929.2020.1712573
33. Self-Brown S, Reuben K, Perry EW, Bullinger LR, Osborne MC, Bielecki J, et al. The impact of COVID-19 on the delivery of an evidence-based child maltreatment prevention program: understanding the perspectives of SafeCare® providers. J Fam Violence. 2022;37(5):825-835. https://doi.org/10.1007/s10896-020-00217-6
34. Jocson RM, Alampay LP, Lachman JM, Maramba DH, Melgar ME, Ward CL, et al. Pre-post mixed methods study of a parent and teen support intervention to prevent violence against adolescents in the Philippines. J Adolesc Health. 2023;73(1):102-109. https://doi.org/10.1016/j.jadohealth.2023.02.027
35. Lestari L, Ramadhaniyati R, Saito R, Tsuda A. Parental perspectives on the maltreatment of children with autism spectrum disorder and associated factors: a cross-sectional study in Indonesia. J Res Dev Nurs Midwifery. 2025;22(2):39-43. https://doi.org/10.61882/jgbfnm.22.2.39

Instructions to Authors

CHNR
Child Health Nursing Research

Child Health Nursing Research
Enacted in April 2006, and most recently revised in November 2024 and, applied from Vol. 31, No. 1 (2025 January)

I. Aim and Scope

Child Health Nursing Research (CHNR) aims to promote the health, development, and well-being of children and their families in Korea and all over the world by disseminating 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 publishes articles that address research, theory, and practice in a wide range of child health nursing areas and relevant cultural issues.

The primary readers of this journal include healthcare professionals, administrators, educators, caregivers, researchers, and various specialists dedicated to serving newborns, infants, children, adolescents, young adults, and their families. The ultimate goal of CHNR is to build a robust body of knowledge that will help improve clinical practice and community care to promote the health of children and families worldwide.

II. Research and Publication Ethics

CHNR is committed to ensuring ethics in scientific research and publishing. For the policies on research and publication ethics that are not stated in these instructions, the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals by International Committee of Medical Journal Editors (ICMJE) or the COPE Guidelines (https://publicationethics.org/guidance/Guidelines) can be applied. Furthermore, all processes of handling research and publication misconduct will follow the applicable COPE flowchart (https://publicationethics.org/resources/flowcharts).

1. Statements of Human and Animal Rights and Protection

CHNR endorses and follows international standards of ethical practice in human rights and protection and the principles described in the Declaration of Helsinki (Medical Research Involving Human Participants; https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/). According to the Bioethics and Biosafety Act of Korea and in order to meet international standards for ethical practice in human rights and protection, any research involving human subjects must be approved by an Institutional Review Board (IRB). When animals are used as research subjects, the study must be conducted in compliance with related regulations, such as those of the Institutional Animal Care and Use Committees (IACUCs, https://ori.hhs.gov/education/products/ncstate/iacuc.htm) or National Institutes of Health (NIH) Guide for the Care and Use of Laboratory Animals (https://grants.nih.gov/grants/olaw/guide-for-the-care-and-use-of-laboratory-animals.pdf). Any treatment methods in conflict with the regulations must be described and may be grounds for rejection.

2. Statements of Informed Consent

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

3. Originality and Duplicate Publications

Duplicate publication or duplicate submission is prohibited in accordance with the ICMJE recommendations (https://www.icmje.org/recommendations/browse/publishing-and-editorial-issues/overlapping-publications.html). Manuscripts that have been published or are being submitted to other journal(s) should not be submitted to CHNR. Manu-

scripts that have been published or are currently under consideration for publication in CHNR must not be submitted to another journal. If a duplicate submission is detected, submission privileges to CHNR will be suspended for 2 years.

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

2) **Multiple, simultaneous, or duplicate submission:** The author(s) should not submit the same research to more than one journal and should not publish the manuscript in different languages. If authors wish to pursue a secondary publication of the manuscript in another language, they should obtain approval from the editor-in-chief of both related journals.

3) **Determination of duplicate publication:** The editorial board will review and assess the manuscript to determine any instances of duplicate submission or publication.

4. Authorship

Authorship is limited to those who have contributed substantially to the manuscript in terms of conception and design, as well as the collection, analysis, and interpretation of the data. All authors should be involved in drafting and reviewing the manuscript and must approve the final version of the manuscript. The corresponding author is required to confirm that all appropriate persons are listed as authors in the manuscript. All authors must agree to be accountable for all aspects of their work and to ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Chatbots or other AI-assisted technologies cannot be listed as authors.

1) **Authorship taxonomy:** The corresponding author is responsible for ensuring that the descriptions are accurate and agreed upon by all authors. Each author's role(s) should be listed using the relevant categories mentioned above. It is possible for authors' contributions to span multiple roles. The CRediT taxonomy does not alter the journal's criteria for authorship qualification. Authors are requested to select the appropriate CRediT statements (https://credit.niso.org/) during the submission process. This information will appear above the references section of the published paper, as illustrated in the example below.

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

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

2) **Changes to authorship:** CHNR does not correct authorship after publication unless the editorial staff has made a mistake. After submission and before publication, any changes in authorship—including adding or removing authors, or rearranging the order of authors—must be detailed in a letter to the editor from the involved authors. This letter must be signed by all authors of the paper. Additionally, every author must complete a copyright assignment.

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

4) **Contributors:** Any researcher who does not meet all four ICMJE criteria for authorship discussed above but contributes substantively to the study in terms of idea development, manuscript writing, conducting research, data analysis, and financial support should have their contributions listed in the Acknowledgments section of the article.

5. Conflict of Interest

Authors are required to disclose commercial or similar relationships to products or companies mentioned in the article being submitted or related to its subject matter. The corresponding author must notify the editor of any potential conflicts of interest that might have affected the study's findings or the way the data were interpreted. Even if the authors are certain that their respective judgments were unaffected when producing the article, any potential conflict of interest should be stated on the title page and at the ending section of the manuscript. Conflicts of interest can include ties to pharmaceutical corporations on a personal or financial level, political pressure from special interest organizations, or issues in the classroom.

Before evaluating a particular paper, CHNR requests that referees notify the editor if they have any conflicts of interest. All article submissions from editors, staff members, or editorial board members are handled in the same manner as unsolicited submissions. They will not participate in the decision-making or reviewer selection process. Even for commissioned manuscripts, editors will not handle their own work.

1) **Disclosure form:** The ICMJE Disclosure of Interest (https://www.icmje.org/disclosure-of-interest/) should be used as the model for the disclosure form.

2) **Role of the funding source:** The author is requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement, then this should be stated.

6. Reporting Standards

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

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

7. Clinical Trials Registration

This journal follows the data sharing policy described in "Data Sharing Statements for Clinical Trials: A Requirement of the International Committee of Medical Journal Editors (ICMJE)" (https://doi.org/10.3346/jkms.2017.32.7.1051).

Registration with an accredited primary registry is essential for clinical research to ensure transparency and accountability. In Korea, the Korea Clinical Research Information Service (CriS, https://cris.nih.go.kr/) serves as an accredited primary registry recognized by the World Health Organization (https://www.who.int/clinical-trials-registry-platform).

ClinicalTrials.gov (https://clinicaltrials.gov), managed by the United States National Institutes of Health, is also a widely accepted registry.

However, registration may be waived if the study involves an educational intervention that poses no harm to participants. In such cases, authors are encouraged to discuss the need for registration with the editor, considering the specific nature of the educational intervention.

8. Fundamental Errors in a Manuscript

If authors find a fundamental error in a published manuscript, they should immediately inform the editor and cooperate with the editor to correct or withdraw the manuscript.

9. Process for Managing Publication Malpractice

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

10. Disclosure of Artificial Intelligence (AI)–Assisted Technology

CHNR follows the Artificial Intelligence (AI)–Assisted Technology policy described in Recommendations of ICMJE (https://www.icmje.org/icmje-recommendations.pdf).

Authors must disclose if they used AI-assisted technologies (e.g., LLMs, chatbots, image generators) in their work. The use of AI should be described in the cover letter and relevant sections of the manuscript, acknowledging writing assistance in the acknowledgment section and data-related uses in the Methods section. For instance, writing assistance should be noted in the Acknowledgments section, while uses in data collection, analysis, or figure generation should be detailed in the Methods section. AI tools such as chatbots should not be listed as authors, as they cannot be held responsible for accuracy or integrity. Authors are responsible for ensuring the work's quality, reviewing AI-generated content for errors or bias, and avoiding plagiarism, including proper attribution for AI-generated text or images.

III. Guidelines for Manuscript Preparation

1. Types of Manuscripts

CHNR publishes original articles, review articles, and editorials on health care and nursing for birth to young people and their families.

1) **Original articles:** CHNR publishes original articles that fit the journal's aims and scope. These are comprehensive papers that present novel research findings. They include reports of empirical data from top-notch scientific and clinical research studies that are relevant to nursing and health care for people from the beginning of life to young adulthood and their families. Original articles cover children's health issues, with topics encompassing nursing theory, practice, and education, among others. The articles published in CHNR present significant research results obtained using a variety of methodologies, including mixed-method designs, observational, quasi-experimental, and experimental investigations, as well as qualitative methods and measurements, including the development and evaluation of instruments. The appropriate standards should be followed when writing research papers.

2) **Review articles:** Critical presentations on themes of interest and importance to child health nursing theory, practice, and education are included. A review article's body should consist of a thorough evaluation of the literature that is supported by academic research, critical analysis, and reasoned conclusions. CHNR publishes comprehensive literature reviews, as well as systematic reviews that target specific research problems, such as scoping reviews. It also issues discussion papers, which are academic works with a discursive or argumentative tone. All articles must contain a discussion and critical evaluation of a significant body of research or other scholarship.

3) **Editorials:** Editorials are by invitation only and feature re-

marks made by institutional representatives or individual authors on topics of current interest. Authors should contact the manager in the editorial office if they have any suggestions for editorials that deal with topics that are critically important to the discipline, especially those that are contentious or closely related to recent or upcoming journal articles.

2. Authors of Manuscripts

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

3. General Information

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

2) Manuscript length: Abstracts, texts, references, tables, and figures included in the manuscript have different limits depending on the type of manuscript submitted, but all submissions must comply with the contents of Table 3. The number of references is recommended to be 30 or fewer for an article. However, authors may include additional references depending on the type of article, such as meta-analyses, systematic reviews, or structural equation models.

Table 3. Recommended maximums for articles submitted to *Child Health Nursing Research*

Publication type	Word count of abstract	Word count of main text	Numbers of tables & figures
Original article	250	6,000	5
Review article	250	8,000	5
Editorial	N/A	2,500	5

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

4) Samples and participants: Authors should confirm the correct use of the words "sex" (when reporting biological factors) and "gender" (identity, psychosocial, or cultural factors), and report the sex or gender of study participants. Authors should define how they determined race or ethnicity and justify its relevance. If a study was done involving an entire population, the authors should explain the reason.

5) Prior approval for the use of psychosocial questionnaires (survey tools): Authors must obtain permission for the utilization of any psychosocial questionnaire from the tool's copyright holder.

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

7) Reference and citation style: References and citations follow National Library of Medicine [NLM] style. The submitting authors are responsible for ensuring adherence to NLM guidelines.

8) Inclusive language: Authors are encouraged to use inclusive language that acknowledges diversity, respects all individuals, and promotes equal opportunities. Assumptions about the reader's beliefs or identities should be avoided, and authors must refrain from language that implies superiority based on factors such as age, gender, race, ethnicity, culture, sexual orientation, disability, or health condition. Writing should be free of bias, stereotypes, and cultural assumptions. Gender neutrality is encouraged by using plural nouns (e.g., "patients") instead of gendered pronouns ("he/she"). Descriptors of personal attributes should only be used if relevant and valid.

4. Reporting Guidelines for Specific Study Designs

Research reports frequently omit important information. Therefore, reporting guidelines have been developed for a number of study designs. Authors are encouraged to adhere to relevant reporting guidelines when describing their study. A good source of reporting guidelines is the EQUATOR Network (https://www.equator-network.org/) and the United

States National Institutes of Health/ National Library of Medicine (https://www.nlm.nih.gov/services/research_report_guide.html)

1) Observational cohort, case-control, and cross-sectional studies: Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)

2) Qualitative studies: Consolidated Criteria for Reporting Qualitative Research (COREQ), Standards for Reporting Qualitative Research (SRQR)

3) Quasi-experimental/non-randomized trials: Transparent Reporting of Evaluations with Non-randomized Designs (TREND)

4) Randomized (and quasi-randomized) controlled trials: Consolidated Standards of Reporting Trials (CONSORT)

5) Study of diagnostic accuracy/assessment scale: Standards for the Reporting of Diagnostic Accuracy Studies (STARD)

6) Systematic review and meta-analysis: Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA), Meta-analysis of Observational Studies in Epidemiology (MOOSE)

7) Quality improvement studies: Standards for Quality Improvement Reporting Excellence (SQUIRE)

5. Sequence of Headings in an Original Article

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

Beginning section	- Cover letter - Title page - Abstract and keywords
Middle section (main text)	- Introduction - 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

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

(2) Title page

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

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

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

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

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

⑥ IRB approval: The author should provide information about the institution that provided IRB approval, in-

cluding the approval number, and informed consent. However, if the study did not involve humans or animals, a statement should be made about IRB exemption.

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

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

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

(3) Abstract and keywords

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

2) Middle section

The text should be composed in the following order: Introduction, Methods, Results, Discussion, and Conclusion.

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

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

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

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

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

(5) Conclusion: Conclusions and recommendations for further study should be presented here, but the study results should not be summarized again.

3) Final section

(1) ORCID and ResearcherID: The authors should provide the ORCID number and ResearcherID.

(2) Authors' contributions: Authors' contributions should be based on the authorship taxonomy.

(3) Conflict of interest: Authors are required to disclose commercial or similar relationships to products or companies mentioned in or related to the subject matter of the article being submitted. If there are no conflicts of interest, the following is an example of a sentence that can be used: "No existing or potential conflict of interest relevant to this article was reported."

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

(5) Data availability: Based on the plan for data sharing, authors should deposit their data after de-identification and report the DOI of the data and the registered site. The corresponding author should be contacted to confirm the availability of data.

Example 1:
The data cannot be publicly disclosed due to the Data Use Agreement with the Society for OOO (OOO). For the research data, contact the OOO (URL) / or the corresponding author's name (abcde@gmail.com).
Example 2:
Data files are available from Harvard Dataverse: https://doi. org/10.7910/OOO/3OOO9O Dataset 1. Raw data of responses from South Korean nursing students in 202X.

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

(7) Declaration of generative AI and AI-assisted technologies in the writing: Authors are required to disclose the utilization of generative AI and AI-assisted technologies in the writing process by including a statement after their work within the main text file, before the References list. The declaration must be positioned in a new section headed "Declaration of Generative AI and AI-assisted Technologies in the Writing Process."

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.

This declaration excludes using basic tools to check grammar, spelling, references, etc. A statement is unnecessary if there is no information to provide.

(8) Supplementary materials: If there are supplementary materials to help the understanding of readers or too much data to be included in the main text, they may be presented as supplementary data.

(9) References: Manuscripts submitted must adhere to the NLM citation style, with authors responsible for ensuring compliance with NLM guidelines and the accuracy of all references. Authors are responsible for the accuracy of the references. The use of DOIs is highly encouraged.

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- Lee SJ, Han YR. The influencing factors of pediatric nurses' perception of patient safety culture and partnership with patients' parents on patient safety nursing activities in South Korea: a descriptive study. Child Health Nurs Res. 2024;30(4):255-265. https://doi.org/10.4094/chnr.2024.008
- 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 of Pediatr Nurs. 2024 Nov 28 [Epub]. https://doi.org/10.1016/j.pedn.2024.11.015
- Cho CU. Stem cell windpipe gives Korean toddler new life. The Korea Herald. 2013 May 2;Sect. 01.

2) Books & Book chapters

- Brown B. Braving the wilderness: the quest for true belonging and the courage to stand alone. Random House: 2017.

- Peate I. The student's guide to becoming a nurse. 2nd ed. John Wiley & Sons; 2012.
- Min KA, Kim CG. Nursing management. Knowledge & Future; 2012.
- Bochner BH. Identification of nodal metastases: the role of iron oxide enhanced MRI. In: Lee CT, Wood DP, editors. Bladder cancer. Humana Press; 2010.
- Radley DC, How SK, Fryer AK, McCarthy D, Schoen C. Rising to the challenge: results from a scorecard on local health system performance, 2012 [Internet]. Commonwealth Fund; 2012 [cited 2017 Feb 8].

Available from: https://www.commonwealthfund.org/sites/default/files/documents/___media_files_publications_fund_report_2012_mar_local_scorecard_1578_commission_rising_to_challenge_local_scorecard_2012_finalv2.pdf

3) Scientific and technical reports

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

4) Unpublished theses or dissertations

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

5) Conference proceedings

- Bell JM. Highlights from the 10th international family nursing conference. 10th International Family Nursing Conference; 2011 June 24-28; Kyoto. Sage Publications; 2012. p. 135-139.

6) Web

- Statistics Korea. Cause of death statistics in 2023 [Internet]. Statistics Korea; 2024 [cited 2024 Dec 10]. Available from: https://kostat.go.kr/board.es?mid=a20108100000&bid=11773&act=view&list_no=433679

7. Tables and Figures Format

1) Table formatting

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

② The title of a table should appear above the table. Only capitalize the first letter of table titles. Ex) Table 1. Responses to question types

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

④ Table data should be explained in the footnotes. All abbreviations used in the tables should be defined in the footnotes of every table in which they appear. Ex) HR, heart rate; T, temperature.

⑤ In a table, use a superscript lowercase letter to indicate each footnote. The tables should be placed beneath the footnotes. Ex) [a]Surviving case; [b]Deceased case.

⑥ If the value of a decimal can possibly exceed 1, a 0 should appear before the decimal point; otherwise, nothing should appear before the decimal point. Ex) $t = 0.26$, $F = 0.92$ Example: $p < .001$, $r = .01$, $R^2 = .61$

⑦ The statistical significance (p-value) should be written without a footnote and should be rounded to three decimal places. Ex) $p = .003$. If p is 0.000, then indicate that p is less than 0.001 ($p < .001$). If p is 1.000, then indicate that p is greater than 0.999 ($p > .999$).

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① The title should appear below an image. Only the first letter of the first word should be capitalized (sentence case). Ex) Figure 1. Mean responses to questions by student grade categories.

② Acceptable figure file formats are BMP, JPG, PSD, TIF, AI, EMF, EPS, WMF, DOC, XLS, PPT, and PDF.

③ The size of the image should be 102×152 mm (4×6 inches). Larger images may be permitted; however, each image should not exceed 203×254 mm (8×10 inches).

④ If one figure contains 2 or more images, consecutive alphabetical letters should be used to distinguish among the images. Ex) Figure 1A, Figure 1B

⑤ The photomicrograph of a tissue sample, the region from which the tissue was extracted, and the staining

method should be noted. The magnification scale must be included.

3) Quotations from other sources

Citations may follow any style, such as NLM, APA, or others.

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

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

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