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Factors affecting adolescents' sexual activity based on the biopsychosocial model: A Cross-Sectional Study Using Korea Youth Risk Behavior Web-based Survey (KYRBS)

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Factors affecting adolescents' sexual activity based on the biopsychosocial model: A Cross-Sectional Study Using Korea Youth Risk Behavior Web-based Survey (KYRBS)

Running title: Factors affecting adolescents' sexual experience

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ABSTRACT

Objectives Sexual activity is an important integrative behavior that interacts with biological, psychological, and social factors among various changes in adolescence. However, early initiation of sexual experience could be associated with negative outcomes. Thus, this study aimed to investigate the factors affecting adolescents’ sexual experience based on the biopsychosocial model.

Design A cross-sectional study.

Setting This study was conducted in Republic of Korea.

Participants We employed four years data (2017-2020) of the cross-sectional Korea Youth Risk Behavior Web-based Survey. In total, 234,567 participants attending middle and high school were analyzed.

Results Sexual experience was defined as having had sexual experience in lifetime. In the biopsychosocial model, biological factors including sex and age, and psychological factors including stress level and suicidal thoughts, and social factors including family structure, etc. were assessed. Logistic regression analysis was performed to identify variables associated with sexual experience. Among the biological factors, age and sex were significant factors affecting sexual experience in adolescents. Regarding the psychological factors, suicidal thoughts were a significant risk factor affecting sexual experience. Furthermore, social factors including sex education, drinking, smoking, and family structure, were associated with sexual experience in adolescents. Particularly, a significantly higher sexual experience was found in the three groups living with a single parent, stepparents, and no parents compared to the group living with both parents in family structure.

Conclusions This study demonstrated the factors affecting adolescents’ sexual experience based on the biopsychosocial model. Further research and policy strategies that consider supporting family communication and mental health and preventing substance use are required to prevent adolescents’ sexual health.

Strengths and limitation of this study

- The data were weighted according to stratification and cluster variables for school and class to ensure the representativeness of the adolescents in Korea.
- Biological factors, psychological factors, and social factors included as variables based on biopsychosocial model and analyzed
- It is difficult to determine causal associations as a cross-sectional study.
- The variables used in this study were limited to questionnaires based on the Korea Youth Risk Behavior Web-based Survey.

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1. Introduction

Adolescence is the period of the important transition from childhood to adulthood ¹. During this period, adolescents experience rough changes, including physical, behavioral, cognitive, psychological, and emotional-social development. Adolescence can be generally divided into early (10–13 years), middle (14–16 years), and late (17–19 years) stages according to developmental characteristics, although the age range for adolescence may vary ². Early adolescence is the stage of rapid physical growth and is marked by the beginning of secondary sexual characteristics and increased sexual interest ³. In middle adolescence, secondary sexual characteristics advance and the growth of the body slows. Late adolescence is the stage of physical maturity and movement from a child-parent relationship to an adult-adult relationship.

Among many changes that happen in adolescence, sexual activity is one of the most important changes. According to a report by the National Center for Health Statistics of the Centers for Disease Control and Prevention (2017), about 55% of US teens have had sexual experience by the age of 18 ⁴. Many adolescents initiate and experience sexual activity in this period, however, several studies reported that early adolescent sexual experience is associated with adverse behaviors ^{5 6}. A study reported that 8.5% of males who had sexual onset before the age of 13 described their first sexual experience as unwanted ⁷. There was a strong association between self-reported depression and early adolescent sexual experience ⁸. Furthermore, about 50% of new sexually transmitted infections (STIs) were reported in adolescents and young adults aged 15–24 ^{9 10}. Adolescents are particularly vulnerable to STIs, such as *Chlamydia trachomatis* and human papillomavirus infection, due to a lack of cervical mucus and are more likely to engage in risky sexual activities without a condom or concurrent partners ^{9 11}. Factors influencing early sexual initiation in adolescence were divided into intrinsic factors, including self-desire to experience sex, social fitness, and economic challenges, and extrinsic factors, including broken home/poor parenting, indecent media content, social/religious ceremonies, and the quest for high academic achievement ¹². In addition, substance use was positively associated with early sexual experience, school attachment was negatively associated with early sexual experience among male and female adolescents, and positive parent communication was negatively associated with early sexual

experience among US female adolescents ⁵.

Sexual behavior in adolescence is a complex behavior that is affected by various factors and needs to be considered at multiple levels. Adolescent sexual behavior is not only sexual maturity at the biological level but is also important at the psychological and social levels ¹³. The biopsychosocial model is useful for understanding individual medical conditions through the complex interaction of biological factors, such as genetic and biochemical factors, psychological factors, such as mood, personality, and behavior, and social factors, such as cultural, familial, socioeconomic, and medical factors ^{14 15}. The biopsychosocial model was used to elucidate the chronic behavior problem ¹⁶ and the relationship between cognitive, physiological, and behavioral stress responses in adolescents ¹⁷. A study reported that the biopsychosocial model was used to identify factors influencing health and complaints in children and adolescents ¹⁸. Furthermore, a biopsychosocial model of hypersexuality in girls with bipolar disorder examined the factors affecting sexual behaviors and provided a framework for cognitive-behavioral intervention ¹⁹.

Therefore, this study aimed to investigate the factors affecting adolescents' sexual experience based on the biopsychosocial model. Furthermore, this study provides basic data on the prevention and management of risky sexual behaviors among adolescents in Korea.

2. Methods

2.1. Study design and participants

The study used data from the 2017 to 2020 Korea Youth Risk Behavior Web-based Survey (KYRBS), Ministry of Health and Welfare, Centers for Disease Control and Prevention Agency. The KYRBS is a cross-sectional, nationwide survey targeting Korean adolescents, including middle and high school students, and has been conducted annually since 2005 to identify their health behaviors. The KYRBS participants were selected using a complex sample design. The sampling process consisted of three steps: population stratification by regional and school characteristics, sampling distribution by proportional allocation methods (400 middle and 400 high schools), and sampling by stratified cluster sampling (school and class units). Participants

responded to an anonymous, self-reporting online survey. In this study, we used data of 234,567 participants from the 13th to the 16th KYRBS (2017–2020) because the survey questions on sexual behaviors have been slightly modified since 2017. The study was approved by the Institutional Review Board of ** University (No. *****_*****_**_***_**).

2.2. Measures

2.2.1 Sexual experience

Sexual experience was defined as having had sexual experience in lifetime, and measured through the question “Have you ever had sex before?” and the answers were “I have had sex before” or “I have never had sex before.”

2.2.2 Biological factors

For the biological variables, we included participants’ age and sex.

2.2.3 Psychological factors

To measure the psychological variables, the level of perceived stress and suicidal thoughts were assessed. The perceived stress level was identified through questions on the level of stress that the participants usually felt. Suicidal thoughts were measured by asking the participants whether they had seriously considered suicide in the last 12 months.

2.2.4 Social factors: *Family structure*

Family structure was categorized based on answers concerning current family members (biological parents and stepparents) and whether the participants lived with these family members. Depending on whether the biological parent was a family member (living together, not living together) or not a family member (absence of biological parents) or whether the stepparent was a family member (living together, not living together), we finally categorized family structure into four types: living with 1) both parents (the participant lives only with a biological father and a biological mother regardless of the presence of stepparents), 2) a single parent (the participant lives only with a biological father or a biological mother regardless of the presence of stepparents), 3) stepparents

(the participant lives with a biological father and a stepmother, a biological mother and a stepfather, a stepmother and a stepfather, a stepmother, or a stepfather regardless of the presence of biological parents and stepparents), and 4) none (absence of biological parents, or even in case of the presence of biological parents or stepparents, they do not live together).

2.2.5 Social factors: *Other variables*

Participation in sex education was measured through the question “Have you received sex education at school in the past 12 months?” and the answers were “yes” or “no.” The participants’ academic grades in the last 12 months, the location of the school (rural area, medium and small city, and big city), and perceived economic level of the household were measured. Behaviors toward drinking and smoking were measured by asking the participants whether they had ever drunk (or smoked) in their lifetime.

2.3. Statistical analysis

To consider a complex sample design of the study, the data were weighted according to stratification and cluster variables for school and class using SAS software (ver. 9.4; SAS Institute, Cary, NC, USA), and P values of $<.05$ were considered statistically significant. Items with missing values were removed before the analysis. The participants’ sexual experience characteristics were calculated using the chi-square test and simple regression analysis. A simple logistic analysis was conducted to identify the association between sexual experience and the variables. The results are presented as the crude odds ratio (cOR) and confidence interval (CI). After adjusting for the potential confounding variables to avoid bias, we carried out a multiple logistic analysis presented by adjusted odds ratio (aOR) and CI to identify the variables associated with sexual experience.

2.4. Patient and public involvement

patients and/or the public were not involved in the design or reporting of this study.

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3. Results

The participants included in this analysis were 119,459 middle school students and 115,108 high school students. Table 1 shows the general characteristics of the study participants according to sexual experience. Regarding the biological factors, the mean age of participants who had sexual experience was 13.9 years in middle school students and 16.8 years in high school students. 3.4% of boys and 1.6% of girls attending middle school had sexual experience, showing a significant difference. 10.4% of boys and 5.1% of girls attending high school had sexual experience ($P<.001$). Psychological factors, including perceived stress and suicidal thoughts, showed a significant difference with sexual experience. In particular, 5.6% of middle school students and 14.1% of high school students who had sexual experiences showed suicidal thoughts. Furthermore, in terms of the social factors, there was a significant difference in sexual experience according to family structure ($P<.001$). Among middle school students, the percentages of participants who had sexual experience were 2.0%, 2.9%, 5.4%, and 13.6% in those who lived with both parents, a single parent, stepparent, and none, respectively. Among high school students, the percentages of participants who had sexual experience were 6.5%, 10.4%, 17.5%, and 21.5% in those who lived with both parents, a single parent, stepparent, and none, respectively. Most participants received sex education at school over the past year (82.3% and 71.9% of middle and high school students, respectively, data not shown), and there was a significant difference between sex education and sexual experience. For both middle and high school students, sexual experience was higher among participants who reported drinking and smoking behaviors.

Table 1. Study participants' general characteristics according to sexual experience (weighted %).

Characteristics	Middle school (n=119,459)		P-value	High school (n=115,108)		P-value
	Sexual experience			Sexual experience		
	No % (SE)	Yes % (SE)		No % (SE)	Yes % (SE)	
BIOLOGICAL FACTORS						
Age, mean (SE)	13.6(0.00)	13.9(0.02)	<.001	16.5(0.00)	16.8(0.01)	<.001
Sex			<.001			<.001
Boy	96.6(0.09)	3.4(0.09)		89.6(0.17)	10.4(0.17)	
Girl	98.4(0.06)	1.6(0.06)		94.9(0.13)	5.1(0.13)	
PSYCHOLOGICAL FACTORS						
Perceived stress			<.001			<.001
Very low	95.8(0.29)	4.2(0.29)		88.4(0.57)	11.6(0.57)	
Low	98.0(0.10)	2.0(0.10)		92.8(0.22)	7.2(0.22)	
Middle	97.9(0.08)	2.1(0.08)		93.2(0.14)	6.8(0.14)	
High	97.6(0.09)	2.4(0.09)		92.5(0.17)	7.5(0.17)	
Very high	94.8(0.23)	5.2(0.23)		87.8(0.34)	12.2(0.34)	
Suicidal thoughts			<.001			<.001
No	97.9(0.06)	2.1(0.06)		93.0(0.12)	7.0(0.12)	
Yes	94.4(0.21)	5.6(0.21)		85.9(0.35)	14.1(0.35)	
SOCIAL FACTORS						
Family structure*, ⁺			<.001			<.001
Both parents	98.0(0.06)	2.0(0.06)		93.5(0.13)	6.5(0.13)	
Single parent	97.1(0.16)	2.9(0.16)		89.6(0.28)	10.4(0.28)	
Stepparent	94.6(0.69)	5.4(0.69)		82.5(1.07)	17.5(1.07)	
None	86.4(0.93)	13.6(0.93)		78.5(0.90)	21.5(0.90)	
Sex education			<.001			0.049
No	96.3(0.15)	3.7(0.15)		91.8(0.20)	8.2(0.20)	
Yes	97.7(0.06)	2.3(0.06)		92.3(0.14)	7.7(0.14)	
Academic grade			<.001			<.001
Low	96.9(0.11)	3.1(0.11)		90.5(0.18)	9.5(0.18)	
Middle	98.1(0.08)	1.9(0.08)		93.8(0.15)	6.2(0.15)	
High	97.5(0.09)	2.5(0.09)		92.5(0.18)	7.5(0.18)	
Location of school			0.731			0.096
Rural area	97.7(0.25)	2.3(0.25)		91.4(0.54)	8.6(0.54)	
Medium and small city	97.5(0.09)	2.5(0.09)		92.4(0.18)	7.6(0.18)	
Big city	97.4(0.09)	2.6(0.09)		91.9(0.20)	8.1(0.20)	
Perceived economic level of household			<.001			<.001
Low	96.0(0.19)	4.0(0.19)		89.2(0.26)	10.8(0.26)	
Middle	98.1(0.06)	1.9(0.06)		93.9(0.13)	6.1(0.13)	
High	97.1(0.09)	2.9(0.09)		91.1(0.19)	8.9(0.19)	
Drinking			<.001			<.001
No	98.6(0.05)	1.4(0.05)		97.4(0.08)	2.6(0.08)	
Yes	94.2(0.16)	5.8(0.16)		87.1(0.20)	12.9(0.20)	
Smoking			<.001			<.001
No	98.3(0.05)	1.7(0.05)		96.0(0.08)	4.0(0.08)	
Yes	86.3(0.45)	13.7(0.45)		74.7(0.36)	25.3(0.36)	

*Both parents mean the family structure in which the participant lives only with a biological father and a biological mother regardless of the presence of stepparents.

Single parent refers to the family structure in which the participant lives only with a biological father or a biological mother regardless of the presence of stepparents.

Stepparent refers to the family structure in which the participant lives with a biological father and a stepmother, a biological mother and a stepfather, a stepmother and a stepfather, a stepmother, or a stepfather regardless of the presence of biological parents and stepparents.

None means the family structure in which the biological parents do not exist, or even if there are biological parents or stepparents, they do not live together.

†The column included missing data (n=31,406), including those who disagreed to respond to the survey on family members and those who responded by living with both their biological father and stepfather

The results of examining the factors associated with sexual experience are presented in Table 2. Regarding the biological factors, sexual experience increased significantly with increasing age (aOR=1.31, 95%CI: 1.28-1.33), and it was lower in girls than in boys (aOR=0.64, 95%CI: 0.60-0.68). Regarding the psychological factors, participants with suicidal thoughts showed significantly higher sexual experience compared to students who did not intend to commit suicide (aOR=1.73, 95% CI: 1.63-1.83). Regarding the social factors, particularly family structure, sexual experience was significantly higher in the group living with stepparents (aOR=2.58, 95% CI: 2.32-2.86), no parents (aOR=1.93, 95%CI: 1.68-2.23), followed by a single parent (aOR=1.34, 95% CI: 1.26-1.43) compared to the group living with both parents. Among middle school students, sexual experience was significantly higher in groups living with stepparents, no parents, a single parent (aOR = 2.91, 95% CI: 2.37-3.56; aOR=1.67, 95% CI: 1.24-2.26; aOR=1.21, 95% CI: 1.07-1.38, respectively) than in the group living with both parents. Among high school students, a significantly higher sexual experience was also found in the three groups living with a single parent, stepparents, and no parents compared to the group living with both parents. Moreover, sexual experience was significantly higher in the group with drinking and smoking experience (aOR=2.53, 95% CI: 2.38-2.68; aOR = 4.57, 95%CI: 4.33-4.82, respectively) than in the group without drinking and smoking experience.

Table 2. Factors associated with sexual experience in adolescents.

Characteristics	Sexual experience (Yes vs. No)					
	Total		Middle school		High school	
	(CI)	aOR (CI)	cOR (CI)	aOR (CI)	cOR (CI)	aOR (CI)
BIOLOGICAL FACTORS						
Age	1.49 (1.47-1.52)	1.31 (1.28-1.33)	1.51 (1.44-1.59)	1.27 (1.21-1.33)	1.36 (1.32-1.40)	1.26 (1.23-1.30)
Sex						
Boy	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Girl	0.48 (0.45-0.50)	0.64 (0.60-0.68)	0.46 (0.42-0.50)	0.50 (0.46-0.56)	0.48 (0.45-0.51)	0.69 (0.64-0.73)
PSYCHOLOGICAL FACTORS						
Perceived stress						
Very low	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Low	0.61 (0.55-0.69)	0.72 (0.63-0.81)	0.51 (0.42-0.62)	0.68 (0.55-0.84)	0.64 (0.59-0.74)	0.74 (0.63-0.86)
Middle	0.64 (0.57-0.71)	0.72 (0.64-0.81)	0.54 (0.45-0.64)	0.74 (0.61-0.89)	0.59 (0.51-0.67)	0.71 (0.62-0.83)
High	0.75 (0.68-0.84)	0.72 (0.64-0.81)	0.64 (0.54-0.77)	0.74 (0.60-0.92)	0.66 (0.57-0.76)	0.72 (0.62-0.83)
Very high	1.35 (1.21-1.51)	0.95 (0.83-1.08)	1.35 (1.12-1.63)	1.06 (0.84-1.34)	1.10 (1.00-1.25)	0.92 (0.79-1.08)
Suicidal thoughts						
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	2.26 (2.15-2.37)	1.73 (1.63-1.83)	2.70 (2.45-2.98)	1.84 (1.64-2.08)	2.22 (2.10-2.35)	1.72 (1.61-1.85)
SOCIAL FACTORS						
Family structure* [†]						
Both parents	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Single parent	1.73 (1.64-1.83)	1.34 (1.26-1.43)	1.47 (1.30-1.66)	1.21 (1.07-1.38)	1.69 (1.59-1.80)	1.38 (1.29-1.48)
Stepparent	5.20 (4.77-5.67)	2.58 (2.32-2.86)	7.78 (6.64-9.11)	2.91 (2.37-3.56)	3.96 (3.57-4.39)	2.49 (2.21-2.80)
None	3.16 (2.79-3.58)	1.93 (1.68-2.23)	2.81 (2.15-3.68)	1.67 (1.24-2.26)	3.07 (2.66-3.55)	2.03 (1.73-2.38)
Sex education						
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	0.75 (0.71-0.79)	1.00 (0.95-1.05)	0.61 (0.55-0.67)	0.75 (0.68-0.84)	0.95 (0.90-1.01)	1.07 (1.01-1.13)
Academic grade						
Low	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Middle	0.61 (0.58-0.65)	0.87 (0.83-0.93)	0.61 (0.55-0.68)	0.97 (0.86-1.09)	0.64 (0.61-0.68)	0.85 (0.80-0.91)
High	0.65 (0.61-0.68)	0.97 (0.92-1.02)	0.75 (0.68-0.82)	1.07 (0.96-1.19)	0.76 (0.71-0.80)	0.94 (0.88-1.00)
Location of school						
Rural area	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Medium and small city	0.87 (0.76-0.99)	1.00 (0.88-1.12)	0.97 (0.77-1.24)	0.97 (0.76-1.23)	0.88 (0.75-1.02)	1.01 (0.88-1.16)
Big city	0.92 (0.81-1.05)	1.12 (1.00-1.26)	1.00 (0.79-1.27)	1.04 (0.82-1.31)	0.92 (0.79-1.08)	1.16 (1.01-1.32)
Perceived economic level of household						
Low	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Middle	0.48 (0.45-0.51)	0.79 (0.74-0.84)	0.46 (0.41-0.52)	0.82 (0.71-0.94)	0.55 (0.51-0.58)	0.79 (0.74-0.85)
High	0.63 (0.59-0.66)	1.14 (1.07-1.21)	0.70 (0.62-0.79)	1.22 (1.06-1.39)	0.79 (0.74-0.85)	1.12 (1.04-1.21)
Drinking						
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	6.19 (5.88-6.52)	2.53 (2.38-2.68)	4.33 (3.97-4.72)	2.16 (1.96-2.38)	5.48 (5.12-5.86)	2.70 (2.51-2.91)
Smoking						

No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	10.07(9.62-10.55)	4.57 (4.33-4.82)	9.48 (8.66-10.36)	4.21 (3.78-4.69)	8.18 (7.55-8.84)	4.68 (4.40-4.97)

cOR, crude odds ratio; aOR, adjusted odds ratio; CI, confidence interval.
*Both parents mean the family structure in which the participant lives only with a biological father and a biological mother regardless of the presence of stepparents.
Single parent refers to the family structure in which the participant lives only with a biological father or a biological mother regardless of the presence of stepparents.
Stepparent refers to the family structure in which the participant lives with a biological father and a stepmother, a biological mother and a stepfather, a stepmother and a stepfather, or a stepfather regardless of the presence of biological parents and stepparents.
None means the family structure in which the biological parents do not exist, or even if there are biological parents or stepparents, they do not live together.
†The column included missing data (n=31,406) including those who disagreed to respond to the survey on family members and those who responded by living with both their biological father and stepfather.

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4. Discussion

This study demonstrated the factors affecting adolescents' sexual experience based on the biopsychosocial model. It is important to identify the factors affecting adolescents' sexual experience to prevent adolescents' sexual health.

Regarding the biological factors, age and sex were significant factors affecting sexual experience in adolescents, including middle and high school students. Although it not easy to determine with the degree of risk to sex in sexual activity, complications from pregnancy and childbirth are among the major causes of death in females aged 15–19 years²⁰. Moreover, age affects sexual activity along with rapid physical growth because adolescence becomes sexually active.

Regarding the psychological factors, suicidal thoughts were a significant risk factor affecting sexual experience in adolescents. A study reported that there was a strong association between adolescent sexual orientation and suicidal thoughts and behaviors in a US national longitudinal study on adolescents' health²¹. Sexual intercourse was associated with an increased risk of suicide attempts²². Several studies have reported mechanisms for explaining the association between sexual experience and suicidal thoughts and attempts; however, it is still unclear^{21 22}. Thus, further research is needed to explain the association between sexual experience and suicidal thoughts and attempts and suggest aggressive suicide prevention interventions that recognize the risk factors for early sexual activity.

Regarding the social factors, sex education, drinking, smoking, and family structure were associated with sexual experience in adolescents. Sex education is reported as one of the ways to prevent risky sexual behaviors and promote healthy and responsible sexuality²³. Particularly, sex education has a protective effect on risky sexual behavior in adolescents who have sexual curiosity and engage in unsafe sexual activity such as STIs, unintended pregnancies, and no use of condoms²⁴. A study reported that the intervention group who received sex education had better knowledge of sexual health and less risky sexual behaviors compared to the control group²⁵. However, some studies reported that sex education encourages young people to be more sexually

active²⁶ or has no preventive effect on sexual activity²⁷. In this study, there was a negative association between sex education and sexual experience in middle school students, but a slightly positive association in high school students. The KYRBWS data collected from 400 middle and 400 high schools may be difficult to evaluate for consistent sex education. Further research is needed using a consistent sex education program for middle and high school students. Moreover, drinking and smoking were risk factors that influenced adolescents' sexual experiences. Several studies reported that sexual risk behaviors are strongly associated with health risk behaviors. Smoking and alcohol consumption were associated with sexual experiences among high school students²⁸⁻³⁰. A study reported that substance use was associated with an increase in early sexual experience among adolescents⁵. Substance use, including smoking and drinking, may increase the risk of unplanned and unprotected sexual activity by impairing judgment^{28 31}.

In particular, family structure was closely associated with adolescents' sexual experiences in this study. Although family stability must be considered, family structure is a very important factor in adolescent development^{32 33}. Among various developments, sexual behavior is related to family structure³⁴. Family structure, including a single parent, stepparent, or no parent, was an obvious risk factor for sexual experience in adolescents, including middle and high school students. Parents were reported to affect sexual experience in adolescents³⁵⁻³⁷. Furthermore, a Kenyan study reported that the presence of parents influences the first sexual experience³⁸, and communication with parents is associated with a delay in the onset of sexual experience^{38 39}. However, difficulty in communicating with stepparents affects adolescents' sexual behaviors and is associated with increased sexual activity^{40 41}. Family structure is an important determinant of adolescents' sexual activity, but true and deep communication with parents is more important despite they are not biological parents than family structure. Therefore, it is necessary to develop a systematic program for sex education at home and in schools and to communicate with families about sexuality.

Furthermore, this study was grouped into middle and high school student. Overall, family structure, including living with a single parent and no parent, sex education, drinking, and smoking were higher risk factors for sexual experience in high school than middle school students.

Stepparents and age were high risk factors for sexual experience in middle school students. The difference between middle and high school students is not clear, and attention to sexual stimuli, sexual desire, and sexual arousal may increase with physical growth⁴².

However, this study has some limitations. It is difficult to determine causal associations in a cross-sectional study. Further longitudinal studies are needed to confirm the factors that affect adolescents' sexual activity. Furthermore, the variables used in this study were limited to questionnaires based on the KYRBS. It is necessary to conduct further studies and include more questions for detailed analysis and evaluation.

5. Conclusion

This study demonstrated the factors affecting adolescents' sexual experience based on the biopsychosocial model. Further research and policy strategies that consider supporting family communication and mental health and preventing substance use are required to promote adolescents' sexual health.

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4 **Contributorship statement**

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6 KYK contributed to the conceptualization, data curation, formal analysis, methodology, project

7 administration, and manuscript writing. HYS contributed to the conceptualization, data curation,

8 formal analysis, funding acquisition, methodology, and manuscript writing. PK contributed to

9 investigation, methodology, validation, resources, and manuscript writing.

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15 **Competing interests**

16 The authors of this work have nothing to disclose.

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27 **Data sharing statement**

28 The data sharing statement for cross-sectional data is available from the Korea Youth Risk

29 Behavior Web-based Survey by Korea Centers for Disease Control and Prevention and Korean

30 Ministry of Health and Welfare. The data are freely available at: <https://www.kdca.go.kr/yhs/>.

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36 The Korea Centers for Disease Control and Prevention provided the data for this study.

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40 **Ethical considerations**

41 The study was approved by the university’s Institutional Review Board (No. 1044396-202109-

42 HR-194-01). Ethical issues regarding plagiarism, informed consent, misconduct, data fabrication

43 and/or falsification, double publication and/or submission, and redundancy have been completely

44 observed by the author.

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	page
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	7
		(e) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	

Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8,10
		(b) Report category boundaries when continuous variables were categorized	Not applicable
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	13-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors associated with adolescents' sexual experience based on the biopsychosocial model: A cross-sectional study using the Korea Youth Risk Behavior Web-based Survey (KYRBS)

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Title: Factors associated with adolescents' sexual experience based on the biopsychosocial model:
A cross-sectional study using the Korea Youth Risk Behavior Web-based Survey (KYRBS).

Running title: Factors associated with adolescents' sexual experience

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ABSTRACT

Objectives Sexual activity is an important integrative behavior that interacts with biological, psychological, and social factors among various changes in adolescence. However, starting sex at an early age is associated with adverse outcomes. Thus, this study aimed to investigate the factors associated with adolescents’ sexual experience based on the biopsychosocial model.

Design A cross-sectional study.

Setting This study was conducted in Republic of Korea.

Participants We employed four years data (2017-2020) of the cross-sectional Korea Youth Risk Behavior Web-based Survey. In total, 234,567 participants attending middle and high school were analyzed. Sexual experience was defined as having had sexual intercourse (oral, anal, or vaginal) in their lifetime. To identify variables associated with adolescents’ sexual experiences, we used a biopsychosocial model. Logistic regression analysis was performed to identify the variables associated with sexual experience.

Results Of the boys, 3.4% and 1.6% of girls attending middle school had sexual experiences, showing a significant difference. A total of 10.4% of boys and 5.1% of girls attending high school had sexual experiences ($P<.001$). Among the biological factors of the biopsychosocial model, age and gender were significantly associated with sexual experiences in adolescents. Regarding the psychological factors, suicidal thoughts were a significant risk factor associated with sexual experience. Furthermore, social factors including sex education, drinking, smoking, and family structure, were associated with sexual experience in adolescents. Particularly, a significantly higher sexual experience was found in the three groups living with a single parent, stepparents, and no parents compared to the group living with both parents in family structure.

Conclusions This study demonstrated the factors associated with adolescents’ sexual experience based on the biopsychosocial model. Further research and policy strategies that consider supporting family communication and mental health and preventing substance use are required to prevent adolescents’ sexual health.

Strengths and limitation of this study

- The data were weighted according to stratification and cluster variables for school and class to ensure the representativeness of the adolescents in Korea.
- Biological factors, psychological factors, and social factors included as variables based on biopsychosocial model and analyzed
- It is difficult to determine causal associations as a cross-sectional study.
- The variables used in this study were limited to questionnaires based on the Korea Youth Risk Behavior Web-based Survey.

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1. Introduction

Adolescence is the important period of transition from childhood to adulthood ¹. Adolescents experience physical, behavioral, cognitive, psychological, and emotional-social changes. As physical growth and sexual maturity occur during this period, sexuality and gender identity are established ¹.

In Korea, approximately 5% of adolescents have had sexual experiences ². The age of onset of sexual experience is reducing ², and the prevalence of recent sexual experience has been increasing in both boys and girls aged 12–13 years ³. According to a report by the Youth Risk Behavior Surveillance System in the US, approximately 38% of high school students have sexual experience in the US ⁴. For adolescent women aged 16–19 years, the rates of sexual experience in the US and Britain were approximately 49% and 65%, respectively ⁵. Compared with Western countries, the sexual experience rate of adolescents in Korea is relatively low. This finding is similar to those observed in Asian countries. The sexual experience rates were 5.3–5.8% and 19.1–11.4% for tenth- and twelfth-grade adolescents in Taiwan ⁶, respectively; 19.9% for Japanese adolescents living in Hawaii ⁷; and 7.0% for Chinese senior high school students ⁸. These sex-related phenomena are closely associated with social norms. For example, Korea is conservative about sex due to the influence of Confucian culture, especially for women. In particular, the sexual experiences of young women or unmarried single women have negative connotations, such as social stigma ⁹. With a culture similar to that of Korea, China is not favorable to sexual experiences before marriage ¹⁰. Although the sexual experience rate of adolescents is low, sexual experience at a young age may increase the likelihood of exposure to several risk factors.

Several studies have reported that early adolescent sexual experiences are associated with adverse behaviors and health outcomes ¹¹. Approximately 50% of Korean adolescents responded that they use contraception during sexual intercourse ², and their sexually transmitted infection (STIs) rate was reported to be approximately 10% (male 9.0%, female 11.4%) ¹². Among high school students in the US, the percentage of high school students who wear condoms during intercourse has decreased over 10 years (61% in 2009 to 54% in 2019), suggesting an increased risk of STIs and AIDS ⁴. Furthermore, about 50% of new STD were reported in adolescents and

young adults aged 15–24^{13,14}. Adolescents are particularly vulnerable to STIs, such as Chlamydia trachomatis and human papillomavirus infection, due to a lack of cervical mucus and are more likely to engage in risky sexual activities without a condom or concurrent partners^{13,15}. Also, the onset of sexual experience at an early age is associated with unplanned pregnancy and physical violence^{5,11}. According to the Korean sexuality survey, the age of sexual debut before the age of 19 was associated with a higher number of sexual partners in life, and the number of pregnancies and experiences of sexual abuse were significantly higher among women¹⁶.

Sexual experience in adolescence is a complex behavior that is affected by various factors and needs to be considered at multiple levels. Adolescent sexual experience is not only sexual maturity at the biological level but is also important at the psychological and social levels¹⁷. The biopsychosocial model is useful for understanding individual medical conditions through the complex interaction of biological factors, such as genetic and biochemical factors, psychological factors, such as mood, personality, and behavior, and social factors, such as cultural, familial, socioeconomic, and medical factors¹⁸. The biopsychosocial model was used to elucidate the chronic behavior problem¹⁹ and the relationship between cognitive, physiological, and behavioral stress responses in adolescents²⁰. A study reported that the biopsychosocial model was used to identify factors influencing health and complaints in children and adolescents²¹. Furthermore, a biopsychosocial model of hypersexuality in girls with bipolar disorder examined the factors associated with sexual experiences and provided a framework for cognitive-behavioral intervention²².

Therefore, this study aimed to investigate the factors associated with adolescents' sexual experience based on the biopsychosocial model. Furthermore, this study provides basic data on the prevention and management of risky sexual behaviors among adolescents in Korea.

2. Methods

2.1. Study design and participants

The study used data from the 2017 to 2020 Korea Youth Risk Behavior Web-based Survey

(KYRBS), Ministry of Health and Welfare, Centers for Disease Control and Prevention Agency. The KYRBS is a cross-sectional, nationwide survey targeting Korean adolescents, including middle and high school students, and has been conducted annually since 2005 to identify their health behaviors. The KYRBS participants were selected using a complex sample design. The sampling process consisted of three steps: population stratification by regional and school characteristics, sampling distribution by proportional allocation methods (400 middle and 400 high schools), and sampling by stratified cluster sampling (school and class units). The participants responded to an anonymous self-report online survey. If the designated school agreed to participate in the survey and the students voluntarily agreed by clicking the participation button in the online survey, the survey began ². In addition, consent for some questions (family members, parents' cohabitation status, etc.) in the survey was added in 2019; they could choose to not respond to any items. In this study, we used data from the KYRBS (2017–2020) because the survey questions on sexual experience have been modified since 2017. A total of 234,567 participants were assessed, excluding those who did not answer the family structure question (n=31,406). The participant response rates for the survey ranged from 94.9% to 95.8%. from 2017 to 2020. This study was reviewed by the institutional review board of Gachon University (No. 1044396-202109-HR-194-01), and approval for the use of raw data from the KYRBS in this study was obtained from the Korea Centers for Disease Control and Prevention (KCDC).

2.2. Measures

To assess the factors **associated with** the sexual experiences of adolescents, the variables were classified into three categories (biological, social, and psychological factors) based on the biopsychosocial model (Figure 1).

2.2.1 Sexual experience

Sexual experience was defined as having had sexual intercourse (oral, anal, vaginal) in one's lifetime, and it was measured through the following question: "Have you ever had sex before?" The answers were "I have had sex before" or "I have never had sex before."

2.2.2 Biological factors

For the biological variables, we included participants' age and sex.

2.2.3 Psychological factors

To assess the psychological variables, the levels of perceived stress and suicidal thoughts were assessed. The perceived stress level was identified through the following question: "How much stress do you usually feel? Participants were able to choose one of the five answers from 'very high' to 'very low.' The question on suicidal thoughts was the following: 'Have you attempted suicide in the last 12 months?' The participants responded with "yes" or "no."

2.2.4 Social factors: Family structure

Family structure was categorized based on answers concerning current family members (biological parents and stepparents) and whether the participants lived with these family members. Depending on whether the biological parent was a family member (living together, not living together) or not a family member (absence of biological parents) or whether the stepparent was a family member (living together, not living together), we finally categorized family structure into four types: living with 1) both parents (the participant lives only with a biological father and a biological mother regardless of the presence of stepparents), 2) a single parent (the participant lives only with a biological father or a biological mother regardless of the presence of stepparents), 3) stepparents (the participant lives with a biological father and a stepmother, a biological mother and a stepfather, a stepmother and a stepfather, a stepmother, or a stepfather regardless of the presence of biological parents and stepparents), and 4) none (absence of biological parents, or even in case of the presence of biological parents or stepparents, they do not live together).

2.2.5 Social factors: Other variables

Participation in sex education was assessed using the following question: "Have you received sex education at school (including class time, broadcasting education, and auditorium education) within the past 12 months?" The answers were "yes" and "no." After this question, questions about the content or timing of sex education were excluded. The participants' academic grades in the last

12 months, the location of the school (rural area, medium and small city, and big city), and perceived economic level of the household were measured. Behaviors toward drinking and smoking were measured by asking the participants whether they had ever drunk (or smoked) in their lifetime.

2.3. Statistical analysis

To consider a complex sample design of the study, the data were weighted according to stratification and cluster variables for school and class using SAS software (ver. 9.4; SAS Institute, Cary, NC, USA), and P values of <.05 were considered statistically significant. Items with missing values were removed before the analysis. The participants’ sexual experience characteristics were calculated using the chi-square test and simple regression analysis. A simple logistic analysis was conducted to identify the association between sexual experience and the variables. The results are presented as the crude odds ratio (cOR) and confidence interval (CI). After adjusting for the potential confounding variables to avoid bias, we carried out a multiple logistic analysis presented by adjusted odds ratio (aOR) and CI to identify the variables associated with sexual experience.

2.4. Patient and public involvement

Patients and/or the public were not involved in the design or reporting of this study.

3. Results

The participants included in this analysis were 119,459 middle school students and 115,108 high school students. Table 1 shows the general characteristics of the study participants according to sexual experience. Regarding the biological factors, the mean age of participants who had sexual experience was 13.9 years in middle school students and 16.8 years in high school students. 3.4% of boys and 1.6% of girls attending middle school had sexual experience, showing a significant difference. And, 10.4% of boys and 5.1% of girls attending high school had sexual experience

($P<.001$). Psychological factors, including perceived stress and suicidal thoughts, showed a significant difference with sexual experience. In particular, 5.6% of middle school students and 14.1% of high school students who had sexual experiences showed suicidal thoughts. Furthermore, in terms of the social factors, there was a significant difference in sexual experience according to family structure ($P<.001$). Among middle school students, the percentages of participants who had sexual experience were 2.0%, 2.9%, 5.4%, and 13.6% in those who lived with both parents, a single parent, stepparent, and none, respectively. Among high school students, the percentages of participants who had sexual experience were 6.5%, 10.4%, 17.5%, and 21.5% in those who lived with both parents, a single parent, stepparent, and none, respectively. Most participants received sex education at school over the past year (82.3% and 71.9% of middle and high school students, respectively, data not shown), and there was a significant difference between sex education and sexual experience. For both middle and high school students, sexual experience was higher among participants who reported drinking and smoking behaviors.

Table 1. Study participants' general characteristics according to sexual experience (weighted %).

Characteristics	Middle school (n=119,459)		P- value	High school (n=115,108)		P- value
	Sexual experience			Sexual experience		
	No % (SE)	Yes % (SE)		No % (SE)	Yes % (SE)	
BIOLOGICAL FACTORS						
Age, mean (SE)	13.6(0.00)	13.9(0.02)	<.001	16.5(0.00)	16.8(0.01)	<.001
Sex			<.001			<.001
Boy	96.6(0.09)	3.4(0.09)		89.6(0.17)	10.4(0.17)	
Girl	98.4(0.06)	1.6(0.06)		94.9(0.13)	5.1(0.13)	
PSYCHOLOGICAL FACTORS						
Perceived stress			<.001			<.001
Very low	95.8(0.29)	4.2(0.29)		88.4(0.57)	11.6(0.57)	
Low	98.0(0.10)	2.0(0.10)		92.8(0.22)	7.2(0.22)	
Middle	97.9(0.08)	2.1(0.08)		93.2(0.14)	6.8(0.14)	
High	97.6(0.09)	2.4(0.09)		92.5(0.17)	7.5(0.17)	
Very high	94.8(0.23)	5.2(0.23)		87.8(0.34)	12.2(0.34)	
Suicidal thoughts			<.001			<.001
No	97.9(0.06)	2.1(0.06)		93.0(0.12)	7.0(0.12)	
Yes	94.4(0.21)	5.6(0.21)		85.9(0.35)	14.1(0.35)	
SOCIAL FACTORS						
Family structure*,+			<.001			<.001
Both parents	98.0(0.06)	2.0(0.06)		93.5(0.13)	6.5(0.13)	
Single parent	97.1(0.16)	2.9(0.16)		89.6(0.28)	10.4(0.28)	
Stepparent	94.6(0.69)	5.4(0.69)		82.5(1.07)	17.5(1.07)	
None	86.4(0.93)	13.6(0.93)		78.5(0.90)	21.5(0.90)	
Sex education			<.001			0.049
No	96.3(0.15)	3.7(0.15)		91.8(0.20)	8.2(0.20)	
Yes	97.7(0.06)	2.3(0.06)		92.3(0.14)	7.7(0.14)	
Academic grade			<.001			<.001
Low	96.9(0.11)	3.1(0.11)		90.5(0.18)	9.5(0.18)	
Middle	98.1(0.08)	1.9(0.08)		93.8(0.15)	6.2(0.15)	
High	97.5(0.09)	2.5(0.09)		92.5(0.18)	7.5(0.18)	
Location of school			0.731			0.096
Rural area	97.7(0.25)	2.3(0.25)		91.4(0.54)	8.6(0.54)	
Medium and small city	97.5(0.09)	2.5(0.09)		92.4(0.18)	7.6(0.18)	
Big city	97.4(0.09)	2.6(0.09)		91.9(0.20)	8.1(0.20)	
Perceived economic level of household			<.001			<.001
Low	96.0(0.19)	4.0(0.19)		89.2(0.26)	10.8(0.26)	
Middle	98.1(0.06)	1.9(0.06)		93.9(0.13)	6.1(0.13)	
High	97.1(0.09)	2.9(0.09)		91.1(0.19)	8.9(0.19)	
Drinking			<.001			<.001
No	98.6(0.05)	1.4(0.05)		97.4(0.08)	2.6(0.08)	
Yes	94.2(0.16)	5.8(0.16)		87.1(0.20)	12.9(0.20)	
Smoking			<.001			<.001
No	98.3(0.05)	1.7(0.05)		96.0(0.08)	4.0(0.08)	
Yes	86.3(0.45)	13.7(0.45)		74.7(0.36)	25.3(0.36)	

*Both parents mean the family structure in which the participant lives only with a biological father and a biological mother regardless of the presence of stepparents.
Single parent refers to the family structure in which the participant lives only with a biological father or a biological mother regardless of the presence of stepparents.
Stepparent refers to the family structure in which the participant lives with a biological father and a stepmother, a biological mother and a stepfather, a stepmother and a stepfather, a stepmother, or a stepfather regardless of the presence of biological parents and stepparents.
None means the family structure in which the biological parents do not exist, or even if there are biological parents or stepparents, they do not live together.
[†]The column included missing data (n=31,406), including those who disagreed to respond to the survey on family members and those who responded by living with both their biological father and stepfather

The results of examining the factors associated with sexual experience are presented in Table 2. Regarding the biological factors, sexual experience increased significantly with increasing age (aOR=1.31, 95%CI: 1.28-1.33), and it was lower in girls than in boys (aOR=0.64, 95%CI: 0.60-0.68). Regarding the psychological factors, participants with suicidal thoughts showed significantly higher sexual experience compared to students who did not intend to commit suicide (aOR=1.73, 95% CI: 1.63-1.83). Regarding the social factors, particularly family structure, sexual experience was significantly higher in the group living with stepparents (aOR=2.58, 95% CI: 2.32-2.86), no parents (aOR=1.93, 95%CI: 1.68-2.23), followed by a single parent (aOR=1.34, 95% CI: 1.26-1.43) compared to the group living with both parents. Among middle school students, sexual experience was significantly higher in groups living with stepparents, no parents, a single parent (aOR = 2.91, 95% CI: 2.37-3.56; aOR=1.67, 95% CI: 1.24-2.26; aOR=1.21, 95% CI: 1.07-1.38, respectively) than in the group living with both parents. Among high school students, a significantly higher sexual experience was also found in the three groups living with a single parent, stepparents, and no parents compared to the group living with both parents. Moreover, sexual experience was significantly higher in the group with drinking and smoking experience (aOR=2.53, 95% CI: 2.38-2.68; aOR = 4.57, 95%CI: 4.33-4.82, respectively) than in the group without drinking and smoking experience.

Table 2. Factors associated with sexual experience in adolescents.

Characteristics	Sexual experience (Yes vs. No)					
	Total		Middle school		High school	
	(CI)	aOR (CI)	cOR (CI)	aOR (CI)	cOR (CI)	aOR (CI)
BIOLOGICAL FACTORS						
Age	1.49 (1.47-1.52)	1.31 (1.28-1.33)	1.51 (1.44-1.59)	1.27 (1.21-1.33)	1.36 (1.32-1.40)	1.26 (1.23-1.30)
Sex						
Boy	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Girl	0.48 (0.45-0.50)	0.64 (0.60-0.68)	0.46 (0.42-0.50)	0.50 (0.46-0.56)	0.48 (0.44-0.51)	0.69 (0.64-0.73)
PSYCHOLOGICAL FACTORS						
Perceived stress						
Very low	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Low	0.61 (0.55-0.69)	0.72 (0.63-0.81)	0.51 (0.42-0.62)	0.68 (0.55-0.84)	0.64 (0.54-0.74)	0.74 (0.63-0.86)
Middle	0.64 (0.57-0.71)	0.72 (0.64-0.81)	0.54 (0.45-0.64)	0.74 (0.61-0.89)	0.59 (0.49-0.67)	0.71 (0.62-0.83)
High	0.75 (0.68-0.84)	0.72 (0.64-0.81)	0.64 (0.54-0.77)	0.74 (0.60-0.92)	0.66 (0.56-0.76)	0.72 (0.62-0.83)
Very high	1.35 (1.21-1.51)	0.95 (0.83-1.08)	1.35 (1.12-1.63)	1.06 (0.84-1.34)	1.10 (0.91-1.25)	0.92 (0.79-1.08)
Suicidal thoughts						
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	2.26 (2.15-2.37)	1.73 (1.63-1.83)	2.70 (2.45-2.98)	1.84 (1.64-2.08)	2.22 (2.10-2.35)	1.72 (1.61-1.85)
SOCIAL FACTORS						
Family structure*+:						
Both parents	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Single parent	1.73 (1.64-1.83)	1.34 (1.26-1.43)	1.47 (1.30-1.66)	1.21 (1.07-1.38)	1.69 (1.59-1.80)	1.38 (1.29-1.48)
Stepparent	5.20 (4.77-5.67)	2.58 (2.32-2.86)	7.78 (6.64-9.11)	2.91 (2.37-3.56)	3.96 (3.57-4.39)	2.49 (2.21-2.80)
None	3.16 (2.79-3.58)	1.93 (1.68-2.23)	2.81 (2.15-3.68)	1.67 (1.24-2.26)	3.07 (2.66-3.55)	2.03 (1.73-2.38)
Sex education						
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	0.75 (0.71-0.79)	1.00 (0.95-1.05)	0.61 (0.55-0.67)	0.75 (0.68-0.84)	0.95 (0.90-1.01)	1.07 (1.01-1.13)
Academic grade						
Low	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Middle	0.61 (0.58-0.65)	0.87 (0.83-0.93)	0.61 (0.55-0.68)	0.97 (0.86-1.09)	0.64 (0.61-0.68)	0.85 (0.80-0.91)
High	0.65 (0.61-0.68)	0.97 (0.92-1.02)	0.75 (0.68-0.82)	1.07 (0.96-1.19)	0.76 (0.71-0.80)	0.94 (0.88-1.00)
Location of school						
Rural area	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Medium and small city	0.87 (0.76-0.99)	1.00 (0.88-1.12)	0.97 (0.77-1.24)	0.97 (0.76-1.23)	0.88 (0.75-1.02)	1.01 (0.88-1.16)
Big city	0.92 (0.81-1.05)	1.12 (1.00-1.26)	1.00 (0.79-1.27)	1.04 (0.82-1.31)	0.92 (0.79-1.08)	1.16 (1.01-1.32)
Perceived economic level of household						
Low	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Middle	0.48 (0.45-0.51)	0.79 (0.74-0.84)	0.46 (0.41-0.52)	0.82 (0.71-0.94)	0.55 (0.51-0.58)	0.79 (0.74-0.85)
High	0.63 (0.59-0.66)	1.14 (1.07-1.21)	0.70 (0.62-0.79)	1.22 (1.06-1.39)	0.79 (0.74-0.85)	1.12 (1.04-1.21)
Drinking						
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	6.19 (5.88-6.52)	2.53 (2.38-2.68)	4.33 (3.97-4.72)	2.16 (1.96-2.38)	5.48 (5.12-5.86)	2.70 (2.51-2.91)
Smoking						
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)

Yes	10.07(9.62-10.55)	4.57 (4.33-4.82)	9.48 (8.66-10.36)	4.21 (3.78-4.69)	8.18 (7.75-8.64)	4.68 (4.40-4.97)
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cOR, crude odds ratio; aOR, adjusted odds ratio; CI, confidence interval.

*Both parents mean the family structure in which the participant lives only with a biological father and a biological mother regardless of the presence of stepparents.

Single parent refers to the family structure in which the participant lives only with a biological father or a biological mother regardless of the presence of stepparents.

Stepparent refers to the family structure in which the participant lives with a biological father and a stepmother, a biological mother and a stepfather, a stepmother and a stepfather, a stepmother, or a stepfather regardless of the presence of biological parents and stepparents.

None means the family structure in which the biological parents do not exist, or even if there are biological parents or stepparents, they do not live together.

†The column included missing data (n=31,406) including those who disagreed to respond to the survey on family members and those who responded by living with both their biological father and stepfather.

4. Discussion

This study demonstrated the factors associated with adolescents’ sexual experience based on the biopsychosocial model. It is important to identify the factors associated with adolescents’ sexual experience to prevent adolescents’ sexual health.

Regarding the biological factors, age and sex were significant factors associated with sexual experience in adolescents, including middle- and high-school students. In general, adolescence is a period of physical and mental development related to sex ¹, and it is important for sexual experience. According to a trend analysis (2006–2017) on the sexual experience of Korean adolescents, the prevalence of sexual experience among 16–17 year-olds is higher than that of 12–13 year-olds, although it has been gradually decreasing ³. Moreover, the greater rate of sexual experience of boys than girls is similar to that reported in other studies. In China, where sex is taboo, male adolescents have more sexual intentions than females ¹⁰. According to the PROmoting School-community University Partnerships to Enhance Resilience (PROSPER) longitudinal study in the United States, female sexual experience is not acceptable to friends while male sexual experience is ²³. This suggests that Korea, like other countries, is still more tolerating of male than female sexual experience from an early age.

Regarding the psychological factors, suicidal thoughts were a significant risk factor associated with sexual experience in adolescents. A study reported that there was a strong association between adolescent sexual orientation and suicidal thoughts and behaviors in a US national longitudinal study on adolescents’ health ²⁴. Sexual experience was associated with an increased risk of suicide attempts in adolescents ²⁵. Several studies have reported mechanisms for explaining the association between sexual experience and suicidal thoughts and attempts; however, it is still unclear ²⁵. Thus, further research is needed to explain the association between sexual experience and suicidal thoughts and attempts and suggest aggressive suicide prevention interventions that recognize the risk factors for early sexual experience.

Regarding the social factors, sex education, drinking, smoking, and family structure were associated with sexual experience in adolescents. Sex education has been reported as one of the

ways to prevent risky sexual behaviors and promote healthy and responsible sexuality²⁶. In particular, sex education has a protective effect against risky sexual behaviors in adolescents who have sexual curiosity and engage in unsafe sexual intercourse and consequences, such as STIs and unintended pregnancies²⁷. A study reported that the intervention group who received sex education had better knowledge of sexual health and engaged in less risky sexual behaviors than the control group²⁸. However, in our study, there was a positive association among high school students. This finding may be closely related to the high school educational environment in Korea. In the education system designed for college admissions, health education for sex is relatively insignificant²⁹. Thus, even if high school students receive sex education, it is difficult to expect positive outcomes related to sexual health. Drinking and smoking are risk factors that influence adolescent sexual experiences. Consistent with our findings, several studies have reported that risky sexual behaviors are strongly associated with risky health behaviors^{8,30}. A study of high school students in China reported that cigarettes and illegal drugs were related to unprotected sex without wearing condoms.

Adolescents with a family structure and living with their parents had significantly less sexual experience than those with step-parents, single parents, and no parents. Family structure is a very important factor in adolescent physical and psychological development and health behaviors³¹; in particular, the support of parents can help their children engage in healthy sexual activity. A meta-analysis reported that parental monitoring delayed the onset of sex and increased the use of condoms and contraceptive practices during sexual intercourse³². Similarly, a Kenyan study reported that the presence of parents influences the first sexual experience³³, and communication with the mother is associated with a delay in the onset of sexual experience in male adolescents^{33,34}. Conversely, adolescents who belong to a family where parental support may be insufficient are more likely to engage in risky sexual behaviors³⁵. Several studies have reported that difficulty in communicating with step-parents affects adolescent sexual behaviors and is associated with increased sexual activity^{36,37}. In step-families and single-mother families, adolescents are more likely to have sexual intercourse before they are 14 years old³⁸. Since sex education by parents can play an important role in sexual health, active interventions tailored to the family structure are required

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This study had some limitations. First, the study design was cross-sectional and could not be used to determine causal relationships. Second, a self-report questionnaire was used; thus, the reliability of the study results may be low. However, since the survey was conducted anonymously, it can reduce the burden of respondents for sensitive questions that they may be reluctant to answer, particularly sex-related questions. Third, the variables used in this study were limited to questionnaire items based on the Korea Youth Risk Behavior Web-based survey. Several sex-related questions were deleted or revised from the 2017 survey, and it was not possible to analyze important variables related to this study (such as the prevalence of STIs, contraceptive practices, contraceptive methods, and age at first sexual intercourse). Family structure and communication with family members are closely related to the sexual behaviors of children; however, there were no survey items about whether the participants lived with siblings or the depth of communication with parents and siblings. Finally, there was a lack of definitions for the survey items. For example, for sexual experience, there was no distinction between heterosexual and homosexual intercourse and what the method (oral, anal, or vaginal intercourse) was. In addition, regarding sex education, the content and time of participation in sex education were not included. Therefore, the effectiveness of sex education may not have been accurately analyzed. Despite these limitations, since this study surveyed middle and high school students nationwide using a complex sample design, our findings could be generalized to Korean adolescents. Since the biopsychosocial model was used to identify factors related to sexual experience, the findings can be presented as objective evidence and intervention strategies based on each dimension.

This study has several implications. This study aimed to determine the sexual experience rate of Korean adolescents and related factors based on the biopsychosocial model, which suggests a multi-faceted intervention strategy for their sexual health and prevention of risky sexual behaviors. In addition, considering that the divorce rate in Korea is rapidly increasing ³⁹, this study suggests the need for active intervention for adolescents who do not live with their parents.

5. Conclusion

This study identified the factors associated with adolescent sexual experiences based on the biopsychosocial model. Biological (age and sex), psychological (suicidal thoughts), and social (sex education, drinking, smoking, and family structure) factors were related to sexual experiences. Based on these factors, we suggest that further research to develop and evaluate the strategy related to these factors should be conducted to promote adolescent sexual and reproductive health in the future.

Contributorship statement

The study was conceived by all of the authors. KYK contributed to the conceptualization, data curation, formal analysis, methodology, and writing-original draft. HYS contributed to the conceptualization, funding acquisition, project administration, methodology, and writing-review and editing. All authors have read and agreed to the published version of the manuscript.

Competing interests

The authors of this work have nothing to disclose.

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Data sharing statement

Data are available upon reasonable request.

Acknowledgments

The Korea Centers for Disease Control and Prevention provided the data for this study.

Ethical considerations

The study was approved by the Gachon University’s Institutional Review Board (No. 1044396-202109-HR-194-01). Ethical issues regarding plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the author.

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Figure legend

Figure 1. Illustration of the Biopsychosocial Model used in our study.

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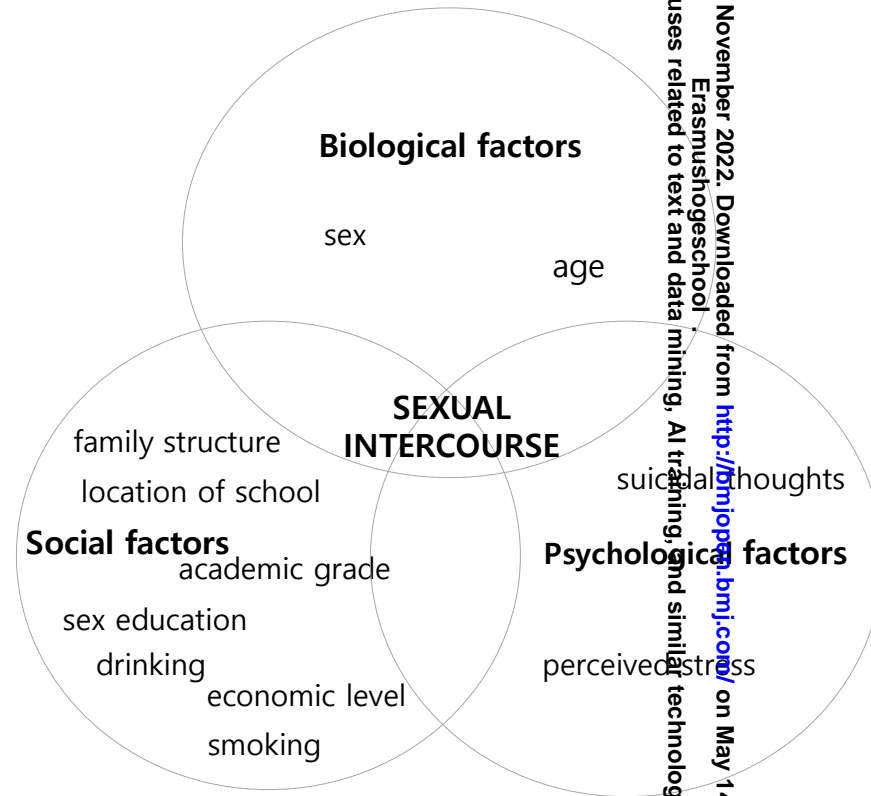


Figure 1. Illustration of the Biopsychosocial Model used in our study.

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	page
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	7
		(e) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	

Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8,10
		(b) Report category boundaries when continuous variables were categorized	Not applicable
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	13-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.