

# Early Initiation of Alcohol Drinking, Cigarette Smoking, and Sexual Intercourse Linked to Suicidal Ideation and Attempts: Findings from the 2006 Korean Youth Risk Behavior Survey

Dong-Sik Kim<sup>1,2</sup> and Hyun-Sun Kim<sup>1</sup>

<sup>1</sup>Institute of Health and Environment, Seoul National University, Seoul; <sup>2</sup>Research Division, World Research Co., Inc., Seoul, Korea.

**Purpose:** This study examined the association between early initiation of problem behaviors (alcohol drinking, cigarette smoking, and sexual intercourse) and suicidal behaviors (suicidal ideation and suicide attempts), and explored the effect of concurrent participation in these problem behaviors on suicidal behaviors among Korean adolescent males and females. **Materials and Methods:** Data were obtained from the 2006 Korean Youth Risk Behavior Survey, a nationally representative sample of middle and high school students (32,417 males and 31,467 females) in grades seven through twelve. Bivariate and multivariate logistic analyses were conducted. Several important covariates, such as age, family living structure, household economic status, academic performance, current alcohol drinking, current cigarette smoking, current butane gas or glue sniffing, perceived body weight, unhealthy weight control behaviors, subjective sleep evaluation, and depressed mood were included in the analyses. **Results:** Both male and female preteen initiators of each problem behavior were at greater risk for suicidal behaviors than non-initiators, even after controlling for covariates. More numerous concurrent problematic behaviors were correlated with greater likelihood of seriously considering or attempting suicide among both males and females. This pattern was more clearly observed in preteen than in teen initiators although the former and latter were engaged in the same frequency of problem behavior. **Conclusion:** Early initiation of alcohol drinking, cigarette smoking, and sexual intercourse, particularly among preteens, represented an important predictor of later suicidal ideation and suicide attempts in both genders. Thus, early preventive intervention programs should be developed and may reduce the potential risks for subsequent suicidal behaviors.

**Key Words:** Alcohol drinking, cigarette smoking, sexual intercourse, suicidal ideation, attempted suicide, life experience

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Corresponding author: Dr. Dong-Sik Kim,  
Institute of Health and Environment,  
Seoul National University, 101 Daehak-ro,  
Jongno-gu, Seoul 110-460, Korea.

Tel: 82-2-3668-7858, Fax: 82-2-745-9104

E-mail: kds22734@snu.ac.kr

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## INTRODUCTION

Since the economic crisis, suicide mortality has risen sharply among Korean adolescents aged 15 to 19 years (i.e., an increase of 40.7% from 5.4 per 100,000 in 2001 to 7.6 per 100,000 in 2005) and is the second leading cause of death among this population.<sup>1</sup> Suicide and suicidal behaviors (suicidal ideation and suicide attempts) among adolescents have become major public health concerns in Korea, and it is thus important to determine the risk factors associated with such behaviors. In recent years, early age of onset of alcohol drinking, cigarette smoking, and sexual intercourse (i.e., during childhood) have been identified as important predictors, beyond the multiple risk factors in adolescence previously noted in the literature,<sup>2-5</sup> of later suicidal behaviors (during adolescence).<sup>6-13</sup> With the exception

of alcohol drinking, which is usually measured by self-reported age at first alcoholic drink excluding those imbibed for religious reasons,<sup>10,12,13</sup> age at initiation of cigarette smoking and sexual intercourse has been conservatively measured in most previous studies (i.e., “regular/daily smoking or smoking a whole cigarette” and “unwanted/forced sexual intercourse”).<sup>7,8,14</sup> By using such methodologies, previous studies may have overestimated the contribution of early initiation of cigarette smoking and/or sexual intercourse to suicidal behaviors. Furthermore, according to Jessor’s Problem Behavior Theory,<sup>15</sup> alcohol drinking, cigarette smoking, and sexual intercourse have been highly correlated, even occurring simultaneously in some cases. Kim<sup>16</sup> and Schmid, et al.<sup>17</sup> reported that concurrent users of alcohol and cigarettes were at higher risk for developing other problem behaviors (e.g., leaving home, delinquency, violating school rules) and substance use (e.g., stimulants/sleeping pills, marijuana, or butane gas/glue), compared to drinkers who did not smoke, smokers who did not drink, and abstainers (neither drinking nor smoking). However, little is known about the nature and extent of the health effects of early concurrent participation in problem behaviors, particularly in regard to later suicidal ideation and suicide attempts.

According to the Korean Ministry of Health and Welfare, the average reported age of drinking and smoking initiation decreased from 15.1 and 15.0 years in 1998 to 13.1 and 12.5 years in 2006, respectively; the prevalence of adolescent female smokers (12.8%) was about twice as high as that of adult female smokers (5.6%); and age at first experience of sexual intercourse also decreased.<sup>16,18</sup> These findings have prompted an increased interest in the subsequent psychological status of such individuals. Nonetheless, despite the numerous factors placing this population at higher risk for problematic and suicidal behaviors, relatively few studies have been conducted in this domain.

Therefore, this study examined the associations between early initiation of alcohol drinking, cigarette smoking and sexual intercourse with suicidal ideation and suicide attempts. This study also determined the effects on each outcome of concurrent engagement in these problem behaviors, controlling for various confounding factors.

## MATERIALS AND METHODS

### Data and participants

Data were derived from the 2006 Korean Youth Risk Behavior Web-based Survey (KYRBWS) conducted by the Korean Centers for Disease Control and Prevention (KCDC) to monitor the prevalence of high-risk behaviors.

This study applied a stratified three-stage clustering design to produce a nationally representative sample of public and private middle and high school students in grades seven through twelve in all regions of Korea. The first stage involved 234 cities and districts with similar characteristics in regard to the degree of geographic accessibility; numbers of schools and residents, and employment rate in general and in the farming, mining, and service industries in particular. In the second stage, 400 middle schools and 400 high schools were selected from within the 234 cities and districts. The third stage of sampling consisted of randomly selecting one class from each grade within each chosen school. All students in selected classes were eligible to participate. The survey proceeded as follows: during July, school teachers were trained to assist students with participating in the survey; during August, the KCDC informed each school about the schedule for conducting the survey and provided certificate numbers for each student; during September and October, students used their certificate numbers to access and complete questionnaires during a regular class period. The KYRBWS was officially approved by the Korea National Statistical Office (KNSO Certificate Number: 11758). Further details regarding the survey design and methods have been provided elsewhere.<sup>18</sup>

From an original pool of 78,593 potential participants, 71,404 students were interviewed (response rate: 90.9%). However, data obtained from 7,520 (10.5%) respondents were omitted from the analysis due to missing information in regard to important questions (e.g., alcohol drinking, cigarette smoking, and sexual intercourse). Consequently, data obtained from 63,884 adolescents (32,417 males and 31,467 females) were available for analysis (age range: 13–19 years; mean age:  $16.2 \pm 1.7$  years for both genders).

### Measures

This study used two outcome variables: suicidal ideation and suicide attempts. Participants were asked whether they had seriously considered attempting suicide and/or had made a suicide attempt during the past 12 months. Responses were divided into yes/no categories for each question.

The primary variables of interest in this study involved three potentially problematic behaviors: alcohol drinking, cigarette smoking, and sexual intercourse. Participants provided information about when, if ever, they had initiated each of these behaviors using a 14-point scale including never, preschool, and first to twelfth grades. Responses were recoded into three categories: teen initiators (seventh to twelfth grades), preteen initiators (first to sixth grades or preschool), and non-initiators. School grade appeared to serve as a more salient cue than age in terms of eliciting recollections from students.<sup>9</sup> To test our second hypothesis, nine different categories were derived, according to the

period at first occurrence, from the combination of the three problem behaviors, as shown in Table 5. For example, “teen initiators with one behavior” referred to individuals who initially experienced one of the three problem behaviors during their teenage years; “preteen and teen initiators with two behaviors” referred to individuals who initially experienced one of the three behaviors during their teenage years and one of the other behaviors during their preteen years.

Categorizations of several important covariates, such as age (in years); family living structure (living with both parents or living with a single parent/others); household economic status (low, middle, and upper); academic performance (low, middle, and upper); perceived body weight (underweight, about right, and overweight); subjective sleep evaluation (satisfaction or dissatisfaction), and depressed mood (“yes” if they had felt so sad or hopeless almost every day for 2 weeks or more in a row that you stop doing some usual activities during the past 12 months) were conventionally defined and straightforward, as shown in Table 2.<sup>19</sup> We also included current alcohol drinking (“yes” if they had consumed alcohol one or more days during the past 30 days), current cigarette smoking (“yes” if they had smoked at least one cigarette during the past 30 days), current butane gas or glue sniffing (“yes” if they often or sometimes sniffed butane gas or glue), and current unhealthy weight control behaviors (“yes” if they had participated in any of the following behaviors during the past 30 days: fasting for 12 hours or more; eating less; taking diet pills, laxatives, or diuretics; vomiting; and eating only one food) in the analyses to test whether early engagement in each problem behavior was independently linked to suicidal ideation and suicide attempts.<sup>4,5,9,19</sup>

### Statistical analyses

Distributions of the incidences of suicidal ideation and suicide attempts varied by gender; therefore, data obtained from males and females were analyzed separately in all analyses. Chi-square tests were used to examine the differences between males and females in the lifetime prevalence of alcohol drinking, cigarette smoking, and sexual inter-

course (Table 1). Distribution of all variables was also presented by gender (Table 2). Descriptive analyses were performed using a chi-square test and univariate logistic regression analysis to investigate the associations between early initiation of problem behaviors and suicidal behaviors (Table 3). To avoid any possible confounding effects among our primary variables, multivariate logistic regression analyses were conducted and included all covariates (Table 4). Multivariate analyses were also performed to determine the effect of concurrent participation in these problem behaviors on each outcome (Table 5). The significance level was set at  $p < 0.05$ . All analyses were performed using SAS statistical software (version 9.1).

## RESULTS

Table 1 shows the grade at first participation in alcohol drinking, cigarette smoking, and sexual intercourse by gender. Overall, the lifetime prevalence for alcohol drinking (61.9% of males vs. 61.1% of females,  $p = 0.034$ ), cigarette smoking (32.0% vs. 22.1%,  $p < 0.001$ ), and sexual intercourse (6.4% vs. 3.2%,  $p < 0.001$ ) was higher in males than in females. In addition, more males than females reported consuming alcohol (19.9% of males vs. 15.2% of females,  $p < 0.001$ ), smoking tobacco (13.2% vs. 7.9%,  $p < 0.001$ ), and having sexual intercourse (1.1% vs. 0.4%,  $p < 0.001$ ) before attending middle school (preteen initiators).

Table 2 summarizes the descriptive information for all variables by gender. In general, females showed a greater risk for suicidal ideation (26.8% of females vs. 18.1% of males,  $p < 0.001$ ), suicide attempts (5.5% vs. 4.1%,  $p < 0.001$ ), unhealthy weight control behavior (57.5% vs. 31.0%,  $p < 0.001$ ), sleep dissatisfaction (43.6% vs. 37.7%,  $p < 0.001$ ), and depression (45.8% vs. 35.7%,  $p < 0.001$ ) than did males. However, current alcohol drinking (26.9% of females vs. 30.0% of males,  $p < 0.001$ ), cigarette smoking (7.9% of females vs. 14.0% of males,  $p < 0.001$ ), and butane gas or glue sniffing (0.9% of females vs. 1.8% of males,  $p < 0.001$ ) were more prevalent in boys than in girls.

**Table 1.** Grade at First Participation in Alcohol Drinking, Cigarette Smoking, and Sexual Intercourse in Korean Adolescent Males (n = 32,417) and Females (n = 31,467)

	Alcohol drinking				Cigarette smoking				Sexual intercourse			
	Males		Females		Males		Females		Males		Females	
	Cases	%*	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Preteen	6,466	19.9	4,774	15.2	4,295	13.2	2,473	7.9	352	1.1	131	0.4
Middle teen	9,581	29.6	11,543	36.7	4,635	14.3	3,641	11.6	774	2.4	353	1.1
Late teen	4,014	12.4	2,899	9.2	1,435	4.4	846	2.7	949	2.9	536	1.7
Total, n	20,061	61.9	19,216	61.1	10,365	32.0	6,960	22.1	2,075	6.4	1,020	3.2

Preteen ranges from preschool to 6th grade; middle teen ranges from 7th to 9th grade; and late teen ranges from 10th to 12th grade.

\*% of total populations (n).

**Table 2.** General Characteristics of Korean Adolescent Males and Females

	Males		Females	
	%	n	%	n
Suicidal ideation				
No	81.9	26,545	73.2	3,034
Yes	18.1	5,872	26.8	8,433
Suicide attempt				
No	95.9	31,099	94.5	29,736
Yes	4.1	1,318	5.5	1,731
Alcohol drinking initiation				
Non-initiators	38.1	12,356	38.9	12,251
Teen initiators	41.0	13,595	45.9	14,442
Preteen initiators	19.9	6,466	15.2	4,774
Cigarette smoking initiation				
Non-initiators	68.1	22,052	77.8	24,507
Teen initiators	18.7	6,070	14.3	4,487
Preteen initiators	13.2	4,295	7.9	2,473
Sexual intercourse initiation				
Non-initiators	93.6	30,342	96.8	30,447
Teen initiators	5.3	1,723	2.8	889
Preteen initiators	1.1	352	0.4	131
Age (mean $\pm$ SD)	16 $\pm$ 23 (1.74)	32,417	16 $\pm$ 26 (1.74)	31,467
Family living structure				
Living with both parents	85.1	27,572	85.2	26,814
Living with a single parent / others	14.9	4,845	14.8	4,653
Household economic status				
Lower	22.3	7,219	23.5	7,410
Middle	71.1	55,414	71.0	22,338
Upper	8.6	2,784	5.5	1,719
Academic performance				
Lower	33.3	10,779	32.9	10,343
Middle	52.3	16,966	54.1	17,048
Upper	14.4	4,672	13.0	4,076
Perceived body weight				
Underweight	35.1	11,364	22.7	7,156
About the right weight	40.0	12,974	49.8	15,669
Overweight	24.9	8,079	27.5	8,642
Current alcohol drinking				
No	70.0	22,676	73.1	23,007
Yes	30.0	9,741	26.9	8,460
Current cigarette smoking				
No	86.0	27,880	92.1	28,986
Yes	14.0	4,537	7.9	2,481
Current butane gas or glue sniffing				
No	98.2	31,832	99.1	31,187
Yes	1.8	585	0.9	280
Unhealthy weight control behavior				
No	69.0	22,355	42.5	13,380
Yes	31.0	10,062	57.5	18,087
Subjective sleep evaluation				
Satisfaction	62.3	20,201	56.4	17,763
Dissatisfaction	37.7	12,216	43.6	13,704
Depressed mood				
No	64.3	20,842	54.2	17,042
Yes	35.7	11,575	45.8	14,425

**Table 3.** Percentage Distributions and Unadjusted Odds Ratios (95% Confidence Intervals) of the Study Variables by Suicidal Ideation and Suicide Attempts in Korean Adolescent Males and Females

	Males						Females					
	Suicidal ideation			Suicide attempts			Suicidal ideation			Suicide attempts		
	%	OR	(95% CI)	%	OR	(95% CI)	%	OR	(95% CI)	%	OR	(95% CI)
Alcohol drinking initiation												
Non-initiators	13.4	1.00		2.7	1.00		20.1	1.00		3.3	1.00	
Teen initiators	19.9	1.60	(1.50 - 1.71)	4.2	1.58	(1.38 - 1.82)	29.1	1.63	(1.54 - 1.72)	5.8	1.81	(1.61 - 2.05)
Preteen initiators	23.4	1.98	(1.83 - 2.14)	6.4	2.44	(2.11 - 2.83)	37.0	2.33	(2.16 - 2.50)	10.2	3.36	(2.93 - 3.85)
Cigarette smoking initiation												
Non-initiators	15.4	1.00		3.2	1.00		23.4	1.00		4.1	1.00	
Teen initiators	22.6	1.60	(1.49 - 1.71)	5.0	1.60	(1.40 - 1.84)	37.9	2.00	(1.87 - 2.14)	10.0	2.64	(2.35 - 2.96)
Preteen initiators	25.6	1.88	(1.74 - 2.04)	7.2	2.37	(2.07 - 2.742)	40.5	2.23	(2.05 - 2.43)	11.7	3.15	(2.74 - 3.62)
Sexual intercourse initiation												
Non-initiators	17.3	1.00		3.5	1.00		26.1	1.00		5.1	1.00	
Teen initiators	29.3	1.99	(1.79 - 2.22)	9.4	2.83	(2.38 - 3.36)	45.7	2.38	(2.08 - 2.72)	14.3	3.08	(2.54 - 3.74)
Preteen initiators	37.8	2.91	(2.34 - 3.62)	23.0	8.14	(6.30 - 10.51)	51.2	2.95	(2.09 - 4.16)	31.3	8.42	(5.80 - 12.22)
Age*	16.4 ± 1.7	1.07	(1.05 - 1.09)	16.3 ± 1.7	1.02	(0.98 - 1.05)	16.3 ± 1.7	1.00	(0.99 - 1.02)	16.1 ± 1.7	0.94	(0.91 - 0.96)
Family living structure												
Living with both parents	17.6	1.00		3.8	1.00		25.7	1.00		5.0	1.00	
Living with a single parent / others	21.2	1.26	(1.17 - 1.36)	5.8	1.59	(1.39 - 1.82)	33.2	1.44	(1.35 - 1.54)	8.2	1.67	(1.48 - 1.88)
Household economic status												
Lower	23.5	1.39	(1.24 - 1.55)	4.9	0.76	(0.63 - 0.92)	36.9	1.92	(1.70 - 2.17)	7.9	1.27	(1.03 - 1.57)
Middle	16.4	0.89	(0.80 - 0.98)	3.5	0.54	(0.45 - 0.63)	24.1	1.09	(0.97 - 1.22)	4.6	0.72	(0.59 - 0.88)
Upper	18.1	1.00		6.4	1.00		22.6	1.00		6.3	1.00	
Academic performance												
Lower	21.4	1.30	(1.19 - 1.42)	5.0	1.02	(0.87 - 1.20)	32.1	1.55	(1.42 - 1.68)	7.1	1.56	(1.32 - 1.83)
Middle	16.2	0.92	(0.95 - 1.00)	3.2	0.65	(0.56 - 0.76)	24.4	1.06	(0.98 - 1.15)	4.7	1.00	(0.85 - 1.17)
Upper	17.4	1.00		4.9	1.00		23.4	1.00		4.7	1.00	
Perceived body weight												
Underweight	18.0	1.13	(1.06 - 1.21)	4.0	1.02	(0.90 - 1.16)	25.4	1.04	(0.97 - 1.11)	5.0	0.99	(0.87 - 1.13)
About the right weight	16.3	1.00		3.9	1.00		24.7	1.00		5.1	1.00	
Overweight	21.1	1.37	(1.28 - 1.47)	4.3	1.09	(0.95 - 1.26)	31.7	1.41	(1.33 - 1.50)	6.6	1.33	(1.19 - 1.49)
Current alcohol drinking												
No	15.8	1.00		3.1	1.00		23.8	1.00		4.2	1.00	
Yes	23.6	1.65	(1.56 - 1.75)	6.3	2.08	(1.86 - 2.32)	35.1	1.74	(1.65 - 1.83)	9.2	2.34	(2.12 - 2.58)
Current cigarette smoking												
No	16.7	1.00		3.4	1.00		25.2	1.00		4.6	1.00	
Yes	26.7	1.82	(1.69 - 1.95)	8.1	2.49	(2.20 - 2.82)	45.6	2.49	(2.29 - 2.71)	16.1	3.97	(3.53 - 4.49)
Current butane gas or glue sniffing												
No	17.7	1.00		3.8	1.00		26.6	1.00		5.3	1.00	
Yes	41.2	3.26	(2.76 - 3.85)	20.2	6.45	(5.23 - 7.96)	48.2	2.57	(2.03 - 3.25)	26.1	6.28	(4.79 - 8.24)
Unhealthy weight control behavior												
No	16.2	1.00		3.6	1.00		22.5	1.00		4.3	1.00	
Yes	22.3	1.48	(1.40 - 1.57)	5.1	1.44	(1.29 - 1.62)	30.0	1.47	(1.40 - 1.55)	6.4	1.50	(1.35 - 1.66)
Subjective sleep evaluation												
Satisfaction	14.7	1.00		3.2	1.00		22.2	1.00		4.3	1.00	
Dissatisfaction	23.8	1.81	(1.71 - 1.92)	5.4	1.71	(1.53 - 1.91)	32.7	1.70	(1.62 - 1.79)	7.1	1.71	(1.55 - 1.88)
Depressed mood												
No	6.7	1.00		1.1	1.00		10.6	1.00		1.5	1.00	
Yes	38.7	8.76	(8.20 - 9.36)	9.5	9.71	(8.40 - 11.24)	46.0	7.22	(6.81 - 7.66)	10.3	7.69	(6.71 - 8.80)

\*Means and standard deviations of both 'non-suicidal ideation' and 'non-suicidal attempts' were 16.2 ± 1.7 for males and 16.3 ± 1.7 for females.

**Table 4.** Adjusted Odds Ratios (95% Confidence Intervals)\* for the Associations of Early Initiation of Alcohol Drinking, Cigarette Smoking and Sexual Intercourse with Suicidal Ideation and Suicide Attempts in Korean Adolescent Males and Females

	Males				Females			
	Suicidal ideation		Suicide attempts		Suicidal ideation		Suicide attempts	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Alcohol drinking initiation								
Non-initiators	1.00		1.00		1.00		1.00	
Teen initiators	1.11	(1.01 - 1.22)	1.06	(0.89 - 1.27)	1.21	(1.12 - 1.30)	1.23	(1.05 - 1.43)
Preteen initiators	1.28	(1.16 - 1.41)	1.27	(1.06 - 1.52)	1.45	(1.33 - 1.59)	1.61	(1.37 - 1.89)
Cigarette smoking initiation								
Non-initiators	1.00		1.00		1.00		1.00	
Teen initiators	1.05	(0.94 - 1.16)	0.82	(0.67 - 1.01)	1.28	(1.17 - 1.41)	1.35	(1.15 - 1.59)
Preteen initiators	1.26	(1.14 - 1.38)	1.15	(0.97 - 1.37)	1.50	(1.31 - 1.61)	1.48	(1.25 - 1.75)
Sexual intercourse initiation								
Non-initiators	1.00		1.00		1.00		1.00	
Teen initiators	1.13	(0.99 - 1.30)	1.54	(1.25 - 1.90)	1.40	(1.19 - 1.63)	1.52	(1.22 - 1.90)
Preteen initiators	1.38	(1.05 - 1.81)	2.55	(1.83 - 3.55)	1.66	(1.10 - 2.53)	2.49	(1.55 - 3.99)

\*Adjusted for age, family living structure, household economic status, academic performance, perceived body weight, unhealthy weight control behavior, current alcohol drinking, current cigarette smoking, current butane gas or glue sniffing, subjective sleep satisfaction, and depressed mood.

Table 3 provides the gender specific percentage distributions and unadjusted odds ratios (95% confidential intervals) of suicidal ideation and suicide attempts by all key variables, including the three problem behaviors. Male and female adolescents who had already initiated these behaviors at any period (either teen or preteen initiators) were at greater risk for suicidal ideation and suicide attempts compared to non-initiators of alcohol drinking, cigarette smoking, or sexual intercourse. In particular, younger initiation of alcohol drinking, cigarette smoking, or sexual intercourse was correlated with greater likelihood of suicidal ideation and actual attempts. That is, male and female preteen initiators were at much greater risk for suicidal ideation and suicide attempts than were male and female teen initiators.

Table 4 presents the results of multivariate logistic regression analysis in the form of odds ratios and 95% confidence intervals for the associations among alcohol drinking, cigarette smoking, and sexual intercourse initiation with suicidal ideation and suicide attempts, after controlling for all covariates. As observed in the descriptive analysis, although the magnitudes of the associations of problem behaviors with suicidal behaviors were considerably attenuated when covariates were taken into account, their associations remained significant, except with regard to some male and female teen or preteen initiators. This finding indicated that preteen initiation of alcohol drinking, cigarette smoking, and sexual intercourse was independently and significantly associated with elevated likelihood of suicidal ideation and suicide attempts in both genders. Moreover, such associations were stronger among the

preteen initiator group than among the teen initiator and non-initiator groups.

Table 5 displays the results of the multivariate analysis focusing on concurrent involvement in problem behaviors, and presenting logistic regression parameter estimates as odds ratios. Overall, the odds ratios increased as the frequency of concurrent engagement in problem behaviors increased during the same period of initiation. Interestingly, the odds ratios showed different patterns of associations between problem behaviors and suicidal behaviors according to when the former was initially experienced. Preteen initiators were at greater risk of suicidal ideation and suicide attempts than were teen initiators given concurrent participation at identical frequencies in problem behavior(s). Indeed, preteen and teen initiators with two or more problem behaviors appeared much more likely to demonstrate suicidal behaviors than teen initiators reporting the same frequency of problem behaviors, but less likely than preteen initiators alone.

## DISCUSSION

Using a large nationally representative sample of Korean adolescents, we found that early initiation of each problem behavior (i.e., alcohol drinking, cigarette smoking, and sexual intercourse) was independently and significantly associated with an increased risk of suicidal ideation and suicide attempts, even when all covariates were controlled (e.g., sociodemographic characteristics, substance use, unhealthy behaviors, and psychological disorders). A



**Table 5.** Adjusted Odds Ratios (95% Confidence Intervals)\* for the Associations of Concurrent Participation in Alcohol Drinking, Cigarette Smoking, and Sexual Intercourse with Suicidal Ideation and Suicide Attempts in Korean Adolescent Males and Females

	Males						Females							
	n	Suicidal ideation			Suicide attempts			n	Suicidal ideation			Suicide attempts		
		%	OR	(95% CI)	%	OR	(95% CI)		%	OR	(95% CI)	%	OR	(95% CI)
Non-initiators	11,267	12.9	1.00		2.7	1.00		11,748	19.5	1.00		3.2	1.00	
Teen initiators with one behavior	7,327	17.0	1.13 (1.02 - 1.25)		3.4	1.08 (0.90 - 1.32)		9,665	25.3	1.22 (1.13 - 1.32)		4.1	1.21 (1.03 - 1.43)	
Teen initiators with two behaviors	3,981	20.8	1.16 (1.02 - 1.32)		3.7	0.81 (0.62 - 1.05)		3,389	35.3	1.56 (1.39 - 1.75)		8.6	1.73 (1.40 - 2.13)	
Teen initiators with three behaviors	937	26.4	1.23 (0.99 - 1.51)		7.5	1.26 (0.89 - 1.79)		432	47.7	2.29 (1.80 - 2.90)		14.6	2.52 (1.78 - 3.56)	
Preteen initiators with one behavior	4,171	19.4	1.30 (1.17 - 1.44)		3.9	1.09 (0.89 - 1.34)		3,305	32.5	1.54 (1.40 - 1.69)		7.1	1.65 (1.38 - 1.97)	
Preteen initiators with two behaviors	1,668	24.6	1.47 (1.27 - 1.69)		6.4	1.44 (1.12 - 1.84)		969	44.1	2.06 (1.76 - 2.40)		13.6	2.33 (1.84 - 2.96)	
Preteen initiators with three behaviors	147	49.7	2.46 (1.63 - 3.70)		34.7	6.55 (4.22 - 10.17)		46	65.2	3.52 (1.73 - 7.14)		54.4	8.09 (3.98 - 16.47)	
Preteen and teen initiators with two behaviors	2,304	25.3	1.55 (1.36 - 1.76)		6.1	1.45 (1.14 - 1.84)		1,663	38.4	1.75 (1.53 - 1.99)		9.7	1.89 (1.51 - 2.36)	
Preteen and teen initiators with three behaviors	615	36.1	1.77 (1.41 - 2.21)		15.3	2.63 (1.90 - 3.65)		250	53.6	2.45 (1.83 - 3.30)		22.8	3.37 (2.32 - 4.91)	

\*Adjusted for age, family living structure, household economic status, academic performance, perceived body weight, current alcohol drinking, current cigarette smoking, current butane gas or glue sniffing, unhealthy weight control behavior, subjective sleep evaluation, and depressed mood.

similar pattern of correlations was revealed in both genders. This finding underscores that adolescent males and females whose initiation into alcohol use, tobacco use, or sexual intercourse occurred in childhood may be vulnerable to suicidal ideation and suicide attempts in adolescence. Understanding why those who have engaged in drinking, smoking, or sexual intercourse during their early lives go on to seriously consider and/or attempt suicide in later life is a complex task. It is possible that individuals with early exposure to these problem behaviors tend to be at higher risk not only for later alcohol abuse/dependence, nicotine dependence, unwanted pregnancy, abortion, and sexually transmitted diseases but also for later illicit drug abuse and antisocial characteristics, potentially leading them to consider and/or to attempt suicide.<sup>10,11,14,17,20</sup> This finding is consistent with previous studies among U.S. high school students<sup>12,13</sup> reporting that preteen alcohol use (i.e., before age 13), compared to abstinence during this period, was significantly associated with both suicidal ideation and suicide attempts, and that initiation of alcohol use during the teen years showed a similar but less significant association with suicide and suicidal behavior. Cho et al.<sup>9</sup> also found a significant association between cigarette smoking and suicidal ideation among adolescent males and females in the U.S., but did not find a relationship between early

alcohol drinking and suicidal ideation and suicide attempts in either gender. Differences between these data and our results may be attributable to differences between the studies in terms of the measures employed; in particular, early onset of alcohol drinking and cigarette smoking in the former study (e.g., the grade in which a young person first got drunk and started smoking regularly) tended to be more conservative than those in our study (e.g., the grade in which they first drank alcohol and smoked). Both problem behaviors were treated as categorical variables in this study, whereas as continuous variables in the previous study. We do not know whether the measurement of the sexual intercourse variable used in this study was construed as including forced sexual intercourse; however, if so, our results support those of previous studies showing that both male and female adolescents who have been forced to have sexual intercourse appeared more likely to engage in serious suicidal ideation.<sup>7,8</sup> Since we measured onset variables less conservatively than did previous studies, our findings may have derived stronger implications than previous studies regarding the early initiation of alcohol use, cigarette smoking, and/or sexual intercourse on suicidal ideation and suicide attempts.

Another distinctive finding of this study emerged in regard to the association between the likelihood of suicidal

ideation and suicide attempts and the time at which the problem behaviors were initially enacted and whether they were enacted concurrently. That is, the likelihood of both suicidal ideation and suicide attempts increased when these problem behaviors were enacted concurrently, particularly among preteens. This finding also provided further evidence for our first hypothesis, and indicated that concurrent participation in multiple problem behaviors had a synergistic effect on suicidal behaviors, and that this synergistic effect may be more detrimental to preteen initiators. Further investigation is necessary to identify the patterns underlying these issues.

This study had several limitations that should be considered in interpreting and generalizing these findings. First, our findings were based on self-reported data in the absence of corroboration from other sources. In addition, each variable (e.g., depression, suicidal ideation, and suicide attempts) was measured by a single item rather than by a scale consisting of multiple items; this may have resulted in reliability and validity problems. Nonetheless, most recent previous studies focusing on various racial and ethnic groups have used this self-reported single question method, and this trend has increased in recent years.<sup>4-7,12,13</sup> Second, the main predictor variables (problem behaviors) used herein were addressed retrospectively. Moreover, these variables generally carry socio-cultural taboos for adolescent populations. Thus, it is possible that study participants did not answer accurately. In addition, our data were obtained from only middle and high school students, thereby excluding those who had dropped out of school and/or had a poor attendance record at the time of the survey, and we also omitted those who did not answer three primary questions (i.e., the onset of alcohol drinking, cigarette smoking and sexual intercourse) from the analysis, even though this excluded group might be characterized by disproportionately greater participation in problem and suicide-related behaviors.<sup>12</sup> Thus, because of these biases, our conclusions may be understated. Third, because certain variables were not addressed in the KYRBWS data, this study could not consider several forms of psychopathology that have been directly or indirectly associated with suicidal behaviors, including adverse childhood experiences, aggressiveness, eating disorders, clinical symptoms, and social support and capital.<sup>24</sup> Finally, the KYRBWS included information on onsets of the problem behaviors but did not include information on onsets of the outcomes. Consequently, we were unable to draw inferences about the causal pathways between problem behaviors and suicide-related behaviors among Korean adolescents. Therefore, future research should consider adopting a longitudinal design to examine the relationships among our focal issues with greater precision.

Despite these limitations, this study has several important strengths. The major strength of the present study was its use of a nationally representative sample and its high response rate, which may enable to generalize our findings to the actual population of Korean adolescents. Moreover, this study was the first to analyze measures of simultaneous alcohol use, cigarette smoking, and sexual intercourse, yielding indications that early initiations of problem behaviors are important predictors of later suicidal ideation and suicide attempts among Korean adolescent males and females. In particular, preteens were more susceptible than teens to the synergistic effects of combinations of these problem behaviors. Given recent trends and unlimited access to alcohol, tobacco, and internet and/or cyberspace sex in modern Korean society, it is not surprising that the age at which problem behaviors manifest continues to decrease. Consequently, the rates of adolescent suicide-related behaviors may continue to increase in the future. In particular, suicidal ideation and suicide attempts in adolescence have been identified as important predictors of suicidal ideation and suicide attempts in adulthood.<sup>21</sup> Therefore, integrated preventive intervention programs targeting the concurrent initiation of alcohol use, cigarette smoking, and sexual intercourse, especially among preteens, should take precedence over those focused on each of these issues separately, thereby reducing the potential risks for subsequent suicidal ideation and suicide attempts.

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