



The impact of psychological problems and adverse life events on suicidal ideation among adolescents using nationwide data of a school-based mental health screening test in Korea

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Received: 19 September 2017 / Accepted: 16 February 2018 / Published online: 28 February 2018
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Abstract

The aim of this study was to investigate the risk factors for suicidal ideation in adolescents by gender and age. This study used 2013 nationwide school-based mental health screening test data from 591,303 seventh grade students and 618,271 tenth grade students in Korea. Suicidal ideation, four psychological problems, and three adverse life events were evaluated using the Adolescents Mental Health and Problem Behavior Screening Questionnaire-II. Of all students, 12.9–14.7% of the boys and 17.1–23.2% of the girls had suicidal ideation. Mood had the greatest impact on the risk for suicidal ideation and other factors also significantly increased the risk of suicidal ideation. Distractibility was positively related to suicidal ideation only in seventh grade students and behavioral problems increased suicidal ideation more in girls than in boys. Violence constituted the most powerful factor for suicidal ideation among the events; however, bullying constituted the most important event that increased suicidal ideation in seventh grade girls. All factors except ‘Distractibility’ increased the risk of severe suicidal ideation. The risk factors for suicidal ideation in adolescents differed by gender and age. Interventions should be made according to these characteristics to reduce suicidal ideation in adolescents.

Keywords Adolescent · Suicidal ideation · Risk factors · Gender · Age

Introduction

Suicide is a major cause of juvenile death. In Korea, the suicide rate for adolescents (age 15–19 years) increased gradually from 5.3 per 100,000 in 2001 to 10.7 in 2009 and then began to decline [1]. However, suicide has been the most common cause of adolescents’ death in Korea since 2009, with the exception of 2014, and the suicide rate for 15–19 years old was the eighth highest among the 33 OCED countries in 2013 (8.2/100,000 in Korea vs. 6.4/100,000 OECD-33 average) [2]. Although the share of juvenile suicide in the entire population’s cause of death is small, it is emerging as an important issue among young people. Suicidal ideation is

a precursor for a suicide attempt [3, 4]. Therefore, knowing the risk factors for suicidal ideation can be the first step in preventing a suicidal attempt.

Risk factors for suicidal ideation among adolescents are well known through many previous studies and can be divided into personal and environmental factors. Typical personal risk factors for suicidal ideation in adolescents include mental disorders, such as a mood disorder, particularly depression, anxiety disorder, or post-traumatic stress disorder [5–8], and psychological impairments, such as hopelessness, low self-esteem, and impulsivity, are other well-known risk factors [9–11]. Disruptive behavior, associated with a conduct disorder, oppositional defiant disorder, or attention deficit hyperactivity disorder (ADHD), and substance abuse can increase the risk of suicidal ideation [7, 12–14]. The environmental risk factors for youth suicidal ideation include a family history of suicidal behavior or mental disorder, family discord, child abuse, interpersonal difficulties, school bullying, and low socioeconomic status, and these factors are associated with psychological problems that affect suicidal ideation or can increase the risk of

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suicidal ideation independently of psychological problems [5, 6, 12, 15–17].

Suicidal behavior is also affected by gender and age. Some studies have reported that the prevalence of suicidal ideation in early adolescence is not very different between males and females, but the actual suicidal intention of suicidal behavior in young adolescents is weaker than that of older adolescents and is highly affected by environmental status, such as peer relationships or familial conflict [18–20]. Suicidal ideation and suicide attempts are more frequently reported in female adolescents, but completed suicide is more frequent in male adolescents [6, 21, 22]. There is also a difference in the factors associated with suicidal ideation according to gender. Health problems, parental separation or divorce, substance use problems, or conduct disorder increase the risk of suicidal ideation more in boys, whereas family structure and functioning, school adjustment, major depression, aggression, religion, peer relationships, and negative feelings are more associated with suicidal ideation in females [18, 19, 23]. Based on the previous results, the risk factors for suicidal ideation may differ by gender and age in adolescents, but very few studies have investigated the differences in risk factors for suicidal ideation by gender in the early and late adolescence. In addition, the previous studies have difficulties generalizing their results, because the numbers of samples were small or they were targeted to specific groups, such as hospital patients.

We used nationwide school-based mental health screening test data to investigate differences in risk factors for suicidal ideation in Korean adolescents according to gender and age (grade). In addition, factors affecting the severity of suicidal ideation were also identified.

Methods

Sample

The Ministry of Education of Korea has been implementing mandatory school-based mental health screening tests for schools since 2012, under the School Health Act, to assess the mental health status of students and to detect or intervene early in psychiatric problems. This mental health screening test for adolescents is conducted for all first grade students of middle and high schools using the Adolescent Mental Health and Problem Behavior Screening Questionnaire-II (AMPQ-II). If the total AMPQ-II score of a student is higher than the cut-off score, they are classified as an at-risk group and recommended for further evaluation and proper treatment.

We used data from middle- and high-school students for this study after permission from the Ministry of Education. These data did not include personally identifiable information other than school, grade, and gender. This study used

data from 591,303 middle school students (98.4% of total) and 618,271 (97.5% of total) high-school students, with the exception of students who had not answered the survey appropriately.

This research was authorized by the Institutional Review Board of Hallym University Sacred Heart Hospital.

Measures

AMPQ-II

The AMPQ is a self-report questionnaire and a school-based mental health screening test for middle- and high-school students that was developed by psychiatrists and mental health experts in Korea [24]. It was modified to a second version in 2011 by Bhang et al. The AMPQ-II is a multi-dimensional tool consisting of 38 items on psychological problems and experience of adverse life events, such as mood, suicidal ideation, thought problems, anxiety, somatization, sleep, inattention, impulsivity, peer relationships, family conflict, violence, and bullying [25]. The AMPQ-II assesses the severity of psychological problems and experiences of adverse life events during the last month. Each item is evaluated on a 4-point scale (0-not at all, 1-slightly, 2-quite, and 3-very much). This is not a diagnostic tool for psychiatric disease, but the aim is to screen high-risk students and provide proper intervention. In the study by Bhang et al., the AMPQ-II had high internal consistency and test-retest reliability (Cronbach's $\alpha = 0.89$ and $r = 0.567$), and a positive correlation was observed between the AMPQ-II and the Symptom Checklist-90-Revision ($r = 0.20$ – 0.70 , $p < 0.01$) [25].

Suicidal ideation In the current study, suicidal ideation was evaluated by, “I have constantly thought about killing myself or developed a concrete suicide plan”, which is one of the AMPQ-II items. Students who responded “not at all” (0 points) to this question were classified as the non-suicidal ideation group and those who answered with 1, 2, or 3 points were classified as the suicidal ideation group.

Psychological problems Independent variables expected to affect suicidal ideation were psychological problems and adverse life events derived from the AMPQ-II. First, 37 items, except suicidal ideation, were divided into 32 items about psychological problems and five items about adverse life events. The 32 items of psychological problems were reclassified through a factor analysis, and the extracted factors were used as independent variables to explore the associations between suicidal ideation and psychological problems. The factor scores were used for the mean score of the sub items.

Adverse life events Adverse life events consisted of ‘Family conflict’, ‘Violence’, and ‘Bullying’, and students were classified into ‘experienced’ or ‘not experienced’ groups for each event. ‘Family conflicts’ were assessed by one item, “My family has familial conflicts”. ‘Violence’ consisted of two items; “I have suffered physical or verbal violence by someone” and, “I have felt shamed sexually by someone”. The items about ‘bullying’ were “I have been harassed or bullied by a peer group” and “I have a friend who bothers me”. Students who answered with 1, 2, or 3 points on each item were considered to have experienced the event. If at least one of the two ‘violence’ or ‘bullying’ questions was more than 1 point, the subject was classified into the experienced group.

Statistical analysis

To classify psychological problems, we conducted a principal axis factoring method with a varimax rotation (eigenvalue > 1) for the 32 items about psychological problems.

We conducted the *t* test and Chi-square test to compare the psychological and adverse life event-experienced characteristics of the suicidal and non-suicidal ideation groups.

Odds ratios (ORs) and 95% confidence intervals (CI) were obtained by binary logistic regression, using the ‘enter’ method to identify the risk factors for suicidal ideation. All psychological problems and adverse life events were included in this model. The analysis was performed to separate male and female by grade to examine differences in the risk factors between genders and age.

To see if there is a change in the influence of risk factors as the cut-off point of suicidal ideation increases, binary logistic regression was performed dividing the cut-off points of the suicidal ideation item by more than 1 point, more than 2 point, and 3 point, respectively, Gender and grade were included as independent variables with psychological problems and adverse life events.

In addition to the binary logistic regression, we conducted a path analysis to examine the relationships between each psychological problem and adverse life event and their effects on suicidal ideation. In this analysis, subjects were collapsed across gender and grade, and the dependent variable (suicidal ideation) was entered as a continuous variable reflecting the AMPQ-II scores.

All statistical analyses were performed with SPSS 22.0 and AMOS 23.0 for Windows (SPSS Inc., Chicago, IL, USA). A *p* value < 0.05 was considered significant.

Results

Classification of psychological problems

Six factors were extracted in the factor analysis of the 32 items. However, because seven items about eating problems, obsessive compulsion, sexual urge, and seizure had a low statistical and clinical correlation with the extracted factors ($r = 0.168$ – 0.315), the factor analysis was retried with 25 items, excluding these seven items. Finally, four factors were extracted, and the results are shown in Table 1. Seven items were symptoms associated with depression or mood instability, so this factor was labeled ‘Mood’ (Cronbach’s $\alpha = 0.79$). The second factor was associated with abnormal thinking and excessive anxiety and was labeled ‘Disturbing thoughts and anxiety’ (Cronbach’s $\alpha = 0.74$). The third factor included four items related to antisocial behavior and was labeled ‘Behavioral problems’ (Cronbach’s $\alpha = 0.62$). The fourth factor was labeled ‘Distractibility’, because it included inattention and related behavioral problems (Cronbach’s $\alpha = 0.76$).

Suicidal ideation

There were 308,575 seventh grade boys and 282,728 seventh grade girls. Of them, 14.7% of the boys and 23.2% of the girls had current suicidal ideation. Of the 320,007 male and 298,264 female tenth grade students, 12.9% of the males and 17.1% of the females answered that they had current suicidal ideation (Tables 2 and 3). Suicidal ideation was significantly more common in female students than in male students ($p < 0.001$, both seventh and tenth grades) and more frequent in seventh grade students than in tenth grade students ($p < 0.001$, both male and female students).

Psychological problems

All psychological problem scores were significantly higher in the suicidal ideation group than in the non-suicidal ideation group (all $p < 0.001$) (Tables 2 and 3). ‘Mood’ was the most severe problem in the suicidal ideation group followed by ‘Distractibility’, ‘Disturbing thoughts and anxiety’ and ‘Behavioral problems’. ‘Mood’ and ‘Disturbing thoughts and anxiety’ were significantly higher in female students than male students in both the seventh and tenth grade suicidal ideation groups, whereas ‘Behavioral problems’ and ‘Distractibility’ were significantly higher in male students than female students (both $p < 0.001$). All psychological problem scores were significantly higher in

Table 1 Factor analysis of 25 of the items on the adolescent mental health and problem behavior questionnaire-II (AMPQ-II)

	1	2	3	4
Mood				
Felt depressed or irritated for no apparent reason	0.590	0.335	0.155	0.145
Felt excited for several days for no apparent reason or had serious mood swings	0.583	0.222	0.061	0.254
Have been overly concerned about matters	0.490	0.385	−0.032	0.263
Often been sick for no apparent reason (e.g., headache, stomach ache, vomiting, nausea, dizziness)	0.488	0.250	0.126	0.127
Felt everything was difficult and boring	0.446	0.217	0.123	0.334
Experienced difficulty falling asleep or waking frequently during the night	0.364	0.185	0.154	0.137
Have lost my temper	0.349	0.140	0.182	0.317
Disturbing thoughts and anxiety				
Thought that others were talking behind my back.	0.340	0.594	0.052	0.197
Been afraid to speak in front of people	0.156	0.532	0.019	0.209
Thought that others may be watching me or preparing to harm me	0.267	0.489	0.190	0.111
Experienced difficulty in making friends or have no close friends	0.150	0.453	0.105	0.104
Experienced hearing something that others could not hear	0.243	0.404	0.183	0.108
Felt as if others knew what I was thinking	0.235	0.399	0.107	0.160
Had feelings of being inferior to others	0.278	0.314	0.042	0.186
Behavior problems				
Committed a serious violation of the rules (e.g., skipping school, running away from home, going to adult entertainment establishments).	0.159	0.038	0.580	0.103
Destroyed, extorted, or stole other's belongings	−0.015	0.252	0.511	0.156
Used substances prohibited for students (e.g., cigarettes, alcohol, drugs)	0.141	−0.051	0.494	0.110
Harassed or struck other people or animals	0.043	0.253	0.470	0.141
Distractibility				
Had trouble concentrating during lessons, study, or while reading books.	0.204	0.086	0.084	0.659
Had trouble understanding the lessons	0.219	0.124	0.128	0.517
Have not waited my turn and acted before thinking	0.324	0.212	0.169	0.415
Have felt restless or fidgeted with my hands and feet	0.281	0.290	0.102	0.413
Defied or opposed my parents or teachers	0.291	0.132	0.281	0.400
Lied frequently	0.129	0.278	0.222	0.393
Experienced difficulty performing daily tasks due to excessive use of the internet or games (e.g., conflicts with parents, difficulty at school	0.031	0.201	0.163	0.377

Items assessing suicidal ideation, negative experiences, eating problems, obsessive–compulsive behavior, sexual urges, and seizure were excluded from the analysis

the tenth grade suicidal ideation group than those in the seventh grade suicidal ideation group ($p < 0.001$).

Adverse life events

Both the seventh and tenth grade suicidal ideation groups had experienced significantly more adverse life events than those in the non-suicidal ideation groups (all $p < 0.001$). Of the seventh grade students, 49.6 and 47.9% of boys and girls with suicidal ideation had family conflict, 63.0 and 53.9% had experienced physical, verbal, or sexual violence; and 47.5 and 45.5% had been bullied by a peer group (Table 2). Of the tenth grade students, 47–57% of the suicidal ideation group had experienced family conflict and physical, verbal, or sexual violence (Table 3). About 38% of male adolescents and 36.7% of female adolescents in the suicidal ideation

group had experienced being bullied by a peer group. Family conflict was more frequent in the tenth grade suicidal ideation group than in the seventh grade suicidal ideation group, whereas violence and bullying victimization were more frequent in the seventh grade suicidal ideation group than the tenth grade suicidal ideation group (all $p < 0.001$, both genders).

Risk factors for suicidal ideation

‘Mood’ had the most effect on increasing the risk of suicidal ideation and had a much greater impact compared to the other factors in seventh grade boys and girls (OR = 3.67, $p < 0.001$ in boys and OR = 4.40, $p < 0.001$ in girls) (Table 2). ‘Disturbing thoughts and anxiety’ and ‘Behavioral problems’ significantly affected suicidal ideation in both

Table 2 Differences in risk factors for suicidal ideation by gender among seventh grade students

	Male (N = 308,575)				Female (N = 282,728)							
	Suicidal N = 45,373 (14.7%)		Non-suicidal N = 263,202 (85.3%)		Suicidal N = 65,524 (23.2%)		Non-suicidal N = 217,204 (76.8%)					
	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %				
I												
Mood	0.89	0.58	0.38	0.38	3.79	1.09	0.62	0.48	0.42	4.40***	4.29	4.52
Disturbing thoughts and anxiety	0.54	0.49	0.20	0.27	1.73	0.62	0.50	0.25	0.29	1.62***	1.56	1.67
Behavioral problems	0.20	0.36	0.04	0.14	2.09	0.09	0.24	0.02	0.09	2.12***	1.96	2.29
Distractibility	0.86	0.51	0.47	0.40	1.23	0.82	0.51	0.44	0.37	1.13***	1.09	1.16
E												
Family conflict	22,508	49.6	56,456	21.4	1.51	31,394	47.9	44,290	20.4	1.54***	1.51	1.58
Violence	28,569	63.0	73,287	27.8	1.87	35,339	53.9	48,118	22.2	1.62***	1.58	1.65
Bullying	21,570	47.5	49,887	19.0	1.48	29,783	45.5	37,859	17.4	1.63***	1.59	1.67

A logistic regression model (includes mean scores and standard deviations, numbers, and percentages)

The suicidal (ideation) group included all students who answered with 1 (slightly), 2 (quite), or 3 (very much) points to each suicidal ideation item. The values for 'Mood', 'Disturbing thoughts and anxiety', 'Behavioral problems', and 'Distractibility' are mean scores and standard deviations, whereas the value of 'Family conflict', 'Violence' and 'Bullying' are numbers and percentages of students who have experienced the event in each group

I individual factors, E environmental factors, SD standard deviation, OR odds ratio, CI confidence interval

***p < 0.001

Table 3 Differences in risk factors for suicidal ideation by gender among tenth grade students

	Male (N = 320,007)				Female (N = 298,264)									
	Suicidal N = 41,341 (12.9%)		Non-suicidal N = 278,666 (87.1%)		Suicidal N = 50,927 (17.1%)		Non-suicidal N = 247,337 (82.9%)							
	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %						
I														
Mood	1.03	0.60	0.45	0.42	3.79***	3.68	3.91	1.26	0.63	0.60	0.47	4.15***	4.04	4.26
Disturbing thoughts and anxiety	0.62	0.52	0.23	0.30	1.82***	1.75	1.89	0.66	0.52	0.27	0.31	1.77***	1.71	1.83
Behavioral problems	0.30	0.78	0.07	0.21	1.82***	1.75	1.89	0.13	0.31	0.02	0.11	2.40***	2.26	2.56
Distractibility	0.94	0.51	0.53	0.42	0.99	0.96	1.03	0.86	0.51	0.49	0.38	0.95**	0.92	0.98
E														
Family conflict	23,493	56.8	70,227	25.2	1.62***	1.58	1.66	28,493	55.9	60,986	24.7	1.74***	1.70	1.79
Violence	23,583	57.0	59,947	21.5	1.93***	1.88	1.98	23,948	47.0	39,906	16.1	1.80***	1.75	1.84
Bullying	15,874	38.4	31,167	11.2	1.62***	1.57	1.67	18,689	36.7	29,576	12.0	1.70***	1.65	1.75

A logistic regression model (includes mean scores and standard deviations, numbers, and percentages)

Suicidal (ideation) group included all students who answered with 1 (slightly), 2 (quite), or 3 (very much) points to each suicidal ideation item. The values for 'mood', 'disturbing thoughts and anxiety', 'behavioral problems', and 'distractibility' are mean scores and standard deviations, whereas the values of 'family conflict', 'violence', and 'bullying' are numbers and percentages of students who have experienced the event in each group

I individual factors, E environmental factors, SD standard deviation, OR odds ratio, CI confidence interval

** $p < 0.01$; *** $p < 0.001$

genders (OR = 1.62–2.12). ‘Distractibility’ also influenced suicidal ideation in both genders but showed a relatively low risk (OR = 1.13–1.20, $p < 0.001$). ‘Family conflict’, ‘Violence’, and ‘Bullying’ significantly increased the risk of suicidal ideation. For boys, ‘Violence’ was the most powerful negative event associated with suicidal ideation (OR = 1.82, $p < 0.001$), whereas ‘Bullying’ showed the highest impact on girls (OR = 1.63, $p < 0.001$).

‘Mood’ was highly associated with increasing the risk of suicidal ideation in both male and female tenth grade students. ‘Disturbing thoughts and anxiety’ and ‘Behavioral problems’ were also major risk factors for suicidal ideation (Table 3). However, unlike seventh grade students, ‘Distractibility’ was not significantly associated with suicidal ideation in male adolescents but, rather, was negatively associated with suicidal ideation in female adolescents (OR = 0.95, $p < 0.01$). All adverse life events significantly contributed to suicidal ideation. Of them, ‘Violence’ was the most powerful risk factor for suicidal ideation in both genders (OR = 1.93, OR = 1.80, respectively).

Changes in the impact of the individual risk factors as the severity of suicidal ideation increased are shown in Table 4. All of the risk factors, with the exception of ‘Distractibility’, had a significant impact on suicidal ideation at the all levels of severity. Female and middle school students were at higher risk of suicidal ideation than were male and high-school students at all levels of severity. In general, the greater the severity of suicidal ideation, the higher the

ORs of ‘Mood’ and ‘Disturbing thoughts and anxiety’, and the lower the ORs of behavioral problems and adverse life events. ‘Mood’ was the most strong risk factor for suicidal ideation in all cases (OR = 3.99, 4.86 and 6.3). ‘Distractibility’ significantly increased the risk of suicidal ideation when the cut-off point of suicidal ideation was more than 1 (OR = 1.07), but when cut-off point was increased, it lost significant impact on suicidal ideation.

Path analysis of suicidal ideation in adolescents

Based on our findings and those of previous studies, we propose three hypotheses. First, each of the risk factors directly affects suicidal ideation. Second, adverse life events have an indirect effect on suicidal ideation via psychological problems, depression and anxiety, in particular. Family dysfunction and peer conflict, including exposure to violence, can affect depression, anxiety, conduct problems, and interpersonal relationships [26–28], and adverse life events are associated with suicidal ideation via depression and anxiety [29]. Third, the effect of ‘Distractibility’ on suicidal ideation is mediated by emotional problems [30–33]. After several modifications, the final model was developed (Fig. 1). Gender and grade, factors that that have been shown to affect suicidal ideation in previous results, were controlled for in the final model. The variables in Fig. 1 are expressed as standardized regression coefficients and all were significant ($p < 0.001$). All the psychological problems and adverse

Table 4 Changes in the odds ratios of risk factors according to suicidal ideation cut-off points

Suicidal ideation cut-off point	More than 1 point			More than 2 point			3 point		
	Number (%) of subjects			Number (%) of subjects			Number (%) of subjects		
	OR	CI		OR	CI		OR	CI	
D									
Gender									
Male	1.0			1.0			1.0		
Female	1.36***	1.34 1.37		1.30***	1.27 1.32		1.21***	1.16 1.27	
Grade									
7 th	1.57***	1.55 1.59		1.90***	1.86 1.93		2.32***	2.23 2.42	
10 th	1.0			1.0			1.0		
I									
Mood	3.99***	3.94 4.05		4.86***	4.75 4.96		6.31***	6.06 6.57	
Disturbing thoughts and anxiety	1.72***	1.69 1.75		1.83***	1.78 1.87		2.01***	1.93 2.10	
Behavioral problems	1.98***	1.93 2.04		1.69***	1.63 1.74		1.38***	1.32 1.45	
Distractibility	1.07***	1.05 1.09		1.00	0.97 1.02		0.97	0.93 1.02	
E									
Family conflict	1.59***	1.57 1.61		1.43***	1.40 1.46		1.23***	1.18 1.29	
Violence	1.78***	1.75 1.80		1.69***	1.65 1.73		1.60***	1.52 1.68	
Bullying	1.58***	1.56 1.60		1.44***	1.41 1.48		1.40***	1.33 1.46	

D demographic information, I individual factors, E environmental factors, SD standard deviation, OR odds ratio, CI confidence interval

*** $p < 0.001$

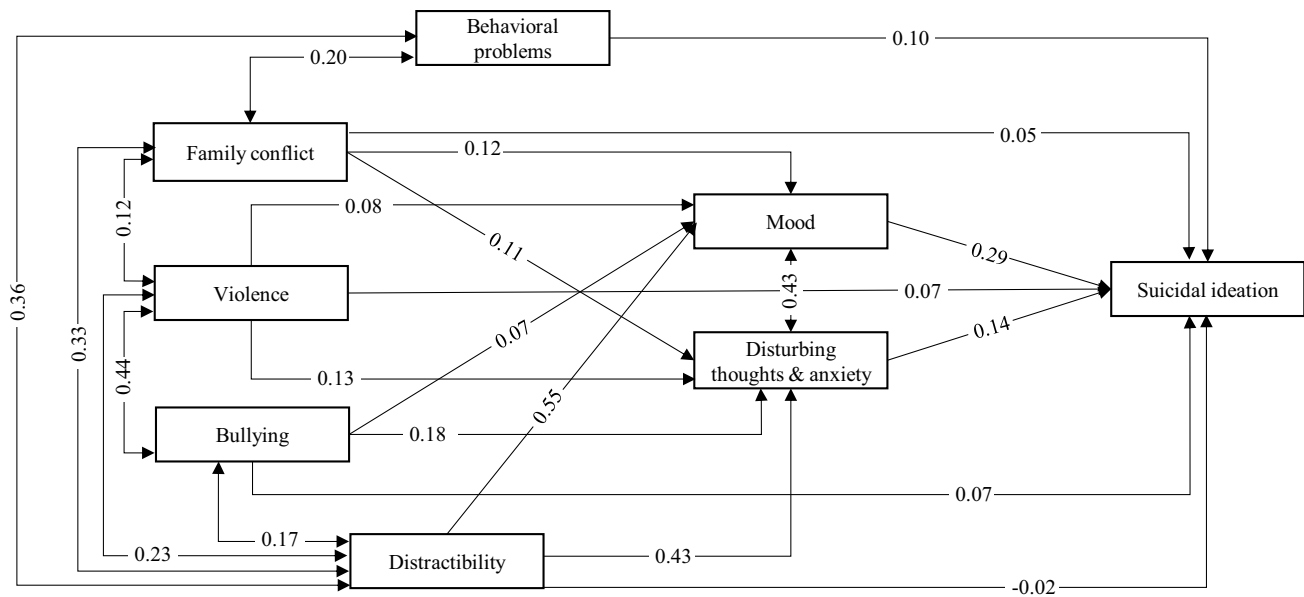


Fig. 1 Path analysis of suicidal ideation in adolescents. All path coefficients shown were significant at $p < 0.001$

life events had a direct effect on suicidal ideation, and ‘Distractibility’, ‘Family conflict’, ‘Violence’, and ‘Bullying’ had indirect effects on suicidal ideation in the final model.

The fit indices of our model were not satisfactory (χ^2 [18, $N = 1,209,574$] = 260,238.357, $p < 0.001$, Comparative Fit Index = 0.911, Goodness Fit Index = 0.962, Normal Fitted Index = 0.911, Tucker and Lewis Index = 0.798 Root Mean Squared Error of Approximation = 0.109), because the independent variables that could be obtained from the database were limited and not suitable for path analysis. However, this is a preliminary study, and we can surmise from our findings that all the factors had a direct effect on suicidal ideation. Further research using additional variables is needed to clarify the pathway through which risk factors influence suicidal ideation.

Discussion

In this study, suicidal ideation of adolescents was high in early adolescence and in female adolescents, and although mood had the greatest impact on risk of suicidal ideation, disturbing thoughts and anxiety, behavioral problems, and adverse life events, such as family conflict, violence, or bullying also independently increased suicidal ideation in adolescents. The risk factors for juvenile suicidal ideation were somewhat different by gender and age, as distractibility increased the risk of suicidal ideation only in early adolescence and behavioral problems were more related to suicidal ideation of female adolescents than male adolescents. In addition, bullying victimization constituted an important

risk factor for increasing the risk of suicidal ideation in younger female adolescents, whereas physical or sexual violence victimization constituted the most powerful risk factor among adverse life events for suicidal ideation among adolescents.

The risk of suicidal behavior in adolescents increases with age, which is related to the increased prevalence of mental illness and the higher probability of suicide planning and attempts according to the cognitive development of later adolescents [18, 34]. However, several studies have reported that suicidal ideation is most prevalent in adolescents before the age of 15 years [35, 36]. In the present study, seventh grade students showed more frequent suicidal ideation than tenth grade students, and the risk of severe suicidal ideation was also higher in seventh grade. These results are consistent with previous findings that the prevalence of suicidal ideation in early adolescence is higher than that of late adolescence. Furthermore, our study is appropriate for such generalizations, because the results were derived from data for all seventh and tenth grade students.

The actual mean mortality rate of Korean adolescents from suicide in 2009–2013 was 1.76/100,000 at 10–14 years and 8.8/100,000 at 15–19 years, which is much higher in late adolescence than early adolescence [1], unlike the higher suicidal ideation in the seventh grade, as compared to tenth grade students, in the present study. The reasons why suicidal ideation is more common in early adolescence, but suicidal behavior is more likely to occur in late adolescence, remains unclear. Various risk/protective factors affect the transition from suicidal ideation to suicidal behavior in that younger adolescents have less exposure to risk factors, such

as current intoxication and availability of lethal agents, and they are more protected by family and society, so suicidal behavior may be less common in early adolescence than in late adolescence. [6, 37]. However, more research is needed to understand the cause.

Psychological problems, with the exception of ‘Distractibility’, increased the risk of suicidal ideation, regardless of gender or grade. In addition to ‘Mood’, which was the strongest risk factor for suicidal ideation, ‘Disturbing thoughts and anxiety’ and ‘Behavioral problems’ also significantly increased the risk of suicidal ideation in all groups, even when ‘Mood’ and other problems were adjusted. Although it remains controversial as to whether the psychopathology, such as anxiety or psychosis, increases the risk of suicide independently of depression [38–41], this study further supports the view that psychiatric disorders other than depression also increase the risk for suicide [42–44]. However, in contrast to the other risk factors, the ORs of ‘Mood’ and ‘Disturbing thoughts and anxiety’ increased as the severity of suicide ideation increased, suggesting that psychopathologies, such as depression and anxiety, have a greater impact on the severity of suicidal ideation than other risk factors.

Behavioral problems were more related to suicidal ideation in female adolescents than in male adolescents. Behavioral problems, such as conduct disorder, are more prevalent in male adolescents than female adolescents, and some studies have reported that the impact of conduct disorder on suicidal behavior in males is higher than females [18, 45, 46]. However, in other studies, some antisocial behaviors, such as fighting or possessing weapons, increase the risk of suicide more in female than male adolescents, consistent with the results of the present study [19, 47, 48]. These conflicting results may be attributed to differences in samples. Psychological autopsy studies on subjects who committed suicide show a higher risk of behavioral problems in suicide of boys, whereas behavioral problems in girls had more of an effect on suicidal ideation than those of boys in community sample studies. Depression with irritability is often associated with oppositional deviant disorder or conduct disorder in female adolescents [49]. This characteristic can affect the relationship between behavioral problems and suicidal ideation among female adolescents. Therefore, female adolescents who exhibit antisocial behavior should be more concerned about the risk of suicide or other mental health problems.

‘Distractibility’ was the only psychological problem that had different effects on suicidal ideation of adolescents by gender and age. In this study, ‘Distractibility’ is a factor that included ADHD-related symptoms, including poor concentration, impatience, and hyperactivity. Although ‘Distractibility’ had a weak positive association with suicidal ideation in the seventh grade students, it had no effect on suicidal ideation in male tenth grade adolescents and reduced the risk

of suicidal ideation in female adolescents. ADHD is generally known to carry a 2–7-fold greater risk for suicidal ideation in adolescents [7, 13, 50, 51]. However, in the present study, ‘Distractibility’, an ADHD-related symptom, had different effects on suicidal ideation in adolescents depending on gender and age. In other words, although ‘Distractibility’ directly affected suicidal ideation in adolescents, the indirect effects mediated through interactions with other risk factors or comorbid symptoms had a greater impact on suicidal ideation. Adverse life events may worsen externalizing behavioral problems and emotional problems and, conversely, disruptive behavior and emotional problems may increase the risk of adverse life events [30–32]. Moreover, depression increases the risk of suicide in children with ADHD [33]. Therefore, symptoms such as poor concentration, impatience, and hyperactivity can be accompanied by various risk factors of suicidal ideation, and they may have a different effect on suicidal ideation depending on the accompanying factors. While impulsive tendencies may increase the risk of mild suicidal ideation, they may not have a significant impact on severe and persistent planned suicidal ideation. Although our preliminary path analysis did not strongly support our hypothesis, we believe that further research will clarify the pathway to suicidal ideation in adolescents and the impact of ADHD-related symptoms.

Family conflict, violence, and bullying victimization were positively associated with suicidal ideation. Of them, violence victimization had the highest impact on suicidal ideation in seventh grade male students and tenth grade male and female students. Violence victimization had the greatest impact on the severity of suicidal ideation associated with three types of adverse events. A direct threat to physical safety, such as physical or sexual abuse, increased the risk of suicidal ideation more than a stressful event associated with psychological distress alone. This finding is consistent with that of previous studies [52–54]. Bullying victimization showed the highest risk for suicidal ideation in seventh grade girls, which seems to reflect the characteristics of younger female adolescents, who attach importance to peer relationships [55]. This finding suggests that family conflict, violence, and bullying victimization increase the risk of suicidal ideation in adolescents, independently of psychological distress, and the degree of the effect may differ according to the developmental characteristics of the adolescent. This is an important issue. Children and adolescents without psychiatric problems often attempt suicide, and the younger the age, the lower the association between suicide and psychopathology [6]. We found that adolescents, who are not yet cognitively mature, and without clinical symptoms, exhibited impulsive suicidal ideation or suicidal behavior when confronted with stressful events.

Although we tried to identify the risk factors for suicidal ideation by gender and age in adolescents, there are several

limitations to this study. First, nearly all middle- and high-school students were involved in the test, but no data were included for out-of-school youth who are more vulnerable to suicide or other mental health problems. However, in South Korea, education is compulsory up to middle school, and fewer than 1.5% of high-school students quit school each year. Therefore, only a small proportion of eligible adolescents were not included in the analysis. Second, besides gender and age, there was a lack of information about other sociodemographic characteristics and personal background that might affect suicidal ideation, such as socioeconomic status. This is because in cases of school-based mental health screening, the collection of personal information that is not needed for mental health assessment was minimized. Third, suicidal ideation was assessed using a single item; psychological problems and adverse life events were not conducted with tools that could be reasonably evaluated for each factor. Moreover, there are limits to a self-report evaluation, as compared to an assessment by an expert. Thus, the suicidal and non-suicidal classifications may not reflect the actual risk of suicide, and it is somewhat difficult to ensure that each item completely represents the psychopathology or event experience. These limitations should be considered when interpreting our findings.

Nevertheless, this study was based on data from almost all Korean seventh and tenth grade students, and the results closely reflect the characteristics of the general population. Therefore, the results of the present study that are different from other studies can provide a new direction for studying suicide in youth. In addition, this study has great significance, because it explored the differences in risk factors for suicidal ideation by gender and age in large-scale school-based data, not only in a high-risk group.

Adolescence is a period of rapid change in physical, emotional, and environmental conditions, and many individuals develop suicidal ideation for the first time in adolescence. The risk factors for suicidal ideation differ by gender and age in adolescents. Interventions should be made according to these characteristics to reduce adolescent suicidal ideation. In the future, it will be necessary to study preventive measures, with a focus on the developmental characteristics of adolescents, to reduce juvenile suicide effectively.

Compliance with ethical standards

Conflict of interest This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2015S1A5B8A02061201).

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