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Association Between Victimization, Internet Overuse, and Suicidal Behaviors Among Adolescents

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ABSTRACT

Purpose: The aim of this study was to identify the association between violence exposure and suicidal ideation, plans, and attempts among adolescents and to test whether these relationships were mediated by internet overuse.

Design and methods: We used a cross-sectional design and analyzed the raw data of 101,440 high school students (52.1% male; mean age = 16.43 years, SD = 0.03) from the 10th–12th Korea Youth Risk Behavior Web-Based Survey.

Results: A series of multivariate logistic regression analyses were conducted. Violence exposure incurred a significantly higher risk of suicidal ideation (crude odds ratio, 95% confidence interval = 4.44, 4.07–4.87), suicidal plans (crude odds ratio, 95% confidence interval = 8.89, 7.94–9.96), and suicidal attempts (crude odds ratio, 95% confidence interval = 11.17, 9.86–12.66). The Sobel test showed evidence of the mediating role of internet overuse in the relationship between violence exposure and each suicidal variable: ideation ($p = .004$), plans ($p = .004$), and attempts ($p = .012$).

Practice implications: The findings suggest a need to organize the protective procedures for victimized high school students so that they can use the internet more securely. In particular, adolescents who are prone to being victimized or bullied should have restricted access to the internet or monitored with caution to prevent internet overuse. Counseling for this population is suggested to reduce the risk of suicide by assessing the motivations and patterns of internet use. It is necessary to spread awareness among potential violence exposure group on coping with violence experience and using the internet appropriately.

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Introduction

Suicide is the leading cause of death among adolescents, with a remarkably high suicide mortality rate of 22.8 per 100,000 (Centers for Disease Control and Prevention, 2015). Moreover, according to the 2016 Youth Statistics issued by the Korean Ministry of Gender Equality and Family (2016), 11.2% of Korean adolescents have experienced suicidal ideation in the past year. Nock et al. (2013) suggested that one-third of adolescents who experienced suicidal ideation go on to develop a suicide plan, while approximately one-third of those who make a plan subsequently make a suicide attempt. Because suicidal ideation has continuity in the form of suicidal behaviors (from ideation to plan to attempt), it is important to identify the factors affecting suicide-related behaviors among adolescents.

Previous studies have demonstrated that exposure to violence as an adolescent may lead to both physical and psychological problems (Centers for Disease Control and Prevention, 2017). Furthermore, traumatic exposure to violence has a major impact on the attachment and semantic system linking individuals and communities, causing grade retention, school absenteeism, and low academic achievement (Kowalski & Limber, 2013). Moreover, adolescents who are exposed to violence tend to engage in more self-destructive behaviors such as depression, suicidal ideation, and suicide attempts (Arango, Opperman, Gipson, & King, 2016; Castellví et al., 2017; Geoffroy et al., 2016; Klomek et al., 2013). Thus, previous studies have demonstrated the strong association between all forms of exposure to violence at an early age and suicidal behavior in youths and young adults (Castellví et al., 2017).

Furthermore, exposure to violence in adolescence is also associated with internet addiction and substance abuse (Chang et al., 2015; Litwiller & Brausch, 2013; Zsila et al., 2018). The internet may have a direct impact on suicide among young people by increasing the frequency with which they are exposed to themes of suicide, such as more specific information related to suicidal behaviors, and by allowing more access to material on suicide than other media sources (Bell, Mok, Gardiner, & Pirkis, 2018; Gámez-Guadix, Orue, Smith, & Calvete, 2013; Mok, Jorm, & Pirkis, 2016). Adolescents' overuse of the internet affects their

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emotions, including their levels of anxiety, depression, and self-esteem (Luk, Wang, & Simons-Morton, 2010; Woods & Scott, 2016). Internet overuse has been shown to be strongly associated with suicidal behavior, including suicidal ideation and attempts, through exposure to violent media (Luxton, June, & Fairall, 2012; van Geel, Vedder, & Tanilon, 2014).

Paradoxically, internet use among adolescents is both constructive and destructive; that is, it not only gives adolescents access to help and support but also to suicide partners (Marchant et al., 2017). Carew, Kutcher, Wei, and McLuckie (2014) also highlighted that internet use has a twofold influence on adolescents: it can cause an isolation effect as well as being a source of help. For example, according to previous studies (Carew et al., 2014; Hetrick, Dellosa, Simmons, & Phillips, 2015), youths conduct online research to seek mental health information. In particular, Saulsberry, Marko-Holguin, Blomeke, and Hinkle (2013) noted that internet use decreased depression and self-harm from 14.46% to 4.82%. Moreover, adolescents can receive positive ideas, including support and encouragement, from online communities and they consider the internet to be a protective platform that is trustworthy and open for communication (Sharkey et al., 2012). However, excessive internet use by adolescents is also associated with the risks of suicide and victimization, including communication problems and conflict with parents (Luk et al., 2010).

While there is a consensus among researchers about internet overuse affecting suicidal behavior among adolescents, there is no standardized definition of internet overuse (Durkee et al., 2012). According to Durkee et al. (2012), problematic internet use is associated with increased hours spent online per day. Internet overuse could be considered pathological if the time and energy spent online lead to psychological problems such as social isolation (Pace, D'Urso, & Zappulla, 2018). Mihara et al. (2016) noted that approximately 30% of adolescents who were considered to display problematic internet use spent >5 h/day on the internet, which fulfills the criteria for excessive usage (Messias, Castro, Saini, Usman, & Peeples, 2011; Mythily, Qiu, & Winslow, 2008; Shin, 2014).

Despite the increasing worldwide interest in exposure to violence and adolescents' suicidal behaviors, little research has examined the relationship between the exposure to violence and suicidal behaviors by identifying mediating or modulating effects. Although approximately 13.8% of high school students reported having seriously considered suicide and 20.7% had experienced victimization over the internet, few studies have been conducted to examine these phenomena among high school students, and this is a serious shortfall as victimization peaks in middle school (Bauman, Toomey, & Walker, 2013; Sohn, Oh, Lee, & Potenza, 2018). In particular, because suicidal behavior in adolescents is a complex phenomenon with multiple causes, it is necessary to examine the mediation effect of internet overuse on the association between exposure to violence and adolescents' suicidal behaviors.

This study aimed to identify differences in Korean adolescents' suicidal behaviors according to their experience of exposure to violence and to examine the mediating effect of internet overuse in suicidal behavior disparities using nationally representative data for South Korea.

Conceptual framework

A conceptual framework was developed based on empirical evidence from previous studies (Fig. 1), which was used to explore the relationships between exposure to violence, internet overuse, and suicidal behavior and suggests in particular that exposure to violence influences suicidal behavior through its effect on internet overuse. In previous studies, related research has been conducted on the association between adolescents' exposure to violence and internet overuse (Litwiller & Brausch, 2013; Olenik-Shemesh, Heiman, & Eden, 2012; Zsila et al., 2018), internet overuse and suicidal behaviors (Bell et al., 2018; Gámez-Guadix et al., 2013; Mok et al., 2016), and exposure to violence and suicide risk (Arango et al., 2016; Geoffroy et al., 2016; Klomek et al., 2013). In other words, exposure to violence among adolescents is frequently associated with suicidal behavior (Arango et al., 2016; Geoffroy et al., 2016; Klomek et al., 2013) while internet overuse is known to be highly associated with suicidal behaviors (Messias et al., 2011). Furthermore, violence-exposed adolescents are more likely to be in the internet overuse group (Zsila et al., 2018). Based on the extant research, internet overuse might be considered a mediator between exposure to violence and suicidal behaviors among adolescents.

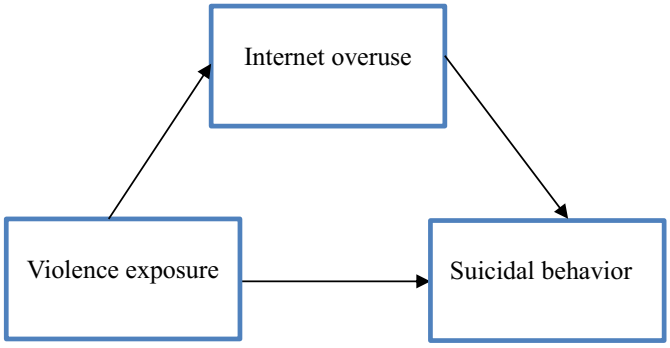

Fig. 1.

Methods

Design

A cross-sectional study was conducted to examine the associations between exposure to violence, internet overuse, and suicidal behaviors in Korean adolescents. We analyzed raw data from the 10th–12th Korea Youth Risk Behavior Web-Based Survey (KYRBWS-X–XII), conducted by the Korea Center for Disease Control and Prevention (KCDC) between 2014 and 2016.

Participants

The KYRBWS is an anonymous self-administered online survey targeting middle school freshmen to high school seniors to examine health-related risk behaviors among Korean adolescents. It employs a complex design involving stratification, clustering, and multistage sampling. In particular, 400 samples each from middle and high schools are selected annually according to school type (middle school and high or vocational high school), with regional groups (big city, medium-sized city, and rural area) used as stratification variables. One class from each grade is then selected, and students from a total of 2400 classes are surveyed. After the survey, sampling weights are suggested in consideration of the response rate and sampling rate, and these sampling weights are applied to the analysis to estimate the parameters.

This study included high school participants of the KYRBWS-X–XII (n = 101,440). The KYRBWS-X (conducted in 2014) distributed surveys to 74,167 students from 800 schools (400 middle and high schools each); of these, 72,060 students completed the survey (response rate: 97.2%; Ministry of Education, Science and Technology; Ministry of Health and Welfare, KCDC, 2015). The KYRBWS-XI (conducted in 2015) distributed surveys to 70,362 students from 800 schools (400 middle and high schools each); of these, 68,043 students completed the survey (response rate: 96.7%; Ministry of Education, Science and Technology; Ministry of Health and Welfare, KCDC, 2016). In the KYRBWS-XII (conducted in 2016), 67,983 students from 800 schools (400 middle and high schools each) completed the survey, and 65,528 students (response rate: 96.4%) returned valid responses (Ministry of Education, Science and Technology; Ministry of Health and Welfare, KCDC, 2017).

Measures

Violence experiences

"During the past 12 months, have you ever been treated at a hospital as a result of violence (physical assault, intimidation, bullying, etc.) inflicted by your friends, those older than you, or adults?"

Suicide

"Have you seriously contemplated suicide during the past 12 months?" Suicide plans were examined by analyzing responses to the question: "Have you established a detailed plan to commit suicide during the past 12 months?" Suicide attempts were examined based on responses to the question: "Have you attempted suicide during the past 12 months?" All responses were classified as "yes" or "no."

Internet overuse

"In the past 30 days, aside from use for learning purposes, for how many hours on average did you use the Internet per day?" Responses were categorized based on the average time spent using the Internet on weekdays, not including study time. Response options were categorized based on previous studies (Messias et al., 2011; Mihara et al., 2016; Mythily et al., 2008) into less than or exceeding 5 h/day.

The participants' demographic characteristics including age, sex, school type (high or vocational high school), urban scale (big city, medium-sized city, and country area), economic status (very high, high, moderate, low, and very low), school performance (very high, high, moderate, low, and very low), and lifetime experience of drinking, smoking, and drug use were also analyzed.

Data analysis

Statistical analyses were performed using SPSS Complex Sample, version 23.0 (SPSS Inc., Chicago, IL, USA) in a manner that reflected sampling weights and provided nationally representative estimates according to KCDC guidelines. Continuous variables were represented by mean and standard error, and *t*-tests were used to identify differences between exposure to violence and suicidal behaviors according to demographic characteristics. Categorical variables were represented by percentages and standard error, and χ^2 tests were used to identify differences between exposure to violence and suicidal behaviors according to demographic characteristics. A logistic regression analysis was conducted to examine associations between exposure to violence and suicidal behaviors. Univariate and multivariate logistic regression analyses were performed to determine the associations between exposure to violence and each of the three outcomes of suicidal ideation, plans, and attempts. Potential confounders included in the analyses were sex, school type, urban scale, socioeconomic status, school performance, depression awareness, lifetime drinking experience, and lifetime smoking experience. All crude and adjusted odds ratios and 95% confidence intervals (CIs) were presented.

The mediating role of internet overuse on the associations of exposure to violence with suicidal ideation, plans, and attempts was examined using Baron and Kenny's (1986) method via a series of multivariate logistic models adjusted for the abovementioned potential confounders. The conditions necessary to demonstrate such a mediating relationship require: (1) significant association between the independent (exposure to violence) and dependent (suicidal ideation, plans, and attempts) variables (Path C); (2) a significant association between the independent variable (exposure to violence) and the assumed mediator (internet overuse) (Path A); and (3) a significant association between the assumed mediator (internet overuse) and the dependent variables (suicidal ideations, plans, and attempts) (Path C). In the fourth and final regression model (4), after controlling the mediator (internet overuse), the previously significant relationship between the independent (exposure to violence) and dependent (suicidal ideation, plans, and attempts) variables was depressed or non-significant (Fig. 1). The Sobel test was used to statistically evaluate whether the indirect effect of exposure to violence on suicidal ideation, plans, and attempts through internet overuse was significant (Sobel, 1982).

Ethical considerations

This study was granted an exemption from ethical review by the first author's university because it used de-identified data from the KYRBWS-X–XII, a government-approved statistical survey that makes data available to the public via a website.

Results

Table 1 represents sample characteristics and differences in exposure to violence according to participants' demographic characteristics. Of the 101,440 participants included in the analyses, the mean age was 16.43 ± 0.03 years; 52.1% of participants were male, 82.5% were in general high school, 49.1% had a moderate economic status, and 29.8% had moderate school performance level. Depression awareness was reported by 27.3% of participants, lifetime drinking by 53.5%, lifetime smoking by 23.7%, and internet overuse (>5 h/day) by 2.6%. Approximately 2.0% of high school students were victims (Table 1).

There were significant differences in exposure to violence by demographic characteristics. Specifically, males, those of a higher age, those in vocational high school, those with very high or very low economic status or school performance, with depression awareness, and with lifetime drinking and smoking experiences were more likely to have experienced violence. Participants who reported having experienced violence spent more time on the internet than those with no violence experience, and their ratio of internet overuse, exceeding 5 h/day, was higher (Table 1).

Table 2 represents differences in suicidal behaviors according to demographic characteristics. There were significant differences in suicidal ideation, plans, and attempts. Specifically, females, those of a higher age, those in general high school, those with low or very low socioeconomic status or school performance, and those who reported depression, lifetime drinking and smoking, and internet overuse were more likely to have had suicidal ideation over the previous 12 months. Additionally, those of a higher age, with low or very low socioeconomic status, very low school performance, and those who reported depression, lifetime drinking and smoking, and internet overuse were more likely to have made suicide plans over the previous 12 months. Lastly, females, those in vocational high school, with very high, low, or very low socioeconomic status, with very low school performance, and who reported depression, lifetime drinking and smoking, and internet overuse were more likely to have attempted suicide over the previous 12 months (Table 2).

Table 3 represents the crude associations between exposure to violence and suicidal behaviors. Violence experience incurred a significantly higher risk of suicidal ideation (crude odds ratio, 95% CI = 4.44, 4.07–4.87), plan (crude odds ratio, 95% CI = 8.89, 7.94–9.96), and attempt (crude odds ratio, 95% CI = 11.17, 9.86–12.66) (Table 3).

A series of multivariate logistic regression analyses were conducted and the results are summarized in Table 4. The regression coefficients of the three paths among the independent variable (exposure to violence), assumed mediator (internet overuse), and each of the dependent variables (suicidal ideation, plans, and attempts) were significant. Entering internet overuse into the equation of exposure to violence rendered the main effect significant for suicidal ideation, plans, and attempts. Therefore, Baron and Kenny's approach revealed that the effects of exposure to violence on suicidal ideation, plans, and attempts were partially mediated by internet overuse. The Sobel test revealed further evidence of the mediating role of internet overuse in the relationship between exposure to violence and each dependent variable: suicidal ideation (p = .004), plans (p = .004), and attempts (p = .012; Table 4).

Table 1
General characteristics of the sample (n = 101,440).

Variable	Classification	Total Mean ± SE or % (SE)	Exposure to violence Mean ± SE or % (SE)		p
			No (n = 99,472)	Yes (n = 1968)	
Age (years)		16.43 ± 0.03	16.43 ± 0.03	16.49 ± 0.03	.014
Sex (%)	Male	52.1 (1.2)	51.6 (1.2)	75.1 (1.2)	<.001
	Female	47.9 (1.2)	48.4 (1.2)	24.9 (1.2)	
School type (%)	High school	82.5 (0.4)	82.6 (0.4)	77.8 (1.3)	<.001
	Vocational high school	17.5 (0.4)	17.4 (0.4)	22.2 (1.3)	
Urban scale (%)	Big city	43.8 (0.5)	43.8 (0.5)	43.1 (1.4)	.208
	Medium-sized city	50.1 (0.6)	50.2 (0.6)	49.6 (1.5)	
	Country area	6.1 (0.4)	6.0 (0.4)	7.3 (0.8)	
Socioeconomic status (%)	Very high	6.3 (0.1)	6.1 (0.1)	16.6 (0.9)	<.001
	High	23.4 (0.2)	23.5 (0.2)	19.9 (0.9)	
	Moderate	49.1 (0.2)	49.3 (0.2)	35.1 (1.1)	
	Low	16.9 (0.2)	16.9 (0.2)	17.1 (0.8)	
	Very low	4.4 (0.1)	4.2 (0.1)	11.3 (0.7)	
School performance (%)	Very high	10.2 (0.2)	10.0 (0.1)	18.3 (0.8)	<.001
	High	23.7 (0.2)	23.8 (0.2)	16.5 (0.7)	
	Moderate	29.8 (0.2)	29.9 (0.2)	23.0 (0.9)	
	Low	24.8 (0.2)	24.8 (0.2)	24.2 (1.0)	
	Very low	11.5 (0.1)	11.4 (0.1)	18.0 (0.9)	
Depression awareness (%)	Yes	27.3 (0.2)	26.7 (0.2)	55.9 (1.1)	<.001
	No	72.7 (0.2)	73.3 (0.2)	44.1 (1.1)	
Lifetime drinking experience (%)	Yes	53.5 (0.3)	53.3 (0.3)	63.5 (1.1)	<.001
	No	46.5 (0.3)	46.7 (0.3)	36.5 (1.1)	
Lifetime smoking experience (%)	Yes	23.7 (0.4)	23.2 (0.4)	47.3 (1.1)	<.001
	No	76.3 (0.4)	76.8 (0.4)	52.7 (1.1)	
Internet use (hour)		1.16 ± 0.01	1.17 ± 0.01	1.03 ± 0.05	.005
Internet overuse	No (≤5 h/day)	97.4 (0.1)	97.5 (0.1)	95.3 (0.5)	<.001
	Yes (>5 h/day)	2.6 (0.1)	2.5 (0.1)	4.7 (0.5)	

Discussion

This study examined the associations between exposure to violence and suicidal ideation, plans, and attempts, with internet overuse as a mediator. The aim of the study was to provide the baseline information required to help improve victims' mental health after experiencing violence and to prevent the risk of internet overuse.

This study examined the mediating role of internet overuse in the pathways from exposure to violence to suicidal behaviors among adolescents. The findings from the mediation analyses indicated that

Table 2
Suicidal behavior by demographic characteristics (n = 101,440).

Variable	Classification	Suicidal ideation Mean ± SE or % (SE)			Suicidal plan Mean ± SE or % (SE)			Suicidal attempt Mean ± SE or % (SE)		
		No	Yes	p	No	Yes	p	No	Yes	p
Age (years)		16.42 ± 0.01	16.46 ± 0.01	<0.001	16.43 ± 0.01	16.47 ± 0.03	0.004	16.43 ± 0.01	16.43 ± 0.02	0.998
Sex (%)	Male	53.1 (1.2)	44.1 (1.2)	<0.001	52.0 (1.2)	52.4 (1.4)	0.692	52.1 (1.2)	48.1 (1.5)	<0.001
	Female	46.9 (1.2)	55.9 (1.2)		48.0 (1.2)	47.6 (1.4)		47.9 (1.2)	51.9 (1.5)	
School type (%)	High school	82.3 (0.4)	83.9 (0.5)	<0.001	82.5 (0.4)	81.1 (0.8)	0.050	82.6 (0.4)	79.1 (1.1)	<0.001
	Vocational high school	17.7 (0.4)	16.1 (0.5)		17.5 (0.4)	18.9 (0.8)		17.4 (0.4)	20.9 (1.1)	
Urban scale (%)	Big city	43.8 (0.5)	44.2 (0.7)	0.679	43.8 (0.5)	44.2 (1.0)	0.123	43.8 (0.5)	43.6 (1.2)	0.207
	Medium-sized city	50.2 (0.6)	49.9 (0.8)		50.2 (0.6)	48.9 (1.1)		50.1 (0.6)	49.2 (1.3)	
	Country area	6.1 (0.4)	5.9 (0.4)		6.0 (0.4)	6.9 (0.7)		6.0 (0.4)	7.2 (0.9)	
Socioeconomic status (%)	Very high	6.3 (0.1)	6.6 (0.2)	<0.001	6.2 (0.1)	9.0 (0.5)	<0.001	6.2 (0.1)	10.1 (0.7)	<0.001
	High	23.6 (0.2)	21.5 (0.4)		23.5 (0.2)	20.7 (0.6)		23.5 (0.2)	18.7 (0.8)	
	Moderate	50.2 (0.2)	41.4 (0.4)		49.5 (0.2)	37.2 (0.8)		49.3 (0.2)	37.3 (1.0)	
	Low	16.2 (0.2)	21.6 (0.4)		16.7 (0.2)	21.1 (0.7)		16.8 (0.2)	20.4 (0.9)	
	Very low	3.7 (0.1)	8.9 (0.3)		4.1 (0.1)	12.0 (0.6)		4.2 (0.1)	13.6 (0.7)	
School performance (%)	Very high	10.3 (0.2)	8.9 (0.3)	<0.001	10.2 (0.2)	10.6 (0.5)	<0.001	10.2 (0.2)	10.7 (0.6)	<0.001
	High	24.1 (0.2)	20.9 (0.4)		23.9 (0.2)	18.3 (0.7)		23.9 (0.2)	16.0 (0.8)	
	Moderate	30.3 (0.2)	26.0 (0.4)		30.0 (0.2)	24.1 (0.7)		29.9 (0.2)	22.5 (0.9)	
	Low	24.5 (0.2)	27.3 (0.4)		24.8 (0.2)	26.8 (0.7)		24.8 (0.2)	25.5 (1.0)	
	Very low	10.8 (0.1)	16.9 (0.4)		11.1 (0.1)	20.2 (0.7)		11.2 (0.1)	25.3 (0.9)	
Depression awareness (%)	Yes	20.7 (0.2)	75.2 (0.4)	<0.001	25.3 (0.2)	78.2 (0.6)	<0.001	26.1 (0.2)	82.9 (0.8)	<0.001
	No	79.3 (0.2)	24.8 (0.4)		74.7 (0.2)	21.8 (0.6)		73.9 (0.2)	17.1 (0.8)	
Lifetime drinking experience (%)	Yes	52.2 (0.3)	62.2 (0.5)	<0.001	53.1 (0.3)	64.1 (0.8)	<0.001	53.2 (0.3)	67.0 (1.0)	<0.001
	No	47.8 (0.3)	37.8 (0.5)		46.9 (0.3)	35.9 (0.8)		46.8 (0.3)	33.0 (1.0)	
Lifetime smoking experience (%)	Yes	22.7 (0.4)	30.5 (0.5)	<0.001	23.2 (0.4)	36.9 (0.9)	<0.001	23.2 (0.4)	44.4 (1.1)	<0.001
	No	77.3 (0.4)	69.5 (0.5)		76.8 (0.4)	63.1 (0.9)		76.8 (0.4)	55.6 (1.1)	
Internet use (hour)		1.14 ± 0.01	1.34 ± 0.02	<0.001	1.16 ± 0.01	1.38 ± 0.04	<0.001	1.16 ± 0.01	1.31 ± 0.04	
Internet overuse	No (≤5 h/day)	97.6 (0.1)	96.0 (0.2)	<0.001	97.5 (0.1)	94.7 (0.4)	<0.001	97.5 (0.1)	94.8 (0.5)	0.001
	Yes (>5 h/day)	2.4 (0.1)	4.0 (0.2)		2.5 (0.1)	5.3 (0.4)		2.5 (0.1)	5.2 (0.5)	<0.001

Table 3
Associations between violence and suicidal ideation, plans, and attempts (n = 101,440).

Variable	Suicidal ideation		Suicidal plans		Suicidal attempts	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Exposure to violence (No)	1		1		1	
Exposure to violence (Yes)	4.44 (4.07–4.87)	<0.001	8.89 (7.94–9.96)	<0.001	11.17 (9.86–12.66)	<0.001

exposure to violence indirectly predicted the risk of suicidal behaviors through adolescents' internet overuse. The indirect pathway would lead to the development of possible preventive measures to manage internet use for adolescents' suicidal behaviors. Lin et al. (2014) noted that spending too much time on the internet might lead to children viewing suicide-related websites. Based on a social learning model, with an increase in the exposure to suicide-related content, the more likely they are to try to imitate and perform similar suicide attempts (Bandura, 2001). This corresponds to the findings of a previous study (Mishna, Cook, Gadalla, Daciuk, & Solomon, 2010) that emphasized the need to enhance awareness and knowledge among adolescents regarding internet safety to ensure psychosocial health. Indeed, internet overuse has been shown to contribute to adolescent suicide and can significantly affect adolescents' emotional and behavioral development, including low self-esteem, poor mental health, and psychiatric disorders (Błachnio, Przepiórka, Senol-Durak, Durak, & Sherstyuk, 2016; Ciarrochi et al., 2016; Durkee et al., 2012). Moreno, Jelenchick, and Breland (2015) noted that many other factors contribute to problematic internet use such as quality of time spent online, online activities, or duration of internet use, not simply absolute time spent on the internet. Moreover, Lin et al. (2014) reported that there were significantly different results in suicidal issues among adolescents according to the characteristics of the internet activities in which they engaged. Therefore, it is also suggested that not only time spent using the internet but also specific kinds of internet activities need to be examined in relation to the risk of adolescent suicide (Lin et al., 2014).

Particularly, with the rapid advance of information and communications technology, another kind of violence called cyberbullying, which occurs by exploiting the use of text messages on cell phones, e-mail, messenger applications, and social network systems, has become more prevalent (Sampasa-Kanyinga & Hamilton, 2015; Sohn et al., 2018). Accordingly, adolescents who overuse the internet tend to be more likely to self-harm and are at greater risk for suicidal ideation and attempts due to cyberbullying (Minkkinen, Oksanen, Kaakinen, Keipi, & Räsänen, 2017). Pace et al. (2018) noted that internet overuse could be considered pathological if psychological distress is related to time and energy immersed in internet use. Moreover, Durkee et al. (2012) found that adolescents' problematic internet use was related to lack of family support in terms of supervision and monitoring of school activities. In other words, such adolescents use the internet to cope with anxiety. Pace et al. (2018) also emphasized that adolescents who have friends and family support have a decreased likelihood of suicide owing to these relationships. In addition, although the internet is unavoidable nowadays, Li, Newman, Li, and Zhang (2016) highlighted that adolescents' problematic internet use is associated with intrapersonal attributes such as temperament, as well as peer affiliation.

Based on the above, parents, schools, and communities should consider steering adolescents away from internet overuse toward restoring their psychological health (Durkee et al., 2012). Based on the findings of this study, it is suggested that warning signs and messages related to self-harm behaviors and suicide methods be posted on suicide websites for victimized high school students (Lin et al., 2014). Lastly, more education related to internet use should be provided to victimized youth, and attention should be paid to the harmful websites they access and their interpretation of information found on the internet. Such individuals should also be informed about the resources available to them and supportive medical services (Minkkinen et al., 2017).

Limitations

This study has several limitations. First, because it utilizes a cross-sectional design, caution is necessary when interpreting causality between exposure to violence and suicidal ideation, plans, and attempts. To more clearly understand this causal relationship, longitudinal studies should be conducted in the future. Second, because it involves secondary data analysis, there is a limit beyond which questions cannot be specifically modified while adjusting various variables. In particular, the internet-use related questionnaires used in this study simply seek information regarding the daily amount of internet usage, which is insufficient in terms of reflecting internet overuse, as the domain of internet activities is excluded. Furthermore, with the continuous development of digital technology, most adolescents use the internet on their smartphones, and this was not measured. Moreover, since exposure to violence, including physical assault, intimidation, and bullying, was measured, we propose further studies to confirm the effect of each variable. Therefore, we recommend including a questionnaire with good psychometric properties in future research to assess these variables. The third limitation concerns the reliability of the KYRBWS. This questionnaire itself may have underestimated the results of high school students who do not attend school because they have experienced violence, as these self-report questionnaires were distributed only among adolescents who attend school. Lastly, the results of this study cannot be generalized because only Korean adolescents were included in this study.

Table 4
Mediational analyses on the relationships between exposure to violence and suicidal ideation, plans, and attempts (n = 101,440).

Variables	Path A		Path B		Path C				Sobel test (*p*)
	Exposure to violence→ Internet overuse		Internet overuse → suicidal behavior		Exposure to violence→ suicidal behavior				
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR- (95% CI)	*p*	OR+ (95% CI)	*p*	
Internet overuse	1.442 (1.152–1.806)	0.001							
Suicidal ideation			1.497 (1.330–1.684)	<0.001	2.786 (2.491–3.115)	<0.001	2.775 (2.482–3.104)	<0.001	0.004
Suicidal plans			1.762 (1.504–2.065)	<0.001	4.715 (4.171–5.331)	<0.001	4.698 (4.154–5.313)	<0.001	0.004
Suicidal attempts			1.541 (1.254–1.895)	<0.001	5.493 (4.787–6.303)	<0.001	5.471 (4.768–6.277)	<0.001	0.012

Note. All models control for sex, school type, urban scale, socioeconomic status, school performance, depression awareness, lifetime drinking experience, and lifetime smoking experience. OR-: Odds ratio from logistic model unadjusted for internet overuse; OR+: Odds ratio from logistic model adjusted for internet overuse.

Practice implications

Our results have demonstrated a significant association among adolescents' experiences of exposure to violence and suicidal behaviors, with internet overuse as a mediator. Therefore, these findings highlight the need to focus on the problem of internet overuse to reduce and prevent the risk of suicidal behaviors among victims of high school violence. Based on these results, we emphasize that not only nursing educators, but also parents, need to be aware of the dangers of internet overuse on suicide risk among victims of high school violence. To advance prevention efforts, schools and communities need to understand the victimized youths' level of suicidal ideation for early detection and intervention. Specifically, recognizing internet overuse among high-school victimized adolescents is the first step in reducing the likelihood of suicidal behaviors. In particular, adolescents who are prone to being victimized or bullied at school should have restricted access to the internet or be monitored to prevent internet overuse. Counseling is also suggested to reduce the risk of suicide among this population who should be identified by examining their motivations and patterns of internet use. It is necessary to spread awareness among victims on coping with school violence and using the internet appropriately.

As internet use is inevitable for today's adolescents, it is necessary to provide specific guidelines and to provide education regarding normal internet use, as well as conducting early-stage intervention including regular screening for violence-exposed adolescents while reducing the risk of internet overuse (Lai & Kwan, 2017). Moreover, there is a need to support the establishment of positive relationships, which is related to family functioning, peer affiliation, teacher rapport, and internet overuse (Jia et al., 2017; Li et al., 2018). Considering this, there is a need for the continuous monitoring of victims of violence. Parents, schools, and communities should pay particular attention to internet overuse while ensuring that vulnerable students are provided with the necessary education and a comfortable environment in which to grow (Lin et al., 2014). In particular, adolescents who experience mental health issues and who are exposed to violence are at risk of excessive internet usage (Lai et al., 2015; Litwiller & Brausch, 2013; Olenik-Shemesh et al., 2012; Zsila et al., 2018) as a means of rebuilding their damaged self-image and self-efficacy following trauma (Schimmenti et al., 2017). Thus, the screening of adolescents who are victims of violence, particularly adolescents who have been identified as traumatized and who report excessive internet usage, is warranted.

Conclusion

Although suicidal behaviors among adolescents are major concerns worldwide, it has been difficult to fully understand the complex phenomena of suicidal behaviors among adolescents for suicide prevention. This study aimed to identify the associations among exposure to violence, suicidal behaviors, and excessive internet usage among Korean adolescents for preventing adolescent suicide. Interestingly, our results showed that there were significant associations among adolescents' exposure to violence and suicidal behaviors, as well as the mediation of internet overuse. These findings support the need for nursing educators to pay attention to the problem of internet overuse in order to reduce and prevent the risk of suicidal behaviors among those who experienced violence. Therefore, it is necessary for nursing educators to provide information regarding coping with trauma related to violence and on how to use the internet properly to prevent suicide among adolescent victims.

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Declaration of Competing Interest

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