



Health Risk Behaviors Affecting Internet Usage in Adolescents: Evidence from the 2018 Korea Youth Risk Behavior Web-Based Survey

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(Received 26 Mar 2021; accepted 09 Jul 2021)

Abstract

Background: The purpose of this cross-sectional study was to assess the effects of health risk behaviors on the daily Internet usage of Korean high school students.

Methods: The data of 19,830 high school students who responded to the Korea Youth Risk Behavior Web-based Survey were analyzed from June to July 2018.

Results: The mean daily Internet usage of high school students was 193.3 ± 125.7 minutes. There were differences in daily Internet usage according to body mass index, grade level, school type, academic achievement, economic status, physical activity, number of physical education classes attended, safety accidents, and safety education ($p < .05$). Daily Internet usage also differed according to health risk behaviors, including smoking ($t = 8.32$), alcohol consumption ($t = 9.36$), drug use ($t = 4.51$), and risky sexual behaviors ($t = 5.94$). The daily Internet usage of students significantly increased in the absence of physical activity and with health risk behaviors such as smoking, alcohol consumption, drug use, and risky sexual behaviors.

Conclusion: It is necessary to develop an intervention program and provide education on increasing physical activity and reducing health risk behaviors for the proper management of health and Internet usage in adolescents.

Keywords: Internet usage; Adolescents; Health risk behavior

Introduction

Internet usage has increased rapidly worldwide as it has become an essential part of people's lives (1). The distribution rate of smartphones is closely related to Internet usage rate as users can access the Internet through their mobile devices. Korea has the highest distribution rate of smartphones worldwide. Approximately 30% of adolescents in the country, the highest among all

groups, are dependent on smartphones (2), and around 98.1% use the Internet at least once a day via their personal computers and mobile devices. The internet has become embedded in our culture and daily lives (3).

The Internet functions to share information and provide education through remote communication, relationship formation, and socialization,



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which were previously impossible. However, various harmful consequences related to addictive Internet usage have been observed, including physical, mental, and social abnormalities that interfere with life, similar to alcohol and drug addiction (4-6). The most important factor in defining addictive Internet usage is Internet browsing time, which leads to increased problematic Internet usage (PIU) (4,5). The excessive use of the Internet and smartphones leads to users being overly dependent on it, which causes abnormalities in daily life through withdrawal and tolerance for Internet usage (7).

Adolescence is an important period for acquiring the health behaviors and life skills necessary to maintain a healthy life. Health risk behaviors begin during adolescence and are likely to continue into adulthood (8). Multiple health risk behaviors are highly associated with chronic diseases and mental health problems (9). Social deviant behaviors, such as smoking and drinking, have also been found to be associated with serious health problems. The number of adolescents engaging in social deviant behaviors has increased, and the mean age at which they begin smoking and drinking has decreased (10,11).

Among adolescent health risk behaviors, drinking and smoking are representative behaviors, and approximately 80% of drinkers and smokers carry out these behaviors for the first time during adolescence (12,13). A number of previous studies have reported an association between behaviors related to smoking and drinking and excessive Internet usage in adolescents (1,11,13). Excessive Internet usage during adolescence can decrease physical activity and lead to health problems, such as an increased body mass index (BMI) (14) and lack of sleep (1,10,15). Undesirable lifestyle habits are also significantly associated with trends in computer addiction (1,16). In addition, the relationship between Internet usage and health risk behaviors, such as drug use and risky sexual behavior, has been reported in previous studies (1,5,10,11,13). However, they lacked consistency as participants of previous studies were mixed with general, Internet-dependent, or addicted adolescents and many reported having is-

sues related to mental health. Moreover, previous research did not show the actual time of Internet usage according to the level of health and/or risk behaviors, especially within the context of Korean adolescents.

The study assesses the health risk behaviors and daily Internet usage of high school students. We also analyze daily Internet usage according to health risk behaviors in order to provide basic data for promoting adolescent health. The specific objectives of the study were as follows: 1) Assess the difference in participants' daily Internet usage according to their general characteristics and health risk behaviors, and 2) assess the factors of health risk behavior that affect participants' daily Internet usage.

Materials and Methods

Design and sample

We used a cross-sectional study design to identify the associations between health risk behavior and Internet usage time among Korean adolescents. We based our study on raw data from the 2018 Korean Youth Risk Behavior Web-based Survey (14th KYRBWS), conducted from June to July 2018 (17).

The KYRBWS is a government-approved statistical survey (Statistics Korea, approval No. 11758), performed annually by the Korea Centers for Disease Control and Prevention to monitor priority health risk behaviors among Korean adolescents since 2005. It was conducted using a complex sample design involving stratification, clustering, and multistage sampling methods. The 14th KYRBWS surveyed 62,823 students from 400 middle schools and 400 high schools. The respondents comprised 15,135 male and 14,676 female students in the first to third year of high school. After excluding those who did not respond to the item on daily Internet usage, the data of 19,830 students were analyzed.

Measures

Internet usage time and health risk behaviors

Daily Internet usage refers to average daily Internet usage on weekdays and weekends expressed in minutes, excluding the time it was used for learning purposes. The assessed health risk behaviors include cigarette smoking, alcohol consumption, drug use, and risky sexual behavior. Smoking was assessed using the item “During the past 30 days, on how many days did you smoke a cigarette?” Those who smoked on one or more days were classified as “yes.” Alcohol consumption was assessed using the question “Have you ever had more than one glass of an alcoholic drink for purposes other than performing ancestral rites and/or religious rituals?” and those who had more than one glass of a drink was classified as “yes.” Drug use was assessed using the item “I have habitually or intentionally used drugs or abused household chemicals as drugs (e.g., sniffing butane gas and glue).” Risky sexual behavior was defined as sexual behavior with undesirable effects or health disadvantages on adolescents according to social conventions. Answers to the three questions, “Have you had sex after drinking alcohol?,” “Have you ever got pregnant?,” and “Did you use contraception during sexual intercourse?,” were considered dichotomous variables. Those you answered “yes” for the first two questions and “no” for the question on contraception use were classified as having risky sexual behavior. If any of the three categories were met, they were classified as having engaged in risky sexual behavior.

Demographic characteristics

Physical activity was defined as the number of days (0, 1-2, or more than 3) in which the heart rate reached a level above the resting heart rate or when the subject was out of breath during physical activity in the last seven days. Physical exercise (PE) class attendance was assessed by the question “how many times have you worked out at the school playground during PE class in the last seven days?” For sleep adequacy, an average sleep duration of 7-8 h a day, and fewer than 7 h or more than 8 hours, were classified as adequate and inadequate, respectively. Safety accidents were defined as accidents while using earphones

and smartphones, and responses to experiences of safety accidents were classified as yes or no using the item “I have received treatment from the hospital after being injured while walking and using earphones/headsets or a smartphone in the last 12 months.” The experience of safety education included all safety education received at school. Respondents were to answer “yes” if they have received or experienced accident prevention education, response drills, rescue and lifesaving education, and cardiopulmonary resuscitation education.

Statistical analysis

A statistical analysis was performed using SAS software (version 9.4; SAS Institute Inc., Cary, NC, USA) in a manner that reflected sampling weights and provided nationally representative estimates according to the Korea Centers for Disease Control guidelines. Continuous variables were presented as mean \pm SE values. A *t*-test and ANOVA were performed to assess differences in the general characteristics according to daily Internet usage, and the Scheffé post-hoc error correction was performed for post-hoc analysis. The *t*-tests were applied to compare risky health behaviors by Internet usage time. Multiple regression analyses were performed to determine the association between risky health behavior and Internet usage time.

Ethical approval

The KYRBWS is a government approved statistics (Approval No. 11758) survey and was approved by the IRB of the KCDC (2014-06EXP-02-P-A).

Results

Daily Internet usage according to the characteristics of the adolescents

There was no difference in the daily Internet usage according to sex ($p=.292$), but differences in daily Internet usage were observed in the different BMI classifications of respondents that did not fall within the normal weight range. Daily

internet usage significantly decreased as grade level increased ($p<.001$), and there were differences in Internet usage depending on the school type ($p<.001$). As academic achievement and economic status were lower, daily Internet usage increased ($p<.001$).

There was no difference in Internet usage according to sleep duration. There was also no difference in daily usage between those who performed physical activity and PE class once or twice in the previous week, and those who did them more than three times. However, there were differences between those who did not per-

form any physical activity and PE class in the last seven days, and those who performed them once, twice, and more than three times ($p<.001$).

Among the subjects, 0.9% experienced safety accidents while using smartphones and earphones. They recorded a daily Internet usage of 223.7 min/day, which was significantly greater than that of those without any experience of safety accidents. ($p=.032$). Of the subjects, 11.3% did not receive any safety education. The daily Internet usage of these subjects was significantly different from that of those with experience of safety education ($p=.022$) (Table 1).

Table 1: Participants’ demographic characteristics and daily Internet usage (N=19,830)

<i>Variable</i>	<i>Classification</i>	<i>n (%)*</i>	<i>Daily Internet usage (mins)</i> <i>M ± SE</i>	<i>t or F(p)**</i>
Daily Internet usage			193.3±1.6	
Sex	Male	9585 (48.3)	191.8±2.2	-1.05(.292)
	Female	10245 (51.7)	194.8±2.1	
Body Mass Index (kg/m ²)	<18.5 ^a	3309 (16.7)	202.1±2.8	12.91(<.002)
	18.5-22.9 ^b	10182 (51.3)	187.0±1.9	a>b,
	23.0-24.9 ^c	2771 (14.0)	195.7±2.6	b<c, d
	≥25.0 ^d	3568 (18.0)	201.2±2.7	
Grade level	1 st year ^a	6223 (31.4)	197.5±2.3	9.30(<.001)
	2 nd year ^b	6580 (33.2)	195.6±2.0	a, b>c
	3 rd year ^c	7027 (35.4)	188.3±2.2	
School type	High school	16274 (83.3)	185.4±1.7	-11.95(<.001)
	Vocational high school	3261 (16.7)	237.8±4.0	
Academic achievement	High ^a	6977 (35.2)	173.7±2.2	332.58(<.001)
	Moderate ^b	10916 (55.0)	194.9±1.7	a<b<c
	Low ^c	1937 (9.8)	253.5±3.9	
Economic status	High ^a	6926 (34.9)	174.8±2.0	195.64(<.001)
	Moderate ^b	9669 (48.8)	196.2±1.8	a<b<c
	Low ^c	3235 (16.3)	225.2±2.9	
Physical activity in previous week	≥3 times ^a	5205 (26.3)	189.4±2.3	26.67(<.001)
	Once or twice ^b	6870 (34.6)	187.0±1.9	a, b<c
	None ^c	7755 (39.1)	201.5±2.1	
PE class in previous week	≥3 times ^a	2614 (20.3)	187.0±2.9	84.87(<.001)
	Once or twice ^b	13277 (24.4)	187.9±1.7	a, b<c
	None ^c	3939(55.3)	215.5±2.7	
Sleep duration	7-8hr	1095 (5.5)	200.8±4.4	-1.73(.084)
	<7hr or >8hr	18735 (94.5)	192.9±1.6	
Experience of safety accident	Yes	187 (0.9)	223.7±14.4	2.14(.032)
	No	19643 (99.1)	193.0±1.6	
Experience of safety education	Yes	17586 (88.7)	192.4±1.6	-2.31(.022)
	No	2244 (11.3)	200.3±3.6	

* Weighted percentage (%); Missing data excluded; ** Scheffé post-hoc analysis

Those with experiences of smoking, alcohol drinking, drug use, and risky sexual behaviors showed significantly greater daily Internet usage

than those without such experiences ($p < .001$) (Table 2) (Fig. 1).

Table 2: Daily Internet usage according to health behavior

Variable	Classification	n (%) [*]	Daily Internet usage (mins) <i>M ± SE</i>	t (p)
Cigarette smoking	Yes	3487 (17.6)	215.4±3.1	8.32 (<.001)
	No	16343 (82.4)	188.6±1.6	
Alcohol consumption	Yes	10469 (52.8)	202.4±1.9	9.36 (<.001)
	No	9361 (47.2)	183.1±1.8	
Drug use	Yes	170 (0.9)	272.6±17.8	4.51 (<.001)
	No	19660 (99.1)	192.6±1.6	
Risky sexual behavior	Yes	1144 (5.8)	222.0±5.1	5.94 (<.001)
	No	18657 (94.2)	191.5±123.9	

* Missing data excluded

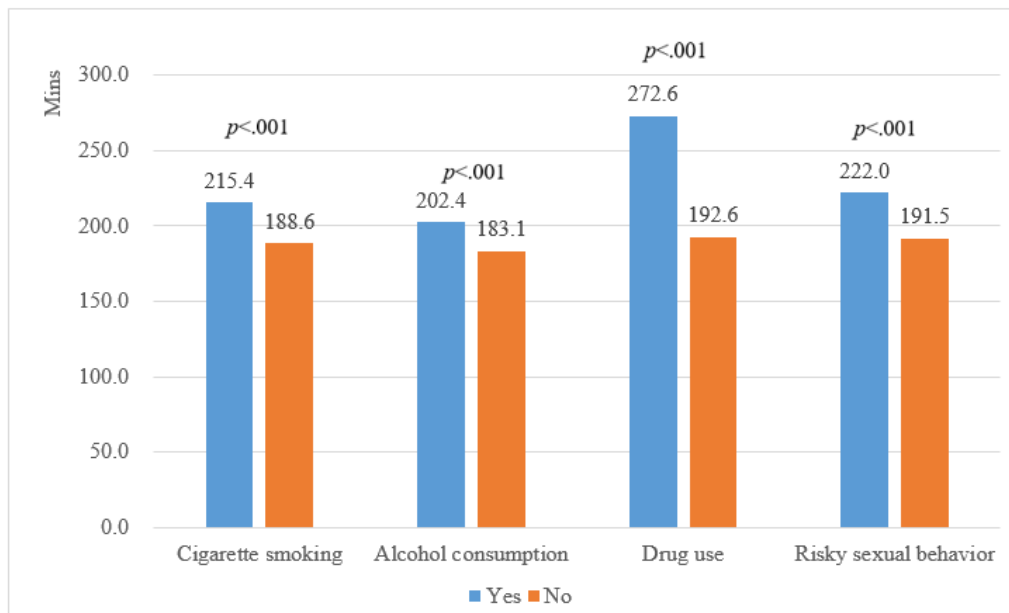


Fig. 1: Differences of daily Internet usage according to health risk behavior among Korean adolescents

Health behaviors affecting daily Internet usage

In Model 1, the factors that affected daily Internet usage were academic achievement, school type, economic status, BMI, grade level, physical activity, smoking, alcohol drinking, drug use, and risky sexual behavior. Sex and sleep duration did not affect daily Internet usage. In Model 2, physi-

cal activity, sleep duration, smoking, alcohol consumption, drug use, and risky sexual behavior were significant factors that affected daily Internet usage, with an explanatory power of 23%. The absence of physical activity, cigarette smoking, alcohol drinking, drug use, and risky sexual behavior increased daily Internet usage (Table 3).

Table 3: Health-related factors affecting participants’ Internet usage

<i>Variable</i>	<i>Model 1</i>				<i>Model 2</i>			
	Beta	SE	<i>t</i>	<i>p</i>	Beta	SE	<i>t</i>	<i>p</i>
Intercept	90.74	20.41	4.45	<.001	228.41	19.18	11.91	<.001
BMI – 18.5-22.9	-12.70	2.68	-4.74	<.001				
Grade level – 1 st year	11.26	2.58	4.36	<.001				
School type – high school	-50.65	4.07	-12.46	<.001				
Academic achievement – high	-63.93	4.31	-14.82	<.001				
Economic status – low	17.74	1.54	11.52	<.001				
Physical activity – none	8.28	2.66	3.11	.002	10.49	2.72	3.85	<.001
PE class – none	8.80	3.07	2.87	.004	26.93	3.64	7.40	<.001
Sleep duration – 7-8hrs	-7.48	4.66	-1.61	.109	-9.44	4.57	-2.06	.040
Cigarette smoking	14.17	3.06	4.64	<.001	18.64	3.12	5.98	<.001
Alcohol consumption	11.52	2.03	5.68	<.001	14.00	2.03	6.91	<.001
Drug use	64.25	17.20	3.74	<.001	67.62	16.94	3.99	<.001
Risky sexual behavior	12.84	4.81	2.67	.008	14.30	4.73	-3.02	.003
F (<i>p</i>)		57.45 (<.001)				56.01 (<.001)		
Adjusted R ²		.057				.023		

Model 2: Adjusted for BMI, grade level, school type, academic achievement, and economic status

Discussion

The finding showed that daily Internet usage decreased as grade level increased is contrary to the result that high school students of higher grades in the United States spend more time using digital media, including the Internet (18). This result could be explained by the high university entrance rate of 70% in Korea, which requires much preparation. In fact, the daily Internet usage of vocational high school students was significantly greater in our study. This suggests students who are not preparing for their college admissions tests can afford to spend more time online. Daily Internet usage was higher in those with low academic achievement and economic status, also reported by various previous studies (3,19). Excessive Internet usage in adolescents decreases their overall physical and psychological functions, impairs social skills in real life, promotes social isolation, and deteriorates learning habits, which in turn leads to decreased academic achievement (5,19). During adolescence, students easily feel the urge to deviate, which leads to an increased chance of PIU in those with low economic status. It is necessary to provide an eco-

nomically and educationally stable environment for them through increased interest from parents, teachers, and friends (15).

Daily Internet usage was significantly higher in those who have not experienced safety training, and in those who have experienced safety accidents due to smartphone/earphone usage. It is important to establish a health policy to provide various types of safety education on topics related to the usage of smartphones and other devices. Education is the most effective way to induce behavioral changes and an understanding of their fundamentals (20). In addition to theoretical education for knowledge transfer, practical education that can be useful in emergency situations can also enhance the effects of education (21). Since most adolescents are familiar with the online environment, educational programs using online media and games to induce interest could increase their concentration and efficiency.

Approximately 39.1% and 55.3% of the adolescents in our study did not perform physical activity and attend PE class in the last seven days, respectively. They had a significantly higher daily Internet usage. Furthermore, adolescents with a BMI outside the normal weight range showed

significantly greater daily Internet usage. Adolescence is the most important period for the formation and maintenance of health behaviors and healthy lifestyles (8). A lack of physical activity during this stage has negative effects on both physical and mental health (22). On one hand, those with an increased daily Internet usage skip breakfast because of lack of sleep and have a high risk exposure to smoking, alcohol consumption, obesity, and drug use. On the other hand, a higher proportion of those with low daily Internet usage perform regular exercises and have adequate sleep duration (1,9,10,15).

Adolescent obesity is affected by the surrounding environment and its biological tendencies. One of the major causes of lifestyle changes is the recent increase in the use of information and communication technology. The excessive use of the Internet and digital devices decreases physical activity, and the resulting static lifestyle can cause weight gain in adolescence, which is likely to trigger being overweight or obese (14,16,23). In previous studies, inactive Korean adolescents were more likely to show an increased daily Internet usage (3), while a higher level of physical activity led to lower daily usage (15). In a one-year longitudinal cohort study on Internet usage, adolescents who spent more time on the Internet were also more likely to become overweight (23). Increasing the rate of regular physical activity during class hours can change lifestyle habits, prevent obesity, and decrease daily Internet usage.

In our study, smoking and alcohol consumption were factors that increased daily Internet usage among adolescents. Drinking alcohol and smoking are representative health risk behaviors, and approximately 80% of alcohol consumption and smoking are first experienced in adolescence (12). Adolescents drink alcohol and smoke tobacco at an experimental level between the ages of 11 and 15 and regularly after two to three years. These behaviors are highly likely to persist into adulthood, and the resulting chronic diseases cause socioeconomic losses (24). Smoking, alcohol consumption, and drug use are health risk behaviors that are linked to each other rather than individual events, and about 89% of adolescents with

PIU show multiple risk behaviors (9,10). Thus, it is necessary to provide health education to prevent children from being exposed to and engaging in dangerous health behaviors from early adolescence. Parents can also be guided on how to protect their children by providing information on Internet parental control software and various after-school activities. It may also include how to set the restrictions on the Internet use with their children in a non-coercive manner.

Drug use was also a factor that increased daily Internet use in our study. The rate of drug use in Korean adolescents is not high; however, the mean ages when adolescents start smoking and drinking alcohol are relatively low at around 13.0 and 13.3 years old, respectively (17). In the early stages, alcohol and cigarettes are mostly used, and adolescents begin to abuse drugs that are readily available in pharmacies (6). Adolescents cannot control drug use initiated by impulsive tendencies and curiosity by themselves, and tolerance may increase this risk (25). Adolescents with experiences of using problematic substances show a high tendency for excessive Internet usage, and Internet addiction is also a predictive indicator of the use of problematic substances (13). Adolescents may easily obtain drugs due to curiosity and peer pressure, and as a form of escape from negative emotions they have about themselves or their environment. Therefore, further studies should be conducted on drug use in adolescents (13). It is necessary to educate and promote risk management skills and induce health-promoting behaviors rather than controlling them. In addition, regulations and punishments on the sales and distribution of problematic substances need to be strengthened to prevent adolescents' exposure to health risk behaviors.

This study showed that risky sexual behavior was associated with increased daily Internet usage. Misconduct, drug use, and risky sexual behaviors often occur together and usually develop from experiences of cigarette and alcohol use (26). Internet usage in adolescents affects pornography exposure and sexual experiences (11,27). Repeated and habitual exposure to pornographic materials induced sexual behavior, which in turn stim-

ulated their desire to view pornography. Thus, repeated exposure to pornography increases the risk of risky sexual behavior (28). Therefore, it is necessary to provide systematic education and strengthen various protection systems so adolescents can prevent themselves from engaging in risky sexual behaviors, and maintain their own physical and psychological health. In addition, it is important to develop and distribute software that blocks harmful sites or videos on smartphones or personal computers to prevent exposure to pornography through the Internet. Because this study followed a cross-sectional design, it had limitations in assessing causal relationships over time. Another limitation of this study is that a self-administered questionnaire was used to collect the data. Nevertheless, our research was meaningful in providing basic data for the promotion of health behavior in adolescents through an analysis of the relationship between health behavior, health risk behavior, and daily Internet usage in Korean high school students.

Conclusion

Our results may be used as a reference for the development of a comprehensive health education program to maintain and promote the health of adolescents.

Our study presents the following recommendations: First, it is necessary to develop programs that can promote regular physical activity and a healthy play culture for leisure and stress relief without Internet use for adolescents. Second, it is necessary to continuously develop education and protection systems that can be systematically applied to all curricula to prevent smoking and alcohol consumption, and promote healthy sexual behaviors. Third, a campaign can be launched to ensure healthy Internet usage for an appropriate duration, regulate and control Internet usage over a certain period of time at home or school, and increase awareness of the problems associated with excessive Internet use.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors declare that there is no conflict of interest.

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