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Original article

## Effect of the Online Game Shutdown Policy on Internet Use, Internet Addiction, and Sleeping Hours in Korean Adolescents

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*Article history:* Received August 2, 2017; Accepted November 16, 2017

*Keywords:* Shutdown system; Internet addiction; Adolescent Internet usage

### A B S T R A C T

**Purpose:** Internet addiction has emerged as a major public health problem worldwide. In November 2011, the South Korean government implemented an online game shutdown policy, lasting from 12:00 to 6:00 AM, as a means of preventing Internet addiction in adolescents aged 15 or below. This study analyzed the effect of this shutdown policy on adolescent Internet use, addiction, and sleeping hours.

**Methods:** We analyzed data collected from the Korea Youth Risk Behavior Web-based Survey from 2011 to 2015. Respondents were divided into two groups by age: aged 15 or below (male = 76,048, female = 66,281) and aged 16 or above (male = 52,568, female = 49,060). A difference-in-difference analysis was used to evaluate the effect of this shutdown policy.

**Results:** In 2012, which is immediately following policy enforcement, daily amount of Internet use (in minutes) decreased more in adolescents affected by the policy (i.e., the aged 15 or below group). However, it steadily increased in 2013, 2014, 2015, and showed no meaningful long-term improvements 4 years after policy implementation (−3.648 minutes in 2012 [ $p = .001$ ], −3.204 minutes in 2013 [ $p = .011$ ], −1.140 minutes in 2014 [ $p = .384$ ], and 2.190 minutes in 2015 [ $p = .107$ ]). The shutdown policy did not alter Internet addiction or sleeping hours. Interestingly, female adolescents, adolescents with low academic performance, and adolescents with low exercise levels exhibited comparatively stronger and longer lasting initial declines in Internet usage.

**Conclusions:** The shutdown policy had practically insignificant effects in reducing Internet use for target adolescents. Thus, policymakers aiming to reduce or prevent Internet addiction should use different strategies.

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### IMPLICATIONS AND CONTRIBUTION

This study suggests that policymakers wishing to reduce or prevent Internet addiction should consider different strategies from the current simple shutdown policy. Furthermore, considering the associations of Internet addiction with gender, academic performance, and exercise status might be useful when planning more efficacious Internet addiction policies.

Jiyun Choi and Hyunseok Cho had equal contributions.

**Conflicts of Interest:** The authors have no conflicts of interest to disclose.

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Alongside the dramatic surge in Internet use worldwide, Internet addiction has become a growing threat to public health. A meta-analysis of data from 31 countries across seven world regions revealed a global Internet addiction prevalence of 6.0% [1]. Internet addiction is particularly prevalent within adolescents. In South Korea, home to the world's most intense gaming culture [2], around 11.7% of adolescents are considered to have Internet addiction, according to a national report by the Ministry of Science, Information and Communications Technology, and Future Planning. Given that the United States and China have shown internet addiction rates of 3.7% and 2.4% among youth [3,4], the situation in South Korea is indeed quite serious.

There is considerable evidence suggesting that Internet addiction is a significant threat to both physical and mental health [5–10], although most of these past studies investigated mere correlations rather than causal relationships among the variables [11]. Excessive Internet usage, including online gaming, has been found to be associated with lower perceived health status [5] and quality of life (both subjective and objective) [1]. Furthermore, especially in adolescents, Internet addiction is associated with elevated levels of anxiety, depression [8,10], and aggressive behavior [7]. Certain factors such as gender [12,13], scholarly achievement [14,15], and exercise [16] are associated with Internet addiction. Spending more time playing online games was negatively associated with both academic performance and level of exercise.

Despite the potential harm caused by Internet addiction, only a few Asian countries have considered preventative measures for reducing the number or severity of those with the addiction. In July 2007, General Administration of Press and Publication implemented the Online Game Anti-Addiction Policy to discourage prolonged usage of online games. In March 2011, the Vietnamese government created a bill to restrict online game use from 10:00 PM to 8:00 AM, such as by closing cyber cafes and imposing fines on companies that offer online games during the restricted hours. Unfortunately, the efficacy of these attempts did not meet expectations, primarily because of the existence of methods to circumvent the regulations, such as creating an account with your parents' personal information, or accessing games using internet protocol addresses overseas [17].

On November 20, 2011, the government of South Korea enforced its own online game shutdown policy to address the social need of preventing Internet addiction and ensuring that adolescents obtain a sufficient amount of sleep. As stated in Article 26 of the Juvenile Protection Act, "Internet games should not be offered to those under the age of 16 from 12:00 AM to 6:00 AM." In other words, the policy restricts adolescents aged 15 or below from playing online games after midnight (12:00–6:00 AM). The policy applies to all online games that require personal information, but not to console-based games or mobile games. The purpose of the policy was to protect adolescents from developing Internet addiction and to improve their health by guaranteeing, at least in theory, a sufficient amount of sleep.

Since its enforcement, researchers have examined various aspects of this peculiar shutdown policy. Questionnaire studies revealed that the perceived effect of the policy was poor [18] and that it has largely failed to effectively prevent Internet addiction [19]. The results of these domestic evaluations were consistent with reports from other countries that have implemented similar schemes. For instance, according to a general study on internet restrictions, cyber cafe operators were more likely to help minors play games after the Vietnamese government forced cyber cafes to close from 10:00 PM to 8:00 AM as part of

its game restriction policy. Likewise, an analysis of the Online Game Anti-Addiction Policy in China revealed that the policy was effectively useless because of methods conceived to circumvent its restrictions [17].

A critical limitation of these studies is that they failed to quantitatively analyze the effects of the policy on adolescent Internet usage status or health-related variables. In fact, most research has taken a legislative focus, such as whether the shutdown system has violated freedom of expression [20,21]. Thus, this study provides a basis for evaluating the shutdown policy by examining the changes in adolescent Internet usage status, Internet addiction status, and sleeping hours following policy enforcement.

The shutdown policy prohibits only adolescents aged 15 or below from playing online games during the late-night hours. Taking advantage of this feature, we compared adolescents aged 15 or below with those aged 16 or above to observe the net effects of the shutdown policy. In detail, we tested the following three hypotheses: (1) After enforcement of the shutdown policy, the Internet usage time of adolescents aged 15 or below will have significantly decreased compared with that of adolescents aged 16 or above. If so, (2) sleeping hours of adolescents aged 15 or below will have increased because of the decline in late-night Internet usage. Finally, (3) male adolescents, adolescents with low academic performance, and adolescents who exercise less will be more strongly affected by the shutdown policy because they will have spent more hours playing online games before policy implementation.

## Methods

### Data and study population

Data from the 2011 to 2015 Korea Youth Risk Behavior Web-based Survey (KYRBS) were used [22]. The KYRBS is an anonymous, self-administered web-based survey conducted annually since 2005 by the Ministry of Education, Ministry of Health and Welfare, and Korea Centers for Disease Control and Prevention to understand the health-related risk behaviors among Korean adolescents. Data from 2005 to 2007 failed to provide any measure of internet usage, whereas questionnaires from 2008 to 2010 differed from those of 2011 to 2015. Therefore, only the data from 2011 to 2015 were used to guarantee internal validity.

The KYRBS uses a stratified multistage cluster sampling design to obtain a nationally representative sample of around 75,000 students each year from 400 middle schools and 400 high schools. The KYRBS does not obtain any personal information susceptible to abuse, such as the students' names, school, telephone number, home address, or social security number. Raw data consist of responses to a questionnaire containing 14 categories of behavior, such as smoking, drinking, exercise, diet, weight control, mental health, and Internet usage. Studies on KYRBS showed that health-risk behavior indices were generally reliable and that self-reported values from the survey showed good validity with directly measured data [23,24].

The KYRBS data from 2011 to 2015 comprised information from 362,367 adolescents. However, 1,956, 84,014, and 40,668 adolescents had missing values for age, Internet usage hours, and sleeping hours, respectively. Thus, we excluded these adolescents and divided the remaining 243,957 adolescents into two groups by age: aged 15 or below ( $n = 142,329$ ) and aged 16 or above ( $n = 101,628$ ), because the shutdown policy affected only adolescents aged 15 or below.

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