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Epidemiology of Internet Behaviors and Addiction Among Adolescents in Six Asian Countries

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Abstract

Internet addiction has become a serious behavioral health problem in Asia. However, there are no up-to-date country comparisons. The Asian Adolescent Risk Behavior Survey (AARBS) screens and compares the prevalence of Internet behaviors and addiction in adolescents in six Asian countries. A total of 5,366 adolescents aged 12–18 years were recruited from six Asian countries: China, Hong Kong, Japan, South Korea, Malaysia, and the Philippines. Participants completed a structured questionnaire on their Internet use in the 2012–2013 school year. Internet addiction was assessed using the Internet Addiction Test (IAT) and the Revised Chen Internet Addiction Scale (CIAS-R). The variations in Internet behaviors and addiction across countries were examined. The overall prevalence of smartphone ownership is 62%, ranging from 41% in China to 84% in South Korea. Moreover, participation in online gaming ranges from 11% in China to 39% in Japan. Hong Kong has the highest number of adolescents reporting daily or above Internet use (68%). Internet addiction is highest in the Philippines, according to both the IAT (5%) and the CIAS-R (21%). Internet addictive behavior is common among adolescents in Asian countries. Problematic Internet use is prevalent and characterized by risky cyberbehaviors.

Background

THE INTERNET IS NO LONGER merely an infrastructure; it has become an unlimited space for information exchange, social networking, and the development of cyberbehaviors. Adolescence is a critical period for behavioral changes. Internet addiction in adolescents has become an urgent issue in the health education and promotion agenda,[1] particularly because of the potential links between sedentary activities, especially technology use, and the pandemic of obesity.[2] Interventions to prevent prolonged screen time are a major component of obesity prevention programs in schools.[3] With the increasing infiltration of the Internet into daily life, psychopathological symptoms of Internet addiction have also been observed in recent years.[4] Specifically, some psychiatrists have proposed that Internet gaming disorders should be classified under substance abuse and addictive disorders in the revised Diagnostic and Statistical Manual of Mental Disorders (DSM-5).[5] For instance, Internet game addicts have cravings that are similar to smokers.[6] A recent meta-analysis involving 1,641 patients and 11,210 controls found significant associations between Internet addiction and alcohol abuse (odds ratio [OR] 3.05), attention deficit and hyperactivity (OR 2.85), depression (OR 2.77), and anxiety (OR 2.70).[7] In addition, clinical evidence of the adverse effect of Internet addictive behavior on brain functions has been reported.[8,9] Various treatments for Internet addiction have been developed and evaluated.[10] Nevertheless, the effectiveness of interventions for Internet game disorder is unclear.[11] Therefore, early assessment and prevention of Internet and game addiction is necessary.

The prevalence of Internet addiction varies across different scales, covering different dimensions of Internet addictive behavior.[12] The Internet Addiction Test (IAT) and the Chen

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Internet Addiction Scale (CIAS) are the two most common scales used to assess Internet addictive behaviors. The 20-item IAT was developed by Young et al., and is a modification of Young's Diagnostic Questionnaire for Internet addiction, which is based on the DSM-IV[13] criteria for pathological gambling.[14] The IAT consists of three subscales: withdraw and social problem, time management and performance, and reality substitute.[15] The IAT has been translated into different Asian languages and used in Korean,[16] Malay,[17] and Chinese[18] speaking populations. The factor structure of the IAT has been tested in Chinese adolescents.[15] The Revised Chen Internet Addiction Scale (CIAS-R), consisting of 26 items, was modified from the original CIAS. The CIAS-R consists of five subscales, including the compulsive use (Sym-C), withdrawal (Sym-W), tolerance symptoms of Internet addiction (Sym-T), interpersonal and health-related problems (RP-IH), and time management problems (RP-TM). Studies using the CIAS-R have determined that Internet addiction is associated with suicidal behaviors in Taiwanese adolescents.[19] The factor structure of the CIAS-R has been validated in Chinese adolescents.[20] However, its use beyond Chinese populations has yet to be investigated.

Although most of the available studies of pathological Internet addiction have been conducted in Asia,[21] Internet addiction could be endemic. Cultural attitudes are one of the major determinants of the level of concern about Internet addiction observed across countries.[22] The prevalence of Internet addiction reported in Western populations varies, probably due to the characteristics of the respondents, the scale used, and the timing of the measurements.[23,24] In China, an incidence rate of 2.4% for Internet addiction has been reported in adolescents.[25] Adaptive problems were found to be the major predictor of Internet addiction in Chinese college students.[26] Moreover, studies have shown that Chinese college students who are Internet addicts are more likely to have eating disorders,[27] and Chinese adolescents who are Internet addicts have a greater likelihood of suffering from depression and anxiety.[28] Despite these studies, there is no overview of Internet addictive behavior in Asia. This population-based epidemiological study screened and compared the Internet addictive behavior of adolescents from six Asian countries.

Methods

Participants were 5,366 adolescents aged 12–18 years from six Asian countries (879 from China, 839 from Hong Kong, 744 from Japan, 936 from South Korea, 969 from Malaysia, and 999 from the Philippines) who took part in the Asian Adolescent Risk Behavior Survey (AARBS). The schools were randomly selected from both rural and urban areas in the respective counties—Southern and Central China, including Shenzhen and Hunan; Kowloon and New Territories of Hong Kong; Western Japan, including Shiga; Northern and Southern South Korea, including Seoul and Pusan; Central Western Malaysia, including Selayang; and the Northern and Southern Philippines, including Kapitolyo, Manila, Marikina, Novaliches, and Obando. Students completed a 40 minute structured questionnaire translated into the languages used in their schools (Simplified Chinese for China; Traditional Chinese for Hong Kong; Japanese for Japan; Korean for South Korea; Malay, English, and Simplified Chinese for Malaysia; and English for the Philippines) by individual bilingual translators, reviewers, and adjudicators, followed by face validation conducted by the researchers. The questionnaires were administered in classes during the 2012–2013 school year. Informed consent was obtained from the students, and ethics approval was obtained from the university and hospital ethic committees.

Students reported their demographic information and computer ownership (no personal or shared computer, shared a computer with one sibling, shared a computer with more than one siblings, owned a personal computer), ownership of electronic devices such as an iPhone, iPad, iPod, Samsung smartphone, HTC smartphone (yes or no), and the places they most frequently used the Internet (cybercafé or other public places, library, home, friends' houses, school). Students were also asked to report the frequency of their Internet behavior, including e-mail, instant messenger (e.g., MSN, ICQ, Yahoo, QQ), social networking (e.g., Facebook, Twitter, Weibo), blogging, joining newsgroups/discussion groups/forums, visiting particular leisure Web sites (e.g., sports Web sites, TV Web sites, etc.), surfing the Web with no set purpose, online shopping, downloading (e.g., pictures, games, music, videos, animation, text software), listening to online radio, and online gaming. The possible answers were once per week, two to three times per week, four to six times per week, once per day, two to three times per day, and more than three times per day. They were also asked to report if they had ever performed or experienced Internet misbehaviors or attended an Internet safety course. The examples of Internet misbehaviors included receiving false information in an e-mail or instant message, pretending to be a different person in an e-mail or instant message, sending e-mails or instant messages to someone they had never met, sending prank e-mails or an e-mail bomb to someone, blocking an instant message from a person, and giving a password to a friend (yes or no).

Internet use patterns, including the average number of hours a day spent online during school days and holidays, and the frequency of Internet use were reported. Participants were required to respond to questions about the frequency of Internet use on a 6-point scale ranging from 1 = ''once a week or less'' to 6 = ''more than three times a day.'' The IAT and CIAS-R were used to screen students for the symptoms of addictive Internet use. According to Young et al.'s criteria,[29] respondents who scored ≥ 70 were classified as addictive Internet users who had encountered significant life problems due to excessive Internet use. Those with an IAT score of 40–69 were classified as problematic Internet users who had encountered general life problems due to excessive Internet use. Respondents with an IAT score of ≤ 39 or below were classified as average Internet users, who only had some problems controlling Internet use. In the CIAS-R, a higher score indicates a more severe addiction to Internet activities. The possible range of CIAS-R scores is 26–104. A higher score indicates a more severe level of Internet addiction. Following a study of Taiwanese adolescents, in this study, a person with a CIAS-R score of ≥ 64 was classified as an Internet addict.[30] The prevalence of Internet behavior and addiction among adolescents was compared between countries.

Results

Table 1 shows that the prevalence of computer ownership varies across countries. About half (51.1%) of Hong

Table 1. Basic Characteristics and Internet Access of the Adolescents from Individual Countries

	China	*Hong Kong*	*Japan*	*South Korea*	*Malaysia*	*Philippines*
Sex, *n* (%)						
Males	470 (53.5)	316 (37.7)	364 (48.9)	575 (61.4)	446 (46.0)	385 (38.5)
Females	409 (46.5)	523 (62.3)	380 (51.1)	361 (38.6)	523 (54.0)	614 (61.5)
Age, mean (*SD*)	15.1 (1.8)	15.8 (2.0)	16.5 (0.5)	13.7 (1.6)	14.7 (1.2)	16.4 (1.7)
Ownership of computer, *n* (%)						
No	562 (66.0)	64 (7.7)	197 (26.5)	83 (9.0)	198 (20.8)	370 (37.2)
Shared with one sibling	112 (13.1)	232 (28.0)	249 (33.5)	394 (42.6)	201 (21.1)	174 (17.5)
Shared with more than one sibling	53 (6.2)	110 (13.3)	153 (20.6)	218 (23.6)	367 (38.6)	279 (28.1)
Own one personally	125 (14.7)	424 (51.1)	145 (19.5)	229 (24.8)	185 (19.5)	171 (17.2)
Ownership of electronic devices (multiple options), *n* (%)						
iPhone	97 (11.0)	120 (14.3)	50 (6.7)	23 (2.5)	103 (10.6)	65 (6.5)
iPad	57 (6.5)	78 (9.3)	16 (2.2)	38 (4.1)	98 (10.1)	59 (5.9)
iPhone or iPad	116 (13.2)	166 (19.8)	62 (8.3)	54 (5.7)	172 (17.8)	118 (11.8)
iPod	45 (5.1)	180 (21.5)	373 (50.1)	25 (2.7)	57 (5.9)	54 (5.4)
Samsung	148 (16.8)	106 (12.6)	12 (1.6)	357 (38.1)	210 (21.7)	181 (18.1)
HTC	62 (7.1)	38 (4.5)	6 (0.8)	10 (1.1)	43 (4.4)	11 (1.1)
Other smartphones	132 (15.0)	136 (16.2)	96 (12.9)	416 (44.4)	226 (23.3)	388 (38.8)
Any smartphone	357 (40.6)	467 (55.7)	475 (63.8)	790 (84.4)	549 (56.7)	671 (67.2)
Most common places for Internet access (multiple options), *n* (%)						
Cybercafé or other public areas	199 (22.6)	16 (1.9)	8 (1.1)	41 (4.4)	237 (24.5)	438 (43.8)
Library	4 (0.5)	34 (4.1)	4 (0.5)	24 (2.6)	32 (3.3)	245 (24.5)
Home	393 (44.7)	768 (91.5)	714 (96.0)	808 (86.3)	761 (78.5)	194 (19.4)
Friends' houses	45 (5.1)	38 (4.5)	18 (2.4)	89 (9.5)	138 (14.2)	72 (7.2)
School	41 (4.7)	22 (2.6)	19 (2.6)	50 (5.3)	48 (5.0)	21 (2.1)

Kong students but less than 15% of mainland Chinese students own a computer personally. For smartphones, the overall rate of ownership is about 62% for the studied countries: 84% in South Korea, 67% in the Philippines, 64% in Japan, 57% in Malaysia, 56% in Hong Kong, and 41% in China. Samsung Galaxy and Apple iPhone are the two most common models owned by students in most of the countries. The home is the most frequent place for students to use the Internet in most countries, with a prevalence ranging from 45% to 96%, except in the Philippines where cybercafés and other public areas (44%) are the most preferred by students. Cybercafés and other public areas are also frequent places for Internet use for students in China (23%) and Malaysia (25%).

Table 2 shows the relative frequency of the different types of daily Internet behavior. E-mails (66%), instant messages (50%), blogging (25%), and visiting leisure Web sites (20%) are relatively more common in Japan, whereas social networking (65%), newsgroups/discussion groups/forums (19%), nonpurposive Web surfing (27%), online shopping (8%), and downloading (28%) are relatively more common in Hong Kong. Furthermore, the prevalence of online gaming in decreasing order is Japan (39%), South Korea (20%), Malaysia (19%), Philippines (18%), Hong Kong (17%), and China (11%).

Table 2. Prevalence of Internet Behaviors (Daily or More Frequent) of the Adolescents from Individual Countries

	China n *(%)*	*Hong Kong* n *(%)*	*Japan* n *(%)*	*South Korea* n *(%)*	*Malaysia* n *(%)*	*Philippines* n *(%)*
E-mail	20 (2.3)	154 (18.2)	490 (65.9)	52 (5.5)	113 (11.6)	176 (17.6)
Instant messenger (e.g., MSN, ICQ, Yahoo, QQ)	311 (35.1)	408 (48.3)	374 (50.3)	141 (15.0)	88 (9.0)	102 (10.2)
Social networking (e.g., Facebook, Twitter, Weibo)	70 (7.9)	549 (65.0)	249 (33.5)	219 (23.3)	370 (37.9)	412 (41.2)
Blogging	32 (3.6)	94 (11.1)	182 (24.5)	92 (9.8)	62 (6.4)	107 (10.7)
Joining newsgroups/discussion groups/forums	55 (6.2)	160 (19.0)	78 (10.5)	92 (9.8)	75 (7.7)	137 (13.7)
Visiting particular leisure websites (e.g., Sports Web sites, TV Web sites, etc.)	62 (7.0)	155 (18.4)	149 (20.0)	126 (13.4)	130 (13.3)	168 (16.8)
Surfing the Web with no set purpose	45 (5.1)	229 (27.1)	104 (14.0)	101 (10.7)	135 (13.8)	202 (20.2)
Online shopping	33 (3.7)	71 (8.4)	11 (1.5)	47 (5.0)	53 (5.4)	65 (6.5)
Downloading (e.g., pictures, games, music, videos, animation, text software)	100 (11.3)	237 (28.1)	134 (18.0)	226 (24.0)	183 (18.8)	250 (25.0)
Listening to online radio	51 (5.8)	94 (11.1)	22 (3.0)	37 (3.9)	98 (10.1)	191 (19.1)
Online gaming	101 (11.4)	144 (17.1)	287 (38.6)	191 (20.3)	184 (18.9)	175 (17.5)

Table 3. Internet Misbehaviors and Safety Course Attendance (Ever) of the Adolescents from Individual Countries

	China n *(%)*	*Hong Kong* n *(%)*	*Japan* n *(%)*	*South Korea* n *(%)*	*Malaysia* n *(%)*	*Philippines* n *(%)*
Received false information about the senders in an e-mail or instant message	50 (5.7)	55 (6.6)	23 (3.1)	239 (25.5)	97 (10.0)	467 (46.7)
Pretended to be a different person when sending e-mail or instant messaging to someone	31 (3.5)	36 (4.3)	30 (4.0)	29 (3.1)	92 (9.5)	146 (14.6)
Sent e-mail or instant messages to someone never met before	150 (17.1)	211 (25.1)	280 (37.6)	91 (9.7)	184 (19.0)	146 (14.6)
Sent prank e-mail or an e-mail bomb to someone	24 (2.7)	19 (2.3)	45 (6.0)	66 (7.1)	28 (2.9)	9 (0.9)
Blocked instant messages from a person you did not want to hear from	84 (9.6)	156 (18.6)	218 (29.3)	337 (36.0)	157 (16.2)	24 (2.4)
Given your password to a friend or someone you know	328 (37.3)	218 (26.0)	48 (6.5)	210 (22.4)	240 (24.8)	65 (6.5)
Attended an Internet safety course	382 (43.5)	116 (13.8)	632 (84.9)	591 (63.1)	690 (96.6)	825 (82.6)

Table 3 shows that receiving false messages/accusations (47%) and using a false online identity (15%) are relatively more common in the Philippines than in other countries. Communication with strangers is most common in Japan (38%), and sharing passwords is most common in China (37%). Spreading spam e-mails (7%) and blocking others (36%) are most common in South Korea. Only about 14% of the students in Hong Kong and less than half (44%) of the students in mainland China have ever attended Internet safety courses.

Table 4 shows that 68% of the students in Hong Kong, 55% in Japan, 48% in the Philippines, 44% in Malaysia, 40% in South Korea, and 26% in China use the Internet at least once daily. In all of the countries, students spend more time on the Internet during holidays than on school days. Students from the Philippines have the longest and students from China have the shortest duration of Internet use on an average school day. Students from Hong Kong have the longest and students from Japan have the shortest duration of Internet use on an average holiday. Regarding the IAT results, ranking the six countries from the highest to lowest mean scores gives the following list: Philippines, Japan, Hong Kong, Malaysia, China, and South Korea. As a screening tool, the IAT suggests that the prevalence of addictive Internet use ranges from 1% in South Korea to 5% in the Philippines, and the prevalence of problematic Internet use ranges from 13% in South Korea to 46% in the Philippines. The mean CIAS-R scores in the six countries are, in order, Philippines, Hong Kong, Malaysia, China, Japan, and South Korea. As a screening tool, the CIAS-R suggests that the prevalence of addictive Internet use in the six countries is Philippines (21%), Hong Kong (16%), Malaysia (14%), South Korea (10%), China (10%), and Japan (6%).

Discussion

This epidemiological study indicates that Internet addictive behavior is common among Asian adolescents, probably due to the popularity of computers and smartphones. We also found a higher rate of smartphone use in most Asian countries (41% to 84%) compared to the United States (46%).[31] The varying rates of smartphone ownership between the six Asian countries may suggest the relative technological and economic advances in the individual counties. At the same time, the high prevalence of smartphone ownership in South Korea, Japan, and China may reflect their status as major computer and smartphone producers, which are also equipped with good telecommunication infrastructures.

The prevalence of ownership of a personal computer in this study ranged from 15% to 51%, whereas it was 84% in New York[32] and 79% in Turkey.[33] Students from Hong Kong and Japan were relatively more likely to engage in daily Internet behaviors such as e-mails, instant messages, social networking, blogging, and Web surfing. It is noteworthy that online shopping was the most common in Hong Kong, but was still practiced by less than 10% of the students, perhaps because of security concerns or technological difficulty. Moreover, small geographic areas do not attract online sales. Daily online gaming is common in Japan (39%), South Korea (20%), and Malaysia (19%), perhaps because of the flourishing local development of the online game industry in China, Japan, and South Korea.[34] The bandwidth availability offered by local Internet providers and the connectivity in these countries are other possible factors.

Social networking addiction is another addictive behavior.[35] Mobile messenger service providers from China, Japan, and South Korea such as Kakao Talk, Line, and WeChat have dominated the global market. These smartphone applications in many cases are culture specific. The collectivistic characteristics of Asian young people and the individualist characteristics of Western young people have been found to affect their behavioral patterns on Facebook.[36] We believe that such differences may also help to explain the higher use of online social networking in Asian adolescents. One cultural similarity across China, Japan, and South Korea is Neo-Confucianism, which may suppress individualism and the expression of individual creativity. The Internet has provided an ideal platform with unlimited space to conform to a traditional culture, but also to allow individual adolescents to express their emotions outside of the family hierarchy system.[37]

Table 4. Internet Use Patterns and Addiction Disorders Screened by the Internet Addiction Test (IAT) and Revised Chen Internet Addiction Scale (CIAS-R)

	China	*Hong Kong*	*Japan*	*South Korea*	*Malaysia*	*Philippines*
Frequency of Internet use (%)						
One a week or less	39.9	7.2	15.9	14.8	20.9	17.7
2–3 times a week	18.5	10.2	17.1	23.9	21.8	17.2
4–6 times a week	15.6	14.3	12.0	21.5	13.2	17.6
Once daily	10.0	20.7	13.2	18.1	10.1	15.5
2–3 times a day	4.4	8.6	9.0	8.0	10.3	9.2
More than 3 times a day	11.6	39.0	32.8	13.8	23.7	22.8
Duration of Internet use (hours/day), mean (*SD*)						
School days	1.40 (2.93)	2.74 (2.95)	1.42 (1.37)	1.48 (1.70)	2.65 (4.32)	2.81 (2.23)
Holidays	3.42 (4.00)	4.82 (4.04)	2.25 (2.33)	2.43 (2.37)	4.31 (5.10)	4.57 (3.95)
IAT, mean (*SD*)						
Withdraw and social problems	13.31 (6.23)	15.19 (6.37)	15.33 (5.98)	12.55 (4.87)	15.63 (6.38)	17.84 (6.54)
Time management	9.91 (5.03)	12.50 (5.14)	14.11 (5.51)	9.98 (3.95)	12.21 (5.24)	12.99 (4.90)
Reality substitute	5.23 (2.60)	6.27 (2.84)	5.81 (2.66)	4.08 (1.80)	5.93 (2.84)	6.43 (2.86)
Total	31.02 (14.08)	37.45 (14.17)	39.99 (14.25)	29.57 (10.65)	37.14 (14.59)	41.66 (14.15)
IAT-defined addictive Internet user, % (95% CI)	2.2 (1.2–3.2)	3.0 (1.8–4.1)	3.1 (1.8–4.3)	1.2 (0.5–1.9)	2.4 (1.4–3.4)	4.9 (3.6–6.2)
IAT-defined problematic Internet user, % (95% CI)	17.1 (14.6–19.7)	31.6 (28.4–34.7)	44.4 (40.8–47.9)	12.5 (10.4–14.6)	35.1 (32.1–38.1)	46.0 (42.9–49.1)
IAT-defined average Internet user % (95% CI)	80.7 (78.0–83.3)	65.4 (62.2–68.7)	52.5 (49.0–56.2)	86.3 (84.0–88.5)	62.5 (59.4–65.6)	49.1 (45.9–52.2)
CIAS-R, mean (*SD*)						
Sym, compulsive use	11.29 (4.66)	11.74 (4.60)	9.76 (3.57)	10.22 (4.90)	11.78 (4.08)	13.06 (4.28)
Sym, withdrawal	8.13 (3.67)	9.08 (3.75)	7.52 (3.08)	7.56 (3.52)	8.33 (3.28)	9.32 (3.50)
Sym, tolerance	7.41 (3.34)	8.58 (3.61)	7.37 (2.84)	7.39 (3.64)	8.82 (3.44)	9.32 (3.29)
RP, interpersonal and health-related problems	6.41 (2.93)	7.48 (3.03)	7.28 (3.02)	6.54 (2.93)	7.01 (2.87)	7.95 (2.88)
RP, time management problems	7.95 (3.59)	9.06 (3.72)	7.70 (3.20)	7.94 (3.14)	9.49 (3.85)	10.21 (3.56)
Total	41.03 (16.28)	45.94 (16.92)	39.63 (14.03)	39.52 (17.52)	45.31 (15.10)	49.74 (15.49)
CIAS-R-defined addictive Internet user, % (95% CI)	9.6 (7.6–11.6)	16.4 (13.9–19.0)	6.2 (4.4–7.9)	9.7 (7.1–12.3)	14.1 (11.9–16.3)	21.1 (18.6–23.7)

CI, confidence interval; Sym, symptoms; RP, related problems.

The prevalence of problematic or addictive Internet use, as defined by the IAT, was highest in the Philippines (51%) and Japan (48%). In China, we found a prevalence of 17% problematic and 2% addictive Internet use; this contrasts with the 8% reported in another study that used the IAT in eight Chinese cities in 2008[38] and 6% in a more recent study in Wuhan, China, in 2010.[39] Moreover, we found that about 32% and 3% of Hong Kong students have IAT-defined problematic or addictive Internet use respectively. Furthermore, 16% were defined as Internet addicts by the CIAS-R, which was comparable to another study in Hong Kong (17%).[40] A previous study in Hong Kong also reported that 72%, 22%, and 7% of adolescents exhibited 0–2, 3–4, and ≥ 5 symptoms of Internet addiction.[41] In South Korea, we found that 14% scored at least 70 in the IAT, which is similar to a previous study in 2005 that found 11% had such scores.[42] A 2006 study conducted in one school in Gwangju reported the proportions of IAT-determined severe addicts and moderate addicts as 3% and 54% in boys and 2% and 39% in girls respectively.[43] Another recent survey using the South Korean Internet Addiction Self-Assessment Tool reported a potential Internet addiction rate of 15% and an Internet addiction rate of 3% in 2010.[44] The relatively low prevalence in South Korea observed in this study may be explained by the shutdown law that went into effect in 2011. According to this law, all children under the age of 16 years are forbidden to access online games between midnight and 6 am.

There have been no recent studies of Japanese, Malaysian, or Filipino adolescents using the IAT or CIAS-R. The prevalence of IAT-defined Internet addiction in Asian countries found in this study was relatively higher than the prevalence reported in Europe. The IAT-defined Internet addiction among adolescents was 1% in Italy[45] and 4% in Turkey.[46] Studies using Young's Diagnostic Questionnaire found the prevalence of Internet addiction in adolescents to be 3% in Greece,[47] 2% in Norway,[48] and 2% in boys and 1% in girls in Finland.[49]

This study has several limitations. Until now, the IAT scale has been validated only in Hong Kong Chinese adolescents,[15] and in South Korean[50] and Malaysian college students.[17] A version of the IAT that focuses on the Internet addictive behaviors of adolescents may be required for more accurate results. The CIAS-R was found to contain more information than the IAT in Chinese students using the item response analysis.[51] Similar analyses are necessary in other Asian populations. The CIAS-R may overestimate the prevalence of Internet addiction in adolescents. The prevalence of CIAS-R-defined Internet addicts within each country was consistently within the interval between the prevalence of IAT-defined problematic and addictive Internet users. This may suggest that CIAS-R-defined Internet addiction should be restated as problematic Internet use. Clinically, the cutoff of 70 for IAT was less stringent for diagnosis, as revealed by a youth study conducted in South Korea,[52] whereas the cutoff of 75th percentile for CIAS (not CIAS-R) was used in another adolescent study in Taiwan.[53]

The instability of Internet and game addiction behavior in adolescents also contributes to the difficulty of assessment.[54] Nevertheless, the use of a universal scale makes these comparisons across countries valid and useful for future reference. Most current literature focused on generalized Internet addiction problems, but there is relatively scant research attention to the study of smartphone and video game addiction.[55] The present results should be interpreted with caution, as nowadays people can go online using mobile communication devices such as smartphones, in addition to the traditional fixed-line communication devices. Therefore, the Internet overuse reported may just be common among smartphone users nowadays. With the development of scales for measuring specific smartphone and online videogame addiction problems among young people,[56–58] future studies may also explore these domains across populations. On the other hand, adolescents from rural areas of the countries should be included to increase the representativeness of the results, especially in China where socioeconomic differences between urban and rural areas could have a large effect on the presence of Internet addictive behavior among adolescents.[59]

Furthermore, an electroencephalogram study found higher impulsiveness in young adults who are Internet addicts.[60] It would not be surprising if Internet-addicted adolescents were found to have a different personality profile than others, with lower extraversion and higher neuroticism and psychoticism.[61] Behavioral and emotional problems are more common in adolescents who are addicted to Internet use than in their peers.[62] Adolescents with Internet use problems are also more prone to other addictive behaviors such as substance abuse[63] and gambling.[64] Appropriate use of the Internet may help to alleviate the situation; for instance, both online and offline social support are important to rectify cyber-misbehaviors.[65] Cognitive–behavioral approaches may be suitable treatments for adolescent Internet addicts.[66] According to recent research, cognitive–behavioral approaches work with adult populations, and further studies may test these approaches for adolescents.[67,68] A prospective study in Taiwan suggested that psychiatric symptoms could actually lead to Internet addiction.[69] Therefore, given the high prevalence of Internet addiction among Asian youth found in this study, these six countries should examine the use of cognitive–behavioral therapies that provide social support and prevent youth from becoming addicted to the Internet. Holistic prevention programs should be used, as psychiatric illness could also accompany Internet addiction among youth. A recent study of Australian adolescents also suggested that adolescents with pathological Internet use had a relatively higher risk of axis I comorbidity than those with pathological video gaming behavior.[70] Therefore, it is reasonable to believe that early prevention and detection of Internet addiction among Asian children and adolescents should be given priority in terms of health education resources.

It is necessary to study the incidence as well of the remission of Internet addiction in adolescents.[71] Childhood behavioral problems are mostly associated with Internet addiction in adolescents.[72] Early intervention is needed to prevent the development of Internet addiction in adolescence. Parents could play an important role in the prevention of Internet addiction among adolescents. Lack of parental monitoring is a major factor in addictive Internet behavior.[73] Therefore, educating parents about healthy Internet use is also urged. In addition to childhood problems, parents' risky behaviors, such as alcohol abuse, could lead to Internet addiction in adolescence.[74] Perhaps governments in Asia should pay more attention to Internet addiction, just as they do to other addictive behaviors such as substance use.[63]

Moreover, other Internet addiction-related behaviors including online gambling,[75] bullying, and stealing are worth exploring in future studies. The cultural influences on perceived control[76] may be another angle from which to investigate the various comorbidities of Internet addiction across countries. More studies are warranted to formulate culture-specific health education approaches to combat this new wave of addiction.

Conclusions

This population-based study reported the prevalence of Internet addictive behavior in six Asian countries. The two most common assessment tools for Internet addiction were administered to adolescent samples in these populations. The study found that problematic Internet use is prevalent in all six countries, and is characterized by risky cyberbehaviors.

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