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The Relationship Between Internet Addiction and Problem Behaviors Amongst Hong Kong Adolescents: A Three-Year Longitudinal Study

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Abstract

Both Internet addiction and adolescent risk behaviors are worldwide public health concerns. Unfortunately, their relationship is grossly under-researched. Adopting a longitudinal research design, this study examined the longitudinal association between Internet addiction and problem behaviors among adolescents in Hong Kong and tested whether early Internet addiction predicted later adolescent problem behaviors. A total of 2,669 junior secondary school students completed three waves of questionnaires testing their Internet addiction behavior and other problem behaviors including drug use, self-harm, suicidal behaviors, delinquency behaviors, and compensated dating. Chi-square analysis showed that Internet addicted students had a high probability to display these problem behaviors at each wave. Logistic regression analyses suggest that early Internet addiction was a precursor of later problem behaviors among adolescents. The results shed light on the relationship between Internet addiction and adolescent problem behaviors, and provide reference for prevention and intervention of these problem behaviors.

Keywords: Internet addiction, adolescent risk behaviors, comorbidity, Chinese adolescents

The Relationship Between Internet Addiction and Problem Behaviors Amongst Hong Kong

Adolescents: A Three-Year Longitudinal Study

The Internet is a great technological innovation in human history, which brings about fast communication across time and space, and greatly reshapes peoples' lives. However, the maladaptive use of the Internet has become a global concern. Generally speaking, Internet addiction refers to the problematic and excessive use of the Internet which leads to various psychosocial and professional problems (Sahin, 2011). Internet addiction is a growing concern among adolescents, with prevalence rates of around 13.9% in European countries (Tsitsika et al., 2014), 8.1% in Japan (Morioka et al., 2017), 11.9% in mainland China (Li, Zhang, Lu, Zhang, & Wang, 2014), and 15.3% in Taiwan (Lin, Ko, & Wu, 2011).

The prevalence rates of Internet addiction are particularly high in Hong Kong. Two large-scale studies showed that around 17% to 26.8% Hong Kong secondary school students exhibited Internet addiction in recent years (Shek & Yu, 2016; Wu et al., 2016). These statistics give an alarm to public policymakers, youth workers and educators. Internet addiction was found to be associated with a wide range of mental health problems such as depression, anxiety, stress, and loneliness (Ostovar et al., 2016; Vasileios et al., 2017). Internet addiction was also related to problematic interpersonal relationships, decreased academic performance, and poor lifestyle patterns (Chen & Peng, 2008; Kim et al., 2010). Unfortunately, despite its high prevalence and possible detrimental consequences, research on Internet addiction was far from enough. Particularly, there is lack of understanding of the relationship between Internet addiction and other adolescent risk behaviors such as drug use, self-harm, suicidal behavior, and delinquency behavior. Hence, further research is strongly needed in this area to advance public understanding and to contribute to better prevention and intervention of these problem behaviors.

Problem behavior refers to behavior that is problematic, inappropriate, or undesirable defined by the social norm or adult authority (Jessor & Jessor, 2017). Problem behaviors have a broad spectrum including but not limited to delinquency behaviors, drug use, sexual behaviors, suicidal behaviors, and deliberate self-harm (Choi, 2007; Wakschlag et al., 2003). These behaviors interfere with a person's normal functioning and could lead to severe damage or harm (Minshawi et al., 2014). For example, deliberate self-harm and suicidal behaviors are two main factors leading to death and injury in the global context (Nock et al., 2008). Drug use could cause brain damage such as deficits in memory, attention, and executive functioning (Lundqvist, 2010).

In Hong Kong, drug use, deliberate self-harm, suicidal behaviors, and delinquency behaviors were reported to have high prevalence among adolescents. For example, one report revealed that around 2.0% and 56.2% Hong Kong adolescents displayed lifetime drug-taking and alcohol-taking behaviors (Narcotics Division, Security Bureau of Hong Kong SAR Government, 2016). Another study on a sample of 3,328 Hong Kong secondary school students showed that 32.7% of the students reported at least one form of deliberate self-harm and 13.7% reported having suicidal thought in previous years (Shek & Yu, 2012b).

Meanwhile, some other youth problem behaviors such as compensated dating also gained increased public attention in Hong Kong in recent years. Compensated dating (CD) refers to a person's (normally a girl) selling of sex service for purpose of receiving financial or other compensations such as moneys or gifts (Lee & Shek, 2013). CD was associated with sexual health problems such as sexually transmitted disease and mental health problems such as suicidal ideation (Li et al., 2015). A recent study suggested the prevalence rate of compensated dating was around 3% in Hong Kong (Li et al., 2015). Despite the high prevalence and adverse consequences of these problem behaviors mentioned above, research on risk factors and

precursors of these problem behaviors was inadequate. Particularly, there were few studies on the relationship between Internet addiction and adolescent problem behaviors.

Several theoretical models propose a relationship between Internet addiction and other adolescent problem behaviors. One is problem behavior theory which maintains that different problem behaviors share the same psychosocial proneness, including personality proneness and environment proneness (Jessor, 1987; Jessor & Jessor, 2017), and they normally coexist in an individual's life style and lead to negative outcomes (Ko et al., 2008). As a problem behavior, Internet addiction might also share the same psychosocial proneness with other problem behaviors and coexist with other problem behaviors.

The cognitive-behavioral model of Internet addiction proposes that Internet addiction includes both problematic Internet-use behaviors and a set of cognitive processes including relying on Internet to achieve self-regulation (e.g., reducing anxiety or loneliness), which leads to poor self-regulation and increased risk for other problem behaviors (Gamez-Guadix, Calvete, Orue, & Hayas, 2015). Scholars also argued that the Internet provides a channel for adolescents to access a large amount of harmful websites and information such as pro-suicide website, online suicide pacts, and cyber bully (Daine et al., 2013; Durkee, Hadlaczky, Westerlund, & Carli, 2011). These contacts would also increase the risk for problem behaviors.

Empirical research suggests that Internet addiction is associated with a variety of adolescent problem behaviors including suicidal behaviors (Messias, Castro, Saini, Usman, & Peeples, 2011; Pan & Yeh, 2018), alcohol and drug use (Ko et al., 2008; Morioka et al., 2017), self-harm (Lam, Peng, Mai, & Jing, 2009; Liu et al., 2017), and delinquency behaviors (Evren, Dalbudak, Evren, & Demirci, 2014). Some studies also showed that Internet addiction was related to youth compensated dating (e.g., Li et al., 2015). However, there are several

weaknesses of the existing studies on the relationship between Internet addiction and other adolescent problem behaviors. First, most of the existing studies are based on cross-sectional designs and there are few longitudinal studies in the field. Second, most of the studies focus on measuring the association between Internet addiction and other adolescent risk behaviors without examining whether Internet addiction would promote the development of other problem behaviors. Third, most of the existing studies were conducted in Western contexts. Comparatively, related Chinese studies are almost non-existent. In short, longitudinal data on the relationship between Internet addition and other problem behaviors among Hong Kong adolescents are urgently needed.

Against the above background, the present study attempted to investigate the longitudinal association between Internet addiction and other problem behaviors among adolescents in Hong Kong using three waves of longitudinal data. For the other problem behaviors, they included drug use, suicidal behaviors, deliberate self-harm, delinquency behaviors, and compensated dating. These risk behaviors were focused upon because they were common concerns in adolescent development. Specifically, two research questions were examined:

1. Is there an association between Internet addiction and other adolescent risk behaviors? Based on the existing theories and research findings, it is expected that there would be an association between Internet addition and each of the problem behaviors in each year (i.e., first set of hypotheses).

2. Does early Internet addiction predict problem behaviors in the later years? Based on the scientific literature, it is predicted that early Internet addiction would predict problem behaviors at the subsequent years (i.e., second set of hypotheses).

Method

Participants and Procedures

The data reported in this paper were extracted from a large-scale longitudinal project tracking the development of adolescents in Hong Kong. Three waves of data were collected from students in 28 junior secondary schools from 2009/2010 to 2011/2012 school years (i.e., from the first year to the third year of junior secondary school). A total of 2,669 students participated in all three waves of the study. Based on the attrition analysis performed by Yu and Shek (2013), there was no significant difference in age, economic status and migration status between the students joining all three waves of data collection and those who did not. However, more male students dropped out than did female students over time.

The gender ratio was quite balanced in this study, with 50.4% of the students being male. The mean student age was 15.49 years ($SD = 0.66$, range = 13–19). Adolescents were mostly from non-poor families (with 11.6% Comprehensive Social Security Assistance recipients), and most of them were born in Hong Kong (with 21.3% migrant children). Regarding parental education, while parents with the level of Bachelor Degree or above constituted approximately half of the sample (51.4%), the other half of the sample had their education at the level of Associate Degree or below (48.6%). The vast majority of parents lived together (84.7%).

Measures

Internet addiction. Internet addiction was measured using the Internet Addiction Test (IAT) in three waves. The scale is comprised of ten items which has been validated by our research team in another study (Shek, Tang & Lo, 2008). The students were asked to indicate whether they had displayed the listed Internet addictive behaviors. A sample item is "feeling

restless or irritable when attempting to cut down or stop on-line use". A student was classified as "Internet addicted" if he/she reported four or more Internet addictive behaviors.

Drug use. A scale consisted of eight items was used to measure drug use in three waves (Shek & Yu, 2012a). It asked participants whether they had consumed eight types of drugs, including alcohol, tobacco, ketamine, cannabis, cough mixture, organic solvent, ecstasy, and heroin. If a student had consumed one of them or more in the past six months, he/she was classified as "having drug use".

Delinquency behaviors. The students were invited to report whether they had performed twelve delinquency behaviors in the past year (Shek, 2005), such as running away from home. A participant was classified as "having delinquency behaviors" if he/she had performed one behavior or more.

Deliberate self-harm. The participants were invited to indicate whether they had displayed any of seventeen self-harm behaviors in the past 12 months (Shek & Yu, 2012b). One example is "using bleach or other chemical materials to scrub skin". A student was classified as "showing deliberate self-harm behavior" if he/she had performed one or more of the behaviors.

Suicidal behaviors. It was measured by asking students to report whether they had suicidal thought, suicidal plan, and suicidal attempt in the past 12 months (Shek & Yu, 2012b). If a student reported that he/she had one or more of them, he/she was classified as "showing suicidal behaviors".

Compensated dating. Students were invited to report whether they had shown compensated dating behavior in the three waves. The example item is "Have you ever accompanied a stranger of either the same or the opposite sex in social activities (e.g., meal, movie, etc.) for the sake of gaining money or material return (e.g., receiving a cell phone as a

gift)?". If a student had performed one or more of three behaviors, he/she was classified as "showing compensated dating behavior".

Covariates. Age, gender, poverty status, parental highest education, whether parents lived together, and migration status were controlled as covariates.

Data Analysis

First, we performed analyses to examine co-existence of Internet addiction and specific problem behavior at each wave using SPSS 25 (IBM, New York). Considering the data of some problem behaviors were very skewed (e.g. compensated dating), we used Internet Addicted versus Non-Addicted status as the predictor variable and examined the percentages of participants with and without different specific problem behavior. The Chi-square Test was performed to compare the percentages. Second, we performed logistic regression analysis to assess if Internet addiction at Wave 1 predicted the likelihood of performing specific problem behavior in Wave 2 and Wave 3, controlling for the covariates.

Results

Several Chi-square tests of independence were conducted to compare the frequency of problem behavior in addicted versus non-addicted students (Table 1). Generally speaking, there was a significant relationship between Internet addiction and adolescent problem behavior. At each wave, Internet addicted students were more likely to show problem behavior in drug use, delinquency, deliberate self-harm, suicidal behaviors, and compensated dating. Results demonstrated comorbidity of Internet addiction with problem behaviors in students in the junior secondary school years.

We also performed logistic regression analyses to investigate whether Internet addiction at the first year predicted problem behaviors in the subsequent years, controlling for the

background covariates. Table 2 and 3 show the estimated odds ratios. Results showed that when students were addicted to Internet at Wave 1, their odds of conducting deliberate self-harm at Wave 2 were 1.431 times larger (95% CI [0.891, 0.183], $p < 0.05$). Similarly, when students were addicted to Internet at the first year of junior school, their odds of consuming drugs and performing delinquency behaviors in the third year were 1.451 times (95% CI [1.127, 1.868], $p < 0.05$) and 1.474 times larger (95% CI [1.049, 2.072], $p < 0.01$), respectively. Besides, if students pathologically used the Internet at Wave 1, their odds of performing at least one problem behavior at Wave 2 and Wave 3 were 1.982 times (95% CI [1.195, 3.287], $p < 0.01$), and 2.189 times larger (95% CI [1.380, 3.417], $p < 0.01$), after controlling all covariates. In sum, the present results strongly suggest that Internet addiction at the first year of secondary school is a good predictor of problem behaviors in the subsequent junior high school years.

Discussion

The present study examined the relationship between Internet addiction and adolescent problem behaviors in Hong Kong based on three waves of longitudinal research data. The study is important for two reasons. First, the prevalence rates of Internet addiction and other problem behaviors among adolescents in Hong Kong are high and the detrimental impact of Internet addiction on adolescent development is strong. Second, there are few empirical studies examining the linkage between Internet addiction and other problem behavior. Amongst the studies of the impacts of Internet addiction on adolescent development, most studies focused on academic performance and well-being such as depression, anxiety, loneliness, and life-satisfaction (e.g., Akhter, 2013; Bozoglan, Demirer, & Sahin, 2013; Ostovar et al., 2016).

The results support the first set of hypotheses, showing that Internet addicted students had a higher likelihood to display problem behaviors including drug use, delinquency behavior,

deliberate self-harm, suicidal behavior, and compensated dating at each wave. This result is in line with the extant literature. For example, existing studies consistently showed that Internet addicted adolescents had a higher probability to exhibit drug use behavior (Fisoun, Floros, Siomos, Geroukalis, & Navridis, 2012; Ko et al., 2008). Research findings also found that Internet addiction was associated with suicidal behaviors, self-harm, and delinquency behaviors across different cultures (Holtz & Appel, 2011; Lin et al., 2014; Kaess et al., 2014).

Methodologically speaking, although these existing studies suggest the coexistence of Internet addiction and other problem behaviors, they were mainly based on cross-sectional data collected from one-time point. Results of the present study further verified these cross-sectional findings by showing a longitudinal association between Internet addiction and adolescent problem behaviors at different time points in the adolescent years. The present findings also support the problem behavior theory that different problem behaviors coexist because they share the same psychosocial proneness shaped by the individual's interaction with his/her environment (Jessor, 1987; Ko et al., 2008).

Besides the correlational findings, the present findings also support the second set of hypotheses that Internet addiction at the first wave predicted problem behaviors in later waves. This finding is very important because existing literature mainly focused on the concurrent relationship between Internet addiction and problem behaviors without looking at the longitudinal relationship across time. Besides, few studies have examined the possibility of causal relationship between Internet addiction and other problem behaviors among adolescents. Based on the cognitive-behavioral model of Internet addiction (Gamez-Guadix et al., 2015) and the argument that Internet addiction provides channels for youth to access unhealthy information which may impair their development (Durkee et al., 2011), it is important to test the precursor

role of Internet addiction in the development of other problem behaviors. Based on the present longitudinal findings, it is conjectured that Internet addiction might be a precursor and cause for other serious problem behaviors among adolescents. This research finding provides important information for prevention of problem behaviors among adolescents.

Despite its pioneer nature, the present study has several limitations. First, this study only examined the relationship between Internet addiction and other problem behaviors. To better understand the mechanisms underlying the relationship, other factors such as personality factors should be examined to test whether the association between Internet addiction and problem behaviors is contributed by the same psychosocial proneness as proposed by the problem behavior theory. Second, the study mainly focused on whether Internet addiction could be a possible cause of problem behaviors. It is also interesting to explore whether the possible dynamic reciprocal relationships exist between Internet addiction and other problem behaviors. This would deepen our understanding of the relationship between Internet addiction and youth problem behaviors. Despite the limitations, this pioneer study contributes to our understanding of the relationship between Internet addiction and problem behaviors among adolescents through a longitudinal study in a Chinese context.

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Table 1

Descriptive Statistics in IA and PBs and Chi-square Test Results (N = 2,669)

	Wave 1			Wave 2			Wave 3		
	Non-IA	IA	X^2	Non-IA	IA	X^2	Non-IA	IA	X^2
DRUG	25.5%	40.1%	49.6**	32.2%	44.7%	33.3**	34.9%	44.1%	15.7**
DE	78.1%	92.8%	69.1**	78.7%	91.0%	50.0**	76.4%	90.2%	50.0**
DSH	17.6%	39.9%	121.0**	17.9%	37.7%	105.0**	18.1%	33.0%	56.3**
SB	10.1%	24.3%	78.7**	9.5%	25.2%	72.5**	9.1%	20.2%	38.8**
CD	NA	NA	NA	1.0%	3.5%	20.7**	1.4%	3.9%	18.6**
PB	83.3%	100%	122.3**	87.4%	100.0%	89.7**	85.3%	100.0%	93.8**

Note. IA = Internet addiction, Non-IA = No Internet addiction, DRUG = Drug use, DE = Delinquency behaviours, DSH = Deliberate

self-harm, SB = Suicidal behaviours, CD = Compensated dating. PB = Have Problem behaviour, NA = Not available. IA, DRUG,

DSH, SB, CD and PB are binary grouping variables. Percentage reported are by column and are within the IA in different waves. ** p

< 0.01 (two tailed), * $p < 0.05$ (two tailed).

Table 2

Results of Binary Logistic Regressions I (N = 2,669)

	Wave 2					Wave 3				
	DRUG	DE	DSH	SB	CD	DRUG	DE	DSH	SB	CD
Covariates										
Age	1.248*	1.166	1.250*	1.083	1.009	1.113	0.983	1.011	1.028	1.501
Male	0.946	0.965	0.580**	0.411**	1.748	0.964	0.953	0.698**	0.512**	3.617**
PV	0.798	0.867	1.323	1.124	2.595	0.877	0.835	0.974	1.020	1.058
PHE	0.987	0.952	1.015	1.015	1.023	1.010	0.983	0.988	1.004	1.087
PLT	0.890	0.970	0.788	1.081	0.434	0.790	0.768	0.854	0.887	1.046
MC	0.756	0.759	0.791	1.243	1.101	0.753	0.931	0.624**	0.913	1.047
Wave1										
IA	1.237	1.050	1.431*	1.364	1.556	1.451**	1.474*	1.286	1.289	1.746
DRUG	7.334**	1.565*	1.461**	1.125	2.178	6.124**	1.928**	1.622**	1.092	1.636
DE	2.061**	6.382**	1.945**	2.482*	2.454	1.542**	4.249**	1.495	1.389	0.308*
DSH	1.515**	1.758**	5.999**	1.351	2.011	1.172	1.490*	3.840**	1.356**	1.446
SB	1.338	2.713**	1.853**	7.934**	1.063	1.261	1.899*	1.974**	5.951	2.833*

Note. PV = Poverty, PHE = Parental highest education, PLT = Parents living together, MC = Migrant children, IA = Internet

addiction, DRUG = Drug use, DE = Delinquency behaviours, DSH = Deliberate self-harm, SB = Suicidal behaviours, CD =

Compensated dating. Male, PV, PLT, MC, IA, DRUG, DSH, SB, and CD are binary grouping variables. Odds Ratios were reported.

** $p < 0.01$ (two tailed), * $p < 0.05$ (two tailed).

Table 3

Results of Binary Logistic Regressions II (N = 2,669)

	PB	
	Wave 2	Wave 3
Covariates		
Age	1.232	1.080
Male	1.030	0.890
PV	0.748	0.914
PHE	0.946	1.004
PLT	0.772	0.922
MC	0.672	0.630*
Wave 1		
IA	1.982**	2.189**
PB	5.933**	5.348**

Note. PV = Poverty, PHE = Parental highest education, PLT = Parents living together, MC = Migrant children, IA = Internet

addiction, PB = Have at least one problem behaviour. Male, PV, PLT, MC, IA and PB are binary grouping variables. Odds ratios were

reported. ** $p < 0.01$ (two tailed), * $p < 0.05$ (two tailed).