

# Comparing Smartphone Addiction: The Prevalence, Predictors, and Negative Consequences in Hong Kong and Mainland China

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This study aimed to identify common and specific factors related to smartphone addiction by systematically comparing the prevalence, predictors, and improper behavioral outcomes of smartphone addiction among university students in two cities. Data were randomly gathered from 661 university students, of which 351 were in Hong Kong and 310 were in Guangzhou (a mainland China city). The findings showed that there was no significant difference in the prevalence of smartphone addiction between the two samples. In addition, the comparison of predictors of smartphone addiction showed similar significant psychological traits (procrastination and urgency) in both regions. The findings also revealed that smartphone addiction

was associated with distinct habits of media use. Entertainment and information seeking behaviors were the unique significant predictors among the Hong Kong students, whereas social interaction was an extremely robust factor among the Guangzhou students. At last, in comparing the predictors of improper use of smartphone, addiction symptoms (craving and complaints) and utility assisting use of smartphone were significant factors for students in both regions.

*Keywords: smartphone addiction, procrastination, preference for solitude, impulsivity, smartphone use activity*

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**T**he popularity and ubiquity of smartphones have given rise to an increasing number of studies on the excessive use of this new technology. A body of literature has focused on teenagers and young adults because of their passion of adopting this mobile technology but immature self-control in resisting its harmful effects. Previous studies in the field of youth and new media technology have shown evidence about addictive symptoms, and identified related predictors and outcomes. However, in existing literature, the significant relationships between certain variables and media addiction found in one study might not align with the findings in other studies. In particular, in locating the significant predictors of addiction symptoms, some

independent variables (e.g., psychological traits and media use activities) were inconsistent in the existing research. For example, Lavoie and Pychyl (2001) found that Internet procrastination was positively associated with perceptions of the Internet as providing entertainment and stress relief. However, in Neo and Skoric's (2009) study, the trait of procrastination failed to predict compulsive instant message use and related negative outcomes. The contradictory findings have raised an inevitable question for media addiction scholars: Is it possible that certain factors are common predictors of addictive behavior among general individuals, whereas others are specific predictors for regional samples? Because previous empirical studies mainly relied on single-sample surveys, the answers to this question have been limited.

The present study adopts a comparative strategy in examining the prevalence, predictors, and negative consequences of smartphone addiction. In order to achieve this goal, university students were selected from two cities: Hong Kong and Guangzhou in China. There are several important reasons for comparing smartphone addiction in these two regions. First, the high penetration rates of smartphone in the two cities call for timely research on related addictive behaviors. For example, a tracked survey showed that, in 2014, the smartphone adoption rate in Hong Kong was 78.1% (Centre for Communication and Public Opinion Survey, 2016). Similarly, in Guangzhou, the number of smartphone users increased to more than four million in 2012, which meant a penetration rate of above 70% (Jin, 2012). Second, in Asia, media addiction has attracted an increasing amount of research, which has included the advances in both conceptualization and methodology (e.g., Bian & Leung, 2015; Hong, Chiu, & Huang, 2012; Koo, 2009; Leung, 2008). Third, although both cities belong to the greater China region, they are distinct societies in many aspects. For example, in terms of economy, Hong Kong is a well-developed capitalist region, whereas Guangzhou is a rising star in socialist China. Regarding education, Hong Kong has adapted many Western practices, while Guangzhou has focused mainly on the traditional characteristic of Chinese education. Regarding student demographics, the majority of students in Hong Kong universities are local, whereas the students in Guangzhou universities are recruited from all over mainland China. Growing up in distinct social environments, the young people in these two cities have cultivated distinct personalities and media use patterns. These

distinctions offer an opportunity to investigate the potentially different social-psychological states of young smartphone users in two distinct social environments. By using a questionnaire survey among the university students in two regions, this study includes a series of psychological predictors (e.g., procrastination, preference for solitude, and impulsivity) and media use factors (e.g., utility assisting, entertainment, information seeking, and social interaction). The purpose of the survey is to gather data that can clarify the potential differences in the symptoms of addictive smartphone use and related predictors and consequences.

## **LITERATURE REVIEW**

### **Smartphone addiction: definition and symptoms**

Conceptually, smartphone addiction, which is also known as smartphone dependence or problematic smartphone use, belongs to the family of media addiction. Similar to research on television, gaming, and Internet addictions, smartphone addiction studies have the theoretical origin in the classic literature on substance abuse and pathological gambling, which are characterized by the maladaptive patterns in compulsive disorders. This tradition of media addiction has drawn on the clinical criteria of substance dependency and pathological gambling recorded in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994). Meanwhile, scholars have also underlined the unique features of media addiction. For example, Griffiths (1996) coined the term “technology addiction” to emphasize that this type of addictive behavior is symbolized by the non-chemical interaction of humans and machines. Based on the above points of view, smartphone addiction can be perceived as a type of “impulse control disorder that does not involve an intoxicant” (Park & Lee, 2011).

Operationally, the studies on media addiction emphasize the identification of diagnostic symptoms. One frequently cited example is Griffiths’ (1996, 2005) six-component model of technology addiction, which contains the dimensions of salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse. A group of representative studies has emerged, in order to reveal the addictive symptoms on different media technologies. For example, Bianchi and Phillips (2005) developed five major issues in problematic mobile phone use: tolerance, escape, withdrawal, craving, and negative

consequences, such as social, familial, work, and financial difficulties. Koo (2009) identified three dimensions in studying cell phone addiction in young Korean people: withdrawal/tolerance, life dysfunction, and compulsion/persistence. Although the concrete expressions of the addictive dimensions might differ according to the specific media technological environment, this approach has shed light on how to locate the basic elements of a particular type of media addiction, especially those of a new one, such as smartphone addiction. In fact, based on this tradition, recent studies on smartphone addiction have revealed several important symptoms. For instance, Kwon, Kim, Cho, and Yang (2013) constructed the smartphone addiction scale, by including the internal factors of daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse, and tolerance. Bian and Leung (2015) also located key symptoms of smartphone addiction, including disregard of harmful consequences, preoccupation, inability to control craving, productivity loss, feeling anxious and lost.

These studies imply that the multi-component model of media addiction can be applied to smartphone addiction research. However, because previous studies mainly targeted a single sample of respondents, the related evidence cannot answer the question of whether certain differences exist in the symptoms of smartphone addiction among diverse groups of people. Therefore, the first objective of this study is to investigate the dimension model of smartphone addiction among the university students in Hong Kong and Guangzhou.

**RQ1: What symptoms of smartphone addiction can be identified among the university students in Hong Kong and Guangzhou, and what are the differences in the symptoms between these two samples?**

Furthermore, by utilizing the diagnostic criteria identified in the answer to the first research question, this study tries to locate the smartphone addicts and examine the potential difference in the prevalence of addiction between the two regions.

**RQ2: To what extent are the university students in Hong Kong and Guangzhou addicted to smartphone use, and is there a significant difference in the prevalence of smartphone addiction between the two regions?**

### **Critical predictors of smartphone addiction**

**Procrastination.** Procrastination refers to the intention to postpone necessary tasks. People adopt the strategy of procrastination probably because of the distraction from alternative activities or the overwhelming pressure of current duties. Silver and Sabini (1981) pointed out that procrastination reflects the state of being ready for one task while seeking diversions.

Procrastination is often regarded as an important predictor of media addiction. Procrastinating individuals seek escape from social pressure by joining in the activities in media spaces. For example, Lavoie and Pychyl (2001) found that about half of their respondents experienced frequent Internet procrastination, which was closely associated with entertainment and stress relief. Similarly, Nalwa and Anand (2003) showed that dependency on the Internet commonly led to delayed work in favor of spending time online, which indicated poor time management and lack of self-control. Philips and Reddie (2007) studied inefficient or inappropriate use of e-mail in workplace and identified procrastination as a significant predictor. Thatcher, Wretschko, and Fisher (2008) found that procrastination was an effective predictor of problematic Internet use among the information technology workers in South Africa. Nevertheless, some studies showed that procrastination failed to predict addiction (e.g., Neo & Skoric, 2009). The inconsistent findings call for updated studies on the effect of this psychological trait.

**Preference for solitude.** Traditionally, loneliness is thought to be a psychological drawback. Related studies have suggested that people might be addicted to the virtual connections provided by media technology, due to their loneliness caused by poor social skills in real-life interactions. For example, loneliness was positively connected to mobile phone addiction among Korean students (Park, 2005). However, recent studies have shown that individuals can actively seek solitude, rather than being passively isolated by others. Solitude implies the absence of social interaction (Burger, 1995). In some research, this psychological status is termed “aleness” (Buchholz & Catton, 1999). Similar to social attachment, solitude (or aleness) is indispensable in personal development because it provides private moments that are necessary for self-reflection. For university students, desiring solitude is part of their personality and socialization development.

Mobile devices, especially smartphones, are ideal partners in solitary situations. Acting as digital assistants, smartphone greatly facilitate users to arrange personal matters. For example, Leung (2015) found that people with a high preference for aloneness tended to use their tablets for utility, information, social, and fun-seeking activities more than others did. These respondents perceived that they used their tablets in solitude as a way of reducing stress. In the existing literature, however, there is still limited evidence on the specific relationship between preference for solitude and media addiction. Therefore, the present study includes this psychological factor in studying smartphone addictions among young people.

**Impulsivity.** Impulsivity is a type of maladaptive personality trait that is related to various forms of psycho-pathological symptoms. Previous studies have revealed that this construct contains multiple dimensions. Whiteside and Lynam (2001) proposed that four distinct facets of personality were associated with impulsive behavior: urgency, (lack of) premeditation, (lack of) perseverance, and sensation seeking. Urgency is the tendency to experience strong impulses and the state of being frequently under conditions of negative affect. (Lack of) premeditation refers to the tendency of (lack of) thinking about the consequences of an act before engaging in that act. (Lack of) perseverance indicates an individual's (lack of) ability to remain focused on a task that may be boring or difficult. Sensation seeking refers to the tendency to enjoy and pursue activities that are exciting and the openness to trying new experiences that may or may not be dangerous.

Past studies have also reported that impulsivity was a diagnostic signal for addictive behaviors. For example, Mottram and Fleming (2009) demonstrated that (lack of) perseverance significantly predicted problematic Internet use. Burnay, Billieux, Blairy, and Laroï (2015) also revealed that (lack of) perseverance and urgency had positive relationships with Internet addiction. In a study on smartphone overuse, Billieux, Van der Linden, and Rochat (2008) found that, for French students, all facets of impulsivity had significant relationships with problematic mobile phones use, and urgency appeared to be the strongest predictor. Previous studies grounded in the four-facet model of impulsivity yielded a body of evidence on media addiction. However, in the field of smartphone addiction research, the amount of related evidence is not sufficient. Consequently, the

present comparative study aims to link the theory of impulsivity with smartphone addiction.

**Smartphone use activities.** Several types of media use activities were identified to maintain close relationships with addictive behaviors. For example, entertainment-oriented activities, such as playing games and watching movies, were at the top of this list (e.g., Mehroof & Griffiths, 2010). Over indulgence in socializing activities on Facebook and microblogs also raised the issue of excessive SNS use (e.g., Koc & Gulyagci, 2013). By integrating multiple functions, smartphones have become attractive for young people. On the one hand, smartphones facilitate information seeking and utility assistance activities, such as checking e-mails, organizing schedules, and note-taking. On the other hand, smartphones also offer numerous games and social networking services (SNSs). The indulgence of these activities can lead to negative outcomes in people's daily lives. With smartphones, people are more likely to procrastinate their jobs and immediately fulfill their desires for pleasure. In the long run, media use is a process of habit formation. For university students, the habit of smartphone use can be an important factor in psychological development. Being intensely occupied by smartphone activities directly cause a series of addictive symptoms. Given the significant role of the habit of smartphone use, this study examines how four major types of smartphone use activities (i.e., utility assisting, entertainment, information seeking, and social interaction) are connected to addiction.

After reviewing a series of prominent predictors of smartphone addiction, this study proposes the third research question, which aims at examining the effects of the above variables in psychological and media use in the two samples.

**RQ3: How can smartphone addiction be predicted by psychological factors (i.e., procrastination, preference for solitude, and impulsivity), smartphone use activities (i.e., utility assisting, entertainment, information seeking, and social interaction), and demographic characteristics in the two regional samples?**

### **Potential negative consequences of smartphone addiction**

The critical predictors of smartphone addiction have been reviewed in the previous section. This section discusses the potential negative outcomes of this addiction. The

harmful effects of excessive smartphone use can negatively influence the daily lives of users. Over indulgence in smartphone activities can lead to poor performance on formal occasions. Previous studies found that, for students, addiction to smartphone was negatively related to their academic performance (e.g., Samaha & Hawi, 2016). It was mainly because that smartphone addiction distracted them from academic activities and social interactions in real world. More specifically, symptoms of smartphone addiction were closely associated with a series of improper behaviors. For instance, Leung (2008) found that mobile phone addiction symptoms, such as craving, feeling lost, escape, and productivity loss, were linked to the improper use of mobile phones in public places, such as making or receiving phone calls in class, meetings, libraries, hospitals, and churches. Another type of improper behavior, the covert taking of photographs, was correlated with common psychological predictors of mobile phone addiction, such as sensation seeking. These findings suggest that addiction symptoms are significant antecedents of the negative behavioral consequences in smartphone adoption.

Because few studies have investigated these negative behavioral outcomes, this comparative study examines the predictive effects of personality traits, media use patterns, and most importantly, symptoms of smartphone addiction, on the negative behavioral outcomes among the two student samples.

**RQ4: How can improper use of smartphone be predicted by smartphone addiction symptoms, psychological factors (i.e., procrastination, preference for solitude, and impulsivity), smartphone use activities (i.e., utility assisting, entertainment, information seeking, and social interaction), and demographic characteristics in the two regional samples?**

## **METHODS**

### **Sampling**

In this study, the respondents were recruited from undergraduate students in the comprehensive universities in Hong Kong and Guangzhou. A paper-based questionnaire survey was conducted from April to October 2014. A stratified random sampling strategy was adopted in this survey. First, one university was identified randomly in each city. Second, within each university, ten departments were randomly selected from all faculties. Third, in each department, about 30 students were visited by researchers in classes that

were randomly selected from all courses recorded in the timetables of a given department. At the beginning of the questionnaire, a screening question was included, in order to guarantee that all the respondents were smartphone users. Totally, 661 questionnaires were successfully collected (response rate: 73.85%).

Among all respondents, 351 (53.10%) were Hong Kong students, and 310 (46.90%) were Guangzhou students. In the Hong Kong sample, 232 (66.10%) were female and 113 (32.19%) were male. The average age was 20.40 years ( $SD = 1.50$ ). The respondents had 2.34 years ( $SD = .89$ ) of undergraduate training on average. In the Guangzhou sample, 146 (47.10%) were female and 158 (50.97%) were male. The mean age was 20.33 years ( $SD = 1.22$ ). The average university education period was 2.12 years ( $SD = 0.78$ ).

## Measures

**Smartphone addiction index.** In order to assess the status of smartphone addiction among university students in Hong Kong and mainland China, this study adopted a comprehensive index that was successfully tested in both regions (e.g., Bian & Leung, 2015; Leung, 2008). This index was created by integrating several instruments that were frequently used to measure addictive media behaviors, including Young's eight-item Internet addiction diagnostic test (Young, 1998), the Mobile Phone Problem Use Scale (MPPUS) (Bianchi & Phillips, 2005), and the Television Addiction Scale (Horvath, 2004). By choosing key addiction symptoms from the above tests, this study constructed an index to evaluate the respondents' tendency toward smartphone addiction by using a five-point Likert scale ranging from one (strongly disagree) to five (strongly agree). Factor analyses were also conducted to extract the most effective items from the available questions.

**Classifying smartphone addicts.** Smartphone addicts were identified by using the same strategy employed in Young's 8-item Internet addiction diagnostic test (Young, 1998). Because these eight items were well modified and embedded in the above smartphone addiction index, they were used to form an instrument for screening addicts in this study. First, the five-point Likert scale of these eight items was transformed into a dichotomous classification: Values from "1" (strongly disagree) to "3" (neutral) in the original scale were recoded as "0" (no), and values of "4" (agree) and "5" (strongly agree) were recoded as "1" (yes). Second, by adding up the values of the eight items, a new

diagnostic scale, ranging from zero to eight, was created. Finally, the respondents with a score of five or above were classified as addicts.

**Improper use of smartphone.** This study measured the frequencies of a series of problematic behaviors in smartphone use. The question items included improper photo-taking behavior and the inappropriate use of smartphones in public places. For example, the respondents were asked how often they “stealthily snap a picture of others when nobody notices?” and “how often they make/receive calls or have ring tone in class, cinema, concerts, and so on?” A six-point Likert scale was used, ranging from zero (never) to five (very often). A composite measure of the variable was created by adding the values of all eight items.

**Procrastination.** In order to access the respondents’ tendency of procrastination, an abbreviated version of Lay’s (1986) procrastination scale was used. Eight items were selected from the original 20-item scale to create a short test. Sample items included “I often find myself performing tasks that I had intended to do days before” and “In preparing for some deadline, I often waste time by doing other things.” The scores of these eight items were combined to create a composite measure of the variable.

**Preference for solitude.** The Preference for Solitude Scale (PSS), developed by Burger (1995), was adopted in this study. This scale offers a list of paired statements, from which the respondents can choose either solitary or collective activities, based on their preference. For example, respondents can select the appropriate description between “I enjoy being around people” and “I enjoy being by myself.” One point was counted if a solitary activity item was chosen by the respondent. The original PSS contained 12 paired statements, but this study only included six pairs as a short scale. A composite measure of this variable, which ranged from zero to six, was created by adding up the scores of the six-paired items.

**Impulsivity.** Whiteside and Lynam’s (2001) UPPS impulsive behavior scale was adopted in this study. The original UPPS assessed impulsivity by using 45 items on a four-point Likert scale ranging from one (very unlike me) to four (very like me). In this survey, 16 items were selected to form a short version (i.e., four items in each impulsive facet). Statistical tests showed that this short version maintained satisfactory reliability in all dimensions (see Table 2). Sample items of the first dimension, urgency, included “It is

hard for me to resist acting on my feelings” and “Sometimes I do things on impulse that I later regret.” Sample items of the second dimension, (lack of) premeditation, included “I usually think carefully before doing anything” and “I like to stop and think things over before I do them.” Sample items of the third dimension, (lack of) perseverance, included “I am a productive person who always gets the job done” and “I concentrate easily.” Sample items of the last dimension, sensation seeking, included “I quite enjoy taking risks” and “I would enjoy the sensation of skiing very fast down a high mountain slope.” Composite measures of the four dimensions were generated by averaging the scores of corresponding question items.

**Smartphone use activities.** The frequencies of four different types of smartphone use were assessed by a six-point Likert scale ranging from zero (never) to five (very often). The first type of smartphone use, utilities assisting, included six activities, such as using the calculator, calendar, or map. The second type of activities, entertainment, contained four items, such as watching a video or playing an online game. The third type of smartphone use, information seeking, included two items, which were reading online news and surfing the Internet. The last one, social interaction, included seven common socializing activities, such as using e-mail, SNSs, or the video phone. For each type of smartphone use activities, a composite measure was formed by averaging the related question items.

## RESULTS

### Identifying smartphone addiction symptoms

Factor analyses showed that a five-factor model of smartphone addiction, which contained 18 items, was successfully constructed in each sample (see Table 1). This model accounted for 64.21% variance in the Hong Kong sample, and 66.25% variance in Guangzhou sample. The five dimensions were craving, productivity loss, escape, complaints, and guilt/peer pressure. The composite measure of each dimension was created by averaging the corresponding items. In addition, Table 2 shows the information about the characteristics of two samples.

**Table 1** Principal components factor analysis of smartphone addiction items with Varimax rotation

How much do you agree or disagree with the statements below describing you?	Factors									
	Hong Kong (N = 347)					Guangzhou (N = 298)				
	1	2	3	4	5	1	2	3	4	5
<b>Craving</b>										
I become irritable if I have to switch off my mobile phone for meetings, dinner engagements, or at the movies. (4)*	.77					.75				
I feel lost without my mobile phone.	.73					.70				
When out of range for some time, I become preoccupied with the thought of missing a call. (1)*	.62					.71				
I feel anxious if I have not checked for messages or switched on my mobile phone for some time.	.66					.60	.45			
I can never spend enough time on my mobile phone. (2)*	.52					.66				
I find it difficult to switch off my mobile phone. (3)*	.61					.56				
<b>Productivity loss</b>										
I find myself engaged on the mobile phone for longer periods than intended. (5)*		.79					.75			
My productivity has decreased as a direct result of the time I spend on the mobile phone. (6)*		.77					.76			
I lose sleep due to the time I spend on my mobile phone.		.72					.74			
I find myself occupied on my mobile phone when I should be doing other things, and it causes problem.		.56					.64			
<b>Escape</b>										
I have used my mobile phone to talk to others when I was feeling isolated.			.91					.92		
I have used my mobile phone to talk to others when I was feeling lonely.			.90					.90		
I have used my mobile phone to make myself feel better when I was feeling down. (8)*			.72					.80		
<b>Complaints</b>										
My friends and family complain about my use of the mobile phone.				.83					.79	
I have tried to hide from others how much time I spend on my mobile phone. (7)*				.80					.81	
I have been told that I spend too much time on my mobile phone.				.81					.73	
<b>Guilt/peer pressure</b>										
All my friends own a mobile phone.					.83					.79
If I did not have a mobile phone, my friends would find it hard to get in touch with me.					.79					.81
<b>Eigenvalue</b>	2.94	2.43	2.38	2.35	1.46	3.07	2.66	2.50	2.17	1.51
<b>Variance explained</b>	16.32	13.51	13.22	13.06	8.10	17.08	14.79	13.91	12.07	8.40

*Notes.* Items are coded from one (strongly disagree) to five (strongly agree). Items marked with “\*” are resemble or equivalent to Young’s 8-item Internet addiction diagnostic questions.

**Table 2****Characteristics of Hong Kong and Guangzhou respondents**

	Hong Kong (N = 351)			Guangzhou (N = 310)			T-test
	M	SD	Cronbach's $\alpha$	M	SD	Cronbach's $\alpha$	
<b>Smartphone addiction symptoms</b>							
Craving	2.77	.76	.79	2.72	.80	.81	.90
Productivity loss	3.00	.82	.77	3.03	.87	.79	-.61
Escape	3.32	.86	.84	3.09	.96	.88	3.27***
Complaints	2.34	.90	.81	2.41	.93	.77	-.94
Guilt/peer pressure	4.17	.75	.57	3.90	.84	.55	4.38***
<b>Improper use of smartphone</b>	1.83	.83	.81	1.53	.73	.77	4.82***
<b>Procrastination</b>	3.05	.56	.70	2.93	.56	.70	2.89**
<b>Preference for solitude</b>	2.60	1.61	.64	2.70	1.73	.69	-.77
<b>UPPS Impulsive Behavior Scale</b>							
Urgency	2.51	.50	.70	2.49	.48	.68	.59
(Lack of) premeditation	2.09	.45	.79	2.20	.48	.77	-2.99**
(Lack of) perseverance	2.35	.48	.79	2.39	.49	.77	-.97
Sensation seeking	2.41	.72	.85	2.33	.59	.79	1.58
<b>Smartphone use activities</b>							
Utility assisting	3.19	.81	.74	2.77	.97	.83	6.04***
Entertainment	2.71	1.05	.70	2.49	1.01	.69	2.75**
Information seeking	3.77	1.02	.65	3.45	1.15	.76	3.79***
Social interaction	2.82	.69	.61	2.81	.77	.66	.17

Note. \*\*  $p < .01$ , \*\*\*  $p < .001$ .

**Comparing symptoms and prevalence rates of smartphone addiction in both regions**

The first research question focused on comparing the symptoms of smartphone addiction among the university students in Hong Kong and Guangzhou. The factor

analysis of the items on the smartphone addiction index revealed a five-dimensional model of symptoms (see Table 1). Furthermore, the t-tests showed that, within these five dimensions, the Hong Kong sample had significant higher average values of escape ( $t = 3.27, p < .001$ ) and guilt/peer pressure ( $t = 4.38, p < .001$ ), compared with the Guangzhou group (see Table 2). These findings indicate that the university students in Hong Kong are more likely to use their smartphones to escape from difficulties in real life, and they are more easily influenced by their peers in smartphone adoption.

The second research question concerned the comparison on the prevalence of smartphone addiction. Following the method in Young's Internet addiction diagnostic test (Young, 1998), this study created a summated scale of the eight items, which were equivalent to those in Young's test. The results showed that, in the Hong Kong sample 57 (16.3%) students were identified as addicts, whereas in the Guangzhou sample 41 (13.5%) students were classified as addicts. The chi-square test showed no significant difference between these percentages (continuity correction = .79,  $p > .10$ ). This finding indicates that the university students in the two regions have similar proportions of smartphone addicts.

Compared with the previous studies for media addiction in other regions, the prevalence rates in Hong Kong and Guangzhou are not high. For example, in Britain, it was found that 18.3% of university students were considered pathological Internet users (Niemz, Griffiths, & Banyard, 2005). In Spain, 10.4% college students matched the criteria for pathological users of cell-phones (Jenaro, Flores, Gómez-Vela, González-Gil, & Caballo, 2007).

### **Comparing predictors of smartphone addiction**

The third research question concentrated on identifying the significant predictors of smartphone addiction. Two multivariate regression analyses were conducted for the Hong Kong and Guangzhou samples. In each regression model, demographics, psychological factors, and smartphone use activities were entered as predictors (see Table 3). The bivariate relationships among all proposed variables are also presented at the end of this paper (see Table 5 and 6 in Appendix).

**Table 3****Predictors of smartphone addiction among Hong Kong and Guangzhou university students**

	Smartphone Addiction Index			
	Hong Kong		Guangzhou	
	<i>sr</i>	$\beta$	<i>sr</i>	$\beta$
<b>Demographics</b>				
Gender (0 = female; 1 = male)	-.06	-.05	-.18**	-.18**
Age	.00	.00	.01	.02
Education	.05	.06	-.08	-.17*
<b>Psychological Factors</b>				
Procrastination	.31***	.37***	.12†	.14*
Preference for Solitude	-.09*	-.08†	-.01	-.01
Urgency (UPPS)	.17**	.16***	.17**	.17**
(Lack of) premeditation (UPPS)	-.08	-.08	-.07	-.07
(Lack of) perseverance (UPPS)	-.04	-.05	.06	.08
Sensation seeking (UPPS)	.10†	.09†	-.02	-.02
<b>Smartphone Activities</b>				
Utility assisting	.03	.04	.05	.08
Entertainment	.11*	.15*	.07	.10
Information seeking	.10†	.11*	.08	.10
Social interaction	.09	.11†	.18**	.27***
<i>R</i> <sup>2</sup>		.31		.33
Adjusted <i>R</i> <sup>2</sup>		.28		.30
<i>F</i> value		10.33***		9.08***
<i>N</i>		317		252

*Note.* Figures are semipartial (or part) correlations and standardized beta-coefficients.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

First, among the psychological factors, procrastination was a significant predictor of smartphone addiction in both samples (Hong Kong students:  $\beta = .37$ ,  $p < .001$ ; Guangzhou students:  $\beta = .14$ ,  $p < .05$ ). Similarly, urgency (a dimension of the UPPS Impulsive Behavior Scale) maintained strong predictive effects for all students (Hong Kong group,  $\beta = .16$ ,  $p < .001$ ; Guangzhou group,  $\beta = .17$ ,  $p < .01$ ). These findings suggest that certain psychological characters are common signals of smartphone addiction, regardless of

regional variation. This study also found that in the Hong Kong sample, preference for solitude ( $\beta = -.08, p < .10$ ) and sensation seeking (UPPS) ( $\beta = .09, p < .10$ ) were weakly associated with smartphone addiction. These results imply that for Hong Kong students, those who prefer solitude are less likely to be addicted to smartphones, and those who have stronger tendencies of sensation seeking are more heavily dependent on smartphone use. Because these two variables failed to contribute significantly in predicting addiction among the Guangzhou students, they can be seen as the unique psychological predictors of smartphone addiction in the Hong Kong sample. It should be noted that (lack of) premeditation and (lack of) perseverance were insignificant factors in both samples. These results highlight the importance of distinguishing heterogeneous dimensions within the broad construct of impulsivity when considering its contribution to media addiction.

The second group of predictors included media activity variables. Regression analyses revealed the distinct roles of media use activities in predicting smartphone addiction. In the Hong Kong sample, activities of entertainment ( $\beta = .15, p < .05$ ) and information seeking ( $\beta = .11, p < .05$ ) were significantly associated with smartphone addiction. These findings indicate that the Hong Kong students who frequently entertain or surf the Internet for information are more likely to indulge in smartphone technology. However, in the Guangzhou sample, using smartphones for social interaction was the most robust predictor of smartphone addiction ( $\beta = .27, p < .001$ ), whereas in the Hong Kong sample, social interaction was only marginally related to smartphone addiction ( $\beta = .11, p < .10$ ). These findings imply that socializing use is the most powerful driver in smartphone addiction for Guangzhou students. The above findings highlight the crucial effects of habitual media use. Since the patterns of smartphone use are established during the socialization process of young people, the effects of cultivating these habits strongly influence university students' dependency on media technology.

With regard to demographics, gender ( $\beta = -.18, p < .01$ ) and education ( $\beta = -.17, p < .05$ ) were significant predictors of smartphone addiction in the Guangzhou sample. The results indicate that, in the Guangzhou sample, female students are more likely to be addicted to smartphones, and education is an effective coping solution in preventing smartphone addiction.

## Comparing predictors of improper use of smartphone

The last research question focused on the negative behavioral consequences of the excessive use of smartphones. Demographics, psychological factors, smartphone activities, and the five dimensions of smartphone addiction were regressed on improper use of smartphone (see Table 4).

**Table 4** Predictors of improper use of smartphone

	Improper Use of Smartphone			
	Hong Kong		Guangzhou	
	<i>sr</i>	$\beta$	<i>sr</i>	$\beta$
<b>Demographics</b>				
Gender (0 = female; 1 = male)	-.03	-.03	.13*	.13*
Age	.07	.10	.00	-.01
Education	-.13*	-.18**	.00	.00
<b>Psychological Factors</b>				
Procrastination	.06	.09	.08	.10
Preference for solitude	-.02	-.02	-.04	-.04
Urgency (UPPS)	.02	.02	-.09	-.10
(Lack of) premeditation (UPPS)	-.01	-.01	.08	.09
(Lack of) perseverance (UPPS)	-.02	-.02	-.06	-.08
Sensation seeking (UPPS)	.13*	.12*	-.02	-.02
<b>Smartphone Activities</b>				
Utility assisting	.10†	.14*	.11†	.21*
Entertainment	-.04	-.07	-.01	-.01
Information seeking	.07	.08	-.05	-.07
Social interaction	.05	.07	.13*	.21**
<b>Smartphone Addiction Index</b>				
Craving	.13*	.17**	.14*	.20**
Productivity loss	-.02	-.04	-.02	-.03
Escape	.12*	.14*	.07	.09
Complaints	.16**	.21***	.11†	.14*
Guilt/peer pressure	-.05	-.05	-.11	-.11
<i>R</i> <sup>2</sup>		.29		.31
Adjusted <i>R</i> <sup>2</sup>		.24		.26
<i>F</i> value		6.54***		5.83***
<i>N</i>		312		251

*Note.* Figures are semipartial (or part) correlations and standardized beta-coefficients.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

First, among the psychological factors, only sensation seeking (UPPS) was a significant predictor ( $\beta = .12, p < .05$ ) in the Hong Kong sample, indicating that the respondents with stronger tendencies toward seeking sensation are more likely to use their smartphones improperly. Although urgency (UPPS) and procrastination maintained significant zero-order correlations with improper use of smartphone in the Hong Kong sample, they were not the significant predictors in regression analysis. Furthermore, in the Guangzhou sample, none of the psychological factors was significantly correlated in the bivariate and multivariate analyses. These results indicate that these psychological characteristics are not the direct triggers of inappropriate smartphone use behaviors.

Second, the four types of smartphone activities had significant bivariate associations with improper smartphone use in both the Hong Kong and Guangzhou samples. However, only two of them were significant predictors. The utility-assisting use of smartphones was an important predictor in both samples (Hong Kong sample,  $\beta = .14, p < .05$ ; Guangzhou sample,  $\beta = .21, p < .05$ ). These results imply that university students who frequently use smartphones for utility-assisting purposes are more likely to exhibit inappropriate behaviors in public places. In the Guangzhou sample, the use of smartphones for social interaction was also a strong predictor ( $\beta = .21, p < .01$ ). This finding suggests that in the Guangzhou sample, the students who are more frequently engaged in social activities on smartphones are more likely to exhibit improper behaviors when using smartphones.

The strongest predictors of inappropriate smartphone use behaviors were found in the dimensions of smartphone addiction index. The zero-order correlation analyses showed that four dimensions (i.e., craving, productivity loss, escape, and complaints) had significant bivariate relationships with the dependent variable. The regression analyses showed that the most robust predictor in the Hong Kong sample was complaints ( $\beta = .21, p < .001$ ), followed by craving ( $\beta = .17, p < .01$ ). These two symptoms also showed significant predictive effects in the Guangzhou sample: Craving was the most important predictor ( $\beta = .20, p < .01$ ), followed by complaints ( $\beta = .14, p < .05$ ). The above findings indicate that in both samples, users who have more intense desires to use their smartphones are more likely exhibit improper behaviors. In addition, the symptom of escape had a significant influence on prediction in the Hong Kong sample ( $\beta = .14, p < .05$ ), which suggests that the

Hong Kong respondents who frequently use their smartphones to escape from problems in real life are more likely to conduct improper behaviors.

Regarding demographics, education level ( $\beta = -.18, p < .01$ ) showed a negative relationship with improper behaviors in the Hong Kong sample, indicating that senior students engage less frequently in inappropriate using smartphones. In the Guangzhou sample, gender ( $\beta = .13, p < .05$ ) was a significant predictor, indicating that male students are more likely to improperly use smartphones in public places.

## DISCUSSION

This study aimed to compare the prevalence, predictors, and negative consequences related to smartphone addiction by analyzing the data collected from two distinct student samples. The findings have important insights on revealing the social-psychological factors of addictive behaviors related to smartphone technology.

First, this study demonstrated that all five symptoms of smartphone addiction could be identified in the two samples of university students, although the extents of some symptoms might vary within the two regions. This finding implies that a relatively stable pattern of symptoms exists among these young smartphone users. Further, the four addiction dimensions (i.e., craving, productivity loss, escape, and complaints) had significant bivariate relationships with improper use of smartphone. In particular, the symptoms of craving and complaints were strong predictors for this dependent variable. Hence, parents and policymakers should pay special attention to addicts who exhibit symptoms in these two harmful dimensions of smartphone addiction, because they can lead to more negative behavioral outcomes.

Second, this study revealed that similar psychological traits (e.g., procrastination and urgency) predicted smartphone addiction in both student samples. The findings demonstrated that the young adults in the samples shared common psychological characteristics. Consistent with previous studies, the manifest roles of procrastination and urgency indicate that the students who have weaker self-regulation are more vulnerable to smartphone addiction.

Nevertheless, some psychological factors in the regression models were not as influential as expected. For example, some facets of impulsivity were not significantly, or

only weakly, related to smartphone addiction, such as premeditation and sensation seeking. Previous studies yielded similar findings (e.g., Billieux, Van der Linden, & Rochat, 2008; Laroi, 2015). Given the existing evidence, urgency is the more stable and prominent predictor of media addiction, compared with the other impulsivity components. However, further in-depth studies are needed to clarify the distinct roles of impulsivity components in addictive behavior. In addition, preference for solitude showed a weak and negative correlation with smartphone addiction only in the Hong Kong sample. This finding implies that, unlike loneliness, which was shown to be a positive predictor for media addiction (e.g., Park, 2005), preference for solitude can inhibit excessive smartphone use among Hong Kong students.

Third, this study reveals the effects of different activities in smartphone use. In predicting smartphone addiction, the four types of proposed smartphone activities had different effects on the student samples. Entertainment and information seeking in smartphone were significant predictors in the Hong Kong sample, whereas social interaction use was an extremely robust factor in the Guangzhou sample. These findings suggest that among different groups of users, smartphone addiction can be associated with distinct habits of media use. Therefore, studies of media addiction should clarify the specific role of a given type of media activity, instead of simply discussing the effects of the general use of media technology. Furthermore, the findings of the present study raise an important perspective on coping with smartphone addiction. Since certain types of media use are significantly connected to smartphone addiction, potential treatments for addicts can focus on guiding young people to reduce the involvement of corresponding media activities.

Fourth, the findings of the study also point out the potential disadvantages of the portability and ready use of smartphones. Although the utility-assisting use failed to predict smartphone addiction, it was a significant predictor of improper behaviors of smartphone in both samples. The result indicate that the accessibility feature of smartphone brings convenience for people's lives, but it can also foster inappropriate behaviors in public places.

To sum up, drawing on a comparative strategy, this study contributes to the smartphone addiction literature, by highlighting the common roles of psychological traits

(i.e., procrastination and urgency) in both regions, and the unique effects of media use activities in different samples (i.e., entertainment and information seeking for Hong Kong students whereas social interaction for Guangzhou students). The study also alarms that improper smartphone use can be closely associated with certain addiction symptoms (craving and complaints) and the utility-assisting use of the devices.

### **Limitations**

Some limitations in this study should be addressed. First, because the study used a cross-sectional survey, it was not sufficient to develop the causal relationships between the proposed variables. Future studies can conduct longitudinal research to offer more evidence on the developmental processes of young adults, especially about their personalities and patterns of media use activities.

Second, although this study adopted a comparative research design, it was confined to Chinese university students with similar cultural backgrounds, which might account for the common predictors of smartphone addiction found in the two samples. However, it remains unclear whether these results can be generalized to the young adults in regions outside the greater China. Thus, future comparative studies can include larger comprehensive samples with more diverse cultural and regional characters.

Third, limited by time and effort, this study only covered a small number of psychological factors for comparison. More efforts are needed in future studies to examine the distinct effects of personality and psychological factors. For example, by far, little study aimed at the different roles between loneliness and preference for solitude (or aloneliness) in predicting smartphone addiction. In previous, both significant and insignificant effects of loneliness were identified (e.g., Park, 2005; Takao et al., 2009). In recent studies, preference for solitude has attracted more and more attention in the field. However, its effect has not been well explained yet. This study showed that preference for solitude marginally predicted smartphone addiction in the Hong Kong sample, but had insignificant effect in Guangzhou sample. These inconsistent findings on the effects of two different psychological concepts call for more in-depth comparison in coming studies.

Fourth, by far, there has been few research dedicating to the questions about why different smartphone use patterns existed among young students from the two societies, and how these patterns maintained distinct associations with addictive behaviors. Based

on the feedbacks of the respondents recruited in the survey, the possible reasons might be linked to certain socialization factors among the students: the heavy workload and academic pressure among Hong Kong undergraduates and the lack of social engagement among Guangzhou undergraduates. In facing intense course work, some Hong Kong university students might use their smartphones to escape or procrastinate difficult tasks. For the Guangzhou university students, because of the relative lack of collective activities in real life, interactions via smartphones might be the alternative mode of peer discussions and news updates by various virtual groups on SNSs.

Finally, since this study was based on a paper-and-pen survey, it faced the inherent weakness of self-report research. The respondents might be reluctant to truly report their actual situations on the question items related to negative personalities and behaviors. The development of new research methods on assessing media addiction, such as the psychoinformatic analysis, is an important direction for future studies (e.g., Montag et al. 2015).

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### Funding and Acknowledgements

This research was supported by the C-Grant, offered by Centre for Chinese Media and Comparative Communication Research (C-Centre), in School of Journalism and Communication, the Chinese University of Hong Kong.

## APPENDIX

**Table 5** Correlation matrix (Hong Kong sample)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Gender	1																		
2. Age	.10†	1																	
3. Education	.09	.56***	1																
4. Procrastination	.03	-.05	-.04	1															
5. Preference for solitude	.07	-.01	.02	.07	1														
6. Urgency (UPPS)	-.12*	-.05	-.02	.25***	.07	1													
7. (Lack of) premeditation (UPPS)	-.06	-.01	.00	.14*	-.01	.11*	1												
8. (Lack of) perseverance (UPPS)	-.03	.03	-.02	.42***	.10†	.24***	.30***	1											
9. Sensation seeking (UPPS)	.15**	.09	.11*	.06	-.06	-.03	.04	-.03	1										
10. Utility assisting	-.06	.08	-.04	.05	-.11*	.04	-.11*	-.03	.04	1									
11. Entertainment	-.04	.02	-.06	.00	-.10†	-.04	-.07	-.04	.00	.52***	1								
12. Information seeking	-.11*	-.02	.05	.08	-.01	.00	-.20***	-.06	-.06	.42***	.39***	1							
13. Social interaction	-.12*	.06	.03	-.04	-.10†	.08	-.15**	-.06	.04	.46***	.46***	.38***	1						
14. Craving	-.01	.04	.08	.27***	-.10†	.18***	-.09†	.14*	.09	.20***	.19***	.21***	.19***	1					
15. Productivity loss	.02	.06	.03	.45***	.08	.21***	-.04	.22***	.01	.20***	.21***	.19***	.15**	.52***	1				
16. Escape	-.18***	-.05	-.06	.12*	-.19***	.14**	-.13**	-.03	.03	.22***	.18***	.25***	.24***	.32***	.31***	1			
17. Complaints	-.01	-.10†	-.02	.24***	-.04	.18***	.08	.05	.12*	.21***	.32***	.12*	.21***	.41***	.41***	.27***	1		
18. Guilt/peer pressure	-.12*	.07	.01	.20***	-.15**	.04	-.09†	.05	.04	.05	.00	.17***	.04	.21***	.14*	.15**	.01	1	
19. Improper use of smartphone	-.08	-.01	-.10†	.16**	-.09	.13*	-.05	-.01	.13*	.31***	.24***	.24***	.25***	.34***	.24***	.31***	.34***	.06	1

*Note.* Figures are zero-order Pearson's correlations. *N* ranges from 333 to 351, due to missing values. †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

**Table 6** Correlation matrix (Guangzhou sample)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Gender	1																		
2. Age	.06	1																	
3. Education	.07	.72***	1																
4. Procrastination	.07	-.01	-.03	1															
5. Preference for solitude	-.01	-.07	.01	.12*	1														
6. Urgency (UPPS)	.01	.01	-.09	.27***	.04	1													
7. (Lack of) premeditation (UPPS)	-.01	-.06	-.11†	.23***	.06	.19***	1												
8. (Lack of) perseverance (UPPS)	.08	.01	-.06	.49***	.13*	.33***	.38***	1											
9. Sensation seeking (UPPS)	.15**	.06	.07	-.01	-.21***	-.04	-.15**	-.15*	1										
10. Utility assisting	-.06	-.07	.01	-.04	-.09	-.05	-.13*	-.22***	.08	1									
11. Entertainment	.07	-.09	-.01	.03	-.10	-.00	.01	-.13*	.12*	.61***	1								
12. Information seeking	.13*	-.04	.11†	.04	-.10	.01	-.11†	-.09	.03	.45***	.41***	1							
13. Social interaction	-.10†	-.09	.05	-.02	-.05	-.05	-.09	-.14*	-.01	.57***	.45***	.44***	1						
14. Craving	-.10†	-.08	-.10†	.22***	-.03	.15*	.12*	.15**	-.06	.22***	.26***	.23***	.30***	1					
15. Productivity loss	-.11†	-.17**	-.14*	.27***	.01	.16**	.06	.19***	-.02	.24***	.17**	.25***	.30***	.52***	1				
16. Escape	-.22***	-.05	-.06	-.03	-.18**	.16***	-.14*	-.10†	.03	.36***	.22***	.15**	.33***	.34***	.26***	1			
17. Complaints	-.01	-.08	-.12*	.13*	-.01	.14*	.10†	.10†	.03	.16**	.23***	.09	.18***	.43***	.45***	.22***	1		
18. Guilt/peer pressure	-.08	-.09	.02	.03	-.07	-.02	-.20***	-.10†	-.11	.15**	.00	.18**	.11†	.12*	.20***	.16**	-.10†	1	
19. Improper use of smartphone	.02	-.02	-.05	.07	-.08	.01	.06	-.04	.05	.36***	.31***	.14*	.37***	.31***	.23***	.27***	.31***	-.08	1

*Note.* Figures are zero-order Pearson's correlations. *N* ranges from 282 to 310, due to missing values. †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .