

# Internet addiction in Hong Kong adolescents: profiles and psychosocial correlates

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## Abstract

This study examined the prevalence of internet addiction among Hong Kong adolescents and its psychosocial correlates in a large sample of early adolescents in Hong Kong. A total of 3328 students (age=12.59±0.74 years) were recruited from 28 secondary schools in Hong Kong. Using Young's 10-item internet addiction test, 26.4% of the participants were classified as having internet addiction. Age and having divorced parents were positively correlated with pathological use of the internet, while higher academic competence, general positive youth development, and positive and clear identity predicted a lower probability of internet addiction. These results demonstrate that internet addiction has become an emergent youth problem in Hong Kong, which deserves more attention from researchers and professionals. Preventive strategies aiming at risk and protective factors identified in the present study should be developed and implemented.

**Keywords:** assessment; Chinese adolescents; Hong Kong; internet addiction; internet addiction test; positive youth development; Project P.A.T.H.S.

## Introduction

The internet has been described as one of the most important inventions of the 20th century. The use of the internet has dramatically changed the way people interact with others, gather

and disseminate information, do business, and have entertainment. Meanwhile, a negative side of this new tool is emerging: addictive behaviors are fostered with the increasing use of the internet. Although there are different conceptions and definitions of internet addiction, the term has been conceived as an individual's inability to control his or her use of the internet (including any online-related, compulsive behavior), which eventually causes one's marked distress and functional impairment in daily life (1). Research findings have shown that excessive use of the internet adversely affected one's physical health, family life, and academic performance (2–4). In recent years, it has been reported that the risk of internet addiction in adolescents continues to grow across the world (5). The present study was intended to provide a descriptive profile of internet addictive behaviors among Hong Kong adolescents and to examine the psychosocial correlates of this phenomenon in a Chinese context.

A number of prevalence studies on internet addiction have been conducted in different parts of the world where different findings were reported (6). In the US, a national telephone survey showed that 5.9% of the respondents suffered from excessive internet use, 3.7% felt preoccupied by the internet when offline, 13.7% found it was difficult to stay away from the internet for several days at a time, and 12.4% was found to stay online longer than intended very often or often (7). In the UK, a study based on 371 randomly selected students showed that 18.3% of the sample were diagnosed as problematic internet users (8). With a sample of 3237 adolescents from Norway, it was found that 1.98% and 8.68% could be regarded as having internet addiction and were at risk of internet abuse, respectively (9).

Some important prevalence studies have been carried out in Asian countries, including different Chinese communities. Using an indigenous instrument, South Korean researchers found 4% and 20.4% of the adolescent respondents (n=627) were high-risk internet users and potential risk internet users, respectively (10). Great concerns about internet addiction are also shown in China because of the dramatic increase of internet use among Chinese adolescents in the last decade. According to a national report in 2009, there were around 10 million Chinese teenagers who met the internet addiction diagnostic criteria (11). A study on 2620 high school students in Changsha showed that 2.4% of them could be diagnosed as internet addicted (12). In another study where 3557 first-year university students in Shanxi were recruited, 6.44% of the respondents were classified as internet addictive users (13). In Taiwan, a study with a sample of 1708 high school adolescents showed that 13.8% of the respondents were identified as internet addicts, who were found to have different psychological and psychiatric problems (14).

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With regard to Hong Kong, utilizing the Young's 20-item questionnaire to examine internet addiction among 976 students, the Tsuen Wan Center of the Chinese YMCA of Hong Kong (15) reported that 61.4% of senior primary school students, 35.2% of secondary 1–3 students, 18.8% of secondary 4–5 students, 35.8% of secondary 6–7 students, and 37.0% of college students could be identified as highly at risk of internet addiction. By comparing the data derived from two studies using the Young's 8-item questionnaire, Chan (16) found that the prevalence of internet addiction had increased from 3.0% in 2000 to 14.7% in 2002. In a more recent study of 6121 adolescents, Shek et al. (17) showed that 19.1% of the respondents were internet addicts using a validated Young's 10-item questionnaire.

While the number of prevalence studies on internet addiction is accumulating, several conceptual and methodological gaps are observed. First, inconsistent findings regarding the prevalence rates of internet addiction were reported by different researchers. Second, different instruments for assessing internet addiction were used. For example, while a 40-item Chinese internet-related addictive behavior inventory was designed and used to assess internet addiction in Taiwan (14), Young's questionnaires were commonly adopted by researchers in China mainland and Hong Kong (13, 18). Third, different diagnostic criterion and cut-off scores were employed in different studies. Although most studies followed Young's proposed cut-off of a 4 of 10 symptoms criteria, some used a higher cut-off score. Fourth, most studies utilized cross-sectional designs and thus cannot provide a complete understanding of how internet addiction developed. Fifth, some prevalence studies were based on small and unrepresentative samples. For example, in a study conducted in Korea aimed at analyzing causes of juvenile internet addiction, only 240 completed questionnaires were collected out of 700 questionnaires distributed, which put both the reliability and validity of the findings in doubt (19). These gaps point to a critical need to establish standardized measures for the assessment of internet addiction and to develop norms and cut-off scores for particular populations through methodologically sound empirical studies. Unfortunately, except a few exceptions (17), there are few validated Chinese measures on internet addiction.

Against this background, the first purpose of the present study is to provide a descriptive profile of internet addictive behavior among Hong Kong adolescents based on a large sample of Hong Kong students. The first wave of data of a large-scale longitudinal research ( $n=3328$ ) in the continuation phase of the Project P.A.T.H.S. collected in the 2009–10 academic year are presented in this paper. Obviously, such a descriptive profile would serve as a baseline profile for the next step of longitudinal research. A validated instrument, Young's 10-item internet addiction questionnaire, is used, which has shown robust psychometric properties on Hong Kong youth population in previous studies (17). It is expected that, based on the longitudinal data, norms and cut-off scores for internet addiction for Hong Kong adolescents would be eventually developed.

To prevent the intensified internet addiction problem in adolescents, one important strategy is to reduce the related risk factors and strengthen the associated protective factors simultaneously. Hence, to devise effective preventive strategies, it is important first to understand both risk and protective factors in the development of internet addiction. A few demographic factors were found to be related to internet addiction. First, gender is correlated with the prevalence of internet addiction. A common finding is that there are significantly more males than females who were identified as internet addicts, although the number of females involved in excessive internet use also increased (20, 21). Second, age has been consistently reported as a predictor of internet addiction. Individuals who are in adolescence and young adulthood are more likely to become internet addicts, as compared to other age groups (20, 22). There are views suggesting that adolescents who are in the process of psychological development and crystallizing their personality may be particularly vulnerable to developing addictive behaviors. Researchers have also pointed out some other risk factors specific to this age group, including a strong desire to develop a sense of identity, a need to build up intimate relationship, and easily having access to the internet either at home or in school (23). However, the relationship between age and internet addiction within adolescence has not been addressed.

Third, parental marital discord is a risk factor for internet addiction. It was reported that internet addiction was more prevalent among adolescents who grew up in single-parent families, had high parent-adolescent conflict, and had interparental conflict (24). Fourth, with specific reference to Hong Kong, a society made up of immigrants, researchers have suggested that immigration status may be a risk factor for youth mental health (25). It has been reported that immigrant youth from mainland China often encountered acculturative stresses, such as language difficulty and unfamiliarity with social resources, which may further lead to peer relationship problems and low self-image (26). As such, it is very likely that immigrant youth would display more behavioral problems than local youth, including internet addiction. Nonetheless, the association between immigration status and adolescent internet addictive behaviors remains to be investigated, especially in the context of Hong Kong.

Positive youth development may be another significant protective factor for adolescent internet addiction. Researchers have reported that youth addictive behaviors, such as gambling and substance abuse could be more effectively prevented by promoting positive youth development, such as pro-social behaviors, social competence, academic performance, and positive self-identity. For example, based on a 2-year longitudinal dataset, Shek reported that positive youth development indexed by different indicators was negatively related to adolescent behavioral intention to gamble, and that positive youth development measures predicted adolescent gambling and their changes over time (27). There are also cross-sectional as well as longitudinal findings showing that positive youth development indirectly influenced problem behavior via life satisfaction (28, 29). Similarly, researchers evaluated the long-term effects of an intervention that incorporate

parental education, teacher training, and social competence training on adolescent health risk behaviors for elementary school students living in high-crime communities (30). The results showed that students who received the intervention reported fewer delinquent behaviors by the age of 18.

With regard to the prevention of internet addiction, Shek and Yu recently reported the long-term effects of a positive youth development program, the Project P.A.T.H.S., on a list of youth problem behaviors, based on a longitudinal randomized group study (31). The results showed that participants' ability to control internet use in the control group decreased more quickly than the experimental group who received the positive youth development program and the experimental group also showed a faster deceleration than the control group. Using the individual curve modeling technique, it was found that at the latter stage of the experiment while the program participants' control over the internet increased, such ability in the controlled participants continued to deteriorate. These findings suggest that positive youth development appears to be a common protective factor for youth problem behaviors, including internet addiction. However, studies that directly examine the relationship between various positive youth development constructs and internet addiction are almost non-existent.

Against this background, the second purpose of this study is to investigate risk and protective factors for internet addiction in Hong Kong adolescents, with particular reference to gender, age, immigration status, parental marital status, and positive youth development. Based on literature review, the following hypotheses are proposed: (1) male students would be more likely than female students to display internet addictive behaviors; (2) growing up in a non-intact family would be positively correlated with internet addictive behavior; (3) immigrant youth would display more pathological internet use than local adolescents; (4) different positive youth development constructs would be negatively related to adolescents' internet misuse. The identification of the relationship between these factors and the incidence of internet addiction would be useful to develop effective approaches to prevent internet addiction among adolescents in the future.

## Methods

As introduced earlier, the present study is part of a large longitudinal study aiming at tracking the developmental trends of different positive youth development indicators and risk behaviors among Hong Kong adolescents over time. A total of 28 secondary schools in Hong Kong were selected to participate in the study. Data regarding internet addiction behaviors collected in the first wave of this study are analyzed in this paper.

## Participants

All Secondary 1 students in the selected school were invited to complete a questionnaire anonymously. There were 3328 students responding to the questionnaire. The mean age of the participants was 12.59 years ( $SD=0.74$ ). These include 1719 boys, 1572 girls, and 37 students did not indicate their gender. While most students were born in Hong Kong (78.1%), there are 19.9% of the participants

came from China mainland and 2.0% were from other places. The background demographic information of the participants is summarized in Table 1.

## Procedures

In the school year of 2009–10, the participants were invited to respond to a comprehensive youth development questionnaire including both existing instruments and scales developed by the first author. The questionnaire survey was conducted by a trained research assistant in classroom settings with standardized instructions. At each measurement occasion, the purposes of the study were introduced and confidentiality of the data collected was repeatedly ensured to all participants. School, parental, and student consent had been obtained before data collection. Participants responded to the questionnaires in a self-administered format. The research assistant was present throughout the administration process to answer possible questions from the participants.

## Instruments

Participants were invited to respond to a composite questionnaire that comprises questions about demographic information, participants' family environment, different measures of youth development

**Table 1** Descriptive statistics about participants.

Categorical variables	n	%	
Gender			
Male	1719	52.2	
Female	1572	47.8	
Place of birth			
Hong Kong	2590	78.3	
Mainland China	655	19.8	
Others	64	1.9	
Parental marital status			
First marriage	2781	84.4	
Divorced	209	6.3	
Separated	73	2.2	
Remarried	129	3.9	
Others (not first marriage)	104	3.2	
Family economic status			
Receiving CSSA	225	6.8	
Not receiving CSSA	2606	78.3	
Others	465	13.9	
Internet addiction			
Yes	847	26.4	
No	2364	73.6	
Continuous variables	Mean	SD	Range
Age	12.59	0.74	10–18
ASC	3.12	0.67	1–5
CBC	4.45	0.75	1–6
PA	4.50	0.89	1–6
GPYDQ	4.50	0.71	1–6
PIT	4.24	0.96	1–6
NET	0.23	0.24	0–1

CSSA, Comprehensive Social Security Assistance; ASC, academic school competence; CBC, cognitive behavioral competence; PA, prosocial attributes; GPYDQ, general positive youth development; PIT, positive and clear identity; NET, internet addiction.

constructs, and problem behaviors. For family factors, participants responded to questions regarding paternal presence, maternal presence, parental marital status, paternal educational level, maternal educational level, and family economic status. Family economic status is indexed by the question of whether the family of the participant is receiving Comprehensive Social Security Assistance (CSSA), a financial aid provided by the Hong Kong government for low-income populations, at the time of survey. Respondents are also asked to indicate the marital status of their parents, including: "divorced and not remarried," "separate and not remarried," "couple, first marriage," "couple, second, or above marriage," and "others." The scales used to assess internet addiction and positive youth development constructs are introduced below.

**Young's 10-item internet addiction test** Young developed several instruments to assess internet addiction, among which the 10-item internet addiction (IAT) test has been validated by Shek et al. (17) for Chinese populations and was selected to measure youth internet addictive behavior in this study. The 10-item IAT asks respondent to answer "Yes" or "No" as to whether they have the listed internet addictive behaviors in the past one year. Example items include "feeling a need to spend more and more time online to achieve satisfaction," and "feeling restless or irritable when attempting to cut down or stop on-line use." A person is classified as "internet addiction" if he/she shows 4 or more of the listed behaviors. Cronbach's  $\alpha$  of IAT for the present sample was 0.79.

**Chinese Positive Youth Development Scale (CPYDS)** The CPYDS consists of 15 subscales which are listed as follows:

1. Bonding Subscale (three items)
2. Resilience Subscale (three items)
3. Social Competence Subscale (three items)
4. Emotional Competence Subscale (three items)
5. Cognitive Competence Subscale (three items)
6. Behavioral Competence Subscale (three items)
7. Moral Competence Subscale (three items)
8. Self-determination Subscale (three items)
9. Self-efficacy Subscale (two items)
10. Beliefs in the Future Subscale (three items)
11. Clear and Positive Identity Subscale (three items)
12. Spirituality Subscale (three items)
13. Prosocial Involvement Subscale (three items)
14. Prosocial Norms Subscale (three items)
15. Recognition for Positive Behavior Subscale (three items)

Based on factor analyses, Shek and Ma (32) proposed that the 15 subscales in the CPYDS could be further reduced to four dimensions:

- Cognitive Behavioral Competence (CBC): Scale score is calculated by averaging scores on Cognitive Competence Subscale, Self-determination Subscale, and Behavioral Competence Subscale.
- Prosocial Attributes (PA): Scale score equals to the mean score of Prosocial Involvement Subscale and Prosocial Norms Subscale.
- Positive Identity (PIT): Scale score is computed by averaging scores of Beliefs in the Future Subscale and Clear and Positive Identity Subscale.
- General Positive Youth Development Qualities (GPYDQ): Scale score equals to the mean score of Resilience Subscale, Social Competence Subscale, Self-Efficacy Subscale, Moral Competence Subscale, Bonding Subscale, Recognition for Positive Behavior Subscale, Spirituality Subscale, and Emotional Competence Subscale.

These four composite indicators were used to assess participants' positive youth development in the present study. Scores of the four indicators all range from 1 to 6 with higher scores representing high competences in the constructs. The Cronbach's  $\alpha$  coefficients for CBC, PA, PIT, and GPYDQ are 0.82, 0.74, 0.82, and 0.88, respectively, in this study. Descriptive statistics about all variables under study are listed in Table 1. It should be noted that although the administered questionnaire includes other subscales of the CPYDQ, findings regarding the overall score of CPYDQ and its subscales will be reported elsewhere. The present paper only focuses on the predictive effects of the four second-order positive youth development constructs on adolescent Internet addictive behaviors.

**Academic and school competence scale** As a relatively independent positive youth development construct, participants' academic and school competence (ASC) were measured by three items. For the first item, participants are required to rate their perceived academic performance as compared to other peer students on a five-point Likert scale, with 1=very poor, 2=below average, 3=average, 4=above average, and 5=very good. The second item asks the extent to which the respondents are satisfied with their academic performance (1=very dissatisfied, 2=dissatisfied, 3=neutral, 4=satisfied, and 5=very satisfied). The last question asks the participants to rate their conduct in school on a five-point Likert scale (1=very poor, 2=below average, 3=average, 4=above average, and 5=very good). The ASC scale score is calculated by averaging the item scores and ranges from 1 to 5, with high scores representing for high academic and school competence. On the present sample, Cronbach's  $\alpha$  coefficient for ASC is 0.67.

### Data analytic plan

The first purpose of the present study was to provide a descriptive profile of different internet addictive behaviors among Hong Kong adolescents. Therefore, numbers and percentages of adolescents who reported pathological use of the internet were first computed. Second, to investigate whether gender, age, immigration status, and positive youth development are predictive of adolescent internet addictive behaviors, multiple regression analysis was performed with the mean score of IAT items as the dependent variable.

Specifically, basic demographic factors (age and gender) were entered in the first block; family economic status, parental marital status, and immigration status of the participant were entered into the second block; youth development constructs including academic and school competence (ASC), cognitive behavioral competence (CBC), prosocial attributes (PA), positive identity (PIT), and general positive youth development qualities (GPYDQ) were entered into the third block of the regression model. To further determine whether different demographic factors and positive youth development constructs contribute to the occurrence of internet addiction, a logistic regression analysis was conducted. Participants who met Young's criterion of internet addiction were first identified. Whether the participant can be diagnosed as internet addiction served as the dependent variable. Independent variables and the order of input were the same as those in the multiple regression analysis.

It should be noted that although the relationship between family economic status and internet addiction was not a major focus of the present study, this variable was also included as an independent predictor throughout the analyses to control for its possible effects. As 465 participants did not indicate whether their family was receiving CSSA in the year of survey, they were not included in the correlation

analyses. In addition, because immigrant youth from other places than mainland China only accounted for 2.0% of the participants, they were also not included in the analyses that investigated the relationship between immigration status and internet addiction. In other words, the present study focused on comparing local and immigrant adolescents from mainland China.

## Results

In this part, a descriptive profile of different type of internet addictive behavior is presented first, followed by the results of multiple regression analyses regarding the predictive effects of demographic characteristics, immigration status, and positive youth development constructs of the participated students on their internet addictive behaviors. Finally, relationships between different predictors and the occurrence of internet addiction at the diagnostic level are reported.

### Descriptive profiles on internet addictive behavior

Numbers and percentages of participants who displayed internet addictive behaviors in the past one year are summarized in Table 2. Several observations can be highlighted from the findings. First, internet addictive behaviors are quite common among Hong Kong adolescents. For example, 39.9% of the respondents reported “feeling preoccupied with the internet or online services and think about it while off-line”; 42.4% of the students “stay online longer than originally intended”; and about 20% of the participants “risk the loss of a significant relationship, job, or educational or career opportunity because of online use.” Second, according to Young’s criterion, 26.4% of the respondents can be classified as internet addiction. Third, 19.2% of the students reported to “go online to escape problems or relieve feelings, such as helplessness, guilt, anxiety, or depression,” which indicate the possible psychological and psychiatric comorbidity. These figures clearly highlight the fact that internet addiction is a growing problem for Hong Kong adolescents.

**Table 2** Percentage of participants with internet addiction behavior.

Internet use behaviors in the past year	No		Yes	
	Number	%	Number	%
1. Feeling preoccupied with the internet or on-line services and think about it while off-line	1993	60.1	1324	39.9
2. Feeling a need to spend more and more time on-line to achieve satisfaction	2243	67.7	1072	32.3
3. Unable to control your on-line use	2561	77.3	752	22.7
4. Feeling restless or irritable when attempting to cut down or stop on-line use	2824	85.4	484	14.6
5. Stay on-line longer than originally intended?	1906	57.6	1404	42.4
6. Risk the loss of a significant relationship, job, or educational or career opportunity because of on-line use	2659	80.5	644	19.5
7. Lie to family members or friends to conceal excessive Internet use	2658	80.3	651	19.7
8. Go on-line to escape problems or relieve feelings, such as helplessness, guilt, anxiety or depression	2666	80.8	633	19.2
9. Showing withdrawal when off-line, such as increased depression, moodiness, or irritability	2902	88.0	395	12.0
10. Keep on using internet even after spending too much money on on-line fees	2962	89.9	331	10.1
Participants can be classified as internet addiction (Young’s criteria)	2364	73.6	847	26.4

### Correlates of internet addictive behaviors

First, to provide a general picture of the relationships among different variables, several basic statistical analyses were performed. Means and standard deviations for the variables under study are shown in Table 1. For the dependent variable, i.e., internet addiction scale score, descriptive statistics by different groups of gender, family economic status, parental marital status, and immigration status are summarized in Table 3. Pearson’s correlation coefficients among positive youth development constructs and internet addiction are also calculated and presented in Table 4 along with the Cronbach’s  $\alpha$  coefficients and mean inter-item correlations for all scales used.

Second, the predictive effects of participants’ demographic variables and positive youth development constructs on pathological use of the internet were examined in a multiple regression model. The results are presented in Table 5. Several significant findings can be highlighted. First, participants’ age was predictive of internet use behaviors: older students tended to display more pathological use of the internet than younger students. Second, participants with divorced parents were more likely to show internet addictive behaviors than participants with an intact family. Third, higher academic and school adjustment, general positive youth development score, and positive and clear identity significantly predicted a lower level of pathological use of the internet. Fourth, unexpectedly, both gender and immigration status did not show significant relationship with participants’ internet addiction. Fifth, the effect of family economic status on internet misuse was non-significant. The whole model explained 15% of the variance in adolescents’ internet addictive behaviors.

### Predictors of the occurrence of internet addiction

The results of logistic regression analysis are presented in Table 6. Using the probability of being diagnosed as internet addiction as the dependent variable, three factors are found to be significant predictors. First, having divorced parents increased the probability of meeting the diagnostic criterion

**Table 3** Means and standard deviations of internet addiction in different groups by gender, immigrant status, family economic status, and parental marital status.

	Internet addiction	
	Mean	Standard deviation
Overall	0.23	0.24
Gender		
Male	0.24	0.25
Female	0.22	0.23
Immigrant status		
Hong Kong	0.22	0.23
Mainland China	0.26	0.25
Family economic status		
Not receiving CSSA	0.23	0.24
Receiving CSSA	0.25	0.23
Parental marital status		
Divorced	0.28	0.26
Separated	0.25	0.22
Married	0.22	0.23
Remarried	0.26	0.24
Others	0.27	0.24

Means and standard deviations in the table are based on scale scores of internet addiction.

of internet addiction, with an odds ratio of 1.77 ( $p=0.01$ ). This indicates that students with divorced parents were 1.96 times more likely to be diagnosed as having internet addiction than students whose parents were in their first marriage. The second factor is academic and school competence. Participants who scored higher on academic performance were less likely to be classified as internet addiction ( $OR=0.69$ ,  $p<0.001$ ). Third, the general positive youth development score served as a protective factor for internet addiction, with an odds ratio of 0.46 ( $p<0.001$ ). This means that when the participant's score on general positive youth development constructs increases one point, the possibility of being diagnosed as having internet addiction would be reduced by half. Again, gender and immigration status were not significant predictors of internet addiction. Males and females showed similar probability of having internet addiction; and the number of internet addicts

**Table 4** Correlations among variables and reliabilities of scales.

	ASC	CBC	PA	GPYDQ	PIT	Cronbach's $\alpha$ (mean) <sup>a</sup>
ASC	–	–	–	–	–	0.67 (0.40)
CBC	0.26	–	–	–	–	0.82 (0.61)
PA	0.28	0.60	–	–	–	0.74 (0.59)
GPYDQ	0.37	0.79	0.74	–	–	0.88 (0.48)
PIT	0.40	0.71	0.63	0.75	–	0.82 (0.69)
NET	–0.22	–0.24	–0.26	–0.33	–0.27	0.79 (0.28)

NET, internet addiction; ASC, academic and school competence; CBC, cognitive-behavioral competencies second-order factor; PA, prosocial attributes second-order factor; GPYDQ, general positive youth development qualities second-order factor; PID, positive identity second-order factor. All correlations are significant at the 0.01 level. <sup>a</sup>Mean inter-item correlations.

**Table 5** Multiple regression analyses on students' internet use behavior.

	B	$\beta$	Sig	R <sup>2</sup>	R <sup>2</sup> change
First block					
Age	0.02	0.05	0.01		
Gender	–0.01	–0.02	0.40	0.01	0.01 <sup>a</sup>
Second block					
Immigration status	0.02	0.04	0.10		
Family economic status	0.00	0.00	0.96		
Parental marital status					
Parent_divorced	0.05	0.05	0.02		
Parent_separated	–0.01	–0.01	0.71		
Parent_remarried	0.04	0.03	0.15		
Parent_others	–0.02	–0.01	0.52	0.01	0.01 <sup>a</sup>
Third block					
ASC	–0.04	–0.11	0.00		
CBC	0.01	0.04	0.23		
PA	–0.01	–0.03	0.28		
GPYDQ	–0.09	–0.27	0.00		
PIT	–0.01	–0.07	0.04	0.15	0.13 <sup>b</sup>

<sup>a</sup> $p<0.01$ ; <sup>b</sup> $p<0.001$ ; immigration status: 1=immigrant from mainland China, 0=local participant; family economic status: 1=receiving Comprehensive Social Security Assistance (CSSA), 2=not receiving CSSA; ASC, academic school competence; CBC, cognitive behavioral competence; PA, prosocial attributes; GPYDQ, general positive youth development; PIT, positive and clear identity.

identified in immigrant adolescents from mainland China did not differ from that of local youth. These findings are basically consistent with the results of linear regression analysis.

**Table 6** Logistic regression analyses on students' internet addiction.

	B	Odds ratio	p-Value
First block			
Age	0.05	1.05	0.53
Gender	–0.08	0.93	0.93
Second block			
Immigration status	0.16	1.17	0.27
Family economic status (CSSA)	0.11	1.12	0.59
Parental marital status			
Parent_divorced	0.57	1.77	0.01
Parent_separated	0.14	1.15	0.69
Parent_remarried	0.40	1.50	0.11
Parent_others	–0.15	0.86	0.64
Third block			
ASC	–0.38	0.69	0.00
CBC	0.00	1.00	0.99
PA	–0.05	0.95	0.60
GPYDQ	–0.79	0.46	0.00
PIT	–0.02	0.98	0.80

Immigration status: 1=immigrant from mainland China, 0=local participant; family economic status: 1=receiving Comprehensive Social Security Assistance (CSSA), 2=not receiving CSSA; ASC, academic school competence; CBC, cognitive behavioral competence; PA, prosocial attributes; GPYDQ, general positive youth development; PIT, positive and clear identity.

## Discussion

This study suggests that internet addictive behaviors in Hong Kong adolescents are prevalent. The results demonstrate that internet addiction has become a serious youth development issue, which requires wider attention from helping professionals and policy makers. It was found that an older age was a risk factor for internet addiction, while good academic and school performance, high general positive youth development score, and positive and clear self-identity predicted a low level of internet addictive behaviors. The identification of these factors would be helpful to develop preventive strategies for internet addiction among local adolescents in Hong Kong. In particular, the use of positive youth development program can be regarded as a promising strategy in preventing internet addiction.

Using Young's criterion, the present study found that 26.4% of the participated students can be identified as internet addicts. The percentages of adolescents displaying different problematic internet use behaviors ranged from 10.1% to 42.4%. Compared with previous prevalence data on Hong Kong adolescents, the present results are generally higher than the rates reported earlier by other researchers (16, 17). Echoing Chan's study (16), this finding indicates that overuse of the internet has become a serious problem for the adolescent population in Hong Kong, and that the problem has intensified in recent years. Clearly, the increasing use of internet in different areas for various purposes, easy accessibility of the internet and implicit or explicit encouragement for internet use for adolescents may contribute to the growing number of young internet addicts. As with other addictive disorders, internet addiction is associated with impaired peer and family relationship, low academic performance, and a range of psychological problems, including depression, low self-esteem, high sense of loneliness, and compulsivity. Therefore, there is an urgent need in Hong Kong society for researchers, educators, parents, and policy makers to work together to solve this issue.

Meanwhile, the Chinese version of Young's 10-item questionnaire demonstrated satisfying reliability and validity in the present study, as reflected in the high internal consistency and the negative relationships with a list of positive youth development constructs (i.e., evidence of construct validity). Different measures and cut-off criterion of internet addiction have led to the inconsistent prevalence rates reported in the literature. Given the results of the present study, the validated Chinese version of Young's 10-item internet addiction questionnaire appears to be a promising instrument to assess pathological use of the internet for Chinese people. Future studies may utilize a wider range of respondents from different Chinese populations to further establish norms and validate cut-off points for the interpretation of this scale based on rigorous research design. In addition, there is a need to look at the relationship between internet addictive behavior and other clinical problems.

The present results also showed that, with age increases, adolescents tend to display more internet addictive behaviors. Previous studies suggest that compared to other age groups,

internet addiction is more likely to happen in adolescence and young adulthood because young people who are in the process of psychological and personality development may be particularly vulnerable to fostering addictive behaviors. It is possible that, within adolescence, the desire to develop a sense of identity and the need to build up intimate relationship for adolescents become increasingly stronger as they grow older (33). This may explain the finding that older adolescents showed more overuse of internet than younger adolescents. In addition, older adolescents tend to have more access to the internet either at home or in school than younger adolescents, which may also contribute to the positive association between age and internet addictive behaviors. The findings also suggest that early identification and prevention are important.

An unpredicted finding of this study is that internet addiction was unrelated to gender. Previous reports generally show that, as with other addictive behaviors, internet addiction is more common in males than in females. For example, Chou and Hsiao reported that only three out of a total of 54 internet addiction cases were female students based on a sample of more than 900 Taiwan college students (34). Scherer (35) found that dependent internet users included a significant larger proportion of men (71%) to women (29%) than the non-dependent users (50% are men and women). As discussed earlier, different instruments and cut-off criterion of internet addiction used in different studies may contribute to the inconsistent findings. In fact, researchers have reported that males and females used the internet differently. For example, Young reported that men tended to seek out dominant activities online while women sought out close friendships and virtual communications online (36). Therefore, if the instrument mainly assesses the applications that are more frequently engaged by males, apparently there would be more males than females being diagnosed as internet addiction. Besides, there are views suggesting that gender difference in internet addiction may simply be due to the fact that more men than women use the internet worldwide (21). This may not be the case in Hong Kong. According to a recent report (37), the percentage of male internet users (51.9%) is only slightly higher than female users (48.1%) in Hong Kong. With reference to adolescent population, the difference may be even smaller. Thus, the existence of gender difference among adolescents with internet addiction remains unclear and further work is needed.

It was found that having divorced parents significantly predicted internet addictive behavior. This is consistent with our prediction that non-intact family status may be a risk factor for internet addiction. Researchers have reported that children living with divorced parents tend to have high parent-adolescent conflicts and low levels of parent-child involvement, which would result in inadequate parental monitoring, and low family cohesion, which in turn would predict adolescents being predisposed to internet addiction (38). Moreover, adolescents who have conflicts with their parents often refuse to conform to the supervision of parents, including rules set for internet use. Lacking support from parents, adolescents living with divorced parents may seek social support from the interacting experiences on the internet. In fact, their excessive use of the internet may further aggregate their conflict with

parents, which forms a vicious circle between poor parent-child relationship and internet addiction, and makes the problem of addicting to the internet more difficult to solve (24). The observation is also consistent with the previous findings that parenting and parent-child relational processes and psychological well-being in adolescents growing up in non-intact families than those in intact families (39, 40).

Contrary to the hypothesis, immigrant youth from mainland China did not show more internet addictive behaviors than local adolescents. This indicates that immigrant youth may not have worse mental health status than local students in Hong Kong, despite the difficulties they might have encountered during adaptation. Researchers have found that positive youth development constructs, such as social competence and resilience, would help adolescents to cope with stress and adversity in a positive manner and prevent them from mental health problems (41–43). It is possible that immigrant youth had a higher level of positive youth development than local students. In fact, this possibility has been supported by a recent study which showed that as compared to local youth, immigrant adolescents exhibited higher levels of self-control, empathy, assertiveness, and the ability to read social cues (44). It would be interesting to further compare other positive youth development indicators between local and immigrant adolescents, and to examine how these factors may contribute to the mental health of immigrant and local students, respectively. While the present findings are intriguing, they must be interpreted with caution because students' immigration status in this study was measured by asking for their place of birth. Therefore, the identified immigrant youth actually include both new immigrants and those who have lived in Hong Kong for many years. These "old" immigrant adolescents may have been adapted to the Hong Kong society as well as local youth. Future research could focus on the mental health of new immigrant adolescents.

One of the most remarkable findings of the present study is the negative relationships between different positive youth development constructs and adolescent internet addiction. Participants who had higher academic and school competence, scored higher on the general positive youth development indicator, and had clearer and more positive identity, display less internet addictive behaviors. This provides evidence for positive youth development as a protective factor for adolescent problem behavior, including internet addiction. The implication is that internet addiction may be prevented through promoting positive youth development. Shek and Yu have reported that participants of the Project P.A.T.H.S., a program that aims to promote holistic positive development among adolescents, displayed higher levels of positive youth development and stronger ability to control internet use, compared to students without joining the program (30). However, the question of whether the improved self-control over internet results from the enhancement of different positive youth development constructs is not directly examined. The present finding that positive youth development constructs significantly predicted low probability of internet addiction provides a positive answer to this question. More in-depth studies are

needed to further examine how positive youth development constructs help to prevent internet addictive behaviors.

In summary, based on a large sample of secondary school students, this study examined the prevalence of internet addiction among Hong Kong adolescents and its relationship with a variety of psychosocial factors. It demonstrated that problematic use of the internet has become an emergent youth problem in Hong Kong, which deserves more attention from researchers and professionals. It was found that age and having divorced parents were risk factors for youth internet addiction while high academic competence, general positive youth development, and positive and clear identity prevented adolescents from developing internet addiction. Preventive strategies must be developed and implemented in a timely manner, with the identified risk and protective factors being considered. Such prevention programs/policies could incorporate age-specific components. More importantly, programs that promote positive youth development, such as the Project P.A.T.H.S., may represent a promising direction for preventing internet addiction among adolescents in the future (45, 46). In view of the lack of preventive and positive youth development programs in Hong Kong (47–49), there is a need to re-think about how positive youth development may help to reduce adolescent developmental problems in Chinese adolescents.

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## Conflict of interest statement

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