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Internet Addiction Amongst University Students Under COVID-19: Prevalence and Correlates

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Abstract:

Under COVID-19, because of extensive online learning and the use of the internet for communication, there is a risk of intensification of Internet addiction (IA) in young people. Unfortunately, there are very few related studies in different Chinese contexts, including Hong Kong. In this study, we examined several research gaps in the literature with reference to university students in Hong Kong: a) prevalence of IA; b) socio-demographic factors related to IA; c) relationships between IA and other mental health problems and stressors (i.e., comorbidity); and protective factors for IA.

To address the above research issues, we conducted an online survey in early 2021 (N = 1,648) using validated instruments on IA, psychological well-being, and stress. Based on the Young Internet Addiction Scale, roughly half of the respondents could be considered as showing excessive IA symptoms. Regarding demographic correlates of IA, younger students and those who experienced personal financial difficulty showed higher IA levels, and there was no observed gender difference. There were positive relationships between IA symptoms and mental health problems (depression, post-traumatic stress disorder, suicidal behavior, and hopelessness) and stresses (difficulties encountered and unmet psychosocial needs), suggesting co-morbidity of IA. IA was also negatively associated with positive psychological attributes such as flourishing and emotional competence, which could be regarded as factors protecting young people from IA. Results are discussed with reference to the different ecological risks and protective factors in IA amongst young people in the Chinese context.

Keywords: Internet addiction; Mental health problems; Positive psychological attributes

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1. Introduction

The internet has become indispensable in our everyday life (Hoffman et al., 2004; Hazar & Vikaliana, 2020; Klobas et al., 2018). Although the internet has made our life more convenient, excessive internet utilization could cause Internet addiction (IA), which is also known as “problematic internet use”, “compulsive internet use” or “pathological internet use” (Wallace, 2014). Excessive use of the internet would cause problems and stress in different domains, including psychological, social, academic, and occupational dimensions (Weinstein et al., 2014). For example, IA-related symptoms such as compulsivity and time management problem were specifically related to lower physical health: Dol (2016) found a positive relationship between IA and pain/fatigue; Sağar and Hülya (2022) showed that higher IA scores were associated with poorer sleep quality among university students. Regarding psychological

health, IA was commonly found coexisting with other mental disorders, including depression (Orsal et al., 2013), anxiety and psychosis (Alavi, 2011; Zhu et al., 2021), delinquency (Zhu et al., 2021) and substance abuse (Ko et al., 2006).

Unlike other mental disorders (e.g., substance abuse) which have clear diagnostic criteria (Nestler, 2014), there is still debate on whether IA is a mental disorder. While some scholars (e.g., Young, 1998) argued that IA should be regarded as a mental disorder, other scholars reasoned that IA should be treated as a result of other disorders rather than a primary mental disorder (Ko et al., 2012; Pies, 2009; Shaffer et al., 2000). As the internet is merely a platform rather than a substance, excessive use of it may merely represent a behavioral manifestation of a new medium (Ha et al., 2006). However, regardless of whether IA is a separate mental disorder, scholars agreed that effective interventions are important (Martins et al., 2020; Stip et al., 2016; Yu & Shek, 2018).

Among the various age groups, young people are the most vulnerable to IA. For example, Chung et al. (2019) found that 25.4% of adolescents in Hong Kong spent an average of 20-50 hours surfing the internet per week in 2007, and such figure increased to 42.0% in 2017. Also, university students have a high potential in developing IA because of academic pressure (Roberts & Seaman, 2018) and psychosocial challenges (Akgun & Ciarrochi, 2003). For example, Shao et al. (2018) found the prevalence of IA in college students in China was approximately 11%. Omoyemiju and Popoola (2021) also found a prevalence rate of 45% for mild and severe IA in university students in Nigeria. Seki et al. (2019) identified a prevalence rate of 58.5% for mild and severe IA in university students in Japan. Mak et al. (2014) reported that students in Hong Kong had the highest number of electronic devices owned by them; IA prevalence rate was also the highest among different Asian countries under study. Hence, there is a need to understand IA in young people, particularly university students, under COVID-19.

1.1 Internet addiction in university students under COVID-19

The COVID-19 pandemic has created much negative health consequences for people in different age groups, including students (Shek, 2021; Shek, Leung et al., in press). Although researchers have examined IA in university students, there are few studies to understand IA in college students under the pandemic, who are "forced" to have online learning and communication. Existing research reported a high prevalence of IA in university students under the COVID-19 pandemic: Jahan et al. (2021) reported that around 71% of Bangladeshi university students showed symptoms of IA; Olawade et al. (2020) found that 55% of university students in Nigeria could be classified as having IA; Gavurova et al. (2022) reported that rough one-third of students in Czech Republic and Slovakia could be classified as having excessive symptoms of IA. Some related studies have been conducted in mainland China: Jiang et al. (2020) and Xia et al. (2021) reported prevalence rates of IA to be 32.4% and 30.6%; Cai et al. (2021) found that 23.3% of the students could be regarded as having IA; Lin (2020) argued that school closure, social distancing restrictions, and related consequences had led students to heavily rely on the internet for meeting their psychosocial needs, hence increasing their risk of developing IA. There are studies showing that failure to meet the daily needs and confrontation with challenges and difficulties would lead to psychological morbidity (Shek, Zhu et al., 2022; Shek, Dou et al., 2022), which might predispose young people to be addicted to the internet. There are also studies showing that negative emotions are precursors of IA (Fernández-Villa et al., 2015; Gavurova et al., 2022).

Besides IA prevalence, sociodemographic correlates of IA also deserve attention (Shek, Lee et al., in press). With regard to age, while some studies showed a negative association between age and IA (e.g., Kumcagiz, 2019; Romero-López et al., 2021), some studies revealed no association between age and IA (e.g., Cai et al., 2021). Regarding socioeconomic status, IA was found to be associated with income status under COVID-19: Olawade et al. (2020) found that students who had no financial income during the pandemic were at higher risk of IA; Cai et al. (2021) reported that students having poor economic status were more likely to have IA than students with fair and rich economic status. Regarding gender differences, there are inconsistent findings. While some studies found gender had no significant association with IA (Cai et al., 2021; Shehata & Abdeldaim, 2021), some studies showed that gender was a significant predictor of IA. For example, Jiang et al. (2022) found that male students were more likely to have IA than did female students under COVID-19.

1.2 Risk factors of Internet addiction

Researchers have identified risk factors to understand the onset and development of IA (Ho et al., 2014). For example, experience of boredom under the COVID-19 pandemic was identified as one risk factor for IA (Olawade et al., 2020). According to the Theory of Triadic Influence (TTI; Petraitis et al., 1995), risk factors of addictive behaviours can be categorized into three types (intrapersonal, social/interpersonal, and cultural/attitudinal). In terms of psychological well-being, individuals who suffer from depression, anxiety, and stress are known to be vulnerable to developing IA. Based on the cognitive-behavioural model (Davis, 2001), researchers have suggested that individuals with emotional distress or other personal problems may use the internet as a means to reduce psychological discomfort, which in turn predisposes an individual to problematic internet use (Lam, 2014; Spada et al., 2008). Empirically, positive associations between IA and depression and anxiety (Cai et al., 2021; Jahan et al., 2021; Jiang et al., 2022) as well as stress (Song & Park, 2019; Zhao et al., 2021) were reported. Li, Hou et al. (2019) also showed that university students with higher levels of anxiety and depression had a higher risk to develop IA three and six months later.

Besides, individuals suffering from PTSD symptoms may develop maladaptive coping strategies, including avoidance. Research has shown that internet dependence may serve an avoidance function for individuals with PTSD symptoms (Hsieh et al., 2016). As a prolonged stressful event, COVID-19 may cause PTSD symptoms that would eventually lead to IA. Cui and Chi (2021) found that COVID-19-related PTSD symptoms among Chinese adolescents positively predicted IA. Besides, hopelessness is also an important risk factor for IA under COVID-19. However, existing findings on the relationship between hopelessness and IA are inconsistent. Chen and colleagues (2021) suggested that hopelessness could explain the presence of internet gaming disorder among Chinese university students with attention deficit and hyperactivity problems. However, a longitudinal study (Yu & Shek, 2018) based on three-wave data collected yearly reported a nonsignificant cross-lagged effect of hopelessness on IA.

Finally, although suicidal ideation and behaviour are commonly recognized as the consequences of IA (see Cheng et al., 2018; Sami et al., 2018), it is logically possible that they predict IA. Theoretically, internet dependence might result from avoiding negative feelings related to suicidal ideation and behaviour, with some indirect evidence for this hypothesis. Marschall-Lévesque et al. (2017) examined the reciprocal relationship between suicidal ideation and substance abuse with a cross-lagged design. They found that adolescent suicidal ideation could predict their alcohol abuse a year later but not vice versa, indicating that suicidal tendency was a determinant (but not a consequence) of addictive behaviour.

As COVID-19 creates many adaptation issues, we also argue that satisfaction of needs and difficulties encountered would also contribute to IA. Regarding needs satisfaction, the compensatory internet use theory proposes that individuals challenged by external hurdles that hinder their basic psychological needs satisfaction (e.g., relatedness) may turn to the internet to compensate for unsatisfied needs (Kardefelt-Winther, 2014a). For example, individuals with interpersonal difficulties used the internet as compensation for unmet needs for a sense of belonging and connection (Weidman et al., 2012), which further developed into internet dependence (Kardefelt-Winther, 2014b). Regarding difficulties encountered, according to the cognitive-behavioural model and compensatory internet use accounts (Davis, 2001; Gamez-Guadix, 2014), people go online to escape real-life issues. In addition, according to Baumeister's (2003) resource model of self-control, when the self's resources have been expanded somewhere else (e.g., dealing with issues met), the resources for self-control might be depleted, thus inhibiting self-regulation and predisposing individuals to addictive behaviours, including IA (Özdemir et al., 2014). Empirical studies have also linked low self-control to IA (Li et al., 2021).

1.3 Protective factors of Internet addiction

There are also research studies on the protective factors associated with IA, including intrapersonal and interpersonal factors (Koo & Kwon, 2014; Robertson et al., 2018). At the intrapersonal level, a set of factors have been identified, including self-esteem, life satisfaction, resilience, emotional competence, self-confidence, beliefs about adversity, and self-control (Awaluddin et al., 2019; Chen et al., 2020; Chung et al., 2019; Fumero et al., 2018; Li, Zhao et al., 2019; Yu & Shek, 2018; Yu & Shek, 2021; Yu & Zhou, 2021). Particularly, researchers have highlighted the importance of the protective role of life satisfaction, resilience, beliefs about adversity, and emotional competence. A meta-analysis based on studies on mainland Chinese college students showed negative linkages between internet overuse and life satisfaction, suggesting that an increase in levels of life satisfaction would help to prevent IA (Lei et al., 2020). Koo and Kwon (2014) also found that emotional regulation negatively predicted IA and considered it as one protective factor against IA among college students. Similarly, Khoshakhlagh and Faramarzi (2012) found emotional intelligence to be a significant predictor of IA and high levels of emotional stability and intelligence would help in preventing IA. Besides, Mak et al. (2018) found resilience was negatively associated with IA in Korean university students and the association between resilience and depression was mediated by IA. Robertson et al. (2018) also found that resilience was a strong protective factor for IA and online gaming, but not Facebook addiction. Furthermore, researchers reported negative associations between IA or problematic internet use and adversity beliefs or flourishing (Gudka et al., 2021; Hui et al., 2017; Yang et al., 2022). Xia et al. (2021) also reported that internal locus of control is a protective factor of IA under COVID-19.

Regarding interpersonal protective factors, there is support for the protective role of family relationship quality and family functioning in IA. Studies found that a detached family relationship was positively associated with IA (Hassan et al., 2020) and quality of family affective involvement was negatively associated with IA (Marzilli et al., 2020). Yan et al. (2014) also found a negative relationship between IA and perceived family functioning. In a meta-analysis conducted by Koo and Kwon (2014), relational ability/quality, parent relationship, and family functioning were identified as protective factors against IA although the protective effects of family factors on IA showed a decrease for college students and adults compared to middle and high school students. Fumero et al. (2018) also found self-esteem, social skills, and positive family functioning were protective factors of IA.

1.4 Research Gaps and the Present Study

While the existing literature indicated the prevalence and potential risk and protective factors of IA among university students, several research gaps could be identified. First, there is limited research on the prevalence of IA in university students under COVID-19, particularly in Hong Kong (Shek, Zhu et al., 2022; Shek, Dou et al., 2022). Whether the prevalence of IA would increase during the pandemic should be investigated because of the heavy reliance on the internet amongst students during the pandemic. Second, as there is inconsistency in findings on sociodemographic correlates of IA, further research is needed. Third, there is limited research on predicting effects of risk and protective factors on IA in university students during the pandemic.

Based on the above discussion, the present study aimed to investigate the prevalence, socio-demographic correlates of, and risk and protective factors for IA in university students in Hong Kong during the pandemic. In specific, several research questions were investigated:

1. What is the extent of the IA problem among Hong Kong university students? With reference to the previous Chinese findings that around 30% of students could be regarded as "internet addicted", we expected that IA prevalence would be pervasive (Hypothesis 1).
2. What are the sociodemographic factors related to IA in university students in Hong Kong? As students would become more mature and have more coping resources, we expected that age would be negatively related to IA (Hypothesis 2a). Besides, as the financial strain has been found to be related to IA, we predicted that financial strain would be positively related to IA (Hypothesis 2b).
3. What are the relationships between IA and other mental health problems indexed by mental health problems, suicidal behaviour, hopelessness, unmet psychosocial needs, and difficulties encountered? Based on the notion of "comorbidity", we expected that IA would be positively related to different measures of psychological morbidity, unmet psychosocial needs, and challenges encountered (Hypothesis 3).
4. What are the relationships between difficulties encountered, stress, and IA? We predicted that difficulties encountered would be positively related to stress and IA (Hypothesis 4), with stress serving as a mediating factor (Hypothesis 5).
5. Is IA related to positive psychological constructs indexed by life satisfaction, flourishing, beliefs about adverse conditions, resilience, emotional competence, and family functioning? Based on different theories of positive psychology, we hypothesized that IA would be negatively related to positive psychological constructs (Hypothesis 6).

2. Materials and Methods

2.1 Participants and Procedures

The participants were undergraduate students at one university in Hong Kong. They were recruited based on quota sampling in which students' faculty and year of study were the adopted stratifying factors. Due to the reason that the campus was partially closed due to the spreading of COVID-19 and most of the courses were changed to online or hybrid mode, the data were collected through an online survey platform *Qualtrics XM* from January to March 2021. Before conducting the survey, the invited students were asked to carefully read an

information sheet stating the research purposes and confidentiality of data, and formal consent was obtained from each participating student. For each participant, a HK$100 supermarket coupon was provided as an incentive.

In total, 1,648 students completed the survey questionnaire. The participants reported a mean age of 20.09 ± 1.38 years old, with 854 (51.8%) being female. Of all participants, 97.9% were local and only 2.1% were international students, including those from mainland China. Regarding the financial situation, 96.8% of the participants' families were not receivers of the "Comprehensive Social Security Assistance" (CSSA) Scheme. In addition, 21.3% of the participants indicated that their families were experiencing financial difficulties and 29.2% of them indicated that they had personal financial difficulties during the period of the survey.

2.2 Instruments

2.2.1 Young's 10-item Internet Addiction Test (IAT-10)

Internet addiction was assessed using "Young's 10-item Internet Addiction Test" (IAT-10) (Young, 1998). The IAT-10 is a self-report scale which includes 10 symptoms related to addictive use of the internet. The Chinese scale was validated by Shek and his colleagues (2008) and demonstrated good reliability in previous studies (Shek & Yu, 2012, 2016). For each item, the students need to answer whether they experience the specified symptom in the past 12 months through a binary rating scale with "1" = "*Yes*" and "0" = "*No*". The score of IA was the sum of all item scores. Based on Young's criteria, of the 10 addictive symptoms, demonstrating four or more symptoms (i.e., having a total score ≥ 4) can be classified as having an IA problem (Shek & Yu, 2016).

2.2.2 Depression Anxiety Stress Scale (DASS-21)

DASS-21 (21 items) measures three mental health symptoms: depression, anxiety, and stress, with each symptom being assessed by seven items. DASS-21 was widely used in different countries and cultural groups (Jiang et al., 2020) and shown to have good psychometric properties (Henry & Crawford, 2005; Mellor et al., 2015). All the items were answered on a scale of four points ("0" = "*Not at all*" to "3" = "*Most of the time*"). The score of each subscale was the sum of all item scores.

2.2.3 Post-Traumatic Stress Disorder During the Pandemic (PTSD)

PTSD during the pandemic was measured using the Trauma Screening Questionnaire (TSQ). TSQ includes 10 items asking whether the participant had experienced different post-traumatic symptoms at least twice a week during the COVID-19 pandemic with a binary rating scale ("0" = "*have not experienced*"; "1" = "*have experienced*"). The scale score is the sum of all item scores.

2.2.4 Centre for Epidemiological Studies Depression Scale Revised (CESD-R)

Besides DASS-Depression, depression was also measured using CESD-R. With 20 items, CESD-R assesses depressive disorder through nine symptom groups according to the "American Psychiatric Association Diagnostic and Statistical Manual" (DSM-V) (Eaton et al., 2004; Radloff, 1977). The measure was widely used in different research assessing depression and was shown to possess good psychometric properties (Ip et al., 2016; Li et al., 2019). For

each item, the participant was asked to indicate whether he/she felt or acted in a stated way through a scale with five points ("0" = "*Not at all or less than 1 day*" to "4" = "*Nearly every day for 2 weeks*"). The total score was obtained by summing the item scores.

2.2.5 Suicidal Ideation and Suicidal Behavior

Suicidal ideation was measured using the Suicidal Ideation subscale of CESD-R which includes two items "*I wished I were dead*" and "*I wanted to hurt myself*". Each item was evaluated on a scale with five points ("0" = "*Not at all or less than 1 day*" to "4" = "*Nearly every day for 2 weeks*"). Suicidal behaviour was assessed using a scale with three items asking whether the participants have had suicidal thoughts, suicidal plans, and suicidal attempts in the past twelve months ("1" = "*Yes*" and "0" = "*No*") (Shek & Yu, 2012).

2.2.6 Hopelessness

We used a modified scale based on the "Beck Hopelessness Scale" (Beck et al., 1974) to measure hopelessness. The scale includes five items assessing the level of personal hopelessness about life through a scale with six points ("1" = "*Strongly disagree*" to "6" = "*Strongly agree*"). For example, one item was "*I could foresee that my future is miserable*".

2.2.7 Needs Unmet During COVID-19

The measure includes 15 items assessing students' needs in different aspects of their life such as academic study and social life (Shek, Dou et al., 2022). Through a six-point scale, the participants indicated how well their needs were satisfied in the past year. To assess students' needs unmet. The score of each item was reverse coded to obtain the mean score of the scale.

2.2.8 Difficulties Encountered Under COVID-19

Difficulties encountered under COVID-19 were measured by 24 items, corresponding to difficulties and challenges in different aspects such as physical, emotional, educational, family, social, and career aspects and so on. Each item was evaluated on a scale of five points. The score of the scale was the mean score of all items.

2.2.9 The Satisfaction with Life Scale (SWLS)

SWLS was employed to assess life satisfaction (Diener et al., 1985). It assesses one's overall satisfaction with life through five items, with each item being rated on a scale of six points ("1" = "*Strongly disagree*" to "6" = "*Strongly agree*"). The total score was gained by averaging all item scores.

2.2.10 Flourishing Scale

The Flourishing Scale (FS) includes eight items measuring an individual's psychological well-being in terms of self-perceived success in different aspects of life, including purposes, psychological functioning, social relationships, self-esteem and so on (Diener et al., 2010). All the items were evaluated on a scale of seven points ("1" = "*Strongly disagree*" to "7" = "*Strongly agree*"). The score of the scale was the mean score of all items.

2.2.11 Beliefs of Adversity

The beliefs of adversity were measured by the "Chinese Cultural Beliefs about Adversity" (CBA) scale developed by Shek et al. (2003). The scale has nine items corresponding to nine traditional Chinese sayings reflecting different beliefs about adversity. Seven items correspond to positive beliefs about adversity and two items correspond to negative beliefs about adversity. The participants need to indicate whether they agree or do not agree with the saying in each item through a scale with six points ("1" = "*Strongly disagree*" to "6" = "*Strongly agree*"). The score of the scale was the average of all item scores.

2.2.12 Resilience and Emotional Competence

Resilience and emotional competence were measured using the subscale of resilience (three items) and the subscale of emotional competence (three items) in the "Chinese Positive Youth Development Scale" (CPYDS) (Shek et al., 2007). The CPYDS was developed referring to the 15 constructs of PYD proposed by Catalano et al. (2004). All the items were evaluated on a scale with six points ("1" = "*Strongly disagree*" to "6" = "*Strongly agree*"). The average score of all items was generated as the total score.

2.2.13 Family Functioning

Family functioning was measured by three subscales in the "Chinese Family Assessment Instrument" (C-FAI) (Shek, 2002). In total, the C-FAI consists of five subscales: "Family Communication", "Family Mutuality", "Family Conflict", "Parental Concern", and "Parental Control". The first three subscales were selected to measure family functioning in this study as they measure family interaction. The items are answered on a scale of five points ("1" = "*Very unlike*" to "5" = "*Very like*"). The total score was the mean score of all items, with scores of the three items in the Family Conflict subscale being reversely coded.

2.3 Data Analyses

First, the mean score, standard deviation, internal consistency, and mean inter-item correlation of each major variable were computed. To examine the prevalence of IA, the frequency and percentage of participants' responses to each item in the IAT and the frequency and percentage of the participants who display IA symptoms based on Young's criteria were computed. Then, we run hierarchical multiple regression to test the predictive power of different risk factors, including DASS-Depression, DASS-Anxiety, DASS-Stress, PTSD, CESD, suicidal ideation, suicidal behaviour, hopelessness, needs unmet, and difficulties encountered on IA with demographic factors being controlled. Also, PROCESS was run to examine the mediating effect of DASS-Stress on the predicting effect of Difficulties Encountered on IA. Finally, hierarchical multiple regression was run to test the predicting effects of different protective factors, including life satisfaction, flourishing, beliefs of adversity, resilience, emotional competence, and family functioning during COVID-19 on IA, with demographic factors being controlled. SPSS Version 25 was used to do all the analyses.

3. Results

Table 1 shows the descriptive statistics and reliability indicators of the major variables. All the scales possessed good internal consistency (a = 0.75 - 0.96) except for suicidal behavior for which a = 0.57.

Table 1
Descriptive Statistics of the Major Variables

Variables	Mean (SD)	Cronbach's a (Mean inter-item correlation)
Internet Addiction	3.78 (2.61)	0.75 (0.23)
Risk Factors		
DASS-Depression	5.91 (4.43)	0.88 (0.52)
DASS-Anxiety	5.39 (4.15)	0.86 (0.47)
DASS-Stress	6.27 (4.46)	0.89 (0.55)
PTSD	3.63 (2.62)	0.75 (0.23)
CESD	18.82 (15.21)	0.96 (0.52)
Hopelessness	3.41 (0.85)	0.83 (0.49)
Suicidal Ideation	0.99 (1.64)	0.81 (0.68)
Suicidal Behavior	0.07 (0.18)	0.57 (0.36)
Needs Unmet	3.22 (0.73)	0.89 (0.34)
Difficulties Encountered	3.10 (0.60)	0.91 (0.30)
Protective Factors		
Life Satisfaction	2.56 (0.56)	0.87 (0.58)
Flourishing	4.50 (1.01)	0.91 (0.57)
Beliefs of Adversity	3.89 (0.65)	0.79 (0.30)
Resilience	4.03 (0.82)	0.78 (0.55)
Emotional Competence	3.97 (0.89)	0.81 (0.59)
Family Functioning	3.31 (0.58)	0.77 (0.28)

3.1 Internet addiction symptoms and socio-demographic correlates

Table 2 shows the frequencies and percentages of different IA behaviors reported by the students in the past 12 months and the prevalence rate of IA based on Young's criteria. The percentages of different IA behaviors ranged from 21.9% to 57.8%. Particularly, the students reported high percentages in the behaviors of "stay online longer than originally intended" (57.8%), "feel a need to spend more and more time online to achieve satisfaction" (48.2%), "feeling preoccupied with the internet or online services and think about it while offline" (46.2%), and "use the internet as a way of escaping from problems or of relieving a dysphoric mood" (46.2%). Based on Young's criteria (endorsement of four or more symptoms), the prevalence rate of IA is 51.9% in the present study. Table 3 shows the significant relationships between IA and age (r = -0.07, p < 0.01), year of study (r = -0.05, p < 0.05), and personal financial difficulties (r = -0.08, p = 0.001).

Table 2
Prevalence of Internet Addiction and Participants' Responses to The Items in The Internet Addiction Test

Items in The Internet Addiction Test (Internet use behaviors in the past 12 months)	Yes		No	
	N	%	N	%
1. Do you feel preoccupied with the internet or online services and think about it while offline?	761	46.2	887	53.8
2. Do you feel a need to spend more and more time online to achieve satisfaction?	795	48.2	853	51.8

3. Have you repeatedly made unsuccessful efforts to control, cut back, or stop internet use?	675	41.0	973	59.0
4. Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop internet use?	622	37.7	1026	62.3
5. Do you stay online longer than originally intended?	953	57.8	695	42.2
6. Have you jeopardized or risked the loss of a significant relationship, job, educational or career opportunity because of the internet?	413	25.1	1235	74.9
7. Have you lied to family members, teachers, social workers, or others to conceal the extent of involvement with the internet?	416	25.2	1232	74.8
8. Do you use the internet as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)?	761	46.2	887	53.8
9. Do you keep returning even after spending too much money on online fees?	361	21.9	1287	78.1
10. Do you feel depressed, irritable, moody, or anxious when you are offline?	475	28.8	1173	71.2
Participants can be classified as having internet addiction (Young's criteria: A person is classified as "internet addiction" if he/she shows 4 or more of the listed behaviors.)	856	51.9	792	48.1

Table 3

Demographic Correlates of Internet Addiction

Demographic Variables	Internet Addiction
Age	-0.07**
Gender	0.01
Year of Study	-0.05*
Local or International Student	0.04
Family receiving CSSA or not	0.02
Family experiencing financial difficulties at the present time	0.01
Personal experiencing financial difficulties at the present time	-0.08[a]

Note. $*p < 0.05$; $**p < 0.01$; $^{a}p = 0.001$

3.2 Risk factors and protective factors

Table 4 shows IA was significantly correlated with all the ten risk factors, including DASS-Depression, DASS-Anxiety, DASS-Stress, PTSD, CESD, suicidal ideation, suicidal behavior, hopelessness, needs unmet, and difficulties encountered (r ranged between 0.07 and 0.86, $p < 0.001$). However, as DASS-Depression, DASS-Anxiety, and DASS-Stress had high multicollinearity with all other risk factors (VIF values are over 4), the three variables were not included in the hierarchical multiple regression. Results of hierarchical multiple regression (Table 5) showed that after controlling the effects of demographic variables, IA was significantly predicted by PTSD, CESD, suicidal behavior, hopelessness, needs unmet, and difficulties encountered (β ranged between 0.043 and 0.400, $p < 0.01$, Cohen's f^2 ranged between 0.002 and 0.185). A separate hierarchical multiple regression was run to test the predictive effects of DASS-Depression, DASS-Anxiety, and DASS-Stress on IA (Table 6). After controlling the effects of demographic factors, IA was significantly predicted by DASS-Depression and DASS-Stress ($\beta = 0.162$ and 0.252, $p < 0.001$, Cohen's $f^2 = 0.008$ and 0.014, respectively), while there was no significant predicting effect of DASS-Anxiety on IA.

Table 4

Correlation of Internet Addiction and Risk Factors (DASS, PTSD, CESD, Suicidal Ideation, Suicidal Behavior, Hopelessness, Needs Unmet and Difficulties Encountered)

	1	2	3	4	5	6	7	8	9	10
1. Internet Addiction	-									
2. DASS-Depression	0.33***	-								
3. DASS-Anxiety	0.29***	0.79***	-							
4. DASS-Stress	0.35***	0.85***	0.86***	-						
5. PTSD	0.53***	0.36***	0.36***	0.40***	-					
6. CESD	0.39***	0.76***	0.73***	0.76***	0.43***	-				
7. Suicidal Ideation	0.20***	0.47***	0.48***	0.47***	0.22***	0.68***	-			
8. Suicidal Behavior	0.21***	0.29***	0.26***	0.28***	0.16***	0.33***	0.37***	-		
9. Hopelessness	0.24***	0.43***	0.36***	0.36***	0.23***	0.38***	0.21***	0.10***	-	
10. Needs Unmet	0.19***	0.22***	0.13***	0.18***	0.24***	0.26***	0.20***	0.12***	0.18***	-
11. Difficulties Encountered	0.34***	0.44***	0.41***	0.46***	0.35***	0.40***	0.07***	0.08***	0.27***	0.15***

*Note. ***p < 0.001*

Table 5

Hierarchical Multiple Regression Results on Predicting Effects of Risk Factors on Internet Addiction

Predictors	**Internet Addiction**		
Step 1	**β**	**t**	**Cohen's f^2**
Age	-0.076	-2.124*	0.003
Gender	0.014	0.557	0.000
Year of Study	-0.004	-0.117	0.000
Local or International Students	0.048	1.908	0.002
Family Receiving CSSA	0.029	1.181	0.001
Family Experiencing Financial Difficulty	0.047	1.759	0.002
Personal Experiencing Financial Difficulty	-0.105	-3.918***	0.009
R2	0.018		
F	4.223***		
Step 2	**β**	**t**	**Cohen's f^2**
PTSD	0.400	17.461***	0.185
CESD	0.163	4.867***	0.014
Suicidal Ideation	-0.056	-1.914	0.002
Suicidal Behaviour	0.089	4.087***	0.009
Hopelessness	0.054	2.465*	0.003
Needs Unmet	0.043	2.031*	0.002
Difficulties Encountered	0.103	4.403***	0.011
R2	0.353		
R2 Change	0.336		
F	63.714***		

*Note. *p < 0.05; ***p < 0.001*

Table 6

Hierarchical Multiple Regression Results on Predicting Effects of Risk Factors on Internet Addiction

Predictors	**Internet Addiction**		
Step 1	**β**	**t**	**Cohen's f^2**
Age	-0.076	-2.124*	0.003
Gender	0.014	0.557	0.000
Year of Study	-0.004	-0.117	0.000
Local or International Students	0.048	1.908	0.002
Family Receiving CSSA	0.029	1.181	0.001
Family Experiencing Financial Difficulty	0.047	1.759	0.002
Personal Experiencing Financial Difficulty	-0.105	-3.918***	0.009
R2	0.018		
F	4.223***		
Step 2	**β**	**t**	**Cohen's f^2**
DASS-Depression	0.162	3.633***	0.008
DASS-Anxiety	-0.045	-0.993	0.001
DASS-Stress	0.252	4.676***	0.014
R2	0.145		
R2 Change	0.127		
F	27.708***		

*Note. *p < .05; ***p < 0.001*

PROCESS was conducted to test the hypothesized mediating role of DASS-Stress on the predicting effect of difficulties encountered on IA (Table 7). With regard to the total effect, difficulties encountered positively predicted IA (β = 0.34, t = 14.58, p < 0.001). With regard to the mediating function of DASS-Stress, difficulties encountered significantly and positively predicted DASS-Stress (β = 0.46, t = 20.81, p < 0.001) and DASS-Stress significantly and positively predicted IA (β = 0.24, t = 9.53, p < 0.001). Bootstrapping with 5,000 samples showed a significant indirect effect (Point estimate = 0.11, 95%CI = 0.09 – 0.13). Hence, DASS-Stress partially mediated the relationship between difficulties encountered and IA.

Finally, Table 8 shows the significant correlations between IA and life satisfaction, flourishing, beliefs of adversity, resilience, emotional competence, and family functioning (r ranged between -0.20 and -0.08, p < 0.01). Hierarchical multiple regression analyses (Table 9) showed that IA was significantly predicted by flourishing (β = -0.131, p < 0.001, Cohen's f^2 = 0.009), and emotional competence (β = -0.097, p < 0.01, Cohen's f^2 = 0.005).

Table 7

Mediating Effect Analyses of DASS-Stress (The Mediator) on The Effect of Difficulties Encountered on Internet Addiction

Regression model for Internet Addiction (DV)	**Difficulties encountered (IV)**		
	β	***SE***	***t***
Total effect of IV on DV	0.34	0.10	14.58***
IV to Mediator (DASS-Stress)	0.46	0.16	20.81***
Mediator to DV	0.24	0.01	9.53***
Direct effect of IV on DV	0.23	0.11	8.97***
Mediating effect	Point estimate	Bootstrapping (BC 95% CI)	
		Lower	Upper

	0.11	0.09	0.13

*Note. *** $p < 0.001$*

Table 8

Correlation of Internet Addiction and Protective Factors (Life Satisfaction, Flourishing, Beliefs of Adversity, Resilience, Emotional Competence, Family Functioning, and Needs Met)

	1	2	3	4	5	6	7
1. Internet Addiction	-						
2. Life Satisfaction	-0.11***	-					
3. Flourishing	-0.20***	0.43***	-				
4. Beliefs of Adversity	-0.12***	0.23***	0.53***	-			
5. Resilience	-0.15***	0.36***	0.65***	0.54***	-		
6. Emotional Competence	-0.18***	0.37***	0.62***	0.51***	0.67***	-	
7. Family Functioning	-0.08**	0.23***	0.40***	0.31***	0.30***	0.30***	-

*Note. **$p < 0.01$; ***$p < 0.001$*

Table 9

Hierarchical Multiple Regression Results on Predicting Effects of Protective Factors on Internet Addiction

Predictors	**Internet Addiction**		
Step 1	**β**	**t**	**Cohen's f^2**
Age	-0.076	-2.124*	0.003
Gender	0.014	0.557	0.000
Year of Study	-0.004	-0.117	0.000
Local or International Students	0.048	1.908	0.002
Family Receiving CSSA	0.029	1.181	0.001
Family Experiencing Financial Difficulty	0.047	1.759	0.002
Personal Experiencing Financial Difficulty	-0.105	-3.918***	0.009
R2	0.018		
F	4.223***		
Step 2	**β**	**t**	**Cohen's f^2**
Life Satisfaction	-0.020	-0.725	0.001
Flourishing	-0.131	-3.637***	0.009
Beliefs of Adversity	-0.014	-0.450	0.001
Resilience	0.008	0.217	0.000
Emotional Competence	-0.097	-2.767**	0.005
Family Functioning	-0.009	-0.336	0.001
R2	0.066		
R2 Change	0.048		
F	8.813***		

*Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$*

4. Discussion

This study investigated the prevalence of IA, its sociodemographic correlates, and risk and protective factors among university students in Hong Kong. There are several unique features of the study. First, this study is among the few studies examining the adjustment of university students under COVID-19, which focused on IA. The present study fills the research gap by investigating the IA in university students in Hong Kong during the pandemic. Second, this study employed a large sample size which is uncommon in other existing studies. With a large sample size, the estimation would be more precise, and the generalizability of the results would increase (Roessner, 2014). Third, this study involved multiple risks and protective factors to IA which were considered important during the pandemic, while existing studies normally focused on one or two predicting factors. By employing multiple risk and protective factors, the study could gain a more comprehensive picture of the relative predictive effects of different risk and protective factors on IA. Finally, we examined the mediating role of stress in the influence of difficulties encountered on IA.

Regarding the prevalence of IA, results from the present study showed a high prevalence (51.9%) of IA in university students in Hong Kong during the pandemic, which gives support to Hypothesis 1. Comparatively, the prevalence rate in this study is slightly higher than the rates identified in other research such as 28.4%-32.4% in mainland China (Jiang et al., 2022; Zhao et al., 2021), 45.1% in Lithuania (Gecaite-Stonciene et al., 2021), and 33.2% in Slovakia (Gavurova et al., 2022). Besides, the prevalence rate in the present study is also higher than the prevalence rates in studies before the pandemic (e.g., 44.6% in Nigeria, Omoyemiju & Popoola, 2021; 31.51% in Iran, Salarvand et al., 2022; 25.5% in Vietnam, Lan et al., 2020). As the pandemic has posed significant challenges to college students in their developmental tasks due to different restriction measures, with high stress and non-satisfaction of developmental needs, there would be an increased risk for using the internet as compensation or maladaptive coping to avoid or escape from negative feelings.

Regarding sociodemographic correlates, the existing literature is inconclusive on the association between age and IA. Some studies showed no association (e.g., Canan et al., 2012; Younes et al, 2016) while some studies showed a significant negative association between age and IA among university students (e.g., Kumcagiz, 2019; Miskulin et al., 2022; Orsal et al., 2013; Romero-López et al., 2021). In another study, Shek et al. (2022) also showed that age was negatively related to depression. Results of the present study add evidence to the existing literature, suggesting that age could be a potential factor correlated with IA among university students, thus giving support to Hypothesis 2a. One possible explanation might be that younger age is associated with weaker emotional management and decreased self-regulation (Li et al., 2021; Romero-López et al., 2021). In addition, the results of this study showed that experiencing personal financial difficulty was positively correlated with IA under COVID-19 (Hypothesis 2b). Servidio et al. (2021) argued that economic difficulties during the pandemic period would bring a high level of stress which would trigger addictive behaviour such as IA. Some earlier studies also identified that financial problem was an important trigger of the symptoms of IA (Young, 1998). Similar to the explanation of other triggers, university students may use the internet as an approach to escape from the stress created by financial difficulties, which increases their risk of being addicted to it.

Interestingly, the present study found no gender difference in students' scores of IA which is not consistent with many of the existing findings indicating male students tend to have a higher level of IA than female students (e.g., Anand et al., 2018; Bhandari et al., 2017; Salehi

et al., 2014). Some scholars argued that the non-significant association between gender and IA may be due to the reason that the influence of gender was influenced by other demographic variables (Kocak et al., 2021) and other factors such as cultural and community values (Khan et al., 2017). Therefore, more studies should be conducted in the future to understand the interacting effect of gender with other demographic factors such as culture.

Regarding comorbidity and risk factors, the present study showed that depression, stress, PTSD, suicidal behaviour, and hopelessness significantly positively predicted IA among university students during the pandemic (i.e., support for Hypothesis 3). The findings are consistent with existing research on the positive relationship between mental health problems and IA. For example, depression was positively associated with IA in university students in different countries, including Turkey (Orsal et al., 2013), Japan (Seki et al., 2019), China (Yang et al., 2022), and the United States (Younes et al., 2016). Existing studies also revealed that stress positively predicted IA in university students (Lan et al., 2020; Mamun et al., 2019; Younes et al., 2016). Besides, existing studies showed that PTSD was also a potential risk factor for IA and a mediator of the predicting effect of other factors such as social support and impulsivity on IA (Cui & Chi, 2021; Evren et al., 2019). Findings from the present study further extend the existing literature by showing that depression, stress, and PTSD were significant predictors of IA in university students during the pandemic.

With regard to hopelessness, while it was identified as a risk factor for students' mental health (Oyekcin et al., 2017; Nalipay & Ku, 2019), there are few studies on the effect of hopelessness on IA in university students. As students' feelings of hopelessness might be elevated during the pandemic and their reliance on the internet would greatly increase, it is important to understand the predictive effect of hopelessness on IA during this special period. The present study suggests that hopelessness is a potential risk factor for IA in university students, particularly during the pandemic. Furthermore, the literature on IA and suicidal behaviour mainly focused on adolescents and mainly examined the predicting effect of IA on suicidal behaviour (Lin et al., 2014; Pan & Yeh, 2018). The present study indicated that suicidal behaviour would also be a potential risk factor for IA during the pandemic.

The present study also found that students' needs dissatisfaction and difficulties encountered during the pandemic significantly predicted their IA. Previous studies showed that dissatisfaction with psychological needs was a unique positive predictor of problematic mobile phone use (Hong et al., 2020). Conversely, students with higher satisfaction of psychological needs tended to display lower IA (Arpaci et al., 2018). The finding of the present study, together with other existing findings (Shek, Dou et al., 2022; Shek, Zhu et al., 2022), further confirm that needs dissatisfaction could be a risk factor for IA, which also supports the theory that students with unmet needs tend to overly rely on the internet as a compensatory or substituted approach to compensate for their unmet needs (Wong et al., 2015). Besides, the present study also showed that difficulties encountered by students in their different aspects of life during the pandemic positively predicted their IA, which is novel in the existing literature. In particular, we found that stress served as a mediator of the influence of difficulties encountered on IA (i.e., support for Hypothesis 4 and Hypothesis 5). Taken together, these findings have significant implications for understanding risk factors for IA during the pandemic as students' needs satisfaction would be greatly hindered and they may encounter greater difficulties during the pandemic.

Regarding protective factors, findings from the existing study showed that flourishing and emotional competence were two unique protective factors of IA during the pandemic (i.e.,

support for Hypothesis 6). Flourishing refers to optimal development and positive functioning in different aspects such as happiness, positive psychological functioning, and social functioning, and meaning and purpose in life (Hui et al., 2019). Existing literature indicates that flourishing is a potential protective factor for university students (Ghasemi & Ghamarani, 2015; Uysal, 2015). However, there are few studies on the predicted effect of flourishing on IA in university students. Besides, consistent with existing literature (e.g., Dou & Shek, 2021), the present study showed that emotional competence was a significant negative predictor of IA in university students. When facing adversities or greater stressors, students with high emotional competence would regulate their emotions and adopt positive and healthy coping strategies instead of maladaptive coping strategies such as problematic use of the internet (Dou & Shek, 2021). Interestingly, the present study found no significant predicting effect of family functioning on IA in university students during the pandemic in Hong Kong. This finding is inconsistent with many existing studies indicating that family functioning is an important protector of IA (e.g., Shi et al., 2017; Yan et al., 2014). One possible explanation might be that many existing studies were conducted on adolescents. As mentioned earlier, university students are normally at the stage of late adolescence and early adulthood whose major tasks are seeking independent identity and establishing an intimate relationship. During this developmental stage, the protective role of family relationship might be weaker and may not compensate for other psychological needs.

5. Conclusion

The present study has theoretical implications. Primarily, the present study reinforces the previous findings and supports the theoretical proposition that IA could be a maladaptive or compensative coping strategy to help adolescents and university students escape or avoid negative emotions or feelings created by psychological distresses or negative life events such as COVID-19. It also supports the theoretical assumption that healthy functioning such as flourishing and emotional competence plays an important role in reducing IA as they help to regulate negative emotions and promote positive emotions with which the students would be less likely to adopt maladaptive coping. For practical implication, findings from the present study highlight several unique risks and protective factors of IA during the pandemic. Intervention or prevention of IA during the pandemic should pay particular attention to these unique factors.

Nevertheless, the limitations of the present study should be noted. First, the present study was based on cross-sectional data which actually could not draw a conclusion on the causal relationship between variables. Longitudinal research should be conducted in future to further examine the relationship among variables. Second, while there was a large sample size, the participants were from one university in Hong Kong. Further studies should employ participants from different universities. Third, we adopted a short version of IAT. Further research should be conducted based on the full version of IAT to verify the relationships. Despite these limitations, the findings of the present study shed light on the prevalence and risk and protective factors of IA during the pandemic, which contributes to understanding and prevention of IA in general literature and during the pandemic.

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Data Availability and Release Statement:

For the data supporting the results reported in this paper, please contact the corresponding author.

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Conflicts of Interest:

The authors declare no conflict of interest.

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