



Using Moderated Mediation Modelling and the Interaction of Person-Affect-Cognition-Execution Model to Explore Relationships between Psychological Distress, Specific Addictive Behaviors, and Quality of Life across Taiwan, Malaysia, Hong Kong, and China

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Abstract

Internet-related addictive behaviors are a public health concern, especially in Asian jurisdictions. Guided by theory, the present study employed moderated mediation modeling using cross-sectional data from Taiwan, Malaysia, Hong Kong, and China to explore relationships between psychological distress, internet-related addictive behaviors, and quality of life (QoL). Jurisdictional differences were also explored. Using snowball sampling to recruit online data, 6,074 participants aged 18 years or older were recruited. Moderated mediation models suggested that psychological distress was related to all internet-related addictive behaviors, and specific behaviors were related to poor QoL in specific domains: gaming addiction to physical and social QoL, shopping addiction to physical, social, and environmental QoL, social networking addiction to all QoL domains, and pornography addiction and gambling addiction to psychological and social QoL (albeit more weakly). Jurisdictional variations were observed, with stronger associations in Taiwan and China compared to Malaysia and Hong Kong. The findings suggest important relationships between psychological distress, internet-related addictive behaviors, and QoL. They also suggest a need for culturally tailored interventions that address psychological distress and specific internet-related addictive behaviors to improve QoL.

Introduction

Quality of life (QoL) is a multidimensional concept that involves various aspects of an individual's well-being, including physical, mental, and social dimensions. It reflects levels of satisfaction that individuals have with their lives, considering factors including health, relationships, personal achievements, and access to resources

(Cai et al., 2021). The World Health Organization (WHO) defines QoL as an individual's perception of their position in life within the context of their culture, values, goals, and expectations (World Health Organization, 1998). Higher QoL is often associated with better physical and mental health outcomes, productivity, and overall psychosocial functioning (Cai et al., 2021). Internet-related addictive behaviors (Brand et al., 2025; Fineberg et al., 2022; Fineberg et al., 2018), such as problematic online gaming, problematic social media use, and problematic online shopping, have been widely recognized as significant determinants of QoL (Chen et al., 2024; Chern & Huang, 2018; Lin et al., 2024). These behaviors often lead to significant physical health problems, including sleep disturbances, fatigue, or chronic illnesses, which can exacerbate mental health conditions such as anxiety, depression, and stress (Alimoradi et al., 2019). Social relationships and professional or academic performance may also decline, contributing to feelings of isolation and dissatisfaction (Ruckwongpatr et al., 2022). Therefore, understanding better how specific internet-related addictive behaviors may negatively impact different aspects of QoL is important.

Internet-related addictive behaviors refer to the problematic or compulsive engagement in online activities that disrupt an individual's daily life and well-being (Huang et al., 2024; Mitropoulou, 2024). These behaviors may be expressed in various manners. For example, internet gaming disorder involves excessive engagement in videogames, leading to functional impairment in one or more important domains of daily living (American Psychiatric Association, 2013; Griffiths et al., 2025; Király et al., 2023). Social media addiction (problematic social media use [PSMU]), is characterized by compulsive use of online social networking sites, such as constantly checking notifications or seeking validation through likes and comments, despite adverse consequences that clinically impair everyday activities (Chang et al., 2022; Montag et al., 2024; Moretta et al., 2022). Online shopping addiction (compulsive buying/shopping), is characterized by impulsive, poorly controlled purchasing behaviors online, leading to negative consequences in various aspects of life (Müller et al., 2021). Gambling disorder involves persistent patterns of gambling despite negative consequences and is often conducted online (Potenza et al., 2019). Online pornography use addiction (problematic pornography use [PPU]), involves excessive consumption of sexually explicit material online, leading to impairment in everyday activities (Gewirtz-Meydan et al., 2025; Müller et al., 2022). While PPU may be considered as a form of compulsive sexual behavior disorder, it and other potentially addictive behaviors (e.g., PSMU) have been proposed as "other specified disorders due to addictive behaviors" (Brand et al., 2020). Because these behavioral addictions negatively impact individuals' lives in various manners, they warrant additional attention from policymakers, public health experts, clinicians, and other stakeholders (Brand et al., 2025; Fineberg et al., 2022; Fineberg et al., 2018).

In Asia, internet-related addictive behaviors have become a significant concern, especially among adolescents and young adults (Gjoneska et al., 2025). Widespread internet access and cultural attitudes contribute to the prevalence of these behaviors (Mak et al., 2014). In Taiwan, research shows a high prevalence of internet addiction (13.4%), particularly among university students (Hsu et al., 2015). The prevalence of internet addiction in Hong Kong is wide ranging (from 3.0% to 26.8%), with higher prevalence estimates reported more recently (Chung et al., 2019). In Malaysia, studies have also indicated a high prevalence of internet addiction (19.2%) (Chia et al., 2020). In China, studies estimate that over 10% of adolescents and young adults exhibit symptoms of internet addiction (Shao et al., 2018). Because internet addiction has been associated with negative impacts among young individuals, the findings highlight the importance of addressing the impact of internet-related addictive behaviors on QoL, especially within Asian jurisdictions.

Psychological distress refers to a range of emotional and cognitive challenges, such as anxiety, depression, and stress, that can disrupt an individual's well-being and daily functioning, leading to a significant reduction in QoL (Chen et al., 2024). The Interaction of Person-Affect-Cognition-Execution (I-PACE) model, developed as a theoretical framework for investigating the etiologies and development of addictive behaviors, offers a comprehensive framework for examining precise roles for psychological distress in internet-related addictive behaviors (Brand et al., 2019; Brand et al., 2016). The model proposes that individual predispositions interact with affective and cognitive processes, which influence the execution of behaviors (Brand et al., 2019; Brand et al., 2016). Emotional stimuli or states may motivate individuals to use specific internet activities as a means of coping or emotional regulation. An individual experiencing psychological distress may therefore seek online activities as a coping mechanism. Cognitive processes, such as biased attention toward online rewards or maladaptive beliefs about internet use, may further reinforce these behaviors. Over time, temporarily alleviating negative emotions and enhancing positive reinforcement may override cognitive control, leading to compulsive engagement despite adverse consequences, potentially worsening overall QoL or specific component domains (Brand et al., 2019; Brand et al., 2016).

Despite extensive research on addictive behaviors and QoL, significant gaps remain in the literature. One major gap is the lack of evidence applying the I-PACE model to explore how psychological distress may impact QoL. Additionally, there are few cross-jurisdictional studies examining how regional differences may impact relationships between addictive behaviors and QoL. Moreover, few studies have simultaneously examined relationships between multiple types of internet-related addictive behaviors and QoL. Therefore, the present study aimed to address these gaps by exploring (i) in moderated mediation models, potential roles for various internet-

related addictive behaviors in the relationship between psychological distress and QoL, guided by the I-PACE model, and (ii) regional differences in these relationships across Taiwan, Malaysia, Hong Kong, and China. These regions have experienced rapid technological development and high internet penetration rates, contributing to high prevalence estimates of internet-related addictive behaviors. While these regions share similarities due to their large proportions of Chinese individuals, they also differ in their socio-economic structures, government policies, and education systems, providing rich and comparative perspectives across cultures. Guided by the I-PACE model, it was hypothesized that psychological distress contributes as an ‘affect’ component which increases engagement in specific internet-related behaviors, which may serve as maladaptive emotional regulation strategies for some individuals. These behaviors, in turn, can negatively influence various QoL domains. Therefore, each online addictive behavior was hypothesized to mediate the relationship between psychological distress and a specific QoL domain. It was also assumed that domain-specific differences might exist in these relationships (e.g., PSMU may relate inversely to social QoL and gaming inversely to physical QoL), although jurisdictional relationships were explored without hypotheses.

1. Methods

2.1 Data collection and recruitment procedure

The online-survey study was conducted using a snowball sampling method between September 2023 and July 2024. Participants (N=6,074) were recruited from Taiwan, Hong Kong, Malaysia, and China. The inclusion criteria were (i) aged 18 years or older, and (ii) capable of reading and comprehending the survey in their respective languages. The informed consent form appeared on the first page of the online survey. Participants had to press an ‘agree’ consent box to complete the survey questions. If the "disagree" option for consent was selected, the survey ended immediately. All survey procedures received approval from the ethics review boards in each respective region (reference numbers: BLIND FOR REVIEW for Taiwan participants, BLIND FOR REVIEW for participants in Malaysia, BLIND FOR REVIEW for Hong Kong participants, and BLIND FOR REVIEW for participants in China). More information is detailed in Supplementary S1.

2.2 Measures

Demographics. All participants were asked to self-report their age (in years) and gender identity (male, female, or other).

Psychological distress. The Depression, Anxiety and Stress Scale-21 (DASS-21) was used to assess past-week

psychological distress (Lovibond & Lovibond, 1995). The DASS-21 includes depression, anxiety, and stress subscales, each containing seven items. An example item of DASS-21 is *“I felt that I was using a lot of nervous energy”*. Items are scored on a four-point Likert scale from 0 to 3, generating a total score ranging from 0 to 63. A higher score on the DASS-21 indicates more severe psychological distress. Previous studies have confirmed high internal consistency of the DASS-21 among populations in Taiwan, Hong Kong, Malaysia, and China (Chen et al., 2023; Li et al., 2021; Mohsen et al., 2024; Tung et al., 2022).

Addictive online behaviors. The Assessment of Criteria for Specific Internet-use Disorders (ACSID-11) was used to assess specific internet-related addictive behaviors (Müller et al., 2022). Items are scored on a four-point Likert scale from 0 (indicating *“never”* or *“not at all intense”*) to 3 (indicating *“often”* or *“intense”*). Further details about the ACSID-11 are provided in Supplementary S2.

Quality of life. The World Health Organization Quality of Life Questionnaire, Brief version (WHOQOL-BREF) was used to assess QoL. The WHOQOL-BREF asks about overall life conditions and four domains of QoL: physical health, psychological health, social relationships, and environment. An example item of the WHOQOL-BREF is *“How satisfied are you with your ability to perform your daily living activities?”* Items are scored on a five-point Likert scale from 1 to 5. Higher scores on the WHOQOL-BREF reflect a better quality of life. Previous studies have reported very good internal consistency for the WHOQOL-BREF among populations in Taiwan, Hong Kong, Malaysia, and China (Leung et al., 2005; Seok et al., 2023; Xia et al., 2012; Yao et al., 2002).

2.3 Data analysis

Apart from using descriptive statistics to summarize demographics and scores on each measure, the present study used a moderated mediation model (i.e., Model #8) in Hayes' Process Macro (Hayes, 2012) to examine associations between psychological distress, addictive behaviors, and QoL. More specifically, moderation effects in the moderated mediation model were conducted using the “stratification” method. That is, region (Taiwan, Hong Kong, Malaysia, or China) was the stratification factor to test moderation effects of different Asian jurisdictions. As well as using region as the stratification factor in the moderated mediation model, age and sex were controlled variables; psychological distress was the independent variable; each type of internet-related addictive behavior (i.e., gaming, shopping/buying, pornography use, social media use, or gambling) was the mediator; and QoL (physical QoL, psychological QoL, social QoL, and environment QoL) was the dependent variable (Figure 1). Because each type of addictive behavior and each type of QoL were analyzed separately in the moderated mediation model, a total of 20 moderated mediation models were constructed. In the moderated mediation model, 5000 bootstrapping samples were used to examine the significance of mediated effects.

Significance occurred when the lower limit confidence interval (LLCI) and upper limit confidence interval (ULCI) at 95% did not cover 0 (Hayes, 2012). Moreover, moderated effects were explored between regions and each type of addictive behavior; and between regions and each type of QoL, with Taiwan as the reference group.

(Insert Figure 1 here)

2. Results

3.1 Participant characteristics

The participants' characteristics are summarized in Table 1. In brief, Taiwanese participants were the oldest, followed by those from Hong Kong, Malaysia, and China. The sex distributions were comparable across the four studied regions: nearly two-thirds of participants were females. Slightly over half of the participants (52.52%) reported online gaming; over four-fifths (84.85%) reported online shopping; nearly one-quarter (24.91%) reported online pornography use; over four-fifths (83.65%) reported social networking; and less than one-tenth (6.42%) reported online gambling. Additional information (e.g., the measures' scores), is reported in Table 1. The present study demonstrated good internal consistency for the DASS-21, WHOQOL-BREF, and ACSID-11 (Appendix Table A1).

(Insert Table 1 here)

3.2 I-PACE model findings for each type of addictive online behavior

All moderated mediation models supported the I-PACE model that internet-related addictive behaviors assessed were associated with psychological distress. More specifically, unstandardized coefficients (B [95% CI]) were 0.020 (0.016, 0.025) for addictive patterns of gaming, 0.018 (0.015, 0.022) for shopping/buying, 0.015 (0.011, 0.020) for pornography use, 0.022 (0.019, 0.026) for social networking, and 0.026 (0.010, 0.042) for gambling (Tables 2 to 6).

(Insert Tables 2 to 6 here)

3.3 Mediated and direct relationships involving each addictive online behavior and each QoL domain

The results showed that various internet-related addictive behaviors mediated the associations between psychological distress and different QoL domains. Gaming addiction mediated the relationships between psychological distress and both physical and social QoL, while also showing direct associations with these domains. Shopping/buying addiction mediated the effects of psychological distress on physical, social, and environmental QoL and had direct relationships with these domains. Pornography use addiction mediated the relationship between psychological distress and physical QoL, with a direct association with physical QoL. Social

media addiction mediated relationships between psychological distress and all four QoL domains, also showing direct associations with each domain. Gambling addiction mediated the relationship between psychological distress and psychological QoL, with a direct association with psychological QoL. Detailed results are presented in Supplementary S3.

3.4 Moderated effects of regions on each addictive online behavior and each type of QoL

The results showed that region moderated the associations between various addictive online behaviors and different QoL domains. Specifically, gaming addiction, shopping addiction, pornography use addiction, social media addiction, and gambling addiction all demonstrated regional differences on physical, psychological, social, and environmental QoL. In general, associations tended to be weaker among participants from Malaysia and Hong Kong when compared to those from Taiwan, with some differences observed in China. Detailed results are provided in Supplementary S4.

3. Discussion

The present study applied the I-PACE model to explore how internet-related addictive behaviors may mediate relationships between psychological distress and QoL in four Asian jurisdictions: Taiwan, Malaysia, Hong Kong, and China. In line with the I-PACE framework, moderated mediation models indicated that psychological distress predicted various internet-related addictive behaviors. In the models, these behaviors, in turn, indicated a negative impact on multiple dimensions of QoL. Additionally, the results indicated regional differences in these relationships. For example, associations between gaming addiction and QoL dimensions were more pronounced in Taiwan compared to other regions. Similarly, associations between social media addiction and QoL were stronger in Taiwan and China than in Malaysia and Hong Kong. These differences may be attributed to cultural differences, policies, attitudes toward online behaviors, or other factors that differ in each region.

According to the I-PACE theoretical framework (Brand et al., 2019; Brand et al., 2016), individuals may use online activities to cope with psychological distress. Those with higher levels of psychological distress are often more likely to have greater desires to engage in online activities. However, to the best of the present authors' knowledge, prior evidence primarily focuses on one or two online activities (mostly involving gaming and social networking) (Lin et al., 2024; Mitropoulou, 2024). The present study extended the findings that the I-PACE model may be applied to various online activities (including addictions to gaming, shopping, pornography use, and social media use, and gambling) (Stirnberg et al., 2024). Taking the present findings as examples, there was a notable association between psychological distress and addictive gaming because individuals may engage in gaming to

escape real-life challenges or relieve stress. Similarly, social media addiction was prevalent, perhaps because these platforms can be used to avoid loneliness and provide social support. The potential impact of psychological distress on these internet-related addictive behaviors suggests the importance of developing interventions to reduce psychological distress and prevent or reduce internet-related addictive behaviors.

The role of internet-related addictive behaviors as mediators in associations between psychological distress and QoL domains was demonstrated to varying degrees. Gaming addiction mediated the relationship between psychological distress and physical/social QoL. Physically, prolonged gaming often leads to sedentary lifestyles, disrupted sleep patterns, and decreased physical activity (Chang et al., 2022). Socially, excessive gaming can reduce time spent on meaningful social interactions, leading to feelings of isolation and diminished social support networks (Yang et al., 2022).

Online shopping addiction can significantly affect physical, social, and environmental domains because it could possibly lead to physical inactivity and poor nutritional consumption (e.g., prolonged sitting while purchasing online and unhealthy food choices from delivery apps) and may contribute to various health issues such as obesity, cardiovascular diseases, and metabolic disorders (Singh et al., 2024), although these are not unique to online shopping addiction and could be consequences of any online addiction. The time and energy devoted to online shopping can interfere with participation in social activities. Individuals who addictively engage in online shopping may spend excessive amounts of time browsing and purchasing items online, which reduces opportunities for meaningful social connections and time spent engaging in face-to-face interactions with family and friends (Durrani et al., 2022). Overconsumption related to online shopping often results in cluttered and disorganized living spaces, along with financial strain, which worsens living conditions and decreases satisfaction with the environmental domain of QoL (Bäckström et al., 2024).

Social media addiction demonstrated a significant mediating effect on all QoL domains. Excessive social media use often leads to prolonged periods of sitting and blue light exposure, contributing to a sedentary lifestyle and sleep disruptions, negatively affecting physical health (Kwok et al., 2021). Psychologically, social comparison may be amplified due to the nature of social media platforms, which can foster feelings of inadequacy, low self-esteem, anxiety, and depression (Tandon et al., 2021). Additionally, social media addiction can lead to fear of missing out, leading individuals to compulsively check social media platforms, further exacerbating anxiety and stress (Bakioğlu et al., 2022). Social QoL can decline due to overdependence on virtual interactions, resulting in superficial relationships and loneliness (Griffiths et al., 2014). Environmentally, time spent on social media platforms reduces engagement with physical surroundings and participation in community activities, further

affecting QoL (Tullett-Prado et al., 2023).

Pornography use addiction and gambling addiction showed relatively weaker mediating effects when compared to other internet-related addictive behaviors. The pornography domain was only inversely associated with physical QoL. One possible, currently speculative explanation may involve effects of frequent masturbation that may result in physical health issues such as desensitization and stress hormone dysregulation (Shan et al., 2024; Simsarian et al., 2024). The gambling domain was only significant in the association with psychological QoL, with gambling being positively associated with psychological QoL (i.e., those with a greater level of gambling had better psychological QoL). The following reasons may explain the positive association between gambling and psychological QoL. First, individuals with gambling problems might be over-confident in their conditions, and therefore, they may misinterpret their problems as strengths (Manda & Sana, 2021). They may also feel more positive about their gambling outcomes, resulting in better psychological QoL. Second, only 6.4% of the entire sample had online gambling experiences. Given this small proportion, individual differences among participants could have biased the findings. Therefore, further analysis (using independent *t*-tests) was carried out. This showed that participants with online gambling experience reported significantly higher QoL scores across all domains compared to those without online gambling experience (physical: $t(434.4)=7.470$, $p<0.001$; psychological: $t(444.451)=6.586$, $p<0.001$; social: $t(425.730)=3.826$, $p<0.001$; environment: $t(426.292)=5.811$, $p<0.001$). These findings suggest that the association between gambling and higher QoL may reflect individual differences between participants with and without online gambling experience.

The study additionally highlighted significant regional differences in relationships between psychological distress, internet-related addictive behaviors, and QoL. For example, online addictions to gaming and social media had stronger negative effects on QoL in Taiwan and China compared to those in Malaysia and Hong Kong. Taiwan and China, with their rapid technological development and high internet penetration rates, might experience more pronounced effects due to greater exposure to online platforms (Cui et al., 2024; Taiwan Network Information Center, 2024). Conversely, the weaker associations observed in Malaysia might suggest cultural values that emphasize community engagement and social cohesion that discourage excessive internet use (Meerangani et al., 2022). The highly urbanized environment in Hong Kong may buffer some negative impacts by offering alternative leisure activities and professional support networks (Zhu & He, 2002). These differences may reflect cultural norms, socio-economic disparities, and variations in internet use patterns, highlighting the need for culturally sensitive interventions to understand better and address regional differences effectively.

The present study extends the I-PACE model by demonstrating its applicability in understanding how

psychological distress may influence QoL through internet-related addictive behaviors. The findings emphasize the value of I-PACE model in identifying psychological and behavioral mechanisms underlying QoL impairments. Given that internet-related addictive behaviors mediated the relationship between psychological distress and QoL, these behaviors represent key targets for intervention. Strategies aimed at improving QoL could include efforts to reduce psychological distress while also addressing maladaptive patterns of internet use. For example, cognitive behavioral interventions can help individuals develop healthier coping strategies, improve emotional regulation, and reduce compulsive engagement in online activities (Agbaria, 2023; Liu et al., 2017). Additionally, psychoeducation and digital literacy programs may raise awareness of the risks associated with excessive internet use and promote more healthy digital habits (Laffier, 2025). Because regional differences influence the strength of these relationships, culturally-tailored interventions are of the utmost importance. Culturally adapted strategies may be important for achieving optimal outcomes, addressing regional differences and ensuring cultural relevance. Collaboration across cultures among researchers, practitioners, and policymakers can enhance the exchange of effective strategies and resources and increase impact across regions.

There are some limitations. First, the cross-sectional design limits the ability to make causal inferences between the study variables, highlighting the need for longitudinal studies to establish temporal relationships. Second, the study relied on self-reported data, which could lead to biases, such as social desirability or recall bias. Third, the study only recruited young adults, and the results may not be generalizable to individuals from other regions or age cohorts.

4. Conclusions

In the present theory-driven study, moderated mediation models indicated that internet-related addictive behaviors acted as mediators between psychological distress and QoL, with regional variations differing by specific addictive online behaviors. By highlighting complexities underlying relationships between psychological distress, specific internet-related addictions, and QoL domains, the findings advance the understanding in ways that may help advance prevention and treatment approaches within and across Asian jurisdictions. The regional differences suggest a need for targeted, culturally sensitive interventions to improve QoL across diverse populations. The findings not only deepen the understanding of internet-related addictive behaviors, but also provide guidance for developing comprehensive, culturally sensitive perspectives to enhance QoL.

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Table 1. Participant characteristics

	All regions (N=6074)	Taiwan (n=887)	Malaysia (n=1044)	Hong Kong (n=1008)	China (n=3135)
Age	21.63 (4.61)	28.82 (6.06)	21.27 (2.54)	22.69 (4.12)	19.30 (1.50)
Sex					
Man	2092 (34.44)	319 (35.96)	317 (30.36)	314 (31.15)	1142 (36.43)
Woman	3979 (65.51)	565 (63.70)	727 (69.64)	694 (68.85)	1993 (63.57)
Other	3 (0.05)	3 (0.34)	0 (0.00)	0 (0.00)	0 (0.00)
Psychological distress score	14.55 (11.46)	12.78 (11.27)	17.91 (12.56)	15.89 (12.33)	13.50 (10.54)
Physical quality of life score	14.11 (2.52)	13.88 (2.43)	14.52 (2.37)	14.05 (2.23)	14.05 (2.67)
Psychological quality of life score	13.14 (2.98)	12.06 (2.89)	13.56 (2.66)	12.07 (2.78)	13.64 (2.99)
Social quality of life score	13.59 (2.98)	12.88 (2.68)	13.61 (3.05)	13.29 (2.58)	13.88 (3.11)
Environment quality of life score	13.69 (2.79)	13.62 (2.48)	14.41 (2.58)	13.52 (2.30)	13.53 (3.03)
Experience with online gaming (Yes)	3190 (52.52)	465 (52.42)	626 (59.96)	545 (54.07)	1554 (49.57)
Experience with online shopping (Yes)	5154 (84.85)	795 (89.63)	967 (92.62)	821 (81.45)	2571 (82.01)
Experience with using online pornography (Yes)	1513 (24.91)	441 (49.72)	276 (26.44)	409 (40.58)	387 (12.34)
Experience with using social media (Yes)	5081 (83.65)	844 (95.15)	1044 (100.00)	949 (94.15)	2244 (71.58)
Experience with online gambling (Yes)	390 (6.42)	50 (5.64)	63 (6.03)	83 (8.23)	194 (6.19)
ACSID-11 score					
Gaming	0.82 (0.68)	0.71 (0.63)	0.96 (0.70)	0.71 (0.63)	0.83 (0.69)
Shopping	0.70 (0.64)	0.61 (0.62)	0.83 (0.68)	0.51 (0.54)	0.74 (0.65)
Pornography	0.65 (0.70)	0.49 (0.56)	0.84 (0.73)	0.58 (0.64)	0.78 (0.81)
Social networking	0.88 (0.69)	0.73 (0.62)	1.24 (0.71)	0.80 (0.65)	0.80 (0.67)
Gambling	0.71 (0.81)	0.62 (0.58)	0.82 (0.84)	0.56 (0.73)	0.76 (0.88)

Table 2. Mediation effects of gaming addiction (GA) in the associations between psychological distress (PD) and quality of life (QoL)

		Unstand. Coeff.	(LLCI, ULCI)	(n=3106)	
	GA (R ² =0.156)	Phy QoL (R ² =0.260)	Psy QoL (R ² =0.316)	Soc QoL (R ² =0.152)	Env QoL (R ² =0.164)
PD	0.020 (0.016, 0.025)	-0.111 (-0.129, -0.094)	-0.161 (-0.181, -0.141)	-0.116 (-0.138, -0.095)	-0.093 (-0.113, -0.073)
Malaysia (Ref: Taiwan)	0.228 (0.096, 0.361)	0.155 (-0.311, 0.621)	1.045 (0.509, 1.580)	0.289 (-0.304, 0.883)	-0.004 (-0.547, 0.540)
Hong Kong (Ref: Taiwan)	-0.036 (-0.166, 0.094)	-0.222 (-0.679, 0.235)	-0.360 (-0.886, 0.165)	0.172 (-0.410, 0.755)	-0.531 (-1.064, 0.003)
China (Ref: Taiwan)	0.145 (0.024, 0.265)	-0.039 (-0.463, 0.386)	1.115 (0.627, 1.603)	0.623 (0.081, 1.164)	-0.478 (-0.974, 0.018)
Interaction term					
Malaysia (Ref: Taiwan)	-0.002 (-0.008, 0.004)	0.045 (0.023, 0.066)	0.061 (0.037, 0.086)	0.055 (0.027, 0.082)	0.037 (0.012, 0.062)
Hong Kong (Ref: Taiwan)	0.001 (-0.005, 0.007)	0.026 (0.004, 0.049)	0.037 (0.012, 0.063)	0.027 (-0.002, 0.055)	0.018 (-0.009, 0.044)
China (Ref: Taiwan)	0.002 (-0.006, 0.006)	-0.005 (-0.025, 0.015)	0.027 (0.004, 0.050)	0.022 (-0.004, 0.048)	-0.017 (-0.040, 0.007)
GA		-0.403 (-0.527, -0.279)	-0.093 (-0.235, 0.050)	-0.193 (-0.351, -0.035)	-0.107 (-0.252, 0.038)
GA (Taiwan)		-0.112 (-0.129, -0.094)	-0.161 (-0.181, -0.141)	-0.116 (-0.138, -0.095)	-0.093 (-0.113, -0.073)
GA (Malaysia)		-0.067 (-0.080, -0.054)	-0.100 (-0.115, -0.084)	-0.062 (-0.079, -0.045)	-0.056 (-0.071, -0.040)
GA (Hong Kong)		-0.085 (-0.100, -0.070)	-0.124 (-0.147, -0.106)	-0.090 (-0.109, -0.071)	-0.075 (-0.093, -0.058)
GA (China)		-0.117 (-0.128, -0.106)	-0.134 (-0.147, -0.122)	-0.094 (-0.108, -0.081)	-0.109 (-0.122, -0.097)
Mediated effect					
PD and GA (Taiwan)		-0.008 (-0.012, -0.005)	-0.002 (-0.005, 0.001)	-0.004 (-0.008, -0.0001)	-0.002 (-0.006, 0.001)
PD and GA (Malaysia)		-0.007 (-0.011, -0.005)	-0.002 (-0.005, 0.001)	-0.004 (-0.007, -0.0001)	-0.002 (-0.005, 0.001)
PD and GA (Hong Kong)		-0.009 (-0.012, -0.005)	-0.002 (-0.005, 0.001)	-0.004 (-0.008, -0.0001)	-0.002 (-0.006, 0.001)
PD and GA (China)		-0.008 (-0.012, -0.005)	-0.002 (-0.005, 0.001)	-0.004 (-0.008, -0.0001)	-0.002 (-0.006, 0.001)

Note. Age and gender are controlled variables; PD is the independent variable; GA is the mediator; Asian region is stratification factor; QoL is outcome.

Phy=physical; Psy=psychological; Soc=social; Env=environment; Unstand. Coeff.=unstandardized coefficient; LLCI=lower limit confidence interval at 95%; ULCI=upper limit confidence interval at 95%. Significant coefficients are **in bold**.

The analyzed model was a moderated mediation model using the Model 8 in the Hayes' Process Macro.

Table 3. Mediation effects of compulsive shopping (CS) in the associations between psychological distress (PD) and quality of life (QoL)

		Unstand. Coeff.	(LLCI, ULCI)	(n=5050)	
	CS (R ² =0.121)	Phy QoL (R ² =0.286)	Psy QoL (R ² =0.347)	Soc QoL (R ² =0.171)	Env QoL (R ² =0.187)
PD	0.018 (0.015, 0.022)	-0.115 (-0.128, -0.102)	-0.159 (-0.174, -0.145)	-0.115 (-0.131, -0.098)	-0.088 (-0.103, -0.073)
Malaysia (Ref: Taiwan)	0.294 (0.200, 0.392)	0.204 (-0.141, 0.548)	1.217 (0.825, 1.609)	0.215 (-0.222, 0.651)	0.220 (-0.179, 0.619)
Hong Kong (Ref: Taiwan)	0.020 (-0.076, 0.116)	-0.153 (-0.488, 0.183)	-0.040 (-0.422, 0.342)	0.170 (-0.255, 0.596)	-0.503 (-0.892, -0.114)
China (Ref: Taiwan)	0.257 (0.169, 0.346)	0.162 (-0.148, 0.476)	1.568 (1.214, 1.922)	0.682 (0.287, 1.076)	-0.148 (-0.508, 0.213)
Interaction term					
Malaysia (Ref: Taiwan)	-0.003 (-0.008, 0.002)	0.044 (0.027, 0.060)	0.059 (0.040, 0.078)	0.047 (0.026, 0.068)	0.032 (0.012, 0.052)
Hong Kong (Ref: Taiwan)	-0.006 (-0.011, -0.001)	0.023 (0.006, 0.040)	0.029 (0.009, 0.048)	0.021 (-0.001, 0.043)	0.016 (-0.004, 0.036)
China (Ref: Taiwan)	0.001 (-0.004, 0.005)	-0.014 (-0.029, 0.001)	0.006 (-0.011, 0.024)	0.008 (-0.012, 0.027)	-0.031 (-0.048, -0.013)
CS		-0.446 (-0.542, -0.349)	-0.069 (-0.179, 0.041)	-0.193 (-0.315, -0.071)	-0.324 (-0.436, -0.213)
CS (Taiwan)		-0.115 (-0.128, -0.102)	-0.159 (-0.174, -0.145)	-0.115 (-0.131, -0.098)	-0.088 (-0.103, -0.073)
CS (Malaysia)		-0.071 (-0.082, -0.061)	-0.101 (-0.113, -0.088)	-0.068 (-0.081, -0.054)	-0.057 (-0.069, -0.045)
CS (Hong Kong)		-0.092 (-0.104, -0.081)	-0.131 (-0.144, -0.117)	-0.094 (-0.108, -0.079)	-0.073 (-0.086, -0.059)
CS (China)		-0.129 (-0.138, -0.121)	-0.153 (-0.163, -0.143)	-0.107 (-0.118, -0.096)	-0.119 (-0.129, -0.109)
Mediated effect					
PD and CS (Taiwan)		-0.008 (-0.011, -0.006)	-0.001 (-0.004, 0.001)	-0.004 (-0.006, -0.001)	-0.006 (-0.009, -0.004)
PD and CS (Malaysia)		-0.007 (-0.009, -0.005)	-0.001 (-0.003, 0.001)	-0.003 (-0.005, -0.001)	-0.005 (-0.007, -0.003)
PD and CS (Hong Kong)		-0.005 (-0.007, -0.004)	-0.001 (-0.002, 0.001)	-0.002 (-0.004, -0.001)	-0.004 (-0.006, -0.002)
PD and CS (China)		-0.008 (-0.011, -0.006)	-0.001 (-0.004, 0.001)	-0.004 (-0.006, -0.001)	-0.006 (-0.009, -0.004)

Note. Age and sex are controlled variables; PD is the independent variable; CS is the mediator; Asian region is the stratification factor; QoL is the outcome.

Phy=physical; Psy=psychological; Soc=social; Env=environment; Unstand. Coeff.=unstandardized coefficient; LLCI=lower limit confidence interval at 95%; ULCI=upper limit confidence interval at 95%. Significant coefficients are **in bold**.

The analyzed model was a moderated mediation model using the Model 8 in the Hayes' Process Macro.

Table 4. Mediation effects of problematic pornography use (PPU) in the associations between psychological distress (PD) and quality of life (QoL)

	Unstand. Coeff.	(LLCI, ULCI)	(n=1471)		
	PPU (R ² =0.208)	Phy QoL (R ² =0.299)	Psy QoL (R ² =0.310)	Soc QoL (R ² =0.155)	Env QoL (R ² =0.173)
PD	0.015 (0.011, 0.020)	-0.120 (-0.136, -0.103)	-0.156 (-0.176, -0.136)	-0.119 (-0.141, -0.096)	-0.089 (-0.109, -0.070)
Malaysia (Ref: Taiwan)	0.256 (0.093, 0.419)	-0.023 (-0.579, 0.534)	0.635 (-0.024, 1.194)	-0.208 (-0.962, 0.547)	-0.280 (-0.933, 0.373)
Hong Kong (Ref: Taiwan)	0.041 (-0.098, 0.180)	-0.311 (-0.785, 0.163)	-0.421 (-0.982, 0.140)	0.117 (-0.526, 0.759)	-0.543 (-1.099, 0.014)
China (Ref: Taiwan)	0.233 (0.073, 0.393)	-1.103 (-1.649, -0.557)	-0.108 (-0.754, 0.538)	-0.558 (-1.298, 0.182)	-1.556 (-2.196, -0.915)
Interaction term					
Malaysia (Ref: Taiwan)	0.005 (-0.002, 0.012)	0.049 (0.025, 0.074)	0.065 (0.037, 0.094)	0.054 (0.021, 0.087)	0.044 (0.016, 0.073)
Hong Kong (Ref: Taiwan)	0.006 (-0.001, 0.012)	0.030 (0.008, 0.053)	0.035 (0.008, 0.062)	0.024 (-0.006, 0.087)	0.008 (-0.019, 0.034)
China (Ref: Taiwan)	0.003 (-0.004, 0.010)	0.028 (0.003, 0.053)	0.064 (0.034, 0.093)	0.062 (0.029, 0.096)	0.021 (-0.008, 0.050)
PPU		-0.310 (-0.485, -0.135)	-0.078 (-0.285, 0.129)	-0.227 (-0.464, 0.010)	-0.148 (-0.353, 0.057)
PPU (Taiwan)		-0.120 (-0.136, -0.103)	-0.156 (-0.176, -0.136)	-0.119 (-0.141, -0.096)	-0.089 (-0.109, -0.070)
PPU (Malaysia)		-0.070 (-0.088, -0.052)	-0.090 (-0.112, -0.069)	-0.065 (-0.090, -0.040)	-0.045 (-0.067, -0.024)
PPU (Hong Kong)		-0.089 (-0.105, -0.073)	-0.121 (-0.140, -0.102)	-0.094 (-0.116, -0.072)	-0.082 (-0.100, -0.063)
PPU (China)		-0.092 (-0.110, -0.073)	-0.092 (-0.114, -0.070)	-0.056 (-0.081, -0.031)	-0.068 (-0.090, -0.047)
Mediated effect					
PD and PPU (Taiwan)		-0.005 (-0.009, -0.002)	-0.001 (-0.005, 0.002)	-0.004 (-0.008, 0.000)	-0.002 (-0.006, 0.001)
PD and PPU (Malaysia)		-0.006 (-0.011, -0.002)	-0.002 (-0.006, 0.003)	-0.005 (-0.010, 0.001)	-0.003 (-0.008, 0.001)
PD and PPU (Hong Kong)		-0.007 (-0.011, -0.002)	-0.002 (-0.006, 0.003)	-0.005 (-0.011, 0.001)	-0.003 (-0.008, 0.001)
PD and PPU (China)		-0.006 (-0.010, -0.002)	-0.001 (-0.006, 0.003)	-0.004 (-0.010, 0.001)	-0.003 (-0.007, 0.001)

Note. Age and sex are controlled variables; PD is the independent variable; PPU is the mediator; Asian region is the stratification factor; QoL is the outcome.

Phy=physical; Psy=psychological; Soc=social; Env=environment; Unstand. Coeff.=unstandardized coefficient; LLCI=lower limit confidence interval at 95%; ULCI=upper limit confidence interval at 95%. Significant coefficients are **in bold**.

The analyzed model was a moderated mediation model using the Model 8 in the Hayes' Process Macro.

Table 5. Mediation effects of problematic use of social media (PUSM) in associations between psychological distress (PD) and quality of life (QoL)

	Unstand. Coeff.	(LLCI, ULCI)	(n=4991)		
	PUSM (R ² =0.192)	Phy QoL (R ² =0.288)	Psy QoL (R ² =0.369)	Soc QoL (R ² =0.177)	Env QoL (R ² =0.191)
PD	0.022 (0.019, 0.026)	-0.114 (-0.127, -0.102)	-0.156 (-0.170, -0.142)	-0.116 (-0.132, -0.100)	-0.089 (-0.103, -0.075)
Malaysia (Ref: Taiwan)	0.382 (0.284, 0.480)	0.258 (-0.068, 0.585)	1.298 (0.928, 1.668)	0.259 (-0.155, 0.674)	0.200 (-0.176, 0.576)
Hong Kong (Ref: Taiwan)	0.012 (-0.084, 0.108)	-0.009 (-0.325, 0.307)	0.070 (-0.289, 0.428)	0.273 (-0.128, 0.675)	-0.368 (-0.733, -0.004)
China (Ref: Taiwan)	0.073 (-0.018, 0.164)	0.204 (-0.096, 0.504)	1.751 (1.411, 2.091)	0.761 (0.380, 1.142)	-0.053 (-0.399, 0.293)
Interaction term					
Malaysia (Ref: Taiwan)	-0.0003 (-0.005, 0.005)	0.045 (0.029, 0.061)	0.056 (0.039, 0.074)	0.049 (0.029, 0.069)	0.031 (0.013, 0.049)
Hong Kong (Ref: Taiwan)	-0.0012 (-0.006, 0.004)	0.020 (0.004, 0.037)	0.022 (0.003, 0.040)	0.019 (-0.002, 0.038)	0.010 (-0.009, 0.029)
China (Ref: Taiwan)	-0.0030 (-0.008, 0.002)	-0.019 (-0.034, -0.004)	0.000 (-0.017, 0.017)	0.012 (-0.007, 0.031)	-0.038 (-0.056, -0.021)
PUSM		-0.344 (-0.436, -0.252)	-0.148 (-0.252, -0.043)	-0.156 (-0.273, -0.040)	-0.117 (-0.223, -0.011)
PUSM (Taiwan)		-0.114 (-0.127, -0.102)	-0.156 (-0.170, -0.142)	-0.116 (-0.132, -0.100)	-0.089 (-0.103, -0.075)
PUSM (Malaysia)		-0.069 (-0.079, -0.059)	-0.100 (-0.111, -0.088)	-0.067 (-0.080, -0.054)	-0.058 (-0.070, -0.047)
PUSM (Hong Kong)		-0.094 (-0.105, -0.083)	-0.134 (-0.147, -0.122)	-0.097 (-0.111, -0.832)	-0.079 (-0.091, -0.066)
PUSM (China)		-0.133 (-0.142, -0.124)	-0.156 (-0.166, -0.146)	-0.104 (-0.115, -0.092)	-0.127 (-0.138, -0.117)
Mediation effect					
PD and PUSM (Taiwan)		-0.008 (-0.010, -0.005)	-0.003 (-0.006, -0.001)	-0.004 (-0.006, -0.001)	-0.003 (-0.005, -0.0001)
PD and PUSM (Malaysia)		-0.008 (-0.010, -0.005)	-0.003 (-0.006, -0.001)	-0.004 (-0.006, -0.001)	-0.003 (-0.005, -0.0001)
PD and PUSM (Hong Kong)		-0.007 (-0.010, -0.005)	-0.003 (-0.006, -0.001)	-0.003 (-0.006, -0.001)	-0.003 (-0.005, -0.0001)
PD and PUSM (China)		-0.007 (-0.009, -0.005)	-0.003 (-0.005, -0.001)	-0.003 (-0.006, -0.001)	-0.002 (-0.005, -0.0001)

Note. Age and sex are controlled variables; PD is the independent variable; PUSM is the mediator; Asian region is the stratification factor; QoL is the outcome.

Phy=physical; Psy=psychological; Soc=social; Env=environment; Unstand. Coeff.=unstandardized coefficient; LLCI=lower limit confidence interval at 95%; ULCI=upper limit confidence interval at 95%. Significant coefficients are **in bold**.

The analyzed model was a moderated mediation model using the Model 8 in the Hayes' Process Macro.

Table 6. Mediation effects of online gambling addiction (OGA) in associations between psychological distress (PD) and quality of life (QoL) (n=360)

	Unstand. Coeff.	(LLCI, ULCI)	(n=360)		
	OGA (R ² =0.165)	Phy QoL (R ² =0.164)	Psy QoL (R ² =0.135)	Soc QoL (R ² =0.085)	Env QoL (R ² =0.092)
PD	0.026 (0.010, 0.042)	-0.099 (-0.152, -0.046)	-0.138 (-0.199, -0.077)	-0.136 (-0.211, -0.061)	-0.113 (-0.181, -0.045)
Malaysia (Ref: Taiwan)	0.283 (-0.216, 0.781)	-1.804 (-3.429, -0.178)	-0.496 (-2.357, 1.365)	-2.980 (-5.255, -0.704)	-1.730 (-3.787, 0.326)
Hong Kong (Ref: Taiwan)	0.218 (-0.196, 0.632)	-0.466 (-1.814, 0.882)	-0.689 (-2.233, 0.855)	-0.146 (-2.034, 1.741)	-0.919 (-2.625, 0.787)
China (Ref: Taiwan)	0.278 (-0.151, 0.706)	-1.857 (-3.254, -0.459)	-1.466 (-3.067, 0.134)	-1.178 (-3.134, 0.779)	-2.599 (-4.367, -0.830)
Interaction term					
Malaysia (Ref: Taiwan)	-0.001 (-0.022, 0.020)	0.072 (0.004, 0.141)	0.096 (0.017, 0.174)	0.159 (0.063, 0.255)	0.092 (0.005, 0.179)
Hong Kong (Ref: Taiwan)	-0.010 (-0.030, 0.020)	0.016 (-0.049, 0.080)	0.036 (-0.038, 0.109)	0.066 (-0.025, 0.156)	0.047 (-0.035, 0.128)
China (Ref: Taiwan)	-0.006 (-0.024, 0.012)	0.040 (-0.020, 0.099)	0.108 (0.040, 0.176)	0.088 (0.005, 0.171)	0.070 (-0.005, 0.144)
OGA		-0.151 (-0.494, 0.191)	0.394 (0.002, 0.786)	0.097 (-0.382, 0.576)	0.314 (-0.119, 0.747)
OGA (Taiwan)		-0.099 (-0.152, -0.046)	-0.138 (-0.199, -0.077)	-0.136 (-0.211, -0.061)	0.113 (-0.181, -0.045)
OGA (Malaysia)		-0.027 (-0.071, 0.018)	-0.042 (-0.093, 0.009)	0.023 (-0.039, 0.085)	-0.021 (-0.077, 0.036)
OGA (Hong Kong)		-0.083 (-0.122, -0.045)	-0.102 (-0.146, -0.059)	-0.071 (-0.124, -0.017)	-0.066 (-0.115, -0.018)
OGA (China)		-0.060 (-0.087, -0.032)	-0.030 (-0.061, 0.001)	-0.048 (-0.086, -0.010)	-0.043 (-0.078, -0.009)
Mediated effect					
PD and OGA (Taiwan)		-0.004 (-0.013, 0.004)	0.010 (0.000, 0.023)	0.003 (-0.011, 0.016)	0.008 (-0.003, 0.024)
PD and OGA (Malaysia)		-0.004 (-0.013, 0.004)	0.010 (0.000, 0.028)	0.002 (-0.009, 0.017)	0.008 (-0.003, 0.026)
PD and OGA (Hong Kong)		-0.002 (-0.009, 0.003)	0.006 (0.000, 0.016)	0.002 (-0.007, 0.010)	0.005 (-0.002, 0.015)
PD and OGA (China)		-0.003 (-0.010, 0.003)	0.008 (0.000, 0.018)	0.002 (-0.008, 0.013)	0.006 (-0.003, 0.018)

Note. Age and sex are controlled variables; PD is the independent variable; GB is the mediator; Asian region is the stratification factor; QoL is the outcome.

Phy=physical; Psy=psychological; Soc=social; Env=environment; Unstand. Coeff.=unstandardized coefficient; LLCI=lower limit confidence interval at 95%; ULCI=upper limit confidence interval at 95%. Significant coefficients are **in bold**.

The analyzed model was a moderated mediation model using the Model 8 in the Hayes' Process Macro.

Appendix Table A1. Internal consistency (Cronbach's α) of the measures used in the present study

	All regions	Taiwan	Malaysia	Hong Kong	China
DASS-21	0.95	0.94	0.95	0.94	0.95
WHOQOL-BREF					
Physical	0.79	0.78	0.73	0.72	0.85
Psychological	0.86	0.86	0.80	0.85	0.87
Social	0.77	0.78	0.63	0.75	0.83
Environment	0.89	0.85	0.84	0.82	0.93
ACSID-11					
Gaming	0.94	0.93	0.92	0.93	0.95
Shopping	0.94	0.94	0.93	0.93	0.95
Pornography use	0.95	0.94	0.93	0.94	0.97
Social networking	0.92	0.92	0.90	0.91	0.94
Gambling	0.97	0.95	0.97	0.96	0.98

DASS-21=Depression, Anxiety, Stress Scale-21; WHOQOL-BREF=World Health Organization Quality of Life Questionnaire-Brief version; ACSID-11=Assessment of Criteria for Specific Internet-use Disorder