Factors Associated with Depressive and Anxiety Symptoms among Middle Adolescents Two Years after the COVID-19 Outbreak in the Bangkok Metropolitan Region*

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Abstract

Purpose: This study aimed to explore the prevalence of depressive and anxiety symptoms and to examine the associations between sex, awareness of COVID-19 infection, family income, family relationships, adverse life events, and internet addiction with moderate to severe levels of depressive and anxiety symptoms among middle adolescents two years after the COVID-19 outbreak.

Design: A cross-sectional descriptive study.

Methods: This study employed a cross-sectional design involving adolescents aged 15-18 residing in Bangkok and its surrounding metropolitan area. A total of 439 adolescents were included in this study. Data were collected from November 2021 to February 2022, using online questionnaires. Univariable and multivariable logistic regression analyses were conducted to examine associations between study variables and moderate to severe depressive and anxiety symptoms.

Main findings: The prevalence of depressive symptoms was 55.1% and anxiety symptoms were 65.2% among middle adolescents during the past two years of the COVID-19 outbreak. These conditions may overlap, as some adolescents experienced both depressive and anxiety symptoms. The multivariable logistic regression models explained 21% of the variance in moderate to severe depressive symptoms and 31% of the variance in moderate to severe anxiety symptoms. Family relationships were significantly associated with lower odds of depressive and anxiety symptoms. In contrast, middle adolescents who experienced adverse life events had approximately twofold higher odds, while those with internet addiction had approximately fourfold higher odds of moderate to severe depressive and anxiety symptoms after controlling for the other variables.

Conclusion and recommendations: This study identified protective factors and risk factors associated with moderate to severe levels of depressive and anxiety symptoms in a crisis. School nurses and health care providers should screen and tailor intervention management to prevent the occurrence of depressive and anxiety symptoms among middle adolescents in crisis.

Keywords: adolescent, anxiety symptoms, COVID-19, depressive symptoms, internet addiction

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ปัจจัยที่มีความสัมพันธ์กับอาการซึมเศร้าและวิตกกังวลในวัยรุ่นตอนกลาง ภายหลังการระบาดของโรคโควิด-19 สองปี ในเขตกรุงเทพมหานครและปริมณฑล*

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บทคัดย่อ

วัตถุประสงค์: เพื่อสำรวจความชุกของอาการซึมเศร้าและอาการวิตกกังวลในวัยรุ่นตอนกลางหลังจากการระบาดของโรคโควิด-19 สองปี และเพื่อศึกษาความสัมพันธ์ระหว่างเพศ การตระหนักรู้เกี่ยวกับการติดเชื้อโควิด-19 รายได้ของครอบครัว ความสัมพันธ์ในครอบครัว เหตุการณ์ในชีวิตที่ไม่พึงประสงค์ และการติดอินเทอร์เน็ต กับอาการซึมเศร้าและวิตกกังวลในระดับปานกลางถึงรุนแรง

รูปแบบการวิจัย: การวิจัยเชิงพรรณนาแบบภาคตัดขวาง

วิธีดำเนินการวิจัย: การศึกษาครั้งนี้เป็นการศึกษาเชิงพรรณนาแบบภาคตัดขวาง โดยศึกษาในกลุ่มวัยรุ่นที่มีอายุระหว่าง 15-18 ปี ที่อยู่ในเขตกรุงเทพมหานครและปริมณฑล เก็บข้อมูลช่วงเดือนพฤศจิกายน พ.ศ. 2564 ถึงเดือนกุมภาพันธ์ พ.ศ. 2565 โดยใช้แบบสอบถามออนไลน์ วิเคราะห์ข้อมูลด้วยสถิติการวิเคราะห์การถดถอยโลจิสติก

ผลการวิจัย: การศึกษาครั้งนี้พบความชุกของอาการซึมเศร้าในวัยรุ่นตอนกลางร้อยละ 55.1 และอาการวิตกกังวลร้อยละ 65.2 ในช่วงภายหลังการระบาดของโรคโควิด-19 สองปี โดยอาการทั้งสองอาจเกิดร่วมกันได้ในวัยรุ่นบางราย โมเดลการถดถอยโลจิสติกสามารถอธิบายความแปรปรวนของอาการซึมเศร้าในระดับปานกลางถึงรุนแรงได้ร้อยละ 21 และอธิบายความแปรปรวนของอาการวิตกกังวลในระดับปานกลางถึงรุนแรงได้ร้อยละ 31 ความสัมพันธ์ในครอบครัวที่ดีสามารถเป็นปัจจัยปกป้องต่อการเกิดอาการซึมเศร้าและวิตกกังวลได้ ในวัยรุ่นตอนกลางที่เคยมีเหตุการณ์ร้ายแรงในชีวิตมีโอกาสเกิดอาการซึมเศร้าและวิตกกังวลระดับปานกลางถึงรุนแรงเพิ่มขึ้นประมาณ 2 เท่า และวัยรุ่นที่ติดอินเทอร์เน็ตมีโอกาสเกิดอาการซึมเศร้าและวิตกกังวลเพิ่มขึ้น 4 เท่า ภายหลังควบคุมตัวแปรอื่นแล้ว

สรุปและข้อเสนอแนะ: การศึกษานี้ได้ระบุปัจจัยปกป้องและปัจจัยเสี่ยงต่อการเกิดอาการซึมเศร้าและความวิตกกังวลระดับปานกลางถึงรุนแรงในภาวะวิกฤต พยาบาลโรงเรียนและบุคลากรสาธารณสุขควรมีการคัดกรองและจัดการแผนการดูแลที่เหมาะสม เพื่อป้องกันการเกิดอาการซึมเศร้าและความวิตกกังวลในกลุ่มวัยรุ่นตอนกลางในช่วงสถานการณ์วิกฤต

คำสำคัญ: วัยรุ่น อาการวิตกกังวล โรคโควิด-19 อาการซึมเศร้า การติดอินเทอร์เน็ต

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Background and Significance

The coronavirus disease 2019 (COVID-19) has been a prolonged global pandemic lasting from 2019 to 2023 and has been widely regarded as a disaster that precipitated a mental health crisis worldwide.[1] This crisis challenged individuals to cope with stressors beyond their usual coping capacity, resulting in emotional disequilibrium, psychological distress, and functional impairment across populations.[1] Evidence has consistently shown that the longer the COVID-19 pandemic persisted, the greater and more severe its impact on mental health.[2]

In Thailand, COVID-19 was first reported in January 2020 and subsequently led to widespread transmission, particularly in Bangkok and surrounding metropolitan areas.[3] According to the Pandemic Health Footprint of COVID-19 over time, the long-term phase of the pandemic is characterized by psychological trauma, mental illness, and burnout, reflecting sustained mental health consequences beyond the acute phase of infection.[4]

Adolescents are particularly vulnerable during crises because they undergo rapid physical, emotional, cognitive, and social changes while transitioning from childhood to adulthood.[5] Adolescent mental health is shaped not only by developmental processes but also by environmental and psychosocial factors, including family, school, peer relationships, and broader social contexts.[5] This developmental period is especially critical for middle adolescents, who experience increasing autonomy and identity formation, which may intensify interpersonal challenges and psychological distress.[6-7]

Risk factors for depression and anxiety among adolescents during the COVID-19 pandemic include individual factors, family factors, and other factors.[5] A study of Chinese adolescents between the ages of 12 to 18 revealed that 43.7% and 37.4% of them had depressive and anxiety symptoms during the outbreak, respectively.[8] In Thailand, a national survey conducted by UNICEF and the Children and Youth Council of Thailand found that adolescents were highly concerned about family financial difficulties and strained family relationships during the pandemic.[9] Awareness of COVID-19 has been associated with anxiety and depressive symptoms, reflecting adolescents' cognitive and emotional responses to pandemic-related threats.[10] Furthermore, prolonged containment measures increased adolescents' reliance on the internet as a coping strategy for stress and social isolation, which has been linked to a higher risk of depression and anxiety symptoms.[11]

Despite growing evidence on adolescent mental health during the COVID-19 pandemic, important knowledge gaps remain. Most studies have focused

on the early phase of the pandemic or on adolescents in Western countries and other Asian contexts, while evidence on long-term mental health outcomes among Thai adolescents remains limited. In particular, little is known about the prevalence of depressive and anxiety symptoms among middle adolescents in Thailand during the long-term phase of the COVID-19 pandemic, approximately two years after the initial outbreak, as well as how individual, family, and social factors are associated with these outcomes.

Moreover, Bangkok and its surrounding metropolitan area represent a critical context for examining adolescent mental health due to high disease burden, prolonged school closures, and stringent social restrictions, which may have intensified psychological stressors. However, empirical evidence focusing on adolescent mental health in this urban setting remains scarce. Addressing these gaps is essential for informing context-specific mental health interventions and policies to support Thai adolescents during prolonged and future public health crises.

Objectives

1. To explore the prevalence of depressive symptoms and anxiety symptoms in middle adolescents two years after the COVID-19 outbreak.

2. To examine associations between sex, family income, family relationships, adverse life events, awareness of COVID-19 disease, and internet addiction and moderate to severe levels of depressive symptoms and anxiety symptoms in middle adolescents two years after the COVID-19 outbreak.

Hypotheses

Sex, family income, family relationship, adverse life events, awareness of COVID-19 disease, and internet addiction are associated with moderate to severe levels of depressive and anxiety symptoms in middle adolescents.

Methodology

A cross-sectional study was conducted at a high school in Bangkok and its surrounding metropolitan area, Thailand, involving adolescents aged 15-18 years. Data collection was conducted over four months period, from November 2021 to February 2022.

Sampling

The population of this study consisted of high school students from public and private schools in Bangkok and surrounding metropolitan areas. Three high schools were selected using simple random sampling from a total of 284 schools, with proportional allocation at a ratio of 2:1 (two public schools and one private school). The sample size for each school was determined proportionally to the size of the student population, and data were collected

using cluster sampling within selected classrooms aged 15-18 years, studying in grades 10-12, who possessed a smartphone, and had internet access. The sample size determined as adequate for a single proportion (proportion of depressive and anxiety symptoms during the COVID-19 pandemic = 0.313), with a margin of error of 0.05, a 30% non-response rate estimated from a previous online school-based study.[12] The significance level was set at a 95% confidence interval. During online data retrieval, additional 10 eligible responses were obtained, cases were identified and included, yielding a final sample size of 439 participants.

Instruments

The Patient Health Questionnaire (PHQ-9) is a standard tool for assessing depressive symptoms through self-report, developed by Kroenke, Spitzer and Williams[13] and translated into Thai by Lotrakul, Sumrithe and Saipanish.[14] This questionnaire consists of 9 items that assess symptoms experienced in the past 2 weeks. Response options regarding the symptom severity contain four levels: not at all (0), some days (1), quite often (2), and almost every day (3). The total score ranges from 0 to 27 points. A score > 9 is considered to have depressive symptoms. The severity is divided into three levels: mild depression (score of 10-14 points), moderate (score of 15-19), and severe (score of > 20) indicated the presence of the condition. The Cronbach's alpha coefficient obtained in this study was .89.

Generalized Anxiety Disorder 7 (GAD-7) is a standard tool for screening self-report anxiety symptoms developed by Spitzer, et al.[15] and translated into Thai by Prachason, et al.[16] It contains seven items that assess symptoms over the past 2 weeks. Each item has four options: not at all (0), some days (1), more than 7 days in the past 2 weeks (2), and almost every day (3). The total score ranges from 0 to 21 points. The cutoff point for anxiety symptoms is ≥ 5 points. The severity is divided into three levels: mild anxiety (score of 5-9), moderate (score of 10-14), and severe (score of ≥ 15) indicated the presence of the condition. The Cronbach's alpha coefficient obtained in this study was .89.

Awareness of COVID-19 was measured using the Knowledge, Attitudes, and Practices (KAP) questionnaire. This questionnaire was initially developed by Zhong, et al.[17] and further developed by Dardas, et al.[18] The questionnaire was based on information from the World Health Organization and the Jordanian Ministry of Health guidelines regarding COVID-19. The questionnaire was translated from English into Thai and back-translated by a language expert. The researcher and colleagues examined and validated the contents of the translated questions. This questionnaire contains 35 questions, divided into three parts: Knowledge of COVID-19 (15 items), attitudes toward COVID-19 (6 items),

and practices (14 items). The higher the score, the greater the awareness of COVID-19. A score above the specified cutoff indicated the presence of the condition. The instrument demonstrated good internal consistency in the present study, with a Cronbach's alpha coefficient of .89.

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The Brief Family Relationship Scale (BFRS) was used to measure family relationships. This scale was developed by Fok, et al.[19] and translated into Thai by Ninnanon, Seeherunwong and Pumpuang.[20] The scale contains 19 items divided into three subscales: cohesion, expressiveness, and conflict. Of the 19 items, 14 are positive, and five are negative. Each item has two answer options: no (0) and yes (1). Scoring is calculated by adding the total scores of all items. Total scores range from 0-19. A higher score indicates a better relationship. In the present study, the instrument demonstrated good internal consistency, with a Cronbach's alpha coefficient of .86.

The Internet Addiction Test (IAT) was used to measure Internet addiction. The IAT was developed by Young[21], translated into Thai, and back-translated by Angsukiattitavorn, et al.[22] The IAT consist of 20 questions assessing the respondents' internet use behaviors. Each question has five response options: never (1), rarely (2), sometimes (3), often (4), and regularly (5). The total score is a sum of all 20 questions ranging from 20-100. The cut off point for internet addiction is 50 indicates regular internet use; a score of $\geq$ 50 or higher is considered problematic for internet use or addiction. In this study, the Cronbach's alpha coefficient for the IAT was .93.

Ethical Consideration

This research study received approval from the Human Research Ethics Committee, Faculty of Nursing, Mahidol University (COA. No.IRB-NS2021/ 22.0406). The adolescent volunteers and their

were informed about the study project. Data were collected using an online questionnaire platform. To ensure confidentiality and data security, no personally identifiable information was collected, and responses were recorded anonymously. The data were stored in a password-protected system with access limited to the research team. Eligible participants were recruited through participating schools and completed the questionnaire via a secure online link. To prevent duplicate responses, each participant was allowed to submit the questionnaire only once. All data would be retained for five years after study completion and then permanently deleted.

Data Collection

The data was collected via the online survey. The first part of the questionnaire collected general information, including sex, age, educational level, family monthly income, history of adverse life events, daily time spent using the internet, the top three activities performed online, and the top three internet applications used. The other instruments are as mention above.

Data Analysis

SPSS Statistics version 27.0.1 was used for all data analyses. Descriptive statistics were used to summarize frequencies, percentages, means, and standard deviations. Univariable and multivariable logistic regression analyses were conducted to examine associations between sex, family income, family relationships, adverse life events, awareness of COVID-19, and internet addiction with moderate to severe levels of depressive symptoms and anxiety symptoms. A significance level at .05 was applied.

Findings

The demographic characteristics of the participants are presented in Table 1. A total of 439 middle adolescents participated in this study. The majority of participants were female (61.7%). The largest proportion of participants were aged 16 years (36.6%), followed by those aged 17 years (31.9%), 15 years (20%), and 18 years (11.4%), respectively. Most participants were enrolled in School 2 (40.8%), followed by School 1 (39.2%) and School 3 (20%). Regarding educational level, the majority of participants were studying in Grade 10 (41.2%).

More than half of the participants reported a family monthly income of 10,000 baht or higher (61.3%). Approximately 18.5% of the adolescents reported having experienced adverse life events. The average daily time spent using the internet was 12.04 hours.

Table 1: Demographics and characteristics of the participants (N = 439)

Characteristics	Frequency (%)
Sex	
Male	168 (38.3)
Female	271 (61.7)
Age (years)	
15	88 (20.0)
16	161 (36.6)
17	140 (31.9)
18	50 (11.4)
School	
School 1	172 (39.2)
School 2	179 (40.8)
School 3	88 (20.1)
Education level	
Grade 10	181 (41.2)
Grade 11	166 (37.8)
Grade 12	92 (21.0)
Family income	
< 10,000 bath/month	170 (38.7)
≥ 10,000 bath/month	269 (61.3)
Experience and adverse life event	
No	358 (81.6)
Yes	81 (18.5)
- Impact of (COVID-19) family infection or death	21 (25.9)
- Related to family members	21 (25.9)
- Related to health or accident	34 (42.0)
- Bullying or harassment at school	5 (6.2)
Average time of internet use per day (hr) (N = 434)	
> 8 hours	128 (29.5)
9-16 hours	227 (52.3)
> 16 hours	79 (18.2)
$\bar{X}$±SD = 12.04±5.31, Min-Max = 1-24	
Internet addiction	
- No	293 (66.7)
- Yes	146 (33.3)
$\bar{X}$±SD = 41.78±20.64, Min-Max = 20-100	

The prevalence of depressive symptoms among the participants was 55.1%. Of these, 33.9% had mild depressive symptoms, 13.9% had moderate depressive symptoms, and 7.3% had severe depressive symptoms. The prevalence of anxiety symptoms was 65.2%. Among participants with anxiety symptoms, 43.3% had mild anxiety, 15.0% had moderate anxiety, and 6.8% had severe anxiety symptoms. These findings are presented in Table 2.

Table 2: Prevalence of depressive symptoms (PHQ-9) and anxiety symptoms (GAD-7) of the participants

Mental health problems	Frequency (%)
PHQ-9: Depressive symptoms	
Normal (0-8 scores)	197 (44.9)
Depressive symptoms (≥ 9 scores)	242 (55.1)
- Mild (9-14 scores)	149 (33.9)
- Moderate (15-19 scores)	61 (13.9)
- Severe (≥ 20 scores)	32 (7.3)
$\bar{X}$±SD = 10.00±6.07, Min-Max = 0-27	
GAD-7: Anxiety symptoms	
Normal (0-4 scores)	153 (34.9)
Anxiety symptoms (≥ 5 scores)	286 (65.2)
- Mild (5-9 scores)	190 (43.3)
- Moderate (10-14 scores)	66 (15.0)
- Severe (≥ 15 scores)	30 (6.8)
$\bar{X}$±SD = 10.64±1.99, Min-Max = 0-21	

The results of univariable and multivariable logistic regression analyses examining factors associated with depressive symptoms are presented in Table 3. After controlling for covariates, family relationships and internet addiction were significantly associated with moderate to severe levels of depressive symptoms (aOR = 0.77; 95%CI [0.69, 0.87]; aOR = 4.07; 95%CI [2.47, 6.70]), respectively. In addition, adolescents who experienced adverse life events had higher odds of depressive symptoms (aOR = 2.11; 95%CI [1.17, 3.79]).

Table 3: Univariable & Multivariable logistic regression analysis for moderate to severe levels of depressive symptoms (PHQ-9) of the participants (N = 439)

Variables	Univariable			Multivariable		
	cOR	95%CI	p-value	aOR	95%CI	p-value
Sex						
Male	1.24	0.77, 1.99	.375	1.32	0.76, 2.28	.411
Female[1]	-	-	-	-	-	-
Family income						
< 10,000 Bath	1.05	0.66, 1.66	.845	0.89	0.52, 1.52	.670
≥ 10,000 Bath[1]	-	-	-	-	-	-
Family relationship	0.72	0.67, 0.84	.001	0.77	0.69, 0.87	.001
Adverse life event						
Yes	0.38	0.23, 0.65	.010	2.11	1.17, 3.79	.010
No[1]	-	-	-	-	-	-
Awareness of COVID-19	1.01	0.98, 1.04	.720	1.01	0.98, 1.052	.515
Internet addiction						
Yes	4.31	2.67, 6.96	.001	4.07	2.47, 6.70	.001
No[1]	-	-	-	-	-	-

[1]reference group; R^2 = .21; OR = odds ratio, CI = confidence interval, cOR = crude odds ratio, aOR = adjusted odds ratio, 95%CI = 95% confidence interval

The results of univariable and multivariable logistic regression analyses examining factors associated with anxiety symptoms are presented in Table 4. After controlling for covariates, family relationships were significantly associated with moderate to severe level of anxiety symptoms (aOR = 0.74; 95%CI [0.65, 0.84]). Adolescents who experienced adverse life events had higher odds of moderate to severe level of anxiety symptoms (aOR = 2.83; 95%CI [1.53, 5.24]). As well, internet addiction was significantly associated with higher odds of moderate to severe level of anxiety symptoms (aOR = 4.00; 95%CI [4.00, 11.50]).

Table 4: Univariable & Multivariable logistic regression analysis for moderate to severe levels of anxiety symptoms (GAD-7) of the participants (N = 439)

Variables	Univariable			Multivariable		
	cOR	95%CI	p-value	aOR	95%CI	p-value
Sex						
Male	1.24	0.77, 1.99	.375	1.32	0.76, 2.28	.323
Female[1]	-	-	-	-	-	-
Family income						
< 10,000 bath	1.05	0.66, 1.66	.845	0.89	0.52, 1.52	.670
≥ 10,000 bath[1]	-	-	-	-	-	-
Family relationship	0.72	0.64, 0.81	.001***	0.74	0.65, 0.84	.001
Adverse life event						
Yes	0.38	0.23, 0.65	.001***	2.83	1.53, 5.24	.001
No[1]	-	-	-	-	-	-
Awareness of COVID-19	0.98	0.96, 1.01	.242	0.98	0.95, 1.02	.288
Internet addiction						
Yes	6.78	4.13, 11.13	.001***	4.00	4.00, 11.50	.001
No[1]	-	-	-	-	-	-

[1]reference group; R^2 = .31; OR = odds ratio, CI = confidence interval, cOR = crude odds ratio, aOR = adjusted odds ratio, 95%CI = 95% confidence interval

Discussion

Two years after the initial outbreak, a high prevalence of depressive symptoms (55.1%) and anxiety symptoms (65.2%) was found among middle adolescents in this study. However, the prevalence rates in this study were higher than those reported in a study of Chinese adolescents, which found prevalence rates of 36.6% for depressive symptoms and 19% for anxiety symptoms.[8] These differences may be explained by variations in cultural and social contexts, as well as methodological differences such as screening tools, cutoff scores, and timing of data collection. In Thailand, particularly in urban areas such as Bangkok, adolescents experienced prolonged school closures, extended online learning, and limited peer interaction, which may have contributed to sustained psychological stress. In the present study, when classifying only Thai adolescents with moderate to severe depressive symptoms, a prevalence rate of 21.9% was found, which is similar to the results of an Indian study.[23] This suggests that although mild symptoms were

more prevalent, the proportion of adolescents with clinically significant depressive symptoms was comparable across settings.

Adolescents who experienced adverse life events were at a significantly greater risk of developing both depressive and anxiety symptoms. After controlling for potential confounders, adverse life events were associated with more than a twofold increase in the odds of depressive symptoms and a 2.83-fold increase in the odds of anxiety symptoms. Exposure to adverse life events may overwhelm adolescents' coping capacity and disrupt emotional regulation, particularly during middle adolescence, a developmental period characterized by heightened vulnerability to stress. Adolescents with internet addiction were approximately four times more likely to develop depressive symptoms and experience anxiety symptoms than those without internet addiction.[11] Excessive internet use may reflect maladaptive coping strategies in response to prolonged stress and social isolation and may contribute to mental health problems through mechanisms such as disrupted sleep, reduced physical activity, and social withdrawal. Consistent with these findings, a survey by Jantapad, et al.[24] reported that during the COVID-19 pandemic, 50.4% of students used the internet excessively (more than 70 hours per week).

These findings can be interpreted within the framework of Aguilera's Crisis Theory.[25] The COVID-19 pandemic may be conceptualized as a disaster crisis that disrupted adolescents' psychological equilibrium. Adverse life events acted as stressors, while limited family support and problematic internet use may have reduced effective coping resources. When adolescents were unable to adequately perceive the situation, receive sufficient support, or employ adaptive coping strategies, psychological imbalance may have persisted, resulting in depressive and anxiety symptoms.

Conclusions and recommendations

Middle adolescents are a high-risk group for mental health problems during challenging periods such as the COVID-19 pandemic, as this developmental stage involves represents a critical transition toward adulthood. Approximately two years after the COVID-19 outbreak, this study found that 55.1% of the participants reported depressive symptoms and 65.2% reported anxiety symptoms. Among these adolescents, 21.2% met the criteria for moderate to severe depressive symptoms, and 21.9% met the criteria for moderate to severe anxiety symptoms, indicating a substantial proportion who may require psychological support.

The findings suggest that family relationships function as an important protective factor against moderate to severe levels of depressive and anxiety symptoms among adolescents. Strengthening family

relationships through open communication, emotional support, and shared activities may enhance adolescents' resilience during prolonged public health crises. At the school level, regular mental health screening using standardized instruments such as the PHQ-9 and GAD-7 is recommended, along with school-based counseling services and teacher training programs to support early identification and assistance for students at risk. At the public health and community level, preventive programs should be implemented to promote emotional regulation, digital literacy, and responsible internet use, while expanding access to online mental health services, including tele-counseling, to ensure continuity of care.

However, several limitations of this study should be acknowledged. First, although the findings addressed the primary research questions, some potential covariates may not have been fully explored. Second, depressive and anxiety symptoms were analyzed separately, and comorbidity between these conditions was not explicitly examined. Third, due to the cross-sectional design, causal relationships between the associated factors and mental health outcomes cannot be established. Therefore, the findings should be interpreted as associations rather than causal effects.

Future research should employ longitudinal designs to better understand the temporal relationships between psychosocial factors, digital behaviors, and adolescent mental health outcomes. Further studies should also examine comorbidity between depressive and anxiety symptoms and include additional contextual and individual factors to provide a more comprehensive understanding of adolescent mental health during and after public health crises.

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