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Research Article

Maladaptive Smartphone use among Jordanian Adolescents: Prevalence, Correlations, and the Role of Cognitive Emotion Regulation

Fatimah S. Tarawneh[1], Alaa Abuattallah[2], Latefa Ali Dardas[3]*

[1]Princess Muna College of Nursing, Mutah University, Al-kark 61710, Jordan

[2]Department of Maternal and Child Health Nursing, Faculty of Nursing, Applied Science Private University, Faculty of Nursing, Amman 11937, Jordan

[3]Department of Community Health Nursing, School of Nursing, University of Jordan, Amman 11942, Jordan

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Background

Maladaptive smartphone use (MSU) has emerged as a significant concern, particularly among adolescents. In Jordan, a country with a youthful population and high rates of smartphone engagement, understanding MSU and its psychological impacts is crucial.

Objective

The study aims to (i) determine the point prevalence and patterns of MSU among Jordanian adolescents, and (ii) examine whether cognitive emotion regulation strategies mediate the relationship between MSU and psychological health.

Methods

A cross-sectional, descriptive, correlational survey was conducted. Using a multistage sampling approach, the study targeted students aged 13 – 17 in Jordanian public and private schools, with schools randomly selected from each region. A structured questionnaire assessed sociodemographic data, smartphone addiction, cognitive emotion regulation, and psychological health targeting depression, anxiety, and stress.

Results

Among the 960 students who participated, 36% exhibited signs of MSU. Adolescents with high MSU reported significantly higher maladaptive cognitive emotion regulation strategies than those with low MSU. Factors such as age, gender, socioeconomic status, and academic performance influenced MSU levels. Maladaptive emotion regulation strategies partially mediated the relationship between MSU and psychological health, with high MSU linked to greater levels of emotional distress.

Conclusion

This study reveals a significant prevalence of MSU among Jordanian adolescents, with notable demographic variations. It proposes a link between MSU and psychological health, emphasizing the mediating role of cognitive emotion regulation. These results contribute to the growing body of literature on smartphone use behaviors and their psychological implications, particularly within the context of Jordanian adolescents. The study's insights are relevant for developing targeted interventions to mitigate MSU and its psychological impacts.

***Corresponding author:**
Latefa Ali Dardas
Department of Community Health Nursing, School of Nursing, University of Jordan, Amman 11942, Jordan
Email: l.dardas@ju.edu.jo

1. INTRODUCTION

In 2023, the number of smartphone users worldwide reached approximately 6.92 billion, accounting for 86.29% of the global population. This represents 86.29% of the world's population.[1] In 2020, the user base expanded by 93 million, reflecting a 1.8% annual growth rate. Mobile subscriptions have surpassed six billion, and the daily addition of new smartphones in use exceeds one million.[2] The emergence of multipurpose smartphones and their subsequent widespread adoption have altered the communication and information landscape, reshaped the values and interests of a large number of users, and raised concerns about usage addiction globally.[3]

Many researchers use the term "smartphone addiction" to describe excessive use of smartphones. However, this term is not included in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, or the upcoming International Classification of Diseases, 11th Revision.[3] Instead, the term maladaptive smartphone use (MSU) is increasingly used, indicating excessive behavior with less severe impairment than addiction.[4] Regardless of the terminology, this phenomenon is widely recognized due to its potentially harmful consequences.[5]

Among adolescents, MSU is particularly evident, and its pattern demonstrates associations with several negative psychosocial and physical consequences, including impulsivity, anxiety, depression, attention deficits,[6,7] dysfunctional family dynamics, strained relationships with friends,[8,9] insomnia, neck pain, and other somatic problems.[10,11] In addition, the heightened utilization of smartphones among adolescents has been linked to compromised cognitive functions and altered brain structure.[12] Together, these findings ought to raise concerns over MSU for clinicians and educators in contemporary society.[7]

Several factors are associated with MSU among adolescents. Cognitive emotion regulation strategies have been reported to play a key role in the process of adaptation and maladaptation to smartphone use.[13,14] Cognitive emotion regulation refers to the cognitive mechanisms involved in handling emotionally charged information, playing a vital role in the human experience by facilitating the management of emotions following stressful events.[15] As children progress in age, there is a developmental shift in their emotion regulation strategies from external, behavior-oriented approaches to internal, cognition-based methods. Children acquire the ability to regulate their emotions through cognitive processes, including but not limited to self-blame, rumination, catastrophizing, acceptance, planning, and redirecting focus toward positive aspects.[16] A notable finding in existing research is how individuals employ cognitive processes to manage their emotions and how this relates to the extent of MSU. Evidence suggests that individuals who struggle with effective emotion regulation may be more prone to MSU, potentially using it as a coping mechanism to escape or alleviate emotional distress.[17] Understanding these cognitive emotion regulation strategies is crucial in comprehending the intricate relationship between psychological tendencies and excessive smartphone dependency.

Jordan, with 63% of its population under the age of 30, possesses one of the youngest demographics globally. Notably, 32% of individuals aged 15 – 30 in the country are currently unemployed.[18] Jordan, classified by the World Health Organization as a nation requiring assistance, initiated the Mental Health Gap Action Programme in 2021.[19] Although the program has been incorporated into Jordan's health policies and the National Mental Health and Substance Use Action Plan, the availability of mental health services remains constrained. This limitation is attributed to the scarcity of primary health-care clinics, the substantial population of Palestinian and Syrian refugees, and the prevalent cultural stigma surrounding mental health issues.[20] A recent study revealed that 59% of Jordanian children engage with YouTube, 25% indulge in gaming, and 23% spend over 5 h daily on the Internet.[21] Atoum *et al*.,[22] called for further investigation on this issue to improve health outcomes in light of the excessive utilization of electronic devices by adolescents in Jordan.

Despite the increasing attention from both scientific literature and mainstream media on MSU as a noteworthy health concern, there remains a paucity of research on this issue in the Arab region in general, and Jordan in particular. The exploration of MSU among Jordanian adolescents and its connection with cognitive emotion regulation strategies emerges as an innovative and crucial research area. Given the widespread integration of smartphones into daily routines, there is a compelling need for a thorough examination of the potential psychological implications within this demographic. Therefore, this study aimed to (i) determine the point prevalence and patterns of MSU among Jordanian adolescents, and (ii) examine whether cognitive emotion regulation strategies mediate the relationship between MSU and psychological health.

2. METHODS

2.1. STUDY DESIGN

A cross-sectional, descriptive, correlational survey design was employed to systematically investigate the study's objectives. Data were collected using a valid and reliable self-reported questionnaire administered to high school students, capturing information related to the study's main variables. The data collection process spanned from February to May 2024, ensuring a comprehensive representation of participants within the designated timeframe. The selection of this research design aligns with the study's objectives, offering a methodologically sound approach to examining the associations among key variables.

2.2. SAMPLING AND POWER ANALYSIS

A multistage sampling method was employed to ensure a representative and methodologically rigorous selection process. In the first stage, the country was stratified into three main regions: northern, central, and southern districts. To maximize school representation, the researcher identified the three governorates with the highest population distribution, as reported by the Department of Statistics in 2023.[23] The selected governorates were Irbid (north), Amman (center), and Al-Karak (south). Based on proportional allocation, approximately 50% of the randomly selected schools were from the central district, 30% from the northern district, and 20% from the southern district. In the second stage, educational directorates within these governorates were randomly chosen from the Ministry of Education's official school list using a simple random selection technique. Specifically, in the northern district, schools were randomly selected from the Irbid Qasabah directorate. In the central district, selections

were made from the Aljamaah and Marka directorates, whereas in the southern district, schools were chosen from the North Mazar directorate. Following this, secondary public schools were stratified by gender, ensuring the inclusion of both male and female schools. Private schools, which accommodate both male and female students within the same institution, were also included. The selection of schools was based on high student density, identified from the Ministry of Education's records. Schools were then randomly selected using a simple random selection method, resulting in an initial total of 16 schools. However, the number of schools was subsequently increased to ensure that the target sample size was met, adjusting based on student response rates. Within each selected school, convenience sampling was employed to recruit participants. The target population comprised male and female students aged 13 – 17 who met the predefined inclusion criteria. This multistage approach ensured a balanced and representative sample, enhancing the generalizability and validity of the study findings. Figure 1 summarizes the sampling procedure.

Cochran's formula, in Equation I,

$$n = (Z^2pq)/e^2 \quad \text{(I)}$$

It is particularly well-suited for large populations, such as school students. In this formula, p represents the estimated proportion of the population possessing the characteristic of interest, e denotes the desired level of precision (i.e., the margin of error), and q is defined as 1-p.[24] The *Z*-value, which corresponds to the desired confidence level, is obtained from a standard *Z*-table. For this study, using a 95% confidence level ($Z = 1.96$), an estimated proportion (p) of 0.5, and a margin of error (e) of 0.05, the sample size was calculated as follows (Equation II):

$$n = (1.962^2 \times 0.5 \times 0.5)/(0.052)^2 = 384 \quad \text{(II)}$$

This calculation indicates that a minimum sample size of 384 participants is required to achieve a 95% confidence level, ensuring that the true population value falls within ±5% of the surveyed value. To account for potential replication errors, attrition, and data entry inaccuracies, a 10% buffer was added, increasing the minimal required sample size to 435 participants.

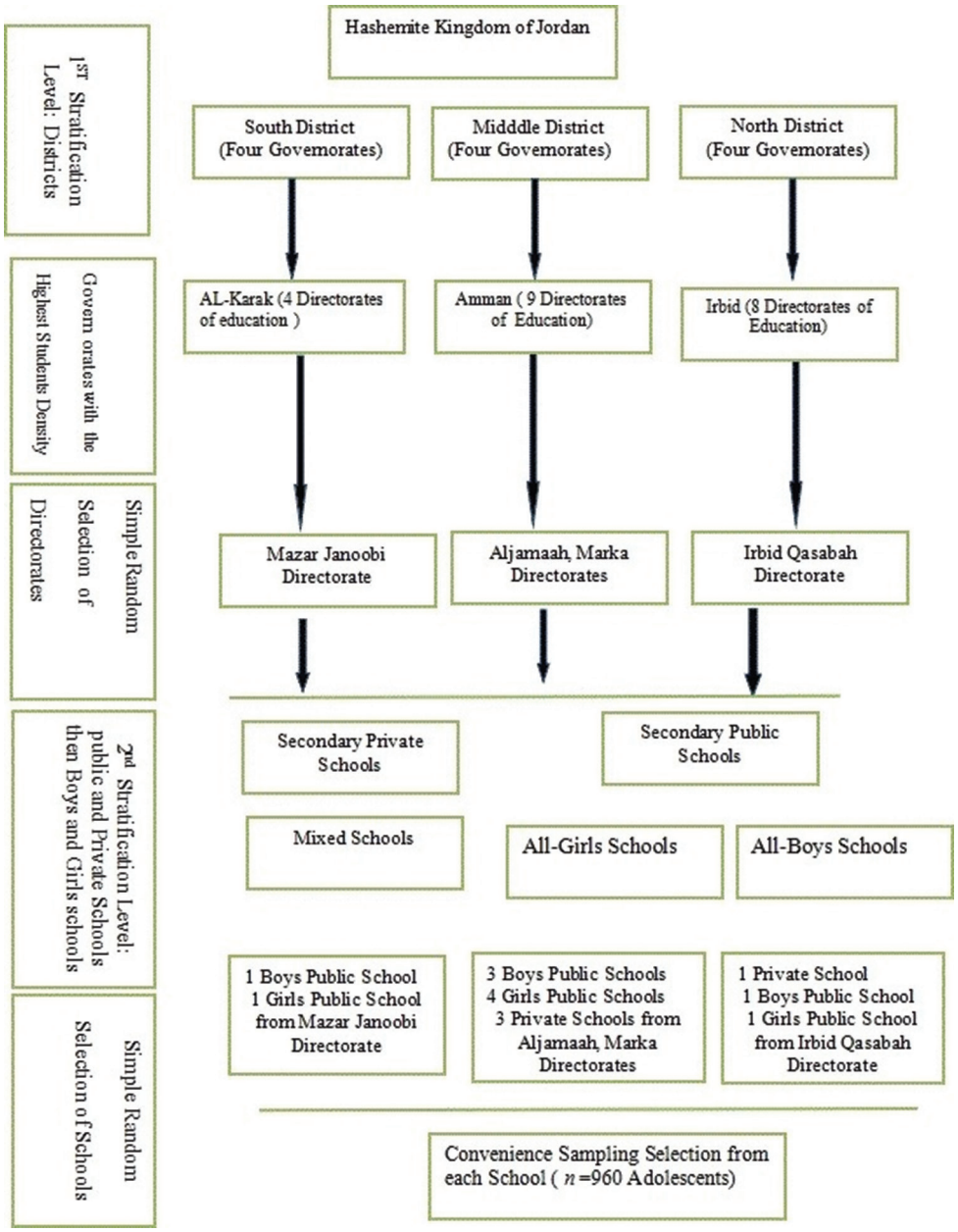

Figure 1. Sampling flowchart

2.3. MEASUREMENT

A structured questionnaire comprising three sections was used. The first section gathered sociodemographic data, including gender, age, educational level (grades 7 – 11), type of school, parental educational level, place of residence, grade point average (GPA), monthly family income, and perceived parental control over smartphone use both at home and outside. In addition, it collected information on the average hours spent on smartphones during weekends and weekdays, as well as the ownership status of smartphones.

The second section included the smartphone addiction inventory (SPAI), a 26-item self-report measure designed to assess smartphone addiction.[25] Each item was rated on a four-point Likert scale: 1 = strongly disagree, 2 = somewhat disagree, 3 = somewhat agree, and 4 = strongly agree. The cutoff score for SPAI is typically set at 64, distinguishing individuals with potential smartphone addiction.[25] The SPAI is structured around four key factors: (i) Compulsive behavior, (ii) functional impairment, (iii) withdrawal, and (iv) tolerance. It has been validated across different cultures and maintains a reliable factor structure across various populations,[26-28] particularly among adolescents.[29] The authors of SPAI established internal consistency, reporting a Cronbach's alpha of 0.94 for the total scale, with a 2-week test–retest reliability ranging from 0.80 to 0.91 across its subscales. In the present study, the Cronbach's alpha correlation coefficient was 0.92, confirming strong reliability.

The third section included the Cognitive Emotion Regulation Questionnaire (CERQ),[30] a 36-item measure designed to assess cognitive emotion regulation strategies in response to stressful or threatening life events. The CERQ consists of nine distinct subscales, including five adaptive strategies (positive refocusing, acceptance, positive reappraisal, refocusing on planning, and putting into perspective) and four maladaptive strategies (rumination, self-blame, blaming others, and catastrophizing). Each subscale was assessed using four items, rated on a five-point Likert scale from 1 ("Almost never") to 5 ("Almost always"), indicating the frequency of use of each strategy. Higher subscale scores reflect a greater tendency to use a specific cognitive regulation strategy.[31] This study employed the validated Arabic version of the CERQ,[32] which demonstrated strong psychometric properties, with a Cronbach's alpha correlation coefficient of 0.86.

The fourth section included the Depression, Anxiety, and Stress Scale-21 Items (DASS-21), a widely used psychometric instrument designed to measure three psychological states: Depression, anxiety, and stress.[33] The scale consists of 21 items, with seven items per subscale, each assessing core symptoms associated with these emotional states. The depression subscale evaluates low mood, lack of interest in life, low self-esteem, and low motivation. The anxiety subscale measures fear responses and physiological symptoms of anxiety, whereas the stress subscale assesses difficulties in relaxation, heightened nervous arousal, and tendencies to become easily upset or irritable. Each item was rated on a four-point scale, ranging from 0 ("Did not apply to me at all") to 3 ("Applied very much or most of the time"). The DASS-21 categorizes scores into normal, mild, moderate, severe, and extremely severe for each psychological state.[33] This scale has been extensively validated and is widely recognized for its reliability and validity. The Arabic version, validated by Parkitny and McAuley,[34] was used in this study, demonstrating a Cronbach's alpha correlation coefficient of 0.920, ensuring strong internal consistency.

2.4. TRANSLATION OF STUDY MEASURES

To ensure linguistic and cultural accuracy, the translation of study instruments followed a rigorous five-stage process. The initial translation involved two bilingual experts independently translating the original English versions of the instruments into Arabic. This was followed by a synthesis process, where a review panel compared the translations and reconciled discrepancies to produce a unified Arabic version. The back-translation stage required two independent translators with no prior exposure to the original instruments to translate the Arabic version back into English. The back-translated English version was then compared with the original English instruments to identify any semantic inconsistencies, and discrepancies were resolved through discussion with linguistic and subject matter experts. Finally, the validation and reliability testing stage involved expert review for linguistic clarity, cultural appropriateness, and religious sensitivity. In addition, Cohen's kappa coefficient and intraclass correlation coefficient were computed to evaluate inter-rater agreement and ensure the reliability of the translation process.[35]

2.5. ETHICAL CONSIDERATIONS

Approval for ethical clearance was obtained from the University of Jordan's Deanship of Scientific Research Institutional Review Board Committee, followed by formal authorization from the Ministry of Education to conduct data collection. In addition, ethical assurances were secured from the original authors of the research instruments used in this study. To uphold ethical integrity and participant protection, multiple safeguards were implemented.

To ensure ethical compliance and participant protection, parental consent and child assent were obtained following the guidelines of the American Academy of Pediatrics (1976).[36] The consent form provided detailed information about the study, including its title, significance, purpose, and the researcher's contact information for any inquiries. Participants were assured that their responses would remain confidential, no personal identifying data would be recorded, and all collected information would be used solely for research purposes.

In collaboration with school counselors, the consent form was distributed to parents through a WhatsApp group for adolescents meeting the inclusion criteria. To enhance parental understanding of the study's objectives and procedures, the form explicitly outlined the study's aim, participation requirements, and contact details for further inquiries. A passive consent approach was adopted, whereby only parents who objected to their child's participation informed the school principals or counselors.

Adolescents were also provided with assent forms to ensure they were fully aware of their participation and could give voluntary consent. Both parents and students were clearly informed about the voluntary nature of the study, any potential risks, and their right to withdraw at any time without consequences. To maintain participant anonymity, all names were coded for data analysis, and confidentiality was strictly upheld. Physical copies of the questionnaires were securely stored in a locked location accessible only to the researcher. Electronic data, including survey files and recordings, was stored on a password-protected computer. Personally identifiable information was maintained in a separate coded file, with access restricted to the researcher and supervisor to ensure the highest level of data security and participant privacy.

2.6. STATISTICAL ANALYSIS

Data were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize participants' demographic characteristics and key study variables. Inferential analyses were conducted to examine group differences and relationships among variables.

Specifically, one-way Analysis of Variance (ANOVA) with Scheffé *post hoc* tests was used to assess differences in MSU scores across sociodemographic subgroups such as age, gender, GPA, income, and sleep quality. Multivariate ANOVA (MANOVA) was performed to evaluate the impact of these factors on MSU subscale scores (compulsive behavior, functional impairment, withdrawal, and tolerance). Independent-sample t-tests were used to compare cognitive emotion regulation strategy scores between adolescents with high and low levels of MSU. Assumptions for each test were assessed and met.

To test the hypothesized mediation model, Partial Least Squares Structural Equation Modeling was conducted using SmartPLS version 4.0, which allowed for the analysis of complex relationships between MSU, cognitive emotion regulation strategies, and psychological health (depression, anxiety, and stress). Model fit was assessed using multiple fit indices, including the Chi-square test, root mean square error of approximation (RMSEA), and comparative fit index (CFI).

All statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics version 28 and SmartPLS version 4.0. $p<0.05$ was considered to be statistically significant.

3. RESULTS

3.1. PARTICIPANTS' DEMOGRAPHIC CHARACTERISTICS

A total of 960 students, comprising 550 girls (57.3%) and 410 boys (42.7%), completed and returned the study questionnaire. Participants were distributed across Jordan as follows: 24.7% in the north (n = 237), 62.5% (n = 600) in the middle, and 12.8% (n = 123) in the south. The mean age of the students was 14.94 (standard deviation [SD] = 1.2) with a range of 13 – 17 years. The majority of the participants were ninth-grade students (32.5%). Of the total sample, 58.9% attended public schools, whereas 41.1% were from private schools. About 43.2% had an excellent GPA of 90% and more (mean n = 85.7, SD = 10.2), and approximately 59.4% of them studied for an average of 1 – 3 h/day. Regarding parental education levels, 50.6% of the parents held a Bachelor's degree or higher, whereas 3.9% were illiterate. In terms of maternal education, 44% of the mothers had attained a Bachelor's degree or higher, whereas 1.8% were illiterate. Overall, maternal education levels were higher compared to paternal education levels. For this survey result, 33,4% had a family monthly income between 501 and 1,000 Jordanian Dinar (JD)/month. Table 1 details all demographic characteristics of respondents.

3.2. SMARTPHONE USAGE PROFILE

The mean score for the MSU was 59.07 (SD = 16.07), ranging from 26 to 103 based on the total score's distribution.

Table 1. Demographic characteristics of respondents

Variables	Mean	Standard deviation
Age	14.94	1.2
Grade point average	85.7	10.2
Variables	Frequency (n)	Percentage (%)
Gender		
Female	550	57.3
Male	410	42.7
Age		
13 years	136	14.2
14 years	212	22
15 years	285	29.7
16 years	228	23.8
17 years	99	10.3
Residence		
North	237	24.7
Middle	600	62.5
South	123	12.8
Type of school		
Public	565	58.9
Private	395	41.1
Fathere education		
Illiterate	37	3.9
11th grade and below	93	9.7
Tawjihi (high school)	232	24.2
Diploma	112	11.7
Bachelor's degree or higher	486	50.6
Mother's education		
Illiterate	17	1.8
11th grade and below	81	8.4
Tawjihi (high school)	264	27.5
Diploma	176	18.3
Bachelor's degree or higher	422	44.0
Family monthly income		
<150 JD	34	3.5
150 – 300 JD	121	12.6
301 – 500 JD	207	21.6
501 – 1,000 JD	321	33.4
1001 – 1,500 JD	122	12.7
1501 – 2,000 JD	155	16.1
Grade point average		
Excellent (90 – 100%)	415	43.2
Very good (80 – 89%)	333	34.7
Good (70 – 79%)	139	14.5
Moderate (60 – 69%)	58	6
Weak (e59%)	15	1.6
Practices a hobby		
Yes	633	65.9
No	327	34.1
Average hours of study per day		
<1 h	153	15.9
1 – 3 h	570	59.4
4 – 6 h	207	21.6
7 – 9 h	26	2.7
More than 9 h	4	0.4

Abbreviation: JD: Jordanian Dinar.

Almost 64% of the sample was under the cutoff score of 64, as the prevalence of MSU among school adolescents was 36%, where 57.3% were females (Table 2).

One-way ANOVA was conducted to examine differences in MSU scores across various demographic factors, including gender, school type, age, GPA, family income, and perceived quality of sleep (Table S1). Scheffe *post hoc* tests were used for multiple comparisons where significant differences were observed. The results indicated that age significantly impacted MSU scores (F [4, 955] = 2.51, p=0.040), with students aged 15 – 17 reporting significantly higher MSU scores than those aged 13 – 14 (p<0.01). Gender differences were also significant, with female students exhibiting higher MSU scores than male students (F [1, 955] = 60.42, p<0.001). Academic performance was inversely related to MSU, as students with lower GPAs reported significantly higher MSU scores than those with excellent GPAs (F [4, 955] = 5.86, p<0.001). Similarly, family income was a significant factor (F [5, 954] = 3.09, p=0.009), with students from families earning 301 – 500 JDs/month displaying higher MSU scores than those from families earning 1,001 – 1,500 JDs/month (p=0.044). Perceived sleep quality showed a strong association with MSU (F [2, 957] = 73.22, p<0.001), with students reporting poor sleep quality exhibiting significantly higher MSU scores than those with moderate or good sleep quality (p<0.001). Conversely, school type, grade level, residence, and parental education level did not show a significant impact on MSU scores (p>0.05).

A MANOVA was conducted to analyze differences in MSU subscales (compulsive behavior, functional impairment, withdrawal, and tolerance) based on sociodemographic characteristics (Table S2). Preliminary assumption testing confirmed no serious violations in normality, linearity, variance homogeneity, or multicollinearity. School type significantly influenced compulsive behavior, with public school students scoring higher than private school students (F [1, 958] = 4.34, p<0.05). Age also had a significant effect on compulsive behavior (F [4, 955] = 4.42, p<0.001), with older adolescents (15 – 17 years) exhibiting higher scores than younger students. Gender differences were evident across all MSU subscales, with female students scoring significantly higher than male students in compulsive behavior (F [1, 958] = 47.17, p<0.001), functional impairment (F [1, 958] = 42.22, p<0.001), withdrawal (F [2, 958] = 47.71, p<0.001), and tolerance (F [2, 958] = 40.55, p<0.001). GPA was inversely correlated with compulsive behavior, functional impairment, and withdrawal symptoms, with students having lower GPAs exhibiting higher MSU subscale scores (p<0.001). *Post hoc* tests indicated that students with weak, moderate, and good GPAs had significantly higher scores in compulsive behavior, functional impairment, and withdrawal symptoms compared to those with excellent GPAs (p<0.01). Residence also played a role, particularly in functional impairment (F [2, 957] = 5.90, p<0.001). Students from southern regions exhibited significantly higher functional impairment than those from central regions (p<0.05). Overall, these findings highlight that age, gender, GPA, family income, and sleep quality significantly influence MSU prevalence and severity, with older adolescents, females, lower academic achievers, and those with poor sleep quality being at higher risk for compulsive smartphone behaviors and psychological impairments.

Table 2. Prevalence of maladaptive smartphone use among school adolescents

Prevalence of maladaptive smartphone use	Statistical values
Mean±standard deviation	59.07±16.07
Median	58
25th, 75th percentile	46, 70
Minimum, maximum values	26, 103
Scores	*n* (%)
>64 (cutoff score)	347 (36.2)
<64 (cutoff score)	613 (63.8)
<46	222 (23.1)
46 – 58	271 (28.2)
59 – 70	227 (23.6)
>70	240 (25)

3.3. PARTICIPANTS' PSYCHOLOGICAL HEALTH AND COPING STRATEGIES

The mean score for the DASS-21 scale was 24.87 (SD = 13.79), ranging from 0 to 63. In particular, the mean scores for depression, anxiety, and stress were 15.62 (SD = 10.02), 16.14 (SD = 10.26), and 18.00 (SD = 10.12), respectively. Based on the DASS classification of depression severity, 29% of the students did not report any depressive symptoms, 17.1% reported mild depression, 25% reported moderate depression, 13% reported severe depression, and 15.9% reported extremely severe depression. As for the classifications of anxiety, 22.5% did not report any anxiety symptoms, 8.4% reported mild anxiety, 18.9% reported moderate anxiety, 13.6% reported severe anxiety, and 36.6% reported extremely severe anxiety. Regarding reports on stress levels, 42.4% did not report any stress symptoms, 14.5% reported mild stress levels, 19.3% reported moderate stress levels, 14.2% reported severe stress levels, and 9.7% reported having extremely severe stress symptoms. Based on the reports on the CERQ, the mean score of the adaptive subscale score was 69.10 (SD = 12.91), ranging from 20 to 99. The mean score of the maladaptive subscale was 51.31 (SD = 12.25). Refocusing on planning, positive reappraisal, and rumination were among the most commonly used coping mechanisms. Table 3 details the students' responses on all subscales.

3.4. COGNITIVE REGULATION STRATEGIES AMONG ADOLESCENTS

An independent sample t-test was used to explore differences in mean scores of cognitive emotion regulation strategies between Jordanian school adolescents with high and low levels of MSU. All test assumptions were first examined to ensure that the data were compatible with the test. The analysis revealed a statistically significant difference (p<0.001) in the mean scores of maladaptive cognitive regulation strategies between those who had a high level of MSU (mean n = 55.31, SD = 10.98) and a low level of MSU (mean n = 47.52, SD = 12.20). In particular, those with high MSU levels reported significantly higher maladaptive cognitive regulation strategies mean scores than those who had low MSU levels.

3.5. COPING STRATEGIES AS POTENTIAL MEDIATORS BETWEEN MSU AND PSYCHOLOGICAL HEALTH

Preliminary and correlation analyses between the study variables were conducted before model testing. The conceptual

Table 3. Reports on study variables from students (*n*=960)

Study measure	(Mean±standard deviation)	P25	Median	P75	Minimum value	Maximum value
The Smartphone Addiction Inventory Scale	59.07±16.07	46	58	70	26	103
Compulsive behavior subscale	19.74±5.51	15	19	24	9	36
Functional impairment subscale	18.09±5.73	14	18	22	8	32
Withdrawal subscale	13.69±4.52	10	13	17	6	24
Tolerance subscale	7.56±2.35	6	7	9	3	12
Adaptive CER Questionnaire	69.10±12.91	61	70	78	20	99
Maladaptive CER Questionnaire	51.31±12.25	43	52	60	16	79
Self-blame subscale	12.74±4.00	10	13	16	4	20
Acceptance subscale	12.42±3.78	10	13	15	4	20
Rumination subscale	14.63±4.14	12	15	18	4	20
Positive refocusing subscale	13.25±4.30	10	13	17	4	20
Refocus on the planning subscale	14.62±4.01	12	15	18	4	20
Positive reappraisal subscale	14.84±3.89	12	15	18	4	20
Putting into perspective subscale	13.97±3.63	12	14	17	4	20
Catastrophizing subscale	12.46±4.21	9	13	16	4	20
Other-blame subscale	11.48±4.43	8	12	15	4	20
Depression, Anxiety, and Stress Scale	24.87±13.79	14	23	34	0	63
Depression subscale	7.81±5.01	4	7	11	0	21
Anxiety subscale	8.07±5.13	4	8	12	0	21
Stress subscale	9.00±5.06	5	9	12	0	21

Abbreviation: CER: Cognitive emotion regulation.

mediation model was then fitted to the data with SmartPLS 4 (version 4.0) to examine coping strategies as potential mediators in the relationship between MSU and psychological health (i.e., depression, anxiety, and stress). The model demonstrated satisfactory model fit, with the following indices: χ^2 of 6.195, p=0.001, RMSEA of 0.074, and CFI of 0.925. As shown in Figure 2, MSU had a significant positive direct effect on psychological health (b = 0.255, p<0.001) and maladaptive coping strategies (b = 0.301, p<0.001). In addition, maladaptive coping strategies had a significant positive direct effect on psychological health (b = 0.811, p<0.001). In contrast, adaptive coping strategies had a significant negative effect on psychological health (b = –0.287, p<0.001). Moreover, the findings showed that maladaptive coping strategies partially mediated the effects of MSU on psychological health (b = 0.244, p<0.001).

4. DISCUSSION

The primary aim of this study was to examine MSU among Jordanian school adolescents, focusing on its prevalence, psychosocial correlations, and the role of cognitive emotion regulation strategies. This study revealed that the prevalence of MSU among Jordanian school adolescents was 36%. To accurately interpret these findings, they should be considered within the broader context of both Eastern and Western literature. Extremera *et al*.[15] reported a 41.9% prevalence of MSU among Spanish adolescents (ages 14 – 18), with no significant gender differences. In Southern Thailand, Kim *et al*.[37] found an alarming 70.3% prevalence of MSU among Thai Muslim adolescents. In India, MSU rates ranged from 39% to 67%,[38] while in Indonesia, 11.4% of junior high students exhibited MSU symptoms.[39]

Among South Korean adolescents, 35.2% were classified as smartphone addicts, with 7.6% at high risk and 27.6% at potential risk.[40] In the Philippines, the MSU rate was 62.6%, with a higher prevalence among males (66.2%) than females (60.2%).[41] In Iran, Esmaeilpour *et al*.[42] reported a 38.9% prevalence, while in Turkey, Çağan and Koca[43] found a 36.9% prevalence, with females (68%) exhibiting higher rates than males (32%). In Saudi Arabia, Al-Amri *et al*.[44] reported that 49.5% of middle-school adolescents exhibited MSU, with a higher prevalence among females (56%) than males (44%). Similarly, studies in Morocco indicated a high prevalence, with 57.8% of adolescents identified as maladaptive users.[45] Another study reported higher susceptibility among girls (69.1%) compared to boys (63%).[46] In Lebanon, 43.4% of adolescents exhibited MSU,[47] while in Kuwait, the prevalence reached 64.6%.[48]

Despite extensive literature on MSU among adolescents worldwide, no studies have specifically examined its prevalence among Jordanian school students using self-report questionnaires. Existing research focuses primarily on university students and adults.[49,50] However, an artificial intelligence-based analysis of online surveys indicated that Jordanian parents perceive a growing trend of MSU among adolescents, with signs of addictive behavior becoming a significant social concern.[21] Regardless of the terminologies and measurement tools used across studies, the prevalence of MSU among Jordanian adolescents appears comparably high, reinforcing the global nature of smartphone addiction and the urgent need for culturally sensitive interventions.

4.1. MSU BASED ON THE DEMOGRAPHIC CHARACTERISTICS OF JORDANIAN ADOLESCENTS

MSU appeared to be significantly higher among older female adolescents from families with low monthly income and those with poor academic performance. Consistent with these findings, other studies have also identified a higher prevalence of MSU among females.[51,52] Girls were found to be between 2 and 7 times more likely to develop MSU than boys.[37,53] While the exact reasons for this difference are

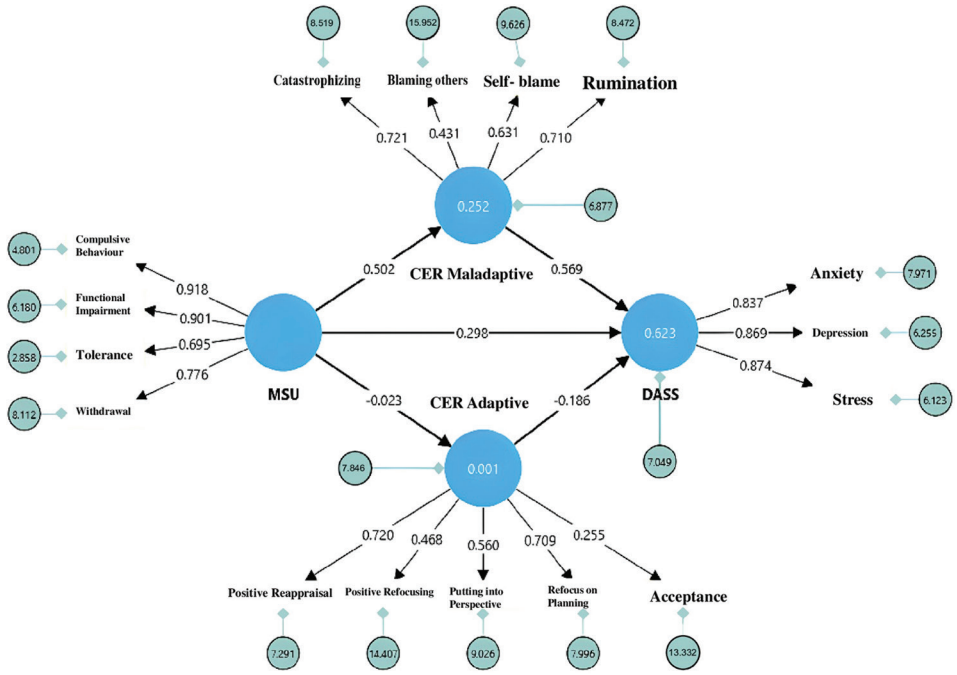

Figure 2. Coping strategies partially mediate the relationship between MSU and psychological health
Abbreviations: CER: Cognitive emotion regulation; DASS: Depression, Anxiety, and Stress Scale; MSU: Maladaptive smartphone use.

not fully understood, it may be related to gender-specific patterns of smartphone use. Girls are more inclined to use their devices for communication functions and social networking services, whereas boys are more likely to engage in activities such as gaming, watching videos, and listening to music.[54] Female adolescents are known to take pleasure in forming and sustaining social relationships, which demands frequent communication and emotional involvement. They also tend to use smartphones to handle emotionally intense matters, resulting in more frequent use and checking of their devices compared to males.[55] In addition, females are less inclined to participate in outdoor activities and events, preferring instead to build relationships with friends on social media.[56] They tend to use their smartphones more frequently in public places to avoid feelings of loneliness. Conversely, males typically use their phones more for professional and technological purposes rather than social interactions. Furthermore, females are more prone to anxiety if they cannot keep up with social media updates.[57]

Smartphone use is widespread across all age groups. Behera[58] found similar results to this study, indicating that 90% of adolescents with MSU were in the 16 – 17 age group. Positive correlations suggest that MSU increases with an increase in student age.[59] Older adolescents exhibit a higher level of smartphone addiction compared to younger ones.[60-62] Age is the most effective predictor variable, determining that the level of MSU increases with age.[63] These results may be due to social media policies and guidelines. Accessibility to major platforms like Facebook, Instagram, and TikTok requires users to meet certain age requirements. In addition, teenagers often seek independence, and their parents may struggle to enforce rules and restrictions. In contrast, a study conducted in Switzerland found a higher prevalence of smartphone addiction among younger adolescents.[64]

The Department of Statistics in Jordan in 2010 estimated that the poverty line for Jordanian families was JD 336 ($516 USD) per month.[65] In this study, MSU was more prevalent among adolescents from families with a monthly income of 301 – 500 JD. In this context, lower economic conditions might heighten the risk of MSU.[37] Low-income families often face challenges in making ends meet and may spend more time away from home. Consequently, parents in these families might not have sufficient opportunity to oversee their children's smartphone usage, increasing the risk of MSU among low-income youth.[66] Smartphone addiction is more prevalent among individuals with low income and socioeconomic status, as it provides an escape from their financial difficulties.[67] In addition, limited family resources may prevent adolescents from participating in outdoor activities, leading them to spend a significant amount of time on their smartphones. However, this finding contrasts with studies indicating that MSU is more common among individuals with high income, where greater financial resources and parental permissiveness allow for increased smartphone access and usage.[53,68] Furthermore, in this study, an analysis of the mean differences between MSU and GPA, an indicator of academic performance, revealed a significant relationship. Specifically, students with higher levels of MSU tended to have lower GPAs. This finding underscores a potential inverse relationship, suggesting that increased smartphone use may negatively impact academic performance. A meta-analysis study revealed that MSU detrimentally affects students' learning and overall academic performance by impairing the skills and cognitive abilities necessary for academic success.[69] When students spend excessive time on their phones, neglecting daily responsibilities, engaging in extensive smartphone use, or excessive texting, their GPAs tend to decline.[69] Excessive smartphone use distracts students and impedes learning, thereby decreasing academic performance.[70]

Sleep quality also emerged as a significant factor influencing MSU among adolescents in this study. Participants reporting poor sleep quality had significantly higher MSU scores than those with moderate or good sleep. This finding is consistent with prior research demonstrating that

excessive smartphone use, particularly during nighttime hours, disrupts sleep patterns and impairs restfulness.[10] Disrupted sleep may, in turn, increase emotional vulnerability and reliance on smartphones as a coping mechanism, creating a negative feedback loop between poor sleep and problematic use. These results highlight the importance of incorporating sleep hygiene education into intervention programs aimed at reducing MSU among adolescents.

Overall, these findings underscore the intricate interplay of sociodemographic factors in shaping MSU behaviors among adolescents. The study highlights how age, gender, economic conditions, academic performance, and sleep quality are all interconnected in influencing the extent and impact of MSU. These results emphasize the need for targeted interventions that consider these sociodemographic factors. Tailored strategies could include educational programs for parents and adolescents about the risks of excessive smartphone use, policies to regulate smartphone usage in schools, and community initiatives to provide alternative recreational activities. Further investigation into contextual influences on MSU behavior is essential to develop a comprehensive understanding of how different environments and circumstances affect smartphone use among adolescents. This research could inform the development of more effective intervention strategies that are sensitive to the specific needs and challenges faced by various demographic groups.

4.2. THE ROLE OF COGNITIVE EMOTION REGULATION STRATEGIES IN SHAPING MSU PATTERNS

This study found that students with high MSU reported significantly higher maladaptive cognitive regulation scores than those with low MSU. Maladaptive cognitive strategies such as rumination, catastrophizing, and self-blame[71] are unhelpful thought patterns that may contribute to problematic smartphone use as a coping mechanism for negative emotions. These findings align with prior research indicating that poor emotion regulation and reliance on negative regulation strategies are associated with MSU.[72]

Furthermore, maladaptive emotion regulation mediates the relationship between social anxiety and MSU, suggesting that smartphones serve as external emotion regulation tools, reinforcing problematic usage.[73] Similar patterns have been observed among Spanish adolescents, where difficulties in regulating emotions correlate with compulsive behaviors and MSU as a coping strategy.[15] Problematic users scored higher in all maladaptive cognitive emotion regulation strategies – including self-blame, rumination, blaming others, and catastrophizing – compared to non-problematic users.[15]

Adolescents who rely on maladaptive coping strategies may use smartphones to escape negative emotions or prolong positive ones when alternative strategies are lacking.[74,75] Deficits in self-regulation contribute to MSU, as emotions act as both warning signals and behavior reinforcers. Effective cognitive emotion regulation is essential for adaptive functioning and emotional resilience.[76]

A meta-analysis confirmed that habitual use of maladaptive emotion regulation strategies is strongly associated with depressive and anxiety symptoms.[77] While adaptive strategies correlate with fewer symptoms, maladaptive strategies are linked to more frequent symptoms, mediating the psychological impact of MSU. In addition, cognitive emotion regulation strategies influence the extent to which smartphone use affects mental health and daily functioning, particularly through emotion suppression and cognitive reappraisal.[78]

Arrivillaga *et al*.[79] found that MSU is significantly associated with depression and anxiety, driven by maladaptive cognitive and emotional processes, such as repetitive negative thinking, susceptibility to boredom, and fear of missing out.[80] Rumination, a key component of maladaptive cognitive emotion regulation, mediates the relationship between MSU severity and psychological maladjustment.[81,82] Psychological flexibility and self-compassion, when mediated by cognitive emotion regulation, can predict MSU risk, highlighting their crucial role in mitigating problematic smartphone use.[83] This study supports findings from prior research, demonstrating that cognitive emotion regulation strategies significantly impact the extent to which smartphone use affects mental health and daily functioning, underscoring the need for targeted interventions.

5. CONCLUSION

Schools, parents, and community organizations should collaborate to develop educational initiatives that address the risks associated with excessive smartphone use. These programs should focus on promoting healthy digital habits, enhancing self-regulation skills, and educating students about the potential negative impacts of MSU on their academic performance and mental health. In addition, interventions should be tailored to address demographic differences, such as age and gender, to effectively reach and engage diverse groups of adolescents. The findings also highlight the need for incorporating emotional regulation skills into interventions aimed at reducing MSU. Programs should focus on helping adolescents develop adaptive coping strategies and improve their emotional resilience.

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CONFLICT OF INTEREST

The authors declare no competing interests.

AUTHOR CONTRIBUTIONS

Conceptualization: Fatimah S. Tarawneh, Latefa Ali Dardas
Data curation: Fatimah S. Tarawneh, Latefa Ali Dardas
Methodology: Fatimah S. Tarawneh, Latefa Ali Dardas
Resources: Fatimah S. Tarawneh
Writing – original draft: All authors
Writing – review & editing: All authors

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Approval for ethical clearance was obtained from the University of Jordan's Deanship of Scientific Research Institutional Review Board Committee (295), followed by

formal authorization from the Ministry of Education to conduct data collection. Parental consent and child assent to participate were obtained following the guidelines of the American Academy of Pediatrics (1976).

CONSENT FOR PUBLICATION

All participants and their legal guardians provided written informed consent for the anonymized data to be used for publication purposes. Consent forms clearly stated that the data collected would remain confidential and would be used strictly for research and academic dissemination. All names were coded for data analysis to maintain anonymity.

DATA AVAILABILITY STATEMENT

Data will be made available upon request to the corresponding author.

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