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Expert Opinion Article

Physical And Psychological Health Correlates Of Excessive Smartphone Usage: A Systematic Review

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ABSTRACT

Modern life is characterized by the ubiquitous use of smartphones, which offer unprecedented connectivity and convenience. However, research shows that excessive smartphone usage can adversely affect a variety of aspects of an individual's well-being. Smartphones, although designed to foster communication, can inadvertently lead to social isolation, loneliness, and a decline in face-to-face interactions, ultimately undermining the quality of human connections, which in turn affect personal growth. The current systematic review study critically analyzed 40 cross-sectional studies published between 2016 and 2024, examining the physical and psychological factors associated with excessive smartphone usage among individuals aged 18 years and above. Data were sourced from PubMed and Scopus using predefined keywords, and studies were appraised using the JBI checklist. The findings revealed moderate to high methodological quality across studies, with consistent use of validated tools to assess smartphone addiction and related health outcomes.

Studies indicate that excessive engagement with smartphones is closely linked to elevated levels of anxiety, depression, and stress. Additionally, excessive smartphone usage may lead to sleep disturbances, physical ailments, such as muscular strains and fatigue. The results of the study emphasizes the need to implement public health policies and regulatory frameworks to guide the use of smartphones in schools and workplaces, and to raise awareness about the psychological and physical risks associated with their misuse. It is crucial for enhancing individual and collective well-being particularly among younger populations. It is imperative that healthy digital habits are promoted and that technology is used for positive connections rather than for harm.

Keywords: Smartphone Usage, Adolescent, Physical health, Psychological health

Introduction

It has become increasingly commonplace for smartphones to become an integral part of modern life, influencing both personal and professional environments equally. There has been a significant increase in smartphone adoption and penetration across the globe due to the availability of affordable devices and increasing mobile network coverage, particularly in populous regions such as China and India. India has emerged as one of the world's largest smartphone markets due to the rapid proliferation of smartphones. Although smartphones have provided significant benefits to society, particularly in terms of information accessibility and connectivity, an increasing body of literature suggests that excessive use of smartphones can negatively affect one's physical, psychological, and social health. There has been an increasing amount of research suggesting that excessive smartphone use adversely impacts physical, mental, and social health (Elhai et al. 2017; Kuss & Griffiths, 2017).

In addition to musculoskeletal strain in the neck, wrists, and fingers (Xie et al. 2020), excessive smartphone use has a number of primary health effects. In younger users, prolonged screen use has been associated with eye strain, disturbed sleep cycles, and even the development of myopia. It may exacerbate psychological effects like anxiety, depression, low self-esteem, and loneliness and social isolation if people use social media platforms excessively on their phones. It has been shown that excessive smartphone use to the extent of addiction reduces productivity, decreases life satisfaction, and affects dopaminergic pathways, which is similar to substance abuse.

Providing a nuanced understanding of the complex impact excessive smartphone use has on physical, psychological, and cognitive well-being, this study examined the impact of excessive smartphone use systematically. In addition to promoting healthy smartphone usage habits, this analysis aims to promote a balanced digital consumption pattern and protect the well-being of the individual. Using a critical examination of recent research and synthesis of evidence to highlight the need to develop

guidelines for responsible smartphone use, this paper examines the effects of smartphone overuse.

Methodology

Study Design

An in-depth analysis of research studies on excessive smartphone usage was conducted in this study using a systematic review methodology. A comprehensive analysis of the implications of excessive smartphone addiction is provided by analyzing studies conducted both nationally and internationally.

Data Sources and Search Strategy

A structured literature search was conducted using electronic databases PubMed, and Scopus (Fig.1). The search included peer-reviewed journal articles, and epidemiological surveys published in English. Keywords used in the search included "mobile phone use", "problematic phone use","smartphone use", “excessive smartphone use”, "smartphone addiction", “problematic smartphone use", "mobile addiction”, "excessive mobile phone use", AND "college", "university", "undergraduate", "student", "emerging adult".

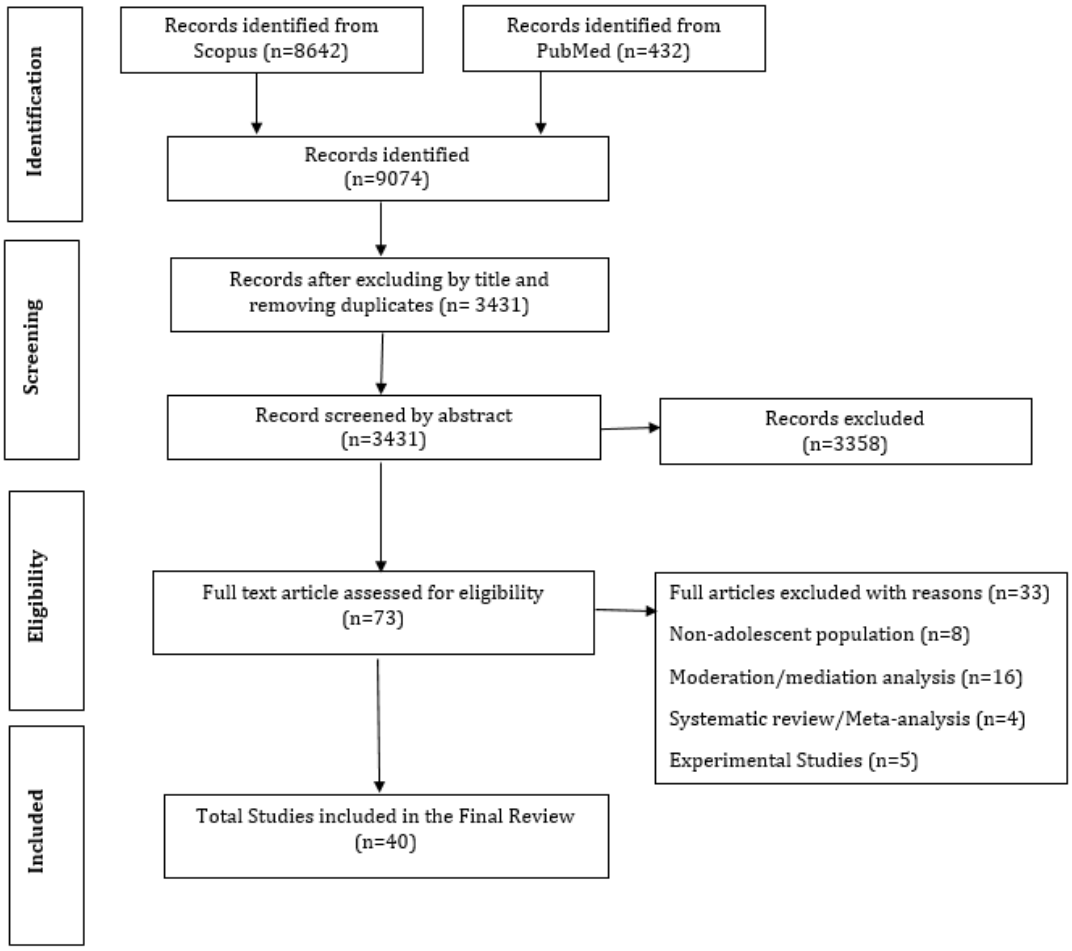
Inclusion and Exclusion Criteria

Studies were selected based on the following criteria:

- **Inclusion Criteria:**
  - Cross sectional studies that investigate the physical and psychological factors associated with smartphone addiction.
  - Research focusing on age group above 18 years.
  - Articles published within 8 years (2016–2024).

- **Exclusion Criteria:**
  - Studies without empirical data.
  - Case reports and theoretical papers.
  - Research focusing on other technological dependencies.
  - Systematic reviews and Mediation moderation analysis articles.

FIGURE 1. The PRISMA Flowchart Illustrating the Selection of Review Articles



Data Extraction and Synthesis

In this analysis, relevant data were extracted by using a structured data extraction form. These data included information about study design, sample size, population characteristics, and key findings. To assess the bias risk and study quality of cross-sectional studies, the Joanna Briggs Institute (JBI) checklist was used (Tables I and II). There are nine

items on the checklist, including sample size, sampling frame, data collection method, assessment tools, and key findings. Using a thematic synthesis approach, major psychological and physical consequences associated with smartphone addiction were identified by categorizing and analyzing the findings.

Quality and Risk of bias

In this systematic review, the JBI critical appraisal of the 40 cross-sectional studies included found the overall methodological quality of the evidence to be moderate to high based on the JBI critical appraisal of the evidence. There was a low risk of bias in the majority of the studies, as well as clearly defined inclusion criteria, well-described study populations, and appropriate settings.

The studies focused primarily on university and medical students aged between 18 and 25 years, with reported mean ages around 20–21 years and standard deviations typically ranging from ±1.0 to ±5.5 years. While sample sizes varied, most studies used moderate to large samples (200–500 participants), enhancing statistical power and generalizability.

Nearly all studies employed validated and reliable instruments to measure both smartphone addiction (e.g., SAS-SV, MPPUS) and health-related outcomes such as sleep quality (PSQI), psychological symptoms (DASS-21, CES-D, GHQ-28), and musculoskeletal pain (NRS-11).

Table I: JBI Checklist Analysis for Cross Sectional Studies - Physical factors related to Smartphone Usage

Sl. No.	*Author(s) Year*	*Clear Inclusion Criteria*	*Subjects & Setting Described*	*Exposure Measured Validly & Reliably*	*Objective Standard Criteria Used*	*Confounding Factors Identified*	*Strategies for Confounding Factors*	*Outcomes Measured Validly & Reliably*	*Appropriate Statistical Analysis*	*Risk of Bias*
1	Özalp 2024	Yes	Yes	Yes	Yes	Partial	No	Yes	Yes	Moderate
2	Chongchitpaisan et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
3	Foltran-Mescollotto et al. 2021	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Moderate
4	Hanphitakphong et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
5	İnal & Serel Arslan 2021	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Moderate
6	McCrann et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
7	Mustafaoglu et al. 2021	Yes	Yes	Yes	Yes	Partial	Partial	Yes	Yes	Moderate
8	Alshahrani et al. 2021	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Moderate
9	Bertozzi et al. 2021	Yes	Yes	Yes	Yes	Partial	No	Yes	Yes	Moderate
10	Myint et al. 2021	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Moderate
11	Szeto et al. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
12	Baabdullah et al. 2020	Yes	Yes	Yes	Yes	Partial	No	Yes	Yes	Moderate
13	Alsalameh et al. 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
14	Al-Hadidi et al. 2019	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
15	Kalirathinam et al. 2017	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
16	Montagni et al. 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

Table II: JBI Checklist Analysis for Cross Sectional Studies – Psychological factors related to Smartphone Usage

Sl. No.	*Author(s) Year*	*Clear Inclusion Criteria*	*Subjects & Setting Described*	*Exposure Measured Validly & Reliably*	*Objective Standard Criteria Used*	*Confounding Factors Identified*	*Strategies for Confounding Factors*	*Outcomes Measured Validly & Reliably*	*Appropriate Statistical Analysis*	*Risk of Bias*
1	Khan et al. 2023	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
2	Liu et al. 2022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
3	Zhang et al. 2022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
4	Sanusi et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
5	Meng et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
6	Gundogmuş et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
7	Kil et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
8	Pan et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
9	Çobanoğlu et al. 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
10	Shoval et al. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
11	Alavi et al. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
12	Alkhateeb et al. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
13	Grimaldi-Puyana et al. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
14	Desouky & Abu-Zaid 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
15	Huang et al. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
16	Awasthi et al. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
17	Ranjbaran et al. 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
18	Tari Selçuk & Ayhan 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
19	Nishida et al. 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
20	Kumar et al. 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
21	Al-Hadidi et al. 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
22	Alhassan et al. 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
23	Boumosleh & Jaalouk 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
24	Chen et al. 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

The statistical analyses were generally appropriate and rigorous, with many studies employing multivariate regression models to assess associations and control for confounders. There was consistent internal consistency of the tools used, indicating a high degree of measurement accuracy.
There were, however, some limitations observed in a few of the studies, including the fact that some studies identified potential confounding variables, such as age, gender, academic performance, and lifestyle habits, but failed to use statistical strategies to fully account for them, which may have influenced the results. Moreover, most studies rely on self-reported data, introducing potential for recall and response biases. This was partially mitigated in some studies by using an app-based behavioral tracking system. Furthermore, a few studies had small or homogeneous samples, which limited their generalizability. These studies provide a solid foundation for understanding the physical and psychological health consequences of smartphone use, and the findings synthesized in this review have validity.

Physical factors related to smartphone usage

The systematic review of 16 cross-sectional studies on excessive smartphone usage is associated with a wide variety of physical health consequences, particularly among university students (Table III). In addition to musculoskeletal discomfort and cognitive strain, these consequences also cause fatigue, headaches, and ocular and cognitive strain. Although there are some differences in the direction and strength of associations across studies resulting from differences in methodology, measurement tools, and sample characteristics, consistent patterns emerge in the relationship between smartphone overuse and physical health.

It has been observed that smartphone use is associated with musculoskeletal pain, and Mustafaoglu et al. (2021) and Alsalameh et al. (2019) have demonstrated strong associations between smartphone addiction and pain in the neck, upper back, and wrists/hands. According to Mustafaoglu, students who had owned smartphones for more than nine years or used smartphones for over six hours daily were significantly more likely to experience musculoskeletal pain in these regions. Furthermore, Alsalameh also reported significant associations between smartphone addiction and pain in the neck (59.5%), the lower back (46.8%), and the shoulder (40.0%) and thus these findings suggest that it is critical to consider the duration of exposure and cumulative usage history when predicting pain.

Table III: Physical Health factors associated with Smartphone Usage (16 Studies)

Sl. No.	*Author(s), Year*	*Country*	*Sample Size and Population*	*Sample Design*	*Mean Age (SD)*	*Tools Used*	*Health Outcomes Reported*	*Key Findings*
1	Chongchitpaisan et al., 2021	Thailand	145 adolescents	Time-series	Not reported	Smartphone output power app, headache diary	Migraine	Smartphone radiation (output power) strongly linked to migraine
2	Foltran-Mescollotto et al., 2021	Brazil	20 university students	Cross-sectional	M=17.4	SAS, Fonseca Index, EMG	Muscle activity, head/neck pain	Muscle activity increased post-use, no pain link found
3	Hanphitakphong et al., 2021	Thailand	2027 university students	Cross-sectional	M=20.5 ± 1.38	Thai-SAPS, Smartphone Addiction Proneness Scale, visual analog scale (VAS)	Upper body musculoskeletal symptoms	Upper body musculoskeletal symptoms was relatively high, especially for female smartphone users and students aged over 20 years
4	İnal & Arslan, 2021	Turkey	325 university students	Cross-sectional	M=20.04 ±1.78	SAS, NMQ, VAS, CFI	Musculoskeletal pain, cognitive flexibility	Positive correlation with neck and hand pain; negative with cognitive flexibility
5	McCrann et al., 2021	Ireland	418 high school students	Cross-sectional	M=16.77 ±4.4	Screen time usage, open ended questionnaire	Myopia	Higher smartphone data usage linked with myopia

6	Özalp, 2024	Turkey	293 university students	Cross-sectional	Not reported	SAS-SV, OSDI, CFQ, CHDQ, CFS	eye dryness, fatigue	Addicted group presented poorer cognitive performance. significant differences were observed in fatigue levels, and eye health
7	Szeto et al., 2020	Hong Kong	18 students	Field observational	M=21.5 ± 2.6	On-field kinematics measurement, Inertial motion sensors	Spinal posture	Greater cervical flexion and less variation during use
8	Alsalameh et al., 2019	Saudi Arabia	242 Medical students	Cross-sectional	Not reported	SAS-SV, NMQ	Musculoskeletal pain	Neck, wrist/hand, knees linked to addiction
9	Baabdullah et al., 2020	Saudi Arabia	387 medical students	Cross-sectional	Not reported	SAS-SV, PRWHE	Thumb/wrist pain	Addiction associated with De Quervain's signs, correlation between heavy smartphones usage and hand pain was found
10	Mustafaoglu et al., 2021	Turkey	249 university students	Cross-sectional	M=21.3 ± 1.9	SAS, modified NMQ	Musculoskeletal pain	Addiction linked with pain in upper back, wrists, neck
11	Alshahrani et al., 2021	Saudi Arabia	40 male students	Cross-sectional	M=21.8 ± 1.6	SAS-SV, endurance/grip tests	Neck muscle endurance	Addicted group had lower flexor endurance
12	Bertozzi et al., 2021	Italy	238 young adults	Cross-sectional	M=22.4 ± 2.2	CROM, NDI, VAS	Neck pain, disability	No correlation with phone time or posture
13	Myint et al., 2021	Malaysia	311 students	Cross-sectional	M=21.6 ± 1.0	CMDQ, digital use survey	Musculoskeletal symptoms	Symptoms linked to posture, screen time, distance
14	Kalirathinam et al., 2017	Malaysia	244 students	Cross-sectional	M=20.67 ± 1.40	self – administered questionnaires	Neck/upper extremity symptoms	Neck pain prevalent; poor ergonomics a risk
15	Montagni et al., 2016	France	4927 students	Cross-sectional	M=20.8 ± 1.8	Screen time survey Baseline Questionnaire	Headache, migraine	High screen time associated with migraines
16	Al-Hadidi et al., 2019	Saudi Arabia	500 students	Cross-sectional	M=21.5 ± 2.6	Online survey	Pain, severity of use	Addiction linked to neck pain and healthcare use

This finding was also echoed by Hanphitakphong et al. (2021), who showed a sixfold increase in upper body musculoskeletal symptoms among students with smartphone addiction. As a result of controlling for gender and age, the adjusted odds ratio is 6.05; 95% confidence interval 4.68–7.84). As further evidenced by Inal and Arslan (2021), smartphone addiction has significant correlations with musculoskeletal pain in the upper and lower back, hips, feet, and upper limbs. Additionally, they found a negative correlation between smartphone addiction and cognitive flexibility, suggesting that it has broader functional implications beyond physical discomfort.

According to Myint et al. (2021) and Kalirathnam et al. (2017), posture-related factors such as lying, side-lying, and prone positions are significant predictors of pain when using a mobile device. As well as stressing the importance of early device use at an early age, Myint emphasized poor ergonomic practices (e.g., a prolonged eye-to-screen distance) as contributing factors. The results of these studies suggest that not only the duration but also the ergonomics of smartphone use influence the physical consequences of engagement.

The study by Baabdullah et al. (2020) found that smartphone addiction was significantly associated with wrist/thumb pain severity, but this relationship

was not statistically significant with clinically confirmed De Quervain tenosynovitis as determined by Finkelstein's test. It may be possible that subjective pain precedes objective clinical pathology in this discrepancy.

Alshahrani et al. (2021) found that smartphone addiction adversely affected neck flexor muscle endurance, but not grip or pinch strength when analyzing muscle performance. The increased engagement in postural muscles that occur when using a smartphone might signal early functional fatigue. The objective measurements presented by Szeto et al. (2020) indicated a significant increase in cervical and upper thoracic flexion during smartphone use, as well as a reduction in postural variation, both of which are biomechanically associated with muscle fatigue and chronic neck pain.

Studies by Chongchitpaisan et al. (2021) and Montagni et al. (2016) examined the impact of smartphone use on migraines and found significant associations between excessive smartphone use and migraines. There is some evidence to support that high smartphone screen time is significantly associated with migraine without aura (adjusted OR = 1.50), while Montagni et al found that high smartphone screen time was significantly associated with migraine with aura (ORadj = 2.02 to 3.25). In both studies, it was noted that there was no significant association between smartphone use and headaches other than migraines or tension headaches, suggesting that smartphones may be contributing to neurological conditions such as migraines through a specific pathway.

Several studies have examined the relationship between smartphone data usage and myopia refractive error, including McCrann et al. (2021) and Zalp (2024). McCrann found a positive correlation between smartphone data usage and myopia refractive error (adjusted OR = 1.08), particularly in participants with familial predispositions. There is also evidence that smartphone-addicted individuals experienced significantly greater eye discomfort and fatigue (based on OSDI scores), as well as eye discomfort among smartphone-addicted individuals. This confirms that the use of excessive smartphone can result in visual strain, which is potentially a result of prolonged nearwork and blue light exposure by smartphone users.
However, Foltran-Mescollotto et al. (2021) found a significant muscular fatigue in the right trapezius despite not finding a statistically significant association between smartphone addiction and neck pain. This localized fatigue in the dominant-side muscle may reflect subtle, early-stage muscular responses that are not yet reflected in broad clinical symptoms, which underscores the importance of EMG and other objective measurements in musculoskeletal evaluations. The findings of Bertozzi et al. (2021) were somewhat contrasting, showing that smartphone usage duration and neck posture did not significantly correlate with pain/disability. It is possible that some individuals can adapt postural tolerance or delay onset of symptoms by finding higher neck flexion angles in males without corresponding pain intensities.

It was shown by Al-Hadidi et al. (2019) that smartphone use duration has a dose-response relationship with neck pain intensity and duration. In the NRS-11, students with high pain scores ((>4/10 on the NRS-11) used analgesics, visited clinics or emergency departments, and modified their posture in a significant manner. These findings highlight the healthcare burden and behavioral consequences of smartphone-induced pain. In a recent study by Özalp (2024), the effects of smartphone addiction on hand disorders, eye health, fatigue, and cognitive failures were investigated among a sample of 423 participants. The study found that increased smartphone addiction was significantly associated with physical symptoms such as hand pain and eye strain, as well as elevated levels of fatigue and more frequent cognitive failures. These findings suggest that excessive smartphone use not only affects physical well-being but also impairs cognitive performance, highlighting the need for awareness and interventions to mitigate the health consequences of prolonged smartphone use.

Psychological factors related to smartphone usage

An extensive synthesis of findings from 24 cross-sectional studies (Table IV) indicates that excessive smartphone usage is associated with a variety of psychological health issues, such as depression, anxiety, stress, sleep disturbances, poor quality of life, and other psychosocial disorders. As a result, these effects have been consistently reported across diverse populations and cultural contexts, indicating the global nature of these problems.

It has been found that smartphone addiction is strongly associated with depressive symptoms across a wide range of studies. In studies conducted by Boumosleh and Jaalouk (2017) and Alhassan et al. (2018), depression significantly correlated with higher smartphone addiction scores, regardless of demographics or behavioral factors. Moreover, Desouky and Abu-Zaid (2020) reported an extraordinarily high odds ratio (OR = 17.76) that smartphone addiction is prevalent among students with depression. In the same vein, Alavi et al. (2020) identified depression and bipolar disorder as major

predictors of addiction, highlighting that individuals with these disorders are particularly vulnerable.

The psychological variable anxiety was also frequently studied, and it was consistently found to be associated with smartphone use. Desouky and Abu-Zaid (2020) found that anxiety was a significant predictor of smartphone addiction (OR = 1.25), whereas Chen et al (2017) and Liu et al. (2022) found anxiety to be a stronger predictor of smartphone addiction among females. Notably, the studies often showed that anxiety and depression co-occurred and jointly contributed to higher smartphone dependency levels.

Multiple studies also pointed to sleep disturbances as a psychological consequence of smartphone addiction. In a study, Kil et al. (2021) found that despite general smartphone usage being negatively associated with distress and positively associated with life satisfaction, the addiction to smartphones itself was directly associated with depression, anxiety, and stress. Kumar et al. (2019), Ibrahim et al. (2018), and Meng et al. (2021) have all found that prolonged use of smartphones, especially before going to bed, significantly disrupts sleeping quality, which in turn exacerbates psychological distress. In a study by Shoval et al. (2020), the authors found that objectively measured nighttime use significantly predicted poor sleep and high anxiety levels compared to subjective self-reports, suggesting that behavioral tracking could provide an additional tool for clinical and research settings.

In several studies, psychological comorbidities, including stress and social dysfunction, have also been evaluated in relation to smartphone addiction, and Selçuk and Ayhan (2020) found that there is a positive relationship between smartphone addiction, depression, anxiety, and stress. Khan et al. (2023) also provided significant evidence to support the notion that problematic smartphone use is associated with psychological distress, with those with a high degree of severe problem showing significantly worse ratings on depression (β = 6.91), anxiety (β = 4.65), and stress (β = 7.02), as well as poorer sleep quality.

Table IV: Psychological Health factors related to Smartphone Usage (24 Studies)

Sl. No.	*Author(s), Year*	*Country*	*Sample Size and Population*	*Sample Design*	*Mean Age (SD)*	*Tools Used*	*Health Outcomes Reported*	*Key Findings*
1	Boumosleh & Jaalouk, 2017	Lebanon	688 Undergraduate university students	Cross-sectional	M=20.64 ± 1.88	SPAI, PHQ-2, GAD-2	Depression, anxiety	Depression and anxiety predicted smartphone addiction
2	Desouky & Abu-Zaid, 2020	Saudi Arabia	1513 University students	Cross-sectional	M=20.58 ± 1.71	PUMP, Beck Depression, Taylor Anxiety Scale (Arabic Version)	Depression, anxiety	Smartphone addiction correlated with depression and trait anxiety
3	Alavi et al., 2020	Iran	1400 University students	Cross-sectional	M=25.17 ± 4.5	CPDQ, Millon Inventory	Multiple mental disorders	Addiction associated with depression, anxiety, bipolar, and somatization
4	Chen et al., 2017	China	1441 Undergraduate students	Cross-sectional	M=19.72 ± 1.43	SAS-SV	Sleep, depression, anxiety	Addiction associated with poor sleep, depression and anxiety
5	Alhassan et al., 2018	Saudi Arabia	935 Participants above the age of 18 years	Cross-sectional	M=31.7 ± 11	SAS-SV, Beck Depression Inventory	Depression	Addiction correlated with higher depression scores
6	Kil et al., 2021	USA	601 Undergraduate students	Cross-sectional	Not reported	DAS scales, life satisfaction	Depression, anxiety, stress and satisfaction with life	Smartphone Addiction positively correlated with DAS symptoms but not related to subjective well being
7	Liu et al., 2022	China	2741 Medical students	Cross-sectional	M=20 ± 2	SAS-SV, SHSQ-25, insomnia scale	Insomnia, subhealth	Addiction predicted insomnia and psychological subhealth

8	Zhang et al., 2022	China	2741 Medical students	Cross-sectional	M=20 ± 2	SAS-SV , The GAD Scale-7, PHQ-9, SHSQ-25	Anxiety, depression	Anxiety status, depression status , and smartphone addiction strong association with subhealth
9	Ibrahim et al., 2018	Saudi Arabia	610 Medical students	Cross-sectional	M=21.60 ± 2	PMPU-Q, PSQI	Sleep, GPA	Addiction associated with poor sleep and lower academic performance
10	Kumar et al., 2019	India	150 Medical students	Cross-sectional	Not reported	SAS-SV, PSQI	Sleep quality	Addiction significantly linked to poor sleep
11	Sanusi et al., 2021	Jordan	420 Undergraduate dental students	Cross-sectional	20.9 ± 2	SAS, PSQI, PSS-10	Stress, sleep	Stress and addiction predicted lower sleep quality
12	Shoval et al., 2020	Israel	40 College students	Pilot	M= 23 ±2.4	Quality Time app by Mobidays,Inc.), PSQI, STAI-T, BDI-II, FoMO Scale	Sleep, well-being	Night phone use negatively affected sleep quality and psychological well being
13	Tari Selçuk & Ayhan, 2019	Turkey	408 College Students	Cross-Sectional	M=20.13 ± 2.43	SAS-short form, Adult ADHD self-report scale, Depression anxiety stress scale 21	Depression, anxiety, ADHD	Addiction linked with comorbid mental health issues
14	Pan et al., 2021	China	730 College students	Cross-sectional	M=20.5 ±1.733	MPATS, PSQI, UCLA Loneliness, CSICDS	Sleep, loneliness	Loneliness and poor sleep linked with smartphone addiction
15	Grimaldi-Puyana et al., 2020	Spain	306 College students	Cross-sectional	M=20.7 ± 1.4	screen-state sensor, PSQI, POMS, The Spanish version of the IPAQ	Physical activity, Mood, sleep	Addiction related to poor mood and more sedentary behavior, sleep patterns
16	Gundogmuş et al., 2021	Turkey	935 University students	Cross-sectional	M=21.89 ± 3.27	SAS-SV, TAS-20	Alexithymia	Addiction positively associated alexithymia
17	Nishida et al., 2019	Japan	295 High school students	Cross-sectional	M=16.2 ± 0.9	Smartphone use, CES-D, Japanese brief version of the Multidimensional Scale of Perceived Social Support (MSPSS)	Depression	Higher SNS use linked with more depression in females
18	Meng et al., 2021	China	4234 Medical school students	Cross-sectional	M=20.66 ± 1.66	Mobile phone usage survey, PSQI	Mobile phone usage surveySleep quality	Sleep worsened with longer bedtime smartphone use
19	Huang et al., 2020	China	439 College students	Cross-sectional	M=18.8 ± 1.7	Chinese Mobile Phone Addiction Index (MPAI), two subscales of the Social Support Rating Scale (SSRS), PSQI	Depression, sleep	Addiction linked with depressive symptoms and poor sleep
20	Awasthi et al., 2020	India	395 Medical students	Cross-sectional	M=20.94 ±1.8	SAS-SV, WHOQOL-BREF	Quality of life	Addiction negatively impacted all domains of QOL
21	Çobanoğlu et al., 2021	Turkey	215 Nursing students	Correlational	20.91 ± 2.06	NMP-Q, DAS, SAS-SV	Nomophobia	Addiction significantly associated with nomophobia

22	Alkhateeb et al., 2020	Saudi Arabia	1941 College students	Cross-sectional	M=21 ± 2	SAS-SV	Daily function, sleep, vision	Addiction significantly associated with musculoskeletal, upper limb, eyes and sleep complications
23	Ranjbaran et al., 2019	Iran	334 Medical university students	Cross-sectional	M=22.29 ± 3.50	Mobile Phone Problem Usage Scale (MPPUS) MPPS, GHQ-28	General health	Anxiety, sleep, and social dysfunction predicted dependency
24	Khan et al, 2023	Australia	655 Australians above age 18 years	Cross-sectional	M= 24.55 ± 5.59	(MPPUS) Depression, Anxiety, Stress Scale (DASS-21) Pittsburgh Sleep Quality Index (PSQI)	Depression, Anxiety, Stress and Sleep Quality	Average depression score was 3.5 points higher for moderate-high smartphone use and 6.9 points higher for high-severe smartphone use. Average stress score was 3.4 points higher for moderate-high smartphone use.

There were several studies that indicated gender-specific differences. For example, Chen et al. (2017) found that gaming and anxiety-related predictors of addiction were more prevalent in males, while multimedia, social networking applications, and depression were more prevalent in females. In a similar study, Nishida et al. (2019) discovered that excessive time spent on social apps was associated with depression among female students, but not with depression among male students, suggesting that social comparison and online social interaction may be responsible for the psychological distress of women.

Excessive smartphone use also negatively impacts quality of life (QOL), as Awasthi et al. (2020) demonstrated that addiction significantly impacted physical, psychological, social, and environmental well-being. Additionally, Pan et al. (2021) reported significant correlations between smartphone addiction, nomophobia, loneliness, and impaired interpersonal relationships. According to these findings, psychological consequences are not limited to clinical symptoms but affect a greater range of daily activities.

The role of comorbid personality traits and psychological constructs such as alexithymia was also investigated. Gündoğmuş et al. (2021) found a strong association between smartphone addiction and alexithymia, indicating that difficulty in identifying and managing emotions may predispose individuals to compulsive smartphone behavior. The subcomponents of alexithymia, including externally oriented thinking and emotional suppression, were notably elevated among addicted users.

Sanusi et al. (2021) conducted a study to explore the association between smartphone addiction, sleep quality, and perceived stress among 885 Jordanian dental students. The findings revealed a significant positive correlation between smartphone addiction and perceived stress, indicating that students who were more addicted to their smartphones experienced higher stress levels. Additionally, poor sleep quality was also significantly associated with increased smartphone addiction, suggesting that excessive phone use may negatively impact sleep patterns. These results emphasize the importance of promoting healthy smartphone usage habits among students to support their psychological well-being and academic performance.

In a descriptive, correlational study conducted by Çobanoğlu, Bahadir-Yilmaz, and Kiziltan (2021), the relationship between digital and smartphone addiction levels and nomophobia was examined among 398 nursing students. The study revealed a significant positive correlation, indicating that students with higher levels of digital and smartphone addiction also reported higher levels of nomophobia. In other words, increased dependence on digital devices was associated with a greater fear of being without them. These findings highlight the growing concern of technology dependence among nursing students and emphasize the need to address this issue within educational settings to support students' mental health and overall well-being.

Several studies also evaluated the contextual factors and patterns of smartphone use. Liu et al. (2022) and Meng et al. (2021) showed that phone use in bed, lack of interest in academic specialty, and alcohol

consumption significantly increased addiction risk. These behavioral factors intersected with psychological distress to worsen overall well-being. Similarly, Grimaldi-Puyana et al. (2020) identified mood states such as anger and confusion as predictors of high screen time, along with sedentary behavior and low physical activity, all contributing to a negative feedback loop.

In addition, this study also supports the notion that smartphone addiction is a behavioral addiction with similar mechanisms to substance-related disorders as well as impulse-control disorder. Ranjbaran et al. (2019) found strong associations between mobile phone dependence and anxiety, depression, and social dysfunction, as well as all subdomains of the GHQ-28. These associations align with DSM-5 criteria for behavioral addictions and suggest that smartphone addiction warrants similar clinical attention.The convergence of findings across cultures and methodological designs provides a robust foundation for concluding that smartphone addiction is both a correlate and potential contributor to psychological morbidity.

Summary

A growing concern has emerged regarding smartphone addiction, especially among university and college students in diverse countries including China, India, Saudi Arabia, Turkey, and Lebanon. According to the literature, these populations are highly prone to excessive smartphone use, with daily screen time exceeding recommended limits. Many students report frequent checking behaviors, compulsive engagement, and notable disruptions in their daily routines, indicating patterns consistent with behavioral addiction. A clear pattern has emerged across Europe, North America, and Asia showing a clear correlation between the use of problematic smartphones and an array of mental health challenges, including an increase in anxiety, depression, and stress levels, when considering the global perspective.

There is a strong correlation between smartphone addiction and psychological consequences that has been found across various studies. In 15 studies, a significant correlation has been demonstrated between increased smartphone use and depressive symptoms (e.g., Boumosleh & Jaalouk, 2017; Chen et al., 2017; Zhang et al., 2022). Depressive symptoms were consistently reported as one of the most consistently reported outcomes. Likewise, anxiety was also a frequent correlate reported in over 12 studies, with high levels of stress and psychological distress frequently associated with excessive smartphone usage (e.g. Ivanova et al., 2020). The impact of loneliness particularly among adolescents, is also notable, with studies by Pan et al. (2021) highlighting the link between problematic mobile use and loneliness.

There are approximately ten studies published across the world that have identified poor sleep quality as another significant consequence of smartphone use during the night. The use of smartphones during the night is specifically associated with delayed sleep onset, sleep interruptions and poor sleep hygiene (e.g., Chen et al., 2017; Huang et al., 2020).

Several studies have shown that overuse of smartphones can affect the physical health as well. For instance, six studies indicate that prolonged device use and poor ergonomics are associated with an increased incidence of musculoskeletal complaints, particularly neck, shoulder, and wrist pain (e.g., Kalirathinam et al., 2017; Alsalameh et al., 2019). In addition, recurrent headaches and eye strain were frequently reported, often associated with extended screen exposure and lack of visual rest (Montagni et al., 2016; Cerutti et al., 2016).Social and behavioral disruptions were also identified as important outcomes.

Several studies reported that excessive smartphone use interfered with daily self-care activities, including sleep, nutrition, and physical activity (Alkhateeb et al., 2020). It appears that smartphone addiction can both trigger and exacerbate psychiatric vulnerabilities, with potentially serious implications for the well-being of young people who are addicted to smartphones.The interplay of emotional, cognitive, and behavioral disruptions underscores the urgent need for comprehensive strategies, including awareness campaigns, digital wellness education, and psychosocial support systems, to mitigate the harmful effects of smartphone overuse in young populations.

The higher addiction scores were also associated with a range of demographic variables, including younger age, female gender, and urban background. As a consequence of smartphone dependence, emerging behaviors such as nomophobia and phubbing have been increasingly recognized as contributing to or resulting from such behavior patterns (Daei et al., 2019; Ivanova et al., 2020). Despite the fact that this issue is more complex when it comes to gender-specific aspects, excessive smartphone usage and loneliness that often accompany it appear to deepen the symptoms of depression. It has been shown that use of smartphones may marginally alleviate feelings of loneliness among female students, suggesting that there are nuanced interactions between technology use and social connections, as well as emotional well-being.

It is clear from these studies that smartphone overuse is a substantial risk factor for various physical and mental health problems. The strength of the association has generally been found to be moderate to high across studies. Collectively, these studies underscore that smartphone overuse is consistently associated with a range of physical and psychological health conditions, particularly musculoskeletal symptoms, anxiety and depression. While some inconsistencies exist in few studies, the strength of association in most of the studies generally ranges from moderate to high, suggesting not only a significant burden of physical and mental health symptoms in young populations but also the need for preventative ergonomics, behavioral modifications, and public health strategies to mitigate the health impact of prolonged smartphone exposure.

Conclusion

In recent years, it has become increasingly apparent that excessive smartphone use has significant and far-reaching consequences when it comes to an individual's overall well-being, including mental and physical wellbeing, cognitive performance, and social interactions, and that these consequences are substantial and far-reaching. It has been shown in several studies that excessive smartphone use is closely related to anxiety, depression, and stress, as well as social anxiety. Furthermore, it contributes to physical health problems, because prolonged sedentary behavior and poor posture can cause muscle strains, fatigue, and chronic health problems, in addition to disrupting sleep patterns.

The excessive use of smartphones for communication may result in reduced face-to-face interactions over time, leading to feelings of loneliness, social isolation, and even withdrawal from society as a whole as a result. Despite the fact that smartphones are intended to connect us, they may inadvertently lead us to become lonely and socially disengaged as a result of this paradox.

As a consequence of these findings, it is evident that there is a growing need for comprehensive, evidence-based interventions aimed at promoting responsible smartphone usage globally. There is also the possibility that, along with educational programs that encourage healthy digital habits, particularly among adolescents and young adults, it is also possible to develop mobile apps that can serve as a way of limiting and monitoring screen time in a way that is effective. Furthermore, in order to mitigate the risks associated with overuse of smartphones, public health policies and regulatory frameworks can have a crucial role to play. It would be beneficial for governments to implement guidelines on smartphones that can be used in schools and workplaces, to provide resources to parents and educators regarding the management of screen time, and to launch public health campaigns that would promote public awareness about the psychological and physical risks associated with excessive smartphone use.

It may be possible to reduce smartphone dependency's negative impacts through concerted, multifaceted efforts. As a result of developing healthier digital habits, individuals and communities around the world can ultimately benefit. In addition to encouraging a healthy relationship between technology and people, this program can also promote sustainable, mindful smartphone usage for the next generation of consumers.

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