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External risk factors for smartphone addiction in adolescents: A systematic literature review

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Abstract: This systematic review synthesizes empirical research on external risk factors for adolescent smartphone addiction. Scopus and Web of Science were searched for English peer-reviewed empirical articles from 2008 onward; 28 met inclusion criteria (excluding non-adolescents, generic internet addiction, non-empirical work, or non-English). Thematic synthesis organized findings into three external risk domains—family, school, and peers—considering cultural/contextual mechanisms. Family dynamics (parental phubbing, harsh parenting, dysfunction), school stressors, and adverse peer relationships were identified as accumulating, direct and indirect contributors to smartphone addiction. These operate within a techno-ecological framework, where digital technologies amplify vulnerabilities and create new pathways for maladaptive use. Evidence favors an ecological, multi-level perspective. Future research should use longitudinal designs, standardize measures across cultures, and examine understudied regions—especially Africa—to guide culturally sensitive interventions.

Keywords: Smartphone addiction; adolescent; family risk factor; school risk factor; peer risk factor

Introduction

In the digital media era, smartphone addiction poses a pervasive risk to diverse user populations. Defined as a behavioral (non-substance) addiction, it is characterized by compulsive, excessive smartphone use that produces significant physiological, psychological, and social impairment (Kwon et al., 2013b). Adolescents are especially vulnerable: developmental challenges such as identity formation and heightened socioemotional reactivity coincide with substantial smartphone engagement—studies report an average of 6.4 h/day spent browsing the Internet on smartphones for social interaction, academic tasks, and leisure. Risk for adolescent smartphone addiction reflects both individual-level factors (e.g., emotion regulation difficulties, impaired cognitive control) and contextual influences (e.g., family dynamics, school environment, peer norms). However, prior research has predominantly focused on personal determinants, with contextual or external factors receiving comparatively less systematic attention (Heo & Lee, 2018; Wang et al., 2023a; Yang et al., 2019; Zhang et al., 2019a). Emerging evidence regarding external contributors has yet to be comprehensively aggregated and synthesized, limiting its applicability for guiding future research and intervention development.

External risk factors in smartphone addiction

External factors such as family dynamics, school climate, and peer relationships likely contribute to adolescents' risk of smartphone addiction. Family-related risk factors include domestic violence, parental addictive behaviors (Gong et al., 2022), negative parenting styles (Wang et al., 2023a), and strained parent-child relationships (Qiao & Liu, 2020; Xin et al., 2022). Moreover, during adolescence the shift toward greater reliance on peers for socio-emotional support—relative to family may increase susceptibility to behavioral addictions (Wang & Liu, 2024; Gou & Hou, 2023). This is especially salient because peers and the school environment strongly shape adolescents' cognitive, emotional, and social development (Härkönen, 2007). Peer-related risk factors for maladjustment include affiliation with deviant peers (Shi et al., 2022), and social isolation and loneliness (Bozzato & Longobardi, 2024). Although the empirical literature on adolescent smartphone addiction is expanding, we found no comprehensive systematic reviews synthesizing the extant evidence; such a synthesis would help guide future research and inform intervention strategies for this vulnerable population.

Ecological techno-subsystem theory

Ecological Systems Theory (EST) proposes that development is shaped by nested environmental systems. The microsystem—the innermost layer—comprises the immediate contexts in which adolescents interact directly (e.g., family, school, and peer networks), while the mesosystem captures the interrelations among these contexts (for example, the nexus between family dynamics and school experiences). Johnson and Puplampu (2008) extended EST by introducing the techno-subsystem, a distinct layer that encompasses interactions with digital technologies and proposed Techno-Ecological Systems Theory (TEST). This extension is particularly salient for contemporary adolescence, given the ubiquity of smartphones. It supports our emphasis on family, school, and peer factors as core microsystem constituents whose functions are increasingly shaped by digital mediation. For example, parental smartphone addiction (a family-level factor) may influence adolescents' peer relations within the school context, illustrating a mesosystem interaction in which the techno-subsystem figures centrally (Peng, 2017).

Beyond mediating interactions among microsystems, the techno-subsystem also moderates the magnitude and direction of traditional ecological influences. Johnson and Puplampu (2008) conceptualize the techno-subsystem as possessing unique moderating properties that can amplify or attenuate the effects of conventional microsystem factors through several mechanisms: (1) intensity modulation, whereby digital technologies magnify or attenuate existing risk exposures; (2) temporal extension, whereby connectivity prolongs the temporal reach of contextual influences beyond face-to-face encounters; and (3) accessibility modification, whereby technology alters how adolescents access resources and encounter stressors. Thus, family conflict that once remained temporally bounded can persist through continuous messaging and social media exposure, whereas the techno-subsystem can also mitigate adverse influences by affording alternative support networks, emotion-regulation resources, and compensatory coping opportunities that were less available in pre-digital contexts. Consequently, TEST offers a fitting theoretical scaffold for this review.

Goal of the study

Informed by Ecological Techno-Subsystem Theory, this review aims to systematically map external risk factors for adolescent smartphone addiction and to clarify the psychosocial mechanisms through which they operate. The theory orients attention to environmental systems and the intra-systemic processes that shape developmental trajectories, and it therefore provides a principled basis for deriving our research questions. Grounded in the framework's core tenets, we pose two complementary questions:

Which specific family-, school-, and peer-level risk factors within the adolescent microsystem are associated with smartphone addiction?

Through which psychosocial pathways do these external factors exert their effects on adolescent smartphone addiction?

Methods

Data sources and searches

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Systematic searches were conducted in Scopus and Web of Science (WOS) to identify relevant studies published between January 2008 and December 2024. The search terms included "SMARTPHONE ADDICTION," "MALADAPTIVE MOBILE PHONE USE," "PROBLEM MOBILE PHONE USE," "MOBILE PHONE ADDICTION," "ADDICTIVE SMARTPHONE BEHAVIOR," "SMARTPHONE OVERUSE," "SMARTPHONE DEPENDENCE," "MOBILE PHONE DEPENDENCE," "MOBILE PHONE ABUSE," "PROBLEMATICAL SMARTPHONE USE," "NOMOPHOBIA," "FAMILY RISK FACTORS," "SCHOOL RISK FACTORS," "PEER RISK FACTORS," and "ADOLESCENTS/YOUTH." These terms were used to capture a comprehensive range of studies related to smartphone addiction and its external risk factors among adolescents. Duplicate articles were removed using reference management software, and the references of identified articles were manually checked for additional relevant publications.

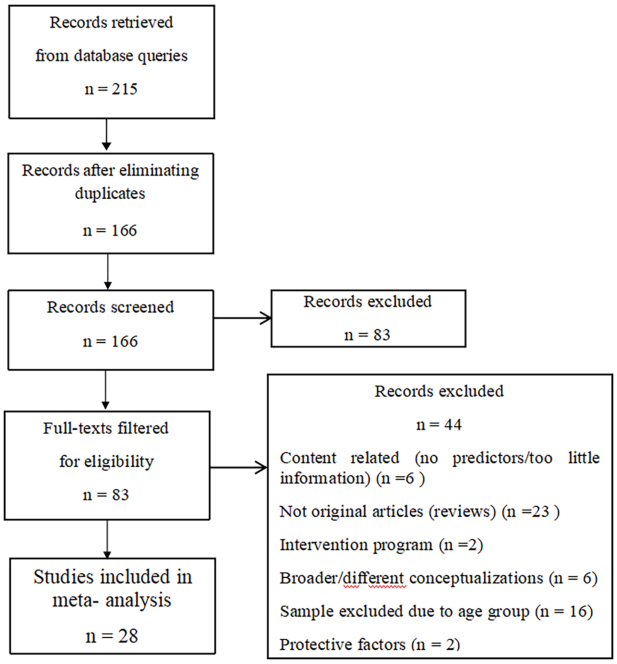

Figure 1. Flowchart of literature search according to PRISMA

Study selection and data extraction

The initial title and abstract screening applied the following inclusion criteria: (1) peer-reviewed empirical studies; (2) publication in English; (3) adolescent samples aged 12–17 years; (4) indexing in Scopus or Web of Science; and (5) explicit examination of external risk factors for smartphone addiction (e.g., family, school, or peer influences). Studies were excluded if they were non-empirical, did not specify the age range of participants, or focused exclusively on protective factors. Screening of titles, abstracts, and full texts was conducted independently by the review authors, with any discrepancies resolved through discussion. Both longitudinal and cross-sectional investigations, and studies employing quantitative, qualitative, mixed-methods, or experimental designs, were eligible for inclusion. The initial search yielded 215 records; after deduplication (n = 166 unique records), independent title/abstract and full-text screening resulted in a final sample of 28 studies (see Figure 1).

Risk of bias assessment

The methodological quality of the included studies was independently appraised by three authors (Lin, Nasir, and Ismail) using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies (Moola et al., 2020). The checklist evaluates seven potential sources of bias: (1) sample representativeness; (2) validity and reliability of exposure and outcome measurement; (3) identification and control of confounding variables; (4) temporal clarity (i.e., evidence that exposure preceded outcome); (5) appropriateness of statistical analyses; (6) ethical considerations and reporting; and (7) transparency in analytic reporting. Discrepancies in item ratings (for example, "unclear risk" vs. "low risk"

for confounding control) were reconciled through consensus discussions among the three reviewers. More than 60% of studies demonstrated strong measurement validity; however, the predominance of cross-sectional designs precluded causal inference, a limitation consistent with prior reviews of smartphone addiction research (Elhai et al., 2016).

Included studies

The final sample comprised 28 studies. Most were conducted in China (78.6%, n = 22), with 10.7% (n = 3) conducted in South Korea; the remaining studies (n = 3) were carried out in other countries. Half of the studies (50.0%, n = 14) used the Smartphone Addiction Scale—either the full version or the Short Version (SAS/SAS-SV; Kwon et al., 2013a). The Mobile Phone Addiction Index (MPAI) was used in 25.0% (n = 7) of studies, while the Smartphone Addiction Proneness Scale (SAPS) and the Mobile Phone Addiction Scale (MPAS) were each applied in 7.1% (n = 2). See Table 1 for further details.

Across the 28 studies, the vast majority (n = 25; 89.3%) exhibited an approximately balanced gender composition, defined here as female representation within ±15 percentage points of parity. Notable departures from this pattern included Bozzato and Longobardi (2024), which reported 66.4% female participants, and Liu et al. (2024), which reported 78.3% female participants. One study (Lai et al., 2022) did not report the gender breakdown.

Data synthesis

Following PRISMA guidelines, we retrieved 215 records; after removal of duplicates, 166 records remained. Title and abstract screening excluded 83 records as irrelevant or non-empirical, leaving 83 for full-text review. Of these, 55 articles were excluded (e.g., reviews, age mismatches, or focus on protective factors), yielding a final sample of 28 studies for inclusion. Both quantitative and thematic

Table 1. Characteristics of the studies and findings related to family, school, and peer risk factors for smartphone addiction

Study	Sample size	Age	Gender	Country	Measure	Main results
Yue et al. (2022)	N = 724	15–17 years	Female = 48.8% Male = 51.2%	China	SAS	Reduced anxiety levels mitigates the adverse influences of parent-child relationships on smartphone addiction.
Wang et al. (2017)	N = 768	M = 16.8 SD = 0.7	Female = 44.0% Male = 56.0%	China	SAS	The student–student relationship establishes a marked negative relationship with adolescent smartphone addiction, self-esteem acting as a partial mediator.
Geng et al. (2021)	N = 1447	M = 16.2	Female = 60.5% Males = 39.5%	China	SAS	Loneliness and the fear of missing out sequentially links the link between parental phubbing and adolescent smartphone addiction.
Xie et al. (2019)	N = 1007	11–16 years M = 13.9 SD = 1.5	Female = 51.4% Male = 48.4%	China	SAS	The relationship between parental phubbing and adolescent smartphone addiction is mediated by parental attachment and connections with deviant peers.
Xiong et al., (2023)	N = 554	11–17 years	Female = 45.8% Male = 54.2%	China	SAS-SV	Adolescents with lower perceived parent-child attachment are more inclined to exhibit higher smartphone addiction, whereas those with stronger deviant peer affiliations have a higher likelihood of experience moderate to high levels of addiction.
Lu & Liu (2020)	N = 1354	14–19 years M = 16.1 SD = 1.0	Female = 54.3% Male = 45.7%	China	SAS-SV	Technology device interference in parent-adolescent relationships has a positive relationship with adolescent smartphone addiction, with attentional control partially mediating the relationship.
Wang et al. (2024)	N = 718	10–17 years	Female = 43.4% Male = 52.6%	China	SAS-SV	Social pain and depression serves as partial mediators in the link between harsh parenting and smartphone addiction with a serial mediation effect observed specifically for maternal harsh parenting.
Wang et al. (2023a)	N = 2407 N = 2260	11–16 years M1 = 12.8 SD1 = 0.6 M2 = 12.8 SD = 0.6	$Female_1$ = 49.9% $Male_1$ = 50.1% $Female_2$ = 50.4% $Male_2$ = 49.8%	China	SAS-SV	Parental phubbing is linked to smartphone addiction.
Lin et al. (2023)	N = 456	M = 13.2 SD = 0.9	Female = 52.6% Male = 47.4%	China	SAS-SV	Depression and experiential avoidance in adolescents, with these factors fully mediating the link between harsh parenting and smartphone addiction.
Zhao et al. (2021a)	N = 304	M = 12.6 SD = 1.2	Female = 54.1% Male = 45.9%	China	MPAI	Parental favouritism positively predicts adolescent smartphone addiction, mediated by sibling hostility.

(Continued)

Table 1. (Continued)

Study	Sample size	Age	Gender	Country	Measure	Main results
Zhang et al. (2022a)	N = 5109	11–25 years M = 15.5	Female = 52.6% Male = 47.4%	China	MPAI	Perceived academic stress predicts depression, with smartphone addiction and sleep quality playing mediating roles in this association.
Liu et al. (2024)	N = 2394	M = 16.7 SD = 0.9	Female = 78.3% Male = 21.7%	China	MPAI	Parental psychological control significantly predicts smartphone addiction, with loneliness serving as a partial mediator. School connection further moderates the link between loneliness and smartphone addiction, intensifying the influence of loneliness for those with strong school engagement.
Li et al. (2022)	N = 3049	11–19 years M = 15.7 SD = 1.5	Female = 50.5% Male = 49.5%	China	MPAI	Parental over-protection further moderates the indirect impact of smartphone addiction through the parent-child relationship.
Gao et al. (2022)	N = 1766	10–18 years M = 13.3 SD = 1.9	Female = 46.9% Male = 53.1%	China	MPAI	The fulfillment of autonomy/relatedness/competence needs significantly mediate the impact of both parent-adolescent and peer relationships on smartphone addiction.
Zhang et al. (2022b)	N = 1857	11–18 years M = 14.9 SD = 1.7	Female = 51.8% Male = 48.3%	China	MPAI	The relationship between parental psychological control and smartphone addiction was partially mediated by shyness.
Lai et al. (2022)	N = 2548 N = 2168 N = 2261	10–18 years		China	SAPS	Early socioeconomic status, childhood family instability, and the dynamics of the parent-child relationship each exerts distinct influences on the development of smartphone addiction during adolescence.
Zhang et al. (2021)	N = 471	11–16 years M = 13.5 SD = 1.1	Female = 59.9% Male = 40.1%	China	MPAS	Social anxiety and core self-perceptions (CSE) play multiple mediating roles in the association between parental smartphone neglect and adolescent smartphone addiction.
Zhao et al. (2022)	N = 931	11–16 years M = 13.5 SD = 1.1	Female = 51.0% Male = 49.0%	China	SAIS	Parental phubbing positively influences smartphone addiction, with boredom proneness acting as a mediator, refusal self-efficacy serving as a moderator in this link.
Wang et al. (2023b)	N = 555	12–19 years M = 15.3 SD = 1.6	Female = 53.0% Male = 47.0%	China	MPAS	Peer relationships are inversely related to smartphone addiction, with alienation acting as a mediator in this association.
Hong et al. (2019a)	N = 1721	11–17 years M = 13.4 SD = 1.6	Female = 51.4% Male = 48.6%	China	PMPU	Parents' phubbing is directly linked to children's smartphone addiction and also exerted an indirect influence through the mediating effects of the parent-child relationship and children's self-esteem.
Liu et al. (2020b)	N = 1265	15–19 years M = 14.8 SD = 1.8	Female = 49.0% Male = 51.0%	China	SAS-SV	Self-compassion moderates the relationship between peer victimization and smartphone addiction, resulting in a weaker association for adolescents exhibiting greater self-compassionn.
Chen et al. (2021)	N1 = 1987 N2 = 1818 N3 = 1820	M = 12.3 SD = 0.5	$Female_{1=}$ 43.9% $Male_1$ = 56.1% $Female_2$ = 44.0% $Male_2$ = 56.0% $Female_3$ = 44.1% $Male_3$ = 55.9%	China	MPAI	Peer victimization emerges as a key indicator of smartphone addiction.
Son et al. (2021)	N = 357	10–19 years	Female = 46.7% Male = 53.3%	South Korea	SAS-SV	Parental awareness of content consumption and the family environment are identified as significant predictors of smartphone addiction.
Kim (2021)	N = 502	12–17 years M = 13.0 SD = 0.8	Female = 54.8% Male = 45.2%	South Korea	SAPS	Factors linked to smartphone addiction tendencies encompass subjective economic status, academic stress, parental support, and experiences of being bullied.
Lee et al. (2016)	N = 3000	13–18 years	Female = 47.3% Male = 52.7%	South Korea	2011 Survey on Internet addiction	Parental restrictions elevate the risk of smartphone addiction.
Kim et al. (2024)	N = 825	M = 15.1 SD = 1.8	Female = 55.7% Male = 44.3%	Thailand	SAS-SV	Higher-quality family relationships are linked to a higher risk of smartphone addiction, whereas parental control and family support are not.

(Continued)

Table 1. (Continued)

Study	Sample size	Age	Gender	Country	Measure	Main results
Bozzato & Longobardi (2024)	N = 529	14–20 years M = 16.3 SD = 1.2	Female = 66.4% Male = 33.6%	Italy	SAS-SV	There is a negative link among school climate, school connectedness, affective engagement in school, and smartphone addiction.
Su et al. (2022)	N = 2100	M = 13.3 SD = 0.9	Female = 43.3% Male = 56.7%	Dutch	SAS-SV	Positive and reciprocal cross-lagged correlations are observed between the frequency of in-person meetings with friends and active social media messaging via smartphones.

Notes. N sample size, M mean, SD standard deviation, SAS-SV Smartphone Addiction Scale-Short Version (Kwon et al., 2013a), cited by Xiong et al. (2023), SAS Smartphone Addiction Scale—Original Version (Kwon et al., 2013b), MPAI the Mobile Phone Addiction Index Scale (Leung, 2008), cited by Zhang et al. (2022a), SAPS the Smartphone Addiction Proneness Scale (Kim et al., 2014), cited by Lai et al. (2022), MPAS the Mobile Phone Addiction Scale (Hong et al., 2012), SAIS the Smartphone Addiction Index Scale (Huang et al., 2014), PMPU a Chinese version of a short form of the Mobile Phone Problem Use Scale (Hong et al., 2019b).

syntheses were performed on this rigorously vetted sample to preserve methodological coherence and reduce the risk of selection bias.

Results

Risk factors through the lens of ecological techno-subsystem theory

The identified external risk factors for adolescent smartphone addiction corroborate the predictions of the ETST, illustrating how interactions among ecological levels-mediated by the techno-subsystem—shape propensity for addiction. Findings are organized according to the three principal microsystem contexts delineated by Johnson and Puplampu (2008).

Microsystem level 1: family context

Within the family microsystem, multiple risk factors operate through the techno-subsystem to influence smartphone addiction patterns. The family environment represents the most proximal influence in adolescents' ecological context, where technology-mediated interactions increasingly shape parent-child dynamics. Family factors substantially influence adolescents' risk of smartphone addiction, although the evidence is mixed. Some studies find no association between sociodemographic indicators—such as parental education and income—and smartphone addiction (Buctot et al., 2020). Conversely, other research links higher parental or household income to increased smartphone engagement, manifested as longer usage durations and greater expenditures (Beison & Rademacher, 2017; Sánchez-Martínez & Otero, 2009). These socioeconomic factors demonstrate how family microsystem characteristics interact with the techno-subsystem through differential access to and regulation of technology resources. Frequency of adolescent smartphone use is associated with parental awareness and monitoring of content consumption (Son et al., 2021), and with maternal regulatory practices regarding device use. Greater time spent on social networking services and maladaptive mother-child communication patterns are also linked to higher smartphone-use frequency (Lee & Kim, 2021). These patterns illustrate how the techno-subsystem mediates traditional parent-child interactions within the family microsystem.

Factors such as interparental conflict and poor parental marital relations (Deng et al., 2015) domestic violence (Kim et al., 2018), family pressure and dysfunction (Chiu, 2014; Wang et al., 2019), parental favoritism (Zhao et al., 2021a), and parental psychological control (Liu et al., 2024) have been identified as risk factors for adolescent smartphone addiction. These familial stressors and coercive parenting practices may predispose adolescents to maladaptive, compensatory smartphone use. According to ETST, these family dysfunction patterns create vulnerabilities that are amplified through adolescents' techno-subsystem interactions, where smartphones become maladaptive coping mechanisms for family-related stress. Similarly, disengaged, chaotic, and enmeshed family functioning (Mangialavori et al., 2021), family cohesion and adaptability (Lian et al., 2023), and technoference in conjugal interactions (Shao et al., 2022) have been recognized as latent risk factors for smartphone addiction.

Parental discipline and restrictive mediation strategies, such as limiting access to applications (Lee & Ogbolu, 2018), parental restriction (Lee et al., 2016), child neglect and psychological abuse (Sun et al., 2019), negative parenting style (Lian et al., 2016), and harsh parenting (Lin et al., 2023; Wang et al., 2023; Wang et al., 2024), including parental phubbing (Hong et al., 2019; Geng et al., 2021; Niu et al., 2020; Xie et al., 2019; Zhang et al., 2021; Zhao et al., 2022) specifically fathers' phubbing and mothers' phubbing (Geng et al., 2021) are risks for smartphone addiction among adolescents. Moreover, parental smartphone addiction (Gong et al., 2022), parental addiction (including substance abuse and gambling issues); child's permissive parenting behaviour (Yun et al., 2022), and emotionally traumatic experiences (Kwak et al., 2018) contribute to risk for smartphone addiction among adolescents. Parental psychological control (Zhang et al., 2022b), parent-child relationship dynamics (Lai et al., 2022; Yue et al., 2022), and cumulative childhood trauma (Xie et al., 2024) appear to elevate the likelihood of smartphone addiction among adolescents. Dysfunctional family dynamics, such as poor marital relationships, parental neglect, and harsh parenting, further exacerbate this risk. In conclusion, family-related factors play a crucial role in smartphone addiction, with various risk influences

contributing to its development. These factors illustrate how the techno-subsystem can perturb conventional family microsystem functioning undermining regulatory, communicative, and relational processes and thereby precipitate cascading effects that increase adolescents' susceptibility to smartphone addiction.

Microsystem level 2: school context

The school microsystem represents another critical ecological context where adolescents interact with the techno-subsystem. Academic environments increasingly integrate technology while simultaneously creating stressors that drive smartphone addiction. Research reveals that attending a private school predicts smartphone addiction (Lopez-Fernandez et al., 2015). Furthermore, high levels of academic stress constitute a significant risk factor for smartphone addiction (Zhang et al., 2022a; Gökçearslan et al., 2018). From an ETST perspective, academic stress represents a school microsystem stressor that adolescents attempt to regulate through techno-subsystem engagement, often resulting in smartphone addiction patterns. Moreover, teacher-student and peer relational dynamics significantly predict adolescent smartphone addiction (Wang et al., 2017; Zhang et al., 2019a; Song, 2021; Zhang et al., 2022a). These relational factors demonstrate how school microsystem social dynamics interact with the techno-subsystem, where poor school relationships may drive adolescents toward smartphone addiction for social connection and emotional regulation. In conclusion, schools exert both direct and indirect influences on smartphone addiction, as factors including academic stress, peer/teacher relationship quality, and school climate collectively exacerbate this risk.

Microsystem level 3: peer context

The peer microsystem becomes increasingly influential during adolescence, with peer relationships heavily mediated through the techno-subsystem via social media, messaging, and digital communication platforms. Among peer relationship types, school victimization and bullying correlate with elevated smartphone addiction risk (Chen et al., 2021; Liu et al., 2020b; Kim, 2021). These adverse peer experiences within the school microsystem drive adolescents toward the techno-subsystem as an alternative social environment, potentially leading to addictive usage patterns. Notably, adolescents experiencing peer bullying show heightened susceptibility (Liu et al., 2020b). Further, deviant peer associations amplify this risk (Xie et al., 2019; Liu et al., 2020a,b; Xiong et al., 2023). According to ETST, deviant peer relationships represent microsystem influences that are often facilitated and maintained through techno-subsystem interactions, creating reinforcing cycles of problematic behavior. Low-quality friendships also predict increased addiction levels (Liu et al., 2020a). Peer phubbing positively correlates with smartphone addiction, while boredom proneness mediates this link. Critically, refusal self-efficacy moderates the phubbing-addiction relationship (Zhao et al., 2021b). Peer phubbing behaviors (Zhao et al., 2021b) specifically illustrate how the techno-subsystem has become embedded within peer microsystem interactions, where technology use itself becomes a social norm that can escalate into addictive patterns.

Mesosystem Interactions and Techno-Subsystem Mediation

Studies reveal mesosystem interactions where multiple microsystems connect through the techno-subsystem. This interconnection creates complex pathways influencing smartphone addiction development in adolescents. For example, parental smartphone addiction affects peer relationship quality through adolescent modeling of technology behaviors. Similarly, academic stress can transfer into family conflicts when adolescents use smartphones to manage school pressures. The techno-subsystem functions as both mediator and amplifier of cross-contextual influences. Technology-mediated communication allows stressors from one microsystem to follow adolescents into other environments, creating pervasive risk factors for smartphone addiction. Family-school interactions demonstrate how stress in one context affects another through smartphone use patterns. Academic pressure often intersects with family dynamics, particularly when parents respond to academic performance with harsh parenting, creating reinforcing cycles of problematic smartphone use. Family-peer interactions show how family dysfunction influences peer relationships and selection. Similarly, school-peer interactions reveal how academic environments shape peer dynamics through technology use, with academic stress intensifying peer competition via social media. This digital permeability of ecological boundaries represents a fundamental shift in environmental system interactions, with the techno-subsystem enabling continuous connectivity between previously distinct contextual influences.

Discussion and implications of this study

The findings of this systematic review provide robust empirical support for predictions of the ETST regarding the development of smartphone addiction. Consistent with ETST, our results indicate that problematic smartphone use emerges from complex interactions among technological affordances and multiple ecological risk factors. At the microsystem level, family-level risks—parental phubbing, harsh parenting, and broader family dysfunction—directly shape adolescents' technology engagement and self-regulatory capacities. School-related stressors and adverse peer dynamics illustrate how distinct microsystems contribute additional, and at times reinforcing, pathways to maladaptive use patterns. These risk factors operate through the techno-subsystem, whereby digital platforms amplify preexisting vulnerabilities and create novel conduits for compulsive engagement. Collectively, the evidence underscores the need for multi-level prevention and intervention strategies that address both ecological contexts and the technological features that mediate their interplay. Researchers have sought to uncover factors contributing to smartphone addiction, positing that future interventions may reduce addictive behaviours by targeting the identified underlying factors.

Firstly, measures assessing smartphone addiction vary significantly across studies. The most common tools are

the Smartphone Addiction Scale (SAS; Kwon et al., 2013b) and its short version (SAS–SV; Kwon et al., 2013a). The Mobile Phone Addiction Index Scale (MPAI; Leung, 2008) ranks as the second most frequent measure. While these scales directly assess smartphone addiction, others focus on broader "mobile phone use". Some studies have repurposed non-specialized measures (Lee et al., 2016), highlighting the need for a standardized, comprehensive assessment tool to advance research rigor.

Secondly, cultural factors such as individualism-collectivism dynamics significantly influence technology adoption and usage patterns (Alhassan et al., 2018), as well as specific phenomena like Internet addiction (Chen & Nath, 2016). For example, a study examing the Internet Addiction Test (IAT) across three cultures contexts—collectivist (China), individualist (United States) and a pan-African sample-revealed psychometric variations shaped by cultural, technological, and socioeconomic factors (Chen & Nath, 2016). Regarding smartphone addiction, usage intensity aligns with culturally shaped engagement patterns. Specifically, smartphones' role in mood regulation varies cross-culturally (Chen & Nath, 2016). Notably, the majority of studies (67.4% and 18.6%) meeting the inclusion criteria originated from China and South Korea respectively. Thus, future research must prioritize nuanced cultural analyses to strengthen cross-cultural validity of smartphone addiction frameworks.

Third, all studies in this review centred on adolescents, whereas research on younger children's smartphone access remains underexplored. This gap may stem from adolescents' higher ownership rates. However, children aged 6–10 have seen a surge in smartphone engagement. Consequently, future research should prioritize younger demographics. examining both parental mediation roles (Hwang et al., 2017), and children's direct experiences with device usage.

Limitations of the study

A downside of this review is that the causal relationships among the variables examined are not statistically robust among all studies. The bulk of the included studies employed correlational research designs and were cross-sectional in nature. To effectively examine directionality—specifically, whether a proposed risk factor acts as a contributor or a consequence—longitudinal studies are necessary. Moreover, the heterogeneity in measurement tools, cultural settings, and research designs across studies limited quantitative comparisons of effect sizes. A future meta-analysis could statistically aggregate findings to identify universal vs. culture-bound risk factors, clarify causal pathways through longitudinal effect sizes, and prioritize intervention targets for underrepresented regions. While there are studies on smartphone addiction in Africa (Al-Mohaimeed et al., 2022) or studies on external risk factors for Internet addiction in Africa (Nwufo et al., 2023), no studies were found that represented the African continent in terms of external risk factors contributing to smartphone addiction among adolescents. This gap is particularly noteworthy given the rapid adoption of mobile technology across Africa and the unique cultural, socio-economic, and technological contexts within different African countries. By addressing this gap, we can better understand the external influences on smartphone addiction, paving the way for targeted interventions in Africa.

Conclusion

Smartphone addiction is a multifaceted issue shaped by various external factors, particularly those related to family, school, and peer dynamics. The family environment plays a crucial role in influencing smartphone addiction, with factors such as parental income, parental control, maternal regulation, and family dysfunction identified as significant risk factors. Additionally, school-related stress, including academic pressure and poor teacher-student relationships, shows a positive correlation with addiction. Peer victimization and associations with deviant peers further increase the risk of smartphone addiction. To advance the field, a clear and standardized tool is necessary to enhance the comparability of future research and promote a more precise understanding of this complex phenomenon.

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