

## Social media engagement patterns in relation to adolescent anxiety and depression: a systematic review

### Submitted:

June 30th, 2025

### Accepted:

September 11th, 2025

### Published:

September 16th, 2025

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### Abstract

**Purpose:** Adolescents are increasingly immersed in social media environments that encourage curated self-presentation and social comparison. Global prevalence estimates from the World Health Organization indicate that 5.5% of adolescents aged 15–19 meet diagnostic criteria for anxiety disorders. While prior research emphasized screen time duration, emerging evidence suggests that how young people engage—primarily through passive, emotionally reactive, or appearance-focused behaviors—may be more predictive of internalising symptoms such as anxiety and depression. This systematic review aimed to synthesize observational evidence on associations between adolescent social media use and internalising symptoms, with particular attention to engagement patterns, psychosocial mediators, and contextual moderators. **Methods:** A comprehensive search across PubMed, Scopus, EBSCOhost, and AI-assisted platforms was conducted between April 14 and 25, 2025. Inclusion criteria were: observational design, adolescent population (10–19 years), validated measures of anxiety/depression, and exposure to social media use. Ten studies published between 2018 and 2025 met eligibility criteria (N=10). Data were synthesized narratively, with quality assessed using the JBI checklist. **Results:** Across studies, problematic use and passive scrolling were more strongly associated with anxiety and depression than total time spent online. Sleep disruption and appearance-based comparison consistently emerged as mediators, while gender, emotional reactivity, and socioeconomic background moderated vulnerability. Girls and gender-diverse adolescents reported higher psychological reactivity. Protective factors included physical activity and family support. Most studies were cross-sectional; only one referenced neurobiological pathways. **Conclusion:** Digital mental health risks in adolescents are driven less by screen exposure time and more by emotionally charged engagement styles. Interventions should prioritize resilience-building and digital literacy, while future research must incorporate longitudinal and biopsychosocial frameworks to capture the complexity of these associations better.

**Keywords:** adolescents; anxiety; depression; mental health; social media use

## INTRODUCTION

Adolescence is a pivotal stage of psychological and emotional development marked by heightened self-awareness, increased emotional reactivity, and growing dependence on peer feedback. In recent years, these processes have become increasingly shaped by digital environments that enable constant social engagement, curated self-presentation, and real-time public evaluation. Adolescents now spend an average of 7 hours and 22 minutes per day on screens, with 95% active on at least one social media platform [1,2]. Concurrently, mental health concerns have risen among youth. Global prevalence estimates from the World Health Organization [3] indicate that 5.5% of adolescents aged 15–19 meet diagnostic criteria for anxiety disorders, and 3.5% for depressive disorders. Beyond diagnostic prevalence, research highlights a broader spectrum of health impacts linked to social media use in adolescents, including sleep disturbance, chronic fatigue, reduced physical activity, and risks of obesity. Psychosocial stressors such as cyberbullying, misinformation exposure, and excessive social comparison further amplify adolescent vulnerability, underscoring the urgency of addressing social media-related health consequences in both clinical and public health domains.

While early research linked these mental health outcomes to overall screen time, recent studies suggest that the nature and intensity of engagement—such as emotionally reactive or appearance-related interactions—may be more relevant than duration alone [4,5]. Adolescents who engage in frequent checking, passive browsing, and socially evaluative posting report significantly higher rates of depression and anxiety symptoms—even when screen time is held constant [6,7]. Sleep disturbance has emerged as a potential mediating factor, while gender identity and peer-based appearance comparison may moderate vulnerability to digital distress [8–10]. Though not focused solely on social anxiety, evidence linking excessive social media use to anxiety, stress, and maladaptive coping among adolescents underscores the clinical relevance of these behavioral patterns [11].

Despite growing research in this area, several gaps remain. Most studies treat digital behavior as a uniform exposure, overlooking how different patterns of engagement may influence mental health through distinct pathways. In addition, few reviews have synthesized this evidence within an integrated framework that accounts for behavioral, clinical, and contextual contributors to adolescent psychiatric vulnerability [12,13]. This review aims to address these

gaps by synthesizing recent observational studies examining the relationship between social media use and symptoms of anxiety and depression in adolescents. The goal is to clarify how engagement patterns—beyond total screen time—may influence mental health, and to offer insights relevant to psychiatric evaluation, preventive care, and future investigations into biopsychosocial and neurobehavioral mechanisms underlying adolescent susceptibility.

## METHODS

A comprehensive literature search was conducted across conventional and AI-powered academic databases between April 14th and 15th, 2025, to identify observational studies examining the association between adolescent social media use and symptoms of anxiety and depression. The review question was structured using the PICO framework: Population = adolescents aged 10–19 years; Exposure = social media use and engagement patterns; Comparison = not applicable (observational studies only); Outcome = anxiety and depression. The search strategy combined structured Boolean logic with natural language processing (NLP)-based queries to enhance conceptual saturation and reduce keyword bias.

Structured Boolean queries were applied across PubMed, Scopus, and EBSCOhost on April 14, 2025. The Boolean search strategy was developed by the first, second, and fourth authors through iterative refinement, combining manual logic structuring and domain expertise. ChatGPT-4o was used later as a supplementary tool to evaluate Boolean coherence and suggest relevant synonym clusters, with all outputs critically reviewed and finalized by the authors. This approach reflects the emerging role of large language models in supporting, but not replacing, expert-driven systematic search strategies in academic research [14]. Database-specific syntax adaptations and filters were used to restrict results to: English-language publications, Human participants, Observational study designs (cross-sectional, longitudinal, cohort), Full-text availability, and Peer-reviewed journals.

To complement the Boolean search, natural language queries were submitted to PubMed, EBSCOhost, Semantic Scholar, and Google Scholar on April 25, 2025 (Table 1). The core query used was: “How does social media usage relate to mental health outcomes in adolescents?” PubMed and EBSCOhost were included due to their evolving NLP capabilities [14,15]. Semantic Scholar, as an AI-native platform, was used explicitly in the last stage to uncover terminological variants and conceptual gaps not

captured through Boolean logic (Table 1). Google Scholar was used for exploratory screening, and citation-based filtering was applied following best practices in gray literature management. In line with established recommendations for grey literature searches, the Google Scholar query was screened manually by reviewing the first 200–300 article titles, beyond which relevance and precision are known to decline [16].

**Table 1. Refined boolean search strings for three databases, developed with support from a large language model (ChatGPT-4o)**

Platform	Query Boolean Refined using Large Language Model [ChatGPT-4o]
PubMed	["social anxiety" [Title/Abstract] OR "social phobia" [Title/Abstract] OR anxiety [Title/Abstract] OR depression [Title/Abstract]] AND ["social media"[Title/Abstract] OR Instagram [Title/Abstract] OR TikTok [Title/Abstract] OR YouTube [Title /Abstract] OR Facebook [Title/Abstract] OR Twitter[Title/Abstract]] AND [adolescent [Title/Abstract] OR teenager [Title/Abstract] OR "young people" [Title/Abstract] OR youth [Title/Abstract]]
EBSCO	[TI OR AB] ["social anxiety" OR "social phobia" OR anxiety OR depression] AND [TI OR AB] ["social media" OR Instagram OR TikTok OR YouTube OR Facebook OR Twitter] AND [TI OR AB] [adolescent OR teenager OR "young people" OR youth]
Scopus	TITLE-ABS-KEY ["social anxiety" OR "social phobia" OR anxiety OR depression] AND TITLE-ABS-KEY ["social media" OR Instagram OR TikTok OR YouTube OR Facebook OR Twitter] AND TITLE-ABS-KEY [adolescent OR teenager OR "young people" OR youth]

Studies were included if they involved an adolescent population (10–19 years); used an observational study design (cross-sectional or longitudinal); measured both social media use and internalising outcomes (specifically anxiety and/or depression); reported full-text, peer-reviewed data in English; and used validated psychological instruments, such as the Generalized Anxiety Disorder 7-item scale (GAD-7) for anxiety, the Patient Health Questionnaire 9-item scale (PHQ-9) for depression, or the Depression Anxiety Stress Scales 21-item version (DASS-21), which assesses depression, anxiety, and stress. Studies conducted in the COVID era and grey literature (including preprints, dissertations, conference abstracts, and non-peer-reviewed sources) were excluded to maintain methodological rigor and peer-reviewed quality. Such exclusions were intended to reduce heterogeneity arising from unreviewed or temporally exceptional data, ensuring that the synthesized evidence reflects stable, generalizable patterns rather than crisis-driven or unpublished fluctuations.

Screening process

Following the database search, all records were imported into Rayyan QCRI, a web-based screening platform for systematic reviews [17]. After deduplication, titles and abstracts were independently screened by two reviewers [second and third author], with disagreements resolved by a third and fourth reviewer (fourth and fifth author). Inclusion decisions were based on predefined eligibility criteria regarding population, exposure type, study design, and outcome measures. QA, DAH, and DP performed the database searches and AI-assisted query refinement; DAH and AKM screened titles and abstracts; YRS resolved conflicts during screening; QA and DP extracted the data; and DAH and YRS assessed risk of bias.

Data extraction and synthesis

From each included study, we extracted: authorship, year, country, sample size, design, population, type of social media exposure (e.g., problematic use, passive/ active style, platform), psychological outcomes, measurement tools, statistical methods, key findings, and effect sizes. Methodological quality was assessed using the JBI Critical Appraisal Checklist for Observational Studies, scored on an 8-point scale. Risk of bias was evaluated independently by DAH and YRS, with consensus reached through discussion.

A narrative synthesis was conducted due to heterogeneity in outcome measurement, study designs, and exposure operationalization. Particular attention was paid to emergent patterns of mediators (e.g., sleep disturbance, body image comparison) and moderators (e.g., gender, family support, socioeconomic context) [18]. A number of the included studies specifically examined nighttime media use [19] or problematic smartphone use [20], in addition to broader measures of social media addiction and engagement styles.

RESULTS

The initial database search yielded 949 records. After removing four duplicates, 472 records were excluded by automation tools based on title/abstract mismatch, and 349 records were removed for reasons such as irrelevance to the topic scope or being outside the target population. This left 124 records for title and abstract screening. Of these, 62 records were excluded based on abstract content, and 62 full-text reports were sought for retrieval. Twenty-eight could not be retrieved, primarily due to access restrictions or unavailable full text. The remaining 32 full-text articles were assessed for eligibility. Twenty-two studies were excluded for the following reasons: COVID-specific digital behaviors (n = 6), Screen time studies without

social media context (n = 5), Non-eligible study design (reviews, qualitative, or systematic) (n = 7), and Incompatible outcomes or population scope (n = 4). Finally, 10 studies were included in the review. The PRISMA 2020 flow diagram (Figure 1) summarizes this process. A flow diagram of study selection from 949 database records shows that 124 were screened, and 32 full-texts were assessed. Ten studies met the inclusion criteria. Exclusions were due to the COVID-era context, non-social media screen time, review designs, or non-standard outcomes (Figure 1).

Table 2 indicates that among adolescents, problematic engagement with smartphones and social media (PSU, SMA, IGD) is consistently associated with higher levels of anxiety, as measured with validated instruments (GAD-7, RCADS, MASC, DASS-21, SDQ). Reported effects ranged from small but significant correlations ( $r \approx 0.3\text{--}0.4$ ) and beta coefficients ( $\beta \approx 0.15\text{--}0.34$ ) to odds ratios exceeding twofold in some studies (e.g., Carter et al., Lahti et al.). Several studies identified sleep disturbance, appearance-based comparison, and emotional reactivity as mediating pathways, while others noted consistent but non-quantified associations. Risk of bias was generally low-to-moderate (JBI 5–8), supporting the robustness of the overall findings.

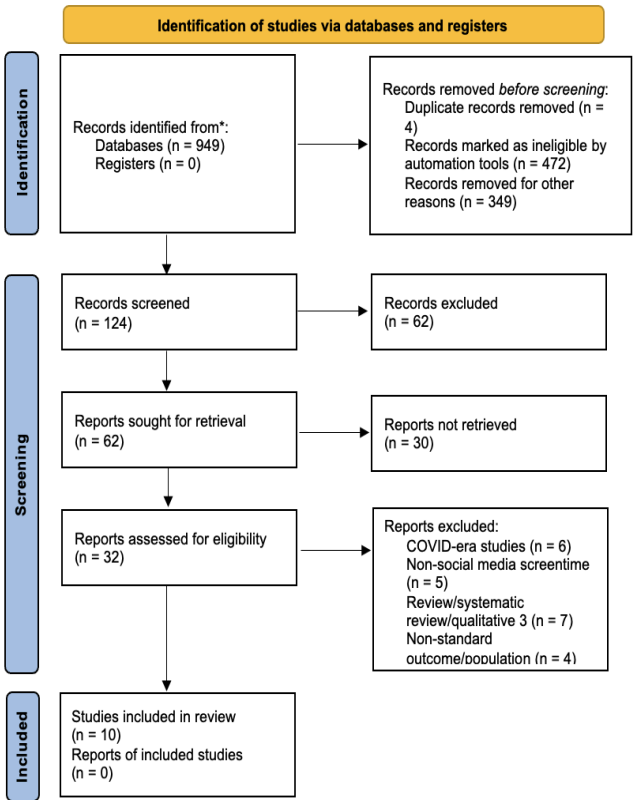


Figure 1. PRISMA flow diagram of study selection

Table 2. Summary of included studies examining social media exposure and anxiety outcomes in adolescents and their associations (2018–2025)

Study (Year)	Type of anxiety	SM exposure type	Design	Key findings (narrative)	Effect size (s)	JBI score (0–8)
Carter et al. (2024) [6]	General (GAD-7)	PSU [SAS-SV], TikTok, Instagram	Cross-sectional	Adolescents with higher PSU scores were >2 times more likely to report moderate-to-severe anxiety; insomnia partially mediated this association. Total screen time was not predictive.	aOR anxiety = <b>2.03</b> (CI 1.28–3.23); insomnia aOR = 1.64	6 (Moderate risk of bias)
	General (GAD-7)	SMA vs IGD via BSMAS	Cross-sectional; network	The SMA group had “feeling down” as a central symptom; the IGD group centered around fatigue. The two groups showed distinct symptom networks.	Not applicable (network centrality only)	8 (Low risk of bias)
Thorisdottir et al. (2020) [22]	Social & physical anxiety (MASC)	Time on IG, Snapchat, FB	Longitudinal (3 waves)	Increased social media use predicted higher psychological distress over time, stronger among girls. Small but cumulative effects.	$\beta$ (social anxiety) $\approx$ <b>0.15</b> (girls); small but significant	8 (Low risk of bias)
Becker & Lienesch (2018) [19]	RCADS (GAD, panic)	Nighttime media use	Cross-sectional	Night media use was associated with shorter sleep and higher anxiety, independent of ADHD severity.	Not explicitly reported; directionally significant	6 (Moderate risk of bias)
Kosola et al. (2024) [7]	GAD-7	SMA via screenshot, TikTok	Population-based	37% scored above anxiety cut-off; BSMAS scores correlated with GAD-7 [ $r = 0.38$ ], fatigue, and body dissatisfaction.	$r$ (anxiety) = <b>0.38</b>	5 (Moderate risk of bias)



Study (Year)	Type of anxiety	SM exposure type	Design	Key findings (narrative)	Effect size (s)	JBI score (0–8)
Lin et al. (2025) [8]	DASS-21	SMA + comparison + sleep	Cross-sectional + mediation	SMA predicted higher anxiety via appearance comparison and poor sleep. Effects are significant in athletic youth.	Mediation indirect effect ( $\beta$ not numerically given)	8 (Low risk of bias)
Gunnlaugsson et al. (2020) [23]	Self-report frequency	General access	Cross-sectional	Adolescents with social media access reported more anxiety and behavioral risks, even in low-access LMIC settings.	OR not explicitly listed (reported as “significant”)	4 (High risk of bias)
Shoshani et al. (2024) [10]	Internalizing (SDQ)	Passive vs active use	Longitudinal (5 waves)	Passive users had higher distress over time; protective effects were seen from extracurricular activity and family support.	Not quantified; consistent across waves	8 (Low risk of bias)
Rutter et al. (2021) [9]	Custom validated anxiety scale	Time + emotional investment	Cross-sectional	Girls and nonbinary adolescents with higher emotional reactivity to social media reported more anxiety; scrolling was worse than posting.	$\beta$ (emotional reactivity $\rightarrow$ anxiety): <b>0.34</b>	7 (Low risk of bias)
Lahti et al. (2024) [24]	Frequency of anxiety (GAD-7)	Monthly SMA threats	Cross-sectional	Any exposure to SMA threats [cyberbullying, pressure] doubled anxiety risk.	OR anxiety = <b>2.60</b> (for $\geq 1$ threat/mo)	8 (Low risk of bias)

Abbreviations: GAD-7, Generalized Anxiety Disorder-7 items; RCADS, Revised Child Anxiety and Depression Scale; MASC, Multidimensional Anxiety Scale for Children; DASS-21, Depression Anxiety Stress Scale–21 items; SDQ, Strengths and Difficulties Questionnaire; PSU, Problematic Smartphone Use; SAS-SV, Smartphone Addiction Scale–Short Version; SMA, Social Media Addiction; IGD, Internet Gaming Disorder; BSMAS, Bergen Social Media Addiction Scale; IG, Instagram; FB, Facebook; aOR, adjusted Odds Ratio; OR, Odds Ratio;  $\beta$ , beta coefficient; CI, Confidence Interval; r, correlation coefficient; ADHD, Attention-Deficit/Hyperactivity Disorder; LMIC, Low- and Middle-Income Countries; JBI, Joanna Briggs Institute.

DISCUSSION

Intensive engagement and adolescent anxiety or depression

This systematic review examined ten observational studies published between 2018 and 2025 that investigated associations between adolescent social media use and internalising symptoms, namely anxiety and depression. The findings indicate that how adolescents engage with emotional or appearance-focused content on social media has a greater impact on their mental health than the amount of time they spend online. Consistent with this, most studies included in this review assessed anxiety using validated instruments (e.g., GAD-7, RCADS, DASS-21) and reported associations independent of screen time volume. Moreover, the risk of bias across studies was generally low to moderate, supporting the reliability of the observed patterns.

Becker & Lienesch [19] showed that nighttime media use was associated with sleep disturbance and internalising psychiatric symptoms. From a biomedical standpoint, this pathway can be understood as the disruption of circadian regulation and neuroendocrine balance—mechanisms through which sleep loss amplifies vulnerability to anxiety and depression. Similarly, Carter et al. [20] confirmed the link between problematic smartphone use and anxiety/depression, which can be interpreted as reflecting stress-system

activation and reward-circuit sensitisation underlying compulsive digital engagement.

A consistent theme across studies was the psychological salience of passive and evaluative behaviors. Carter et al. found that problematic smartphone use, especially tied to emotionally reactive apps like Instagram and TikTok, predicted moderate levels of anxiety and depression, independent of total screen time [6]. Similarly, Rutter et al. [9] and Shoshani et al. [10] demonstrated that passive consumption and emotional investment, rather than volume of exposure, more strongly predicted internalising symptoms, particularly among girls and gender-diverse adolescents. This aligns with Zhang et. al [21] network analysis, which showed that depressed mood was the central symptom node in adolescents with Social Media Addiction (SMA), in contrast to fatigue in those with Internet Gaming Disorder. This supports the growing recognition that different types of digital engagement yield distinct psychological profiles—and that blanket “screen time” measures are inadequate. Across the studies, other mechanisms were implicated. Notably, sleep disturbance and appearance-based comparison emerged as key mediators, particularly in studies using mediation models. Carter, Lin, and Becker each provided evidence for disrupted sleep—especially insomnia—as a pathway from social media exposure to psychological distress [8,19,20].

Lin et al. [8] further demonstrated that body image comparison mediated the association between social

media addiction and negative affect in adolescent athletes, a group especially vulnerable to idealized appearance norms—notably, contextual moderators such as gender, socioeconomic status, and digital literacy shaped mental health outcomes. Thorisdottir et al. [22] found that girls exhibited stronger emotional reactions and distress trajectories over time. Kosola et al. [7] and Rutter et al. [9] echoed these gendered vulnerabilities. Meanwhile, Gunnlaugsson et al. [23] studied adolescents in a low-income context. They showed that even minimal social media access correlated with elevated anxiety and risk behaviors, suggesting that digital harms are not confined to high-exposure populations.

### **Moderators, protective factors, mediating pathway**

While multiple studies highlighted risk factors, several also pointed to protective elements. Several studies identified social support as a buffering variable that attenuates the clinical expression of anxiety and depressive symptoms in high-exposure adolescent groups [9,10,24]. These findings underscore that buffering mechanisms can moderate digital risk exposure, shifting the conversation from restriction to resilience. Nevertheless, the current literature remains predominantly psychosocial in scope. Only one study, Becker and Lienesch (2018), referenced biological mechanisms such as sleep regulation or neurochemical disruption, and none incorporated neuroimaging, biomarkers, or hormonal measures [19]. This absence limits the field's ability to explain how psychological vulnerability maps onto physiological stress systems. Future research should incorporate biopsychosocial models, integrating emotion regulation networks and sleep–wake physiology with digital behavior metrics. Finally, although algorithmic systems were not directly addressed in the included studies, several implicitly referred to platform structures that reinforce appearance-based comparison and reward-seeking loops, primarily among girls [22,24]. These findings support calls to investigate how social media design and reinforcement influence user behavior. Algorithms contribute to digital mental health risk—a gap that remains underexplored.

### **Insights for national policy**

These findings resonate strongly with recent national expert consensus in Indonesia, which identified adolescents as a high-risk group for emotional disorders (9.8% prevalence), emphasized peer pressure and bullying as key mental health priorities (75.6%), and acknowledged the detrimental role of social media misinformation and gadget use in exacerbating psychological distress—highlighting the

urgency of shifting from screen time quantity to the emotional and evaluative nature of digital engagement as central to adolescent anxiety [25].

### **Strengths and limitations**

To the best of our knowledge, this is the first systematic review in adolescent digital mental health to integrate a structured human–AI collaboration within the search methodology. Boolean search strings were iteratively refined with the assistance of a large language model (ChatGPT), used specifically to improve keyword logic and semantic breadth across databases. This reflects methodological innovations highlighted by Ma et al. [26], who demonstrated that NLP-based keyword augmentation significantly boosts recall and precision, and by [14], who advocated for the use of large language models in enhancing Boolean search strategies for systematic reviews. The search process was further strengthened by dual-screening in Rayyan and formal appraisal using JBI checklists, ensuring transparency and replicability. Consistent with observations by Alaniz [27], this review positions AI tools as enablers of human expertise, rather than replacements—demonstrating how such integration can support more efficient and conceptually coherent evidence gathering.

In contrast to many prior reviews, this study also avoids conflation by excluding COVID-era studies and clearly separating social media use from total screen time—allowing for a cleaner interpretation of digital behaviors in everyday, non-crisis contexts. By focusing on emotionally charged, passive, and appearance-focused engagement patterns and examining psychosocial mediators such as sleep disturbance and social comparison, the review brings a sharper conceptual focus to digital mental health risks.

Nevertheless, the reliance on mostly cross-sectional studies limits causal interpretation, and the absence of research exploring neurobiological or algorithmic mechanisms suggests areas for further development. As such, this review contributes not only to mapping psychosocial risk pathways in adolescents but also to advancing methodological practice in the use of AI-assisted, interdisciplinary systematic review frameworks. The review was conducted in accordance with PRISMA 2020 guidelines, with predefined eligibility criteria, dual screening, independent extraction, and structured risk of bias assessment. While the protocol was not prospectively registered in PROSPERO or OSF, these measures were taken to ensure methodological rigor and transparency.

Taken together, these findings underscore the importance of moving beyond screen time as a proxy for digital mental health risk and toward a more

nuanced understanding of how specific engagement patterns contribute to adolescent psychopathology. While this review highlights consistent psychosocial pathways, such as sleep disruption, body image concerns, and gender-based vulnerability, it also exposes the absence of studies examining neurobiological, physiological, or algorithmic mechanisms. Future research that integrates behavioral data with neuroregulatory, hormonal, or cognitive-affective biomarkers may provide deeper insights into the biopsychosocial underpinnings of digital vulnerability and help inform psychiatric screening, early intervention, and individualized prevention strategies in youth populations. Implication for policy and practice that interventions targeting adolescent digital mental health must move beyond generic screen time limits. Instead, policies should focus on reducing emotionally compulsive and appearance-centric engagement, enhancing sleep hygiene and digital boundaries, and strengthening protective environments through family, schools, and digital literacy.

## CONCLUSION

Overall, the evidence indicates that adolescent anxiety is shaped less by total screen exposure and more by problematic engagement patterns such as passive browsing, emotionally reactive use, and appearance-based comparison. Sleep disruption and body image concerns consistently mediated these associations, with stronger vulnerability observed in girls and gender-diverse youth. For parents and caregivers, this highlights the importance of limiting late-night gadget use, fostering open dialogue about online appearance norms, and encouraging protective routines such as physical activity. For schools and communities, digital literacy and peer-support programs can buffer the effects of cyberbullying and peer pressure. At the same time, public health policies should also address misinformation and algorithm-driven content that reinforces harmful social comparison. At the national level, adolescent mental health strategies should integrate family education, school-based resilience programs, and regulatory attention to digital platforms, ensuring that psychosocial risks are managed alongside structural determinants.

## REFERENCES

1. Kemp S. Digital 2024: global overview report. DataReportal. 2024. Available from: [Website]
2. Faverio M, Sidoti O. Teens, social media and technology 2024. Pew Research Center. 2024. Available from: [Website]
3. World Health Organization (WHO). Mental health of adolescents. 2024. Available from: [Website]
4. Alsunni AA, Latif R. Higher emotional investment in social media is related to anxiety and depression in university students. *Journal of Taibah University Medical Sciences*. 2021;16(2):247–52.
5. Papapanou TK, Darviri C, Kanaka-Gantenbein C, Tigani X, Michou M, Vlachakis D, et al. Strong correlations between social appearance anxiety, use of social media, and feelings of loneliness in adolescents and young adults. *International Journal of Environmental Research and Public Health*. 2023; 20(5):4296.
6. Carter B, Ahmed N, Cassidy O, Pearson O, Calcia M, Mackie C, et al. 'There's more to life than staring at a small screen': a mixed methods cohort study of problematic smartphone use and the relationship to anxiety, depression and sleep in students aged 13–16 years old in the UK. *BMJ Mental Health*. 2024;27: 1–7.
7. Kosola S, Möro S, Holopainen E. Smartphone use and well-being of adolescent girls: a population-based study. *Archives of Disease in Childhood*. 2024; 109(7):1-6.
8. Lin W, Cen Z, Chen Y. The impact of social media addiction on the negative emotions of adolescent athletes: the mediating role of physical appearance comparisons and sleep. *Frontiers in Public Health*. 2025;12:1452769.
9. Rutter LA, Thompson HM, Howard J, Riley TN, De Jesús-Romero R, Lorenzo-Luaces L. Social media use, physical activity, and internalizing symptoms in adolescence: cross-sectional analysis. *JMIR Mental Health*. 2021;8(9):e26134.
10. Shoshani A, Kor A, Bar S. The impact of social media use on psychiatric symptoms and well-being of children and adolescents in the post-COVID-19 era: a four-year longitudinal study. *European Child & Adolescent Psychiatry*. 2024;33:4013–4027.
11. Ruckwongpatr K, Paratthakonkun C, Sangtongdee U, Pramukti I, Nurmala I, Angkasith K, et al. Validity, reliability, and measurement invariance of the Thai smartphone application-based addiction scale and Bergen social media addiction scale. *International Journal of Mental Health Promotion*. 2024;26(4): 293–302.
12. Zhu X, Griffiths H, Xiao Z, Ribeaud D, Eisner M, Yang Y, et al. Trajectories of screen time across adolescence and their associations with adulthood mental health and behavioral outcomes. *Journal of Youth and Adolescence*. 2023;52:1433–1447.

13. Mougharbel F, Chaput JP, Sampasa-Kanyinga H, Colman I, Leatherdale ST, Patte KA, et al. Longitudinal associations between different types of screen use and depression and anxiety symptoms in adolescents. *Frontiers in Public Health*. 2023;11: 1101594.
14. Han J, Qiu W, Lichtfouse E. ChatGPT in scientific research and writing: a beginner's guide. In: *chatGPT in Scientific Research and Writing*. Springer. 2024. Available from: [[Website](#)]
15. EBSCO. Introducing EBSCO's AI natural language search mode. 2025. Available from: [[Website](#)]
16. Haddaway NR, Collins AM, Coughlin D, Kirk S. The role of google scholar in evidence reviews and its applicability to grey literature searching. *PLoS ONE*. 2015;10(9):e0138237.
17. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan—a web and mobile app for systematic reviews. *Systematic Reviews*. 2016;5(210).
18. Hilton M. JBI critical appraisal checklist for systematic reviews and research syntheses (product review). *Journal of the Canadian Health Libraries Association*. 2024;45(3).
19. Becker SP, Lienesch JA. Nighttime media use in adolescents with ADHD: links to sleep problems and internalizing symptoms. *Sleep Medicine*. 2018;51: 171–178.
20. Carter B, Payne M, Rees P, Sohn SY, Brown J, Kalk NJ. A multi-school study in England, to assess problematic smartphone usage and anxiety and depression. *Acta Paediatrica*. 2024;113(10):2240–48.
21. Zhang W, Jiang L, Yu M, Ma R, Wang T, Liang X, et al. Different characteristics of psychological and sleep symptoms across social media addiction and internet gaming disorder in Chinese adolescents- a network analysis. *Psychiatry Investigation*. 2024;21 (7):782–791.
22. Thorisdottir IE, Sigurvinsdottir R, Kristjansson AL, Allegrante JP, Lilly CL, Sigfusdottir ID. Longitudinal association between social media use and psychological distress among adolescents. *Preventive Medicine*. 2020;141:106270.
23. Gunnlaugsson G, Whitehead TA, Baboudóttir FN, Baldé A, Jandi Z, Boiro H, et al. Use of digital technology among adolescents attending schools in Bissau, Guinea-Bissau. *International Journal of Environmental Research and Public Health*. 2020; 17(23):8937.
24. Lahti H, Kokkonen M, Hietajärvi L, Lyyra N, Paakkari L. Social media threats and health among adolescents: evidence from the health behaviour in school-aged children study. *Child and Adolescent Psychiatry and Mental Health*. 2024;18(62).
25. Basrowi RW, Wiguna T, Samah K, Djuwita F Moeloek N, Soetrisno M, Purwanto SA, et al. Exploring mental health issues and priorities in Indonesia through qualitative expert consensus. *Clinical Practice & Epidemiology in Mental Health*. 2024;20:e17450179 331951.
26. Ma J, Wu X, Huang L. The use of artificial intelligence in literature search and selection of the pubmed database. *Scientific Programming*. 2022; 2022(1):8855307.
27. Alaniz L, Vu C, Pfaff MJ. The utility of artificial intelligence for systematic reviews and boolean query formulation and translation. *Plastic & Reconstructive Surgery-Global Open*. 2023;11(10): e5339.