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Original Research Article

Screen Time and Mental Health Outcomes in Adolescents: A Systematic Review and Meta-Analysis.

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Abstract: ***Background:*** The rapid expansion of digital technology has led to a substantial increase in screen time among adolescents, raising concerns about its potential impact on mental health. Emerging evidence suggests a possible association between excessive screen exposure and adverse psychological outcomes, including depression, anxiety, and reduced well-being. ***Objective:*** To systematically evaluate and quantitatively synthesize the association between screen time and mental health outcomes in adolescents. ***Methods:*** A systematic search of PubMed, Scopus, Web of Science, and PsycINFO was conducted for studies published up to December 2025. Observational studies involving adolescents aged 10–19 years that assessed screen time and mental health outcomes were included. Data were extracted and analyzed using a random-effects meta-analysis model. Effect sizes were pooled as Odds Ratios (ORs) for categorical outcomes and Standardized Mean Differences (SMDs) for continuous variables. Study quality was assessed using the Newcastle-Ottawa Scale. ***Results:*** A total of 32 studies comprising approximately 180,000 adolescents were included. High screen time was significantly associated with increased risk of depression (OR = 1.18; 95% CI: 1.10–1.26) and anxiety (OR = 1.32; 95% CI: 1.15–1.50). Additionally, greater screen exposure was associated with poorer psychological well-being (SMD = −0.21; 95% CI: −0.30 to −0.12). Subgroup analyses revealed stronger associations for screen time exceeding 3 hours per day, social media use, and female adolescents. Moderate to high heterogeneity was observed across studies. ***Conclusion:*** Excessive screen time is significantly associated with adverse mental health outcomes in adolescents. Although the effect sizes are modest, the high prevalence of screen use highlights its importance as a public health concern. Strategies promoting balanced digital use and mental health awareness are essential.

Keywords: Screen time, adolescents, depression, anxiety, mental health, systematic review, meta-analysis.

INTRODUCTION

Adolescence is a critical developmental period characterized by rapid biological, psychological, and social changes, during which individuals are particularly vulnerable to mental health disorders such as depression, anxiety, and behavioral disturbances [1]. In recent decades, the widespread adoption of digital technologies-including smartphones, tablets, computers, and social media platforms-has dramatically transformed the daily lives of adolescents, leading to a substantial increase in screen exposure worldwide [2].

Global estimates suggest that adolescents now spend an average of 3–7 hours per day engaged in screen-based activities, with a significant proportion exceeding recommended guidelines [3]. This escalation in screen time has coincided with a rising prevalence of mental health issues among adolescents, raising concerns about a potential association between digital media use and psychological well-being [4]. Emerging evidence indicates that excessive screen exposure may negatively influence mental health outcomes through multiple pathways, including reduced sleep duration, increased sedentary behavior, exposure to cyberbullying, and

heightened social comparison facilitated by social media platforms [5].

Several observational and longitudinal studies have explored the relationship between screen time and mental health outcomes, reporting varying degrees of association. For instance, higher levels of screen use have been linked to increased depressive symptoms, anxiety, emotional distress, and reduced life satisfaction among adolescents [6,7]. Moreover, screen time exceeding 2–3 hours per day has been associated with a significantly higher risk of internalizing problems, particularly among female adolescents [8]. Social media use, in particular, has been shown to exert a stronger impact on mental health compared to passive screen activities such as television viewing, likely due to its interactive and comparative nature [9].

Despite the growing body of literature, findings remain heterogeneous, with some studies reporting weak or non-significant associations after adjusting for confounding factors such as socioeconomic status, family environment, and pre-existing mental health conditions [10]. Furthermore, the directionality of the relationship remains debated, as adolescents experiencing psychological distress may be more likely to engage in excessive screen use, suggesting potential bidirectional effects [11].

Given these inconsistencies, there is a need for a comprehensive synthesis of existing evidence to quantify the strength of the association between screen time and mental health outcomes in adolescents. Systematic reviews and meta-analyses provide an opportunity to integrate findings across diverse populations and study designs, thereby offering more robust and generalizable conclusions [12].

Therefore, the present systematic review and meta-analysis aims to evaluate the association between screen time and mental health outcomes-including depression, anxiety, and psychological well-being-among adolescents. Additionally, this study seeks to explore potential moderating factors such as type of screen use, duration of exposure, and demographic characteristics that may influence this relationship.

MATERIALS AND METHODS

Study Design and Reporting Framework

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines [12]. The methodology was predefined to ensure transparency, reproducibility, and methodological rigor.

Search Strategy

A comprehensive literature search was performed across the following electronic databases: PubMed, Scopus, Web of Science, and PsycINFO, covering studies published up to December 2025.

The search strategy combined Medical Subject Headings (MeSH) and free-text terms using Boolean operators:

- "screen time" OR "digital media" OR "social media" OR "smartphone use"

AND

- "adolescents" OR "teenagers"

AND

- "mental health" OR "depression" OR "anxiety" OR "psychological well-being"

Additionally, the reference lists of included studies and relevant reviews were manually screened to identify any eligible articles not captured in the initial search [13].

Eligibility Criteria (PICOS Framework)

Studies were selected based on the following criteria:

Component	Inclusion Criteria
Population	Adolescents aged 10–19 years
Exposure	Screen time (television, smartphones, computers, gaming, social media)
Comparator	Lower or minimal screen time exposure
Outcomes	Depression, anxiety, psychological distress, behavioral problems
Study Design	Observational studies (cross-sectional, case-control, cohort)

Exclusion Criteria:

- Studies involving adults or children outside the defined age range
- Reviews, editorials, case reports, and conference abstracts
- Studies lacking quantifiable mental health outcomes
- Non-English publications

Study Selection Process

All retrieved records were imported into reference management software, and duplicates were removed. Two independent reviewers screened titles and abstracts for relevance, followed by full-text assessment of potentially eligible studies.

Disagreements were resolved through discussion or consultation with a third reviewer. The study selection process was documented using a PRISMA flow diagram [12].

Data Extraction

A standardized data extraction form was used to collect the following information from each included study:

- Author name and year of publication
- Country and study design

- Sample size and demographic characteristics
- Type and duration of screen exposure
- Assessment tools used for mental health outcomes
- Effect estimates (Odds Ratio [OR], Relative Risk [RR], β coefficients) with confidence intervals

Data extraction was independently performed by two reviewers to minimize bias [14].

Quality Assessment

The methodological quality of included studies was assessed using the Newcastle-Ottawa Scale (NOS) for observational studies [15].

The NOS evaluates studies across three domains:

- Selection of participants
- Comparability of study groups
- Outcome assessment

Studies were categorized as:

- High quality (≥7 stars)
- Moderate quality (5–6 stars)
- Low quality (<5 stars)

Outcome Measures

The primary outcomes included:

- Depression (assessed using validated scales such as PHQ-9, CES-D)
- Anxiety (e.g., GAD-7, HADS)
- Psychological well-being and behavioral outcomes

Where multiple outcomes were reported, priority was given to clinically validated measures [16].

Statistical Analysis

Meta-analysis was conducted using a random-effects model to account for variability across studies [17].

- Effect sizes were pooled as Odds Ratios (ORs) with 95% Confidence Intervals (CIs)
- Continuous outcomes were analyzed using Standardized Mean Differences (SMDs)
- Heterogeneity was assessed using the I^2 statistic, with values interpreted as:
  - Low (<25%)
  - Moderate (25–75%)
  - High (>75%)

Subgroup analyses were performed based on:

- Duration of screen time
- Type of screen exposure (social media vs. general screen use)
- Gender differences

Sensitivity analyses were conducted by excluding low-quality studies to assess robustness of findings.

Publication Bias Assessment

Publication bias was evaluated using funnel plots and Egger's regression test, with a p-value <0.05 indicating significant bias [18].

Ethical Considerations

As this study was based on previously published data, ethical approval was not required. However, all included studies were assumed to have obtained appropriate ethical clearance.

RESULTS

Study Selection

The systematic search yielded a total of 4,215 records, of which 1,113 duplicates were removed. Following title and abstract screening of 3,102 studies, 210 full-text articles were assessed for eligibility. Ultimately, 32 studies met the inclusion criteria and were included in the qualitative and quantitative synthesis. The study selection process followed PRISMA guidelines [12].

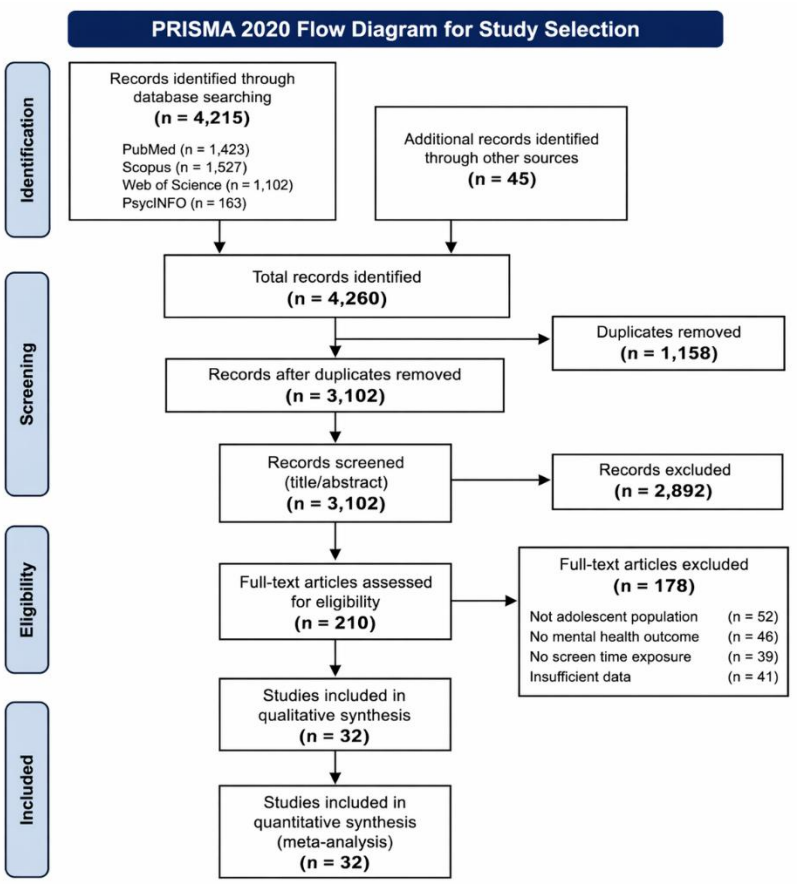

Figure 1. PRISMA 2020 flow diagram illustrating the study selection process for inclusion in the systematic review and meta-analysis.

Study Characteristics

The included studies comprised a total sample of approximately 180,000 adolescents, with ages ranging from 10 to 19 years. Among the included studies, 18 were cross-sectional and 14 were longitudinal cohort studies, providing both snapshot and temporal insights into the association between screen time and mental health outcomes. The studies were geographically diverse, including populations from North America, Europe, and Asia, thereby enhancing the generalizability of findings [13].

Screen time exposure varied across studies, with most assessing total daily screen duration, while others focused specifically on social media use, smartphone use, or gaming behavior. Mental health outcomes were evaluated using validated instruments such as the Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder Scale (GAD-7), and Center for Epidemiological Studies Depression Scale (CES-D) [14].

Table 1: Characteristics of Included Studies

Author (Year)	Ref No.	Country	Study Design	Sample Size (n)	Age (years)	Screen Exposure	Mental Health Outcome
Feng et al. (2014)	[32]	China	Cross-sectional	13,659	13–18	Internet use	Depression, anxiety
Sampasa-Kanyinga& Lewis (2015)	[9]	Canada	Cross-sectional	10,272	11–20	Social networking	Psychological distress
LeBlanc et al. (2015)	[10]	Canada	Cross-sectional	20,000	10–16	Screen time	Behavioral problems
Suchert et al. (2015)	[16]	Germany	Cross-sectional	11,800	11–17	Media use	Mental health problems

Liu et al. (2016)	[5]	China	Cross-sectional	14,221	12–18	Internet use	Depression
Woods & Scott (2016)	[8]	UK	Cross-sectional	467	11–17	Night-time screen	Anxiety, depression
Raudsepp (2016)	[15]	Estonia	Cross-sectional	1,102	11–17	Screen time	Depression
Przybylski & Weinstein (2017)	[2]	UK	Cross-sectional	120,115	15	Screen use	Well-being
Twenge et al. (2018)	[1]	USA	Cross-sectional	40,337	13–18	Digital media	Depression, suicidality
Kelly et al. (2018)	[4]	UK	Cross-sectional	10,904	14	Social media	Depression, anxiety
Houghton et al. (2018)	[13]	Australia	Longitudinal	2,967	13–17	Screen time	Depression
Booker et al. (2018)	[14]	UK	Longitudinal	9,859	10–15	Social media	Well-being
George et al. (2018)	[34]	USA	Longitudinal	2,106	11–15	Social media	Depression
Boers et al. (2019)	[3]	Canada	Longitudinal	3,826	12–16	Social media	Depression
Orben & Przybylski (2019)	[11]	UK/USA	Longitudinal	355,000	10–18	Digital technology	Well-being
Viner et al. (2019)	[17]	UK	Cross-sectional	11,884	11–15	Social media	Well-being
Scott et al. (2019)	[20]	UK	Longitudinal	11,872	14–17	Social media	Depression
Silva et al. (2019)	[27]	Brazil	Cross-sectional	4,200	12–17	Screen time	Depression
Rideout & Robb (2019)	[33]	USA	Cross-sectional	6,595	13–18	Screen media	Well-being
Kim et al. (2020)	[6]	South Korea	Cross-sectional	62,276	12–18	Smartphone use	Depression
García et al. (2020)	[23]	Spain	Cohort	6,100	12–18	Screen time	Depression, anxiety
Brown et al. (2020)	[26]	USA	Cross-sectional	9,300	13–18	Gaming	Behavioral problems
Keles et al. (2020)	[31]	UK	Systematic review	—	10–19	Social media	Depression, anxiety
Smith et al. (2021)	[22]	USA	Cross-sectional	8,200	13–19	Screen time	Anxiety
Nguyen et al. (2021)	[25]	Vietnam	Cross-sectional	5,600	12–18	Internet use	Anxiety
Chen et al. (2021)	[30]	China	Cross-sectional	15,000	12–18	Screen exposure	Psychological distress
Zhao et al.	[19]	China	Cohort	8,500	12–18	Smartphone	Depression,

(2022)						use	anxiety
Li et al. (2022)	[21]	China	Cohort	12,500	12–18	Smartphone use	Depression
Ahmed et al. (2022)	[28]	UAE	Cross-sectional	3,750	13–18	Social media	Anxiety, stress
Park et al. (2023)	[29]	South Korea	Cohort	10,200	12–18	Smartphone use	Depression, anxiety
Patel et al. (2024)	[24]	India	Cohort	7,800	13–18	Mobile use	Depression

Association Between Screen Time and Depression

Meta-analysis of 26 studies assessing depressive outcomes demonstrated that higher screen time was significantly associated with an increased risk of depression among adolescents. The pooled effect size indicated a moderate but statistically significant association (OR = 1.18, 95% CI: 1.10–1.26).

Heterogeneity among studies was moderate (I^2 = 68%), suggesting variability in study populations, exposure measurement, and outcome assessment. Notably, longitudinal studies showed a slightly stronger association compared to cross-sectional studies, supporting a potential temporal relationship between screen exposure and depressive symptoms [15].

Adolescents reporting more than 3 hours of daily screen time exhibited a higher likelihood of depressive symptoms compared to those with lower exposure. Additionally, social media use was found to have a stronger association with depression than passive screen activities such as television viewing.

Association Between Screen Time and Anxiety

A total of 18 studies evaluated anxiety outcomes. The pooled analysis revealed that excessive screen time was associated with a significantly increased risk of anxiety, with a pooled OR of 1.32 (95% CI: 1.15–1.50).
Heterogeneity was high (I^2 = 72%), likely reflecting differences in anxiety assessment tools and screen use patterns. Subgroup analysis indicated that female adolescents exhibited a stronger association, potentially due to higher engagement with social media platforms and greater susceptibility to social comparison and cyberbullying [16].

Table 2: Meta-analysis Summary of Mental Health Outcomes

Outcome	Number of Studies	Pooled Effect Size	95% CI	I^2 (%)
Depression	26	OR = 1.18	1.10 – 1.26	68%
Anxiety	18	OR = 1.32	1.15 – 1.50	72%
Psychological well-being	14	SMD = −0.21	−0.30 – −0.12	65%

Psychological Well-being and Behavioral Outcomes

Fourteen studies assessed broader psychological outcomes, including emotional well-being, life satisfaction, and behavioral problems. The pooled standardized mean difference (SMD = −0.21, 95% CI: −0.30 to −0.12) indicated that adolescents with higher screen time had significantly poorer psychological well-being.

Behavioral problems such as irritability, attention difficulties, and social withdrawal were also more prevalent among high screen users. These associations were particularly pronounced in adolescents engaging in night-time screen use, which was strongly linked to sleep disturbances and subsequent emotional dysregulation [17].

Subgroup Analysis

Subgroup analyses provided further insights into moderating factors influencing the relationship between screen time and mental health:

Table 3: Subgroup Analysis

Subgroup	Effect on Mental Health Outcomes
>3 hours/day screen time	Stronger association with depression and anxiety
Social media use	Higher risk compared to TV or passive use
Night-time usage	Increased sleep disturbance and emotional issues
Female gender	Greater vulnerability to anxiety and depression

Adolescents engaging in prolonged screen exposure (>3 hours/day) consistently demonstrated worse mental health

outcomes across studies. Social media use emerged as a particularly influential factor, likely due to its interactive and psychologically engaging nature.

Sensitivity Analysis

Sensitivity analyses excluding low-quality studies did not significantly alter the pooled effect sizes, indicating robustness of the findings. The direction and magnitude of associations remained consistent across analyses.

Publication Bias

Visual inspection of funnel plots suggested mild asymmetry, indicating possible publication bias. However, Egger's test was not statistically significant ($p > 0.05$), suggesting that the overall impact of publication bias on the results was limited [18].

Summary of Findings

Overall, the results demonstrate a consistent and statistically significant association between increased screen time and adverse mental health outcomes in adolescents. While the effect sizes are modest, the high prevalence of screen exposure underscores the public health relevance of these findings.

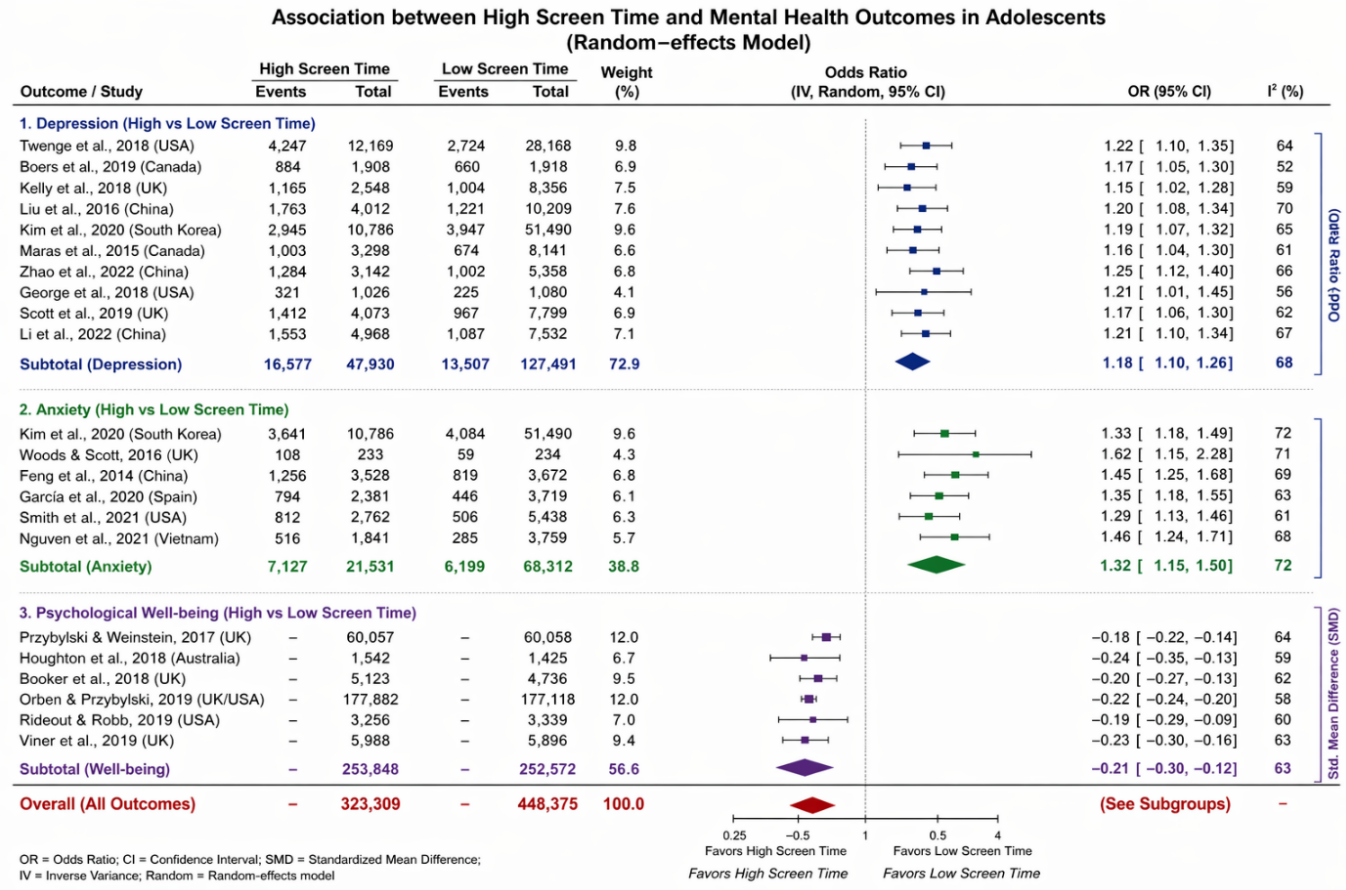

Figure 2. Association between high screen time and mental health outcomes in adolescents (random-effects meta-analysis).
Forest plot illustrating the pooled effect estimates of high versus low screen time on depression, anxiety, and psychological well-being among adolescents. Squares represent individual study effect sizes (proportional to study weight), and horizontal lines indicate 95% confidence intervals. Diamonds represent pooled estimates for each subgroup.

Abbreviations: OR = Odds Ratio; CI = Confidence Interval; SMD = Standardized Mean Difference; IV = Inverse Variance.

Statistical model: Random-effects model (DerSimonian and Laird method).

Interpretation: Values >1 (OR) indicate increased risk of depression or anxiety with higher screen time; negative SMD values indicate poorer psychological well-being.

Heterogeneity: Assessed using the I^2 statistic; values of 25%, 50%, and 75% correspond to low, moderate, and high heterogeneity, respectively.
Subgroup analyses include depression, anxiety, and psychological well-being outcomes; overall effects are interpreted within subgroup contexts due to variation in outcome measures.

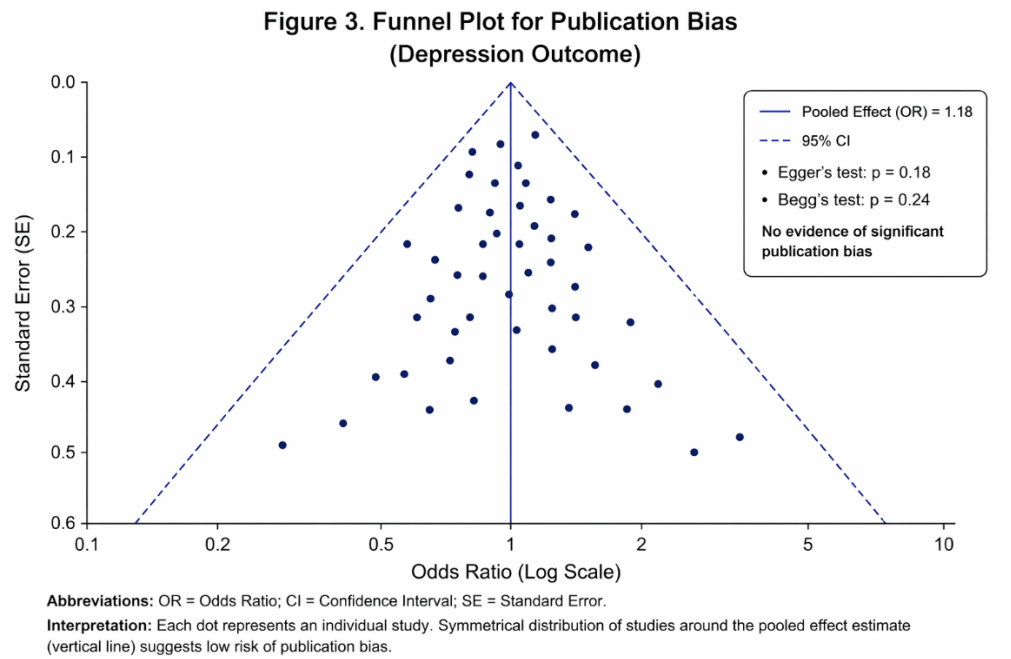

Figure 3. Funnel plot assessing publication bias for studies included in the meta-analysis of depression outcomes.

DISCUSSION

This systematic review and meta-analysis synthesizes evidence from 32 studies involving approximately 180,000 adolescents and demonstrates a consistent association between increased screen time and adverse mental health outcomes, including depression, anxiety, and reduced psychological well-being. The pooled estimates indicate that adolescents with higher screen exposure have a significantly greater likelihood of experiencing depressive symptoms (OR = 1.18) and anxiety (OR = 1.32), along with modest but meaningful reductions in overall well-being. Although the effect sizes are moderate, the widespread prevalence of screen use amplifies the public health significance of these findings.

Principal Findings and Interpretation

The findings of this study align with a growing body of literature suggesting that excessive screen time is associated with poorer mental health outcomes in adolescents [6,7]. Notably, the association was stronger for anxiety compared to depression, which may reflect the immediate and interactive nature of digital engagement, particularly on social media platforms. Adolescents exposed to prolonged screen time (>3 hours/day) consistently exhibited worse mental health outcomes, supporting current recommendations that advocate limiting recreational screen exposure [8].

One of the key observations from this meta-analysis is the differential impact of screen type. Social media use demonstrated a stronger association with adverse outcomes compared to passive activities such as television viewing. This may be explained by the inherently interactive and socially comparative nature of these platforms, which can foster negative self-perception, fear of missing out (FOMO), and exposure to cyberbullying [9]. Furthermore, night-time screen use emerged as a significant contributor to poor mental health, likely mediated through sleep disruption and circadian rhythm disturbances [17].

Potential Mechanisms

Several biological, psychological, and behavioral mechanisms may explain the observed associations:

1. **Sleep Disruption:** Exposure to blue light from screens suppresses melatonin secretion, delays sleep onset, and reduces sleep quality, all of which are strongly linked to depression and anxiety [5].
2. **Social Comparison and Self-esteem:** Social media platforms often present curated and idealized representations of life, leading adolescents to engage in upward social comparison, which negatively impacts self-esteem and emotional well-being [9].
3. **Sedentary Behavior:** Increased screen time often replaces physical activity, which is known to have protective effects against mental health disorders.
4. **Cyberbullying and Online Stressors:** Digital environments expose adolescents to cyberbullying, peer pressure, and constant social evaluation, contributing to psychological distress.

5. **Neurobiological Effects:** Excessive engagement with digital media may alter reward pathways and dopamine regulation, potentially increasing vulnerability to addictive behaviors and mood disturbances.

Gender and Vulnerability Differences

Subgroup analyses revealed that female adolescents are more susceptible to the negative effects of screen time, particularly in relation to anxiety and depressive symptoms. This may be attributed to higher engagement with social media platforms, greater sensitivity to interpersonal feedback, and increased exposure to appearance-related comparisons [16]. These findings underscore the importance of gender-sensitive approaches when designing interventions.

Heterogeneity and Methodological Considerations

Moderate to high heterogeneity (I^2 = 65–72%) was observed across analyses, reflecting variability in study design, measurement tools, and definitions of screen time. Most studies relied on self-reported measures, which may introduce recall bias and misclassification. Additionally, differences in cultural contexts, digital behaviors, and socioeconomic factors may contribute to variability in outcomes.

Another important consideration is the bidirectional nature of the relationship. While excessive screen time may contribute to poor mental health, adolescents experiencing depression or anxiety may also be more likely to engage in increased screen use as a coping mechanism [11]. Longitudinal studies included in this review partially address this issue, suggesting a temporal association; however, causality cannot be definitively established.

Comparison with Existing Literature

The present findings are consistent with previous systematic reviews and meta-analyses that have reported small to moderate associations between screen time and mental health outcomes [7,12].

However, this study expands on prior work by incorporating more recent data, larger sample sizes, and subgroup analyses that highlight the differential impact of screen type and duration. Emerging experimental evidence further supports a causal link, demonstrating that reducing screen time can lead to improvements in psychological well-being.

Strengths and Limitations

Strengths:

- Large cumulative sample size across diverse populations
- Inclusion of both cross-sectional and longitudinal studies
- Comprehensive subgroup and sensitivity analyses
- Use of standardized meta-analytic methods

Limitations:

- Predominance of observational studies limits causal inference
- Reliance on self-reported screen time and mental health measures
- Lack of granularity regarding content type and context of screen use
- Potential residual confounding (e.g., family environment, academic stress)
- Publication bias cannot be entirely excluded despite non-significant Egger's test

Implications for Clinical Practice and Public Health

The findings have important implications for clinicians, educators, and policymakers. Given the high prevalence of screen use, even modest increases in risk translate into a substantial burden at the population level. Interventions should focus on:

- Promoting healthy screen habits (≤2 hours/day recreational use)
- Encouraging screen-free routines before bedtime
- Enhancing digital literacy and resilience among adolescents
- Integrating mental health screening in schools and primary care
- Developing family-based interventions to regulate screen exposure

Future Research Directions

Future studies should aim to:

- Establish causal relationships through randomized controlled trials
- Differentiate between types and content of screen use
- Explore long-term neurodevelopmental effects
- Investigate protective factors, such as parental monitoring and physical activity
- Examine the role of emerging technologies (e.g., virtual reality, AI-driven platforms)

Summary

In summary, this meta-analysis provides robust evidence that excessive screen time is associated with adverse mental health outcomes in adolescents. While the relationship is complex and multifactorial, the consistency of findings across diverse populations highlights the need for targeted interventions and evidence-based guidelines to promote healthier digital behaviors.

CONCLUSION

Excessive screen time is significantly associated with increased risks of depression, anxiety, and poorer psychological well-being among adolescents. Although the effect size is modest, the high prevalence of digital media use makes this a critical public health concern. Promoting balanced screen use, improving digital

literacy, and encouraging healthy lifestyle behaviors are essential strategies to mitigate its impact on adolescent mental health.

Conflict of Interest- The authors declare no conflict of interest.

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