



Smartphone Addiction and Physical Activity: Bibliometric Analysis and Systematic Review

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ABSTRACT

This study examines the global research landscape of smartphone-related digital addiction and its relationship with physical activity and sedentary behavior. We used a two-stage methodology, analyzing 721 English-language, peer-reviewed articles from Scopus published between 2016 and 2026. In Stage 1, we conducted bibliometric science mapping with the bibliometrix package in R to assess publication trends, collaboration patterns, keyword co-occurrence, and thematic structures. Stage 2 followed PRISMA 2020 guidelines to systematically review a prioritized set of 213 studies. The results show rapid growth in the literature, with an annual increase of 30.51% and peak publication output in 2025 ($n = 173$). Most research appeared in public health and psychology journals, with China and Turkey leading in publication volume. Adolescents and university students constitute the primary study populations in the current literature. Research on smartphone addiction is prevalent, while studies addressing short-video addiction are notably scarce ($n = 17$), indicating a significant emerging research gap. Despite considerable expansion of the field, the evidence base is largely composed of cross-sectional, self-report studies, which limits causal inference. This review reconceptualizes physical activity as a health outcome, a protective factor, a self-regulatory resource, and an intervention target. This approach offers a more comprehensive framework for understanding the relationship between digital addiction and movement behaviors.

Keywords: Smartphone Addiction, Digital Addiction, Physical Activity, Gaming Disorder, Social Media Addiction, Bibliometric Analysis, Systematic Review.

1. INTRODUCTION

The widespread integration of smartphones has significantly altered daily routines by enabling communication, learning, entertainment, and health monitoring. As screen engagement has increased, empirical interest in problematic smartphone use has grown in parallel with research on behavioral addictions, internet use disorders, gaming disorder, and social media addiction. Recently, scholarly attention has shifted toward compulsive behaviors associated with short-form video platforms and algorithmically curated content (Abbasi & Dibble, 2025). A primary conceptual challenge in this field is differentiating non-pathological, high-frequency use from functional impairment and behavioral addiction. As a result, scholars utilize nuanced terminology, such as problematic smartphone use, mobile phone dependence, and smartphone addiction, based on the measurement instruments employed and the theoretical frameworks adopted (Abualait & Ahsan, 2026).

Physical activity offers a valuable framework for examining this field. Smartphone-related digital addiction can influence movement behavior through mechanisms such as time displacement, sleep disruption, emotional distress, sedentary routines, and diminished offline social participation. Additionally,

physical activity may serve as a protective factor by enhancing mood regulation, self-control, sleep quality, and the maintenance of structured daily routines.

Reviews of problematic smartphone use have emphasized anxiety, depression, sleep quality, and youth mental health outcomes (Elhai et al., 2017; Sohn et al., 2019; Yang et al., 2019; Yang et al., 2020). Reviews of social network site addiction and problematic social media use have developed a parallel literature around online social networking, addictive symptoms, and related psychological correlates (Andreassen, 2015; Casale & Banchi, 2020; Kuss & Griffiths, 2011). Broader screen-time reviews also locate digital media exposure within child and adolescent health concerns (Lissak, 2018; Stiglic & Viner, 2019).

Previous systematic reviews have predominantly focused on the psychiatric and somatic correlates of digital overuse, establishing strong links with anxiety, depression, poor sleep quality, social isolation, and compromised youth mental health (Alharbi et al., 2026; d'Hombres et al., 2026; Elhai et al., 2017; Oliveira et al., 2026; Sohn et al., 2019; Yaakoubi et al., 2026; Yang et al., 2019; Yang et al., 2020). Study on social networking site (SNS) addiction and problematic social media use highlights key addictive symptoms, social-evaluative processes, and underlying psychological correlates (Andreassen, 2015; Casale & Banchi, 2020; Kuss & Griffiths, 2011). At the same time, comprehensive assessments of pediatric and adolescent screen-time have placed digital exposure within developmental and systemic health hazards (Lissak, 2018; Stiglic & Viner, 2019).

Despite growing interest, the literature examining the relationship between smartphone-related digital addiction and movement behavior remains highly heterogeneous. Existing studies demonstrate marked variation across target populations, digital addiction constructs, physical activity metrics, and analytical designs. To address this conceptual and methodological fragmentation, a hybrid methodology combining bibliometric mapping with a PRISMA-guided systematic review is employed. The macro-level bibliometric analysis delineates the structural evolution, publication dynamics, and thematic clustering of the broader field. Subsequently, the micro-level systematic review filters this corpus to distill a rigorous empirical evidence base capable of addressing specific mechanisms, behavioral outcomes, and research gaps.

The central analytical challenge in this field is conceptual rather than purely statistical. While bibliometric analyses readily confirm that digital addiction and physical activity terms co-occur in the literature, simple co-occurrence fails to elucidate the underlying behavioral mechanisms. Theoretical clarity requires grounding this relationship in established models of behavioral addiction and movement behavior. The Components Model of Addiction conceptualizes compulsive digital engagement through six core dimensions: salience, mood modification, tolerance, withdrawal, conflict, and relapse (Griffiths, 2005). Complementing this, the Interaction of Person-Affect-Cognition-Execution (I-PACE) model provides a dynamic framework wherein predisposing personal vulnerabilities, affective and cognitive responses, executive control deficits, and situational triggers interact over time (Brand et al., 2019). Together, these frameworks position problematic use as a dysregulated behavioral pattern rather than a passive byproduct of screen duration.

Integrating physical activity introduces a crucial second theoretical layer. Movement behavior operates multidimensionally—as a competing time allocation, a self-regulatory resource, a social context, and a protective mental health behavior. Furthermore, sedentary behavior demands precise conceptual delineation; sitting time, screen-based sedentary behavior, and physical inactivity represent distinct constructs with disparate physiological and psychological measurement implications (Tremblay et al.,

2017). This distinction is methodologically vital for the present review, as an empirical inquiry measuring structured exercise frequency evaluates a fundamentally different mechanism than one assessing screen-based sedentary duration or moderate-to-vigorous physical activity (MVPA). To address these conceptual, theoretical, and methodological challenges, this review addresses four specific research questions:

RQ1: How has global scientific output on smartphone-related digital addiction and physical activity evolved in volume and trajectory from 2016 through 2026?

RQ2: Which primary journals, contributing countries, key authors, and keyword structures configure the macro-level bibliometric landscape?

RQ3: What constitutes the synthesized empirical evidence base linking digital addiction constructs to physical activity and sedentary outcomes under PRISMA-guided eligibility criteria?

RQ4: What primary conceptual, methodological, and empirical gaps emerge from the integrated science map and systematic review screening?

2. METHODOLOGY

2.1 Research Design and Dataset Retrieval

This study implemented a sequential two-stage methodology designed to separate macro-level field mapping from micro-level empirical evidence synthesis. Stage 1 comprised a bibliometric science-mapping analysis executed on the initial Scopus dataset (N = 721) to capture broad disciplinary trajectories and structural networks. Stage 2 applied a systematic literature review (SLR) workflow guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework to filter, extract, and synthesize high-priority empirical findings.

The initial dataset was extracted from the Scopus database, comprising 721 English-language peer-reviewed journal articles published over a 10-year window from 2016 to 2026. Using BOOLEAN OPERATORS, Search strings combined smartphone-related digital addiction constructs with physical activity-related terms. Digital addiction terms included “Smartphone addiction”, “Mobile phone addiction”, “Problematic smartphone use”, “Nomophobia”, “Social media addiction”, “Gaming disorder”, “Internet gaming disorder”, “Short-video addiction”, and “problematic TikTok” or “short-video use”. Movement-related terms encompassed “physical activity”, “Exercise”, “Sport participation”, “physical inactivity”, “Sedentary behavior”, “fitness”, “active lifestyle”, and “Motor activity”.

2.2 Bibliometric Analysis and Systematic Review (PECO) Framework

The bibliographic records were exported from Scopus in RIS (Research Information Systems) format and imported into R, where they were converted into a bibliometric data frame using the bibliometrix R package (Aria & Cuccurullo, 2017).

Bibliometric analyses were then conducted to examine annual scientific production trends, journal source distributions, country-level research productivity, keyword frequency distributions, manually coded topic-family classifications, and keyword co-occurrence network structures.

The SLR protocol adhered strictly to PRISMA 2020 reporting guidelines (Page et al., 2021). The review scope and eligibility criteria were established using the PECO (Population, Exposure, Comparator, Outcome) framework. Population (P) included human participants across all demographic groups and developmental stages. Exposure (E) comprised smartphone-related digital addiction constructs, including

problematic smartphone use, social media addiction, gaming disorder, and short-video addiction. Comparator (C) consisted of non-problematic, low-risk, or healthy digital media use patterns, where applicable. Outcome (O) encompassed physical activity–related indicators, including physical activity levels, exercise frequency, sport participation, sedentary behavior, physical inactivity, and physical fitness outcomes. Table 1 shows the eligibility criteria of the PRISMA

Table 1. Eligibility Criteria for the PRISMA-Guided Systematic Literature Review

Decision	Eligibility Criterion
Include	Human empirical studies and systematic or scoping reviews published in English between 2016 and 2026.
Include	Primary studies explicitly measuring both an eligible digital addiction construct and a physical activity–related construct.
Include	Empirical studies reporting statistical associations, predictive relationships, mediation, moderation, group comparisons, or intervention effects examining the relationship between digital addiction and physical activity.
Exclude	Studies assessing only general screen time or routine smartphone use without measuring problematic or addictive digital behaviors.
Exclude	Studies focusing exclusively on physical activity without including an eligible digital addiction construct.
Exclude	Technical or engineering studies using smartphones solely as hardware sensors for physical activity monitoring, motion recognition, or activity detection.
Exclude	Conference abstracts, editorials, commentaries, study protocols without empirical findings, non-peer-reviewed publications, duplicate records, and studies providing insufficient data for analysis.

2.3 Data Extraction, Quality Appraisal, and Synthesis Plan

Following PRISMA 2020 screening, full-text articles meeting the eligibility criteria were independently reviewed using a standardized data extraction form. The extracted information included: (i) bibliographic details and study location; (ii) participant characteristics and sample size; (iii) study design and analytical methods; (iv) digital addiction constructs and measurement instruments; (v) physical activity and movement-behavior outcomes, exercise frequency, sedentary behavior, and sport participation); (vi) theoretical frameworks and principal findings; (vii) the analytical role of physical activity (e.g., outcome, predictor, mediator, moderator, or intervention target); and (viii) reported study limitations, reviewer-identified methodological concerns, and quality appraisal outcomes.

Methodological quality and risk of bias were assessed using appraisal tools appropriate to each study design. Analytical cross-sectional and cohort studies were evaluated using the relevant Joanna Briggs Institute (JBI) Critical Appraisal Checklists. Randomized controlled trials were assessed using the Cochrane Risk of Bias 2 (RoB 2) tool, whereas non-randomized intervention studies were evaluated using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) instrument. Qualitative studies were

appraised using the Critical Appraisal Skills Programme (CASP) Qualitative Checklist, and systematic reviews were evaluated using AMSTAR 2 (A Measurement Tool to Assess Systematic Reviews).

3. RESULTS

3.1 Descriptive Bibliometric Profile

The retrieved corpus comprised 721 English-language peer-reviewed articles published across 352 journals from 2016 through 2026. Science mapping via bibliometrix identified 2,939 unique authors with 3,765 total author appearances. The corpus demonstrated a mean document age of 2.82 years and an average citation rate of 16.26 citations per document. Collaborative patterns were pronounced: the average co-author count was 5.22 authors per document, and the international co-authorship rate reached 26.63%. Annual scientific production expanded rapidly over the 10-year window, exhibiting a compound annual growth rate (CAGR) of 30.51%. As illustrated in Figure 1, publication volume accelerated markedly following 2020, reaching an empirical peak in 2025 with 173 articles. The reduced count observed in 2026 ($N = 86$) represents partial-year output at the time of data collection.

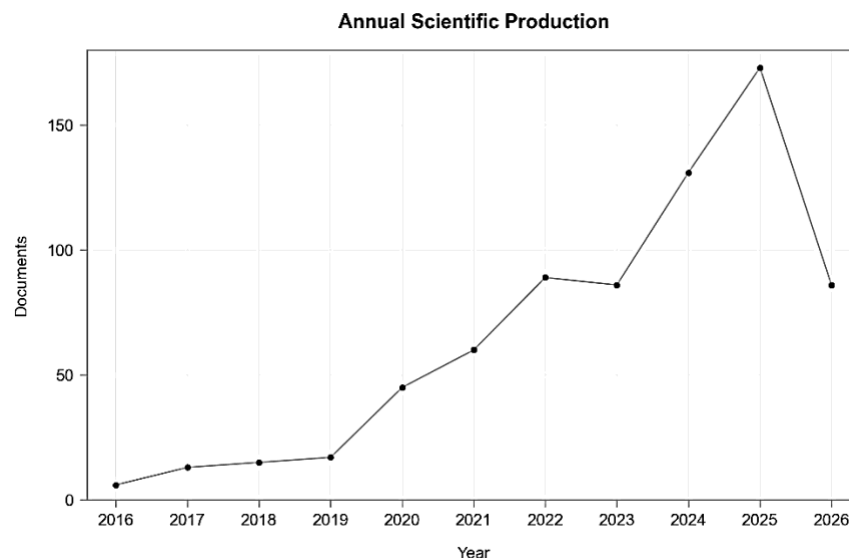


Figure 1. Annual Scientific Production (2016-2026)

3.2 Primary Sources and Geographic Contributions

The distribution of publications across leading journals highlights the inherently interdisciplinary nature of research on digital addiction and physical activity, spanning public health, psychology, psychiatry, behavioral medicine, and addiction science (Figure 2). The International Journal of Environmental Research and Public Health published the largest number of studies ($n = 39$), followed by Frontiers in Psychology ($n = 36$), Frontiers in Psychiatry ($n = 30$), PLOS ONE ($n = 26$), and Frontiers in Public Health ($n = 20$).

Specialized behavioral addiction journals, such as the Journal of Behavioral Addictions ($n = 16$), contributed a comparatively smaller share of the overall literature, indicating that research in this area is

disseminated primarily through broad interdisciplinary health and behavioral science journals rather than discipline-specific addiction outlets.

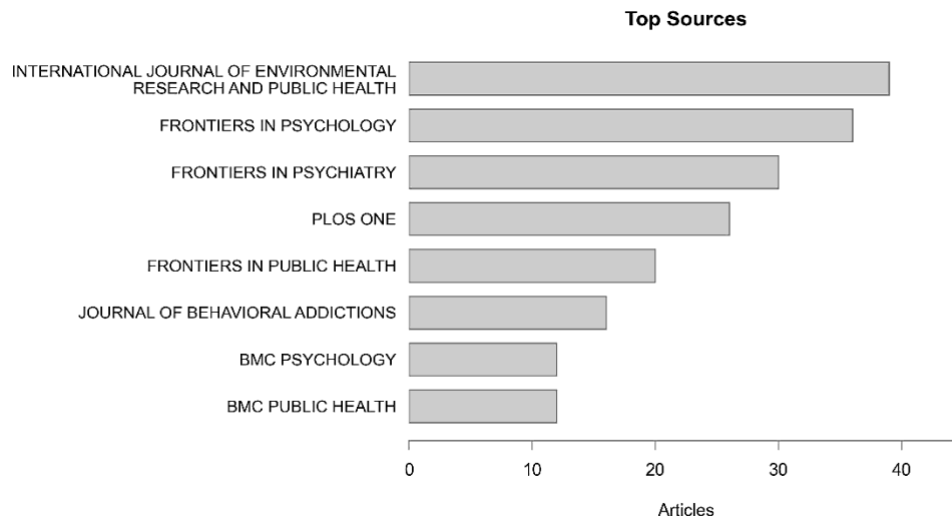


Figure 2. Most Relevant Sources

This source distribution reveals a distinct methodological profile. High-volume interdisciplinary health journals frequently publish large-scale, cross-sectional survey research. Consequently, while rapid publication growth demonstrates widespread public health interest, it also indicates that empirical expansion has outpaced methodological refinement, necessitating careful quality appraisal during systematic synthesis.

Geographic research output was concentrated in a limited number of countries, reflecting an uneven global distribution of scholarly activity (Figure 3). Based on author affiliations, China emerged as the leading contributor ($n = 194$), followed by Turkey ($n = 96$), the United States ($n = 58$), South Korea ($n = 55$), and the United Kingdom ($n = 50$). Collectively, these countries accounted for a substantial proportion of the published literature, underscoring the dominance of East Asia, Europe, and North America in advancing research on digital addiction and physical activity.

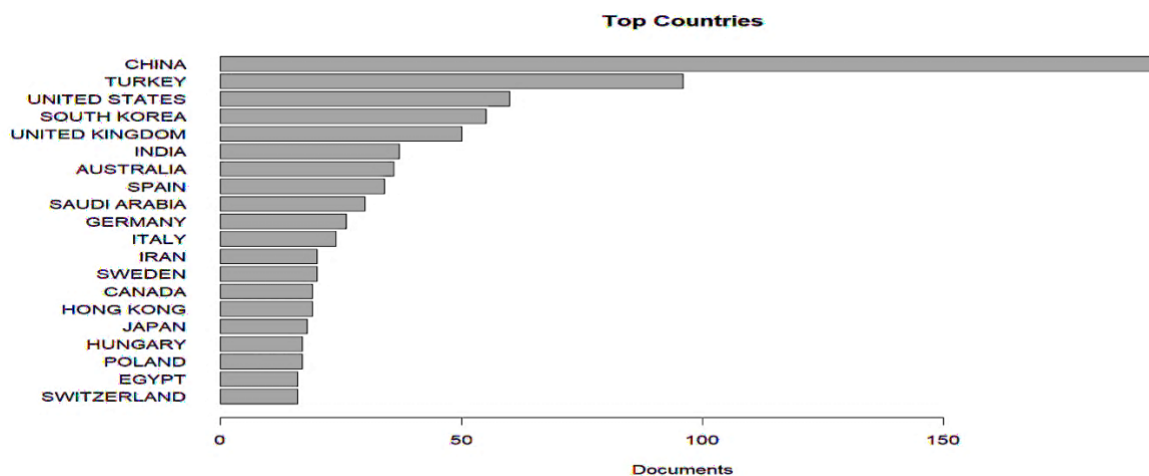


Figure 3. Top Countries

This geographical distribution represents research production capacity rather than underlying epidemiological prevalence. The high concentration of studies originating from China and Turkey provides a substantial empirical base regarding adolescent and university student cohorts. However, it concurrently highlights a regional imbalance, leaving working adult populations, older demographics, and low-resource health settings relatively underrepresented in the current literature.

3.3 Keyword Topology and Topic-Family Structure

Keyword analysis revealed a three-tiered thematic structure within the literature. After excluding generic indexing terms *human*, *article*, *male*, and *female*, the most frequently occurring keywords clustered into three major domains: (i) movement behaviors, including *physical activity*, *exercise*, and *sedentary behavior*; (ii) digital addiction constructs, including *smartphone addiction*, *mobile phone addiction*, *internet addiction*, *gaming addiction*, and *social media addiction*; and (iii) psychosocial correlates, including *depression*, *anxiety*, *mental health*, *sleep quality*, *students*, and *adolescents*.

These thematic clusters indicate that the literature has evolved at the intersection of digital addiction, movement behaviors, and psychological well-being.

Classification of author keywords into thematic topic families (Figure 4) revealed clear concentrations across the literature. Physical activity was the most frequently represented topic ($n = 696$), followed by adolescents and students ($n = 580$), mental health ($n = 411$), smartphone addiction ($n = 386$), gaming disorder ($n = 226$), sleep quality ($n = 214$), social media addiction ($n = 134$), physical inactivity and sedentary behavior ($n = 121$), and short-video addiction ($n = 17$).

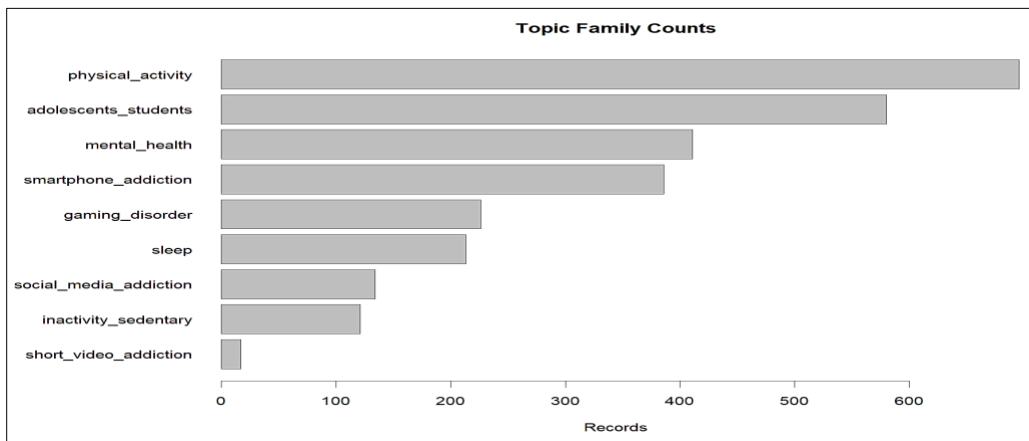


Figure 4. Topic-Family Counts

The distribution as shown in Figure 5 highlights physical activity as the dominant outcome domain and smartphone addiction as the principal digital addiction construct investigated across the literature. Related constructs, including gaming disorder and social media addiction, form important secondary research themes, whereas short-video addiction remains markedly underrepresented. Despite the rapid global adoption and highly immersive design of short-video platforms, only 17 records addressed this emerging form of digital addiction, identifying it as a significant gap and a promising direction for future research

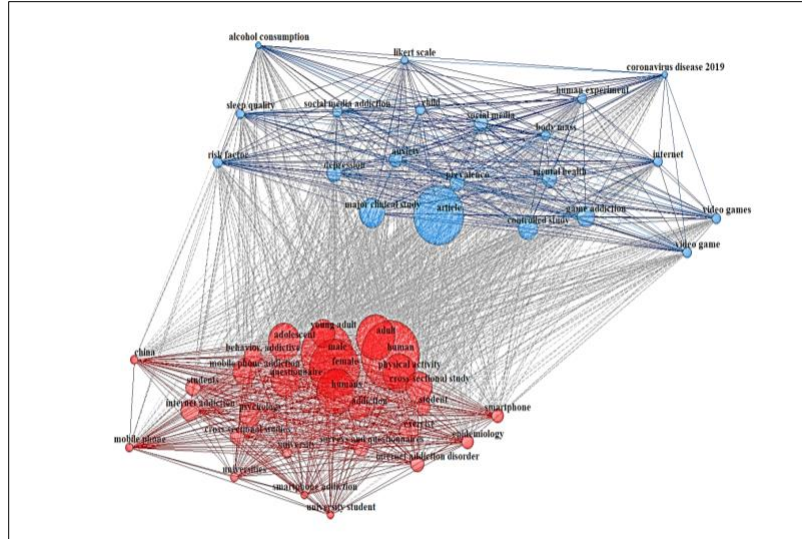


Figure 5. Keyword Co-Occurrence Network

3.4 PRISMA Systematic Literature Review Synthesis

Screening the initial 721 Scopus records against the PECO eligibility criteria yielded a final SLR synthesis corpus of 213 high-priority empirical articles (Figure 6).

A total of 508 records were excluded due to indirect relevance, non-empirical designs, or lack of explicit bivariate/multivariate connections between digital addiction and movement behavior.

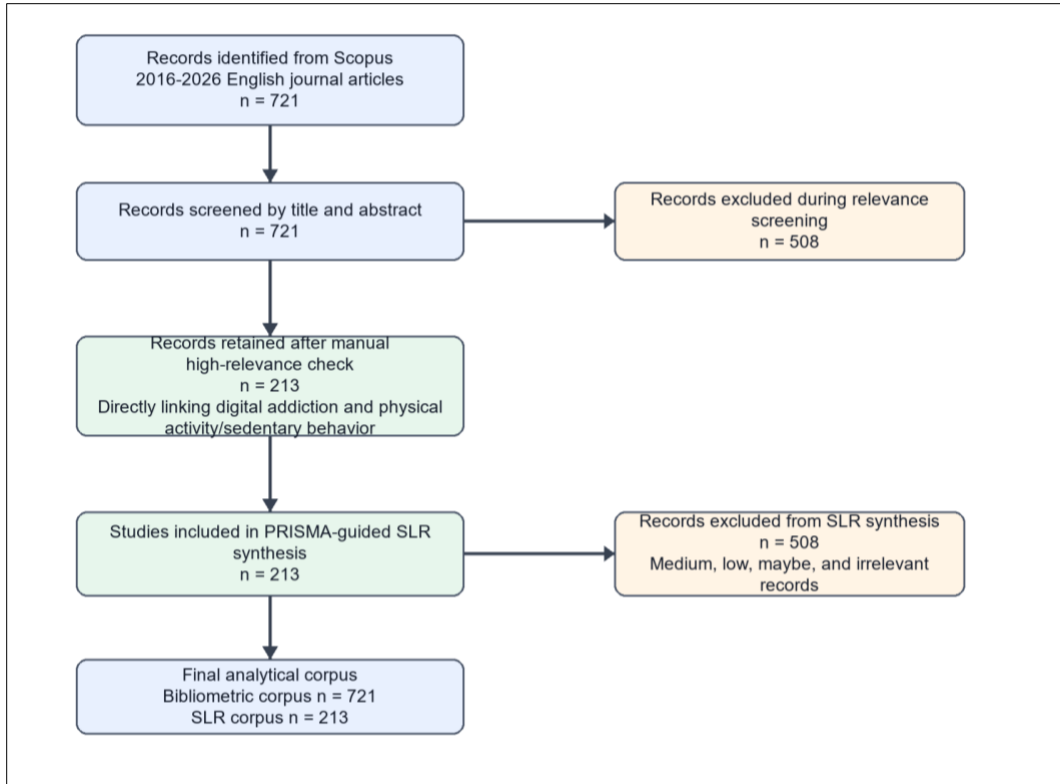


Figure 6. PRISMA Transition Flow from Bibliometric to SLR Screening

3.4.1 Thematic Synthesis

The 213 retained studies establish several empirical linkages between smartphone-related digital addiction and movement behaviors. As summarized in Table 2, research centered on university and adolescent cohorts links problematic smartphone use with physical activity through self-regulatory mechanisms, including core self-evaluation, resilience, and sleep architecture (Gong et al., 2023; Tong & Meng, 2023; Wu et al., 2024; Zhao & Kou, 2024). Emerging studies extend these frameworks to older adult populations, cognitive function, academic burnout, and depressive symptoms, demonstrating that physical activity can serve protective and restorative functions across different developmental stages (Chen et al., 2025; Jin et al., 2023; Li et al., 2025; Yang et al., 2024; Yang et al., 2026).

Targeted interventions and platform-specific investigations represent critical efforts to advance beyond cross-sectional correlations. Smartphone reduction protocols and structured exercise programs (e.g., calisthenics) demonstrate direct therapeutic utility in mitigating compulsive device usage (Karaca et al., 2025; Steunf et al., 2024). In parallel, gaming studies link internet gaming disorder with physical inactivity, altered sleep, and reduced quality of life, while evaluating augmented reality and gamified physical activity interventions as therapeutic countermeasures (Bezgin et al., 2024; Lee & Huh, 2024). Social media studies highlight interactions between social media addiction, fitness application engagement, and cognitive-behavioral physical activity patterns among youth (Liu, 2024; Sonmez Sari et al., 2025; Wang et al., 2025).

Table 2. Structural Themes Identified from the Bibliometric and Systematic Literature Review (n = 213)

Theme	Structural Status	Critical Interpretation
Smartphone/Mobile Phone Addiction and Physical Activity	Dominant Theme	Core Physical activity is most frequently conceptualized as a negative correlate, protective factor, or health outcome associated with problematic smartphone use, making this the central research focus within the literature.
Gaming Disorder and Movement Behavior	Major Research Domain	Gaming disorder is consistently associated with reduced physical activity, increased sedentary behavior, sleep disturbances, and poorer mental health, while intervention studies increasingly explore gamified approaches to promote physical activity.
Social Media Addiction, Sleep, and Mental Health	Established Secondary Theme	Problematic social media use is commonly linked to anxiety, depression, loneliness, fear of missing out (FoMO), and poor sleep quality, with physical activity frequently examined as a protective lifestyle factor that may mitigate these adverse outcomes.
Short-Video Addiction	Emerging Research Frontier	Research on short-video addiction remains limited despite the rapid global growth of algorithm-driven platforms. Existing evidence provides insufficient understanding of how personalized content delivery, continuous novelty, and rapid reward mechanisms influence physical activity and movement behaviors.
Sedentary Behavior and Physical Inactivity	Methodological Gap	Sedentary behavior is investigated less frequently than overall physical activity, and many studies fail to distinguish between sedentary time, screen time, and physical inactivity, reducing conceptual clarity and limiting comparability across studies.

3.4.2 Methodological Gaps and Critical Interpretation

Integrating the bibliometric analysis with the systematic literature review provides a comprehensive overview of the field's major research hotspots, methodological limitations, and emerging knowledge gaps. Table 3 summarizes the principal findings and their critical methodological implications. Overall, the evidence indicates rapid growth in publication volume, a strong emphasis on adolescent populations and smartphone addiction, and increasing attention to mental health and sleep outcomes. Nevertheless, the literature remains dominated by cross-sectional, self-report studies, with limited causal evidence, inconsistent conceptualization of movement behaviors, and comparatively little research on emerging forms of digital addiction, particularly short-video addiction.

Table 3. Synthesis of Research Hotspots, Methodological Gaps, and Critical Interpretation

Empirical Finding	Bibliometric/Systematic Evidence	Critical Interpretation
Publication Growth	Sharp increase after 2020, peaking in 2025 ($n = 173$).	Rapid publication growth reflects increasing public health interest but does not necessarily indicate equivalent advances in theoretical development or causal evidence.
Population Concentration	Adolescents and university students dominate the literature ($n = 580$).	Heavy reliance on convenience samples limits generalizability to working adults, older adults, clinical populations, and athletes.
Construct Prominence	Physical activity-related terms appeared in 696 records.	Many studies do not clearly distinguish physical activity, exercise, sedentary behavior, sport participation, and MVPA, reducing conceptual consistency across the literature.
Psychosocial Context	Mental health, sleep, depression, and anxiety were frequently co-investigated ($n = 411$).	Psychological variables are often assumed to explain observed relationships, yet few studies rigorously evaluate mediation, moderation, or causal pathways.
Emerging Research Gap	Short-video addiction appeared in only 17 records.	Evidence remains limited despite the rapid expansion of algorithm-driven short-video platforms, highlighting an important priority for future research.

4. DISCUSSION

4.1 Publication Growth to Knowledge Maturity

The bibliometric analysis demonstrates a marked expansion of research on digital addiction and physical activity, with publication output increasing rapidly after 2020 and reaching its highest level in 2025. However, growth in publication volume should not be interpreted as evidence of corresponding conceptual or methodological maturity. Although the increasing number of studies reflects heightened recognition of digital addiction as a public health concern across disciplines including public health, psychology, psychiatry, and behavioral sciences, much of this expansion has been driven by repeated cross-sectional investigations rather than advances in causal or theory-driven research.

The post-2020 acceleration is likely attributable to several converging factors, including the widespread adoption of digital technologies during the COVID-19 pandemic, prolonged online learning and remote working environments, increasing concerns regarding mental health and excessive smartphone use, and growing awareness of sedentary lifestyles and declining physical activity. These societal changes stimulated substantial research interest in understanding the health consequences of problematic digital media use.

Despite this rapid growth, the evidence base remains largely descriptive. Most studies focus on documenting associations between digital addiction and physical activity or related health outcomes, whereas comparatively few investigate the underlying behavioral, psychological, or physiological mechanisms that explain these relationships. Consequently, the field has achieved considerable descriptive breadth but remains limited in explanatory depth. Future research should move beyond correlational evidence by adopting longitudinal, experimental, and intervention-based designs grounded in robust

theoretical frameworks to strengthen causal inference and advance knowledge of the mechanisms linking digital addiction with movement behaviors.

4.2 Digital Addiction: Conceptual Challenges

One of the principal challenges identified in the literature is the conceptual fragmentation of digital addiction. Terms such as “*smartphone addiction, problematic smartphone use, mobile phone dependence, nomophobia, social media addiction, gaming disorder*”, and “*short-video addiction*” are frequently used interchangeably despite representing conceptually distinct constructs. As argued by Billieux et al. (2015), problematic mobile phone use should be evaluated through rigorous behavioral frameworks before being classified as a behavioral addiction. Likewise, Panova and Carbonell (2018) cautioned against the premature pathologization of frequent smartphone use in the absence of clinically meaningful impairment. Consequently, future evidence syntheses should distinguish these constructs rather than aggregating them into a single, overarching category of digital addiction.

Treating these constructs separately reveals distinct behavioral mechanisms through which different forms of digital media use may influence physical activity and movement behaviors. Gaming disorder is primarily associated with prolonged gaming sessions, disrupted sleep, altered reward processing, and extended sedentary behavior. Social media addiction is more closely linked to fear of missing out (FoMO), social comparison, social-evaluative anxiety, mood regulation, and habitual nighttime checking behaviors. In contrast, short-video addiction appears to be driven largely by platform-specific design features, including infinite scrolling, algorithmic content personalization, continuous novelty, and frictionless transitions between videos, all of which encourage frequent, fragmented engagement throughout the day. These findings suggest that the mechanisms underlying different forms of digital addiction are unlikely to be identical and should therefore be investigated and interpreted independently.

4.3 Physical Activity in Digital Addiction

A key conceptual contribution of this review is the reconceptualization of physical activity as more than a downstream health outcome. Previous studies have predominantly viewed reduced physical activity as a consequence of digital addiction, typically explained through time displacement and prolonged sedentary behavior. Although these mechanisms are plausible particularly when excessive screen engagement displaces leisure-time activity or disrupts sleep evidence suggests that physical activity also functions as an upstream protective factor and a dynamic self-regulatory resource.

Regular physical activity contributes to improved mood regulation, executive functioning, sleep quality, and social connectedness, thereby reducing the psychological vulnerabilities that may contribute to compulsive digital media use. Accordingly, the relationship between digital addiction and physical activity

is likely bidirectional: excessive digital engagement may reduce movement behaviors, while insufficient physical activity may increase susceptibility to problematic digital use by weakening emotional regulation and self-control.

This bidirectional perspective highlights the limitations of simple causal interpretations. Associations between smartphone addiction and lower physical activity levels may be influenced by unmeasured confounding factors, including psychological distress, sleep disturbances, social isolation, academic stress, and deficits in executive functioning. The Interaction of Person–Affect–Cognition–Execution (I-PACE) model provides a useful theoretical framework for understanding these complex relationships by conceptualizing addictive behaviors as the product of interactions among individual predispositions, affective and cognitive responses, and executive control processes (Brand et al., 2019). Within this framework, physical activity may strengthen executive functioning and emotional regulation, whereas prolonged sedentary digital engagement may progressively diminish self-regulatory capacity.

4.4 Methodological Challenges

The bibliometric and systematic review findings reveal a strong reliance on subjective, self-report methodologies. Most primary studies measured digital addiction using self-reported addiction scales and assessed physical activity through exercise recall questionnaires or self-estimated sedentary time. Although these instruments are practical for large-scale population research, they remain susceptible to recall bias, social desirability bias, and inconsistent diagnostic or behavioral thresholds. Moreover, many studies do not clearly distinguish between problematic smartphone use, subjective dependence, screen time, functional impairment, and clinically significant addictive behaviors, thereby limiting conceptual precision and comparability across studies.

Advancing this field requires a more robust evidence hierarchy. Cross-sectional surveys remain valuable for identifying population-level associations and monitoring emerging behavioral trends; however, they cannot establish temporal ordering or causal relationships. Longitudinal cohort studies are needed to examine behavioral trajectories, reciprocal relationships, and developmental changes over time. Experimental and intervention studies are essential for determining whether physical activity interventions reduce digital addiction symptoms or whether digital detox and behavioral modification programs lead to sustained improvements in movement behaviors. Finally, greater adoption of objective assessment methods—including smartphone application logs, accelerometry, wearable activity monitors, and ecological momentary assessment (EMA) would substantially reduce self-report bias and improve the validity of behavioral measurement.

Overall, strengthening the methodological rigor of future research will require integrating longitudinal and experimental designs with objective behavioral monitoring and standardized measurement frameworks. Such advances will provide stronger causal evidence and a more comprehensive understanding of the complex relationship between digital addiction and physical activity.

4.5 Explaining Mixed Findings

Empirical evidence should be interpreted in light of the considerable heterogeneity across study populations, research designs, and measurement approaches. While many studies report a significant negative association between physical activity and problematic smartphone use, others identify weaker or non-significant relationships, or indirect effects mediated by sleep quality, self-control, anxiety, social support, or other psychosocial factors. These inconsistencies suggest that physical activity functions as a context-dependent behavioral resource rather than a universally protective factor.

The protective effects of physical activity are likely to vary according to its type, intensity, and social context. For example, structured sport participation may reduce the risk of problematic digital use by promoting routine, social connectedness, and self-regulation, whereas unstructured or sporadic physical activity may provide limited protection when academic stress, sleep disturbance, or platform-specific reinforcement mechanisms dominate daily routines. Consequently, future research should explicitly specify the analytical role of physical activity—as an outcome, predictor, mediator, moderator, or intervention target to improve conceptual clarity and facilitate meaningful comparisons across studies.

4.6 Population and Cultural Context

The bibliometric and systematic review findings reveal a pronounced concentration of research among adolescents and university students, particularly in high-output countries such as China and Turkey. Although these populations represent accessible and high-exposure cohorts for studying digital addiction, their predominance limits the generalizability of current evidence to older adults, working populations, clinical groups, and athletes.

Cultural and contextual factors further influence the relationship between digital addiction and physical activity. Differences in smartphone use norms, educational demands, family environments, sport participation opportunities, and digital platform preferences may shape both behavioral patterns and health outcomes. Consequently, findings derived from one sociocultural context should not be generalized uncritically to other populations.

Moreover, national publication output primarily reflects research capacity—including funding availability, institutional infrastructure, journal indexing, and survey capability—rather than the actual prevalence or severity of digital addiction. Bibliometric indicators describe patterns of scientific knowledge

production, whereas estimates of epidemiological burden require population-based surveillance and nationally representative data.

4.7 Short-Video Addiction

One of the most notable gaps identified in this review is the limited evidence on short-video addiction, which accounted for only a small proportion of the bibliometric corpus ($n = 17$). Despite the rapid global expansion of platforms such as TikTok, Douyin, and Instagram Reels, research has yet to adequately examine how their unique design characteristics influence movement behaviors and health outcomes.

Unlike conventional smartphone use or traditional social networking, short-video platforms are characterized by algorithm-driven content personalization, infinite scrolling, rapid reward delivery, and highly immersive mobile-first interfaces. These features encourage frequent, fragmented, and often nocturnal engagement, making their displacement effects on physical activity more difficult to capture using conventional screen-time measures.

Future research should recognize short-video addiction as a distinct area of investigation and employ platform-sensitive behavioral indicators, including application-opening frequency, session fragmentation, nocturnal use, algorithmic feed engagement, passive scrolling behavior, and users' pre-use emotional states. Incorporating these measures will provide a more nuanced understanding of how emerging forms of digital media use influence physical activity, sedentary behavior, and broader health outcomes.

5. CONCLUSION AND RECOMMENDATIONS

Research on smartphone-related digital addiction and physical activity has expanded rapidly between 2016 and 2026, with dominant themes including physical activity, youth populations, mental health, smartphone addiction, gaming disorder, sleep, social media addiction, and sedentary behavior. Despite this growth, the evidence remains largely correlational, with limited understanding of causal mechanisms, platform-specific effects, and intervention effectiveness. This review reconceptualizes physical activity as more than a health outcome, highlighting its roles as a protective factor, self-regulatory resource, behavioral context, and intervention target. It also identifies short-video addiction as an emerging research frontier requiring platform-specific investigation. Future research should prioritize theory-driven, longitudinal, and experimental studies using objective behavioral measures to strengthen causal evidence and inform effective interventions.

Future research should move beyond documenting associations between digital addiction and physical activity toward testing specific behavioral mechanisms. Greater attention should be given to pathways

involving time displacement, sleep disruption, emotion regulation, and self-control, as these mechanisms may differ across smartphone addiction, gaming disorder, social media addiction, and short-video addiction. The I-PACE model could be extended by incorporating movement behaviors, positioning physical activity as a protective factor that strengthens self-regulation and reduces vulnerability to problematic digital use.

Future studies should adopt longitudinal, experimental, and mixed-method designs to strengthen causal inference. Greater use of objective behavioral measures, including smartphone application logs, accelerometry, wearable devices, and ecological momentary assessment (EMA), is recommended to reduce self-report bias. Standardized measurement of digital addiction constructs and physical activity outcomes would also improve comparability across studies. Interventions should integrate digital self-regulation with physical activity promotion rather than focusing solely on reducing screen time. Schools, universities, and public health agencies should encourage structured physical activity, healthy sleep habits, and digital well-being education. Platform-specific intervention strategies are also needed, as smartphone addiction, gaming disorder, social media addiction, and short-video addiction involve distinct behavioral mechanisms requiring tailored prevention and intervention approaches.

6. LIMITATIONS AND FUTURE STUDIES

This review has several limitations such as the bibliometric analysis was restricted to the Scopus database and may not capture studies indexed exclusively in Web of Science, PubMed, or other databases. Second, the exported records lacked complete cited-reference data, preventing co-citation and bibliographic coupling analyses. Third, although 213 studies were systematically reviewed, detailed quantitative risk-of-bias assessment was constrained by the availability of full-text information. These limitations should be considered when interpreting the findings.

Declarations

Author contributions: All authors contributed equally to the conception, design, analysis, interpretation, and preparation of this manuscript.

Ethical Statement: This study is a bibliometric analysis and systematic literature review based exclusively on published literature. No human participants, animals, or identifiable personal data were involved; therefore, ethical approval was not required.

Consent to Participate: Not applicable

Competing Interests: The authors declare that they have no known competing financial or non-financial interests that could have influenced the work reported in this manuscript.

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