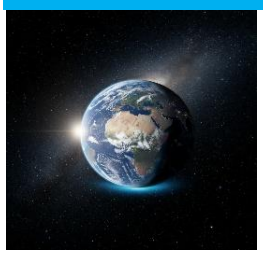
Journal of Education, Health and Sport. 2026;88:68323.
eISSN 2391-8306.

https://doi.org/10.12775/JEHS.2026.88.68323



Journal of Education, Health and Sport. eISSN 2450-3118

Journal Home Page
https://apcz.umk.pl/JEHS/index

STĘPIEŃ, Dawid, NAWROCKA, Natalia, HOJDA, Alicja, BEDNAREK, Filip, MAŁAJEWICZ, Izabela, PLINTA, Olga, PIETRZYK, Małgorzata, RODAK, Hanna and OSKROBA, Karolina. The Impact of physical activity and screen time on mental, physical and social health in children and adolescents: a narrative review. Journal of Education, Health and Sport. 2026;88:68323. eISSN 2391-8306.
https://doi.org/10.12775/JEHS.2026.88.68323

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).
Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).
The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 15.01.2026. Revised: 10.02.2026. Accepted: 14.02.2026. Published: 20.02.2026.

The impact of physical activity and screen time on mental, physical and social health in children and adolescents: a narrative review

Author: Dawid Stępień (MD)
Affiliation: Zespół Opieki Zdrowotnej Hospital in Dębica, Krakowska 91 Street, 39-200 Dębica, Poland.
Corresponding author e-mail: dawidstep21@gmail.com
ORCID: https://orcid.org/0009-0009-3374-2127

Author: Natalia Nawrocka(MD)
Affiliation: J. Dietl Specialist Hospital in Cracow, Skarbowa 4 Street, 31-121 Cracow, Poland
Corresponding author e-mail: natalia.nawr@gmail.com
ORCID: https://orcid.org/0009-0000-8593-0730

Author: Alicja Hojda
Affiliation: The University Hospital in Krakow, Marii Orwid 11 Street, 30-688 Cracow, Poland
Corresponding author e-mail: ala.gymn@gmail.com
ORCID: https://orcid.org/0009-0002-8844-2542

Author: Filip Bednarek
Affiliation: St Anne's Hospital in Miechów, Szpitalna 3 street, 32-200 Miechów, Poland
Corresponding author e-mail: feel030799@gmail.com
ORCID: https://orcid.org/0009-0008-5526-2426

Author: Izabela Małajewicz
Affiliation: Stefan Żeromski Specialist Hospital in Kraków, Osiedle Na Skarpie 66 Street, 31-913, Cracow, Poland
Corresponding author e-mail: izamalajewicz@gmail.com
ORCID: https://orcid.org/0009-0005-7294-5059

Author: Olga Plinta
Affiliation: Stefan Żeromski Specialist Hospital in Kraków, Osiedle Na Skarpie 66 Street, 31-913, Cracow, Poland
Corresponding author e-mail: olplin@interia.pl
ORCID: https://orcid.org/0009-0003-2022-6920

Author: Małgorzata Pietrzyk
Affiliation: The University Hospital in Krakow, Marii Orwid 11 Street, 30-688 Cracow, Poland
Corresponding author e-mail: malgorzata.pietrzyk99@gmail.com
ORCID: https://orcid.org/0009-0005-8193-0035

Author: Hanna Rodak
Affiliation: Szpital Zakonu Bonifratrów Św. Jana Grandego w Krakowie: Kraków,
Corresponding author e-mail: rodakhanna00@gmail.com
ORCID: https://orcid.org/0009-0002-0444-4015
Author: Karolina Oskroba
Affiliation: Stefan Żeromski Specialist Hospital in Kraków, os. Na Skarpie 66, 31-913 Kraków
Corresponding author e-mail: karolinaoskroba1@gmail.com
ORCID: https://orcid.org/0009-0003-7169-2841

Highlights

Biopsychosocial Impact: Integrating physical activity, screen time, and sleep within a unified framework offers a critical perspective on youth health.

Sleep as Mediator: Recent evidence (2024–2025) identifies sleep disruption as a primary mechanism linking intensive social media use to mental health deficits.

Protective Buffer: Regular physical activity significantly attenuates the adverse effects of digital saturation, including problematic smartphone use.

Practical Framework: The review provides actionable, multi-level recommendations for families, schools, and healthcare professionals to promote digital hygiene.

Abstract

Background: Digital technologies have become deeply embedded in the everyday lives of children and adolescents, while physical activity levels are declining in many countries. These parallel trends raise concerns about their impact on mental, physical and social health.

Aim: The aim of this narrative review is to summarize current knowledge on the relationships between physical activity, different forms of screen use (including social media and problematic smartphone use) and health outcomes in youth.

Results: Evidence from reviews and large observational studies indicates that high total screen time is associated with more depressive and anxiety symptoms, reduced wellbeing, sleep disturbances, obesity and school difficulties. Intensive social media use and problematic smartphone use show particularly strong links with depression, anxiety, loneliness and functional impairment, and may display addiction-like features. In contrast, regular physical activity is consistently related to better mental health, higher life satisfaction and healthier sleep patterns, and may partly buffer the negative effects of excessive screen exposure. Sleep, loneliness and family context appear as important mediators and moderators of these associations.

Conclusions: Excessive screen time and problematic smartphone use represent modifiable risk factors for youth health, whereas physical activity is a central protective factor that supports healthy development. Prevention strategies should therefore focus on promoting regular movement, setting limits on evening and night-time screen use, supporting healthy sleep hygiene and encouraging balanced, purposeful use of digital media in families, schools and health care settings.

Keywords: physical activity; screen time; adolescents; mental health; social media; smartphone addiction; sedentary behavior.

1. Introduction

Over the last two decades, information and communication technologies have fundamentally reshaped the everyday lives of children and adolescents. Smartphones, tablets, computers and game consoles have become ubiquitous, gradually replacing many traditional forms of leisure. At the same time, population-based data indicate declining levels of physical activity among young people, with a growing proportion not meeting the recommended 60 minutes of moderate-to-vigorous physical activity per day [17].

These lifestyle changes have direct implications for physical health (including higher prevalence of overweight and obesity, musculoskeletal complaints and poorer fitness) as well as for mental health, with rising rates of depressive and anxiety disorders and sleep problems

being reported in many countries [2–4,6,18,19]. Odgers and Jensen [8] emphasize that adolescence now unfolds in a context of "digital saturation", in which the boundaries between online and offline worlds become increasingly blurred. Social media platforms have turned into a primary arena for identity development, peer relationships and social comparison. However, a growing body of research shows that intensive use of these platforms – particularly passive browsing – may be associated with lower self-esteem, greater self-consciousness and vulnerability to criticism [9,10].

At the same time, epidemiological data suggest a deterioration in youth mental health, which some authors link to the steep increase in digital media use during the last decade [3,18–20,23]. Against this background, it is crucial to understand how different forms of screen-based activity (e.g. video games, social media, streaming services, online learning) affect mental, physical and social outcomes in youth, and what role physical activity plays as a potential protective factor. Regional studies from Poland and other European countries published in Pedagogy and Psychology of Sport and Quality in Sport similarly emphasize the links between physical activity, healthy behaviors and weight-related health outcomes in youth [26,27].

Early work by Biddle and Asare [1] highlighted the beneficial impact of physical activity on mental health in children and adolescents, whereas Stiglic and Viner [2] synthesized evidence on the health consequences of screen time. More recent reviews and large surveys have extended this perspective, considering content and context of media use, problematic smartphone use, sleep disruption and school functioning [3–7,11–16,18–25]. The present review integrates these findings, with a particular focus on the interplay between physical activity and different dimensions of screen use, and on the role of sleep and contextual factors in shaping health outcomes.

2. Materials and methods

2.1. Design

This article is a narrative review. Although it is narrative in nature, a systematic search strategy was adopted to minimize selection bias and ensure a comprehensive coverage of high-quality evidence. The aim was to integrate and critically discuss findings from reviews and large observational studies addressing the relationships between physical activity, screen time, social media use, problematic smartphone use and health in children and adolescents.

2.2. Search strategy and information sources

A structured literature search was conducted in January–February 2025 in the PubMed, Web of Science and Scopus databases. The search covered the period from January 2011 to December 2024, with an additional targeted search for early 2025 online-ahead-of-print articles. Combinations of the following keywords and MeSH terms were used: “screen time”, “digital media”, “social media”, “smartphone”, “problematic smartphone use”, “internet use”, “physical activity”, “exercise”, “youth”, “children”, “adolescents”, “mental health”, “depression”, “anxiety”, “sleep”, “school absenteeism”. Reference lists of key review articles and position papers were screened to identify additional relevant publications [1–5,8–11,21,23,24].

2.3. Eligibility criteria

The inclusion criteria were as follows:

- peer-reviewed articles written in English;
- studies focusing on children and/or adolescents (typically 10–19 years of age);
- papers examining associations between physical activity, total screen time, specific screen media activities (e.g. social media, gaming), problematic smartphone use or internet use and at least one health-related outcome (mental health, sleep, physical health, school functioning, wellbeing);
- review articles (systematic reviews, scoping reviews, critical reviews) or large observational studies with sample sizes above 1,000 participants.

Narrative reviews and conceptual papers from leading journals were included when they offered a particularly relevant synthesis or theoretical framework [5,8,21].

2.4. Study selection and data extraction

The initial database search yielded several hundred records. Titles and abstracts were screened for relevance to the research questions. Full texts of potentially eligible papers were then examined, and 25 key publications were selected for inclusion in this narrative synthesis: these comprised review-of-reviews on physical activity and mental health [1], screen time and health [2], critical reviews of screen media activity [5], systematic reviews on social media use [9–11,23] and problematic smartphone use [12–16,21,22], and large population-based studies on digital media use, sleep and health outcomes [3,4,17–20,24,25]. Data extracted from the

included studies included: study design, population, measures of physical activity and screen use, health outcomes and main conclusions.

2.5. Synthesis

Given the heterogeneity of designs, measures and outcomes, no quantitative meta-analysis was attempted. Instead, findings were grouped thematically according to type of exposure (physical activity, total screen time, specific media activities, problematic smartphone use) and outcomes (mental health, sleep, physical health, school functioning). Particular attention was paid to potential mediators and moderators (e.g. sleep, loneliness, leisure-time physical activity, family context and socioeconomic status).

3. Results

3.1. Theoretical background – a biopsychosocial model

Interpretation of links between physical activity, screen time and health in young people is facilitated by a biopsychosocial model. According to this framework, health results from the dynamic interplay of biological (e.g. genetic predispositions, neurobiology, sleep), psychological (e.g. cognitive schemas, coping strategies, self-esteem) and social factors (e.g. family relationships, peer support, school context).

Digital technologies affect all three layers at the same time. From a biological perspective, excessive screen exposure may influence the nervous system through chronic sleep restriction, circadian rhythm disruption and sustained emotional and cognitive arousal [6,11,19]. Blue light emitted by screens in the evening can suppress melatonin secretion and delay sleep onset, while emotionally engaging content may activate stress-related systems.

Psychologically, social media can foster upward social comparisons, internalization of unrealistic standards of beauty and success, and a heightened need for external validation [9,10]. Socially, increased time online may reduce face-to-face interactions, potentially undermining social skills and sense of belonging, although some studies also highlight opportunities to build supportive online communities [8,23].

Physical activity can be conceptualized as a protective factor at each level: biologically (improving cardiovascular and brain health), psychologically (reducing depressive and anxiety

symptoms, enhancing self-esteem) and socially (facilitating peer integration and feelings of competence) [1,17,22]. Therefore, examining physical activity and screen time in isolation is insufficient; their interaction and balance are crucial for understanding youth health in the digital age.

3.2. Physical activity and mental health

One of the most robust findings in the literature is the positive association between physical activity and mental health in young people. The review-of-reviews by Biddle and Asare [1] concluded that higher levels of physical activity are consistently linked to lower levels of depressive symptoms, reduced anxiety, better mood and higher self-esteem. These effects are observed for both organized sport and informal recreational activity.

More recent studies confirm these observations. Jerome et al. [17] reported that adolescents who meet physical activity guidelines are less likely to exceed recommended screen time limits and report better overall health and life satisfaction. Zhang et al. [15] demonstrated that leisure-time physical activity moderates the association between smartphone addiction and negative health outcomes, reducing the impact of loneliness and problematic phone use on mental health. Wang [22] further showed that physical activity may protect against mobile phone addiction through enhanced self-control and resilience among university students, a mechanism that is likely to be relevant already in late adolescence. Together, these findings support the view that physical activity is a key resource helping young people cope with the challenges of the digital era.

3.3. Screen time and mental health

The systematic review by Stiglic and Viner [2] found that higher total screen time is consistently associated with poorer mental health, lower life satisfaction, more depressive and anxiety symptoms and poorer sleep. Schmidt-Persson et al. [4] confirmed these associations, showing that both total screen time and intensive use of certain screen media are linked to emotional problems and lower wellbeing in children and adolescents.

Large population-based analyses add further evidence. Zablotsky et al. [3] reported that US teenagers with the highest levels of screen time had worse mental health, more behavioral problems and more somatic complaints (such as headaches, back pain and fatigue) than peers with moderate use. Frielingsdorf et al. [18] demonstrated that time spent on different types of digital media is differentially related to self-rated health, with passive consumption of video

content showing the strongest negative associations. Clayborne et al. [23] highlighted that the relationship between screen time and positive mental health is complex: patterns of use and context (e.g. active vs. passive use, social vs. solitary) appear to be more important than total hours alone.

3.4. Social media use and wellbeing

Social media are one of the most intensively studied aspects of screen use. Vidal et al. [9] showed in a scoping review that frequent social media use, especially passive browsing, is associated with higher levels of depressive symptoms among adolescents. Keles et al. [10] demonstrated in a systematic review that intensive use of social media is related not only to depression, but also to anxiety and general psychological distress. Longitudinal research by Nagata et al. [20] indicated that higher social media use in early adolescence predicts increasing depressive symptoms over subsequent years.

Ahmed et al. [11] expanded this picture by examining social media use, mental health and sleep simultaneously. Their meta-analytic findings indicate that sleep disruption is a key mediator: high social media use, particularly before bedtime, is linked to delayed sleep onset, shorter total sleep time and poorer subjective sleep quality, which in turn relate to increased emotional difficulties. These results highlight the need to consider not only the quantity and content of social media use, but also the timing of engagement across the day.

3.5. Problematic smartphone use and digital addiction

Problematic smartphone use (PSU) has emerged as a major concern in adolescent health research. Karabey et al. [12] synthesized evidence showing that high levels of PSU are associated with poorer family relationships, reduced academic performance, sleep problems and more frequent symptoms of depression and anxiety. Wacks and Weinstein [13] summarized studies demonstrating that excessive smartphone use is linked to a wide range of mental and physical health problems, including neck pain, fatigue, impaired concentration, irritability and low mood.

Mayerhofer et al. [14] and Zhu et al. [16] presented empirical data suggesting that PSU shares several features with behavioral addictions, such as tolerance, withdrawal symptoms (irritability and restlessness when phone access is restricted) and loss of control. Ndayambaje and Okereke [21] further reviewed the psychopathology of PSU, emphasizing the role of underlying vulnerabilities, such as emotion dysregulation, impulsivity and comorbid

psychiatric conditions. Zhang et al. [15] proposed a model in which loneliness mediates the relationship between smartphone addiction and health, while leisure-time physical activity moderates these effects. Overall, the evidence indicates that PSU should be taken seriously as a risk factor for mental health, particularly when it co-occurs with high levels of social media use and poor sleep.

3.6. Physical health and school functioning

Beyond mental health, excessive screen time is associated with numerous somatic and educational consequences. Devi and Singh [6] described an increased risk of overweight and obesity, poorer posture, musculoskeletal pain and ocular symptoms among children and adolescents spending many hours in sedentary screen-based activities. Long periods of sitting and low levels of physical activity contribute to the development of lifestyle-related diseases later in life.

Kosola et al. [19] reported that excessive internet use, short sleep duration and low physical activity are jointly associated with higher school absenteeism in adolescents. Students who spend large amounts of time online are more likely to miss classes, report fatigue, concentration difficulties and problems in meeting academic demands. In the Middle East and North Africa region, Alnaqbi et al. [24] showed that high screen time often co-occurs with unhealthy dietary habits and low physical activity, forming risk clusters for obesity and metabolic problems. Lewandowska et al. [25], analyzing data published in the Journal of Education, Health and Sport, found that excessive screen time, short sleep and obesity frequently co-occur in children, underscoring the need for integrated lifestyle interventions.

3.7. Sleep as a key mediator

Sleep appears to be a central mechanism linking screen time to mental and physical health outcomes. Ahmed et al. [11] reported that intensive social media users tend to go to bed later, sleep fewer hours and experience poorer sleep quality. Kosola et al. [19] demonstrated that short sleep duration is associated not only with worse mood, but also with higher school absenteeism. Chronic sleep disruption can lead to hyper-reactivity of limbic structures, impaired emotion regulation and greater vulnerability to depressive and anxiety disorders.

Biological mechanisms include melatonin suppression by evening exposure to blue light, disruption of circadian rhythms and persistent physiological arousal due to emotionally engaging digital content [6,11]. In addition, cognitive–emotional factors, such as rumination

and fear of missing out (FoMO), may prolong the time spent online at night. Thus, interventions aimed at limiting evening screen time and promoting healthy sleep hygiene are likely to play a crucial role in preventing mental health problems among young people.

3.8. Protective role of physical activity

Across the reviewed studies, physical activity emerges as one of the most important protective factors against the negative effects of excessive screen time. Zhang et al. [15] showed that regular physical activity attenuates the association between smartphone addiction and poor health, particularly by buffering the impact of loneliness. Jerome et al. [17] observed that physically active adolescents report better sleep and lower stress levels, even when their screen time is relatively high.

Biddle and Asare [1] outlined several neurobiological mechanisms that may underlie these protective effects: increased production of brain-derived neurotrophic factor (BDNF), improved cerebral blood flow, regulation of the hypothalamic–pituitary–adrenal axis and reduced cortisol levels. Physical activity also supports more adaptive cognitive schemas, enhances self-efficacy and provides opportunities for positive peer experiences and achievement. Taken together, these findings justify the inclusion of physical activity promotion as a core component of any strategy aimed at counteracting the risks associated with high screen exposure.

Table 1. Overview of selected key review studies on physical activity, screen time and youth health.

First author (year)	Type of review	Population	Main exposure(s)	Main conclusions
Biddle (2011) [1]	Review of reviews	Children, adolescents	Physical activity	Higher physical activity consistently associated with better mental health (less depression, anxiety, higher self-esteem).

Stiglic (2019) [2]	Systematic review of reviews	Children, adolescents	Total screen time	Higher screen time relates to poorer mental health, lower wellbeing and more sleep problems.
Odgers (2020) [8]	Annual research review	Adolescents	Digital media, social media	Digital technologies have complex effects; risks are concentrated in vulnerable youth, but moderate use is not uniformly harmful.
Vidal (2020) [9]	Scoping review	Adolescents	Social media use	Frequent social media use, especially passive, is associated with higher depressive symptoms.
Ndayambaje (2025) [21]	Narrative review	Adolescents, young adults	Problematic smartphone use	PSU shows addiction-like features and is linked to depression, anxiety and functional impairment; prevention should target mediating factors.

4. Discussion

4.1. Summary of main findings

The studies reviewed in this article consistently show that excessive screen time is an important risk factor for mental, physical and social problems in youth [2–4,6,11–13,18–20,24,25]. Social media use, gaming and problematic smartphone use are associated with

depressive and anxiety symptoms, sleep disturbances, loneliness and difficulties in school functioning [9–16,20–23]. At the same time, physical activity stands out as a robust protective factor, linked to better mental health, higher wellbeing and lower vulnerability to the adverse effects of digital media [1,15,17,22]. Sleep appears to be a key mediator in these relationships, with evening and night-time screen use playing a particularly detrimental role [11,19].

4.2. What this review adds

Several comprehensive reviews have already examined physical activity and mental health [1], or screen time and health outcomes [2,5,9–11]. The present narrative review expands on this work in four main ways. First, it explicitly integrates evidence on physical activity, total screen time, specific media activities, problematic smartphone use and sleep within a single biopsychosocial framework, highlighting how these factors jointly shape youth health [3–7,12–16,18–21,23–25]. Second, it emphasizes the moderating and mediating role of physical activity, loneliness and sleep in the association between digital media use and mental health, drawing on newer studies published after 2020 [11,15,18,22,23]. Third, it incorporates emerging evidence from different cultural contexts, including the Middle East and North Africa region [24] and Central and Eastern Europe [25], demonstrating that socioeconomic and infrastructural factors significantly modify the risks associated with screen time. Finally, it translates this body of evidence into concrete, multi-level practical implications for families, schools, health professionals and policy makers.

4.3. Broader context and individual differences

The results of the reviewed studies must also be interpreted in the context of broader social and cultural changes. Digitalization of everyday life is not uniform; different social groups and education systems adopt and regulate digital technologies in diverse ways. Some evidence suggests that the negative impact of excessive screen time is particularly pronounced in populations with limited access to alternative leisure opportunities such as organized sport, outdoor recreation or cultural activities [1,6,17,24]. This underscores the importance of environmental and infrastructural factors that either facilitate or constrain healthy alternatives to screen-based leisure.

Public and media discourse often employs simplified narratives that portray digital media as inherently harmful or, conversely, as harmless tools. Longitudinal studies and sophisticated statistical models indicate, however, that the relationship between screen time and mental health is complex and reciprocal [5,9–11,20,23]. Young people with pre-existing mental health

difficulties may turn to online activities to regulate their emotions, while chronic, compulsive use can in turn exacerbate symptoms. This calls for nuanced, individualized assessments of the role of technology in a young person's life, rather than reliance on fixed daily screen time thresholds. Individual differences also play an important role. Temperament, coping styles, social support, prior adverse experiences and co-occurring neurodevelopmental conditions (e.g. ADHD, autism spectrum disorders) may modify the association between digital media use and mental health. Future studies should systematically consider this heterogeneity in order to develop tailored interventions for specific subgroups of youth.

5. Conclusions

Available evidence clearly indicates that excessive screen time – particularly intensive social media use, problematic smartphone use and passive video consumption – poses a significant risk to mental, physical and social health in children and adolescents [2–4,6,9–16,18–21,24,25]. Elevated risk of depression, anxiety, sleep disturbances, obesity, school difficulties and loneliness constitutes a major public health challenge in the digital era. At the same time, physical activity emerges as a central protective factor capable of partly buffering the adverse effects of high screen exposure [1,15,17,22]. Therefore, preventive programs should combine promotion of regular physical activity with education on digital hygiene and sleep hygiene. Only an integrated, multi-level approach that involves families, school, health services and policy makers offers a realistic chance to support healthy development of young people in a highly digitalized world.

6. Limitations and future directions

This review has several limitations. It is a narrative rather than systematic review; although the search strategy was structured and covered three major databases, no formal risk-of-bias assessment was conducted and publication bias cannot be excluded. Many of the included studies are cross-sectional, limiting causal inference [2–4,6,9,10,18]. Self-report measures of screen time and physical activity, which are prone to recall and social desirability biases, are still predominant in the field. Few studies distinguish in detail between different types of digital activities, often combining watching television, online learning and social media use into a single "screen time" variable [5,18]. Future research should prioritize longitudinal designs, objective measures of physical activity and screen use (e.g. accelerometers, device logs) and more fine-grained assessment of media content and context. Intervention studies are needed to test the effectiveness of strategies that reduce specific high-risk forms of screen use or

promote healthier patterns of digital engagement. There is also a need for research that integrates digital media use with other lifestyle factors, such as diet, sleep and substance use, to better understand risk clusters in different cultural and socioeconomic contexts [19,21,24,25].

7. Practical implications

The conclusions summarized in this review highlight the need for a multi-sectoral approach. Practical recommendations are outlined below for four key areas:

Family Level

Establish Rules: Implement clear and realistic rules about digital media use, such as limiting screen time before bedtime and creating screen-free zones (e.g., during meals).

Sleep Hygiene: Ensure smartphones and tablets are kept out of children's bedrooms at night to prevent sleep disruption.

Active Alternatives: Promote joint family activities like walking, cycling, or playing sports as attractive alternatives to sedentary screen-based leisure.

Role Modelling: Parents should model balanced technology use, as their habits strongly influence children's practices.

School Environment

Digital Literacy: Combine digital literacy education with health promotion. Programs should cover digital hygiene, critical evaluation of online content, and coping with social pressure.

Physical Opportunities: Provide attractive opportunities for physical activity through physical education, extracurricular sports clubs, active breaks, and outdoor initiatives.

Engagement: Focus on making physical activity enjoyable and meaningful for students, rather than a purely obligatory task.

Healthcare Settings

Routine Assessment: Incorporate routine assessment of digital media use and physical activity into pediatric and adolescent consultations.

Early Intervention: Pediatricians and family physicians should identify early signs of screen-related problems (e.g., sleep issues, withdrawal symptoms) and refer young people to appropriate support.

Prescribing Activity: Use "physical activity on prescription" or referrals to organized sports programs as part of the treatment plan for mild mental health issues.

Policy Level

Regulation: Implement regulations on marketing and content targeting minors to reduce exposure to harmful digital environments.

Infrastructure: Invest in sports infrastructure, green spaces, and safe environments to facilitate active play and transport.

Cross-sector Collaboration: Foster collaboration between education, health, and social policy sectors to address the complex challenges of digitalization comprehensively.

Disclosure

The author declares that this narrative review did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contributions

Conceptualization, D.S., M.P. and N.N; methodology, D.S.; validation, D.S., K.O.; formal analysis, D.S., A.H.; investigation, D.S.; resources, D.S., H.R. and A.H.; data curation, D.S., F.B.; writing-original draft preparation, D.S.; writing-review and editing, D.S., N.N. and M.P.; visualization, O.P., I.M.; supervision, D.S., I.M.; project administration, D.S., F.B. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Institutional Review Board Statement

Not applicable. This article is a narrative review and does not involve original research on human participants or animals.

Informed Consent Statement

Not applicable.

Data Availability Statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Acknowledgements

The author would like to thank colleagues and students for inspiring discussions on youth mental health in the digital age.

Conflicts of Interest

The author declares no conflict of interest.

Declaration of the Use of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the author used ChatGPT (OpenAI, San Francisco, CA, USA) to support English language editing, improve style and clarity, and streamline the organization of some sections. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the substantive content of the publication.

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