



Cover Page



EFFECTS OF SCREEN TIME AND DIGITAL LIFESTYLE ON PHYSICAL ACTIVITY AMONG ADOLESCENTS: A SYSTEMATIC REVIEW

¹Dr. Manoj Kumar Dhadwal and ²Dr. Sangeeta Rani

¹Assistant Director of Physical Education, Sports Section, BBAU, (Central University), Lucknow

²Principal (B. P. Ed), MAA Omwati College of Education, Hassanpur, Palwal

Abstract

The adolescence is a critical developmental stage in which there is consolidation of movement behaviours, media habits, sleep routines and social identity and health trajectory for life. The speedy growth of smartphone use, social media, online gaming, streaming and screen-based learning on a daily basis, by adolescents has changed the time use of adolescents and has increased concern over sedentary digital behaviour. This appraisal synthesizes presented proof accessible in the public domain that presently screen time and digital lifestyle influences physical activity patterns. Using peer-reviewed literature and public-health sources of repute collected from PubMed/MEDLINE, Google Scholar, WHO, UNICEF, CDC, and related reference lists, a narrative review with scoping elements of literature was conducted. The review examined the screen exposure and sedentary behaviour of adolescents and school-aged children in recreational and academic activities, respectively, along with other health-related outcomes. Studies show that high recreational screen time often accompanies lower levels of physical activity, lessened sport participation, more sedentary commuting, poorer sleep, higher risk of adiposity, musculoskeletal pain, and negative mental-health attitudes. Nevertheless, the relationship is not constant. There are many factors that can influence childhood and adolescence screen time. That includes screen modality, content, timing, sex, age and socio-economic context. Furthermore, the association may involve parental regulation, school workload, neighbourhood safety and access to safe play spaces. The physical use of smartphones as well as involvement in social media may curtail activity through displacement, sleep disruption, compulsive checking and motivational pathways. Furthermore, active video gaming, fitness apps and exercise sites may enable movement if intentionally designed and supervised. Evidence indicates a balanced public-health approach to reduce prolonged passive screen sitting while protecting educational opportunity and maximising the use of digital health tools. There is a need for integrated family, school, community, clinical and policy strategies to reincorporate active time into adolescent routines.

Keywords : Adolescents; Screen Time; Digital Lifestyle; Physical Activity; Sedentary Behaviour; Social Media.

1. Introduction

Adolescence is not just a bridge from childhood and adulthood, it is the period where the development of neurobiological maturation, social autonomy, identity, cardio metabolic risk profiles and behavioural routines occurs rapidly. The behaviors regarding health set up in this age group often remains in adult life too. So, this age group is a key area for public-health intervention (Patton et al. 2016). Physical activity underpins this developmental process as it specifically promotes development of the musculoskeletal system; cardiorespiratory, motor, psychosocial and sleep development; and the development of body composition (Chaput et al, 2020; World Health Organization, 2020).

Concurrently, adolescents are maturing in an extremely digital social environment or ecology. Smartphones, social media, streaming, video gaming, online learning, and messaging are no longer peripheral; they are now part of schooling, peer engagement, entertainment, and self-expression. Digital media can encourage learning, connection, creativity and health promotion. At the same time, it can also lead to a shift in daily routines characterised by prolonged sitting, divided attention, night-time use and lesser active play and outdoors activity (OECD, 2025; UNICEF, 2017).

The world suffers from not enough adolescents being physically active and this is a public health issue. WHO-backed analyses reveal that most adolescents do not engage in enough physical activity. It is usually the case that girls are less active than boys (Guthold et al., 2020). Children and adolescents should engage in at least 60 minutes of moderate-to-vigorous intensity physical activity daily as per the WHO guidelines, along with reduced sedentary behaviour and



Cover Page



recreational screen time. The phenomenon of children being overexposed to digital things (screens) and underexposed to movement consequently begs the question: does screen time engage in direct competition with physical activity or does it do so via a broader set of behavioural, environmental and psychosocial routes?

The purpose of this review is to assess the evidence on screen time and digital lifestyle with respect to adolescent physical activity. It highlights the screen modality, behavioural context, sex and socioeconomic difference, environmental constraints, and the difference between passive digital consumption and the purposeful promotion of technology-assisted activity.

2. Conceptual and Theoretical Framework

2.1 Screen Time and Digital Lifestyles

The amount of time spent performing activities on a screen is called screen time. It includes watching television, smartphone use, computer use, tablet use, gaming, and other exposure to digital media. The Sedentary Behavior Research Network defines that screen time may be sedentary or active. For instance, a person may be seated while scrolling on a phone but may be mobile while using an active video game (Tremblay et al, 2017). Digital lifestyle is a bigger idea which does not only refer to the duration of screen exposure but also the purpose, time, social context, type of content, emotional dependence and integration of the use of digital devices in daily living.

2.2 Sedentary Behaviour, Inactivity, and Reduced Movement Activity

The term sedentary behaviour refers to any waking behaviour with low energy expenditure which occurs while sitting, reclining or lying. It varies from physical inactivity, which is defined as failure to achieve a sufficient amount of physical activity (Tremblay et al., 2017). A teen or adolescent could be active for 60 minutes each day but still spend long hours sitting in front a screen. This difference is significant because public-health interventions must both boost movement and disrupt extended periods of sedentarism.

2.3 Physical Activity and Moderate-to-Vigorous Physical Activity

The energy expenditure of an organism is enhanced via bodily movement produced by muscular tissues. Moderate-to-vigorous physical activity (MVPA) is an important indicator in adolescent health research which captures activities such as brisk walking, running, sport, cycling, active games and vigorous play. An average of no less than 60 minutes of MVPA daily throughout the week, along with vigorous and muscle- and bone-strengthening activities on at least three days per week, is recommended by the WHO (Chaput et al., 2020; World Health Organization, 2020).

2.4 Recreational and Academic Screen Use and Digital Media Dependency

Forms of screen usage that recreational are watching video, leisure social media engagement, browsing, gaming and streaming services not for schoolwork. The usage of screens including online classes, platforms for homework, e-books, apps for learning, and research is academic screen use. There exist implications of behavioural diversity. Academic screen time may be unavoidable and structured, while recreational and night-time screen time may have stronger associations with sleep disturbance, compulsive use, and displacement of active leisure. Dependence on or problematic use of digital media can be defined as loss of control, craving, preoccupation, tolerance, withdrawal-like distress, and interference with school, sleep, family life, exercise, etc. (Young, 1998).

3. Method Used in the Review

The current work has been conceived as a narrative review with a scoping element. This research study aimed to synthesize existing evidence on the association between adolescent screen exposure, digital lifestyle, sedentary behaviour and physical activity. They did not aim to estimate pooled effect sizes. Only published secondary literature and credible public-health sources were used; no primary data collection was undertaken.



Cover Page



3.1 Literature Search Strategy

We searched the literature from PubMed/MEDLINE, Google Scholar, WHO publications, UNICEF reports, CDC publications, OECD reports, and backward searched relevant systematic reviews and guideline papers. The Boolean logic was used to combine the terms and they included: adolescent OR youth OR teenager; screen time; digital media; smartphone use; social media; gaming; sedentary behaviour; physical activity; MVPA; active commuting; sport participation; obesity; sleep; mental health; and digital health intervention.

3.2 Inclusion and Exclusion Criteria

The articles were included if they were focused on adolescents or school-aged youth; were about screen-time, smartphone use, social media, gaming, online learning, sedentary behaviour, physical activity, sport, active commuting, sleep, or related health outcomes; and were published in a peer-reviewed journal or recognized public-health organization. Sources published from 2020 to 2025 were preferred and older landmark texts were included for terminology, theory and early evidence. Studies focusing only on adults or preschoolers, opinion pieces, data with no clear connection to digital behaviour or physical activity, and bibliographically untraceable sources were excluded.

3.3 Evaluation Method

The literature was organised by theme rather than by statistic. The synthesis of evidence was conducted in the domains of screen-time patterns, sedentary behaviour, physical activity displacement, social media, gaming, online learning, social and environmental modifiers, health consequences, theoretical explanations and intervention implications. Due to the absence of a registered protocol and reproducible screening log, PRISMA record counts were not performed because this was not conducted as a formal systematic review.

4. Patterns of Screen Time in Adolescence

Adolescents face different types of screen exposure. The conventional television viewership may still be relevant but since a lot of adolescent screen time now occurs on a smartphone, tablet, laptop, online gaming console, and social media. The fact that they are portable, socially rewarding and available 24/7, including breaks in the classroom, commuting, meals, and at bedtime, gives smartphones particular behavioural significance. The portability makes natural boundaries between studying, resting, socializing, and playing weak.

The pattern has accelerated with the pandemic, as education, contact with peers, entertainment and family contact moved online. In the US sample from the Adolescent Brain Cognitive Development study, recreational screen time was high across several screen modalities during the pandemic, including streaming, gaming, social media, texting, video chatting and browsing (Nagata et al., 2022). A recent systematic review and meta-analysis revealed that screen time for children and adolescents rose considerably during the pandemic, with higher rises for adolescents and handheld devices and personal computers (Madigan et al. 2022). Some pandemic impacts may have lessened after lifting restrictions. However, cohort evidence shows that increased screen time continued beyond the earliest (Hedderston et al. 2023) lockdowns.

The digital infrastructure, household income, education of parents, the school system, safety of public spaces and culture existing in society regarding education influences global and regional patterns.

Increased screen time due to the pandemic highlights the importance of clear public health messaging. According to OECD (2025) and UNICEF (2017), screens can provide education, support, health information, assistive tech, and structured home activities for some teens. The issue at stake is no longer presence of screens, but the right balance between inactive digital time, active time, sleep, school demands and the life of the person.



5. Effects of Screen Time on Activity Level

5.1 Displacement of Scheduled Activity Time

Displacement is the most common explanation for the screen time-physical activity relationship. Time has limits. Hours spend being passively entertained on digital devices may take away time from going outside to play, sport, actively transport, move freely and socially recreate face to face. This type of displacement is most likely to occur when engagement with screens happens after school, during weekends, or at night, when adolescents may otherwise be physically active in their leisure time or resting for the next day.

5.2 Impacts on Moderate-to-Vigorous Physical Activity and Related Outcomes

Reports of inverse associations between high screen-based media use and movement outcomes have emerged. According to the Norwegian HBSC data explains that higher screen-based media use was negatively related to MVPA, sports club participation and active commuting, In addition, social media and gaming had particularly strong negative associations (Haug, 2025). According to a Canadian HBSC study, non-active social media use was created with less odds of reaching physical activity recommendation, participation in several physical activity domains, while intense social media use shows a more complicated association (Morningstar et al., 2023). The findings show that the effects of digital engagement are very much dependent on whether screen use is passive or social or compulsive or linked to an active offline identity.

5.3 Heterogeneity Based on Screen Modality

The proof is not entirely consistent. This Swedish study with objectively measured smartphone screen time and physical activity for children and adolescents (10-15 years) found no clear association between screen time on a smartphone and physical activity (Dahlgren et al., 2021). A Chinese cross-sectional study presents evidence which has indicated that television viewing and body mass index were negatively associated with physical fitness, while computer/video game time was associated with weaker or non-significant associations in some models (Dong et al., 2021). Evidence from studies conducted in Korea shows that for male middle-schoolers, excessive use of Internet gaming and game-streaming was linked to lack of moderate-intensity physical exercise (Kim et al., 2023) In sum, these studies warn against the treatment of all screen time as a uniform exposure.

5.4 Direct and Indirect Pathways

Greater screen time has the potential to reduce physical activity directly by substituting it for active time, and through indirect pathways. Using screens late at night can shorten and break up sleep. This can cause tiredness, less energy during the school day and less motivation to play sport or walk or cycle to school. Social media platforms can create cycles of reward that encourage frequent checking and a decrease in self-regulation. Due to reinforcement schedules and team-based online obligations, gaming can produce prolonged bouts of sitting. On the other hand, providing a goal, feedback, peer support, coaching, and gamified movement challenges are helpful to encourage activity through digital platforms (Oh et al., 2022).

6. Digital Lifestyle and Sedentary Behaviour

The digital lifestyle alters how high school students live. Passive consumption of a screen usually involves sitting, reclining or lying down with long bouts of uninterrupted engagement. These spells may include snacking, bad posture, less exposure to light, and low social interaction with the household. Using multiple devices can increase sedentary time because it makes uses seem fragmented instead of continuous, due to the greater daily exposure.

Disruption of sleep is one of the important mediating pathways. When youth use their media in the evening, this makes it harder to go to bed, increase arousal both cognitive and emotional, expose youth to light, and produce notifications that interrupt sleep. A systematic review has linked electronic media usage to poor sleep outcomes in children and adolescents (Lund et al., 2021). Furthermore, population evidence demonstrates that high screen time, irregular sleep routine and lower



Cover Page



feeling of being well rested are associated with each other (Zablotsky et al., 2025). Being low on sleep can lead to reduced levels of activity. Some of the reasons for this can include fatigue, mood disturbance, and others.

Another pathway of concern is musculoskeletal pain. Using smartphones and laptops in the long term can lead to sustained neck flexion, rounded shoulders and reduced postural variation and static loading. Our understanding of how posture influences pain can differ depending on how we measure posture. However, the development of adolescent digital lifestyles that reduce time spent moving and increase time spent in a static posture is likely to have biological effects that may contribute to pain, stiffness, and reluctance to take part in physical activity (Priftis & Panagiotakos, 2023).

7. Social Media, Gaming, and E-Learning Functions

7.1 Uses of Social Media

The impact of social media can be both method of risk and opportunity in physical activity. The risk pathways that were considered included scrolling passively, fear of missing out, appearance comparison, messaging late at night, and peer interaction that is active being displaced. Some teens may forgo sport or outdoor activity when validation online becomes the dominant mode of relationship with peers. Nonetheless, this social media page can also create exercise challenges and sport identities, peer encouragement as well as health promotion messages. The effect direction varies depending on the content and user motivation, interactive social norms, social interactions leading to off-line movements (Morningstar et al., 2023; Rutter et al., 2021).

7.2 Online Gaming and Streaming Activities

When playing on the console, mobile, or computer in a seated position, gaming and streaming are generally sedentary. Extended gaming sessions may lead to the reprimanding of sleep and active leisure; particularly in games that have rankings, live events or social pressure to stay online. Nonetheless, gaming is not universally sedentary. Playing active video games and exergames may expend more energy than when gaming while seated. Further, the active gaming forms might be a pathway for disengaged adolescents to participate in sport. According to Oh et al. (2022), when unstructured and free play happens often enough outdoors, the ability to supplement organized and unique play is stronger.

7.3 Internet-Based Education

Using screens to help with online learning is not this same as using screens for fun. Be that as it may, online classes and digital homework can raise total sitting time, reduce walking during school days and compress leisure time after classes. When screen time for academic purposes is added to recreational screen time and no scheduled movement breaks are enforced, health risk occurs. Consequently, each school must integrate these interventions into their screen-mediated learning design: a break for eye rest, ergonomic guidance and physical activity can help reduce fatigue.

7.4 Positive Digital Health Opportunities

When they are behaviourally designed to support autonomy, competence and social relatedness, digital tools can encourage activity. Fitness apps, wearable feedback, step counting challenges, online coaching, remote PE, active video games and social media campaigns can help set and monitor behaviours. Evidence from systematic reviews indicates interventions targeting both physical activity promotion and healthy digital media practices are more promising than simple restriction messages (Oh et al., 2022).

8. Gender, Age, Socioeconomic, and Environmental Factors

A wide variety of factors were found to influence the relationship between screen time and physical activity, including sex, age, socioeconomic position, family rules, school environment, peer culture, and neighbourhood context. The global surveillance reveals that adolescent girls are less active than adolescent boys as per the recommendations (Guthold et al., 2020). Factors like safety concerns, body image and peer norms will affect whether screen time displaces physical activity or not. Gendered expectations, access to sports and household responsibilities will also be a reason.



The impact of age matters. The academic workload, exam pressure, independent ownership of devices, online peer networks and sedentary leisure increase as adolescents transition from early to late adolescence. By virtue of being older adolescents, they already may be less likely to participate in organized sport if school demands, work, transport barriers or social media take up their activities (van Sluijs et al., 2021).

Socioeconomic context serves a dual purpose. Higher-income households may have greater access to devices and private internet which increases the opportunity for screen use but may offer organized sport, safe transport, and structured extra-curricular activity. Adolescents from lower-income backgrounds may have to contend with unsafe neighborhoods, reduced access to parks, inadequate opportunities for school-based sport, and overcrowded housing, which may mean that leisure time spent on a screen is the easiest recreation choice for them. Urbanization can enhance digital exposure, but it also diminishes safe informal play spaces. Thus, discipline-based guidance alone may be insufficient if communities do not offer safe, inclusive and affordable opportunities to move.

9. Adverse Health Effects

Adolescents' excessive use of screens for sedentary activities may influence their health. According to the experts, being on the phone for too long can cause obesity, decrease cardio-respiratory fitness, sleeping problems, mental-health problems, musculoskeletal pain, reduced face-to-face social interaction and long-term risk of non-communicable disease.

The adverse outcomes do not occur from screen exposure alone, but from clustered behaviours including low physical activity, sedentary behaviour, poor diet, short sleep duration, stress, and reduced outdoor time (Priftis & Panagiotakos, 2023; Stiglic & Viner, 2019).

The risk of obesity results from energy imbalance, sedentary time, food advertising, screen use snacking and decreased active leisure. A recent systematic review and dose-response meta-analysis indicated that screen time contributes to the increased risk of overweight and obesity among adolescents (Haghjoo et al., 2022). Cross-sectional evidence from US adolescents similarly supports screen time-related outcomes and obesity outcomes (Bakour et al., 2022).

There is a close relationship between mental health and outcomes. According to a study released this month, active children have better moods than their sedentary counterparts. Moreover, excessive screens may be bad for kids. Adolescents with high screen time for non-schoolwork activities are more likely to report low physical activity, irregular sleep routine, depression symptom, and anxiety symptom in a US national survey. (Zablotsky et al., 2025) Tandon et al. (2021), during the COVID-19 pandemic, more physical activity and less screen time were related to better mental health among US children and adolescents.

Table 2. Health effects of excessive screen time and sedentary digital behaviour among adolescents

Health domain	Likely pathway	Examples of observable indicators	Representative evidence
Physical activity and fitness	Time displacement, fatigue, reduced active commuting and sport participation	Low MVPA, reduced sports club attendance, low active transport, poor fitness tests	Haug (2025); van Sluijs et al. (2021); Dong et al. (2021)
Adiposity and metabolic risk	Sedentary time, snacking, energy imbalance, food marketing exposure	Higher BMI, weight concerns, overweight or obesity risk	Haghjoo et al. (2022); Bakour et al. (2022); Zablotsky et al. (2025)
Sleep and recovery	Delayed bedtime, arousal, notifications,	Short sleep, irregular sleep routine, tiredness,	Lund et al. (2021); Orben & Przybylski (2020); Zablotsky et al. (2025)



Health domain	Likely pathway	Examples of observable indicators	Representative evidence
	light exposure, irregular routines	poor school-day readiness	
Mental health	Lower activity, social comparison, FoMO, disrupted sleep, perceived isolation	Depressive symptoms, anxiety symptoms, poor emotional support	Rutter et al. (2021); Tandon et al. (2021); Wang & Peiper (2022)
Musculoskeletal comfort	Sustained sitting, neck flexion, low postural variation, repetitive hand use	Neck/shoulder discomfort, back pain, reduced willingness to move	Priftis & Panagiotakos (2023); Stiglic & Viner (2019)
Social and behavioural development	Reduced face-to-face interaction, family conflict, compulsive checking	Reduced social participation, difficulty regulating media use, lower offline peer activity	OECD (2025); UNICEF (2017); Young (1998)

10. Explanatory Theories

A multi-dimensional theoretical approach is necessary because screen time is not a single behaviour whereas physical activity is influenced by social, motivational, environmental and technologic contexts. There are five theoretical perspectives of particular relevance.

10.1 Displacement Theory

The displacement theory suggests time spent in sedentary digital pastimes displaces time spent in active play or sport, active transport, sleep, or household movement. This model is mostly persuasive for recreational and late-night screen use. However, it would be insufficient when used on its own. Not all adolescents with high screen exposure are inactive and not all inactive adolescents have excessive screen exposure.

10.2 Social Ecological Model

According to the social ecological model, adolescent movements are influenced by individual, interpersonal, school, community, and policy factors. A large body of research already exists on the influence of the following domains on healthy choice behaviour (Bronfenbrenner, 1979, Sallis et al. 2008) (individual, family, school, community, and policy). More specifically, research has shown the following: At the individual level, motivation and self-regulation influence behaviour. At the family level, parental modelling and digital rules shape behaviour. At the school level, physical education and screen-mediated instruction affect daily movement. At the community level, safe parks and transport enable activity. At the policy level, digital regulation, school health standards, and urban planning influence behaviour.

10.3 Self-Determination Theory

Self-determination theory explains why some adolescents use digital tools to engage actively while others prefer passively using media. Efforts towards change are likely to be more effective when they support people's autonomy, competence and relatedness rather than merely restricting or surveilling (Deci & Ryan, 2000). Digital health platforms can help support these requirements by self-chosen goals, feedback, peer encouragement and progressing on the basis of mastery.



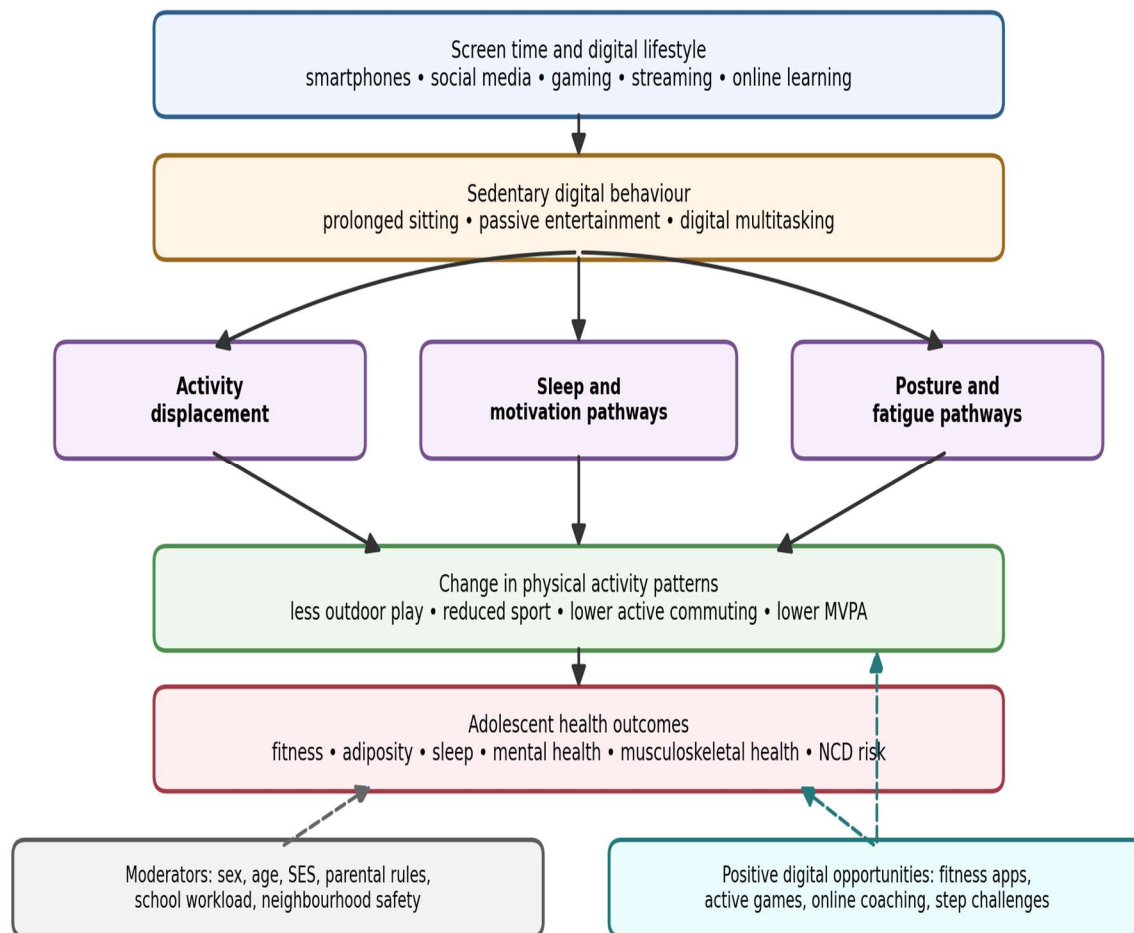
10.4 Behavioural Addiction Model

The behavioral addiction model applies when use becomes excessive, leading to an inability to regulate emotions or function. In such cases, duration is not the only concern but loss of control, craving, salience, tolerance, withdrawal-like distress, and interference with exercise, schoolwork, sleep, and family life (Young, 1998).

10.5 Health Behaviour Theory

Theories on health behaviour emphasize the importance of perceived benefits, barriers, cues to action, self-efficacy, social norms, reinforcement, and learning through observation. According to social cognitive theory, adolescents learn from their peers, influencers, family members, and online communities. Digital media can either normalise inactivity or model active lifestyles depending on the content and social reinforcement associated with it (Bandura, 1986).

Conceptual framework: screen time, sedentary behaviour, physical activity, and adolescent health



Note. MVPA = moderate-to-vigorous physical activity; SES = socioeconomic status; NCD = non-communicable disease.

Figure 1. Conceptual framework explaining pathways between screen time, sedentary digital behaviour, physical activity, and adolescent health outcomes.

11. Review of Literature

The literature indicates a consistent but heterogeneous relationship between screen exposure and adolescent physical activity. Table 1 summarizes selected genuine studies and authoritative sources relevant to screen time, sedentary behaviour, physical activity, and health outcomes. The table includes surveillance studies, cross-sectional studies, cohort analyses, systematic reviews, and guideline papers to reflect the breadth of available evidence.

Table 1. Summary of reviewed studies and authoritative evidence

Author/year	Country/region	Design and sample	Key findings	Relevance to this review
Tremblay et al. (2017)	International	Terminology consensus project	Provided consensus definitions for sedentary behaviour, physical inactivity, screen time, recreational screen time, sitting, and sedentary patterns.	Clarifies key concepts and prevents conflation of screen time with all sedentary time.
World Health Organization (2020)	Global	Public-health guideline for children, adolescents, adults, and older adults	Recommended average 60 minutes/day of MVPA for children and adolescents and limiting sedentary behaviour, especially recreational screen time.	Provides global benchmark for interpreting adolescent movement behaviour.
Chaput et al. (2020)	Global	Evidence summary for WHO guideline, ages 5-17 years	Summarized evidence supporting MVPA, vigorous activity, muscle/bone strengthening, and reduced sedentary behaviour in children and adolescents.	Links sedentary behaviour guidance with physical and mental health outcomes.
Guthold et al. (2020)	146 countries	Pooled analysis of 298 school-based surveys; 1.6 million adolescents aged 11-17 years	Approximately 81% of adolescents were insufficiently physically active; inactivity was higher among girls than boys.	Shows the global scale of adolescent inactivity into which digital lifestyle is embedded.
van Sluijs et al. (2021)	Global	Lancet review of adolescent physical activity behaviours	Identified persistent global inactivity and emphasized schools, digital/social environments, and urban design as intervention settings.	Frames screen use as one part of a wider adolescent activity ecology.
Dahlgren et al. (2021)	Sweden	Cross-sectional study; 121 adolescents/children aged 10-15 years with objective smartphone and activity measures	Did not find a clear association between objectively measured smartphone screen time and physical activity.	Demonstrates that screen modality and measurement method influence findings.
Dong et al. (2021)	China	Cross-sectional study; 10,002 adolescents	Television viewing and BMI were negatively associated with physical fitness; computer/video game time showed weaker associations.	Supports differentiation among screen types and physical fitness outcomes.
Tandon et al. (2021)	United States	Cross-sectional national survey; 1,000 children/adolescents aged 6-	More physical activity and less screen time were associated with better mental health during the COVID-19	Links screen time, activity, and mental health in a pandemic context.



Cover Page



Author/year	Country/region	Design and sample	Key findings	Relevance to this review
		17 years	pandemic.	
Nagata et al. (2022)	United States	Cross-sectional ABCD Study sample; adolescents aged 10-14 years	Reported high recreational screen use across streaming, gaming, social media, texting, video chat, and browsing during the pandemic.	Documents modality-specific adolescent screen patterns during a major digital shift.
Madigan et al. (2022)	International	Systematic review and meta-analysis; 46 studies and 29,017 youth	Screen time increased during the COVID-19 pandemic, especially among adolescents and handheld/personal computer use.	Shows population-level acceleration of digital exposure.
Hedderston et al. (2023)	United States	Cohort study; 228 children aged 4-12 years	Screen time increased during the pandemic and remained elevated after many restrictions were lifted.	Suggests digital behaviour changes may persist beyond acute disruptions.
Morningstar et al. (2023)	Canada	HBSC cross-sectional study; 12,358 students in grades 6-10	Non-active social media use was associated with lower odds of meeting physical activity recommendations; associations differed by social media-use pattern.	Shows that social media has heterogeneous links with activity domains.
Kim et al. (2023)	South Korea	National adolescent survey analysis; middle-school adolescents	Excessive Internet gaming and game-streaming were associated with lack of moderate-intensity exercise among male students.	Highlights sex-specific and gaming-related displacement.
Sanz-Martin et al. (2022)	Spain	Adolescent study examining physical activity, screen time, sleep, sex, and weekday/weekend differences	Physical activity, screen time, and sleep varied by sex and day of the week.	Supports time-use and sex-specific analysis rather than total screen-time generalization.
Wen et al. (2022)	China	Adolescent study in less-developed areas	Screen-related sedentary behaviours and physical activity were examined in relation to anxiety.	Connects screen inactivity patterns with mental-health outcomes in lower-resource contexts.
Rutter et al. (2021)	United States	Cross-sectional adolescent analysis	Social media use, physical activity, and internalizing symptoms were interrelated.	Supports integrated interpretation of screen use, activity, and mental health.
Wang and Peiper (2022)	United States	YRBS cross-sectional analysis; high school students	Physical activity and sports participation were inversely associated with depressive symptoms.	Shows combined relevance of movement and sedentary digital behaviour to adolescent mental

Author/year	Country/region	Design and sample	Key findings	Relevance to this review
			device/computer use was associated with higher depressive symptoms.	health.
Zablotsky et al. (2025)	United States	National Health Interview Survey-Teen; July 2021-Dec 2023	About half of teens reported 4+ hours/day of non-schoolwork screen time; high screen time was associated with infrequent physical activity, poor sleep, weight concerns, depression, and anxiety.	Provides recent population evidence linking high screen time to multiple adolescent health domains.
Haug (2025)	Norway	HBSC 2021/2022 cross-sectional study; 3,737 adolescents aged 11, 13, and 15 years	High screen-based media use was negatively associated with MVPA, sports club participation, and active commuting.	Directly supports the review focus on movement outcomes.
Priftis and Panagiotakos (2023)	International	Narrative review of health consequences of screen time	Excessive screen time was associated with obesity/cardiometabolic, mental-health, sleep, dietary, ocular, headache, and musculoskeletal concerns.	Summarizes broader health consequences relevant to adolescent physical activity displacement.



12. Discussion

A multi-dimensional theoretical approach is necessary because screen time is not a single behaviour whereas physical activity is influenced by social, motivational, environmental and technologic contexts. There are five theoretical perspectives of particular relevance.

12.1 Displacement Theory

The displacement theory suggests time spent in sedentary digital pastimes displaces time spent in active play or sport, active transport, sleep, or household movement. This model is mostly persuasive for recreational and late-night screen use. However, it would be insufficient when used on its own. Not all adolescents with high screen exposure are inactive and not all inactive adolescents have excessive screen exposure.

12.2 Social Ecological Model

According to the social ecological model, adolescent movements are influenced by individual, interpersonal, school, community, and policy factors. A large body of research already exists on the influence of the following domains on healthy choice behaviour (Bronfenbrenner, 1979, Sallis et al. 2008) (individual, family, school, community, and policy). More specifically, research has shown the following: At the individual level, motivation and self-regulation influence behaviour. At the family level, parental modelling and digital rules shape behaviour. At the school level, physical education and screen-mediated instruction affect daily movement. At the community level, safe parks and transport enable activity. At the policy level, digital regulation, school health standards, and urban planning influence behaviour.

12.3 Self-Determination Theory

Self-determination theory explains why some adolescents use digital tools to engage actively while others prefer passively using media. Efforts towards change are likely to be more effective when they support people's autonomy, competence and relatedness rather than merely restricting or surveilling (Deci & Ryan, 2000). Digital health platforms can help support these requirements by self-chosen goals, feedback, peer encouragement and progressing on the basis of mastery.

12.4 Behavioural Addiction Model

The behavioral addiction model applies when use becomes excessive, leading to an inability to regulate emotions or function. In such cases, duration is not the only concern but loss of control, craving, salience, tolerance, withdrawal-like distress, and interference with exercise, schoolwork, sleep, and family life (Young, 1998).

12.5 Health Behaviour Theory

Theories on health behaviour emphasize the importance of perceived benefits, barriers, cues to action, self-efficacy, social norms, reinforcement, and learning through observation. According to social cognitive theory, adolescents learn from their peers, influencers, family members, and online communities. Digital media can either normalise inactivity or model active lifestyles depending on the content and social reinforcement associated with it (Bandura, 1986).

Table 3. Recommendations for reducing sedentary digital behaviour and supporting adolescent physical activity

Stakeholder	Recommendation	Practical implementation	Evidence-informed rationale
Adolescents	Use planned digital routines and movement breaks.	Set screen-free activity blocks; stand and stretch every 30-60 minutes; replace one passive screen session with	Supports self-regulation and reduces uninterrupted sedentary bouts.



Cover Page



Stakeholder	Recommendation	Practical implementation	Evidence-informed rationale
		walking, sport, dance, cycling, or active play.	
Parents and caregivers	Model balanced device use and create family media rules.	Keep devices out of bedrooms at night; agree on recreational screen limits; encourage shared outdoor activity; avoid using screens as the only reward.	Family rules and modelling shape both screen behaviour and physical activity opportunities.
Schools	Design active digital learning environments.	Include movement breaks in online classes; maintain daily physical education; reduce unnecessary homework screen burden; provide safe sport and play options.	School is a high-reach setting for reducing sedentary time and increasing MVPA.
Healthcare professionals	Screen for movement, sleep, and digital habits together.	Ask about recreational screen time, bedtime device use, sport participation, active commuting, pain, sleep, mood, and family routines during adolescent visits.	Integrated counselling captures clustered behaviour risks rather than treating screen time alone.
Policy makers	Create environments where active choices are feasible.	Invest in safe parks, active transport, school sport, gender-inclusive activity programmes, and evidence-based digital media guidance.	Structural supports are necessary when inactivity is driven by safety, cost, or access barriers.
Digital health developers	Build technology that promotes movement rather than passive engagement.	Use privacy-protective activity prompts, social support, gamified step goals, inclusive content, and evidence-based coaching; avoid addictive design for youth.	Digital tools can support autonomy, competence, relatedness, and activity adherence.

13. Future Research Directions

Going forward, studies must change to look beyond total screen-time measures and towards screen modality, content, timing, posture, social context, and emotional dependence. Longitudinal studies are required to determine whether exposure to screens predicts future declines in MVPA, or if low levels of this activity lead to greater dependence on screens later on. Natural experiments like a school's smartphone policy and changes in digital learning requirements may allow a stronger causal inference.



The scope of objective measure must be broadened. Understanding when and how screen exposure displaces physical activity could be clarified through the combination of various new technologies. These include accelerometers, posture sensors, device-use logs, sleep trackers, and ecological momentary assessment. Nonetheless, these tools should be deployed with strong privacy protections for adolescents, clarity of consent, and data-minimization and careful data minimization.

The study of interventions must assess multicomponent approaches. Interventions with potential include family media planning, movement breaks in schools, walking and cycling to school programs, peer-led sport programs, bedroom device boundaries and digital health interventions. Studies should also take place in low- and middle-income settings as well as rural, urban informal settlements, and diverse populations with different access to technology, academic pressures, gender norms, and safety standards for play.

Next, future works should explore positive digital pathways. When designed to optimize adolescent autonomy and enjoyment, fitness apps, exergaming, online coaching, social media sport communities and remote PE can increase activity. The goal of future research should not only be to discover how to protect sleep, mental health, movement and social development from digital devices but also to design a system that will have these features.

14. Conclusion

Excessive time spent with screens on other recreational activities and physically inactive digital behaviour is an important correlate of reduced physical activity in adolescence, but the relationship is complex, the evidence shows. Exposure to screens may reduce movement through displacing activity, altering sleep patterns, increasing sedentary time, hijacking motivation reward pathways, and social-environmental constraints. Nonetheless, not all screen use is detrimental. The right use of academic screen time, health promotion platforms, online exercise resources and active video games may foster adolescent development when balanced with movement, sleep and offline social participation.

To avoid moral panic, a balanced public-health response should worry about routine design. Adolescents require measures to help them engage in mainly moderate-to-vigorous physical activity (MVPA) through structured opportunities for social and physical play, access to sport, active commuting, enabling school policies, purposeful family level digital boundaries, and digital tools that facilitate rather than displace movement.

The public health guidelines must differentiate between passive leisure screen sitting and active educational screen use. The focus is not on banishing technology from the lives of youths, but rather to prevent digital lifestyles from occupying other more productive movement behaviours that support physical, mental and social health.

References

- Bakour, C., Mansuri, F., Johns-Rejano, C., Crozier, M., Wilson, R., & Sappenfield, W. (2022). Association between screen time and obesity in US adolescents: A cross-sectional analysis using National Survey of Children's Health 2016-2017. *PLOS ONE*, 17(12), e0278490. <https://doi.org/10.1371/journal.pone.0278490>
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.
- Chaput, J.-P., Willumsen, J., Bull, F., Chou, R., Ekelund, U., Firth, J., Jago, R., Ortega, F. B., & Katzmarzyk, P. T. (2020). 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5-17 years: Summary of the evidence. *International Journal of Behavioral Nutrition and Physical Activity*, 17, 141. <https://doi.org/10.1186/s12966-020-01037-z>
- Dahlgren, A., Sjoblom, L., Eke, H., Bonn, S. E., & Trolle Lagerros, Y. (2021). Screen time and physical activity in children and adolescents aged 10-15 years. *PLOS ONE*, 16(7), e0254255. <https://doi.org/10.1371/journal.pone.0254255>



Cover Page



- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227-268. https://doi.org/10.1207/S15327965PLI1104_01
- Dong, X., Ding, L., Zhang, R., Ding, M., Wang, B., & Yi, X. (2021). Physical activity, screen-based sedentary behavior and physical fitness in Chinese adolescents: A cross-sectional study. *Frontiers in Pediatrics*, 9, 722079. <https://doi.org/10.3389/fped.2021.722079>
- Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1.6 million participants. *The Lancet Child & Adolescent Health*, 4(1), 23-35. [https://doi.org/10.1016/S2352-4642\(19\)30323-2](https://doi.org/10.1016/S2352-4642(19)30323-2)
- Haghjoo, P., Siri, G., Soleimani, E., Farhangi, M. A., & Alesaeidi, S. (2022). Screen time increases overweight and obesity risk among adolescents: A systematic review and dose-response meta-analysis. *BMC Primary Care*, 23, 161. <https://doi.org/10.1186/s12875-022-01761-4>
- Haug, E. (2025). Adolescents' screen-based media use and the relationship with moderate-to-vigorous physical activity, sports club participation and active commuting. *Scandinavian Journal of Public Health*, 53(1_suppl), 42-51. <https://doi.org/10.1177/14034948241293603>
- Hedderson, M. M., Bekelman, T. A., Li, M., Knapp, E. A., Palmore, M., Asiodu, I. V., Zhu, Y., & Elliott, A. J. (2023). Trends in screen time use among children during the COVID-19 pandemic, July 2019 through August 2021. *JAMA Network Open*, 6(2), e2256157. <https://doi.org/10.1001/jamanetworkopen.2022.56157>
- Kim, G., Jeong, H., & Yim, H. W. (2023). Associations between digital media use and lack of physical exercise among middle-school adolescents in Korea. *Epidemiology and Health*, 45, e2023012. <https://doi.org/10.4178/epih.e2023012>
- Lund, L., Solvhoj, I. N., Danielsen, D., & Andersen, S. (2021). Electronic media use and sleep in children and adolescents in western countries: A systematic review. *BMC Public Health*, 21, 1598. <https://doi.org/10.1186/s12889-021-11640-9>
- Madigan, S., Eirich, R., Pador, P., McArthur, B. A., & Neville, R. D. (2022). Assessment of changes in child and adolescent screen time during the COVID-19 pandemic: A systematic review and meta-analysis. *JAMA Pediatrics*, 176(12), 1188-1198. <https://doi.org/10.1001/jamapediatrics.2022.4116>
- Morningstar, B., Clayborne, Z., Wong, S. L., Roberts, K. C., Prince, S. A., Gariepy, G., Goldfield, G. S., Janssen, I., & Lang, J. J. (2023). The association between social media use and physical activity among Canadian adolescents: A Health Behaviour in School-aged Children (HBSC) study. *Canadian Journal of Public Health*, 114(4), 642-650. <https://doi.org/10.17269/s41997-023-00754-9>
- Nagata, J. M., Cortez, C. A., Cattle, C. J., Ganson, K. T., Iyer, P., Bibbins-Domingo, K., & Baker, F. C. (2022). Screen time use among US adolescents during the COVID-19 pandemic: Findings from the Adolescent Brain Cognitive Development (ABCD) Study. *JAMA Pediatrics*, 176(1), 94-96. <https://doi.org/10.1001/jamapediatrics.2021.4334>
- OECD. (2025). How's life for children in the digital age? OECD Publishing. <https://doi.org/10.1787/0854b900-en>
- Oh, C., Carducci, B., Vaivada, T., & Bhutta, Z. A. (2022). Interventions to promote physical activity and healthy digital media use in children and adolescents: A systematic review. *Pediatrics*, 149(Suppl 5), e2021053852I. <https://doi.org/10.1542/peds.2021-053852I>
- Orben, A., & Przybylski, A. K. (2020). Teenage sleep and technology engagement across the week. *PeerJ*, 8, e8427. <https://doi.org/10.7717/peerj.8427>
- Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., Arora, M., Azzopardi, P., Baldwin, W., Bonell, C., Kakuma, R., Kennedy, E., Mahon, J., McGovern, T., Mokdad, A. H., Patel, V., Petroni, S., Reavley, N., Taiwo, K., ... Viner, R. M. (2016). Our future: A Lancet commission on adolescent health and wellbeing. *The Lancet*, 387(10036), 2423-2478. [https://doi.org/10.1016/S0140-6736\(16\)00579-1](https://doi.org/10.1016/S0140-6736(16)00579-1)
- Priftis, N., & Panagiotakos, D. (2023). Screen time and its health consequences in children and adolescents. *Children*, 10(10), 1665. <https://doi.org/10.3390/children10101665>



Cover Page



- Rutter, L. A., Thompson, H. M., Howard, J., Riley, T. N., De Jesus-Romero, R., & Lorenzo-Luaces, L. (2021). Social media use, physical activity, and internalizing symptoms in adolescence: Cross-sectional analysis. *JMIR Mental Health*, 8(9), e26134. <https://doi.org/10.2196/26134>
- Sallis, J. F., Owen, N., & Fisher, E. B. (2008). Ecological models of health behavior. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research, and practice* (4th ed., pp. 465-486). Jossey-Bass.
- Sanz-Martin, D., Ubago-Jimenez, J. L., Ruiz-Tendero, G., Zurita-Ortega, F., Melguizo-Ibanez, E., & Puertas-Molero, P. (2022). The relationships between physical activity, screen time and sleep time according to the adolescents' sex and the day of the week. *Healthcare*, 10(10), 1955. <https://doi.org/10.3390/healthcare10101955>
- Shimoga, S. V., Erlyana, E., & Rebello, V. (2019). Associations of social media use with physical activity and sleep adequacy among adolescents: Cross-sectional survey. *Journal of Medical Internet Research*, 21(6), e14290. <https://doi.org/10.2196/14290>
- Stiglic, N., & Viner, R. M. (2019). Effects of screentime on the health and well-being of children and adolescents: A systematic review of reviews. *BMJ Open*, 9, e2023191. <https://doi.org/10.1136/bmjopen-2018-023191>
- Tandon, P. S., Zhou, C., Johnson, A. M., Gonzalez, E. S., & Kroshus, E. (2021). Association of children's physical activity and screen time with mental health during the COVID-19 pandemic. *JAMA Network Open*, 4(10), e2127892. <https://doi.org/10.1001/jamanetworkopen.2021.27892>
- Tremblay, M. S., Aubert, S., Barnes, J. D., Saunders, T. J., Carson, V., Latimer-Cheung, A. E., Chastin, S. F. M., Altenburg, T. M., Chinapaw, M. J. M., & SBRN Terminology Consensus Project Participants. (2017). Sedentary Behavior Research Network (SBRN) - Terminology Consensus Project process and outcome. *International Journal of Behavioral Nutrition and Physical Activity*, 14, 75. <https://doi.org/10.1186/s12966-017-0525-8>
- UNICEF. (2017). *The state of the world's children 2017: Children in a digital world*. United Nations Children's Fund.
- van Sluijs, E. M. F., Ekelund, U., Crochemore-Silva, I., Guthold, R., Ha, A., Lubans, D., Oyeyemi, A. L., Ding, D., & Katzmarzyk, P. T. (2021). Physical activity behaviours in adolescence: Current evidence and opportunities for intervention. *The Lancet*, 398(10298), 142-171. [https://doi.org/10.1016/S0140-6736\(21\)01259-9](https://doi.org/10.1016/S0140-6736(21)01259-9)
- Wang, C. H., & Peiper, N. (2022). Association between physical activity and sedentary behavior with depressive symptoms among US high school students, 2019. *Preventing Chronic Disease*, 19, 220003. <https://doi.org/10.5888/pcd19.220003>
- Wen, X., Zhu, F., Yuan, Z., & Mao, Z. (2022). Relationship between physical activity, screen-related sedentary behaviors and anxiety among adolescents in less developed areas of China. *Medicine*, 101, e30848. <https://doi.org/10.1097/MD.00000000000030848>
- World Health Organization. (2020). *WHO guidelines on physical activity and sedentary behaviour*. World Health Organization.
- Young, K. S. (1998). Internet addiction: The emergence of a new clinical disorder. *CyberPsychology & Behavior*, 1(3), 237-244. <https://doi.org/10.1089/cpb.1998.1.237>
- Zablotsky, B., Ng, A. E., Black, L. I., Haile, G., Bose, J., Jones, J. R., & Blumberg, S. J. (2025). Associations between screen time use and health outcomes among US teenagers. *Preventing Chronic Disease*, 22, 240537. <https://doi.org/10.5888/pcd22.240537>