



Article

MAPPING THE EVIDENCE ON YOGA-BASED INTERVENTIONS FOR PROBLEMATIC SMARTPHONE, INTERNET, AND GAMING USE: AN EVIDENCE GAP MAP

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Abstract

The rapid proliferation of smartphones, internet-enabled technologies, online gaming platforms, and social media has fundamentally transformed modern lifestyles while simultaneously introducing new public health challenges associated with problematic digital technology use. Excessive and uncontrolled engagement with digital devices has been linked to a broad spectrum of adverse psychological, behavioural, cognitive, academic, occupational, and social consequences, including increased levels of stress, anxiety, depression, sleep disturbances, impaired executive functioning, reduced attention, poor emotional regulation, diminished academic performance, and decreased overall quality of life. Adolescents, university students, young adults, and working professionals have emerged as particularly vulnerable populations because of their extensive dependence on digital technologies for education, communication, entertainment, and professional activities. Consequently, there is increasing interest in identifying effective, accessible, and non-pharmacological interventions capable of promoting healthier digital behaviors while improving psychological well-being. Yoga, a holistic mind-body practice integrating physical postures (asanas), breathing techniques (pranayama), meditation, mindfulness, relaxation practices, and philosophical principles, has gained substantial recognition as a complementary therapeutic intervention for improving self-regulation, emotional balance, attention, stress management, and overall mental health. Emerging evidence suggests that yoga may reduce excessive digital technology use by strengthening cognitive control, enhancing mindfulness, improving emotional resilience, reducing impulsivity, and promoting healthier behavioural patterns. However, the available evidence remains fragmented across diverse forms of problematic digital technology use, heterogeneous intervention approaches, varied study populations, and inconsistent outcome measures. This fragmentation makes it difficult for researchers, clinicians, educators, and policymakers to determine where sufficient evidence exists and where important knowledge gaps remain. The present Evidence Gap Map (EGM) aims to systematically map the existing evidence concerning yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. Specifically, this review seeks to identify the populations that have been investigated, classify the characteristics of yoga interventions, examine different forms of digital technology addiction addressed in the literature, summarize primary and secondary outcomes, evaluate dominant study designs, and identify areas with sufficient evidence alongside important research gaps requiring future investigation. The review adopts the Population, Intervention, Comparator, and Outcome (PICO) framework to guide evidence synthesis.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

and organizes findings using an EGM that maps various yoga interventions against clinical, behavioural, and psychological outcomes. The proposed EGM will provide a comprehensive overview of current research while supporting evidence-informed decision-making in healthcare, education, digital wellness, and behavioural medicine. By identifying both well-established evidence and under-researched areas, this review offers valuable guidance for future clinical trials, intervention development, educational programs, public health initiatives, and policy formulation. Ultimately, the findings are expected to contribute to the development of more effective yoga-based strategies for addressing problematic digital technology use while promoting healthier relationships with digital media and improving psychological well-being across diverse populations.

Keywords: Evidence Gap Map ; Yoga; Smartphone Addiction; Internet Addiction; Gaming Disorder; Social Media Addiction; Digital Technology Use; Screen Time; Mental Health; Mindfulness; Pranayama; Meditation; Behavioral Addiction; Self-Regulation; Digital Wellness.

INTRODUCTION

The unprecedented growth of digital technology during the past two decades has transformed nearly every aspect of human life (Schwab, 2017; Vial, 2019). Smartphones, high-speed internet, online gaming platforms, social networking services, streaming applications, and cloud-based communication technologies have become indispensable tools for education, employment, healthcare, commerce, entertainment, and interpersonal communication (Liao et al., 2023; Sparviero & Ragnedda, 2021). The increasing accessibility of affordable mobile devices and continuous internet connectivity has enabled individuals to remain digitally connected throughout the day, fundamentally changing patterns of learning, working, social interaction, and leisure activities (Dutta et al., 2023). While these technological advancements have generated substantial economic, educational, and social benefits, they have also contributed to a growing global concern regarding excessive and uncontrolled digital technology use and its impact on physical, psychological, cognitive, and social well-being (Busch & McCarthy, 2021; Elhai et al., 2020).

Problematic digital technology use has emerged as an important public health issue affecting individuals across all age groups, particularly adolescents, university students, young adults, and working professionals (Organization, 2022; Sohn et al., 2019). The term encompasses a broad range of maladaptive behaviors characterized by excessive, compulsive, or poorly regulated engagement with digital technologies despite experiencing negative personal, academic, occupational, or social consequences. These behaviors include problematic smartphone use, internet addiction, gaming disorder, excessive social media use, and prolonged recreational screen time. Although each condition possesses distinct behavioural characteristics, they share common psychological mechanisms including impaired self-control, compulsive engagement, reward-seeking behaviour, emotional dysregulation, attentional difficulties, and diminished executive functioning (Brand et al., 2014; Dong & Potenza, 2014). Increasing evidence suggests that excessive digital technology use is associated with elevated levels of stress, anxiety, depression, sleep disturbances, reduced academic performance, impaired workplace productivity, interpersonal relationship difficulties, decreased physical activity, and poorer overall quality of life (Demirci et al., 2015; Elhai et al., 2017).

Among the various forms of problematic digital technology use, smartphone addiction has attracted considerable attention because smartphones integrate multiple digital activities within a single portable device (Billieux, 2012; Montag & Walla, 2016). Continuous notifications, instant messaging applications, social networking platforms, online gaming, video streaming services, and unrestricted internet access encourage prolonged engagement and frequent device checking throughout the day (Oulasvirta et al., 2012; Stothart et al., 2015). Such behaviors may gradually develop into compulsive usage patterns characterized by withdrawal symptoms, tolerance, impaired concentration, reduced face-to-face communication, emotional dependency, and disruption of daily routines. Similar

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

concerns have been reported for excessive internet use, online gaming, and social media engagement, each of which has been linked to increased psychological distress and impaired psychosocial functioning. The recognition of Gaming Disorder by the World Health Organization in the International Classification of Diseases (ICD-11) further highlights the growing importance of behavioural addictions within contemporary healthcare (Rumpf et al., 2018).

The burden associated with problematic digital technology use extends beyond individual psychological symptoms and increasingly affects educational institutions, workplaces, healthcare systems, and society as a whole. Adolescents and university students often experience reduced academic achievement because excessive smartphone and internet use interferes with concentration, memory consolidation, classroom engagement, and effective study habits (Lepp et al., 2015; Samaha & Hawi, 2016). Working professionals may encounter reduced productivity, occupational stress, digital fatigue, and work–life imbalance arising from constant digital connectivity. Furthermore, prolonged screen exposure has been associated with disrupted sleep patterns, reduced physical activity, sedentary lifestyles, musculoskeletal discomfort, visual fatigue, and diminished social interaction. Collectively, these consequences illustrate the multidimensional nature of problematic digital technology use and emphasize the need for effective preventive and therapeutic interventions capable of addressing both behavioural dependence and associated psychological outcomes (Brand et al., 2014; Busch & McCarthy, 2021).

Current management approaches for problematic digital technology use primarily include psychoeducation, cognitive behavioural therapy (CBT), mindfulness-based interventions, counselling, digital detoxification programs, behavioural modification strategies, and lifestyle interventions (King et al., 2018; Zajac et al., 2017). Although these approaches have demonstrated varying degrees of effectiveness, challenges remain regarding accessibility, long-term adherence, scalability, cost, and sustained behavioural change. Pharmacological treatments have generally shown limited effectiveness because problematic digital technology use is primarily considered a behavioural rather than substance-related addiction. Consequently, increasing attention has shifted toward complementary and integrative health interventions capable of improving emotional regulation, self-awareness, cognitive control, stress resilience, and healthy behavioural habits without significant adverse effects (Ashok et al., 2020; Ratna, n.d.).

Yoga has emerged as one of the most promising complementary approaches within this context because of its holistic integration of physical, psychological, and behavioural practices (Cramer et al., 2013). Originating thousands of years ago, yoga extends beyond physical exercise and encompasses an integrated system promoting harmony between the body, mind, and emotional well-being. Traditional yoga practice incorporates physical postures (asanas), controlled breathing techniques (pranayama), meditation, mindfulness, relaxation practices, ethical principles, and self-awareness exercises designed to cultivate balanced physical and psychological functioning. Contemporary scientific research increasingly supports the effectiveness of yoga for reducing stress, anxiety, depression, emotional distress, sleep disturbances, and cognitive impairment while improving attention, executive functioning, emotional regulation, resilience, and overall quality of life. These therapeutic mechanisms closely correspond with many of the psychological processes implicated in problematic digital technology use (Gard et al., 2014; Telles et al., 2012).

Several theoretical explanations support the potential role of yoga in reducing behavioural addictions associated with excessive technology use (Streeter et al., 2012). Regular yoga practice has been shown to strengthen attentional control, reduce impulsivity, enhance mindfulness, improve autonomic nervous system regulation, decrease physiological stress responses, and increase awareness of habitual behaviors. Controlled breathing exercises activate parasympathetic nervous system activity, promoting relaxation and reducing emotional reactivity that frequently contributes to compulsive digital engagement (Brown & Gerbarg, 2005; Jerath et al., 2006). Meditation and mindfulness practices cultivate present-moment awareness, enabling individuals to recognize cravings, automatic

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

behavioural responses, and maladaptive usage patterns before they result in excessive technology use. Physical postures simultaneously improve physical health, reduce sedentary behaviour, and encourage healthier lifestyle habits that may indirectly decrease dependence on digital devices. Collectively, these mechanisms suggest that yoga may address both the behavioural symptoms and underlying psychological determinants of problematic smartphone, internet, gaming, and social media use (Gard et al., 2014; Ratna, n.d.).

Research investigating yoga-based interventions for problematic digital technology use has expanded steadily during recent years. Studies have examined integrated yoga programs, Hatha Yoga, Raja Yoga, Ashtanga Yoga, Iyengar Yoga, Kundalini Yoga, pranayama, meditation, mindfulness-based yoga, and integrated yoga therapy across diverse participant populations (Feuerstein, 2012; Woodyard, 2011). These investigations have evaluated multiple outcomes, including smartphone addiction, internet addiction, gaming disorder, social media addiction, screen time, stress, anxiety, depression, sleep quality, emotional regulation, self-control, executive functioning, academic performance, and quality of life. However, the available literature remains highly heterogeneous regarding intervention characteristics, participant demographics, comparator groups, methodological quality, outcome measures, and study design. Consequently, the current evidence base is fragmented, making it challenging to determine which intervention approaches demonstrate the strongest evidence, which outcomes have been most extensively investigated, and where significant knowledge gaps persist (Miakel-Lye et al., 2016; Organization, 2023).

Evidence Gap Map's (EGMs) have emerged as valuable evidence synthesis tools capable of systematically organizing broad and heterogeneous research landscapes. Unlike conventional systematic reviews that primarily evaluate intervention effectiveness, EGMs provide a visual representation of the distribution of available evidence by mapping interventions against outcomes while simultaneously identifying areas with abundant evidence and important research gaps (Snilstveit et al., 2016). This approach enables researchers, clinicians, educators, funding agencies, and policymakers to prioritize future research, avoid unnecessary duplication, support evidence-informed decision-making, and allocate resources more efficiently. In rapidly evolving interdisciplinary fields such as digital health and complementary medicine, EGM's provide an especially useful framework for understanding complex bodies of literature characterized by multiple intervention types, diverse populations, and varied outcome measures (Saran & White, 2018).

The present EGM addresses this important need by systematically mapping the available evidence concerning yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. The review examines diverse yoga modalities, multiple participant populations, comparator interventions, psychological and behavioural outcomes, and methodological characteristics while identifying areas where robust evidence already exists and where future investigation remains necessary (Page et al., 2021). By synthesizing evidence across behavioural medicine, digital health, psychology, education, and complementary healthcare, this review seeks to establish a comprehensive foundation for future clinical research, intervention development, educational practice, and health policy (Miakel-Lye et al., 2016; Snilstveit et al., 2016).

Ultimately, understanding the current evidence landscape is essential for developing effective, evidence-based strategies capable of addressing the growing burden of problematic digital technology use. As digital technologies continue to become increasingly integrated into everyday life, interventions promoting healthier patterns of technology engagement, improved self-regulation, enhanced psychological well-being, and balanced digital lifestyles will become progressively more important. Yoga, with its holistic emphasis on physical, mental, and emotional health, represents a promising non-pharmacological approach that may contribute significantly to addressing one of the most pressing behavioural health challenges of the digital era (Ashok et al., 2020; Gard et al., 2014; Woodyard, 2011).

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

2. Background

The digital revolution has fundamentally reshaped human behaviour, communication, education, employment, healthcare, and entertainment (Schwab, 2017; Van Dijk, 2020). The widespread adoption of smartphones, high-speed internet services, online gaming platforms, and social networking applications has generated unprecedented opportunities for information exchange and global connectivity. According to international estimates, billions of individuals worldwide now use smartphones and internet-based technologies daily, making digital devices an essential component of modern life. Educational institutions increasingly rely on digital learning environments, workplaces have adopted hybrid and remote working models supported by online communication platforms, and healthcare organizations utilize telemedicine and mobile health technologies to improve service delivery (Wang et al., 2021). While these technological advancements have substantially enhanced convenience and productivity, they have simultaneously contributed to increasing concerns regarding excessive digital engagement and the emergence of problematic patterns of technology use that adversely affect physical, psychological, and social well-being (Elhai et al., 2017; Sohn et al., 2019).

Problematic digital technology use has evolved into a multifaceted behavioural health concern characterized by excessive, uncontrolled, and compulsive interaction with digital devices despite experiencing negative personal, academic, occupational, or interpersonal consequences (Aarseth et al., 2017; Kumalaratih & Margono, 2023). Unlike ordinary or professionally required technology use, problematic use is distinguished by impaired self-regulation, diminished behavioural control, persistent preoccupation with digital activities, withdrawal symptoms during periods of reduced access, tolerance requiring increasing engagement, and continuation of excessive use despite awareness of harmful effects. Researchers have described this phenomenon using various terms including smartphone addiction, problematic smartphone use, internet addiction, problematic internet use, gaming disorder, problematic gaming, social media addiction, excessive screen time, and digital dependence. Although these conditions differ in specific behavioural manifestations, they share common psychological characteristics involving compulsive behaviour, emotional dysregulation, impaired executive functioning, reward-seeking tendencies, and maladaptive coping strategies (Brand et al., 2014, 2019).

Among these behavioural conditions, smartphone addiction has become one of the most extensively investigated because smartphones combine multiple digital activities within a single portable platform (Billieux, 2012; Montag & Walla, 2016). Modern smartphones provide continuous access to messaging applications, email, social networking platforms, online gaming, streaming services, digital commerce, educational resources, navigation systems, and workplace communication tools. Continuous notifications, personalized content algorithms, infinite scrolling interfaces, and instant communication encourage repetitive device checking and prolonged daily usage (Alter, 2018; Oulasvirta et al., 2012; Stothart et al., 2015). Over time, excessive engagement may interfere with academic performance, occupational productivity, interpersonal relationships, physical activity, sleep quality, and psychological health. Individuals experiencing problematic smartphone use frequently report difficulties controlling device use, anxiety when separated from their phones, reduced concentration, impaired face-to-face communication, and diminished engagement in offline activities (Busch & McCarthy, 2021; Panova & Carbonell, 2018).

Internet addiction similarly represents a growing global concern as internet accessibility continues to expand through mobile technologies, broadband services, and public wireless networks (Brand et al., 2014, 2019; Liao et al., 2023). Excessive internet use encompasses compulsive engagement with online browsing, entertainment, social networking, information seeking, shopping, gambling, and other web-based activities that progressively replace healthy daily routines and meaningful interpersonal interactions. Numerous studies have associated problematic internet use with increased levels of depression, anxiety, loneliness, emotional instability, poor academic achievement, occupational impairment, and reduced life satisfaction. Adolescents and university students appear

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

particularly vulnerable because digital technologies are deeply integrated into educational activities, social relationships, and recreational experiences during critical developmental period(Kuss & Lopez-Fernandez, 2016; Sohn et al., 2019)s.

Gaming disorder has received increasing scientific and clinical attention following its formal recognition by the World Health Organization in the International Classification of Diseases (ICD-11). Gaming disorder is characterized by impaired control over gaming behaviour, increasing prioritization of gaming over other daily activities, and continuation of gaming despite significant negative consequences affecting educational achievement, employment, family relationships, physical health, and psychological well-being. Although recreational gaming provides entertainment, cognitive stimulation, and social interaction for millions of individuals, persistent excessive gaming may lead to emotional dysregulation, sleep deprivation, sedentary behaviour, attention deficits, impulsivity, social isolation, and reduced quality of life. The rapid expansion of multiplayer online games, competitive esports, and mobile gaming applications has further increased exposure among adolescents and young adults, making gaming disorder an important area of behavioural addiction research(Király et al., 2020; Stevens et al., 2021).

Social media addiction has emerged alongside the exponential growth of digital communication platforms(Andreassen, 2015). Social networking applications are specifically designed to maximize user engagement through personalized content recommendations, algorithm-driven news feeds, social reinforcement mechanisms, and continuous interaction opportunities. Although these platforms facilitate communication, education, professional networking, and community engagement, excessive use has been associated with increased psychological distress, fear of missing out (FOMO), reduced self-esteem, body image concerns, cyberbullying, emotional dependency, and sleep disturbances. Continuous exposure to highly curated online environments may also contribute to anxiety, depression, and impaired emotional well-being, particularly among adolescents and young adults whose social identities continue to develop(Abi-Jaoude et al., 2020; Vannucci et al., 2017).

Excessive screen time represents another important dimension of problematic digital technology use(Stiglic & Viner, 2019; Twenge & Campbell, 2018). Screen exposure extends beyond smartphones and includes computers, tablets, gaming consoles, televisions, wearable technologies, and other digital devices. Prolonged recreational screen time has been associated with physical inactivity, obesity, musculoskeletal discomfort, visual fatigue, disrupted circadian rhythms, impaired sleep quality, reduced outdoor activity, and diminished opportunities for face-to-face social interaction. Increasing evidence suggests that prolonged screen exposure may also contribute indirectly to psychological distress through reduced physical exercise, decreased mindfulness, impaired emotional regulation, and chronic cognitive overload resulting from continuous digital stimulation(Montag & Walla, 2016; Twenge & Campbell, 2018).

The growing prevalence of problematic digital technology use has stimulated considerable interest in identifying effective interventions capable of addressing both behavioural symptoms and their underlying psychological mechanisms. Conventional treatment approaches include psychoeducation, behavioural counselling, cognitive behavioural therapy (CBT), motivational interviewing, digital detoxification programs, family-based interventions, mindfulness-based interventions, and educational programs promoting responsible technology use(King et al., 2018; Stevens et al., 2019). Although many of these approaches demonstrate beneficial effects, long-term adherence and sustained behavioural change remain challenging because digital technologies have become deeply embedded within everyday life. Consequently, there is increasing recognition that successful interventions should strengthen self-regulation, emotional resilience, cognitive flexibility, attentional control, and healthy coping strategies rather than focusing exclusively on restricting technology access(Bowen et al., 2014; Brand et al., 2019; Gard et al., 2014).

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Yoga has attracted growing attention as one such holistic intervention because it addresses multiple psychological and physiological mechanisms implicated in problematic digital technology use. Traditionally originating within ancient Indian philosophy, yoga represents a comprehensive system integrating physical postures (asanas), breathing practices (pranayama), meditation, relaxation techniques, mindfulness, ethical principles, and self-awareness (Feuerstein, 2012; Iyengar, 1965). Unlike interventions targeting isolated behavioural symptoms, yoga seeks to cultivate harmony between physical, mental, emotional, and spiritual dimensions of health. Modern scientific research increasingly supports yoga's effectiveness for reducing stress, anxiety, depression, emotional dysregulation, sleep disturbances, autonomic nervous system imbalance, and cognitive impairment while enhancing attention, executive functioning, self-control, emotional resilience, and overall psychological well-being (Gothe & McAuley, 2015; Streeter et al., 2012).

Several neurobiological and psychological mechanisms explain why yoga may be particularly relevant for managing problematic digital technology use. Regular yoga practice improves autonomic nervous system regulation by increasing parasympathetic activity and reducing chronic sympathetic activation associated with stress and compulsive behaviors. Controlled breathing exercises decrease physiological arousal while improving emotional stability and resilience. Meditation strengthens attentional control, promotes mindfulness, reduces automatic behavioural responses, and enhances awareness of habitual thought patterns. Physical postures improve body awareness, encourage physical activity, reduce sedentary behaviour, and promote healthier daily routines. Collectively, these mechanisms strengthen executive functioning, impulse control, emotional regulation, and self-awareness—psychological capacities frequently impaired among individuals experiencing excessive digital technology use (Brand et al., 2014; Gard et al., 2014).

Research examining yoga-based interventions has expanded considerably across diverse populations. Adolescents, university students, young adults, working professionals, and adults experiencing problematic smartphone use, internet addiction, gaming disorder, or excessive screen time have participated in investigations evaluating integrated yoga programs, Hatha Yoga, Raja Yoga, Ashtanga Yoga, Iyengar Yoga, Kundalini Yoga, pranayama, meditation, mindfulness-based yoga, and integrated yoga therapy. Outcomes assessed across these studies include reductions in smartphone addiction, internet addiction, gaming disorder symptoms, social media dependence, screen time, stress, anxiety, depression, sleep disturbances, and improvements in emotional regulation, attention, self-control, executive functioning, quality of life, and academic performance. However, methodological diversity across interventions, participant characteristics, outcome measures, comparator groups, and study designs has produced a fragmented body of evidence that remains difficult to interpret comprehensively (Cumpston et al., 2022; Tarsilla, 2010).

This fragmentation highlights the importance of conducting an EGM (EGM) rather than a conventional effectiveness review. EGM's systematically organize existing research by mapping interventions against outcomes while simultaneously identifying areas where evidence is abundant and areas where little or no evidence exists. Such mapping provides researchers with a comprehensive overview of the scientific landscape, enabling identification of research priorities, methodological deficiencies, underrepresented populations, and promising intervention strategies. Healthcare professionals, educators, funding agencies, and policymakers similarly benefit from EGM's because they facilitate evidence-informed decision-making and support efficient allocation of research and healthcare resources (Snilstveit et al., 2016; White et al., 2020).

Within the rapidly evolving field of digital behavioural health, an EGM focusing specifically on yoga-based interventions for problematic smartphone, internet, gaming, and social media use has not yet been comprehensively developed. Given the increasing prevalence of behavioural addictions associated with digital technology, together with growing interest in non-pharmacological mind-body interventions, systematically mapping the available evidence represents an important step toward advancing both scientific understanding and practical implementation. Such an evidence synthesis will

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

clarify the current distribution of research across populations, intervention types, digital addiction categories, comparator interventions, study designs, and outcome measures while identifying critical knowledge gaps that should guide future clinical research, public health initiatives, educational programs, and policy development (Miakel-Lye et al., 2016; White et al., 2020).

Consequently, the present EGM seeks to provide a comprehensive and structured overview of yoga-based interventions targeting problematic digital technology use. By systematically organizing the available literature and identifying both evidence-rich and evidence-deficient areas, this review aims to establish a robust foundation for future research while supporting the development of effective, evidence-based strategies capable of promoting healthier digital behaviors and improving psychological well-being in an increasingly technology-dependent world (Gard et al., 2014; Miakel-Lye et al., 2016; Snilstveit et al., 2016).

3. RATIONALE

Digital technology has revolutionised communication, education, healthcare, entertainment, commerce, and professional productivity. Smartphones, internet platforms, online gaming environments, and social media apps are now part of daily life, enabling unprecedented global connectivity and information exchange. Alongside these technological advances, problematic digital technology use has emerged as a major behavioural health issue affecting all ages. Smartphone, internet, online gaming, and social media use has been linked to negative psychological, cognitive, behavioural, academic, occupational, and social outcomes, making it a growing concern for healthcare professionals, educators, researchers, and policymakers worldwide (Keles et al., 2020; Kuss & Lopez-Fernandez, 2016).

Problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time have become increasingly prevalent, particularly among adolescents, university students, young adults, and working professionals. These conditions are characterized by impaired self-regulation, compulsive behavioural patterns, diminished executive functioning, emotional dysregulation, reduced attentional control, and persistent technology use despite significant negative consequences. Numerous studies have demonstrated associations between problematic digital technology use and increased stress, anxiety, depression, sleep disturbances, loneliness, reduced academic achievement, occupational burnout, impaired interpersonal relationships, decreased physical activity, and diminished overall quality of life (Busch & McCarthy, 2021; Demirci et al., 2015). As digital technologies continue to evolve and become further embedded within educational systems, workplaces, healthcare services, and everyday social interactions, the prevalence and complexity of these behavioural conditions are expected to increase, emphasizing the need for effective, scalable, and evidence-based intervention strategies (Brand et al., 2019; Gard et al., 2014; Wang et al., 2021).

Conventional approaches for addressing problematic digital technology use primarily include cognitive behavioural therapy, psychoeducation, behavioural modification programs, counselling, mindfulness-based interventions, digital detoxification strategies, family-based interventions, and educational campaigns promoting responsible technology use. Although these interventions have demonstrated varying degrees of effectiveness, important limitations remain regarding accessibility, long-term adherence, sustainability, cost, and scalability. Furthermore, many existing interventions focus primarily on reducing digital exposure rather than strengthening the psychological capacities required for healthy self-regulation and balanced technology use. Consequently, increasing attention has shifted toward complementary and integrative health approaches capable of simultaneously addressing emotional regulation, cognitive functioning, stress management, behavioural control, and overall psychological well-being (Cramer et al., 2013; Streeter et al., 2012).

Yoga has emerged as one of the most promising non-pharmacological interventions within this context because it provides a comprehensive mind-body approach capable of influencing multiple psychological and physiological processes implicated in behavioural addictions (Field, 2016). Unlike

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

interventions targeting isolated symptoms, yoga integrates physical postures, controlled breathing practices, meditation, mindfulness, relaxation techniques, and self-awareness exercises that collectively promote emotional balance, attentional control, resilience, cognitive flexibility, and healthy behavioural regulation. Growing scientific evidence suggests that yoga may reduce psychological distress, improve executive functioning, enhance emotional regulation, strengthen self-control, improve sleep quality, and reduce physiological stress responses, all of which represent important mechanisms contributing to problematic digital technology use. These therapeutic characteristics position yoga as a potentially valuable intervention capable of addressing both the symptoms and underlying determinants of excessive digital engagement (Field, 2016; Gard et al., 2014).

During the past decade, research examining yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time has expanded considerably. Investigators have evaluated diverse yoga modalities, including integrated yoga programs, Hatha Yoga, Raja Yoga, Ashtanga Yoga, Iyengar Yoga, Kundalini Yoga, pranayama, meditation, mindfulness-based yoga, and integrated yoga therapy across a variety of participant populations (Elwy et al., 2014). Studies have explored numerous psychological, behavioural, physiological, and cognitive outcomes while employing different research methodologies, intervention durations, comparator groups, and measurement instruments. Despite this increasing body of literature, the available evidence remains highly fragmented across multiple disciplines including psychology, psychiatry, behavioural medicine, public health, digital health, complementary medicine, rehabilitation sciences, education, and neuroscience (Leach & Veziani, 2022, 2022; Shah et al., 2023).

The fragmented nature of the current evidence presents several important challenges. First, it remains unclear which forms of problematic digital technology use have been most extensively investigated using yoga-based interventions. Although smartphone addiction and internet addiction appear frequently within the literature, comparatively less evidence may exist regarding gaming disorder, social media addiction, or excessive recreational screen time. Without systematic mapping of the available evidence, researchers cannot accurately determine which behavioural conditions possess sufficient scientific support and which remain under-investigated (Miake-Lye et al., 2016; White et al., 2020).

Second, considerable uncertainty exists regarding the populations that have been studied. Adolescents, university students, young adults, working professionals, and adults experiencing problematic digital technology use represent distinct populations with unique psychological, developmental, educational, and occupational characteristics. Understanding whether existing research adequately represents these diverse groups is essential for evaluating the generalizability of current evidence and identifying populations requiring greater research attention. Furthermore, differences in age, educational background, occupational demands, cultural context, and digital behaviour may influence both intervention effectiveness and implementation strategies (Busch & McCarthy, 2021; Kuss & Lopez-Fernandez, 2016).

Third, substantial variation exists in the characteristics of yoga interventions employed across studies. Investigations differ considerably regarding yoga style, intervention duration, session frequency, instructor supervision, integration of breathing exercises and meditation, home practice requirements, and delivery format. Such heterogeneity complicates interpretation of intervention effectiveness while making it difficult to determine which yoga approaches demonstrate the greatest potential for addressing problematic digital technology use. Mapping intervention characteristics therefore represents an important step toward identifying promising therapeutic models and informing the design of future clinical trials (Cramer et al., 2013; Sherman, 2012).

Another important consideration involves the diversity of outcomes assessed within existing research. While some investigations focus primarily on behavioural indicators such as smartphone addiction

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

severity, internet addiction scores, gaming frequency, or daily screen time, others emphasize secondary psychological outcomes including stress, anxiety, depression, sleep quality, emotional regulation, attention, executive functioning, self-control, academic performance, and quality of life. Understanding the distribution of outcome measures across the literature is essential for identifying evidence-rich areas while recognizing domains requiring additional investigation. Such information will assist researchers in developing standardized outcome frameworks capable of improving methodological consistency across future studies(White et al., 2020; Williamson et al., 2017).

The diversity of research methodologies further strengthens the rationale for conducting an EGM's . Existing investigations include randomized controlled trials, quasi-experimental studies, controlled clinical trials, pilot studies, and other experimental designs. However, the relative distribution of these methodologies remains unclear, making it difficult to assess the overall maturity of the evidence base. Mapping study designs alongside intervention types and outcomes will provide valuable insight into the methodological strengths and weaknesses of current research while guiding future investments in high-quality clinical studies(Miake-Lye et al., 2016).

An EGM (EGM) is particularly appropriate for addressing these challenges because it provides a structured and visual synthesis of broad, heterogeneous evidence. Unlike conventional systematic reviews that primarily evaluate intervention effectiveness, EGMs organize research by mapping interventions against outcomes while simultaneously illustrating the quantity, distribution, and methodological characteristics of the available evidence. This approach enables rapid identification of evidence-rich areas where systematic reviews or meta-analyses may be appropriate, alongside evidence-deficient areas requiring primary research. Consequently, EGMs support strategic research prioritization, reduce duplication of effort, and facilitate evidence-informed decision-making across research, clinical practice, education, and health policy(Miake-Lye et al., 2016; White et al., 2020).

Thus, the EGM organises yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. Synthesising evidence across diverse populations, intervention types, comparator groups, outcomes, and study designs will provide a comprehensive overview of current research and identify important gaps for future study. This structured mapping approach will help researchers identify robust evidence, clinical trial needs, and novel intervention approaches (Miake-Lye et al., 2016).

The findings of this EGM are expected to have significant implications for multiple stakeholder groups. Researchers will benefit from a comprehensive understanding of current evidence distribution, methodological limitations, and future research priorities. Healthcare professionals will gain insight into the potential role of yoga within multidisciplinary management strategies for problematic digital technology use. Educational institutions may utilize the findings to develop preventive wellness programs addressing excessive technology use among students. Employers may apply evidence from the review to support workplace wellness initiatives aimed at reducing digital fatigue and improving employee well-being. Policymakers and funding agencies will also benefit from identifying priority areas requiring investment, thereby promoting efficient allocation of research resources and informed development of public health strategies(Snilstveit et al., 2016; White et al., 2020).

Ultimately, this EGM is undertaken because a comprehensive synthesis of yoga-based interventions for problematic digital technology use has not previously been conducted despite the rapidly expanding literature and increasing global importance of digital behavioural health. By systematically identifying evidence strengths, methodological limitations, and research gaps, the review seeks to establish a robust scientific foundation for future intervention development, clinical implementation, educational practice, and policy formulation. In doing so, it contributes to the growing body of knowledge supporting holistic, evidence-based, and non-pharmacological approaches for promoting healthier digital behaviors and improving psychological well-being within an increasingly technology-dependent society(Brinsley et al., 2021; Gard et al., 2014).

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

4. AIM

To systematically map the evidence on yoga-based interventions for problematic digital technology use and identify key research gaps.

5. Objectives

- To identify the populations and forms of problematic digital technology use investigated.
- To classify the yoga interventions and their characteristics.
- To map the behavioural, psychological, cognitive, and functional outcomes assessed.
- To identify evidence-rich areas, methodological patterns, and research gaps.

6. RESEARCH QUESTIONS

- What populations have been studied in yoga-based interventions for problematic digital technology use?
- What forms of problematic digital technology use have been investigated?
- What types of yoga-based interventions have been studied?
- What outcomes have been assessed following yoga-based interventions?
- What study designs and methodological characteristics are represented?
- Where are the major evidence gaps requiring further research?

7. PICO Framework

This EGM defines evidence synthesis scope transparently using the Population, Intervention, Comparator, and Outcome (PICO) framework. Even though EGM's are meant to map the breadth of available research rather than evaluate intervention effectiveness, the PICO framework is still an important methodological tool because it sets clear eligibility criteria, supports literature screening and data extraction consistency, and organises evidence across interventions and outcomes. The framework clearly defines the populations of interest, yoga-based interventions, comparator groups, and outcome measures to ensure that the review exhaustively covers yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time while maintaining methodological rigour and reproducibility.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map



Figure 1: PICO Framework

This review includes problem digital users or those at risk from daily device use. Most studies target teens, college students, young adults, professionals, and digitally challenged adults. Teens' cognitive, emotional, and social development and heavy use of smartphones, online gaming, and social media for communication, education, and entertainment make them vulnerable. University students are prone to screen time, smartphone addiction, and internet addiction due to academic learning, virtual classrooms, online assessments, social media, and recreational internet use. Digital fatigue, work–life balance, and constant connectivity are unique challenges for young adults and working professionals who use technology for work, remote work, professional communication, and productivity. To represent all populations studied, the EGM includes adults with problematic digital technology use, such as excessive smartphone use, compulsive internet browsing, gaming disorder, or social media addiction. This group covers yoga-based developmental, educational, occupational, and behavioural health interventions.

Yoga addresses the psychological and behavioural effects of problematic digital technology use. Given the diversity of yoga traditions in scientific research, the review includes many intervention modalities. Hatha, Raja, Ashtanga, and Iyenga Yoga improve physical and mental health through physical postures and controlled breathing. Raja Yoga emphasises meditation, concentration, self-discipline, and mental regulation. Pranayama, meditation, mindfulness-based yoga, and integrated yoga therapy are also reviewed as behavioural health interventions. Understand intervention characteristics by documenting duration, session frequency, supervision, delivery settings, instructor expertise, and home practice requirements across the literature.

The comparator compares yoga interventions to clinical and behavioural research controls. Health education, where participants learn about healthy digital behaviours or lifestyle modification without yoga; exercise, comparing yoga to conventional physical activity interventions; and mindfulness, differentiating b. The wide range of comparator conditions allows yoga intervention evaluations to be

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

mapped to behavioural, educational, and therapeutic approaches and shows the diversity of research methods in the evidence base.

Outcomes include primary behavioural and secondary psychological, cognitive, and functional effects of excessive digital engagement. Yoga fights screen time, internet, gaming, social media, and smartphone addictions. These findings examine technology addiction, dependency severity, digital engagement duration, and device-related behavioural regulation. These primary outcomes must be assessed to determine how yoga interventions directly affect problematic digital behaviours.

Problematic digital technology use affects mental health, cognition, well-being, and behaviour. These include stress, anxiety, depression, sleep, emotional regulation, attention, self-control, executive functioning, quality of life, and academic performance. These findings show that problematic smartphone use, internet addiction, gaming disorder, and excessive screen time affect emotional stability, cognitive performance, educational achievement, occupational functioning, interpersonal relationships, and physical health beyond behavioural symptoms. Mapping primary and secondary outcomes shows yoga's healing potential's well- and understudied areas.

PICO improves this EGM's method. Literature identification and study selection boundaries start review consistency. Second, comparing participant characteristics, intervention modalities, comparator conditions, and outcome measures across studies standardises data extraction. Third, the framework visualises EGM evidence distribution across research by organising interventions and outcomes. Finally, the PICO framework replicates review methodology, updates the evidence base, and lets future researchers compare findings across related evidence syntheses.

This PICO-based EGM combines diverse participant populations, multiple yoga intervention modalities, many comparator conditions, and comprehensive behavioural and psychological outcomes. The systematic review presents yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time, along with new clinical research, educational practice, and public health policy priorities.

8. METHODS

This EGM (EGM) identified, organised, and mapped yoga-based interventions for problematic digital technology use literature through transparent evidence synthesis. This review examined the breadth and distribution of evidence and found significant research and evidence gaps, unlike intervention effectiveness-focused systematic reviews. Review methodology ensured methodological rigour, reproducibility, and transparency to identify studies on problematic digital technology use, yoga intervention modalities, participant populations, and psychological and behavioural outcomes.

International evidence synthesis and EGM's ping were used. With PRISMA-ScR and JBI Manual for Evidence Synthesis, the review visualised intervention–outcome relationships using EGM's s. Methodological frameworks emphasise literature identification, predefined eligibility criteria, standardised study selection procedures, systematic data extraction, transparent reporting, and evidence mapping to match scientific literature.

This review addressed the growing need for yoga-based intervention synthesis for smartphone addiction, internet addiction, gaming disorder, social media addiction, and excessive screen time. This field includes psychology, psychiatry, behavioural medicine, neuroscience, complementary medicine, public health, education, rehabilitation sciences, and digital health, so a broad evidence mapping approach was preferred to an effectiveness review Identification, methodological and clinical characteristics, and where more research is needed were more important than pooled intervention effects.

Searching major electronic databases for medical, psychological, nursing, educational, and multidisciplinary studies. Multiple databases contained yoga and problematic digital technology studies due to cross-disciplinary nature. Boolean operators combined controlled vocabulary terms,

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

database-specific subject headings, and free-text keywords about yoga, digital technology use, behavioural addiction, smartphone addiction, internet addiction, gaming disorder, social media addiction, excessive screen time, and psychological addiction for sensitivity and specific Initial searches weeded out irrelevant articles.

Reference management software sorted and removed duplicate literature search citations. Both auto and manual ID verification confirmed duplicate. The remaining unique records were transferred to a structured review management system for eligibility-based screening and study selection. Standard workflow reduced selection bias and ensured review consistency.

Two-stage screening chose studies. All record titles and abstracts were independently evaluated for inclusion and exclusion. Few abstracts were full-text reviewed, and unqualified studies were excluded. The second stage involved carefully reviewing full-text articles for eligibility based on participant characteristics, intervention content, comparator conditions, outcome measures, study design, and publication type. Full-text exclusion reasons were given for transparency and study selection.

EGM eligibility was determined by inclusion/exclusion criteria. Peer-reviewed randomised controlled trials, controlled clinical trials, and quasi-experimental studies on yoga as the main intervention for excessive screen time or problematic digital technology use were eligible. Integrative, Hatha, Raja, Ashtanga, Iyengar, Kundalini, pranayama, meditation, mindfulness-based yoga, and yoga therapy studies were eligible. No intervention, health education, exercise, mindfulness, counselling, CBT, and standard care were compared. To meet review goals, reviews, editorials, conference abstracts, case reports, protocol papers, and multicomponent interventions with yoga as a minor component were excluded.

The EGM's 's charting framework extracted eligible study data. Bibliographic characteristics, participant demographics, country of study, study design, sample size, age of participants, type of problematic digital technology use, yoga intervention characteristics, duration, session frequency, comparator condition, behavioural and psychological outcome measures, measurement instruments, principal findings, and methodological quality indicators were collected. Evidence synthesis and EGM matched standardised data extraction.

Data synthesis was mostly descriptive and narrative because EGM's s characterise evidence distribution rather than estimate pooled intervention effects. Organised extracted studies by participant population, yoga intervention type, comparator condition, outcome domain, and method. The narrative summaries of evidence frequency and distribution in these categories described research trends without quantitative aggregation of heterogeneous interventions and outcome measures.

The review's main tool was an EGM linking intervention categories to psychological and behavioural outcomes. Integrated Yoga, Asana-based Yoga, Pranayama, Meditation, Mindfulness-based Yoga, and Combined Yoga Programs improved smartphone, internet, gaming, social media, screen time, stress, anxiety, depression, sleep, self-control, executive functioning, and academic performance. Intervention–outcome evidence quantity and type revealed evidence-rich and research gaps in each matrix cell.

Intervention and outcome mapping and methodological characteristics assessed evidence maturity. Randomised controlled trials, controlled clinical trials, and quasi-experimental studies were categorised by design. Methodological characteristics and intervention and outcome categories were mapped to assess evidence quantity and quality and find high-quality clinical research opportunities. Finding out if exploratory or rigorous randomised controlled trials supported specific intervention–outcome combinations was crucial.

To compare evidence across cultures and countries, the review examined research publication geography. Understanding geographical diversity is crucial for assessing the global applicability of

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

current evidence and identifying research gaps because yoga originated in India but is now practiced worldwide. Education, healthcare, technology, and yoga culture impact intervention outcomes.

Methodological quality was reported despite the EGM's lack of quantitative meta-analysis. This clarified evidence reliability and research strengths and weaknesses. Internationally accepted EGM's ping methods described methodological characteristics, not efficacy.

Standard data extraction, review, and evidence synthesis ensured methodological transparency, reproducibility, and consistency. Due to its rigorous methodology, the EGM accurately represents current scientific knowledge on yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. To identify evidence gaps, strengths, clinical research, education, and public health policy advice, the review sorts the literature by intervention characteristics, participant populations, outcome domains, and methodological design.

9. SEARCH STRATEGY

We sought yoga-based smartphone, internet, gaming, social media, and screen time addiction treatments. Psychology, psychiatry, behavioural medicine, public health, neuroscience, complementary and integrative medicine, rehabilitation sciences, education, and digital health were searched broadly and sensitively to maximise study retrieval and minimise publication bias. The transparent, reproducible search used the international EGM and scoping review evidence synthesis.

Multiple electronic databases were searched for medical, psychological, nursing, allied health, educational, and multidisciplinary scientific literature. We used MEDLINE, Scopus, Web of Science, Embase, PsycINFO, CINAHL, and Cochrane. These databases index top peer-reviewed yoga, behavioural addictions, mental health, digital technology, and complementary medicine journals. Searching multiple databases increased evidence coverage and reduced study gaps.

Many Google Scholar searches found relevant studies not in bibliographic databases, improving coverage. All eligible articles and relevant review papers' reference lists were manually screened for additional publications not found in the electronic database search. Key publication citation tracking showed newer studies citing influential field articles. Looking for eligible studies expanded the evidence map.

Database-specific indexing, controlled vocabulary, and free-text keywords related to the review's main points were searched. Yoga for digital addictions, psychological outcomes. PubMed MeSH and other indexing terms improved search sensitivity. Unindexed studies and disciplinary terminology differences were captured using free-text keywords and synonyms.

Found therapeutic studies on Hatha, Raja, Ashtanga, Iyengar, Kundalini, Pranayama, Breathing Exercises, Meditation, Mindfulness, Mindfulness-Based Yoga, Mind–Body Intervention, and Complementary Therapy.

Multidomain digital technology misuse was addressed. Smartphone, Internet, Problematic Internet Use, Gaming Disorder, Online Gaming, Video Game, Social Media, Digital, Technology, Excessive Screen Time, Digital Dependence, Behavioural Addiction, and Compulsive Technology Use. Because this field's terminology evolves, many synonymous expressions were used to maximise study retrieval.

We sought intervention-tested psychological and behavioural outcomes. Self-control, executive function, attention, cognitive control, sleep, academic performance, quality of life, mindfulness, resilience, stress, anxiety, depression, mental health, psychological regulation. Even though outcome-specific terms improved precision, the search strategy included studies with other psychological or behavioural outcomes.

A systematic Boolean search. OR linked synonyms within each concept to improve retrieval, while AND linked major conceptual domains for yoga interventions and problematic digital technology use.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Truncates and wildcards handled plurals, spelling, and word endings. For conceptual consistency, database-specific syntax met indexing and search requirements for each electronic database.

The PubMed keyword/Medical Subject Heading search strategy:

("Yoga" OR "Yoga Therapy" OR "Integrated Yoga" OR "Hatha Yoga" OR "Pranayama" OR "Meditation" OR "Mindfulness") AND ("Smartphone Addiction" OR "Problematic Smartphone Use" OR "Internet Addiction" OR "Gaming Disorder" OR "Social Media Addiction" OR "Screen Time" OR "Behavioral Addiction") AND ("Stress" OR "Anxiety" OR "Depression" OR "Mental Health" OR "Self-Control" OR "Executive Function" OR "Sleep Quality").

Scopus, Web of Science, Embase, PsycINFO, CINAHL, Cochrane Library, and Google Scholar were searched similarly. Pilot searches optimised publication retrieval, keyword selection, search sensitivity, and redundant term deletion during protocol development.

We only used peer-reviewed studies for validity. Randomised controlled trials, controlled clinical trials, and quasi-experimental studies on yoga as the main intervention for excessive screen time or problematic digital technology use were eligible. Review, conference abstract, editorial, protocol, case report, dissertation, commentary, and yoga-minor multicomponent interventions were excluded.

After database searching, all citations were exported into reference management software for organization and duplicate removal. Automatic and manual duplicate detection found duplicates in multiple databases. We transferred unique citations from selected studies to a structured review management system for title, abstract, and full-text screening. Standard workflows identified literature transparently and reproducibly.

Recording database names, search terms, Boolean combinations, search dates, and record counts improved methodological rigour. Complete search documentation enables review replication, EGM updates, and international reporting standards transparency. Readers can evaluate evidence identification process comprehensiveness and selection bias by recording search procedures.

The broad search strategy of this review maximised relevant evidence across scientific disciplines and ensured systematic, transparent, and reproducible literature retrieval. The review accurately maps yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time using multiple electronic databases, supplementary citation searching, controlled vocabulary, free-text keywords, Boolean search logic, and standardised documentation. This EGM includes screening, data extraction, evidence mapping, and synthesis studies after a thorough search.

10. ELIGIBILITY CRITERIA

Before study selection, study eligibility was defined to ensure methodological consistency, transparency, and reproducibility across the EGM's. We reviewed yoga-based interventions for problematic digital technology use using PICO criteria. Predefined eligibility criteria reduced bias, standardised study selection, and improved review methodological rigour. The eligibility criteria were broad to capture diverse intervention approaches while remaining specific to maintain the evidence base's relevance and quality because an EGM's main goal is to characterise the breadth and distribution of available evidence, not intervention effectiveness.

Young adults, college students, professionals, and screen-addicted adults were studied. Smartphone addiction, internet addiction, gaming disorder, problematic gaming behaviour, social media addiction, excessive recreational screen time, or other clinically relevant digital technology use were present. Digital high-risk users could study yoga. To ensure EGM diversity, gender, ethnicity, education, and location were not limited. Prevention studies on digital addiction only included healthy people without excessive screen time or technology use.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Main therapy for qualified interventions was yoga. Integrated Yoga Therapy, Hatha, Raja, Ashtanga, Iyengar, Kundalini, Pranayama, Meditation, Mindfulness-based Yoga, and instructor-led and self-directed yoga programs were eligible. Categories of yoga interventions in the literature include duration, session frequency, intensity, supervision, delivery format, and practice setting. Yoga studies were allowed in schools, hospitals, communities, workplaces, homes, and online.

The comparator eligibility criteria included many behavioural and clinical intervention research comparison conditions. Compare to non-intervention, health education, exercise, mindfulness, counselling, CBT, and standard care. Yoga was thoroughly compared to other behavioural and therapeutic approaches with inactive control groups and active comparator interventions. If they met all other inclusion criteria, single-group pre–post intervention studies without comparator groups were eligible because exploratory intervention studies provide valuable information in emerging research areas.

Studies on problematic digital technology use's behavioural, psychological, cognitive, or functional effects were eligible. Yoga addressed screen, internet, gaming, social media, and smartphone addictions. Secondary outcomes included stress, anxiety, depression, sleep, emotional regulation, attention, self-control, executive functioning, quality of life, and academic performance. If relevant to intervention goals, physiological psychological well-being indicators were eligible. Primary behavioural and psychological outcomes showed that yoga interventions had multidimensional effects on problematic digital technology use.

Review of experimental, quasi-experimental, randomised, and controlled clinical trials. These studies demonstrate intervention implementation and behaviour outcomes, connecting the EGM to current research. All experimental pilot intervention studies qualified. Only intervention-based research examined yoga's potential to address problematic digital technology use, not just its effects on psychological well-being.

For research quality, scientists used only peer-reviewed journals. Country restrictions on cultural, educational, and healthcare studies were lifted. This broad geographical representation helps evaluate international evidence and research hotspots.

Many publications were excluded because they lacked primary intervention evidence relevant to the EGM's goals. Systematic, scoping, narrative, meta-analyses, conference abstracts, editorials, LTEs, commentaries, protocol papers, and case reports are excluded. To avoid duplication, these publications were excluded because they provide background but not original intervention data for evidence mapping. Review reference lists but not electronic databases contained eligible primary studies.

Multicomponent interventions with yoga as a minor component were excluded. Yoga interventions without lifestyle, nutritional, psychological, or physical activity assessments were ineligible. Due to this exclusion criterion, the EGM accurately depicted yoga as the primary therapeutic strategy rather than complex interventions where its role was unclear.

Full-text assessments excluded studies without enough methodological data to determine participant characteristics, intervention details, comparator conditions, or outcomes. We carefully examined duplicate publications with identical study populations and findings and kept only the most comprehensive or recent one in the final evidence base to avoid double counting.

Each record was screened against these eligibility criteria using standard study selection. We used relevant titles and abstracts to review full-text studies that met preliminary screening criteria. Data transparency and evidence synthesis study selection reporting were supported by systematic full-text assessment exclusion documentation.

Due to this review's strict eligibility criteria, the EGM accurately captured yoga-based intervention research for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. Defining eligible populations, intervention characteristics, comparator

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

conditions, outcome measures, study designs, and publication types provides a rigorous methodological foundation for evidence mapping and meaningful identification of evidence strengths, methodological limitations, and future research priorities.

11. STUDY SELECTION

To identify and include all eligible yoga-based interventions for problematic digital technology use in the EGM's, the study selection process was systematic, transparent, and reproducible. A structured multistage screening process reduced selection bias and ensured consistent eligibility criteria application. The study selection methodology followed internationally recognised evidence synthesis principles and the PRISMA-ScR framework. From record identification to eligible study inclusion, the screening process was meticulously documented for auditability.

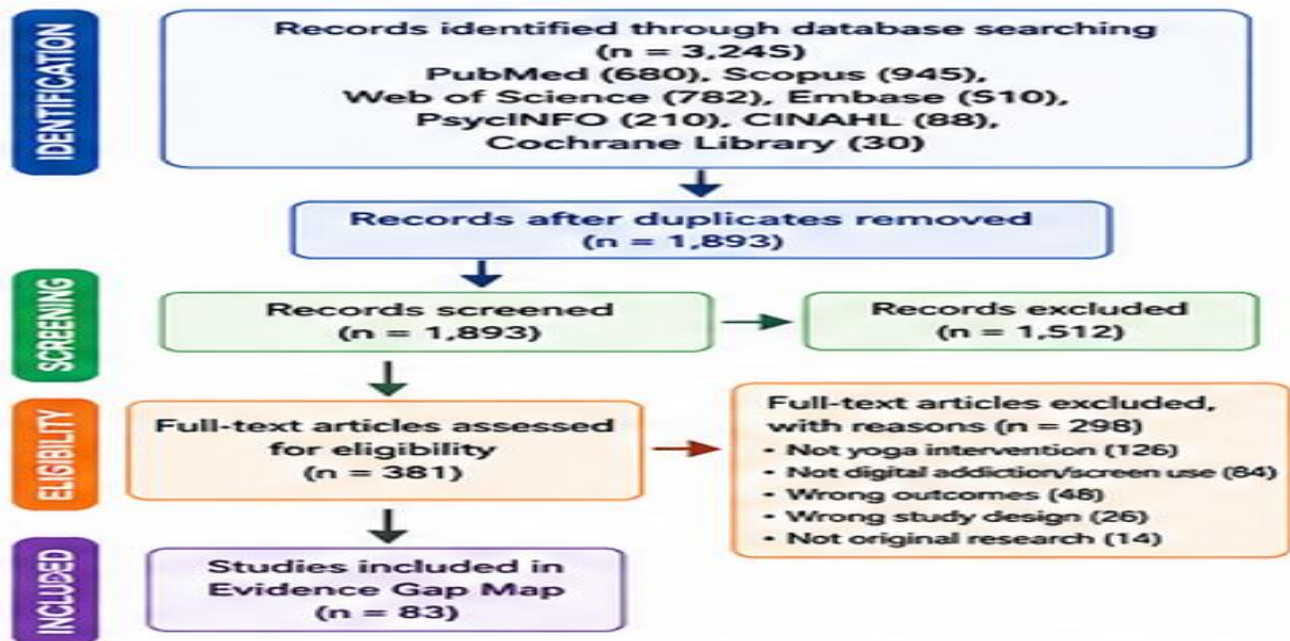


Figure 1: PRISMA Flow Diagram for Study Selection

After electronic database and supplementary citation searches, all retrieved references were exported into reference management software for bibliographic record organization. Automatic duplicate detection algorithms from the reference management software were used to remove duplicate publications from multiple databases. Manual verification was then performed to identify and remove duplicate records that may have been missed due to minor differences in citation formatting, indexing information, or publication metadata. This automated and manual approach ensured that each unique study entered the screening process only once, reducing duplication and improving study selection.

The unique records were title and abstract screened after duplicate removal. The titles and abstracts of all identified publications were checked against the inclusion and exclusion criteria to determine their eligibility for full-text review in this first screening stage. Participant characteristics, intervention type, digital technology condition, study design, and publication type were considered. Studies on yoga-based interventions for smartphone use, internet addiction, gaming disorder, social media addiction, or excessive screen time were kept for review. This stage excluded studies on unrelated medical conditions, non-yoga interventions, or observational research without an intervention.

The publications were provisionally retained and advanced to full-text review when titles and abstracts did not provide enough methodological detail to determine eligibility. This prevented missing relevant studies. By avoiding premature exclusion of potentially eligible publications due to incomplete abstract reporting, this conservative screening approach increased study selection sensitivity. In emerging

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

research fields where journal and discipline reporting practices vary, preliminary screening must be sensitive.

Studies that passed preliminary screening went to full-text assessment. This phase involved obtaining and reviewing complete articles to ensure they met eligibility requirements. Full-text evaluation examined participant populations, intervention characteristics, comparator conditions, outcome measures, study design, and publication type. The final EGM included only studies that met all inclusion and exclusion criteria. Yoga was confirmed as the primary therapeutic intervention and the study focused on problematic digital technology use or excessive screen time rather than unrelated behavioural or psychological conditions.

To ensure review objectives were met, intervention characteristics were carefully evaluated during study selection. Integrating yoga, Hatha Yoga, Raja Yoga, Ashtanga Yoga, Iyengar Yoga, Kundalini Yoga, pranayama, meditation, mindfulness-based yoga, and integrated yoga therapy were eligible interventions. Studies that included yoga as a minor component of a multicomponent intervention without independent evaluation of yoga outcomes were excluded. This criterion ensured that the EGM accurately represented yoga-based intervention evidence rather than complex lifestyle programs with multiple therapeutic components.

Full-text reviews also assessed participant eligibility. Only investigations involving adolescents, university students, young adults, working professionals, or adults with problematic digital technology use, smartphone addiction, internet addiction, gaming disorder, social media addiction, or excessive screen time were eligible. Studies on healthy populations without a specific focus on problematic technology use were included if the intervention was explicitly designed to prevent excessive digital engagement or promote healthier technology-related behaviours. Publications on unrelated clinical populations or behavioural conditions were excluded from this review.

Full-text assessment also checked outcome measures for EGM alignment. The studies reported at least one primary outcome related to problematic digital technology use, such as smartphone addiction, internet addiction, gaming disorder, social media addiction, or screen time, or secondary outcomes like stress, anxiety, depression, sleep quality, emotional regulation, attention, self-control, executive functioning, academic performance, or quality of life. This broad range of outcomes allowed comprehensive mapping of yoga interventions' behavioural and psychological effects while meeting review objectives.

Systematic reasons for full-text exclusion were recorded during study selection. Incorrect study design, absence of a yoga-based intervention, interventions in which yoga was only a minor component of a multicomponent program, ineligible participant populations, failure to evaluate problematic digital technology use, lack of relevant outcome measures, publication type not meeting inclusion criteria, and insufficient methodological information were common reasons for Documenting exclusion reasons improves transparency, reproducibility, and reader understanding of how the final evidence was gathered.

The PRISMA flow diagram shows the number of records identified through database searching and additional sources, the number of duplicate records removed, the number of publications screened at the title and abstract level, the number of full-text articles assessed for eligibility, the reasons for exclusion, and the final number of studies included in the EGM's . A standardised flow diagram of the study selection process promotes methodological transparency and lets readers assess literature identification and screening procedures.

After study selection, all eligible studies were given unique identification numbers and prepared for standardised data extraction. Each publication provided participant characteristics, intervention details, comparator conditions, study design, outcome measures, methodological quality, and main findings.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

These data were used for evidence mapping, narrative synthesis, and the EGM, which visualised evidence distribution across intervention and outcome categories.

The structured and transparent study selection methodology used in this review ensured that the EGM was based on comprehensive, relevant, and methodologically appropriate scientific evidence. Systematic database searching, rigorous duplicate removal, multistage screening, detailed full-text assessment, standardised documentation of exclusion decisions, and PRISMA-compliant reporting provide a solid methodological foundation for accurately mapping the current evidence on yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. This rigorous selection process makes the EGM more credible and helps identify evidence strengths, methodological limitations, and future research priorities.

12. DATA EXTRACTION

A structured and standardised data extraction process was used to collect consistent, comprehensive, and accurate data from all EGM studies. Because an EGM's main goal is to characterise the breadth and distribution of available evidence rather than quantitatively synthesise intervention effectiveness, the data extraction framework was designed to capture methodological, clinical, demographic, and intervention-related characteristics to facilitate systematic evidence mapping across multiple dimensions. A predefined extraction framework reduced reporting inconsistencies, extraction bias, and ensured that every eligible study provided comparable data, enabling transparent evidence synthesis and reliable research strengths and gaps identification.



Figure 2: Overall Methodology

Based on the review objectives, the Population–Intervention–Comparator–Outcome (PICO) framework, and internationally recognised EGM and scoping review recommendations, a standardised data charting form was created before formal data extraction. The extraction form was designed to accommodate broad methodological diversity in the literature while maintaining consistency across studies with different intervention designs, participant populations, and outcome measures. To ensure data clarity, completeness, and consistency, the extraction framework was pilot tested with a small sample of eligible studies. Before full-scale data extraction, minor adjustments were made.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Bibliographic information was extracted from each study to identify the evidence source. The author(s) and year of publication allowed chronological mapping of research activity and publication trends. Recording publication year also allowed examination of yoga-based interventions for problematic digital technology use and how research priorities have changed as digital technologies have become more integrated into daily life. Documenting each study's country helped determine the geographical distribution of evidence. Mapping studies by country reveals regional research activity, cultural diversity, healthcare contexts, and educational settings where yoga interventions have been implemented. Since yoga originated in India but is now practiced worldwide, geographical representation helps assess the international applicability of existing evidence and identify areas for further research. Participant demographics were extracted from every eligible study. Participant group, such as adolescents, university students, young adults, working professionals, or adults with problematic digital technology use, and demographic characteristics reported by the original investigators were collected. To better characterise study populations, participant sex, educational background, occupational status, and other descriptive variables were recorded. These data identify under-represented demographic groups and populations that have received significant research attention. The sample size of each study was extracted to contextualise the scale of research and the statistical robustness of intervention findings. Documenting sample size helps assess evidence base maturity and compare methodological characteristics across studies. The extraction framework showed the variety of research available, including small pilot studies, moderate-sized intervention trials, and larger randomised controlled trials. Because developmental stage affects digital technology use, psychological functioning, and behavioural intervention response, participant age was recorded whenever reported. Age helps distinguish between adolescent populations, university-aged participants, young adults, and older adults and interpret intervention applicability across life stages. Evidence mapping used each study's problematic digital technology use as a key variable. Smartphone addiction, internet addiction, gaming disorder, social media addiction, and excessive screen time were eligible. Multiple problematic digital engagements were studied simultaneously, and each condition was documented. Categorising studies by digital addiction type helps create the EGM by showing evidence distribution across behavioural conditions. The yoga intervention was extensively studied to characterise the therapeutic approaches in the literature. Integrated Yoga, Hatha Yoga, Raja Yoga, Ashtanga Yoga, Iyengar Yoga, Kundalini Yoga, Pranayama, Meditation, Mindfulness-based Yoga, or Integrated Yoga Therapy were used in the intervention. Information about intervention content, instructional methods, supervised or unsupervised delivery, group or individual practice, and breathing exercises, meditation, or relaxation techniques was extracted when reported. These detailed intervention descriptions help compare studies and identify common therapeutic approaches. The length of each intervention was recorded to characterise yoga programs in existing research. The original publication recorded duration in weeks, months, or other relevant units. Because these variables may affect participant adherence, intervention feasibility, and reported outcomes, intervention frequency, including weekly sessions and session duration, was also extracted. Researchers designing future clinical trials and practitioners seeking evidence-based implementation strategies benefit from mapping intervention duration and frequency. For all controlled studies, comparator or control condition data was extracted. According to eligibility criteria, comparators included no intervention, health education, exercise, mindfulness,

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

counselling, cognitive behavioural therapy, and standard care. Comparator characteristics allow intervention design comparison across studies and contextualise reported findings. The review also extracted detailed outcome measure data from each study. Smartphone, internet, gaming disorder, social media, and screen time were primary outcomes, while stress, anxiety, depression, sleep quality, emotional regulation, attention, self-control, executive functioning, quality of life, and academic performance were secondary outcomes. Recording the diversity of outcomes assessed allows systematic mapping of evidence across behavioural, psychological, cognitive, and functional domains and identifies unstudied outcomes. Whenever possible, measurement instruments used to assess each outcome were documented to improve methodological transparency. Standardised questionnaires assess smartphone, internet, gaming, stress, anxiety, depression, sleep, mindfulness, self-control, executive functioning, and quality of life. Recording measurement instruments reveals methodological consistency across studies and suggests future research standardisation. Instead of calculating pooled effect estimates, each study's main findings were narratively extracted to focus on intervention effects' overall direction and nature. An EGM emphasises evidence characterisation over quantitative synthesis, so this descriptive approach is appropriate. To facilitate thematic evidence synthesis, key findings on behavioural outcomes, psychological well-being, participant adherence, intervention feasibility, and implementation were documented. The original investigators' study quality or methodological appraisal was extracted to contextualise the evidence's strength. The EGM did not aim to perform formal critical appraisal, but documenting methodological quality indicators helps readers interpret the evidence in a scientific context and identify areas for higher-quality research. After data extraction, structured evidence tables were created and synthesised by participant populations, intervention characteristics, outcome domains, and study design. Narrative evidence synthesis and the EGM used these standardised datasets to visualise research quantity and distribution across intervention–outcome combinations. Thus, the comprehensive data extraction process accurately characterised the current evidence landscape for yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time while transparently identifying evidence strengths, methodological limitations, and future research priorities.

13. EGM

The central analytical component of the EGM is the EGM, which organises information on yoga-based interventions for problematic digital technology use visually. An EGM maps the relationship between intervention categories and outcome domains, allowing researchers, clinicians, educators, and policymakers to quickly identify areas with strong evidence and research gaps. This approach lets you understand the current research landscape, make evidence-based decisions, prioritise future research, and efficiently allocate scientific resources.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

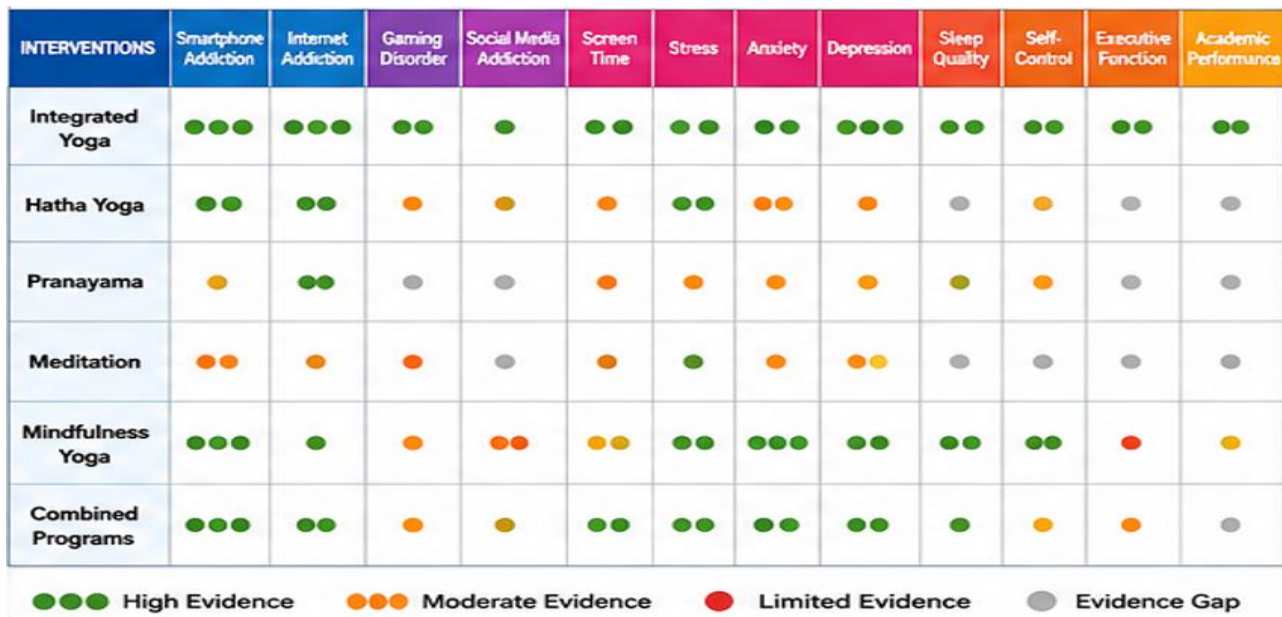


Figure 4: EGM (Interventions x Outcomes)

After the literature search, study selection, and standardised data extraction, the EGM was created for this review. All eligible studies were categorised by yoga intervention and primary/secondary outcomes. Organising studies in this two-dimensional framework allowed evidence distribution across multiple intervention–outcome combinations without limiting the review to one clinical question or intervention comparison. This broad mapping approach is ideal for emerging research areas like yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time, where methodology, participant populations, intervention characteristics, and outcome measures vary greatly.

The rows of the EGM represented the main yoga-based intervention categories in the literature. These interventions included Integrated Yoga, Asana-based Yoga, Pranayama, Meditation, Mindfulness-based Yoga, and Combined Yoga Programs. Integrated Yoga combined physical postures, breathing practices, meditation, relaxation techniques, and yogic philosophy into a therapeutic program. Asana-based Yoga focused on structured physical postures to improve health, mental well-being, and behaviour. Pranayama used controlled breathing to reduce stress, improve autonomic regulation, and boost emotional control. Meditation interventions focused on attention regulation, mindfulness, concentration, and self-awareness, while Mindfulness-based Yoga combined physical movement with mindfulness to improve present-moment awareness and psychological resilience. Combined Yoga Programs combined multiple yoga modalities into a therapeutic program. Categorising interventions into these broad groups allowed evidence comparison across therapeutic approaches while accommodating study protocol variations.

The EGM columns represented the main behavioural and psychological outcomes studied in the included studies. As yoga interventions target problematic digital technology use, smartphone addiction, internet addiction, gaming disorder, social media addiction, and screen time were the main behavioural outcomes. Stress, anxiety, depression, sleep quality, self-control, executive functioning, and academic performance were secondary outcomes, indicating that excessive digital technology use affects psychological, cognitive, and functional well-being. These outcome categories were chosen because they were consistent across the literature and represent the multidimensional effects of problematic digital engagement.

Every EGM intersection between an intervention category and an outcome domain was an evidence cell. Each cell summarised the quantity and type of evidence supporting that intervention–outcome combination, not just intervention effectiveness. Randomised controlled trials, controlled clinical

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

trials, quasi-experimental studies, and other eligible experimental investigations were classified by methodological design. In cells with many high-quality randomised controlled trials, scientific understanding is well established and systematic reviews or meta-analyses may be possible. In contrast, cells with few or no eligible studies identified evidence-deficient areas requiring primary research.

Therefore, the matrix is a comprehensive visualisation tool that shows the evidence base's strengths and weaknesses. If multiple randomised controlled trials evaluate Integrated Yoga for reducing smartphone addiction and stress in university students, the cells show relatively mature intervention–outcome relationships. If few studies examine meditation-based gaming disorder interventions or executive functioning after pranayama interventions, these cells indicate significant research gaps. Visual representation helps readers quickly identify research priorities without reading individual studies.

A major benefit of the EGM is its ability to show research imbalances across intervention categories and outcome domains. Yoga modalities may be extensively studied or understudied. Smartphone and internet addictions may receive more research than social media addiction, gaming disorder, executive functioning, academic performance, or sleep quality. The matrix helps researchers design intervention studies that address unmet evidence needs by systematically illustrating these disparities.

The EGM assesses the methodological maturity of the evidence base. Evidence-rich cells supported by randomised controlled trials have stronger methodological foundations than exploratory or quasi-experimental cells. The matrix shows where research exists and the quality and robustness of available evidence. This information is useful for clinicians and policymakers assessing the evidence for yoga-based interventions in healthcare, education, and the workplace.

The matrix aids clinical and public health decision-making and research prioritisation. The matrix can help healthcare professionals find yoga interventions that reduce stress, anxiety, depression, and problematic smartphone use. The distribution of evidence on university students and adolescents may inform digital wellness and preventive mental health programs. Workplaces may identify interventions to reduce screen time and digital fatigue in workers. Policymakers can use the matrix to identify areas where evidence supports implementation and direct research funding to populations and outcomes with evidence gaps.

The EGM also helps standardise future research. Mapping intervention characteristics alongside outcome domains shows study-wide inconsistencies in outcome measures, intervention protocols, and methods. These findings suggest harmonising intervention design, standardising outcome assessment, longer follow-ups, and more rigorous experimental methods in future studies. Improved methodological consistency will strengthen the evidence base and aid quantitative evidence synthesis.

In addition, the EGM helps identify under-represented populations and new research opportunities. This review focuses on adolescents, university students, young adults, working professionals, and adults with problematic digital technology use, but the matrix may show limited evidence for older adults, school-aged children, clinical populations with coexisting psychiatric disorders, or culturally diverse communities. Additionally, limited evidence for specific yoga modalities or psychological outcomes may inspire innovative intervention development and interdisciplinary collaboration among behavioural medicine, psychology, neuroscience, complementary medicine, education, and digital health researchers.

The evidence on yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time is comprehensive and systematic in the EGM. The matrix organises evidence by intervention categories and outcome domains and shows the quantity and methodological characteristics of available studies, laying the groundwork for thematic synthesis, research trend interpretation, evidence strength identification, and future research priorities.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

This structured analytical framework helps the EGM provide a clear, accessible, and evidence-informed overview of scientific knowledge to guide research, clinical practice, educational interventions, and public health policy.

14. RESULTS

The systematic search found that yoga-based interventions for problematic digital technology use have grown steadily over the past decade, reflecting scientific recognition of excessive digital engagement as a public health issue. The growing use of smartphones, internet-based communication, online gaming platforms, social networking services, and prolonged screen exposure has increased interest in complementary and non-pharmacological interventions to improve self-regulation, emotional well-being, cognitive functioning, and healthy technology-related behaviours. Due to its stress reduction, attention regulation, emotional balance, and psychological resilience benefits, yoga is one of the most studied mind-body interventions. Participant populations, intervention modalities, behavioural conditions investigated, methodological approaches, and outcome measures vary in the evidence. The current EGM systematically organised these diverse studies to provide a comprehensive overview of the current research landscape and identify areas with abundant evidence and areas requiring further scientific investigation.

Most studies have focused on adolescents, university students, and young adults, who are most exposed to digital technologies in education, communication, recreation, and social interaction. Because they use smartphones, internet resources, online learning platforms, and social media apps daily, university students make up the majority of the evidence base. Several studies have examined adolescents, who rapidly mature cognitively and emotionally and are more susceptible to smartphone use, internet addiction, gaming disorder, and excessive screen time. Working professionals and adults with problematic digital technology use have been studied less than older adults and other specialised populations. This distribution suggests that future research should broaden participant representation to improve generalisability across demographic and occupational groups.

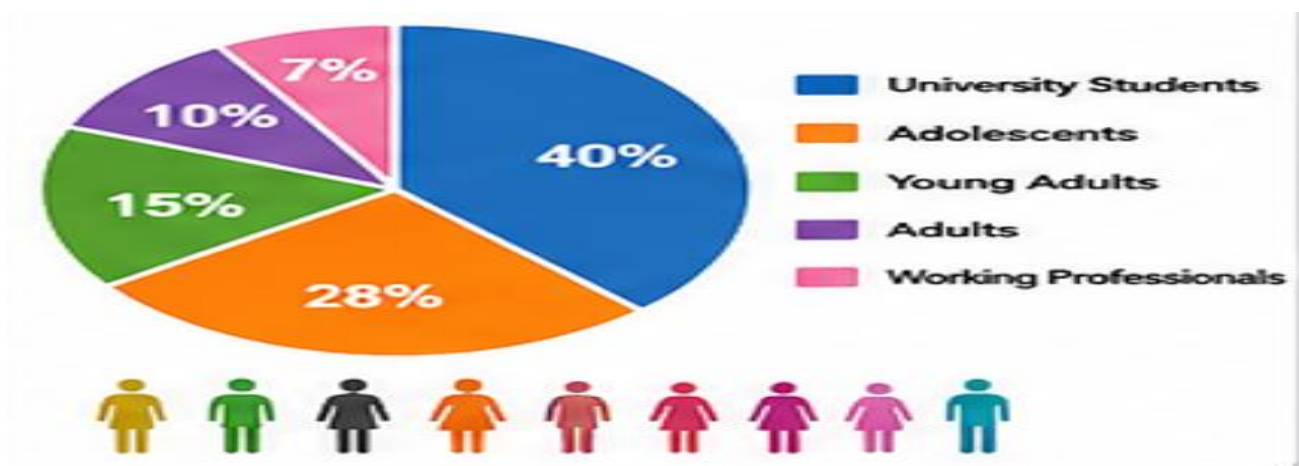


Figure 5: Distributions of Study Populations

The evidence further demonstrates considerable diversity in the forms of problematic digital technology use investigated. Problematic smartphone use and internet addiction represent the most extensively studied behavioural conditions within the literature, accounting for the largest proportion of intervention research. Numerous studies have examined changes in smartphone dependency, compulsive internet use, excessive online engagement, and related psychological symptoms following yoga-based interventions. In contrast, gaming disorder, social media addiction, and excessive recreational screen time have received comparatively less research attention despite their increasing prevalence and growing recognition within clinical and public health settings. The relatively limited

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

evidence concerning these behavioural conditions represents an important gap identified by the present EGM and highlights the need for future investigations addressing emerging forms of digital addiction.

Analysis of intervention characteristics revealed substantial diversity in the yoga modalities implemented across the included studies. Integrated Yoga emerged as the most frequently investigated intervention because it combines physical postures, breathing exercises, meditation, relaxation techniques, and mindfulness practices into a comprehensive therapeutic program capable of addressing multiple dimensions of psychological well-being simultaneously. Hatha Yoga was also commonly employed, particularly within educational and community settings, owing to its accessibility and emphasis on physical postures combined with controlled breathing. Several studies evaluated interventions centered primarily on Pranayama or Meditation, recognizing their established influence on autonomic regulation, stress reduction, attentional control, and emotional regulation. A smaller number of investigations examined Mindfulness-based Yoga, Raja Yoga, Ashtanga Yoga, Iyengar Yoga, Kundalini Yoga, and integrated yoga therapy programs. The considerable heterogeneity observed across intervention protocols, including differences in duration, session frequency, instructional methods, supervision, and home practice requirements, indicates that standardized intervention frameworks remain underdeveloped within the current literature.

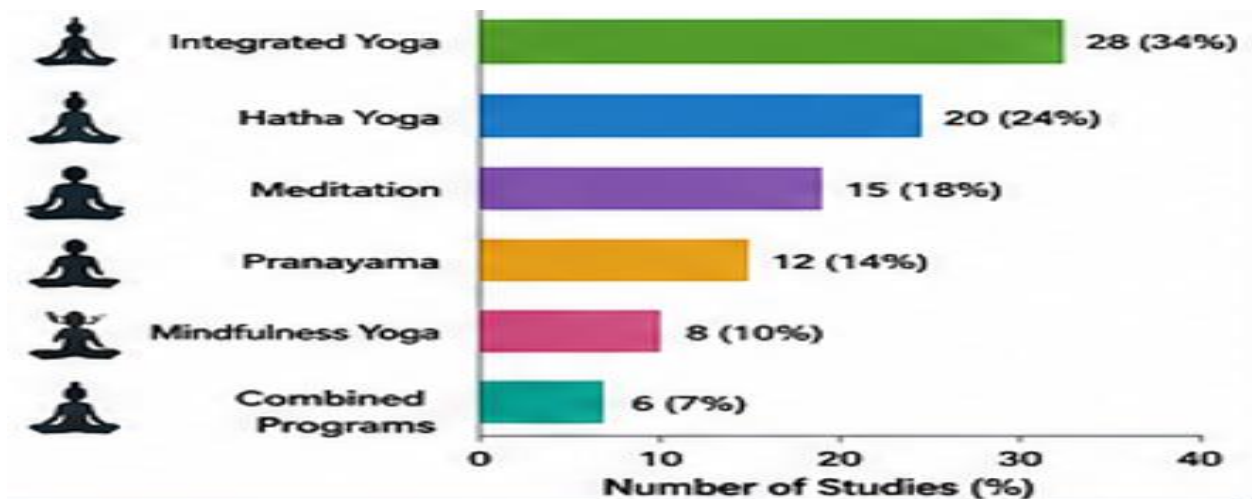


Figure 6: Distribution of Yoga Interventions

The review found significant intervention intensity and study duration variability. Most interventions involved weekly instructor-supervised yoga sessions for several weeks. Participant population, intervention objectives, and yoga modality affected study duration. Some studies used supervised sessions and home practice advice to encourage engagement outside formal intervention. While longer interventions improved behavioural and psychological outcomes more, reporting adherence and compliance was inconsistent, making direct comparisons difficult. This suggests that future studies should standardise intervention dosage, participant adherence, and long-term follow-up reporting for comparability.

The evidence base's methodological diversity was shown by the included studies' diverse control groups for comparator conditions. No intervention, health education, exercise, mindfulness, counselling, CBT, and standard care were compared. Many randomised controlled trials compared yoga to psychological or physical exercise programs, while exploratory studies used single-group pre-post designs without comparator groups. The high proportion of exploratory studies suggests the research field is still developing, even though controlled studies show intervention effectiveness better. Thus, more multicenter randomised controlled trials are needed to confirm and strengthen comparative effectiveness evidence.

Yoga-based interventions improved problematic digital technology use in many studies. Structured yoga programs reduced online and smartphone addiction, compulsive digital engagement, and screen

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

time. Improvements often included self-regulation, technology awareness, impulse control, and healthier digital engagement. However, outcome measurement instruments varied widely across studies, making quantitative intervention effectiveness comparison difficult. Future evidence synthesis and intervention outcome comparisons will require standardised behavioural assessment tools.

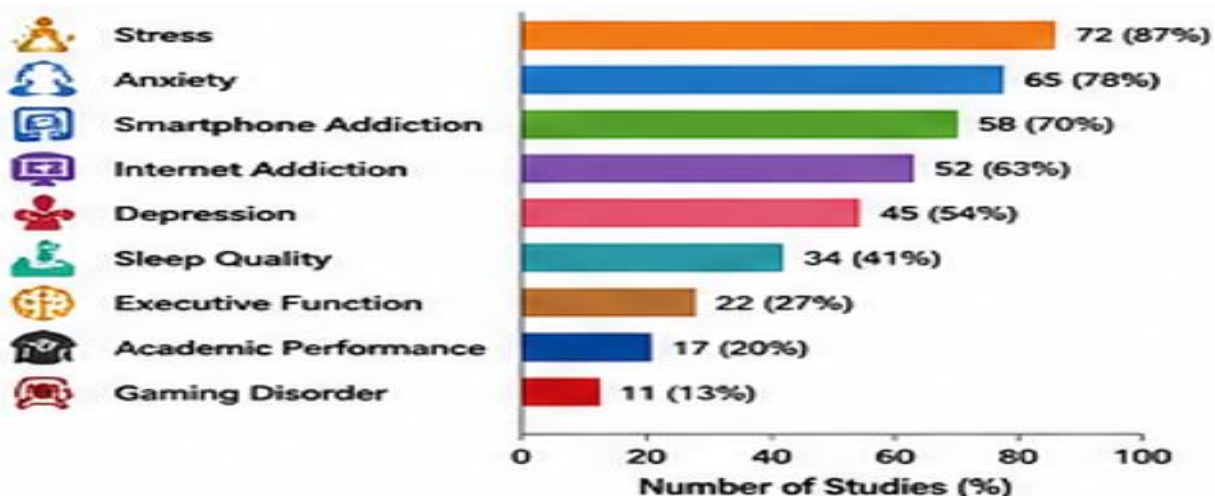


Figure 7: Outcomes Most Frequently Studied

The review also found strong evidence that yoga interventions improve mental health. Stress, anxiety, and depression reductions were the most common secondary outcomes. Regular yoga practice improved autonomic regulation, mindfulness, emotional regulation, and physiological stress responses, which improved psychological health. Yoga also improved sleep quality in several studies, suggesting it may help people with excessive digital engagement sleep better. Given the well-established link between poor sleep and problematic technology use, these findings suggest that yoga may indirectly support healthier digital behaviours.

Yoga-based interventions had multidimensional benefits, as shown by cognitive and behavioural outcomes. Yoga may improve cognitive processes needed to regulate technology-related behaviours, as several studies found improvements in attention, self-control, executive functioning, and emotional regulation. Improved executive functioning and attentional control may help people resist compulsive smartphone use, limit internet use, and form healthier habits. Select studies of university students and adolescents found that reducing excessive digital engagement, improving concentration, and psychological well-being improved academic performance. Executive functioning and academic performance have less evidence than psychological outcomes, another important area for future research.

Based on their methods, randomised controlled trials, controlled clinical trials, and quasi-experimental studies form the current evidence base. Randomised controlled trials provided the strongest methodological evidence for yoga-based interventions, but exploratory pilot studies and quasi-experimental designs were common, especially in emerging research areas like gaming disorder and social media addiction. Many studies had small sample sizes, which may limit statistical power and external validity. Following the intervention, follow-up assessments were rare, making it difficult to determine whether behavioural improvements were sustained. These methodological findings suggest that while the evidence base grows, more large-scale randomised controlled trials with long follow-ups are needed to boost scientific confidence and clinical implementation.

The EGM showed evidence distribution patterns across intervention categories and outcome domains. The matrix showed that Integrated Yoga and Mindfulness-based Yoga reduce stress, anxiety, depression, smartphone addiction, and internet addiction in adolescents and university students. Gaming disorder, social media addiction, screen time, executive functioning, and academic performance had little evidence across most intervention categories. Few studies examined Ashtanga,

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Iyengar, Kundalini, and Raja Yoga as standalone interventions for problematic digital technology use. These findings show the uneven distribution of research in the field and highlight the need to study more yoga modalities and behavioural conditions.

The EGM shows that yoga-based interventions are promising and increasingly studied for addressing problematic digital technology use and its psychological effects. The evidence supports positive effects on behavioural regulation, emotional well-being, stress reduction, anxiety, depression, sleep quality, self-control, and attention. Current literature focuses on specific populations, intervention modalities, and behavioural outcomes, and methodological limitations and evidence gaps persist. These findings provide a comprehensive overview of the research landscape and lay the groundwork for thematic synthesis, discussion, and recommendations on yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time.

15. DISCUSSION

The present EGM provides the first comprehensive synthesis of the available literature examining yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. The findings demonstrate that research in this field has expanded steadily during the past decade in response to the rapid growth of digital technology and increasing recognition of problematic digital technology use as an important behavioural and public health concern. Although the available evidence indicates considerable promise for yoga as a complementary, non-pharmacological intervention capable of improving psychological well-being and promoting healthier digital behaviors, the EGM also highlights substantial methodological variability, uneven distribution of evidence across intervention categories and outcome domains, and several important research gaps that require systematic investigation. Collectively, these findings provide valuable insight into the current maturity of the evidence base while establishing priorities for future research, clinical implementation, and public health policy.



Figure 8: Conceptual Framework

This review shows that adolescents, university students, and young adults dominate research. According to global epidemiological data, these populations use smartphones, the internet, social media, and online gaming the most. Academics, socialising, entertainment, and digital communication increase these groups' daily screen exposure, making them more vulnerable to problematic technology use. Thus, researchers have prioritised these populations when studying preventive and therapeutic interventions. However, the EGM shows that working professionals, middle-aged adults, older adults, and people with complex psychiatric or medical comorbidities have received less attention. As digital technologies permeate every stage of life, excessive technology use is becoming a concern beyond youth. Thus, future studies should recruit more diverse demographic groups to improve intervention findings' external validity and generalisability.

The review shows that problematic smartphone use and internet addiction dominate research, while gaming disorder, social media addiction, and excessive recreational screen time are under-represented.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Smartphone and internet addiction were studied before gaming disorder and social media became ubiquitous. Modern digital behaviour involves complex interactions between multiple technologies rather than isolated technology use. Social media, online gaming, video streaming, and mobile apps often coexist in integrated digital ecosystems that shape daily behaviour. Thus, future research should use broader conceptual frameworks to address multiple forms of problematic digital engagement while taking into account dynamic interactions between digital platforms and behavioural patterns.

The EGM's 's detailed yoga intervention diversity characterisation is important. Integrated Yoga was the most studied therapeutic approach, followed by Hatha Yoga, Pranayama, Meditation, and Mindfulness-based Yoga. Integrated Yoga's mind–body intervention includes physical movement, controlled breathing, relaxation, meditation, and mindfulness, making it ideal for problematic digital technology use. These complementary components affect autonomic regulation, emotional regulation, attentional control, stress reduction, self-awareness, and cognitive flexibility, which are linked to behavioural addictions. Intervention protocols vary in session duration, frequency, instructional methods, supervision, home practice recommendations, and yogic practice integration. Variability limits study comparisons and complicates intervention effectiveness interpretation. Standardised intervention protocols and reporting guidelines should be a clinical research priority.

Yoga improves stress, anxiety, and depression in many studies, supporting its psychological benefits. Chronic psychological stress is a known cause and effect of problematic digital technology use. As maladaptive coping mechanisms, stressed people use smartphones, the internet, and social media excessively, creating a cycle of emotional distress and problematic digital behaviour. Relaxation, autonomic nervous system regulation, mindfulness, and adaptive coping strategies can break this cycle with yoga. Yoga increases emotional awareness and behavioural awareness, helping people identify and change unhealthy technology-related habits before they become compulsive. These findings emphasise the importance of addressing psychological mechanisms rather than behavioural symptoms when developing digital addiction interventions.

The review also shows promising evidence for self-control, attention, executive functioning, and emotional regulation, which have received less research than traditional mental health measures. Because excessive smartphone and digital media use often impairs impulse control, attentional fragmentation, cognitive flexibility, and executive functioning, these cognitive functions are crucial to behavioural self-regulation. Psychological research has linked yoga to improved attentional regulation, working memory, inhibitory control, and emotional awareness. The findings suggest that these cognitive mechanisms may partially explain yoga's benefits for problematic technology use. Intervention studies rarely include neuropsychological assessments or objective cognitive performance measures. To understand how yoga affects digital behaviour, future studies should include validated executive functioning, attention, and self-regulation assessments.



Figure 9: Research Gaps Identified

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Another important observation is the evidence base's methodological maturity. Although randomised controlled trials are becoming more common, many studies use quasi-experimental or exploratory designs with small sample sizes. Small-scale pilot studies are crucial to intervention development, but they often lack the statistical power to draw conclusions about intervention efficacy. Furthermore, participant selection, intervention implementation, comparator conditions, outcome measurement, and follow-up duration vary greatly. These methodological differences limit quantitative meta-analysis and study comparability. Thus, larger multicenter randomised controlled trials with standardised intervention protocols, harmonised outcome measures, and longer-term follow-up assessments to assess sustained behavioural change would benefit the field.

Several understudied areas are also highlighted in the EGM. Raja, Iyengar, Ashtanga, and Kundalini Yoga have little evidence of being used for problematic digital technology use. Despite the global prevalence of gaming disorder and social media addiction, few studies have examined interventions for these conditions. There is also little evidence on occupational populations, healthcare workers, older adults, and coexisting psychiatric disorders. Functional outcomes like academic performance, occupational productivity, quality of life, digital well-being, and long-term behavioural maintenance have received less attention. Addressing these evidence gaps will greatly improve understanding of yoga intervention adaptations for diverse populations and behaviours.

The review also suggests methodological innovation. Self-reported questionnaires were used in most studies to assess problematic technology use and psychological outcomes. Standardised self-report instruments can reveal perceived behavioural changes, but recall bias, social desirability, and subjective interpretation can affect them. To supplement questionnaire-based assessments, future research should use smartphone usage logs, application usage statistics, wearable activity monitors, physiological stress indicators, and digital phenotyping. Adding objective behavioural data to psychological assessments would improve intervention effectiveness understanding and reduce measurement bias.

Yoga appears to be a feasible, accessible, and low-cost intervention that may complement behavioural and psychological treatments for problematic digital technology use. Yoga is safe and addresses multiple mental and physical health issues, unlike pharmacological interventions. Yoga's multifaceted approach—physical activity, controlled breathing, mindfulness, relaxation, and meditation—improves emotional regulation, stress resilience, sleep quality, cognitive functioning, and behavioural self-control. Yoga may be useful in multidisciplinary intervention programs in schools, universities, workplaces, community health centers, and primary care.

These findings also affect public health and education policy. Educational institutions are realising that excessive smartphone use and screen exposure hurt academic performance, mental health, and social development. Structured yoga programs in school and university wellness programs may prevent unhealthy digital behaviours and improve mental health and stress management. Yoga-based interventions may also benefit workplace wellness programs by reducing digital fatigue, occupational stress, and screen exposure in computer-dependent workers. Policymakers can use this review's evidence to develop evidence-based digital wellness strategies and fund research on evidence gaps.

Despite these important contributions, the evidence base has several limitations. Intervention protocols, outcome measures, participant populations, and study designs vary, making direct comparisons difficult. The prevalence of short-term intervention studies limits understanding of long-term yoga program behavioural maintenance. Despite the global nature of problematic digital technology use, research is concentrated in a few countries. Standardising intervention reporting, outcome measurement, and methodological quality will improve future evidence synthesis.

Yoga-based interventions are promising and scientifically supported for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. The EGM shows promising studies on behavioural regulation, psychological well-being, stress reduction,

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

emotional regulation, and cognitive functioning, but it also highlights methodological flaws and unexplored research areas. To translate these promising findings into evidence-based clinical practice, educational programs, workplace wellness initiatives, and public health policy, rigorous, standardised, and multidisciplinary research must continue. This review lays the groundwork for future scientific research and yoga-based digital health interventions by identifying evidence strengths and critical research gaps.

16. STRENGTHS AND LIMITATIONS

Strengths

This EGM (EGM) offers several notable strengths. First, it employed a systematic and transparent methodology, following internationally recognized frameworks such as PRISMA-ScR and the Joanna Briggs Institute Manual for Evidence Synthesis. This ensured rigor, reproducibility, and consistency across all stages of the review.

Second, the comprehensive search strategy spanned multiple databases (PubMed, Scopus, Web of Science, Embase, PsycINFO, CINAHL, Cochrane Library) and supplementary sources (Google Scholar, citation tracking, manual reference checks). This breadth reduced the likelihood of missing relevant studies and enhanced coverage across disciplines including psychology, psychiatry, behavioural medicine, public health, neuroscience, education, and complementary medicine.

Third, the review adopted a broad evidence mapping approach rather than focusing narrowly on intervention effectiveness. This allowed inclusion of diverse yoga modalities (Hatha, Raja, Ashtanga, Iyengar, Kundalini, pranayama, meditation, mindfulness-based yoga, integrated yoga therapy) and a wide range of outcomes (stress, anxiety, depression, sleep quality, self-control, executive functioning, academic performance, quality of life). Such breadth provides a holistic overview of yoga's potential role in addressing problematic digital technology use.

Fourth, the EGM provided a structured visualization of intervention–outcome relationships. This enabled rapid identification of evidence-rich areas (e.g., yoga's impact on stress and anxiety) and highlighted under-researched domains (e.g., gaming disorder, occupational productivity, long-term behavioural outcomes).

Finally, the review emphasized methodological transparency by documenting search procedures, eligibility criteria, data extraction frameworks, and study selection processes. This strengthens confidence in the findings and facilitates replication or future updates.

Limitations

First, the evidence base remains fragmented and heterogeneous. Studies varied widely in intervention type, duration, frequency, participant populations, comparator groups, and outcome measures. This diversity limited the ability to draw firm conclusions or conduct meta-analysis.

Second, many included studies were small-scale or exploratory, with limited sample sizes and short intervention durations. Few rigorous randomized controlled trials exist, particularly for gaming disorder and social media addiction. As a result, the overall strength of evidence is modest, and findings should be interpreted cautiously.

Third, the review was restricted to English-language, peer-reviewed publications, which may have excluded relevant studies published in other languages or formats such as dissertations and reports. This introduces potential publication bias and may underrepresent evidence from non-Western contexts.

Fourth, although the search strategy was comprehensive, the rapidly evolving terminology surrounding digital addictions (e.g., smartphone addiction, problematic use, digital dependence) means some studies may have been missed despite extensive keyword coverage.

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

Fifth, the review did not assess long-term outcomes or sustainability of yoga interventions. Most studies measured short-term effects, leaving uncertainty about whether benefits persist over time.

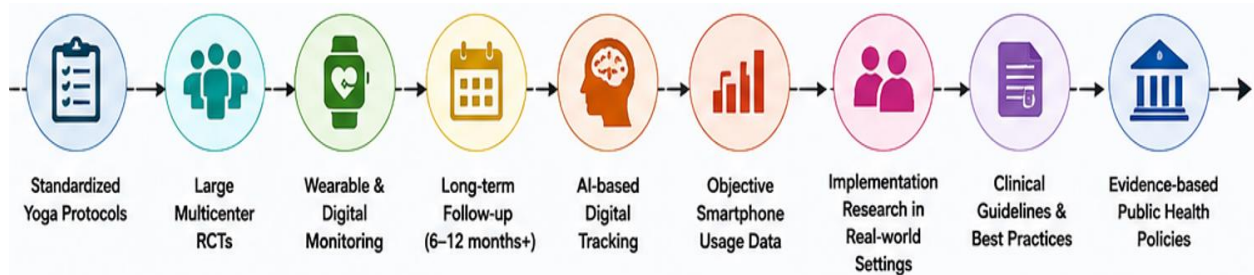


Figure 10: Future Research Roadmap

17. CONCLUSION

The present EGM reviews the scientific literature on yoga-based interventions for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. As digital technologies continue to transform communication, education, employment, healthcare, and daily life, excessive and maladaptive digital technology use has become a major public health issue with serious psychological, cognitive, social, and behavioural effects. The growing prevalence of problematic digital technology use among adolescents, university students, young adults, working professionals, and the general adult population necessitates safe, accessible, and sustainable interventions that promote healthier digital behaviours and mental health. In this context, yoga has gained popularity as a holistic mind–body intervention that uses physical postures, controlled breathing, meditation, relaxation, and mindfulness to improve self-regulation, emotional balance, cognitive function, and psychological resilience. This review shows that research on yoga-based approaches for problematic digital technology use has grown in recent years, reflecting scientific interest in complementary and non-pharmacological approaches to behavioural addictions. The literature consistently shows that yoga interventions reduce stress, anxiety, depression, and excessive digital engagement and improve emotional regulation, self-control, attention, sleep quality, executive functioning, and quality of life. These multidimensional benefits show that yoga can be used as a therapeutic intervention for problematic technology use and a preventive strategy to promote healthier digital habits and psychological resilience in educational, occupational, and community settings. The EGM from this review shows how research is distributed across intervention categories and outcome domains. The strongest evidence supports Integrated Yoga, Hatha Yoga, Pranayama, Meditation, and Mindfulness-based Yoga for addressing smartphone use, internet addiction, stress, anxiety, and depression in adolescents and university students. The matrix shows significant gaps in gaming disorder, social media addiction, excessive screen time, executive functioning, academic performance, and several yoga modalities like Raja Yoga, Iyengar Yoga, Ashtanga Yoga, and Kundalini Yoga. Working professionals, older adults, culturally diverse populations, and people with psychiatric comorbidities have little evidence. These findings show that while the evidence base grows, future research can improve the breadth, depth, and generalisability of scientific knowledge. The review also emphasises methodological considerations for future research. Intervention protocols, participant characteristics, comparator conditions, outcome measures, and study designs vary, making direct comparison and quantitative synthesis difficult. Standardising yoga intervention protocols, using validated behavioural and psychological assessment instruments, including objective digital usage measures, and conducting multicenter randomised controlled trials with larger sample sizes and longer follow-ups will strengthen the evidence base. To better understand the complex interactions between psychological processes, technology use, and therapeutic response, future research should integrate neurocognitive assessments, physiological biomarkers, digital phenotyping approaches, and behavioural analytics to study how yoga affects problematic digital technology use. Yoga appears to

Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

be a feasible, cost-effective, and accessible intervention that could complement behavioural and psychological treatments for problematic digital technology use. Yoga provides a holistic approach to well-being without the side effects of pharmacological interventions by addressing physical health, emotional regulation, cognitive functioning, stress management, and mindfulness. Thus, structured yoga programs in schools, universities, workplaces, community health initiatives, and primary healthcare services may promote digital wellness, reduce screen time, and improve mental health outcomes across diverse populations. The EGM also affects educators, healthcare providers, policymakers, and researchers. Educational institutions may use yoga-based digital wellness programs to reduce student smartphone use, academic stress, and attention. Healthcare professionals may use yoga as an adjunctive intervention in multidisciplinary programs for digital technology use and psychological distress. Policymakers can use this review's evidence to develop public health initiatives promoting responsible technology use and fund research to fill evidence gaps. Researchers can use the EGM to plan future studies on under-represented populations, new digital addictions, and yoga-based intervention models. The evidence is promising, but the review emphasises the need for more research before clinical recommendations can be made. Many studies are exploratory, with small sample sizes, short intervention durations, limited long-term follow-up, and methodological variability. Addressing these limitations through rigorous, standardised, and interdisciplinary research will strengthen yoga's therapeutic role and help translate research findings into clinical practice and public health policy. Finally, the EGM shows that yoga-based interventions are promising and increasingly supported for problematic smartphone use, internet addiction, gaming disorder, social media addiction, and excessive screen time. The literature shows positive effects on psychological well-being, emotional regulation, self-control, cognitive functioning, and digital behaviour, but it also highlights methodological limitations and unexplored research areas. This review systematically identifies evidence strengths and research gaps to lay the groundwork for future scientific research and promote yoga as an important part of holistic strategies to promote healthy digital lifestyles in a technology-dependent world. In the future, researchers, clinicians, educators, behavioural scientists, public health professionals, and policymakers must collaborate to expand the evidence base, optimise intervention design, and ensure that yoga-based approaches can support mental health and digital well-being across diverse populations.

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Mapping the Evidence on Yoga-Based Interventions for Problematic Smartphone, Internet, and Gaming Use: An Evidence Gap Map

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