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Identification and Ranking of Digital Lifestyle Components in the Formation of Sleep Disorders

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ABSTRACT

This study aimed to identify and rank the key components of digital lifestyle that contribute to the development of sleep dis orders. This research employed a sequential exploratory mixed-methods design. In the qualitative phase, data were collected exclusively through a comprehensive literature review of peer-reviewed articles, academic reports, and authoritative scientific sources related to digital behavior and sleep health. The extracted data were coded and analyzed using NVivo 14 until theoretical saturation was achieved. In the quantitative phase, a structured questionnaire derived from the qualitative results was administered to 200 participants residing in Tehran. A five-point Likert scale measured the perceived influence of each identified component on sleep disturbance. Data analysis was conducted using SPSS-26, applying descriptive statistics and the Friedman test to rank digital lifestyle components. The Friedman analysis revealed significant differences in the influence of the seven identified components on sleep disorders ($p < .05$). Digital Engagement Intensity received the highest ranking ($M = 4.52$), followed by Sleep Hygiene Disruption ($M = 4.41$) and Physiological Arousal ($M = 4.38$). Mid-level components included Emotional and Psychological Factors ($M = 4.29$) and Behavioral Lifestyle Patterns ($M = 4.17$). Lower-ranked components were Social–Digital Interaction ($M = 4.05$) and Digital Content Exposure ($M = 3.98$). These results indicate that behavioral and physiological digital mechanisms exert stronger influences on sleep disturbance than content-related factors. Digital lifestyle significantly contributes to sleep disturbance through behavioral, psychological, physiological, and environmental pathways. The study highlights that high engagement intensity, poor digital–sleep boundaries, and digital-induced physiological arousal are the most critical predictors of sleep disorders. These findings provide a structured framework for designing preventive strategies, digital-wellness programs, and sleep-health interventions tailored to high-risk populations.

Keywords: Digital lifestyle; sleep disorders; internet use; social media; physiological arousal; sleep hygiene; behavioral patterns

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Introduction

Sleep is widely recognized as a fundamental biological necessity that regulates emotional stability, cognitive performance, physiological restoration, and overall well-being. Growing evidence indicates that the rise of digital lifestyles—characterized by continuous internet connectivity, pervasive social media use, and digital communication—has fundamentally reshaped sleep behaviors across different age groups. With

the rapid expansion of digital technologies, individuals increasingly interact with screens late into the night, often experiencing altered sleep patterns, sleep deficits, and impaired sleep quality. These behavioral, cognitive, and physiological disruptions have intensified the prevalence of sleep-related problems, particularly among adolescents, university students, and young adults living in technologically intensive environments. Contemporary studies confirm that digital consumption patterns play a measurable role in shaping sleep health, with specific behavioral components, psychological mechanisms, and biological responses contributing to the onset and persistence of sleep disturbances (1-3).

In recent years, scholars have emphasized that digital lifestyle factors—including internet addiction, problematic device use, and excessive interaction with social media—directly influence sleep onset latency, sleep duration, nighttime awakenings, and overall sleep satisfaction. Internet addiction, in particular, has been strongly linked to deficits in sleep quality among young populations, especially medical students and adolescents who frequently rely on digital tools for academic, social, and entertainment purposes. For instance, research on Saudi medical students demonstrated that excessive internet engagement is significantly associated with poor sleep quality and daytime dysfunction, suggesting that high-intensity digital behavior may disrupt circadian rhythms and reduce restorative sleep (1). Similar findings have been echoed in studies on secondary school students, where social media and internet use during late hours markedly reduced sleep duration and quality (2). These findings highlight that as digital reliance increases globally, sleep health becomes increasingly vulnerable to technologically mediated lifestyle choices.

Neuroscientific investigations have expanded understanding of the mechanisms connecting digital use to sleep impairment, pointing to altered neural network functioning and cognitive hyperactivation. Studies exploring the intrinsic default-mode network demonstrate that individuals with higher tendencies toward internet addiction experience disruptions in neural connectivity that correlate with diminished sleep quality (3). From a developmental and psychological standpoint, adolescents and emerging adults appear particularly susceptible to these disruptions, as their neurobiological systems are more sensitive to overstimulation. Moreover, demographic factors, social pressures, and psychological characteristics—such as worry, stress, mood fluctuations, and emotional vulnerability—intensify the interaction between digital usage and sleep, creating a multifaceted behavioral phenomenon (4). These overlapping behavioral, psychological, and neurological pathways demonstrate that digital lifestyles must be understood as complex, multidimensional constructs rather than isolated behavioral choices.

The broad spectrum of digital lifestyle factors extends beyond screen time to include interpersonal dynamics, social health, and relational behaviors. Some studies highlight that social health and engagement in digital networks influence lifestyle habits and overall well-being, including sleep hygiene routines (5). In parallel, lifestyle behaviors such as nutrition, COVID-related health practices, and physical activity also intersect with digital habits, showcasing the broader role of lifestyle patterns in shaping individuals' physical and psychological resilience (6). Given these interconnected variables, sleep disturbances cannot be understood solely as biological reactions to digital stimuli; instead, they represent the combined effect of behavioral, psychological, social, environmental, and technological components of modern life.

Other studies reinforce that lifestyle variables—particularly patterns of chronic stress, physical inactivity, or maladaptive coping behaviors—contribute to the vulnerability of individuals experiencing digital exhaustion or device-related hyperstimulation. Persistent exposure to stressors, whether digital or

environmental, has been shown to amplify physiological arousal and prolong nighttime activation, ultimately delaying sleep onset and reducing sleep continuity. For example, research conducted among Austrian women demonstrated that lifestyle factors and chronic stress significantly influence migraine and headache intensity, illustrating broader implications for sleep-related physiological functioning (7). These findings suggest that lifestyle-based disturbances such as stress, sleep irregularity, and digital fatigue are part of a larger framework of biopsychosocial influences linked to sleep health.

Parallel evidence has emerged in intervention-based studies, showing that digital platforms can also play constructive roles in improving sleep health when used in structured therapeutic formats. Research on internet-delivered cognitive behavioral therapy (iCBT) programs demonstrates that digital therapeutic interventions can enhance sleep quality, improve executive functioning, and reduce anxiety when appropriately designed (8, 9). These intervention studies underscore that while digital technology poses risks for sleep disruption, it also offers opportunities for clinical and behavioral improvement when used intentionally. This dual role of digital technologies emphasizes the importance of distinguishing harmful digital lifestyle patterns from beneficial digital applications, especially in youth and student populations.

Concerns about digital behavior extend particularly to adolescents and young adults, who constitute one of the highest-risk groups for sleep disturbances. Studies from India demonstrate high prevalence rates of internet addiction among university students and professionals, showing that excessive digital socialization can significantly interfere with academic performance, interpersonal relationships, and sleep patterns (10). Adolescents' susceptibility to social media addiction, digital fatigue, and the constant pressure of online connectivity further intensifies challenges associated with nighttime device use. Psychological studies from South Asia highlight that social media addiction is closely associated with disrupted sleep patterns, heightened stress, and decreased daytime functioning (11). These patterns paint a consistent global picture: digital lifestyle behaviors increasingly interfere with critical biological processes and psychosocial well-being.

Social media has emerged as a particularly potent factor influencing sleep, with multiple studies identifying emotional, behavioral, and cognitive pathways through which it disrupts rest. Mechanisms such as social comparison, emotional hyperarousal, self-monitoring, and the compulsive checking of notifications have been identified as key mediators of sleep disruption (12). The relationship between social media, stress, and sleep is well-documented, with U.S. studies revealing that perceived stress significantly interacts with social media use to predict diminished sleep quality (13). In addition, problematic exposure to negative or emotionally stimulating content before bedtime has been linked to nightmares, altered emotional states, and lower affective well-being (14). These findings collectively suggest that the psychological and emotional dimensions of digital lifestyles play an equally important role in shaping sleep health as physiological mechanisms.

Cultural and religious lifestyle dimensions have also been explored. For instance, religious orientation and Islamic lifestyle practices have been shown to predict student sleep health, indicating that behavioral and cultural frameworks can buffer or amplify the effects of digital exposure (15, 16). Such findings highlight the need for culturally contextualized analyses of sleep disturbances within digitally connected societies. Other psychological and demographic studies emphasize the role of social support, daytime sleepiness, and

depressive symptoms in moderating the effects of internet addiction on young adults (17), suggesting that individual vulnerability factors significantly influence the impact of digital life on sleep.

Additional investigations support the notion that digital behaviors and sleep disruptions often co-occur with broader mental health challenges, especially among populations dealing with substance use disorders or chronic stress conditions. Evidence indicates that sleep quality may mediate the relationship between problematic internet behavior and overall quality of life in high-risk groups (18). Similarly, the relationship between social media addiction and sleep has been documented in medical student populations across different cultural contexts, demonstrating consistent patterns of delayed sleep, reduced efficiency, and heightened nocturnal arousal (19). These global trends illustrate that digital lifestyle behaviors represent one of the most important contemporary public-health challenges with far-reaching consequences for sleep physiology and psychological functioning.

Beyond addiction and psychological influences, structural elements of digital engagement—such as the nature of online content, the pressure of constant connectivity, and the academic or workload-related responsibilities mediated through digital platforms—have also been identified as contributing factors to sleep disturbances. This has been particularly evident among college students, whose academic obligations often require extended online activity, thereby increasing exposure to digital stimuli that disrupt circadian rhythms (20). As digital media becomes further integrated into educational systems, workplace environments, and interpersonal communication, sleep health risks may escalate across all age groups unless compensatory lifestyle adjustments and protective behavioral measures are implemented.

Taken together, these studies demonstrate that digital lifestyles contribute to sleep disturbances through multiple pathways, including neural overstimulation, psychological stress, emotional dysregulation, behavioral irregularities, social pressures, and lifestyle-related vulnerabilities. The rising ubiquity of digital technology across societies underscores the urgency of identifying, conceptualizing, and ranking the specific components of digital lifestyle most responsible for shaping sleep outcomes. Despite extensive research linking digital behavior with sleep health, there remains a need to systematically identify the core dimensions of digital lifestyle and empirically assess their relative importance across populations, particularly in urban contexts where digital engagement is high.

Therefore, the aim of this study is to identify and rank the components of digital lifestyle that contribute to the formation of sleep disorders.

Methods and Materials

Study Design and Participants

This study was conducted using a sequential exploratory mixed-methods design consisting of two distinct phases. The first phase employed a qualitative approach aimed at identifying the components of the digital lifestyle associated with the formation of sleep disorders. In this phase, no human participants were involved; instead, data were derived exclusively from an extensive literature review encompassing peer-reviewed articles, academic books, reports, and authoritative scientific sources published in the domains of digital behavior, lifestyle studies, and sleep science. The process continued until theoretical saturation was achieved, meaning no new concepts emerged and the identified components demonstrated stability and conceptual adequacy.

The second phase of the study adopted a quantitative approach to rank the identified components and determine their relative importance. In this stage, 200 individuals residing in Tehran were selected as participants. Inclusion criteria required participants to be at least 18 years old, regular users of digital technologies (including smartphones, social media, online gaming, or digital consumption platforms), and willing to complete the research questionnaire. Individuals with diagnosed neurological disorders or severe psychiatric conditions were excluded to prevent confounding effects on sleep-related outcomes.

Data Collection

In the qualitative phase, data collection relied on systematic and narrative review techniques. Search queries were conducted in major scientific databases such as Web of Science, Scopus, PubMed, and Google Scholar using keywords including *digital lifestyle*, *screen time*, *sleep hygiene*, *technology use*, and *sleep disorder*. Studies were screened using predefined inclusion and exclusion criteria. Extracted data—concepts, themes, and relevant components—were imported into NVivo 14 software for coding, categorization, and thematic synthesis. The coding procedure included open coding to identify initial concepts, axial coding to establish thematic relationships, and selective coding to refine overarching digital lifestyle components.

In the quantitative phase, data were collected using a structured questionnaire designed based on the components identified in the qualitative phase. The questionnaire applied a Likert-scale format and was distributed both online and in paper form to participants across Tehran. Prior to data collection, the instrument underwent expert review to ensure content validity. Ethical considerations—including confidentiality, informed consent, and voluntary participation—were fully observed.

Data analysis

Qualitative data analysis was performed using NVivo 14. The software facilitated systematic coding, memo writing, and theme development. Coding reliability was enhanced through repeated review cycles and peer debriefing. Theoretical saturation was confirmed when subsequent literature sources produced no new themes or categories, ensuring robustness of the extracted components.

Quantitative data analysis aimed at ranking and prioritizing the digital lifestyle components derived from the qualitative phase. Data were entered into SPSS version 26 for descriptive and inferential statistical analysis. Descriptive statistics (mean, standard deviation, frequency distribution) were used to summarize participant characteristics and component-level responses. Inferential analysis included the use of Friedman ranking test to prioritize components, and Kendall's W coefficient to evaluate agreement in ranking. Statistical significance was set at $p < .05$.

Findings and Results

The qualitative phase of the study aimed to identify the core components of the digital lifestyle that contribute to the formation of sleep disorders. This phase was conducted through an extensive literature review, examining scientific sources related to digital behavior, sleep health, and technology–induced psychological and physiological changes. Using NVivo 14 software, extracted data were coded, categorized, and synthesized. The analytical process followed open, axial, and selective coding. Theoretical saturation was achieved when no new concepts emerged, ensuring that the identified components represented a

comprehensive and theoretically grounded set of factors influencing sleep disturbances within digital environments.

Table 1. Main Themes, Subthemes, and Concepts Identified Through Qualitative Analysis

Main Themes (Categories)	Subthemes (Subcategories)	Concepts (Open Codes)
1. Digital Engagement Intensity	Excessive Screen Time	Prolonged device exposure; Late-night scrolling; Screen overuse habits; Irregular usage cycles
	Multi-Platform Usage	Switching between apps; Overlapping digital tasks; Simultaneous media use
	Digital Overload	Information saturation; Cognitive fatigue; Constant connectivity; Digital burnout; Overstimulation
2. Sleep Hygiene Disruption	Bedtime Technology Use	Watching videos in bed; Smartphone dependency; Device near pillow; "One more episode" pattern
	Poor Digital–Sleep Boundary	No fixed digital curfew; Work/study notifications; Evening social media use
3. Physiological Arousal	Blue Light Exposure	Melatonin suppression; Retinal stimulation; Circadian rhythm delay
	Cognitive Hyperactivation	Overthinking after digital use; Mental replay of content; Heightened alertness; Emotional arousal
	Sensory Stimulation	Loud notifications; Vivid imagery; High-tempo gaming sounds; Visual overstimulation
4. Emotional & Psychological Factors	Anxiety Triggered by Digital Content	Fear of missing out (FOMO); Social comparison worry; Distress from news exposure
	Digital Stress	Over-engagement pressure; Online performance anxiety; Social media fatigue; Constant responsiveness
	Mood Dysregulation	Irritability after long use; Emotional swings from media; Reward-seeking behavior
	Nighttime Rumination	Repetitive thoughts; Pre-sleep worry loops; Thinking about online conflicts; Anticipatory anxiety
5. Behavioral Lifestyle Patterns	Irregular Sleep Schedules	Delayed bedtime routines; Weekend–weekday mismatch; Revenge bedtime procrastination
	Sedentary Digital Practices	Long sitting hours; Minimal physical activity; Gaming-related immobility
	Digital Eating Behavior	Snacking during online use; Irregular meal timing; Eating in front of screens
6. Social–Digital Interaction	Nighttime Online Communication	Late-night messaging; Group chat overactivity; Online social engagement
	Social Validation Seeking	Checking for likes; Emotional dependence on feedback; Fear of negative evaluation
7. Digital Content Exposure	Stimulating Entertainment Content	Fast-paced videos; Competitive gaming; Thriller/horror consumption
	Work-/Study-Related Content	Late-night assignments; Remote work obligations; Online class materials
	Addictive Platform Algorithms	Auto-play mechanisms; Infinite scrolling systems; Personalized content loops; Notification-based engagement

Theme 1: Digital Engagement Intensity: The first theme, *Digital Engagement Intensity*, represents the overarching pattern of individuals' deep and continuous involvement with digital technologies, which emerged as a major contributor to sleep disturbance. The analysis indicated that excessive screen time—characterized by prolonged device exposure, late-night scrolling, and irregular usage cycles—creates an environment in which disengaging from digital activities becomes increasingly difficult near bedtime. Multi-platform usage further intensifies this pattern, as individuals often switch between several apps or engage in overlapping digital tasks, leading to simultaneous media consumption and persistent attention fragmentation. Additionally, digital overload surfaced as a significant subtheme, marked by information saturation, cognitive fatigue, constant connectivity, digital burnout, and overstimulation. These forms of engagement collectively prolong arousal levels and delay the cognitive transition required for healthy sleep onset, demonstrating how the quantity and diversity of digital interactions can disrupt sleep routines.

Theme 2: Sleep Hygiene Disruption: The second theme, *Sleep Hygiene Disruption*, highlights the erosion of healthy sleep-related habits due to digital technology use. Bedtime technology use appeared as a major subtheme, where behaviors such as watching videos in bed, keeping smartphones close to the pillow, and persisting with the "one more episode" pattern directly interfered with winding down before sleep. Furthermore, poor digital–sleep boundaries demonstrated how the absence of a digital curfew, exposure to nighttime notifications related to work or study, and engaging in evening social media use prevent individuals from establishing consistent pre-sleep routines. Together, these patterns suggest that digital tools, when integrated into bedtime behaviors, significantly undermine sleep hygiene by replacing restorative rituals with high-engagement digital consumption, ultimately influencing both sleep onset and sleep quality.

Theme 3: Physiological Arousal: The third theme, *Physiological Arousal*, reflects how digital technology use triggers bodily and neurological responses that interfere with the natural sleep cycle. Blue light exposure emerged as a crucial subtheme, with melatonin suppression, retinal stimulation, and circadian rhythm delay presenting clear physiological mechanisms through which screens disrupt sleep-wake patterns. In parallel, cognitive hyperactivation manifested through overthinking after digital use, replaying consumed content, heightened alertness, and emotional arousal. Sensory stimulation, caused by loud notifications, vivid imagery, high-tempo gaming sounds, and visually intense content, further contributed to physiological alertness. These interconnected physiological mechanisms illustrate how digital activities elevate arousal levels and inhibit the body's ability to transition into a restful state, thereby exacerbating sleep difficulties.

Theme 4: Emotional and Psychological Factors: The fourth theme, *Emotional and Psychological Factors*, demonstrates how digital environments influence emotional states and psychological processes that contribute to sleep disturbances. Anxiety triggered by digital content appeared prominently, involving fear of missing out (FOMO), social comparison concerns, and distress caused by exposure to negative news or stressful content. Digital stress added another dimension, emerging from pressures of over-engagement, online performance demands, social media fatigue, and expectations for continuous responsiveness. Mood dysregulation also played a role, as irritability, emotional fluctuations driven by media content, and reward-seeking digital habits were linked to nighttime discomfort. Nighttime rumination further intensified psychological arousal, with individuals experiencing repetitive thoughts, pre-sleep worry loops, and anticipatory anxieties often rooted in online interactions. These psychological processes collectively create an emotionally charged pre-sleep environment, limiting individuals' capacity to mentally disengage and relax.

Theme 5: Behavioral Lifestyle Patterns: The fifth theme, *Behavioral Lifestyle Patterns*, captures the broader behavioral habits that accompany digital use and contribute to sleep problems. Irregular sleep schedules were commonly observed, including delayed bedtime routines, inconsistencies between weekday and weekend sleep patterns, and revenge bedtime procrastination—a phenomenon in which individuals delay sleep to compensate for perceived loss of personal time. Sedentary digital practices also emerged, as extended sitting hours, minimal physical activity, and prolonged gaming sessions reflected lifestyle immobility linked to digital engagement. Additionally, digital eating behaviors—such as snacking during online use, irregular meal timing, and screen-based eating—were found to further disturb metabolic rhythms

associated with sleep. These patterns reveal how digital lifestyles shape daily behaviors that collectively disrupt the biological and behavioral foundations of healthy sleep.

Theme 6: Social–Digital Interaction: The sixth theme, *Social–Digital Interaction*, emphasizes the role of online social behavior in shaping sleep disturbances. Nighttime online communication—through late-night messaging, active group chats, and extended online social engagement—was frequently linked to delayed sleep onset and heightened cognitive arousal. Furthermore, social validation seeking emerged as a powerful driver of nighttime digital activity, as individuals repeatedly checked for likes, relied emotionally on positive feedback, and feared negative evaluations from online audiences. These socially driven behaviors extend digital engagement into late hours and intensify psychological investment in digital interactions, thereby prolonging wakefulness and interfering with the mental detachment needed for restful sleep.

Theme 7: Digital Content Exposure: The seventh theme, *Digital Content Exposure*, concerns the types of content individuals consume and their direct influence on sleep quality. Stimulating entertainment content—such as fast-paced videos, competitive gaming, and thriller or horror media—was shown to elevate physiological and emotional arousal near bedtime. Work- or study-related content similarly contributed to sleep disruption by maintaining cognitive activation through late-night assignments, remote work tasks, or review of educational materials. Addictive platform algorithms also played a critical role, as auto-play features, infinite scrolling, personalized recommendation loops, and notification-based engagement encouraged prolonged usage beyond intended time limits. These forms of content exposure create conditions that delay disengagement and reinforce nighttime wakefulness, ultimately heightening the risk of sleep disorders.

The quantitative phase of the study aimed to rank and determine the relative importance of the digital lifestyle components previously identified during the qualitative phase. A total of 200 participants residing in Tehran completed the structured questionnaire derived from the seven major themes. Participants responded to items using a five-point Likert scale reflecting the perceived contribution of each component to sleep disturbances. Data analysis was performed using SPSS version 26, where descriptive statistics, Friedman ranking tests, and mean score comparisons were applied. This phase provided an empirical prioritization of the digital lifestyle factors influencing sleep disorders, enabling a clearer understanding of which components exert the greatest impact.

Table 2. Ranking of Digital Lifestyle Components in the Formation of Sleep Disorders

Rank	Component	Mean Score
1	Digital Engagement Intensity	4.52
2	Sleep Hygiene Disruption	4.41
3	Physiological Arousal	4.38
4	Emotional & Psychological Factors	4.29
5	Behavioral Lifestyle Patterns	4.17
6	Social–Digital Interaction	4.05
7	Digital Content Exposure	3.98

The ranking results showed that *Digital Engagement Intensity* achieved the highest mean score (M = 4.52), indicating its dominant role in shaping sleep disturbances among digital users. *Sleep Hygiene Disruption* and *Physiological Arousal* were ranked second and third, demonstrating their substantial influence on bedtime routines and biological sleep processes. *Emotional and Psychological Factors* followed closely, highlighting the relevance of digital-induced stress and anxiety. The mid-level ranking of *Behavioral*

Lifestyle Patterns and *Social–Digital Interaction* suggests that while they contribute meaningfully, their impact is comparatively less pronounced. *Digital Content Exposure* received the lowest ranking, indicating that although content type matters, it plays a secondary role relative to engagement intensity and physiological mechanisms. Overall, participants perceived the interplay between behavioral engagement, cognitive arousal, and disrupted sleep hygiene as the most powerful drivers of sleep problems.

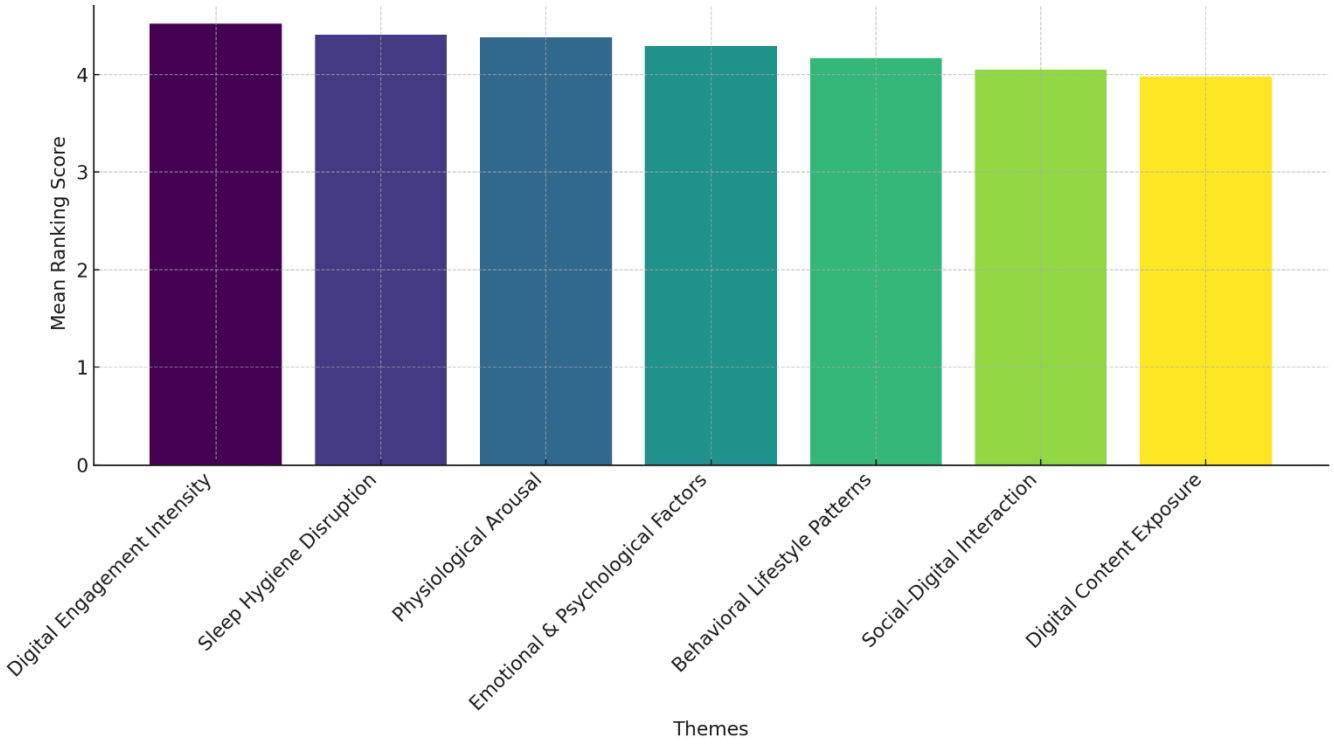

Figure 1. Ranking of Digital Lifestyle Components in Sleep Disorders

Discussion and Conclusion

The purpose of this study was to identify and rank the components of digital lifestyle that contribute most significantly to the formation of sleep disorders. The results revealed seven core dimensions—digital engagement intensity, sleep hygiene disruption, physiological arousal, emotional and psychological factors, behavioral lifestyle patterns, social–digital interaction, and digital content exposure—each exerting varying degrees of influence on sleep health. Ranking analysis showed that *digital engagement intensity* emerged as the strongest predictor, followed closely by *sleep hygiene disruption* and *physiological arousal*, while *digital content exposure* ranked lowest among the identified components. These findings illustrate that although the nature of digital content matters, it is the behavioral and physiological mechanisms associated with digital overuse that exert the most direct and potent influence on sleep disturbances. The results not only align with previous research but also extend the understanding of digital lifestyle factors by systematically identifying and prioritizing them in a single integrated framework.

Consistent with the findings of this study, excessive internet and social media use has been repeatedly linked to poor sleep quality among adolescents, students, and young adults. For example, research conducted among medical students in Saudi Arabia demonstrated that higher levels of internet addiction were significantly associated with reduced sleep quality, daytime dysfunction, and overall health impairment (1).

This aligns with our ranking results, where digital engagement intensity—characterized by excessive screen time, multi-platform use, and cognitive overload—was identified as the most substantial contributor to sleep disruption. Similar findings among secondary school students in Baghdad revealed that social media use and prolonged nighttime internet activity were strongly associated with delayed sleep onset and reduced sleep duration (2). These converging results reinforce that heavy engagement with digital devices, especially at night, disrupts circadian rhythms and interferes with pre-sleep cognitive downregulation.

The second-highest ranked factor, sleep hygiene disruption, directly reflects the growing dominance of digital devices in bedtime routines. Prior research suggests that adolescents and school-going youth experience sleep difficulties due to habits such as using smartphones in bed, watching videos before sleep, or responding to notifications during nighttime hours (4). These patterns mirror our findings that poor digital–sleep boundaries—including the absence of digital curfews and cross-interference of work or academic notifications—significantly degrade sleep quality. Studies on student populations emphasize that lifestyle behaviors related to digital media are often embedded within broader social health contexts, such as family dynamics and daily routines (5). Therefore, disruptions in sleep hygiene are rarely isolated behaviors but part of a broader digital lifestyle ecosystem that shapes daily functioning.

Physiological arousal ranked as the third most influential dimension, supporting widespread evidence that digital screens and online engagement activate neurophysiological pathways that impair sleep. Neuroscientific findings indicate that problematic internet use affects the default-mode network and contributes to cognitive hyperactivation, which delays sleep onset and reduces sleep depth (3). Chronic exposure to blue light, emotionally stimulating content, and high-intensity sensory input—particularly through gaming—further disrupts melatonin production and circadian processes. Furthermore, studies show that lifestyle factors and chronic stress exacerbate physiological arousal, thereby worsening sleep parameters (7). These findings strongly correspond with our theme identifying sensory stimulation, blue-light exposure, and cognitive hyperarousal as core mechanisms through which digital lifestyles impede biological sleep regulation.

The fourth-ranked dimension, emotional and psychological factors, reflects the psychological consequences of excessive digital use, including stress, worry, rumination, and emotional dysregulation. These findings align with extensive literature documenting the interplay between stress, social media use, and deteriorating sleep quality. For example, research on adolescents and emerging adults in the United States found that excessive social media use interacts with perceived stress to predict substantial reductions in sleep quality (13). Moreover, studies demonstrate that digital environments can provoke nightmares, emotional fluctuations, or fear-based responses, contributing to disrupted sleep and reduced affective well-being (14). Psychological vulnerabilities—such as social anxiety, mood instability, and fear of missing out—further compound these effects. Our findings closely mirror these patterns by identifying anxiety triggered by digital content, digital stress, mood dysregulation, and nighttime rumination as potent psychological contributors to sleep disorders.

Behavioral lifestyle patterns ranked fifth and included elements such as irregular sleep schedules, sedentary digital practices, and nighttime snacking during device use. Evidence from COVID-19 lifestyle research shows that unhealthy lifestyle behaviors—including physical inactivity, excessive screen time, and inconsistent routines—intensify physiological stress and increase vulnerability to health complications (6).

Moreover, studies on internet addiction demonstrate that digital socialization patterns disrupt not only academic and professional functioning but also natural rhythms associated with daily living, including meal timing and sleep consistency (10). Our identification of behavioral lifestyle patterns as a mid-level influence on sleep suggests that while these behaviors meaningfully contribute to sleep disturbance, their effects are moderated by more immediate physiological and psychological digital interactions.

The sixth-ranked component, social–digital interaction, reflects influences associated with social validation seeking and nighttime online communication. Research indicates that social media addiction significantly impacts sleep patterns, particularly among adolescents and young adults who are emotionally invested in online interactions (11). Mechanisms linking social media use and sleep disruption include compulsive checking of notifications, emotional dependence on feedback, and heightened sensitivity to social comparison—all of which intensify nighttime arousal (12). Studies also show that depressive symptoms, daytime sleepiness, and reduced social support are important mediators linking digital engagement with sleep impairment (17). Our findings confirm these associations, ranking social–digital interaction as an important, though not dominant, contributor to sleep disruption.

The lowest-ranked dimension, digital content exposure, includes stimulating entertainment, academic or work-related content, and addictive algorithmic mechanisms. Although this dimension scored lower than others, it remains an important part of the sleep disturbance pathway. Research on substance use populations emphasizes that poor sleep quality magnifies the negative effects of problematic internet use on quality of life, suggesting that content-related arousal may worsen clinical vulnerability (18). Similarly, studies in university settings reveal that both academic and entertainment-related digital use at night contribute to delayed sleep and impaired functioning (20). In medical student populations, content-driven social media addiction has been shown to significantly reduce sleep efficiency, underscoring the importance of understanding the nature—not just the duration—of digital exposure (19). Additionally, religious lifestyle research highlights how exposure to digital content that conflicts with personal values may impair cognitive-emotional regulation and sleep quality (15, 16). These insights reinforce that although digital content exposure ranked lowest, it remains a relevant and multifaceted contributor to sleep outcomes.

Overall, the study results align with a broad multidisciplinary body of research. They collectively highlight that digital lifestyles disrupt sleep through interlinked behavioral, psychological, social, neurological, and environmental pathways. The ranking of digital engagement intensity, sleep hygiene disruption, and physiological arousal at the top underscores the primacy of mechanisms involving overstimulation and behavioral immersion. At the same time, contextual factors such as emotional health, lifestyle routines, social relationships, and content types create additional layers of influence that cumulatively shape sleep health. The findings extend previous literature by offering a structured and empirically validated hierarchy of digital lifestyle components, providing researchers and practitioners with a practical framework for developing targeted interventions, preventive strategies, and public health guidelines.

This study, while comprehensive, is subject to several limitations. The first relates to its geographic and demographic boundaries: participants were drawn exclusively from Tehran, which may limit the generalizability of findings to other urban or rural populations with different cultural, socioeconomic, or technological environments. Second, the quantitative phase relied on self-report questionnaires, which may introduce response bias or inaccuracies related to self-perception, recall, or social desirability. Additionally,

the qualitative phase, based solely on literature review, may have overlooked unpublished studies, gray literature, or rapidly emerging digital behaviors not yet captured in academic databases. The cross-sectional nature of the study also prevents determination of causal relationships between digital lifestyle components and sleep outcomes. Finally, while the ranking method identifies relative influence, it does not provide detailed interaction effects or mediating pathways among the components.

Future research should expand the sample population to include diverse age groups, cultural contexts, and geographic regions to improve generalizability and comparative analysis. Longitudinal or experimental studies are recommended to determine causality and explore the temporal dynamics of digital lifestyle patterns and sleep disturbances. Future studies may also examine mediating variables such as emotional regulation, personality traits, or biological markers to uncover deeper mechanisms underlying the relationship between digital behavior and sleep. Additionally, research could investigate protective factors, including digital literacy, coping strategies, and lifestyle modifications, that may buffer the negative impacts of digital engagement on sleep. Finally, exploring culturally specific digital behaviors or religious lifestyle moderators would enrich the understanding of how digital habits shape sleep health across different societal frameworks.

Practitioners should prioritize developing educational programs that emphasize digital–sleep boundaries, such as limiting screen use before bedtime and establishing structured nighttime routines. Clinicians may incorporate digital lifestyle assessment into sleep evaluations, identifying behaviors related to overstimulation, nighttime social interaction, and cognitive hyperactivation. Schools and universities can implement digital hygiene workshops to reduce unhealthy device use among students, while policymakers should consider national guidelines addressing digital use and sleep health. Digital wellness interventions—such as screen-time management tools, behavioral reminders, and technology-free zones—can support individuals in creating healthier sleep environments. Furthermore, integrating digital well-being strategies into public health initiatives may help reduce the widespread sleep disruption associated with modern digital lifestyles.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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