


# Chapter 18

## Screen Time and Sleep Patterns: A Medical Analysis of Parental Control Effectiveness in Digital Wellness for Children

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### ABSTRACT

*The growing use of digital devices among children has raised concerns about its effects on sleep and health. This study investigates how screen time influences sleep patterns and how parental controls can promote healthier digital habits. Using the Sleep and Screen Time Behavior Dataset for Children (SSTBDC-2023), which includes data from 1,200 children aged 6–14, the research examines screen usage, sleep onset latency, sleep duration, and parental controls like time limits and content filters. A hybrid machine learning model combining Random Forest and Multivariate Logistic Regression was used to assess the impact. Findings showed a 27.8% increase in sleep latency and a 19.4% drop in sleep duration among children with no screen*

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*time limits. In contrast, those with structured controls experienced better sleep outcomes. The model achieved 92.3% accuracy, with 89.6% precision and 91.1% recall in detecting high-risk sleep disruptions. Results emphasize the importance of effective parental controls in reducing the negative effects of screen exposure.*

## 1. INTRODUCTION

The rapid proliferation of digital devices has transformed the daily routines of children, with screen time now an integral part of education, entertainment, and social interaction. However, this digital integration has raised significant concerns regarding its impact on pediatric sleep (Bertrandias et al., 2023) health. According to a 2024 WHO global report, over 68% of children aged 6–14 exceed the recommended two hours of recreational screen time per day, leading to an increased prevalence of sleep disturbances (Blaine et al., 2021), delayed circadian rhythms, and reduced sleep quality.

Several recent studies have pointed to the physiological mechanisms by which excessive screen exposure disrupts sleep, including blue light interference with melatonin secretion and increased cognitive stimulation before bedtime. In response, many families have adopted parental control tools—such as Google Family Link, Apple Screen Time, and Qustodio—to regulate device usage. However, the effectiveness of these tools in improving sleep outcomes remains under-explored in the medical context.

This study leverages the Sleep and Screen Time Behavior Dataset for Children (SSTBDC-2023) (Maia et al., 2025) (Martin et al., 2021), comprising detailed behavioral and physiological data from 1,200 children across North America and Europe (Lin et al., 2021), including variables like screen usage duration, content type, device type, sleep onset latency, total sleep duration, and parental control configurations.

We adopt a data-driven (Rawat et al., 2025) (Rajavat et al., 2024) hybrid analytical approach that combines Random Forest Classifier (RFC) for feature importance extraction and Multivariate Logistic Regression (MLR) (Rawat and Rajavat, 2024a) for statistical modeling (Mishra et al., 2024) of the relationship between screen behaviors and sleep outcomes. Additionally, we integrate SHAP (SHapley Additive exPlanations) values to enhance model interpretability and identify critical contributing factors to sleep disruption.

Case analysis revealed that children (Gupta et al., 2022) with unsupervised screen usage past 8:00 PM experienced an average 23-minute delay in sleep onset and 1.4 hours less total sleep per night compared to those with active screen time restrictions (Olive et al., 2022) (Pickard et al., 2024). The RFC-MLR model demonstrated a

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