IMPACT OF DIGITAL MEDIA USE ON PATTERN OF SLEEP HABITS IN CHILDREN

THESIS SUBMITTED TO

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

In partial fulfillment of the requirement for the degree of

DOCTOR OF MEDICINE (M.D.)

(PEDIATRICS)

DR. DORESWAMY C

JULY, 2020

AIIMS, JODHPUR

DECLARATION

I declare that the thesis titled **"Impact of Digital Media use on Pattern of Sleep Habits in Children"** embodies the original work carried out by the undersigned at All India Institute of Medical Sciences, Jodhpur.

Dr. Doreswamy C
Department of Pediatrics
All India Institute of Medical Sciences,
Jodhpur, (Rajasthan)

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

CERTIFICATE

This is to certify that the thesis titled **"Impact of Digital Media use on Pattern of Sleep habits in Children"** is the bonafide work of **Dr. Doreswamy C** carried out under our guidance and supervision in the Department of Pediatrics, All India Institute of Medical Sciences, Jodhpur.

Dr. Kuldeep Singh
Professor and Head
Department of Pediatrics
All India Institute of Medical Sciences, Jodhpur

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Supervisor

DR. PRAWIN KUMAR
Additional Professor
Department of Pediatrics
AIIMS Jodhpur

Co-Supervisors

DR. KULDEEP SINGH
Professor and Head of the Department
Department of Pediatrics
AIIMS Jodhpur

DR. JAGDISH PRASAD GOYAL
Professor
Department of Pediatrics
AIIMS, Jodhpur

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All India Institute of Medical Sciences, Jodhpur

Dean (Academic) R.N. 14995 Date 2/1/23 AIIMS, Jodhpur

AIIMS/JDH/Pediatics/2023/0180

Through Proper Channel

Date: 02 January, 2023

To

The Dean (Academic)

All India Institute of Medical Sciences

Jodhpur - 342005

Rajasthan, India

Subject: Submission of Thesis for MD degree titled "Impact of Digital Media use on Pattern of Sleep Habits in Children"

Respected Sir,

I am submitting five copies of my MD thesis titled **"Impact of Digital Media use on Pattern of Sleep Habits in Children"**

Please kindly accept my thesis.

Thank you for your consideration.

Yours Sincerely

Dr. Doreswamy C

Junior Resident (Academic)

Department of Pediatrics

AIIMS Jodhpur

AIIMS Jodhpur

FPA

डॉ. कुलदीप सिंह
Dr. Kuldeep Singh
Professor & Head, Pediatrics
AIIMS, Jodhpur (Raj.)

Department of Pediatrics, AIIMS Jodhpur, Basni Industrial Area, Phase- II, Jodhpur -342005.

ACKNOWLEDGEMENT

I am grateful to dedicate this dissertation to ***Dr. Prawin Kumar****, Additional Professor in the Department of Pediatrics at AIIMS Jodhpur. His guidance and support throughout this process have been invaluable, and I am thankful to have had the opportunity to learn from such a talented and compassionate teacher. Sir had always believed in my abilities and provided encouragement and reassurance when I needed it most. His words of wisdom and inspiration have motivated me to do my best and strive for excellence. I have learned so much from him, not just about my field of study but also about life in general. I am grateful to have had him as a mentor and role model, and this dissertation is a small way of expressing my appreciation for all he has done for me.*

I also thank my co-guides, ***Professor Kuldeep Singh, and Professor Jagdish Prasad Goyal****, for their valuable input and constant support.*

I would like to extend my thanks to all the teachers - ***Professor Arun Singh, Dr. Neeraj Gupta, Dr. Daisy Khera, Dr. Aliza Mittal, Dr. Bharat Choudhary, Dr. Siyaram Didel, Dr. Thanigai Nathan, Dr. Lokesh Saini, Dr. Jitendra Kumar Meena, Dr. Sushil Kumar Choudhary.*** *I have learned something from each of them; without their teachings, my training as a researcher or student would be incomplete.*

I dedicate this dissertation to my parents, ***Anitha, Santhosh, Saraswathi, Jaya Naik, Dr. Saraswathi V Naik and Lakshmi Amma****, who has been a constant source of strength and motivation for me. I also want to express my gratitude to my dear* ***Dr. Rakshitha Yadav M****, who provided support and care while completing my thesis and residency. As I complete this dissertation, I also want to pay tribute to my grandparents, Nagya Naik and Nagibai.*

I dedicate this dissertation to my extended family in Rajasthan, including ***Rajendra P Choudhary uncle, Rama aunty, Gitika didi, Rishabh, and Nanu****, who provided care and love during this journey and made me feel at home in Jodhpur.*

A special thanks to my dearest postgraduate friends, ***Dr. Vishnu, Dr. Anil, Dr. Kandha Kumar, Dr. Kkomal and Dr. Sanjana,*** *this dissertation would not be complete without their assistance.*

I extend my gratitude to all my seniors, juniors, and nursing staff in the department.

I am thankful to all my patients and enrolled children in the study, who have helped me to continually improve and grow as a healthcare professional.

Several other individuals have significantly contributed to my thought process and work. I am grateful for their support and inspiration, and I hope to maintain a strong relationship with them in the future. They have been a valuable source of friendship and trust for me.

Dr. Doreswamy C

Dedicated to

GOD

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INTRODUCTION

Sleep is a fundamental requirement of human beings. It is a physiological process to keep our body in a state of homeostasis, to regenerate and restore body cells and functions. Sleep improves memory and enhances brain synapses. For optimal health and well-being, a good night's sleep is necessary. We sleep for roughly one-third of our lives. Children need optimal sleep to maintain their physical and mental health. It favors physical activity, learning ability, boosts immunity, improves mood, and regulates metabolism. Instilling healthy sleep patterns in children at a young age is therefore crucial. Optimal sleep reduces behavioural problems and intellectual deficiencies that may affect their capacity to learn in school (1).

Sleep deprivation in children leads to decreased physical activity, tiredness, and drowsiness. It impairs cognitive abilities like lack of focus, lower performance, thinking ability, memory processing disability, lack of motivation, and mental health issues are the main effects of sleep deprivation. Lack of sleep makes it harder to think, manage stress, compromise immune function and emotion management. It is also associated with weight gain, obesity, inflammation, and cardiovascular diseases like hypertension and metabolic diseases like diabetes and long-term mortality (2, 3).

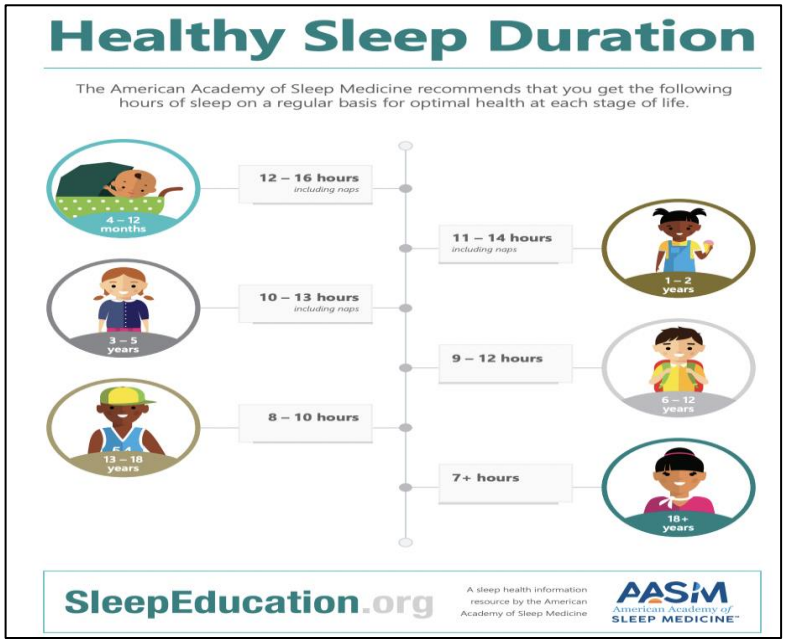
A child may nod off at school, feel fatigued, suffer from poor concentration, experience memory loss, become irritable and frustrated, and have an increased risk of accidents or injuries due to sleep deprivation. According to the world health organization (WHO), daily tiredness can be seen as an impact of short-duration sleep deprivation; long-term effects have been linked to daytime drowsiness and behavioural issues. Children not getting enough sleep has been linked to attention-deficit hyperactivity disorder (4).

The sleep pattern and duration depend on several factors: age, sex, development, geographical regions, cultural background, socioeconomic status, etc. It is imperative in infants and children as it is essential for numerous biological functions, such as immunological and metabolic regulation (5,6). The American Academy of Sleep Medicine (AASM) recommends an age-specific sleep duration (Figure 1). In school-age children, 9-12 hours of sleep is recommended (7). However, there is a regional variation in sleep duration and patterns among children.

There is an increasing report of sleep-related problems in children. It varies from benign conditions like primary snoring to severe debilitating issues. It is becoming more a result of lifestyle and environmental variables. In western countries, studies suggest 25 to 50% of preschool-aged children may have sleep issues, while approximately 37% of children aged 4 to 10 years may also experience sleep difficulties (12-13). A school-based study from India showed that 60% of adolescents had sleep deprivation(15).

Digital media use is widespread among school children, even in remote areas. It is estimated that more than 45% of children use digital media before they turn one year old. Additionally, it is reported that approximately 75% of children aged up to 8 years old have access to smartphones (16). National sleep foundation has estimated that 97% of American adolescents use digital media devices in the bedroom, including entertainment gadgets, video games, audio players, mobile, TV, computer, and Internet browsing (17). Television use has been linked to decreased sleep time, late bedtime, bedtime resistance, and sleep anxiety.

Figure 1: Normal sleep duration in healthy children (by American Academy of Sleep Medicine)



It is postulated that digital media devices have an adverse impact on sleep via various mechanisms by directly displacing, postponing, or disrupting sleep time. Circadian rhythm is affected secondary to blue light emitted by digital media devices(18-20).

Over the past few decades, obesity has increased three times among children(21). Childhood obesity may result in academic and mental health issues, lifelong obesity, and cardiovascular disorders. These outcomes negatively impact the quality of living and result in a significant financial burden(22, 23). Digital media have reduced sleep duration, increased weight gain risk, and lower physical activity levels(24). Children with obesity reported low self-esteem, low physical satisfaction, and peer bullying. (25,26).

REVIEW OF LITERATURE

There is increasing evidence of sleep problems among children. It is also observed that digital media exposure may impact sleep, physical well-being, and academic performance. In this modern era, lifestyle is becoming busier and fast-moving; recently, much attention has been paid to sleep quality and its association with quality of life and health. We did a literature search on sleep habits, digital media use in children, and its impact on sleep habits. The summary of the review of literature is shown in Table 1.

A systematic review by Lisbeth Lund in 2021 comprised 49 studies on electronic media usage and sleep in children and adolescents in western nations. They concluded that media use had been linked to shorter sleep duration, delayed bedtime, and reduced sleep quality in children. Digital media use has also been attributed to social media use for a more extended period reducing the quality of sleep among adolescents (27).

The study titled "Screen media use and sleep disturbance symptom severity in children" was published in Sleep Health journal in 2020. It was conducted by Garrett C. Hisler et al. The study's sample size was 10,666 children between the ages of 9-10 years. The study aimed to investigate the relationship between screen media use and sleep disturbance symptom severity in children. Results indicated that higher levels of screen media use were significantly associated with higher levels of sleep disturbance symptom severity. The authors suggest that reducing screen media use may be an important target for interventions aimed at improving sleep in children (46).

In their 2019 study, Beyens and Nathanson investigated the relationship between electronic media use and sleep in pre-schoolers in a cross-sectional survey. The

sample included preschool-aged children from the United States. They collected data on the children's electronic media use and sleep patterns. The results showed that higher levels of electronic media use were associated with later bedtimes, shorter sleep duration, and less consolidated sleep. These findings suggest that limiting electronic media use may promote optimal sleep in preschool-aged children(53).

Yanhui Wu et al. performed a systematic review and meta-analysis of 13 studies among children up to 18 years. The result revealed a significant correlation between obesity with decreased sleep duration among children (28).

The study, conducted by Brambilla et al. in 2017, aimed to examine the relationship between sleep habits and patterns and the use of video devices in evening and night activities in children aged 1 to 14 years old. The study included a sample of children from Italy of sample size 2030. The researchers found that video devices in evening and night activities were associated with children's poor sleep habits and patterns. The findings of this study suggest that limiting the use of video devices and encouraging healthy sleep habits and routines may be beneficial for promoting optimal sleep in children(51).

Chantelle N. Hart performed a systematic review in 2011, which included 29 studies on sleep and obesity in children and adolescents. They observed that decreased sleep duration and late sleeping increase the risk of sleep-associated problems during childhood, which can increase the risk of obesity in adulthood(29).

Table 1: Summary of related studies in the literature

S. No	Authors, Study title Journal, year	Study Group, Sample Size	Study design and method	Outcome
1.	Lisbeth L et al. (27) BMC Public Health 2021	0–15 year 49 Studies	**Systematic review**	Media use has been linked to shorter sleep duration in children. Digital media use has also been attributed to Social media use for a longer duration, which reduces the quality of sleep among adolescents.
2.	Garret C.H et al. (36) SLEEP HEALTH 2020	9-10years Sample size: 10,666	**Cross-sectional study**	Higher levels of screen media use were significantly associated with higher levels of sleep disturbance symptom severity.
3.	Ine Beyens et al. (53) Health Communication 2019	3-5years Sample size: 402	**Cross-sectional study**	The results showed that higher levels of electronic media use were associated with later bedtimes, shorter sleep duration, and less consolidated sleep.
4.	Yanhui Wu et al. (28) J Pediatric Child Health 2017	Up to 18 years. 13 studies	**Systematic review and meta-analysis**	The study revealed the correlation between obesity with decreased sleep duration among children.
5.	Brambilla et al. (51) Italian Journal of Pediatrics. 2017	1-14 years Sample size: 2030	**Cross-sectional study**	The use of video devices and evening and night activities was associated with poor sleep habits and patterns in children.

6.	Chantelle N. Hart. et al. (29) Pediatr Clin North Am 2011	Up to 18 years. 29 studies	**Systematic review**	Decreased sleep duration and late sleeping were seen to increase the risk of adequate sleep during childhood and can increase the risk of obesity in adulthood.
7.	Ming et al. (55) Clin Med Insights Circ Respir Pulm Med. 2011	9-12th grade (14-17 years) Sample size: 1941	**Cross-sectional study**	Sleep insufficiency and sleep health problems were associated with poor performance in high school students.
8.	Julia F. Dewald et al. (30) Sleep Med Rev. 2010	8 to 18 years. 17 studies	**A meta-analytic review**	Children with inadequate sleep and poor sleep hygiene have poor academics.
9.	Shenghui Li et al. (31) Sleep, Vol 30, No. 3. 2007	5-11 years. Sample size:19,299	**Cross-sectional study**	Digital media use was seen in almost 50% of children. Children with access to media in the bedroom and use prolonged duration have associated late sleeping, late awakening, and decreased sleep duration, bedtime resistance and sleep anxiety.
10.	Judith Owens et al.(32) PEDIATRICS Vol.104 No. 3. 1999	4-10 years Sample size: 495	**Cross-sectional study**	The viewing of Television is most strongly linked to sleep disturbance. Television viewing has been associated with Bedtime resistance, sleep onset delay, and sleep anxiety.

In the study by Ming et al. in 2011, the researchers aimed to investigate the relationship between sleep insufficiency, sleep health problems, and performance in high school students. The sample included high school students in the United States. The results of the study showed that sleep insufficiency and sleep related health problems were associated with poor performance in high school students. The findings suggest that addressing adolescent sleep issues may be necessary for improving academic performance(55).

Julia F. Dewald. Conducted a systematic review in 2010, which included 17 studies on children 8 to 18 years. Children with good sleep were noted to have better academic performance, and those with inadequate sleep and poor sleep hygiene have poor academics(30).

Shenghui Li performed a cross-sectional study of school children 5-11 years (n=19,299) in China to evaluate media usage and Television; items were combined with the CSHQ to measure sleep patterns. Children who have access to media in their bedrooms and use it for extended periods tend to sleep later, get up later, and get less sleep overall. It also impacts sleep-related areas, including anxiety and bedtime resistance (31).

Judith Owens performed a cross-sectional study, Television viewing habits and sleep disturbances among 495 children aged 4 to 10 years. A parent and the school teacher responded to questionnaires, Children with sleep-related health issues were excluded. Television viewing has been associated with bedtime resistance, sleep onset delay, and sleep anxiety (32).

WHAT IS ALREADY KNOWN ON THIS SUBJECT?

The sleep pattern and duration in children from western countries are well known. There is increasing evidence of the use of digital media on sleep patterns and duration in children from western countries.

LACUNAE IN LITERATURE

- There is a paucity of studies on sleep habits in children from India.
- The impact of digital media use on sleep habits in children from India is not well known.

RESEARCH QUESTION

Does the use of digital media have an impact on the sleep habits of children?

AIM AND OBJECTIVES

Primary objective

- To assess the Impact of Digital Media use on Sleep Habits in Children.

Secondary Objective

- To explore the pattern of sleep habits in children.
- Evaluate the impact of sleep habits on academic performance in children.
- Evaluate the association of sleep habits with obesity in children.

MATERIALS AND METHODS

Study design: Cross-sectional study

Study setting: Pediatrics OPD AIIMS Jodhpur

Study duration: January 2021 to July 2022

Inclusion criteria:

- Healthy children from 4 to 10 years of age coming to pediatric OPD for
    - Routine check-up
    - Immunization, and
    - Healthy siblings of patients

Exclusion criteria:

- Refusal for consent
- Any active illness in the current visit or in the past two weeks
- Any chronic disease
- On any medication affecting sleep, e.g., antihistamines

Sample size

A convenient sample size was taken, wherein eligible children visiting pediatric OPD from January 2021 to July 2022 were enrolled.

Material for the study

We used two validated questionnaires in this study for the assessment of sleep patterns and the use of digital media. Children's sleep habit questionnaire (CSHQ) was used to

assess sleep patterns. SCREENS-Q was used for the assessment of the use of digital media. Permission has been taken from the authors of both questionnaires. Overweight and obesity in enrolled children were labelled as per the Indian Academy of Pediatric (IAP) growth Chart 2015 (35).

Children Sleep Habit Questionnaire (CSHQ)

It consists of 33-question items in eight sleep domains and has a total score of 99. The different domains and question items are described in Table 2.

Table 2: Sleep domains and question items of CSHQ

Sleep Domain	**Items**
Bedtime resistance	6 items
Sleep Onset Delay	1 item
Sleep Duration	3 items
Sleep anxiety	4 items
Night awakening	3 items
Parasomnia	7 items
Sleep-disordered breathing	3 items
Daytime sleepiness	8 items

Parents were asked to provide information about their child's regular sleep patterns over the previous week. Items were graded on a 3-point scale:

- *Usually*: 5-7 days/week
- *Sometimes:* 2-4 days/week, and
- *Rarely*: 0-1 day/week

A higher CSHQ score indicates poor sleep habits. A score of > 41 is considered significant. This study used the Hindi version of CSHQ (33, 56). **(Annexure-6).**

SCREENS-Q Questionnaire:

It consists of 19 questions items in six categories validated for children's screen media use. The different domains of SCREENS-Q are shown in Table 3. In this study use of digital media ≥ 2 hours/day was considered significant (34). **(Annexure 7).**

Table 3: SCREENS-Q domains and question items

Domains	Items
Screen media environment	7
Child's screen media use	3
Context of screen media use	2
Early exposure	1
Parental perception of child's media use	1
Parental media use	3

Data collection:

The children coming to the pediatric OPD of AIIMS Jodhpur were screened for the eligibility criteria. Once their parents were willing to participate in the study, written informed consent was taken. The demographic details, like age, sex, residential address, education, etc., were recorded on the case record form (CRF). They were also given a copy of the Hindi version of CSHQ and SCREENS-Q and asked to complete the responses.

STATISTICAL ANALYSIS

The data were entered into a Microsoft excel worksheet. The analysis was performed using STATA 13 software. Normally distributed data were represented in mean (SD) and median (IQR) for not normally distributed data. Descriptive statistics were used to summarise demographics. Association between two or more qualitative variables was assessed using the chi-square test. T-test was used to compare the mean between two groups, while one-way ANOVA was used for more than 2 groups. The correlation between two quantitative variables was assessed with the Pearson correlation coefficient (r). P value < 0.05 was considered statistically significant.

ETHICS AND DISSERTATION

Research ethics approval: The study was undertaken after the ethical clearance from the institute's ethical committee.

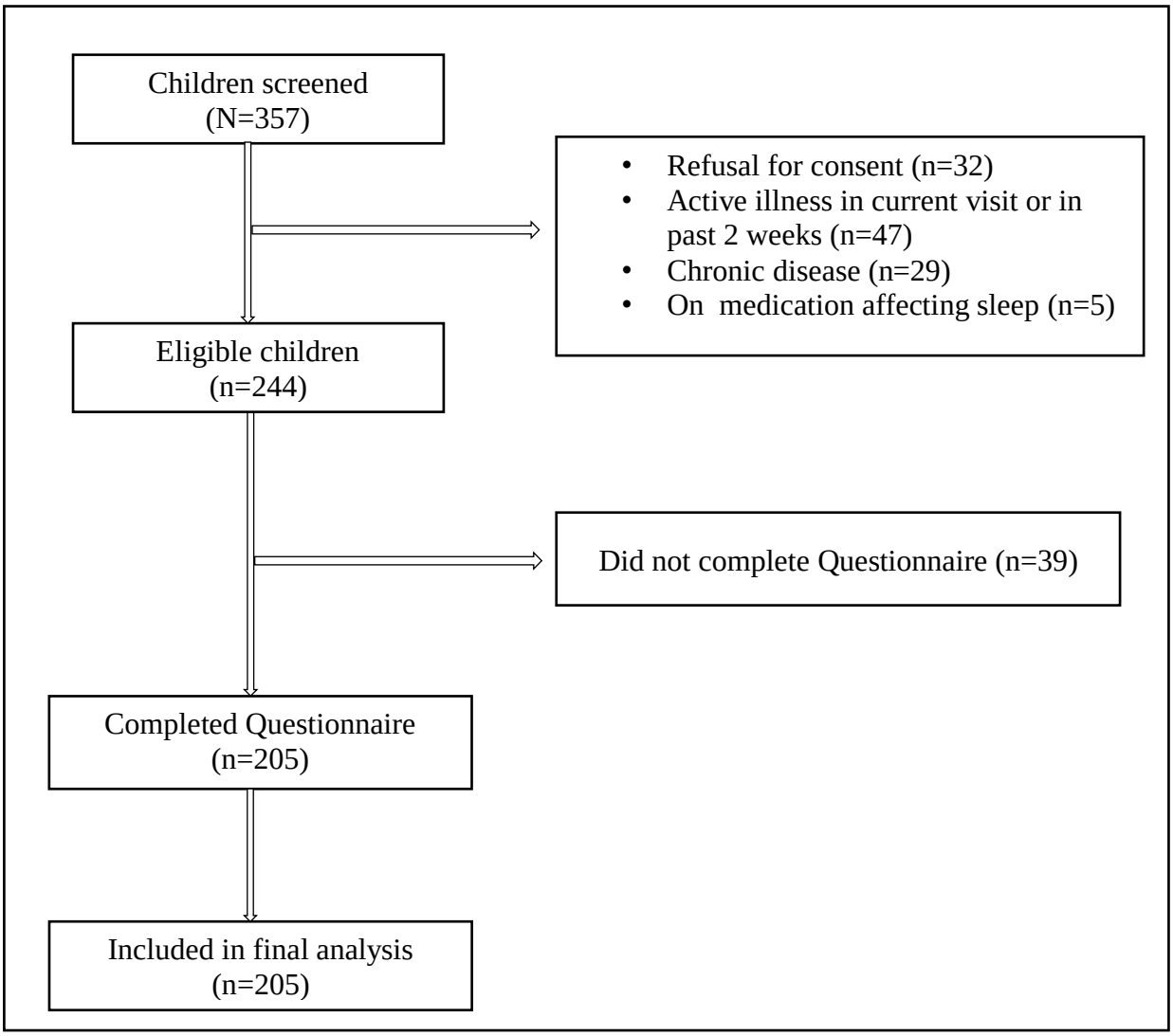
Consent: The purpose and design of the study were explained to the child's parents. Before enrolling in our study, we obtained informed consent from parents/guardians.

Confidentiality: The confidentiality of the information obtained was maintained

OBSERVATIONS AND RESULTS

A total of 357 children were screened during the study period, and 244 were found eligible for the study. However, parents or guardians of only 205 children have given consent, completed the questionnaire, and are therefore included in the final analysis. The flow of the study is shown in **Figure 2**.

Figure 2: Diagram showing the flow of the study



Demographic characteristics

The mean (SD) age of enrolled children was 7.1 (2.0) years, and 55.6% were male. Other demographic characteristics of enrolled children are summarised in Table 4.

Table 4: Demographic Characteristics of Enrolled Children (n=205)

Characterises	Number (SD)
Age (years)	7.1(2.0)
Gender (%) Male Female	 114(55.6) 91(44.4)
Residence (%) Urban Rural	 113(55.1) 92(44.8)
Anthropometry (SD) Weight(kg) Height(cm) BMI(kg/m2)	 20.1 (5.9) 115.6 (11.9) 15.4 (2.7)
Children's Education status (%) School going Non-school going	 153 (74.7) 52 (25.3)
Children's Academic Performance (%) Good Average/Poor	 138(67.32) 67(32.6)
Parents Education Status(%) Profession or Honours Graduate Intermediate or diploma High school certificate Middle school certificate Primary school certificate Illiterate	 1(0.48) 20(9.7) 59(28.7) 40(19.5) 65(31.7) 7(3.4) 13(6.3)
Socioeconomic status (%) Upper Upper Middle Lower Middle Upper Lower Lower	 20(9.7) 52(25.3) 98(47.8) 20(9.7) 15(7.3)

Sleep habits in enrolled children

The mean (SD) CSHQ score was 50.6 (5.1), and 189 (92%) children had CSHQ score > 41. It is shown in Figure 3. The mean (SD) score of different sleep domains is summarized in Table 5.

Figure 3: CSHQ scores in enrolled children (n=205)

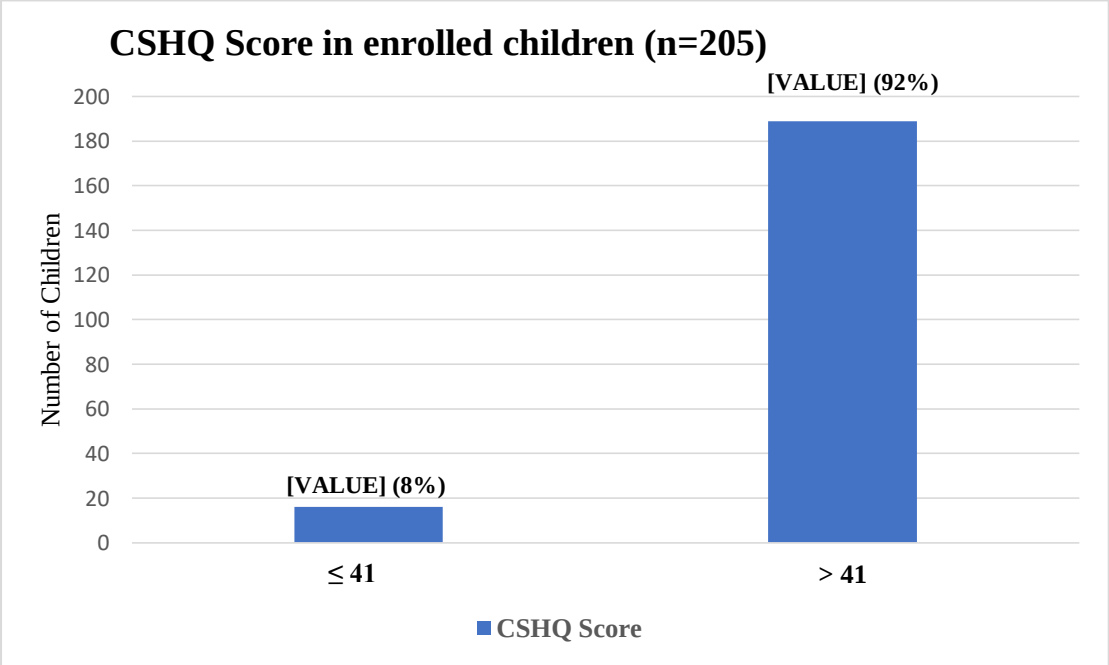


Table 5: Mean (SD) score of different Sleep Domains in enrolled children (n=205)

Sleep Domain	Mean (SD)
Bedtime resistance	11.3 (1.6)
Sleep Onset Delay	2.1 (0.3)
Sleep Duration	6.3 (0.9)
Sleep anxiety	6.1 (1.9)
Night awakening	4.1 (0.9)
Parasomnia	8.6 (1.4)
Sleep-disordered breathing	3.1 (0.4)
Daytime sleepiness	10.8 (1.7)

Characteristics of different sleep domains

Bedtime resistance is characterized by postponing or children's behavior to avoid going to bed. The characteristics of bedtime resistance are shown in Table 6.

Table 6: Characteristics of Bedtime Resistance in enrolled children (n=205)

Characteristics	Frequency N (%)
Usually, go to bed at the same time	125(60.9)
Usually falls asleep in own bed	83(40.4)
Usually falls asleep in other's bed	30(14.6)
Usually needs parent in room to sleep	31(15.1)
Usually struggles at bedtime	16 (7.8)
Usually afraid of sleeping alone	29 (14.1)
Usually (5-7/week)	

Sleep onset delay: It is the duration between going to bed and falling asleep. Out of 205, 100 (48.7%) children fell asleep within 20 minutes.

Sleep Duration: It is the duration from sleep onset to wake up. The characteristics of sleep duration are shown in table 7.

Table 7: Characteristics of sleep duration in enrolled children (n=205)

Characteristics	Frequency N (%)
Usually Sleeps too little	7(3.4)
Usually Sleeps the right amount	112 (54.6)
Usually Sleeps the same amount each day	109 (53.1)
Usually (5-7/week)	

Sleep anxiety: It is a symptom of worry or fear before going to bed. The characteristics of sleep anxiety are shown in Table 8.

Table 8: Characteristics of sleep anxiety in enrolled children (n=205)

Characteristics	**Frequency N (%)**
Usually Needs parent in room to sleep	31 (15.1)
Usually Afraid of sleeping in the dark	23 (11.2)
Usually Afraid of sleeping alone	29 (14.1)
Usually, Trouble sleeping away	7 (3.4)
Usually (5-7/week)	

Night waking: it is an arousal from sleep. The characteristics of night awakening are shown in Table 9.

Table 9: Characteristics of Night waking in enrolled children (n=205)

Characteristics	**Frequency N (%)**
Usually Moves to other's bed in the night	1(0.48)
Usually Awakes once during the night	11(53.6)
Usually Awakes more than once	10(48.7)
Usually (5-7/week)	

Parasomnia is abnormal and undesirable behaviour during sleep and is thought to be due to sleep state instability. The characteristics of Parasomnia resistance are shown in Table 10.

Table 10: Characteristics of Parasomnia in enrolled children (n=205)

Characteristics	Frequency N (%)
Usually Wets the bed at night	8(3.9)
Usually Talks during sleep	5(2.4)
Usually Restless and moves a lot	19(9.2)
Usually Sleepwalks	2(0.9)
Usually Grinds teeth during sleep	8(3.9)
Usually Awakens screaming, sweating	11(5.3)
Usually Alarmed by scary dream	2(0.9)
Usually (5-7/week)	

Sleep-disordered breathing is the disruption of normal respiratory patterns and ventilation during sleep. The characteristics of sleep-disordered breathing resistance are shown in Table 11.

Table 11: **Characteristics of sleep-disordered breathing in enrolled children (n=205)**

Characteristics	**Frequency N (%)**
Usually Snores loudly	1(0.48)
Usually Stops breathing	2(0.97)
Usually, Snorts and gasps	1(0.48)
Usually (5-7/week)	

Daytime sleepiness is the inability to maintain wakefulness or alertness during the major waking episodes of the day. The characteristics of daytime sleepiness are shown in Table 12. **Nap** is the short daytime sleep duration; it was present in 111(54%) children.

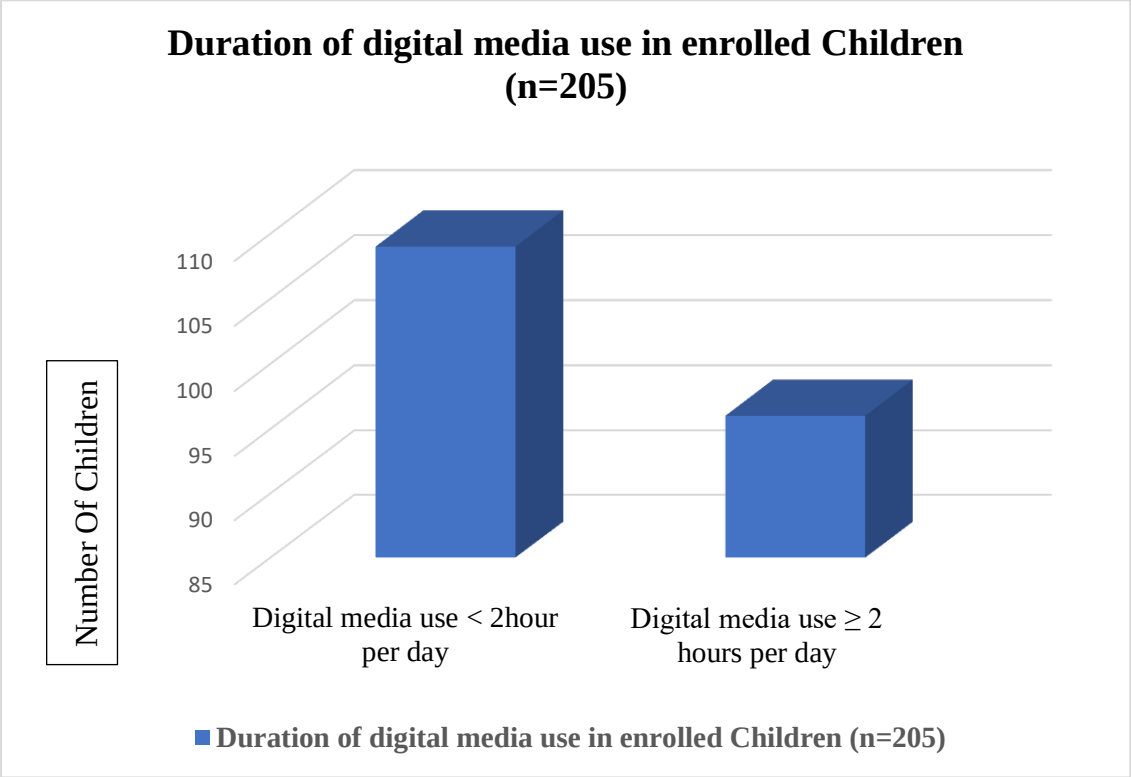
Table 12: characteristics of daytime sleepiness in enrolled children (n=205)

Characteristics	Frequency N (%)
Usually Wakes by himself	71(34.6)
Usually Wakes up in negative mood	10(4.8)
Usually Others wake child	13(6.3)
Usually Hard time getting out of bed	7(3.4)
Usually Takes long time to be alert	1(0.48)
Usually Seems tired	1(0.48)
Falls asleep Usually while Watching TV	3(1.4)
Falls asleep Usually while Riding in the car	9(4.4)
Usually (5-7/week)	

SCREENS Q scores in enrolled children

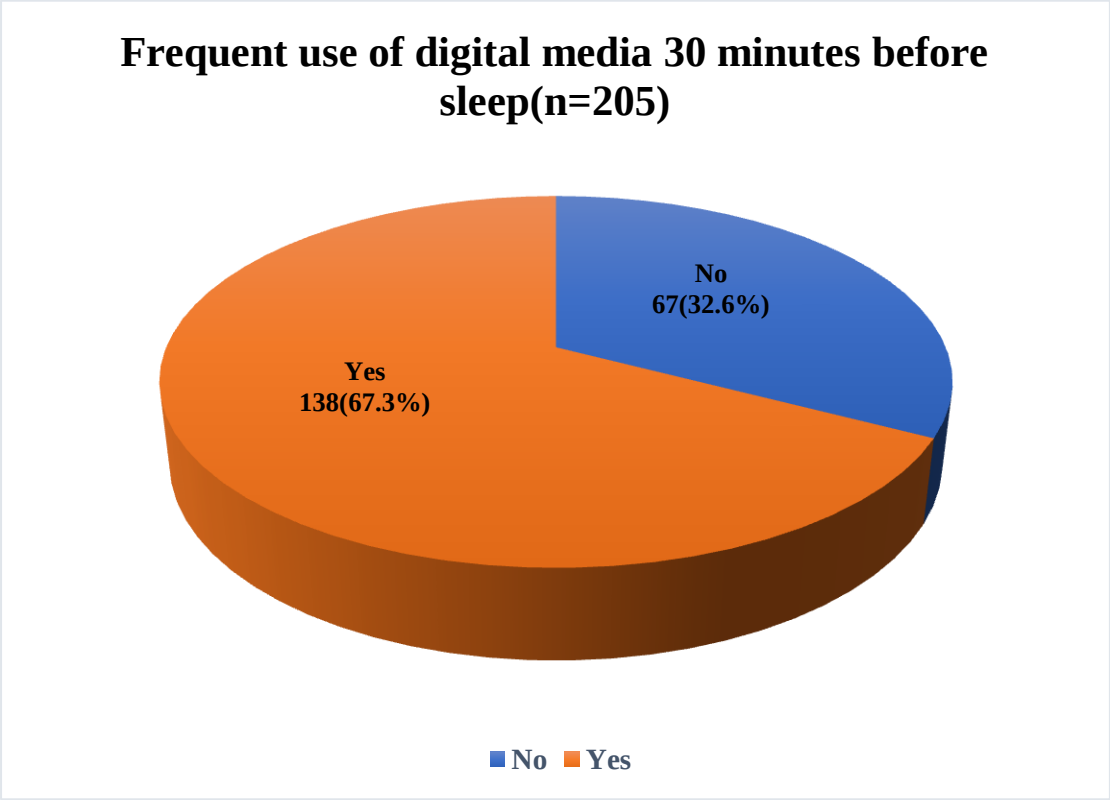
The mean (SD) SCREENS Q score was 43.5 (8.1). The use of digital media was observed in 204 (99.5%). Of them, 96 (46.8%) children used digital media ≥ 2 hours/ day. It is shown in Figure 4.

Figure 4: Duration of digital media use in enrolled children (n=205)



A total of 204 (99.5%) had digital media in their house. Out of them, only 9 (4.3%) children had their own digital media device. 147(71.1%) children were using digital media every day, and 39(19%) children had access to digital media during school. Parents of 83(40%) children strongly agreed to setting up rules for digital media use at home, while 110(53.9%) parents were of a neutral opinion. The use of digital media 30 minutes before bed was observed in 138(67.32%) children. It is shown in figure 5.

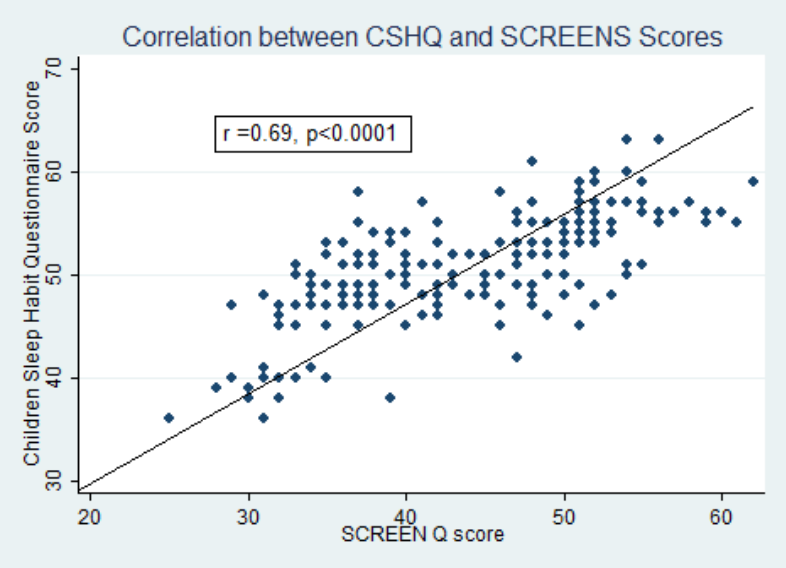
Figure 5: Frequent use of digital media 30 minutes before sleep (n=205)



Primary Objective: Impact of Digital Media use on Sleep Habits in Children

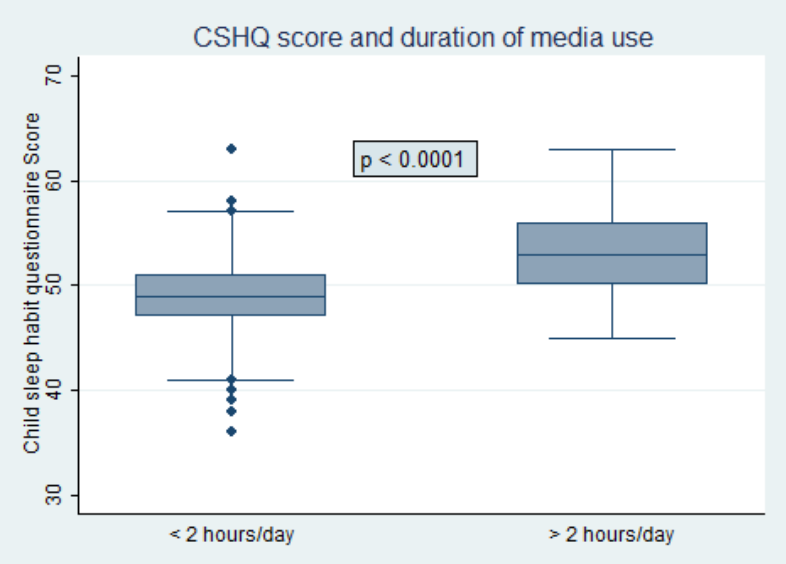
There was a linear correlation between CSHQ and SCREENS-Q scores. The Pearson correlation coefficient (r) was 0.69 with a p-value of <0.0001. It is shown in Figure 6.

Figure 6: Correlation between CSHQ score and SCREENSQ score



The mean (SD) CSHQ score was statistically higher in children using digital media for ≥ 2 hours/day than those who use < 2 hours/day [53.1 (3.9) vs. 48.5 (4.9); p <0.001]. It is shown in Figure 7.

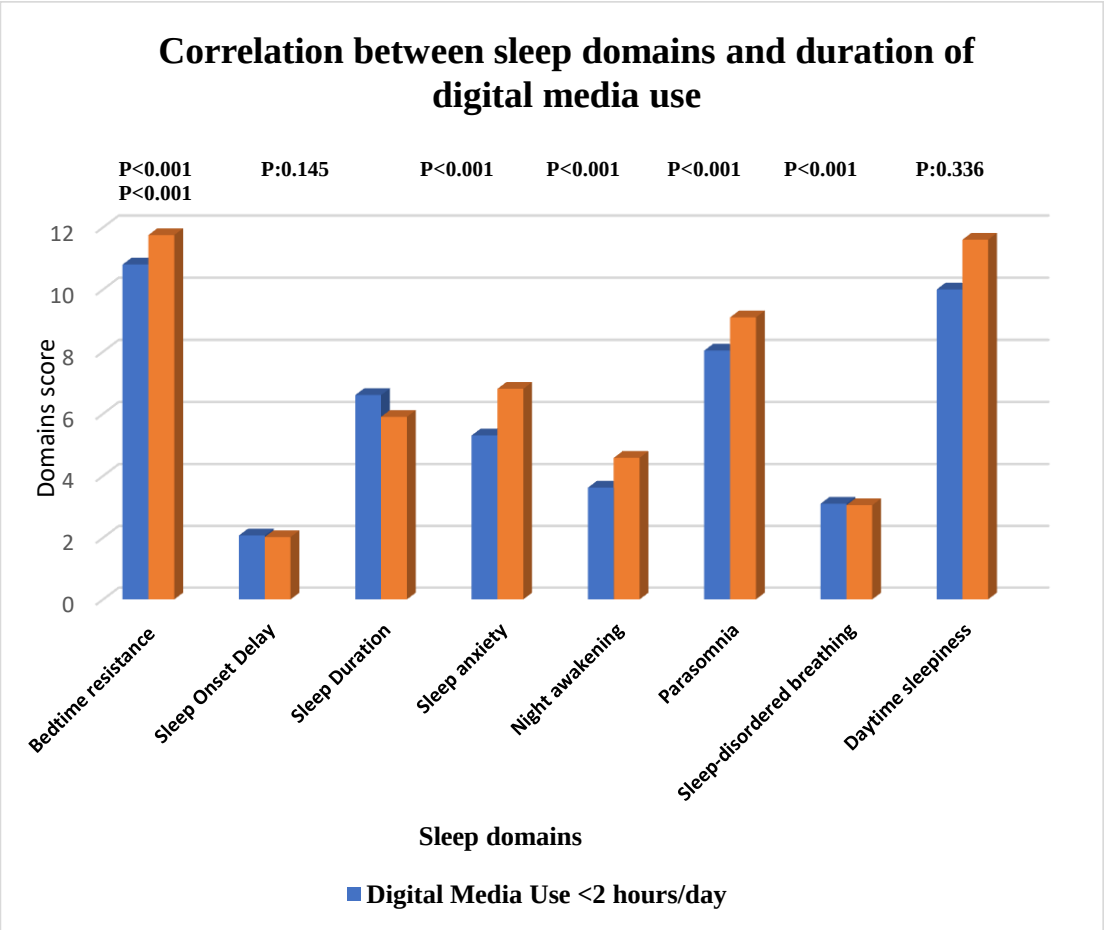
Figure 7: Correlation between CSHQ score and duration of media use



Correlation between sleep domains and duration of digital media use

The average sleep duration was 7.58(0.80) hours. The domain of sleep which are statistically significantly associated with prolonged use of digital media (≥ 2 hours/day) were bedtime resistance, sleep duration, sleep anxiety, night awakening, parasomnia, and daytime sleepiness. It is shown in Figure 8.

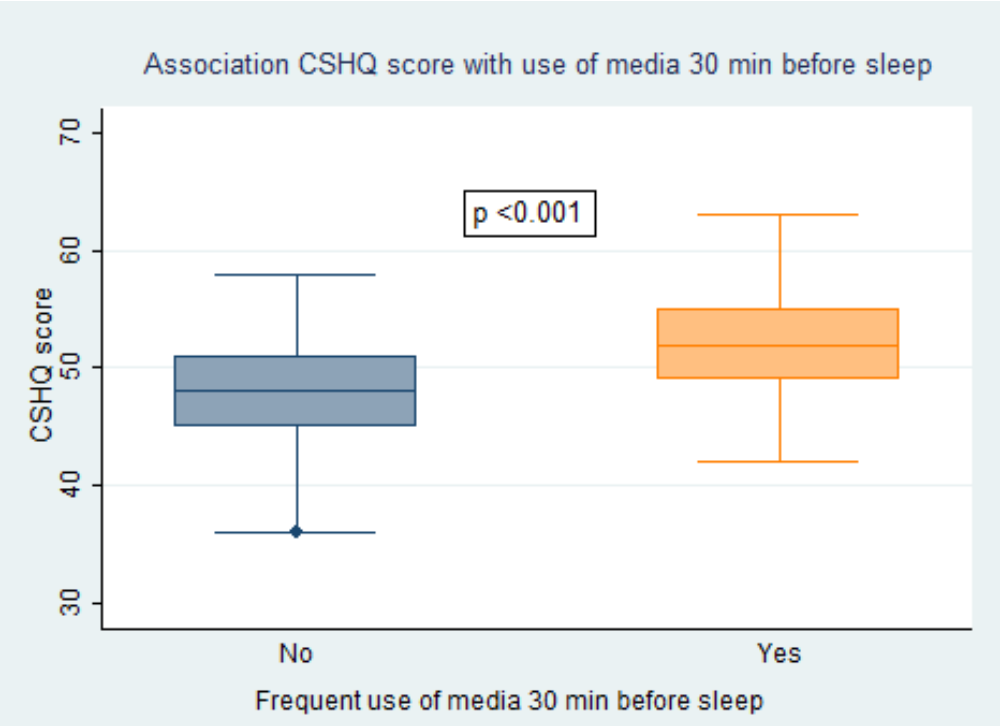
Figure 8: Correlation between sleep domains and duration of digital media use



Impact of use of digital media 30 minutes before sleep

A total of 138(67.3%) used screen media 30 minutes before bed. The mean (SD) CSHQ score was statistically higher in children using digital media 30 minutes before bed than those who did not use digital media 30 minutes before bed [52.3 (4) vs. 47.1 (5.2); p <0.001]. It is shown in Figure 9.

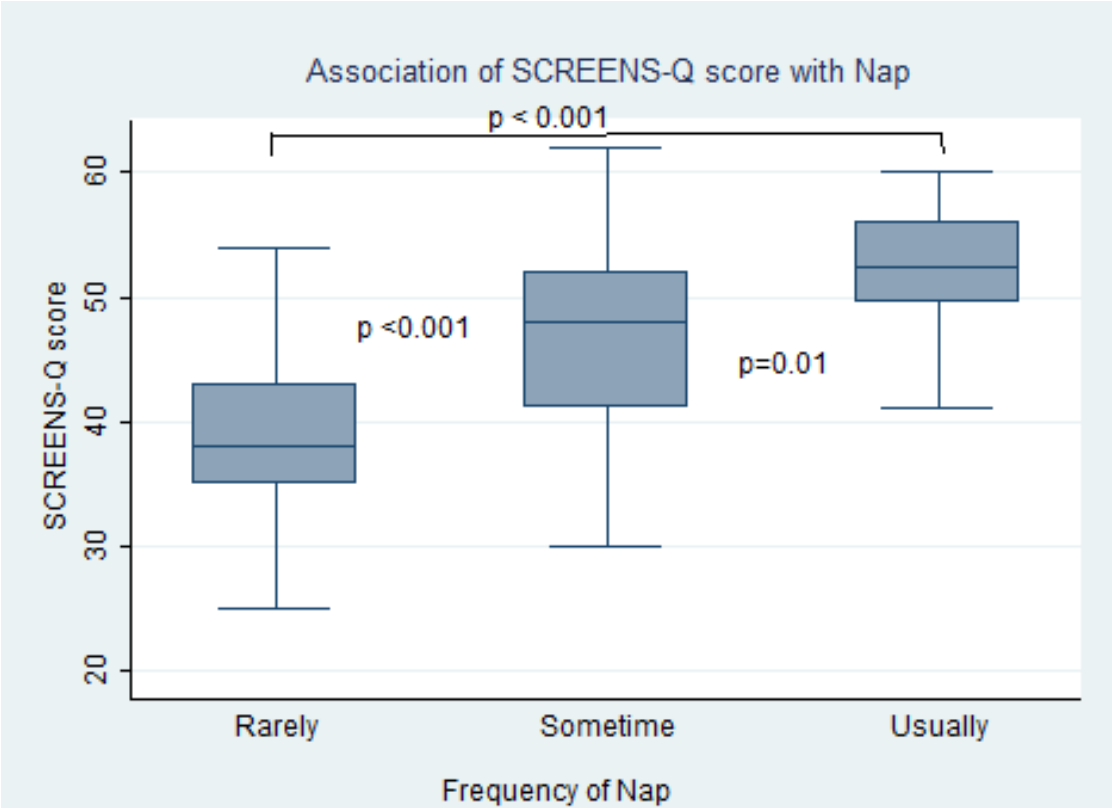
Figure 9: Impact of the use of digital media 30 minutes before sleep



Impact of digital media use on nap

The mean (SD) SCREENS-Q score was statistically higher in children who took nap in compared to children who did not take nap. The mean (SD) SCREENS-Q score was 52.41(1.5), 46.5(0.7), and 39.1(0.7) in children who took usually, sometime and rarely nap, respectively. It is shown in figure 10.

Figure 10: Impact of digital media use on nap



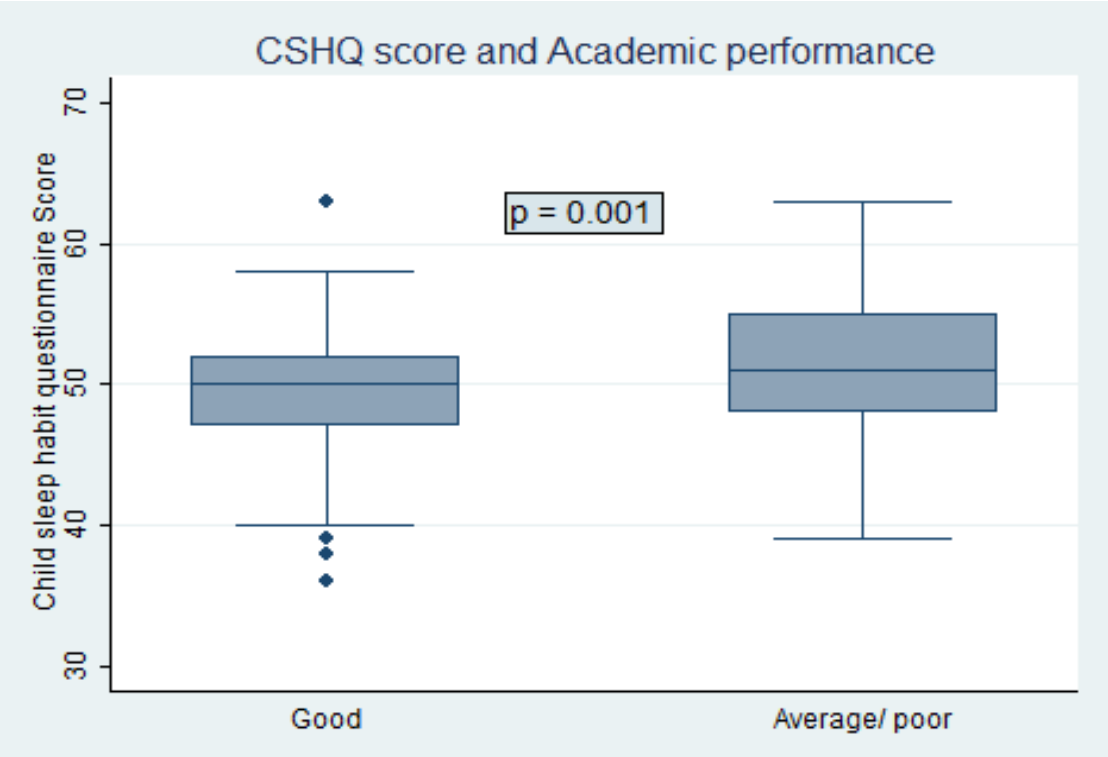
Secondary Objective-1: To explore the pattern of sleep habits in children.

The majority of children in this study had a poor sleep habits 189 (92%), as shown in figure 5. Sleep characteristics of enrolled children are shown in Tables 5 to 12.

Secondary Objective-2: Impact of sleep Habits on Academic Performance of Children

Parents reported good academic performance in 67 (32.7%) children, while average and/or poor performance in 138 (67.3%). The mean (SD) CSHQ score was statistically higher in children with average and/or poor academic performance than those who have good performance [51.4 (4.5) vs. 49.1 (5.8); p=0.001]. It is shown in Figure 11.

Figure 11: Correlation between Sleep pattern and Academic performance



Secondary objective-3: To study the association of sleep habits in children with obesity

In this study, the mean (SD) BMI was 15.4 (2.6) kg/m2 and only two children were obese. Therefore analysis was not done for this objective.

DISCUSSION

In this study, we have assessed the impact of digital media use on children's sleep habits. We found that majority of children had poor sleep habits. Digital media use in children was a prevalent condition; about half of the children use it for ≥ 2 hours/per day. There was a statistically significant correlation between digital media use on sleep habits in children. It affected almost all the sleep domains. In addition, children using digital media 30 minutes before going to sleep significantly impacted their sleep habits. Children with increased exposure to digital media were found to have an increased frequency of naps. Digital media use also has a significant impact on the academic performance of children.

Though polysomnography is the gold-standard test for diagnosing sleep problems; however, it is costly, not readily available in developing countries, and very cumbersome to perform. There are various validated questionnaires that can be used for the assessment of sleep habits in children, viz. Children's Sleep Habits Questionnaire (CSHQ), Paediatric Sleep questionnaire (PSQ), Tayside Children's Sleep Questionnaire (TCSQ, etc. (36). CSHQ is a widely used questionnaire to assess sleep habits in school children (37-38). In this study, we used CSHQ to evaluate sleep habits in the enrolled children. It is also used in many children's sleep studies by Garrison MM et al., Schnapp A et al., Shui AM et al., Chen X, Hua X et al., and Lewien et al. to study various sleep domains and sleep patterns among children (39-43).

In this study, we observed that most children had poor sleep habits. Studies from western countries observed that 25 to 50% of preschool-aged children have sleep issues, and approximately 37% of children aged 4 to 10 years also experience sleep

difficulties (12-13). A school-based study from India showed that 60% of adolescents had sleep deprivation (15). In a study by Yerra A et al., 46.4% of children had one or the other form of sleep-related problems (14). In another study from Germany, a 15-44% prevalence of sleep problems in children (43).

The optimum duration of sleep varies per age and geographical area. The AASM recommends daily 10-13 hours of sleep for children 3-5 years of age and 9-12 hours for children 6-12 years of age daily for good health (7, 44). However, studies have shown a marked cross-cultural difference in sleep habits possible due to different rituals, co-sleeping, bed-sharing, beliefs and practices, privacy, and sleep environment. A study by Yi-Ching L et al. documented that Taiwanese participants had a short sleep duration, whereas UK participants had a long sleep duration(8). The study by Hanger et al. in the USA found 9.1 hours of sleep per day in toddlers (9). Greece's study shows 9.4 hours of sleep per day, and Iranian children slept 11.7 hours per day (10). There is a tendency for longer sleep durations in winter compared to summer(11). In our study, the mean sleep duration in school children was also lesser than recommended values.

In the last decade, digital media use has been increasingly common among children in India, especially after the COVID-19 pandemic. Digital media usage among children is widespread globally, with studies showing that it ranges from 68% to 95% in North America, Europe, and Asia (45). It can be assessed using questionnaires like the digital-screen exposure questionnaire (DSEQ) (66) and the SCREENS-Q questionnaire (34). We used SCREENS-Q to evaluate digital media use among children.

The optimum duration of digital media use in children is not well defined. The American academy of pediatrics (AAP) recommends less than 1-2 hours per day of media use in children (7). Studies by Shenghui Li et al., Hisler et al., and Sahoo B et al. used a cut-off of 2 hours per day of digital media in their research (46, 47). The use of ≥ 2 hours/day of screen time during school days increases the risk of poor school performance. We also took a cut-off of ≥ 2 hours/day of digital media to impact sleep patterns.

We observed that the mean CSHQ score was statistically higher in children using digital media for ≥ 2 hours/day. Digital media use in other studies is also significantly associated with poor sleep patterns. Garrison M et al., who studies digital media use on sleep patterns, found a significant impact of digital media use on sleep (49). A study among 10,666 children 9-10 years of age by Garrett C. et al. also had similar findings that favors our study (46).

In our study, all sleep domains were affected by digital media use, except sleep onset delay and sleep disorder breathing. In a cross-sectional survey of school children. 4–10 years among 495 US school children by Judith Owens's, bedtime resistance was influenced by television watching habits(32). Shenghui Li conducted cross-sectional research, delineating that media consumption was positively connected with later bedtimes, later wake-up times, and shorter sleep duration on weekdays and weekends in Chinese school-age children. Overall, bedtime and waking times, sleep length on weekdays, sleep disorders of bedtime resistance, and sleep anxiety were the most impacted sleep behaviours (31). According to Lisbeth Lund's systematic evaluation of 49 studies, there is evidence linking the use of electronic media with later bedtimes and worse sleep quality; screen time leads to difficulty in falling asleep(27).

In our study, we found that increased digital media use was also associated with an increased frequency of naps in children. According to research including 2068 kids under the age of three by Thompson DA et al., irregular naptime routines and irregular bedtime schedules were linked to the number of hours of Television viewed each day (50). Digital media use is associated with increased napping and problems falling asleep, as seen in Lisbeth Lund's systematic review (27). Television, smartphone use, and evening media hours are significantly associated with the rise in naps duration in a study among children in the USA by Ine Beyens et al. (51).

Digital media use before bedtime is much more prevalent. In our study, children who used digital media 30 minutes before bed had significantly poor sleep scores. 60% of American children use media before bed (52). In a study by Paolo B et al., 63.5% of children who used digital media before bed also found a negative impact on sleep (51). Similar evidence was seen in the study by Ine Beyens et al., which shows bedtime media use leads to sleep disturbances (53). Chang et al. studied digital media use before bedtime in young adults, which shows it significantly impacts sleep via melatonin suppression, delaying sleep onset (54). These studies support our findings.

Studies have shown that poor sleep habit also influences academic performance. A study by Julia F. Dewald et al. suggested that poor sleep quality, insufficient sleep, and sleepiness are significantly associated with worse school performance (30). Xue Ming studied 1,941 teenagers, results showed a high incidence of night waking and a relationship between low academic achievement and delayed sleep onset was seen. Students who slept for fewer than 7 hours on weekdays and weekends performed poorly academically (55). In our study, the mean CSHQ score was statistically higher in children with average and/or poor academic performance, which supports other studies finding.

Obesity is increasingly seen in the pediatric age group. Several studies suggest poor sleep as having an unfavourable outcome on physical health, including obesity. A detailed analysis by Chantelle N. Hart et al. about Sleep and Obesity in Children and Adolescents, it was discovered that late bedtimes increased the risk of obesity, short sleep, and being overweight (29). We found only two children having BMI in the range of obesity. Therefore we did not assess the impact of poor sleep habits on obesity. In a developing country, nutritional factors, lifestyle, and poor socioeconomic status predispose to a lack of adequate nutrition rather than obesity which could be a reason for less obesity in enrolled children.

STRENGTHS AND LIMITATIONS OF THE STUDY

Strength of study

1. Validated questionnaires were used for the study
2. We included healthy children only
3. We used cut-off references from the American Academy of Sleep Medicine

Limitation of Study

- Parent's Recall biases about children's sleep habits
- Cross-sectional study
- Relatively small sample size

CONCLUSION

In this study, we found that most children had poor sleep habits. Digital media use in children was a prevalent condition; about half of the children use it for ≥ 2 hours. There was a significant impact of digital media use on sleep habits in children, and it affected almost all the sleep domains. In addition, children using digital media 30 minutes before bed significantly impacted their sleep habits. It also has a significant impact on the academic performance of children. A further multicentric, large prospective cohort study is needed from India to gather more information on the impact of digital media use on sleep patterns and academic performance.

SUMMARY

Title of the study: Impact of Digital Media use on Pattern of Sleep Habits in Children

Background

Sleep is an integral part of a child's growth and development. It is crucial for developing memory, learning, behaviour, and emotional control. Insufficient sleep is linked to poor concentration and suboptimal academic performance. Digital media use is common in school-age children and might impact sleep quantity and quality. Decreased sleep duration and late bedtimes are associated with an increased risk of obesity. There is a paucity of data on it from developing countries like India.

Objective

The primary objective of this study was to assess the impact of digital media use on sleep habits in children. The secondary objectives were to explore the sleep pattern and impact of poor sleep habits on academic performance and obesity in children.

Methods

It was a cross-sectional study of school-age children (4-10 years) attending pediatric OPD for routine health check-ups or immunization. The children with chronic disease, active illness in the past two weeks, and medication use affecting sleep were excluded. Sleep habits were assessed with the Children's Sleep Habits Questionnaire (CSHQ); a score > 41 indicates poor sleep hygiene. The use of digital media was assessed with SCREENS-Q. A p-value <0.05 was considered statistically significant.

Results

A total of 205 children mean (SD) age of 7.1 (2.1) years were enrolled; 114 (55.6%) were boys. Their mean (SD) weight, height, and BMI were 20.9 (5.9) kg, 115.6 (11.8) cm, and 15.4 (2.6) kg/m^2, respectively. The mean (SD) CSHQ score was 50.6 (5.1); 189 (92%) children had a score > 41. The use of digital media was observed in all children except one, and 96 (46.8%) children used digital media for ≥ 2 hours per day. The mean (SD) CSHQ score was statistically higher in children using digital media for ≥ 2 hours per day than those who use < 2 hours per day [53.1 (3.9) vs. 48.5 (4.9); p < 0.001]. A total of 138(67.3%) used screen media 30 minutes before bed. The mean (SD) CSHQ score was statistically higher in children using digital media 30 minutes before bed than those who did not use digital media 30 minutes before bed [52.3 (4) vs. 47.1 (5.2); p <0.001]. The mean (SD) SCREENS-Q score was statistically higher in children who took naps frequently than in children who did not. The mean (SD) SCREENS-Q score was 52.41(1.5), 46.5(0.7), and 39.1(0.7) in children who took naps usually, some time and rarely, respectively. The domain of sleep which are significantly associated with prolonged use of digital media was bedtime resistance (p<0.001), sleep duration (p<0.001), sleep anxiety (p<0.001), night awakening (p<0.001), parasomnias (p < 0.001) and daytime sleepiness (p<0.001). Parents reported good academic performance in 67 (32.7%) children, while average or poor performance in 138 (67.3%). The mean (SD) CSHQ score was statistically higher in children with average or poor academic performance than those who have good performance [51.4 (4.5) vs. 49.1 (5.8); p=0.001].

Conclusions

In this study, we found that most children had poor sleep habits. Digital media use in children was a prevalent condition; about half of the children use it for ≥ 2 hours. There was a significant impact of digital media use on sleep habits in children, and it affected almost all the sleep domains. In addition, children using digital media 30 minutes before going to sleep significantly impacted their sleep habits. It also has a significant impact on the academic performance of children. Parents should be educated about the consequences of media use, and pediatricians should regularly screen children's digital media use and sleep habits.

Further, a multicentric large prospective cohort study is needed to gather more information on sleep patterns in Indian children and the impact of digital media use on sleep patterns in children.

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APPENDIX-1

All India Institute of Medical Sciences Jodhpur, Rajasthan

INFORMED CONSENT FORM

Title of Thesis: Assessment of the Impact of Digital Media use on Sleep Habits in Children

Name of PG Student: DR. DORESWAMY C

Tel. No. 953522484/_____

Patient/Volunteer Identification No._____

I, _____ F/o or M/o or Guardian/o_____R/o_____ _____ give my full, free, voluntary consent to be a part of the study "Profile of patients utilising the tele-medicine service of the Paediatrics Department of AIIMS Jodhpur and to assess their satisfaction and compliance with the service", the procedure and nature of which has been explained to me in my language to my complete satisfaction. I confirm that I have had the opportunity to ask questions. I understand that my participation is voluntary, and am aware of my right to opt-out of the study at any time without giving any reason.

I understand that the information collected about me and any of my medical records may be looked at by responsible individuals from the Department of Pediatrics, ALL INDIA INSTITUTE OF MEDICAL SCIENCES (AIIMS) or regulatory authorities. I permit for these individuals to have access to my records.

Date:

Place: Signature/Left thumb impression

This is to certify that the above consent has been obtained in my presence.

Date:

Place:

Signature of PG Student

1. Witness-1

Signature: _____

Name: _____

Address: _____

2.Witness-2

Signature: _____

Name: _____

Address: _____

APPENDIX-2

अनुलग्नक -2
अखिल भारतीय आयुर्विज्ञान संस्थान जोधपुर, राजस्थान
सूचित सहमति प्रपत्र

थीसिस का शीर्षक: बच्चों में स्लीप हैबिट्स के पैटर्न पर डिजिटल मीडिया के उपयोग का प्रभाव

पीजी छात्र का नाम: डॉ। डोरस्वामी सी

तेल। नंबर 953522484 / _____

रोगी / स्वयंसेवक पहचान संख्या .____

I, _____ F / o या M / o या गार्जियन / o _____ R / o _____

मेरी पूरी, मुफ्त, स्वैच्छिक सहमति दे, अध्ययन का हिस्सा बनने के लिए एम्स जोधपुर के पेडियाट्रिक्स विभाग की टेली-मेडिसिन सेवा का उपयोग करने वाले मरीजों की प्रोफाइल। सेवा के साथ उनकी संतुष्टि और अनुपालन का आकलन करें ", जिस प्रक्रिया और प्रकृति से मुझे अपनी भाषा में मेरी पूर्ण संतुष्टि के लिए समझाया गया है। मैं पुष्टि करता हूं कि मुझे सवाल पूछने का अवसर मिला है। मैं समझता हूं कि मेरी भागीदारी स्वैच्छिक है और बिना किसी कारण के किसी भी समय अध्ययन से बाहर निकलने के मेरे अधिकार से अवगत हूं।

मैं समझता हूं कि मेरे और मेरे किसी भी मेडिकल रिकॉर्ड के बारे में एकत्रित जानकारी को बाल रोग विभाग के जिम्मेदार व्यक्ति, चिकित्सा विज्ञान विभाग (AIIMS) के सभी भारतीय संस्थान या नियामक अधिकारियों से देखा जा सकता है। मैं इन व्यक्तियों को अपने रिकॉर्ड तक पहुंचने की अनुमति देता हूं।

तारीख: _____ _____

जगह: हस्ताक्षर / बाएं अंगूठे का निशान

यह प्रमाणित करने के लिए कि मेरी उपस्थिति में उपरोक्त सहमति प्राप्त हुई है।

तारीख: _____

स्थान: _____ पीजी छात्र के हस्ताक्षर

1. गवाह 2. गवाह

हस्ताक्षर: _____ हस्ताक्षर: _____

नाम _____ नाम: _____

पता :_____ पता: _____

APPENDIX-3

PATIENT INFORMATION SHEET

Title: Assessment of Impact of Digital Media use on Sleep Habits in Children

Introduction: This statement describes the purpose, procedures, benefits, risks and discomforts of the study and your right to withdraw from the study at any point in time.

Purpose: To Assess of Impact of Digital Media use on Sleep Habits in Children

Study Procedure: With proper consent, Questionnaires regarding your child's digital media use and sleep habits will be given to you, and your data input will be taken to assess the impact of digital media on a child's sleep.

Benefits: No monetary benefits will be given to you.

Confidentiality: Records of your study participation will be kept confidential under safe custody. Any publication of data will not identify you by name. By signing the consent form, you authorize sharing your study-related medical records with the regulatory authorities and the Institutional Ethical Committee.

Information regarding withdrawal: You have the right to withdraw from the study at any time during the study.

Contact for additional information: Any time during or after the study, you can obtain further information from Dr. Doreswamy C, Junior Resident, Department of Pediatrics, AIIMS Jodhpur, Phone no.-9535228484, All India Institute of Medical Science, Jodhpur, Rajasthan.

APPENDIX-4

अनुलग्नक 4

रोगी सूचना पत्र

शीर्षक: बच्चों में स्लीप हैबिट्स के पैटर्न पर डिजिटल मीडिया के उपयोग का प्रभाव

परिचय: यह कथन अध्ययन के उद्देश्य, प्रक्रियाओं, लाभों, जोखिमों और असुविधाओं और किसी भी समय अध्ययन से हटने के आपके अधिकार का वर्णन करता है।
उद्देश्य: बच्चों में स्लीप हैबिट्स पर डिजिटल मीडिया के उपयोग के प्रभाव का आकलन करना

अध्ययन प्रक्रिया: उचित सहमति प्राप्त करने के साथ, आपके बच्चे के डिजिटल मीडिया के उपयोग और नींद की आदतों के बारे में प्रश्नावली आपको दी जाएगी, और बच्चे की नींद पर डिजिटल मीडिया के प्रभाव का आकलन करने के लिए आपका डेटा इनपुट लिया जाएगा।
लाभ: कोई मौद्रिक लाभ आपको नहीं दिया जाएगा।
गोपनीयता: सुरक्षित अभिरक्षा के तहत, आपके अध्ययन की भागीदारी के रिकॉर्ड को गोपनीय रखा जाएगा। डेटा का कोई भी प्रकाशन आपको नाम से नहीं पहचानेगा। सहमति पत्र पर हस्ताक्षर करके आप अपने अध्ययन से संबंधित मेडिकल रिकॉर्ड को नियामक अधिकारियों और संस्थागत नैतिक समिति को साझा करने के लिए अधिकृत करते हैं।
वापसी के बारे में जानकारी: अध्ययन के दौरान किसी भी समय आपको अध्ययन से खुद को वापस लेने का अधिकार है।
अतिरिक्त जानकारी के लिए संपर्क करें: अध्ययन के दौरान या बाद में किसी भी समय, आप डॉ। डोरेस्वामी सी, जूनियर रेजिडेंट, बाल रोग विभाग, एम्स जोधपुर, फोन नंबर -9535228484, अखिल भारतीय आयुर्विज्ञान संस्थान, जोधपुर से अध्ययन के बारे में अधिक जानकारी प्राप्त कर सकते हैं। , राजस्थान Rajasthan।

APPENDIX-5

CASE RECORD PROFORMA

Enrolment number	
Date:	

PURPOSE OF THE FORM:

- This form is meant to be filled only if the child satisfies all the criteria mentioned in the screening form.

Part A: Baseline characteristics of the patient

S. No.	**Items**		**Response**
1.	Name		
2.	Age (completed years)		
3.	Gender (Male=1/female=2)		
4.	Address 1:		
	1. Urban ; 2. rural		
5.	Contact numbers	Landline	
		Mobile 1	
		Mobile 2	

Anthropometry		
	Items	
1.	Height	
	IAP Z score	
2.	Weight	
	IAP Z score	
3.	BMI (kg/m^2)	
	IAP Z score	
Academic Performance		
1.	Good	
2.	Average/Poor	
Immunization status		
1.	Completely Immunized	
2.	Partially Immunized	
3.	Unimmunized	
Parents Education and Socioeconomic status : Modified kuppuswamy classification		

Education of head of family	Score
Profession or honours	7
Graduate or postgraduate	6
Intermediate or post high school diploma	5
High school certificate	4
Middle school certificate	3
Primary school certificate	2
Literate	1
Occupation of head of family	
Profession	10
Semi- profession	6
Clerical, Shop-owner	5
Skilled owner	4
Semi-skilled worker	3
Unskilled worker	2
Unemployed	1
Monthly income of family (2017)	
>41430	12
20715-41429	10
15536-20714	6
10357-15535	4
6214-10356	3
2092-6213	2
<2091	1

Socioeconomic status		Total Score
I	Upper	26-29
II	Upper Middle	16-25
III	Lower Middle	11-15
IV	Upper Lower	5-10
V	Lower	<5

APPENDIX-6

CSHQ Questionnaire:

बिस्तर पर जाने का समय

बच्चे की बिस्तर पर जाने का समय का समय लिखें- - - -

		आमतौर पर	कई बार	बहुत कम	सम्सया? हां	सम्सया? नहीं	सम्सया? लागु नहीं
1	बच्चा रात को सोने के लिए एक ही समय बिस्तर पर जाता है। (R)	( )	( )	( )	( )	( )	( )
2	बच्चा बिस्तर पर जाने के 20 मिनट के अन्दर ही सो जाता है।(R)	( )	( )	( )	( )	( )	( )
3	बच्चा अकेले अपने बिस्तर पर सो जाता है।(R)	( )	( )	( )	( )	( )	( )
4	बच्चा माता पिता या भाई बहन के बिस्तर पर सो जाता है।	( )	( )	( )	( )	( )	( )
5	बच्चे को सोने के लिए कमरे में माता पिता की जरूरत होती है।	( )	( )	( )	( )	( )	( )
6	बच्चा सोने के समय संघर्ष/जूझता रहता है, रोता रहता है, सोने को मना करना इत्यादि।	( )	( )	( )	( )	( )	( )
7	बच्चे को अंधेरे में सोने से डर लगता है।	( )	( )	( )	( )	( )	( )
8	बच्चा अकेले सोने से डरता है।	( )	( )	( )	( )	( )	( )

नींद का व्यवहार

बच्चा अक्सर हर दिन कितनी देर सोता है।

		आमतौर पर	कई बार	बहुत कम	सम्सया? हां	सम्सया? नहीं	सम्सया? लागु नहीं
9	बच्चा बहुत कम सोता है।	( )	( )	( )	( )	( )	( )
10	बच्चा पर्याप्त मात्रा में सोता है।	( )	( )	( )	( )	( )	( )
11	बच्चा प्रतिदिन एक जैसे समय के लिए सोता है।(R)	( )	( )	( )	( )	( )	( )
12	बच्चा रात को बिस्तर गीला कर देता है।	( )	( )	( )	( )	( )	( )
13	बच्चा नींद में बातें करता है ।	( )	( )	( )	( )	( )	( )
14	बच्चा नींद में बैचेन रहता है और काफी हिलता -डुलता रहता है	( )	( )	( )	( )	( )	( )
15	बच्चा रात के समय नींद में चलता है ।	( )	( )	( )	( )	( )	( )
16	बच्चा रात को किसी ओर के बिस्तर पर चले जाता है, माता, पिता, बहन, भाई इत्यादि ।	( )	( )	( )	( )	( )	( )
17	बच्चा नींद के दौरान दांत किटकिटाता है, आपके दांतों के डाक्टर ने आपको यह बताया हो सकता है ।	( )	( )	( )	( )	( )	( )
18	बच्च जोर से खराटें मारता है ।	( )	( )	( )	( )	( )	( )

19	नींद के दौरान बच्चे की सांस रूक जाती है ।	( )	( )	( )	( )	( )	( )
20	बच्चा नींद के दौरान मारता और/या सांस रूक जाती है ।	( )	( )	( )	( )	( )	( )
21	ब्चचे को घर से दूर सोने में मुश्किल/परेशानी आती है, छुटिटयों में रिश्तेदारों के घर जाने में भी परेशानी होती है।	( )	( )	( )	( )	( )	( )
22	बच्चा रात को नींद से रोते हुए जागता हे, पसीना आता है, समझाना मुश्किल होता है।	( )	( )	( )	( )	( )	( )
23	बच्चा डरावना सपना देखकर जाग जाता है ।	( )	( )	( )	( )	( )	( )

रात में नींद के दौरान जागना

		आमतौर पर	कई बार	बहुत कम	सम्सया? हां	सम्सया? नहीं	सम्सया? लागु नहीं
24	बच्च रात में एक बार जागता है ।	( )	( )	( )	( )	( )	( )
25	बच्चा रात में एक बार से अधिक जागता है ।	( )	( )	( )	( )	( )	( )

बच्चा रात में कितनी देर के लिए जागता है । दिन में / दिन के कौन से समय जागना ।

		आमतौर पर	कई बार	बहुत कम	सम्सया? हां	सम्सया? नहीं	सम्सया? लागु नहीं
26	बच्चा आपने आप जागता है(R)	( )	( )	( )	( )	( )	( )
27	बच्चा अच्छे मूड में नही जागता ।	( )	( )	( )	( )	( )	( )
28	बड़े या छोटे भाई-बहन बच्चे को जगाते है ।	( )	( )	( )	( )	( )	( )
29	बच्चे को सुबह बिस्तर छोड़ने में मुश्किल आती है ।	( )	( )	( )	( )	( )	( )
30	बच्चा दिन में चुस्त/ जागरूक होने में काफी समय लगता है	( )	( )	( )	( )	( )	( )
31	बच्चा थका हुआ लगता है ।	( )	( )	( )	( )	( )	( )

ऐसा लगता है कि बच्चे को नींद आ रही है या बच्चा निम्न चीजों के दौरान सो जाती है, जो लागु होता है उस पर निशान लगाये ।

		आमतौर पर	कई बार	बहुत कम	सम्सया? हां	सम्सया? नहीं	सम्सया? लागु नहीं
32	टी. वी देखते समय ।	( )	( )	( )	( )	( )	( )
33	वार में बैठे हुए ।	( )	( )	( )	( )	( )	( )

APPENDIX-7

SCREENS Q Questionnaire:

Domains	Number of questions and items *(question-number in SCREENS-Q)* Chosen statistical test for reliability	Areas of interest/example questions and response category
Screen media environment	**7 questions** **43 items reduced to 39** *(3, 4, 5, 6,7 8 + 8.1, 10, 11)* Kappa, weighted kappa	Does your child have its own: laptop, PC, tablet, smartphone, TV, not-hand-held device (PlayStation/x-box/Nintendo), hand-held-device (I.e. PSP, Nintendo Switch, and Gameboy), E-reader, Other *(yes/no)?* How many of the following screen media devices are present in the household where the child lives? *(numbers)* How often has the child used the following screen media devices in the household within the past month [same devices as above]? *(5- point Likert scale; every day – never).* Access to screen medias during school time *(4- point Likert scales; never – daily).* How often is the TV on in your home without anyone watching? *(4- point Likert scale; never – daily)* Rules for Screen media use set by the parents *(9 questions (after field-testing reduced to 5), categorial response options: agree/disagree)*
Childs Screen Media Use	**3 questions** **16 items** (9, 12, 13) ICC and BA plots	Time spent on screen medias (hours and minutes) allocated on different activities (Film/TV, games, homework, social medias, and film or musical apps) on a typical weekday/weekend day? *(none, 1–29 min, 30–59 min, 1–2 h., 2–3 h., 3-4 h, 4–5 h, > 5 h)* How many days a week does your child have screen media use the first 30 min after waking up in the morning? / the last 30 min before he/she goes to sleep *(0–5 days a week/0–2 days in the weekend*), on a typical day (weekday/weekend day) How many minutes/hours does your child use screen media before school, after school – before dinner, after dinner? *(0, 15, 30, 45, 60.90. 120, 150, 180, 240, 300, 330)*
Context of screen media use	2 questions 2 items (14, 15) Weighted kappa	When using screen media, how often does your child use more than one screen device? *(5- point Likert scale: never-always)* When your child use screen media is it then usually with: *1) you/another adult, 2) friends, 3) siblings, 4) alone*
Early exposure	1 question 4 items 2 items changed after field-testing *(17, 17.1, 17.2, 17.3)* Weighted kappa	Age when child has its own tablet/smartphone *(age 0–7)* *Instead of2 questions asking about age of daily use, we inserted 2 questions of age when child had its own PC and laptop*
Parental perception of child's media use	1 question 16 items *(16.1–16.16)* Weighted kappa	If your child can choose activity on its own will he/she choose screen media / play outside, Screen media use helps my child; calm down, learn math, read, write, social networking, My child's screen media use is sufficient? I am worried about my child's SMU in relation to mental/physical health? Making rules for SMU often leads to conflicts? My child wishes to use screen medias on a daily basis. *(4-point Likert scale, totally agree-totally disagree)*
Parental Media Use	3 questions 15 items *(18, 18.1, 19)* Kappa, Weighted kappa ICC and BA plots	Parents were asked if the home was their primary place for working *(yes/no, unemployed)* and if yes, how much time they spend on work related screen time in the home *(min and hours).* Time spent on screen medias (hours and minutes) allocated on different activities (film/TV, games, SoMe, Facetime/Skype, surfing the internet, Other:i.e. photo-, film, office programs) on a typical weekday/weekend day? *(none, 1–29 min, 30–59 min, 1–2 h, 2–3 h, 3–4 h, 4–5 h, > 5 h)*

स्क्रीन क्यू हिंदी प्रश्न

क्या आपके बच्चे के पास अपना है: लैपटॉप, पीसी, टैबलेट, स्मार्टफोन, टीवी

- ◯ हां
- ◯ नहीं

जिस घर में बच्चा रहता है, वहां निम्नलिखित में से कितने स्क्रीन मीडिया उपकरण मौजूद हैं?

- ◯ 1
- ◯ 2 या अधिक

बच्चे ने पिछले एक महीने में घर में निम्नलिखित स्क्रीन मीडिया उपकरणों का कितनी बार उपयोग किया है

- ◯ कभी नहीं
- ◯ प्रति सप्ताह 2 दिन
- ◯ प्रति सप्ताह 4 दिन
- ◯ प्रति सप्ताह 6 दिन
- ◯ हर दिन

स्कूल समय के दौरान स्क्रीन मीडिया तक पहुंच

- ◯ कभी नहीं
- ◯ कभी-कभार
- ◯ कभी-कभी
- ◯ लगभग हमेशा

आपके घर में बिना किसी को देखे टीवी कितनी बार चालू रहता है?

- ◯ कभी नहीं
- ◯ कभी-कभार
- ◯ कभी-कभी
- ◯ लगभग हमेशा

माता-पिता द्वारा निर्धारित स्क्रीन मीडिया उपयोग के नियम

- ◯ दृढ़तापूर्वक सहमत
- ◯ मान लेना
- ◯ तटस्थ
- ◯ असहमत
- ◯ दृढ़तापूर्वक असहमत

एक विशिष्ट कार्यदिवस/सप्ताहांत के दिन विभिन्न गतिविधियों (फिल्म/टीवी, गेम, होमवर्क, सोशल मीडिया और फिल्म या संगीत ऐप्स) पर आवंटित स्क्रीन मीडिया पर बिताया गया समय?

- ◯ कोई भी नहीं
- ◯ 1–29 मि
- ◯ 30-59 मि
- ◯ 1-2 घंटा
- ◯ 2-3 घंटे
- ◯ 3-4 घंटे
- ◯ 4-5 घंटे
- ◯ 5 घंटे से अधिक

आपका बच्चा सप्ताह में कितने दिन सुबह उठने के बाद पहले 30 मिनट में स्क्रीन मीडिया का उपयोग करता है? या उसके सोने से पहले के आखिरी 30 मिनट

- ◯ सप्ताह में 0-5 दिन
- ◯ सप्ताहांत में 0-2 दिन

आपका बच्चा स्कूल से पहले, स्कूल के बाद - रात के खाने से पहले, रात के खाने के बाद कितने मिनट / घंटे स्क्रीन मीडिया का उपयोग करता है?

- ◯ 0 मिनट
- ◯ 15 मिनट
- ◯ 30 मिनट
- ◯ 45 मिनटों
- ◯ 60 मिनट
- ◯ 90 मिनट
- ◯ 120 मिनट
- ◯ 150 मिनट
- ◯ 180 मिनट
- ◯ 240 मिनट
- ◯ 300 मिनट

स्क्रीन मीडिया का उपयोग करते समय, आपका बच्चा कितनी बार एक से अधिक स्क्रीन डिवाइस का उपयोग करता है?

- ◯ कभी नहीं
- ◯ कभी-कभार
- ◯ कभी कभार
- ◯ कभी-कभी
- ◯ लगभग हमेशा

जब आपका बच्चा स्क्रीन मीडिया का उपयोग करता है तो यह आमतौर पर साथ होता है

- ◯ आप या कोई अन्य वयस्क
- ◯ दोस्त
- ◯ सहोदर
- ◯ अकेला

1. उम्र जब बच्चे के पास अपना टैबलेट/स्मार्टफोन हो (उम्र वर्षों में) (0 से 7)

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7

यदि आपका बच्चा अपने आप गतिविधि चुन सकता है तो क्या वह स्क्रीन मीडिया / बाहर खेल का चयन करेगा, स्क्रीन मीडिया का उपयोग मेरे बच्चे की मदद करता है; शांत हो जाओ, गणित सीखो, पढ़ो, लिखो, सोशल नेटवर्किंग।

- ◯ हां
- ◯ नहीं

एक विशिष्ट कार्यदिवस/सप्ताहांत के दिन विभिन्न गतिविधियों (टीवी, गेम, इंटरनेट पर सर्फिंग, अन्य) पर आवंटित स्क्रीन मीडिया (घंटे और मिनट) पर बिताया गया समय?

- ◯ कोई भी नहीं
- ◯ 1–29 मि
- ◯ 30-59 मि
- ◯ 1-2 घंटा
- ◯ 2-3 घंटे
- ◯ 3-4 घंटे
- ◯ 4-5 घंटे
- ◯ 5 घंटे से अधिक

प्रस्तुत स्पष्ट प्रपत्र

मेरे बच्चे का स्क्रीन मीडिया का उपयोग पर्याप्त है?

- ◯ हां
- ◯ नहीं

मैं अपने बच्चे के मानसिक/शारीरिक स्वास्थ्य के संबंध में स्क्रीन मीडिया के उपयोग को लेकर चिंतित हूं? स्क्रीन मीडिया उपयोग के लिए नियम बनाने से अक्सर विवाद उत्पन्न होते हैं?

- ◯ हां
- ◯ नहीं

मेरा बच्चा दैनिक आधार पर स्क्रीन मीडिया का उपयोग करना चाहता है।

- ◯ कभी नहीं
- ◯ कभी-कभार
- ◯ कभी-कभी
- ◯ लगभग हमेशा

माता-पिता से पूछा गया था कि क्या घर काम करने के लिए उनका प्राथमिक स्थान था, यदि हाँ, और वे घर में दैनिक आधार पर काम से संबंधित स्क्रीन पर कितना समय बिताते हैं

- ◯ 1 घंटा
- ◯ दो घंटे
- ◯ तीन घंटे
- ◯ 4 घंटे
- ◯ 5 घंटा
- ◯ 5 घंटे से अधिक
- ◯ नहीं

APPENDIX-8

Ethical clearance certificate

अखिल भारतीय आयुर्विज्ञान संस्थान, जोधपुर
All India Institute of Medical Sciences, Jodhpur
संस्थागत नैतिकता समिति
Institutional Ethics Committee

No. AIIMS/IEC/2021/ 3488 **Date: 12/03/2021**

ETHICAL CLEARANCE CERTIFICATE

Certificate Reference Number: **AIIMS/IEC/2021/3323**

Project title: **"Impact of Digital Media use on Pattern of Sleep habits in Children"**

Nature of Project:	**Research Project Submitted for Expedited Review**
Submitted as:	**M.D. Dissertation**
Student Name:	**Dr. Doreswamy C**
Guide:	**Dr. Prawin Kumar**
Co-Guide:	**Dr. Kuldeep Singh & Dr. Jagdish Prasad Goyal**

Institutional Ethics Committee after thorough consideration accorded its approval on above project.

The investigator may therefore commence the research from the date of this certificate, using the reference number indicated above.

Please note that the AIIMS IEC must be informed immediately of:

- Any material change in the conditions or undertakings mentioned in the document.
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.

The Principal Investigator must report to the AIIMS IEC in the prescribed format, where applicable, bi-annually, and at the end of the project, in respect of ethical compliance.

AIIMS IEC retains the right to withdraw or amend this if:

- Any unethical principle or practices are revealed or suspected
- Relevant information has been withheld or misrepresented

AIIMS IEC shall have an access to any information or data at any time during the course or after completion of the project.

Please Note that this approval will be rectified whenever it is possible to hold a meeting in person of the Institutional Ethics Committee. It is possible that the PI may be asked to give more clarifications or the Institutional Ethics Committee may withhold the project. The Institutional Ethics Committee is adopting this procedure due to COVID-19 (Corona Virus) situation.

If the Institutional Ethics Committee does not get back to you, this means your project has been cleared by the IEC.

On behalf of Ethics Committee, I wish you success in your research.

Dr. Praveen Sharma
Member Secretary

Member secretary
Institutional Ethics Committee
AIIMS,Jodhpur

Basni Phase-2, Jodhpur, Rajasthan-342005; **Website:** www.aiimsjodhpur.edu.in; **Phone:** 0291-2740741 Extn. 3109
E-mail : ethicscommittee@aiimsjodhpur.edu.in; ethicscommitteeaiimsjdh@gmail.com

| ID | age | gender | grade | performance | height | weight | bmi | SES | Parents Education | immunization | SLEEP DURATION | CSHQ01 | CSHQ02 | CSHQ03 | CSHQ04 | CSHQ05 | CSHQ06 | CSHQ07 | CSHQ08 | CSHQ09 | CSHQ10 | CSHQ11 | CSHQ12 | CSHQ13 | CSHQ14 | CSHQ15 | CSHQ16 | CSHQ17 | CSHQ18 | CSHQ19 | CSHQ20 | CSHQ21 | CSHQ22 | CSHQ23 | CSHQ24 | CSHQ25 | CSHQ26 | CSHQ27 | CSHQ28 | CSHQ29 | CSHQ30 | CSHQ31 | CSHQ32 | CSHQ33 | CSHQ(total) | SQ1 | SQ2 | SQ3 | SQ4 | SQ5 | SQ6 | SQ7 | SQ8 | SQ9 | SQ10 | SQ11 | SQ12 | SQ13 | SQ14 | SQ15 | SQ16 | SQ17 | SQ18 | SQ19 (extended duration) | SQ20 | bedtime routine | sleep onset delay | sleep duration | sleep anxiety | night walking | parasomnia | disordered breathing | daytime sleepiness | Child naps during the day |
|---|---|---

| | | |