Section: Pediatrics

Original Research Article

A CROSS SECTIONAL DESCRIPTIVE STUDY ON THE EFFECT OF SCREEN TIME ON NEURODEVELOPMENT, SLEEP, BEHAVIOR AND HEALTH OF CHILDREN AGED 1-5 YEARS

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ABSTRACT

Background: Screen-time is the amount of time a person spends in front of an electronic/digital device such as television, a smartphone, a tablet or a computer. **Objective:** To study the impact of screen timeon children's mental and physical health.

Materials and Methods: This cross-sectional study was carried out in the Pediatric Outpatient Department to examine screen habits in 280 children between the ages of 1 and 5 years.

Results: The study population had a mean age of 40.9 months, with females making up 63.57% of the participants and males accounting for 36.4%. A majority of the study participants belonged to the lower middle-class category, comprising 44.6% of the sample. Older children (48 - 60 months) exhibited higher levels of electronic media exposure compared to younger age groups (12-24 months) ($p< 0.001$). Minimal high media exposure time was observed in males compared to females ($p=0.048$).

Conclusion: The most commonly used electronic media devices in the population were smartphones (95.7%) and televisions (98.5%). On average, families had 3.37 ± 0.79 electronic media devices. Higher electronic media exposure was noted in the upper and upper-middle socioeconomic groups compared to other socioeconomic categories ($p<0.001$).

Keywords: Screen Time, Neurodevelopment, Sleep, Behavior and Health, Children Aged 1-5 Years.

INTRODUCTION

In recent times, our lives have been significantly impacted by digital media. It has completely changed how we connect with each other, communicate, and get information. With the growth of social media and web-based technologies, we can now reconnect with old friends and acquaintances and communicate in a more involved way. It is a constant presence in children's, adolescents' and their parents' time table. Traditional media such as television and radio are being replaced by electronic and interactive media such as computers, smartphones, and tablets.[1]

However, It can also have a negative health impact on children's and adolescents' learning, behaviour, sleep, attention, and health if there is unlimited access.[2]

Increasing screen time in pediatrics has been associated with several negative outcomes, including emotional reactivity, aggression, language development delays, adiposity, and poor performance on developmental screeners.

Emotional reactivity and aggression are two significant concerns, as excessive screen time has been linked to increased emotional reactivity, aggression, and externalizing behaviors in children.[3]

This can lead to difficulties in social interactions and relationships, as well as increased risk of behavioral problems. Language development delays are another area of concern, as excessive screen time has been associated with cognitive delays and poorer academic performance.[4]

Poor performance on developmental screeners is another negative outcome associated with excessive screen time. Research has shown that longer hours of screen time are negatively associated with children's healthy development, and excessive screen time exposure has been independently associated with poorer development outcomes among children under 5 years old.[5]

However, pediatric associations in India have not developed such guidelines. This could be due to the lack of large and comprehensive studies conducted in India to assess screen habits in rural and urban children and the effects of such habits on behavior, development, diet, sleep, and health. Therefore, we designed this study to study the effects of electronic media on children in our setting in order to gain an understanding into this emerging age problem.

MATERIAL AND METHODS

The cross-sectional observational study was carried out on children between 1-5 years coming to the OPD of Maheshwara Medical College and Hospital for minor illness and vaccination for a period of 24 months from September 2022 to August 2024.

The study population was a randomized, cumulative, clinic-based convenience sample.

Inclusion Criteria

Participants in the study were all children aged between 1 and 5 years who had been to the OPD for routine immunizations, regular health check-ups or minor illnesses.

Exclusion Criteria

This study did not include children with a chronic neurological disorder or a known developmental disorder such as cerebral palsy or Down syndrome.

Methodology

The study enrolled all children aged 1–5 years who visited OPD for routine immunizations, health check-ups and minor illnesses. At enrolment, patient details were entered into a pre-designed case record form, which included socio-demographic information, family history and general health related information, dietary information, and information on electronic media exposure for the child and parents, Child Anthropometric Assessment.

Astandardized, validated questionnaires were completed to evaluate neuro development, behaviour and sleep habits in these children.

Sample Size

In a research conducted by Shah et al in rural Western India, the study found that the average screen time for 379 pre-schoolers was 2.7 hours with a standard deviation of 1.7. Using a significance level (α) of 0.05, power of 80%, and effect size (δ) of 0.18, the sample size was initially calculated to be 254. To accommodate missing data, the sample size was increased by 10% to reach a final sample size of 280.

Statistical Analysis

Statistical analysis was conducted by entering the data into Microsoft Excel and then converting it to Stata 17 for further analysis. The study calculated means and standard deviations for continuous variables and assessed the normality of data using the Kolmogorov-Smirnov test. In cases where the data were non-parametric, medians and interquartile ranges (IQR) were estimated. Proportions were determined for categorical variables. Statistical comparisons were made using unpaired t-tests for two groups, paired t-tests for paired data, and the Mann Whitney test for median equality assessment. For analyses involving more than two groups, Dunn's test with Bonferroni correction and Kruskal Wallis test were utilized to compare medians. Proportions were compared using the chi-square test or Fisher's exact test for low expected cell counts. A p-value of less than 0.05 was considered statistically significant.

RESULTS

For the ease of the conduction of the study, the study groups have been broadly divided into 3 groups, 1st group consisting of children between 12-24 Months, 2nd group consisting children between 25-48 Months and third group containing children between 49-60 Months. The study predominantly had children between 24 to 48 Months. The mean age of the population was 40.95 ±14.66.

Among the 280 children102 were males (36.4%) and178 were females (63.57%).

The mean size of the family was4.3 members with SD± 0.89. The mean number of siblings is 0.71 with SD of ±0.77.

Max no of families in the study belong to lower middle class, contributing to 44.6% of the total study.

The mean number ofdevices in the family were 3.37 with SD±0.79. Most of the families are having 3 devices i.e,151families (53.9%), while 84 families were having 4 devices (30%).

Types of devices

The predominant types of electronic devices in the family was Television (98.5%) followed by Smart Phone (95.7%). [Table 1]

GENERALHEALTHCOMPLAINTS

Most of the children in the study population had no eye problems (92.14%), while 7.86 % of the children had minor issues.

General Health Complaints: The predominant complaints in the population was headache and neck pains, accounting for 12.13 %, while majority had no issues.

DEVELOPMENTAL ASSESSMENT USING AGES AND STAGES QUESTIONNAIRE: In terms of communication skills, the majority of the study population (83.9%) demonstrated normal abilities, while a notable proportion (13.21%)required additional learning activities to improve their communication skills. A smaller percentage (2.85%) necessitated close monitoring to address specific communication challenges.

Regarding gross motor skills, a significant proportion (7.85%) of the study population required both targeted learning activities and ongoing monitoring to address deficits. The majority (80.71%) exhibited normal gross motor skills, while a notable percentage (11.4%) required professional assessment to identify areas for improvement.

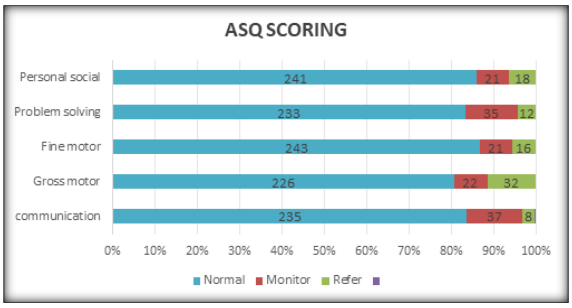

Figure 1: ASQ Scoring

The study's findings indicate that in the fine motor domain, the majority (86.78%) of the population demonstrated normal skills, while a smaller proportion (5.75%) required professional assessment to identify areas for improvement. A notable percentage (7.5%) needed targeted learning activities and ongoing monitoring to address fine motor deficits.

In the problem-solving domain, a small percentage (4.2%) required professional assessment, while 12.5% needed a combination of learning activities and monitoring to enhance their problem-solving skills. The majority (83.21%) of the population demonstrated normal problem-solving abilities.

Regarding the personal-social domain, 7.5% of the population required learning activities and monitoring to improve their personal-social skills, while 6.42% needed professional assessment to identify areas for development. The majority (86.07%) of the population demonstrated normal personal-social skills.

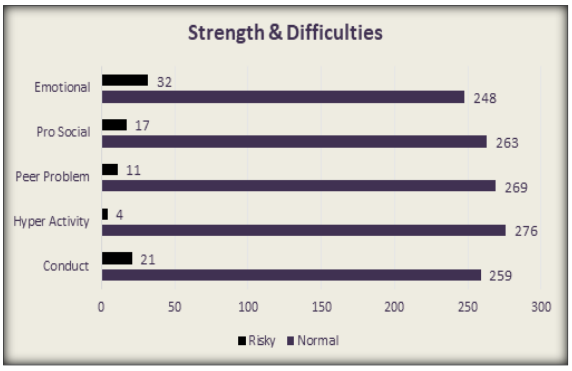

Figure 2: SDQ Scoring

The study's findings indicate that in the Emotional domain, the vast majority (88.5%) of the population demonstrated normal emotional regulation, while a smaller proportion (11.5%) were identified as being at risk of emotional difficulties.

In the ProSocial domain, a small percentage (4%) were deemed at risk, whereas the majority (96%) exhibited normal prosocial behaviors.

In the Hyperactivity domain, an overwhelming majority (98.5%) of the population demonstrated normal levels of activity, with only a small percentage (1.5%) identified as being at risk of hyperactivity.

Regarding the Peer-Social domain, nearly all (98.9%) of the population demonstrated normal peer-social skills, with a minimal percentage (1.1%) identified as being at risk. In the Conduct domain, a notable percentage (7.5%) were identified as being at risk of conduct difficulties, while the majority (92.5%) demonstrated normal conduct.

Table 1: Type of Devices

Type of Device	YES	NO	Total
TV	276	4	280
Smart Phone	268	12	280
Mobile	72	208	280
Computer	25	255	280
Laptop	54	226	280
Tablet	15	265	280

Table 2: Eye Problem

Eye problems	Frequency	Percent
No problem	258	92.14
Redness	7	2.5
Watering	6	2.14
Itching	4	1.42
Pain	0	0
Blurring of vision	5	1.78
Total	280	100.0

Table 3: General Health Complaints

General Health Complaints	Frequency	Percent
Headache	11	3.92
Bodyache	0	0
Neck pain	23	8.21
Abdominal pain	0	0
No Issues	246	87.85
Total	280	100

Table 4: ASQ

Domain	Normal	Monitor	Refer	Total
Communication	235	37	8	280
Percentage (%)	83.9	13.21	2.85	100
Gross motor	226	22	32	280
Percentage (%)	80.71	7.85	11.4	100
Finemotor	243	21	16	280
Percentage (%)	86.78	7.5	5.75	100
Problemsolving	233	35	12	280
Percentage (%)	83.21	12.5	4.2	100
Personalsocial	241	21	18	280
Percentage (%)	86.07	7.5	6.42	100

BEHAVIOURAL PROBLEMS USING STRENGTHSAND DIFFICULTIES QUESTIONNAIRE

Table 5: SDQ

Domain	Normal	Risky
Conduct	259	21
Hyper Activity	276	4
Peer Problem	277	3
Pro Social	269	11
Emotional	248	32

DISCUSSION

The study included 280 children aged 1 to 5 years who visited the pediatric outpatient department for minor illnesses, immunizations, and regular check-ups. The mean age of the participants was 40.95 ± 14.66 months. In terms of age distribution, 51.07% of the children were between 24.1 to 48 months old, 10.7% were aged between 12.1 to 24 months, and 38.2% were in the age group of 48.1 to 60 months. Various studies, such as the research by Cheng et al. on electronic media exposure in toddlers involving 390 children was done on children aged 2 to 5 years.[6]

A similar study by Sharif et al. was done on 4508 school-going children aged 9 to 15 years. Due to the widespread availability of digital devices and the impact of the COVID-19 pandemic, there has been a notable rise in children's screen time in recent years.[7]

In our study group of 280 children, there were 102 males, accounting for 36.4%, and 178 females, accounting for 63.57%. In a similar study by Cheng et al. involving 390 toddlers on electronic media exposure, 52.3% were males and the remaining were females.[6]

Another study by Sharif et al. in the northeastern United States focusing on middle school children included 4508 subjects, with 49% being boys.[7]

The average number of devices per family was 3.37 with a standard deviation of ± 0.79. The majority of families owned 3 devices, accounting for 53.9%, while 30% of families had 4 devices. Nearly all families had a television (98.5%) and smartphones (95.7%). A portion of families, 25.1%, still used featured phones. Additionally, 28.2% of families had either a laptop or computer, and 5.3% had tablets.

In a study by Chang et al., most households had a television (94.6%), personal computer (90%), tablet (48.21%), and smartphones (95.9%). Conversely, only a small percentage of households had video consoles (14.6%)and portable game devices (10.0%). Smart phones have now reached 95% penetration in all households.[4]

In our study involving 280 children, the majority were of lower middle class, comprising 125 families (44.6%), given our hospital's location in an industrial hub, a significant portion of our patients belong to the working-class. Higher levels of electronic media exposure were observed in the upper and upper-middle class (Kuppuswamy scale) with a median exposure time of 4 hours. The median exposure time was 3.50 hours for the lower middle class, upper-lower and lower socioeconomic classes. This disparity in exposure times could be linked to the increased availability of electronic devices within households. Nevertheless, with the widespread use of digital media devices becoming more common and affordable even in economically challenged Indian.

Contrasting with a study by Mendelsohn et al. involving 154 mothers of low socioeconomic status, where 149 (96.8%) reported daily media exposure in

their infants, with a median exposure of 120 minutes over a 24-hour period.[8]

The study utilized the AGES & STAGES QUESTIONNAIRE, which assesses five domains of child development. In the communication domain, 83.9% of the study population were classified as normal, while 16.1% required additional learning activities and monitoring. There was no significant correlation was found between total screen time and the development of the communication domain in children (p=0.342).

Research by Tomopoulos et al in New York involving 259 infants revealed that increased media exposure at 6 months was linked to lower cognitive and language development at 14 months.[41] Another study by Zimmerman et al demonstrated a negative relationship between viewing baby DVDs/videos and vocabulary acquisition in children aged 8 to 16 months.[9]

Pagani et al's study on 2,837 infants in Québec, Canada, showed that higher televiewing at 29 months was associated with lower scores on language and number knowledge tests.[10]

In the gross motor domain, 80.71% of children were classified asnormal,7.85 % required monitoring, and 11.4% needed assessment by a professional. A significant correlation was found between delays in the gross motor developmental domain and total electronic media exposure (p=0.008).

Pagani et al's study revealed that children who watched more television at 29 months performed poorly on the locomotion subscale of the test of gross motor development.[10]

The Bayley Scales of Infant Development-second edition and Peabody Developmental Motor Scales-second edition were utilized to assess developmental skills. Among 75 children with frequent television exposure, they watched an average of 67.4 minutes of television daily before the age of 2. This increased television viewing raised the risk of delayed cognitive, language, and motor development in these children.[11]

In the fine motor domain, 86.78% of children were categorized as normal, while 7.5% required assessment by a professional, and 5.75% needed learning activities and monitoring. There was a significant association between the need for assessment and learning activities with total media exposure time (p<0.001). This suggests that the amount of media exposure may have an impact on fine motor development in children.

In the problem-solving domain, 4.2% of the population required assessment by a professional, 12.5% needed learning activities and monitoring, and 83.21% were classified as normal. Interestingly, there was significant association found between screen time and the problem-solving domain (p<0.001).

Regarding the personal-social domain, 7.5% of children required learning activities and monitoring, 6.42% needed assessment by a professional, and 86.07% were considered normal. Similarly, there was significant association observed between total electronic media exposure and delays in the personal-social domain(p<0.001).

The study concluded that the gross motor, fine motor, personal-social and problem solving domains of the ASQ were significantly linked to screen time, while the communication domain showed no significant association with total screen time in children.

The study utilized the Strengths and Difficulties Questionnaire to assess behavioral aspects across five domains: conduct (p=0.427), hyperactivity (p=0.186), peer problem (p=0.103), prosocial (p=0.090), emotional wellbeing (p=0.300). The results indicated that there was no significant association found between electronic media exposure and these behavioral domains in the study.

In a study by Lisa et al involving 876 8- to 9-year-old children in Australia, findings revealed that boys who played more video games had higher odds of exhibiting borderline/abnormal conduct and emotional problems for each additional hour of weekly use. Television viewing was linked to increased odds of hyperactivity/inattention in boys, while no significant relationships were observed for girls.[12]

Another study by Mistry et al analyzed data from the Healthy Steps for Young Children national evaluation. The research focused on television exposure defined as >2 hours daily at specific ages and having a television in the child's bedroom. The study found that sustained television viewing was associated with behavioural outcomes, and concurrent television exposure was linked to fewer social skills. However, heavy television viewing only in early childhood did not consistently relate to behavioral or social skills outcomes.[13]

The studies mentioned focused on children, including adolescents and early adulthood, unlike our study, which was limited to children aged 1-5 years. This difference in age range could potentially explain the variations in results observed across the studies.

CONCLUSION

The most commonly used electronic media devices in the population were smartphones (95.7%) and televisions (98.5%). On average, families had 3.37 ± 0.79 electronic media devices. Higher electronic media exposure was noted in the upper and upper-middle socioeconomic groups compared to other socioeconomic categories (p< 0.001).

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