

## Impact of Screen Time on Sleep Patterns in School Children

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**Citation:** Khan M, Batool U, Akbar M, et al. Impact of Screen Time on Sleep Patterns in School Children. *Medi Clin Case Rep J* 2024;2(3):423-429. DOI: doi.org/10.51219/MCCRJ/Ayaz-Ali/116

**Received:** 01 August, 2024; **Accepted:** 02 August, 2024; **Published:** 05 August, 2024

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### ABSTRACT

**Background:** Digital technology has become integral to daily life, with children increasingly using devices like smartphones, tablets, laptops, and TVs. This study investigates the impact of screen time on sleep patterns and physical activity levels among school-aged children.

**Objectives:** To determine the average daily screen time among school-aged children, assess their sleep patterns and quality, compare the relationship between screen time and sleep quality, and identify demographic and behavioral factors influencing these variables.

**Methods:** A cross-sectional study was conducted with 1,152 participants aged 5-10 years from primary schools and daycare centers in Swat, KPK, Pakistan. Data were collected using structured questionnaires administered to parents/guardians, covering screen time, sleep patterns, and demographic information. Stratified random sampling ensured representation across different schools and age groups. Descriptive statistics, chi-square tests, and correlation analyses were used to examine the data.

**Results:** The study found that increased screen time was significantly associated with poorer sleep quality, shorter sleep durations, and greater sleep disturbances. Children who did not engage in screen time had the best sleep quality. Additionally, higher screen time was correlated with decreased engagement in physical activity.

**Conclusion:** Excessive screen time negatively impacts sleep patterns and physical activity levels in school-aged children. Interventions to reduce screen time, promote screen-free environments, and establish consistent bedtime routines are crucial to improving children's sleep health and overall well-being.

**Keywords:** Screen time; Sleep patterns; Physical activity; School-aged children; Digital technology; Sleep quality; Cross-sectional study; Children's health; Parental involvement; Sleep disturbances

## Introduction

Digital technology has become an important part of our lives, and youngsters are using displays like smartphones, tablets, laptops, and TVs more than ever<sup>1</sup>. While modern technologies have numerous benefits, there are concerns about how too much screen time may harm children's health, notably their sleep and academic performance<sup>2</sup>. A new research of 11,875 children aged nine to ten in the United States investigated how screen usage affects mental health, conduct, academic achievement, sleep, and friendships. According to the findings, greater screen usage is associated with poorer mental health, more behavioral issues, lower academic achievement, and less sleep, as well as modestly improved peer interactions. However, these associations were weak, with socioeconomic status (SES) having a greater impact on these outcomes. The study did not establish that screen time causes these difficulties, implying that increasing screen time may not be directly hazardous to children in this age group. The study contributes to our understanding of how screen usage affects children's well-being and emphasizes the necessity of encouraging healthy practices<sup>3</sup>. Sleep is critical for children's development and learning. It improves memory, emotions, and overall wellness. Experts recommend specific amounts of sleep for different ages to help children grow and develop properly<sup>4</sup>. However, using electronic gadgets, especially before bedtime, may make it difficult for youngsters to sleep effectively<sup>1,5</sup>. Sleep consists of several stages, each of which is vital for thinking and feeling. Too much screen time may make it difficult for youngsters to sleep effectively and affect how frequently they remember their dreams. Our study adds to what we already know by looking at how screen usage affects children's sleep and dream memory<sup>5</sup>. Our research sheds light on the multifaceted consequences of screen use on school-aged children, demonstrating links between sleep quality, frequency of dream recall, and academic achievement. These findings emphasize the importance of a measured and conscientious approach to screen use, acknowledging its potential impact on several aspects of a child's life. Understanding and minimizing the effects of screen time on children's well-being is critical in an increasingly digital environment. Such activities are critical in nurturing their overall growth and ensuring the well-being of future generations<sup>6</sup>. Children and adolescents spend more time on screens and electronic media than ever before, with 95% of teens in the US having access to a smartphone<sup>7</sup>. While global inequities in technology usage exist-in 71 out of 195 nations worldwide, fewer than half the population has access to the internet-it is apparent that average global technology use is on the rise, especially among millennial<sup>8</sup>. Screens (televisions, laptops, smartphones, tablets, and video game consoles) are becoming increasingly significant in children's life, beginning at a young age. Prior to the COVID-19 pandemic, children

under 2 years old spent an average of 49 minutes per day in front of a screen, while children aged 2 to 4 spent an average of 2 hours and 30 minutes<sup>9</sup>. The implications of overexposure to screens during this important era of brain development are being acknowledged<sup>10</sup>. Several studies have shown how detrimental screens are to children's cognitive development<sup>11,12</sup>.

It has been demonstrated that preschoolers who spend a lot of time in front of mobile displays have behavioral issues (hyperactivity, attention abnormalities)<sup>13</sup>. It also affects language development, vision, and the quality of sleep<sup>7,14,15</sup>.

## Objectives

To determine the average daily screen time among school-aged children.

To assess sleep patterns and quality in school-aged children

To compare the relationship between screen time and sleep quality, including sleep duration and disturbances, in school-aged children

To identify potential demographic and behavioral factors influencing screen time and sleep patterns in school-aged children

## Methodology

**Study Design:** Cross-sectional study

**Study Population:** school-aged children (ages 5-10)

**Sample Size:** In our study, we utilized a substantial sample size of 1,152 participants to ensure the accuracy and reliability of our findings. This large sample size allows for a comprehensive analysis of the impact of screen time on sleep patterns and physical activity among school children, providing robust and generalizable results.

**Setting:** primary schools, and daycare centers in Swat kpk Pakistan.

### Inclusion criteria:

Children aged 5-10 years

Parental/guardian

### Consent for participation

### Exclusion Criteria:

Children with diagnosed sleep disorders

Children with developmental disorders that affect screen time or sleep

### Sampling Technique:

Stratified random sampling to ensure representation from different schools, daycare centers, and age groups

**Data Collection**

**Questionnaires:** A structured questionnaire will be administered to parents/guardians to collect data on screen time and sleep patterns.

**Screen Time:** Questions on the type and duration of screen time (TV, smartphones, tablets, computers).

**Sleep Patterns:** Questions on bedtime routines, sleep duration, sleep disturbances, and overall sleep quality.

**Demographic Data:** Age, gender, socioeconomic status, and parental education level.

**Data Analysis**

Descriptive statistics to summarize screen time and sleep patterns school age children chi-square tests to compare screen time and sleep quality, sleep duration, sleep schedule in school-aged children.

**Ethical Considerations**

Obtain approval from the Institutional Review Board Khyber medical college (IRBKMC).

Informed consent will be obtained from parents/guardians.

Ensure confidentiality and anonymity of participant.

**Results**

**Table 1:** Age Distribution among Children Aged 5 to 9 Years

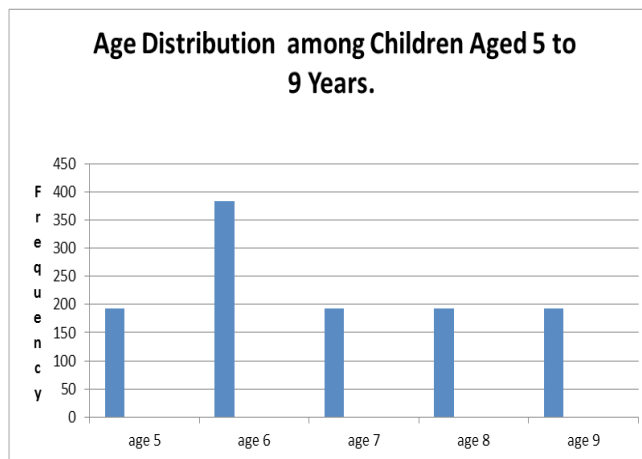
age	Frequency(N)	Percentage (%)	Mean age
5	192	16.7%	6.83
6	384	33.3%	
7	192	16.7%	
8	192	16.7%	
9	192	16.7%	
Total	1152	100%	

In this study total of 1,152 children aged 5 to 9 years were included. The age distribution of the participants is summarized in (Table 1).

The majority of the participants were 6 years old, comprising 33.3% of the total sample (N=384). Each of the other age groups (5, 7, 8, and 9 years old) had an equal distribution, with each group representing 16.7% of the total sample (N=192 each).

The mean age of the participants was calculated to be 6.83 years. This indicates that the sample was slightly skewed towards the younger end of the age range. The uniform distribution across most of the age groups ensures a balanced representation, allowing for a comprehensive analysis of screen time impact across different ages within the school children population.

The balanced representation across the different age groups ensures that any findings related to screen time and sleep patterns can be considered reflective of the broader age range of children within this demographic. The slight skew towards younger children, as indicated by the mean age, should be taken into account when interpreting the results, particularly if age-specific trends or patterns are identified (Table 1 and Figure 1).



**Figure 1:** Age distribution among children aged 5 to 9 years.

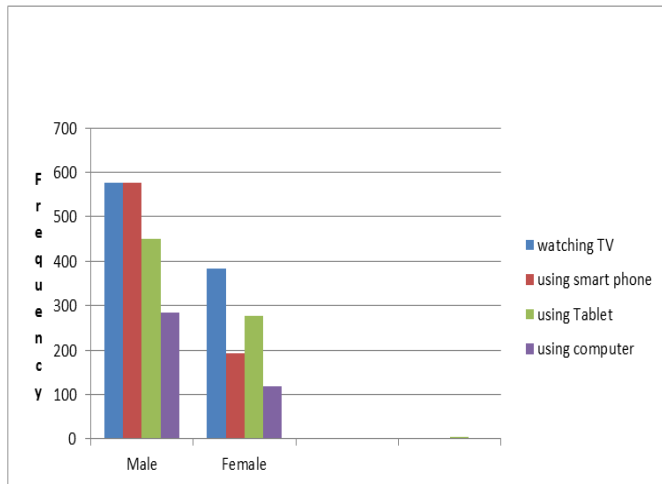
**Table 2:** Gender distribution of screen types used.

Gender	Watching TV(N)%	Using smart phone (N)%	Using tablet (N)%	Using computer/laptop (N)%
Male	576(75%)	576(75%)	450(58%)	284(38%)
Female	384(15%)	192(50%)	276(71%)	120(23%)
Total	960	768	726	404

The study also examined the gender distribution of different screen types used by the participants. Among the children, watching TV was the most common screen type, with a total of 960 children reporting this activity. Male children had a significantly higher percentage (75%) compared to female children (15%). The use of smartphones was also high, with a total of 768 children. Similar to TV watching, a higher percentage of male children (75%) reported using smartphones, while 50% of female children reported using this screen type.

For tablet use, 726 children reported this activity. Unlike TV and smartphones, a higher percentage of female children (71%) used tablets compared to male children (58%). Lastly, 404 children reported using computers or laptops. Male children had a higher percentage of use (38%) compared to female children (23%).

In summary, male children tended to use TVs and smartphones more frequently than female children. However, female children had a higher usage rate for tablets compared to male children. The usage of computers or laptops was also higher among male children than female children. This gender-based distribution of screen types is essential for understanding the varying impacts of different screen types on sleep patterns and could provide insights into tailoring interventions aimed at reducing screen time among school children.



**Figure 2:** Gender distribution of screen types used.

**(Table 3)** presents data on the relationship between screen time and sleep quality among school children, categorized by the type of screen used.

For children watching TV, those who watched for 1 hour reported varying sleep quality: 192 had very poor sleep, 384 had poor sleep, 140 had fair sleep, 192 had good sleep, and none reported very good sleep, with a p-value of 0.001 indicating a significant association. Children who watched TV for 2 hours had poorer sleep quality, with 250 reporting very poor sleep and 192 reporting poor sleep, while none reported fair, good, or very good sleep, also with a p-value of 0.001. Children who did not watch TV reported the best sleep quality, with none having very poor, poor, or fair sleep, 220 having good sleep, and 280 having very good sleep, with a p-value of 0.001, highlighting the significant positive impact on sleep quality.

**Table 3:** Relationship between screen time and sleep quality among school children.

Type of Screen	Screen time in hours	Sleep quality					P value(N)
		Very poor(N)	Poor(N)	Fair(N)	Good(N)	Very good(N)	
<b>Watching TV</b>							
	1 hour	192	384	140	192	0	0.001
	2 hour	250	192	0	0	0	0.001
	Don't watch	0	0	0	220	280	0.001
<b>Using smart phone</b>							
	1 hour	192	384	192	0	0	0.001
	Don't watch	0	0	0	192	200	0.001
<b>Using tablet</b>							
	1 hour	192	384	0	0	0	0.001
	Don't watch	0	0	0	250	192	0.001
<b>Using computer</b>							
	1 hour	192	200	250	150	0	0.001
	More than 3 hours	280	360	100	0	0	0.001
	Don't watch	0	0	0	360	150	0.001

Regarding smartphone use, children who used smartphones for 1 hour had 192 with very poor sleep, 384 with poor sleep, and 192 with fair sleep, but none reported good or very good sleep, with a p-value of 0.001. Those who did not use smartphones at all had better sleep quality, with none reporting very poor, poor, or fair sleep, 192 having good sleep, and 200 having very good sleep, with a significant p-value of 0.001.

For tablet use, children who used tablets for 1 hour had very poor (192) and poor (384) sleep, with none reporting fair, good, or very good sleep, supported by a p-value of 0.001. In contrast, children who did not use tablets had much better sleep quality, with none having very poor, poor, or fair sleep, 250 reporting good sleep, and 192 reporting very good sleep, with a significant p-value of 0.001.

For computer use, children who used computers for 1 hour had 192 reporting very poor sleep, 200 poor sleep, 250 fair sleep, and 150 good sleep, but none reported very good sleep, with a p-value of 0.001. Those who used computers for more than 3 hours had worse sleep quality, with 280 reporting very poor sleep, 360 poor sleep, and 100 fair sleep, with none reporting good or very good sleep, with a significant p-value of 0.001.

Children who did not use computers had the best sleep quality, with none having very poor, poor, or fair sleep, 360 reporting good sleep, and 150 reporting very good sleep, supported by a p-value of 0.001.

Overall, the data indicates a clear trend: children who do not engage in screen time generally have better sleep quality, while increased screen time is associated with poorer sleep quality across all types of screens. The consistently significant p-values (0.001) confirm the strong statistical significance of these findings, emphasizing the adverse impact of screen time on sleep quality in school children.

The **(Table 4)** presents the correlation between screen time and sleep patterns, focusing on the number of participants, sleep duration, and adherence to a proper sleep schedule.

For children with 1 hour of screen time, there were 568 participants who generally had a sleep duration between 6 and 7 hours. Out of these, 168 followed a proper sleep schedule while 400 did not, with a p-value of 0.001 indicating a significant association between screen time and adherence to a proper sleep schedule.

**Table 4:** Correlation between screen time and sleep patterns.

Screen time	Number of participants	Sleep duration	Proper sleep schedule (Yes)	Proper sleep schedule(N0)	P value
1 hour	568	Between 6 and 7 hours	168	400	0.001
2 hours	240	Less than 6 hours	50	190	0.001
More than 3 hours	190	Less than 5 hours	30	160	0.001
Don't watch	154	More than 8 hours	146	8	0.001
Total	1152				

Children who spent 2 hours on screens had 240 participants with a sleep duration of less than 6 hours. Among these, only 50 maintained a proper sleep schedule, while 190 did not. The p-value of 0.001 shows a significant negative impact of increased screen time on maintaining a proper sleep schedule.

For those using screens for more than 3 hours, there were 190 participants with a sleep duration of less than 5 hours. Of these, 30 followed a proper sleep schedule, and 160 did not. The p-value of 0.001 reinforces the significant negative correlation between excessive screen time and maintaining a proper sleep schedule.

Children who did not engage in screen time had 154 participants with a sleep duration of more than 8 hours. A substantial majority, 146 of these children, adhered to a proper sleep schedule, while only 8 did not, with a p-value of 0.001 highlighting a significant positive relationship between the absence of screen time and proper sleep scheduling.

Overall, the data indicates that as screen time increases, the likelihood of maintaining a proper sleep schedule decreases, and sleep duration shortens. Conversely, children who do not engage in screen time tend to have longer sleep durations and better adherence to a proper sleep schedule. The consistently significant p-values (0.001) confirm the robustness of these associations, emphasizing the impact of screen time on sleep patterns among school children

**Table 5:** Correlation between Screen Time with engagement in physical activity.

Screen time	Number of participants	Engagement in physical activity			
		Daily	Several times in a week	Once in a week	rarely
1 hour	568	52	58	258	200
2 hours	240	20	37	79	104
More than 3 hours	190	2	11	19	158
Don't watch	154	120	20	8	6
Total	1152				

The (Table 5) examines the correlation between screen time and engagement in physical activity among school children, detailing the number of participants and their frequency of physical activity based on their screen time.

For children with 1 hour of screen time, there were 568 participants. Among these, 52 engaged in physical activity daily, 58 several times a week, 258 once a week, and 200 rarely. This

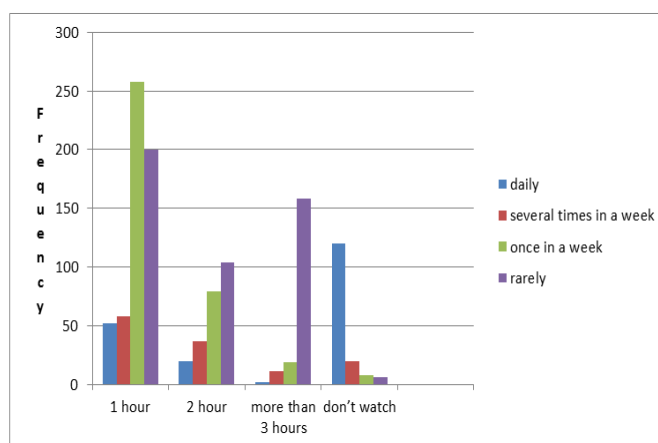
distribution indicates that while a portion of children with 1 hour of screen time engage in physical activity regularly, a significant number still engage rarely.

Children with 2 hours of screen time had 240 participants. Of these, only 20 engaged in physical activity daily, 37 several times a week, 79 once a week, and 104 rarely. This suggests that increased screen time is associated with a decrease in the frequency of physical activity.

For those with more than 3 hours of screen time, 190 participants were observed. Here, only 2 engaged in physical activity daily, 11 several times a week, 19 once a week, and a large majority of 158 engaged rarely. This highlights a strong negative correlation between excessive screen time and engagement in physical activity.

Children who did not engage in screen time had 154 participants. Among these, 120 engaged in physical activity daily, 20 several times a week, 8 once a week, and only 6 rarely. This indicates that the absence of screen time is strongly associated with higher levels of physical activity (Figure 3).

Overall, the data indicates a clear trend: as screen time increases, the frequency of physical activity decreases. Children who do not engage in screen time tend to be more active, engaging in physical activities more frequently. The stark contrast in physical activity levels between children with varying amounts of screen time emphasizes the impact of screen time on physical activity engagement among school children.



**Figure 3:** Correlation between Screen Time with engagement in physical activity.

**Discussion**

In the literature, a review of 32 articles investigating the link between television watching and sleep outcomes revealed that 25 studies (78%) found a significant association between television watching and either delayed bedtimes or reduced total sleep time (TST). Specifically, studies that identified a

significant negative impact of television watching on sleep duration reported that greater amounts of screen time were linked to a more pronounced reduction in total sleep time or a higher likelihood of experiencing shorter sleep durations<sup>17</sup>.

These findings are consistent with our study, which also observed significant correlations between increased screen time and poorer sleep quality among children. Our results show that higher screen time, whether from watching TV, using smartphones, tablets, or computers, is associated with shortened sleep durations and increased sleep disturbances. This parallel suggests that, similar to the literature, excessive screen time in our study is linked to more severe negative impacts on sleep patterns, reinforcing the importance of managing screen exposure to maintain healthy sleep habits in children<sup>18</sup> highlights the importance of environmental and behavioral factors in fostering healthy sleep patterns. Creating a screen-free bedroom environment reduces distractions and stimuli that can delay falling asleep. Additionally, engaging parents in establishing and maintaining bedtime routines helps create a consistent sleep-wake schedule, crucial for quality sleep. Educating families about good sleep hygiene-such as limiting screen time before bed, ensuring a quiet and dark sleep environment, and keeping regular sleep hours-can significantly improve children's sleep health<sup>18</sup>.

These recommendations align with our study's findings. Our data shows that children with higher screen time had poorer sleep quality and shorter sleep durations. This underscores the need for interventions that promote screen-free environments and involve parents in managing screen time and establishing consistent sleep routines. By following these practices, families can help mitigate the adverse effects of screen time on sleep, supporting better overall sleep health in children.

A recent study reported that children spend a significant amount of time watching TV, with 52.9% of them doing so, and 30.4% watching TV in their bedrooms. On school days, these children spend approximately 5.85 hours per day watching TV, and this increases to 7.15 hours per day on weekends. Additionally, children spend more time using cellphones than playing video games or using computers, averaging 1.58 hours per day on school nights and 3.87 hours per day on weekend nights<sup>19</sup>.

Comparatively, our study also found that screen time is prevalent among children, impacting their sleep patterns and physical activity levels. We observed that children with 1 hour of screen time already exhibited varied levels of sleep quality, and those with more than 3 hours of screen time experienced significantly poorer sleep quality and shorter sleep durations. Furthermore, our data showed that higher screen time was associated with decreased engagement in physical activity.

These findings align with the aforementioned study, emphasizing the need to address screen time habits to promote better sleep and overall health in children. Both studies highlight the extensive use of screens, particularly TV and cellphones, and their potential negative impact on children's sleep and physical activity. This underscores the importance of interventions to reduce screen time and encourage healthier habits.

A study has done, This study identified four factors associated with insufficient sleep among all respondents: watching TV for 2 hours or more ( $p=0.000$ ), using a cellphone for 2 hours or more ( $p=0.033$ ), total screen time exceeding 2 hours per day

( $p=0.000$ ), and experiencing difficulty falling asleep ( $p=0.000$ ). However, the factors linked to insufficient sleep differed between boys and girls. For boys, insufficient sleep was related to spending more than 2 hours on screen time ( $p=0.000$ ) and having difficulty sleeping ( $p=0.006$ ). For girls, the significant factors were watching TV for 2 hours or more ( $p=0.013$ ) and experiencing difficulty sleeping ( $p=0.000$ )<sup>20</sup>.

Our study similarly found that increased screen time negatively impacted sleep quality and duration. Children with more than 2 hours of screen time per day exhibited poorer sleep quality, shorter sleep durations, and greater difficulty maintaining a proper sleep schedule. Additionally, our results showed that children who did not engage in screen time had better sleep quality and longer sleep durations, emphasizing the adverse effects of excessive screen time on sleep health.

Both studies underscore the significant impact of screen time on sleep patterns in children. The findings highlight the need for strategies to limit screen time, particularly in the evening, to promote better sleep quality and overall health. The gender-specific factors identified in the other study further suggest that tailored interventions may be necessary to address the unique sleep challenges faced by boys and girls.

### Limitations

Our study has several limitations that should be considered when interpreting the results. First, the cross-sectional design of the study limits our ability to establish causality between screen time, sleep patterns, and physical activity levels. Second, the data were collected through self-reported measures, which may be subject to recall bias and social desirability bias. Additionally, the study was conducted in a single city, which may limit the generalizability of the findings to other regions. Future research should consider expanding the scope to include a larger, more diverse population across the entire province to enhance the external validity of the results. Lastly, other potential confounding factors such as dietary habits, socioeconomic status, and parental influence were not controlled for in this study, which could have impacted the outcome.

### Conclusion

In conclusion, our study highlights the significant impact of screen time on the sleep patterns and physical activity levels of school-aged children. The findings indicate that increased screen time is associated with poorer sleep quality, shorter sleep durations, and greater sleep disturbances. Specifically, children who engaged in more than 3 hours of screen time per day exhibited the most severe negative effects on their sleep patterns. Additionally, the study revealed a clear negative correlation between screen time and engagement in physical activity, with children who did not engage in screen time being more physically active.

These results align with existing literature that emphasizes the detrimental effects of excessive screen time on children's health. The consistency of these findings across various studies underscores the need for interventions aimed at reducing screen time to promote better sleep and overall health in children. Creating a screen-free bedroom environment, involving parents in establishing consistent bedtime routines, and educating families about good sleep hygiene are essential steps in mitigating the adverse effects of screen time.

Furthermore, our study contributes to the growing body of evidence that suggests a multifaceted approach is necessary to address the impact of screen time on children's well-being. By understanding and minimizing the effects of screen time, we can support the healthy development and overall well-being of future generations in an increasingly digital environment.

**Author's contribution:** All authors have equally contributed so all are considered as 1<sup>st</sup> authors.

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