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Screen Time and Sleep Quality Among Deaf Adolescents: A Cross-Sectional Study

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ABSTRACT

This study examined the connection of screen time with quality sleep among adolescents with hearing impairment. In the modern digital era, the screen time has become and crucial element of daily life that influencing individual health and behaviour pattern. This cross-sectional study investigates the connection between screen time and the quality sleep related functional outcome among deaf adolescents in Punjab Pakistan. The purposive sample of 202 hearing impaired students age ranging from 13 to 19 years, surveyed using the questionnaire for screen time of adolescents (QueST) and functional outcomes of sleep questionnaire (FOSQ-10). The results of study revealed the prominant negative correlation between excessive screen time and both general productivity and physical activity while there was a positive correlation found with vigilance. However, the overall screen time was not directly connected with the sleep but there is an indirect effect of excessive screen time observed. Moreover, adolescence who became hearing impaired after birth shows significantly higher screen time as compared to those deaf by birth. Additionally, the results showed the length of enrollment in specialized education was inversely effective screen usage, with shorter duration liked higher screen time while the longer duration in the specialized education linked with lower screen time. Moreover, vigilance, productivity, and activity level as a significant predictor of the screen time.

Keywords: *deaf, screen-time, sleep, productivity, adolescents, functional outcome of sleep*

INTRODUCTION

The world has become the global village, where the screen exposure has become the essential part of living. In the digital world everyone is engaged in screen for different purposes. Sleep is the very essential part of development of an individual. In the current busy world, the quality sleep has become really difficult. The insufficient sleep has now become the global issue. The Insufficient quality sleep led to many problems such as physical and mental health (Chattu et al., 2018). The integration of technology in the life has many benefits but also having many adverse effects to sleep and daily functioning of life as the past research studies suggest the negative association of screen time with sleep quality (Vézina-Im et al., 2022).

Extra screen time was connected to more risk of obesity, less physical activity, and sleep problems, also social and emotional problems (Goswami & Parekh, 2023). In general population, a systematic review and meta-analysis study revealed that the bed time screen-based media use was connected to poor sleep quality and day-time sleepiness in children and teenagers. (Carter et al., 2016). The deaf population use their eye as they learn things through eye and by hands they interact with others. The use of screen in deaf population has been increased as their communication is visual based and has unique digital communication habits. The deaf population engaged to prolonged screen-time as compared to the general population. Although, there are many studies are present on the impact of screen-time on adolescents'

sleep but the no study has found that are focused to deaf adolescents about the connection of screen-time and quality sleep.

This study focus to explore the association of prolonged screen time and sleep quality in deaf adolescents and also explores how different type of screen is being used by the deaf and how they are associating with sleep. Also, this study explores the functional problems faced by the deaf adolescents due to insufficient sleep.

By aligning with the aim of study the following research questions are posed;

i. What is the association between Screen-time and Quality sleep among adolescent with hearing impairment?
ii. Does Quality sleep effects daily functioning of life?

Research Objectives

i. To study the relationship between the use of different type of screen-media on quality sleep among hearing impaired adolescents.
ii. To study the association of daily life dysfunctional due to the association of screen-time and quality sleep.

METHODS

Research Design

The structured cross-sectional quantitative research design was used to explore the relationship between screen-time and quality sleep. The purposive sampling technique was utilized to obtain the data from the targeted population. The study was carried out from November 2024 to May 2025.

Participants

The sample of 202 students were selected from schools of children with special needs. The data was collected over the period of two months from different institutes. The data was collected from the schools of Dina, Jhelum, and kharian, cities in Punjab, Pakistan.

Instrument

The Questionnaire for Screen-time of Adolescents QueST (Ribeiro et al., 2019)

The instrument was developed to measure the screen-time activities including studying, doing work/internship, watching videos, playing games, and using social media. It includes response of participants in hours spent on electronic devices on weekdays and weekends.

QueST is the self -administered scale with the cut-off score >14 hours of using screen time per day. Scale content validity index (S-CVI) is >0.90 and item level content validity (I-CVI) is 0.78. The Quest showed the fair to excellent results for calculating various screen-time constructs and also showed that content validity was approved as satisfactory by expert reviewers, and use of QueST is recommended.

Functional Outcome Sleep Questionnaire (Chasens et al., 2009)

The shorter version of FOSQ with 10 items is self-administered and two-dimension scale that measure the sleep related disorders and their impact of the daily functioning of life. This scale was utilized to measure the effect of extra sleep on multiple daily operation of life on adolescents. It includes the five Subscale/Domain e.g. Overall productivity, physical activity, alertness, social functioning, and sexual relationship. Although the Item 10 was excluded from the research questionnaire due to the cultural factor. This scale includes 4-point Likert scale ranging from "No difficulty=4" to the "Yes, extreme difficulty=1". Total score ranging from 5-20 whereas the more score indicates the better functional status. The FOSQ-10 shows strong psychometric properties with test re-test reliability alpha=0.97, internal consistency =0.87. FOSQ-10 can discriminate between the normal group of individual and the individuals who suffering from sleep related impairment in daily life.

Procedure

Participants were taken from different schools of Jhelum and Dina including private and government institutes. Prior to the collection of data, permission was formally obtained from the administrative authorities of the respective institutes. Total 200 participants took part in the study. The researcher coordinated with school teachers to facilitate the process of data collection. The questionnaires were administered in the classroom to students throughout the school day, in a controlled classroom setting. The teachers helped the researchers guide the students through the process to clarify any confusion. Any confusion was handled by teachers and researchers for questions without influencing the content of the response. On average, the completion of the survey instruments took 20–25 minutes per participant.

Ethical Consideration

All the ethical considerations were followed at various steps of the study. A comprehensive overview of the research was given to the participants of the research with the help of teachers. A written informed consent was also provided and signed by the participant before proceeding to data collection. Participation in this study was completely voluntary. Participants had the option of quitting from the study at any time and this was made clear to participants. The researcher made every effort during the study to preserve participants' confidentiality and anonymity. Identifying information did not collect, and the raw data were stored in secure folders and used only for academic and research purposes. The results are reported in aggregate form, and no identifying information about any one participant was included in any publication or presentation resulting from this study.

RESULTS

Table 1

Pearson correlation between excessive ST, general productivity, activity level, vigilance, social outcome and quality sleep

Variables	1	2	3	4	5	6
1 Excessive ST	--					
2 General Productivity	-.29**	--				
3 Activity level	-.268**	.347**	--			

4 Vigilance	.282**	.066	-.087	--		
5 Social Outcome	.107	.032	.131	.146*	--	
6 total FOSQ	.006	.51**	.47**	.53**	.71**	--

P<0.001

Pearson product-moment correlation coefficient test was used to find the relationship between excessive ST, general productivity, activity level, vigilance, social outcome and quality sleep. Excessive screen time (ST) was significantly negatively correlated with general productivity ($r = -.29$**, $p < .01$) and activity level ($r = -.27$**, $p < .01$), suggesting that higher screen time was associated with lower self-reported productivity and physical activity. Conversely, excessive ST showed a small positive correlation with vigilance ($r = .28$, $p < .01$). General productivity was positively correlated with activity level ($r = .35$, $p < .01$) and total scores on the Functional Outcomes of Sleep Questionnaire (FOSQ; $r = .51$, $p < .01$). Activity level also correlated positively with total FOSQ scores ($r = .47$, 95% CI [.36, .57], $p < .01$). Vigilance demonstrated a weak positive association with social outcomes ($r = .15$, $p = .03$) and a strong correlation with total FOSQ scores ($r = .54$, $p < .01$). The strongest relationship emerged between social outcomes and total FOSQ scores ($r = .72$, $p < .01$), indicating that better social outcomes were closely tied to improved sleep-related functioning.

Table 2

The difference in the mean excessive screen time score for deaf by birth and deaf after birth

Variables	Deaf by Birth		Deaf after Birth				
	M	*SD*	*M*	*SD*	*t*(200)	*P*	Cohen's *d*
Excessive ST	1.4	.49	1.8	.41	-3.4	<0.001	-.811
General Productivity	3.06	.68	2.8	.82	1.1	.394	.265
Activity Level	3.09	.61	3.0	.67	.64	.879	.151
Vigilance	1.86	.89	1.98	1.01	-.55	.372	-.132
Social Outcome	2.95	1.1	3.15	1.04	-.71	.368	-.168
Total FOSQ	13.71	2.41	13.76	3.04	-.08	.534	-.020

An independent sample t-test was used to examine the difference in mean of excessive screen-time for the deaf by birth and deaf after birth. There was a statistical difference in screen time usage among deaf by birth (M=1.4, SD=0.49) and deaf after birth (M=1.8, SD=0.41); t (200) = -3.4, p<0.001, two-tailed). The effect size of the difference reported is large (eta squared=0.06).

Table 3

Descriptive statistics in one-way analysis of variance to compare mean scores of five groups of deaf for excessive screen time

Age group	N	M	SD
<1 year	22	1.54	.50
2-4 year	102	1.57	.49
5-7 year	21	1.38	.49
8-10 year	23	1.13	.34
>10 year	34	1.23	.43

Table 4

One-way analysis of variance of five groups deaf for excessive screen-time

Age group	*sum of square*	D*f*	*MS*	*F*	sig
Between group	5.89	4	1.47	6.5	<.001
Within group	44.00	197	.223		
Total	49.90	201			

Eta squared= 0.13

One-way analysis of variance was used to compare the effect of years of enrollment on use of screen-time among deaf adolescents. The deaf adolescents are divided into 5 groups on the basis of enrollment (<1 year, 2-4 years, 5-7year, 8-10 year, >10 year). There was statistically significant difference $p<0.001$ for five groups, $F(4,197) = 6.5$, $p<0.001$. $\eta^2= 0.13$ shows a medium effect size.

Table 5

The unstandardized and standardized regression coefficient for the variable entered into the design

Variables	B	*B*	SE B
Constant	2.01**		
Vigilance	.149**	.270	.036
General productivity	-.179**	-.251	.049
Activity level	-.138	-.171	.056
Social outcome	.041	.098	.027
R^2	.205		

B= unstandardized regression coefficient; SE B= standard error; *B*= standardized regression coefficient; p= level of significance

A standard multiple regression was used to assess the variance in the excessive screen time accounted by predictors vigilance, general productivity, activity level, social outcome. The significant correlated predictors were entered in the model. A significant model emerged; $F(4,197) =12.71$, $p<0.001$, $R^2=0.205$). the model explains 20% of variance in excessive screen time (Adjusted $R^2=0.189$). the individual predictors were further examined and indicated that vigilance ($t=4.1$, $p<0.001$), general productivity ($t=-3.6$, $p<0.001$), and activity level ($t=-2,4$, $p= 0.014$) were significant predictor in the model.

RESULTS AND DISCUSSION

The study investigated the relationship between increased screen time and sleep quality. As the scale used in the study to measure the quality sleep has covered the various functional outcome areas such as vigilance, social outcome, general productivity, activity level and intimacy behavior (that was excluded

due to the culture inappropriateness). The finding of the study revealed a notable inverse relationship was observed between excessive screen time and both general productivity ($r=-2.9$, $p<0.001$) and activity level ($r=-0.26$, $p<0.001$) These results also align with previous research studies indicating that higher screen time is connected with the reduced physical activity and productivity levels. Research conducted among Chinese college students in the COVID-19 found that increased screen time was linked with higher rate of depressive symptoms and also with lower physical activity levels. (Li et al., 2021).

According to the finding the excessive screen time demonstrated no significant direct relationship with total FOSQ scores (quality sleep). It suggests that overall screen time do not predict sleep related functional outcomes among deaf adolescence. Whoever the indirect relationship has seen through productivity and activity levels. Both general productivity and activity level were strongly correlated with total FOSQ scores. This suggest that screen time itself do not directly practice sleep related functioning but it negatively impacts productivity and physical activity and they could indirectly compromise to sleep quality. For instance, a Deaf adolescent with the high screen time experiences reduces productivity and physical activity which could negatively affect their sleep quality.

The recent body of literature verifies this evidence that how screen time influenced adolescents' sleep quality indirectly, through decreases in physical activity levels, which served as mediators (Wang et al., 2022). Some other evidences also reported in their systematic review that screen time does not always have a direct effect on sleep, but instead occurs through actions such as decreased movement and delayed bedtimes (Dumuid et al., 2021). reported that the combination of a delayed bedtime and less physical activity due to technology use strongly contributed to sleep disturbances experienced by adolescents (Minges and Redeker, 2021). Additionally, Knebel et al. (2023) also identified a strong negative correlation between screen time and both physical activity and sleep duration, using the QueST instrument, an example that will be explored further in this review. Knebel et al. (2023) also found moderation among respondents qualifying as non-physical activity, referring to their technology use, further reinforcing the idea that screen-related habit influences sleep through actions that demonstrate behavior.

There is also a positive association between the general productivity activity level and the total FOSQ score, which means daily functioning and the sleep quality has association. Enhance productivity physical activity levels are associated with better sleep related functioning. It means if deaf adolescents have excessive screen time which leads to lower productivity, physical activity, and overall productivity, and also has disturbed sleep patterns which means sleep and screen time are associated. Research studies also support this Nation according to research (Naing et al., 2024) adolescents using more screen time had poor sleep quality. The vigilance was positively co related with screen time ($r= .28$, $p<.001$) and also strongly connected with FOSQ scores ($r= .53$, $p<.001$). It shows that influence of vigilance on sleep quality is multifaceted, increased stream time might initially high vigilance but prolonged use of screen time may disturb sleep quality throw over stimulation, light exposure, and delayed sleep on set (Naing et al., 2024).

The study also revealed that deaf teenagers who are enrolled in the specialized educational system for less than 4 years reported higher screen time as compared to those who enrolled more than 8 years of enrollment. This finding suggest that the length of time spent in specialized educational setting is protective against excessive screen time. Also, the study revealed that adolescents who became the after birth ($M= 1.8$, $p<0.001$) have excessive screen time as compared to those adolescents who are deaf by birth ($M=1.4$, $p<0.001$). All the study includes only 9.9% adolescence who became the after birth still they contributed a huge difference in the study. This indicates due to more challenges in learning and

integrating into social and educational environment, these adolescents rely more on screen to maintain social interactions.

LIMITATION

The limitation of the study includes as the self-reported measures usually include socially desirable answers and self-biased responses. Also, the deaf adolescents were not able to understand the questionnaire by reading it, so the instructor demonstrated the sign language this could build the pressure on the deaf adolescents to make biased responses. The other drawback of the study is that the outline of the research was cross-sectional that limits the causal relationship. The results cannot be generalized as the sample was drawn from a specific population of deaf adolescents.

FUTURE DIRECTION

The future directions should be use of longitudinal study to study the causal relation between variables, also use of technological measure to reduce the self-reported error such as sleep measure devices.

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