



ORIGINAL ARTICLE

**Impact of Mobile Display Technology and Settings on Reaction Time in Young Adults: A Cross Sectional Observational Study**

Franc Oumanath,<sup>1,\*</sup> Hemalatha Manjeshwara<sup>2</sup> and Gopinath Manavazhagan<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Physiology, Aarupadai Veedu Medical College and Hospital, Vinayaka Mission's Research Foundation (Deemed to Be University), Kirumampakkam, Puducherry 607403, India

<sup>2</sup>Assistant Professor, Department of Physiology, Aarupadai Veedu Medical College and Hospital, Vinayaka Mission's Research Foundation (Deemed to Be University), Kirumampakkam, Puducherry 607403, India

<sup>3</sup>Professor & Head, Department of Physiology, Aarupadai Veedu Medical College and Hospital, Vinayaka Mission's Research Foundation (Deemed to Be University), Kirumampakkam, Puducherry 607403, India

Accepted: 31-January-2026 / Published Online: 3-April-2026

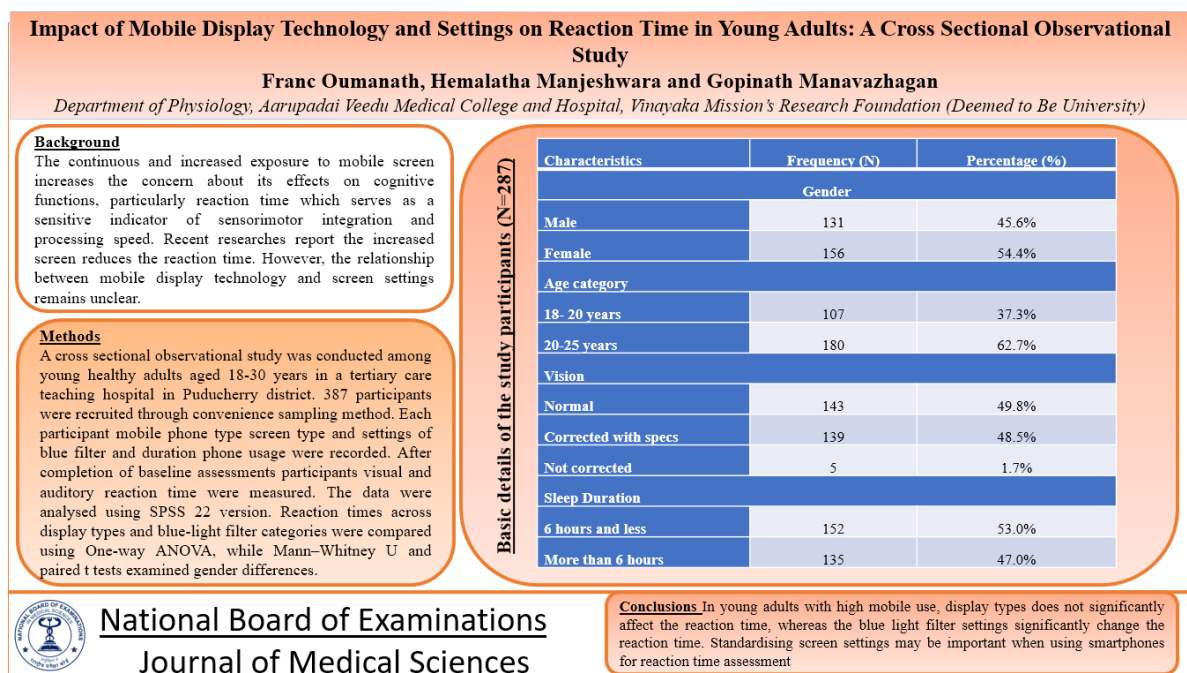
**Abstract**

**Background:** The continuous and increased exposure to mobile screen increases the concern about its effects on cognitive functions, particularly reaction time which serves as a sensitive indicator of sensorimotor integration and processing speed. Recent researches report the increased screen reduces the reaction time. However, the relationship between mobile display technology and screen settings remains unclear. **Aims & Objectives:** To assess difference in reaction time (Visual and Auditory) with various mobile display and display settings and to determine the association between gender and reaction time among the study participants. **Methods:** A cross sectional observational study was conducted among young healthy adults aged 18-30 years in a tertiary care teaching hospital in Puducherry district. 387 participants were recruited through convenience sampling method. Each participant mobile phone type screen type and settings of blue filter and duration phone usage were recorded. After completion of baseline assessments participants visual and auditory reaction time were measured. The data were analysed using SPSS 22 version. Reaction times across display types and blue-light filter categories were compared using One-way ANOVA, while Mann–Whitney U and paired t tests examined gender differences. **Results:** Out of 387 part, 156 (54.4%) were females out of which, 180 (62.7%) were between 20 to 30 years of age. Most of the participants reported more than 6 hours of daily mobile use. Reaction times did not differ significantly across display types or refresh rates ( $p > 0.05$ ). In contrast, visual reaction times varied with blue-light filter status, discriminatory visual RT reports significant difference among groups ( $p = 0.020$ ), and simple visual RT was borderline significant ( $p = 0.050$ ), while auditory measures were unaffected. A small but significant gender difference was observed for simple visual RT, and mean heart rate increased post-testing ( $p = 0.022$ ). **Conclusions:** In young adults with high mobile use, display types does not significantly affect the reaction time, whereas the blue light filter settings significantly change the reaction time. Standardising screen settings may be important when using smartphones for reaction time assessment.

**Keywords:** Reaction time, Mobile screen types, Blue light filters, screen time

\*Corresponding Author: Franc Oumanath  
Email: francoumanath@gmail.com

## Graphical Abstract



## Introduction

Mobile phones have become essential part of everyone's life particularly in young adults with average daily screen time more than seven hours for various activities ranging from education to entertainment [1]. This continuous use increases the concern about its effects on cognitive functions, particularly reaction time which serves as a sensitive indicator of sensorimotor integration and processing speed. Reaction time represents the interval between stimulus onset and motor response encompassing sensory detection, neural processing and effector activation [2].

Visual reaction time typically exceeds the auditory reaction time due to additional retinal to cortical processing demands. The normal visual reactive time value in young adults aged 18 to 25 years at optimal condition ranges from 250-350 minutes. These values vary with stimulus complexity and individual factors like age, gender and fatigue [3].

Many researches have reported that increase in daily screen time and prolongs

the reaction time. Most of the investigations focus on the usage duration and overlooking device specific factors [4]. With the surge in mobile phone use for academic, recreational, and clinical tasks, concerns have risen about how digital screen exposure influences cognitive-motor performance. Modern mobile displays differ markedly in refresh rates, panel type, brightness levels and modulation technique. Display types and display setting also tend to influence the reaction time. There was a dearth of research related to the reaction time with display type and display screen. Hence, this study was planned to assess the differences in the various screen type and to find relationship between screen type with reaction time.

## Objectives:

1. To assess difference in reaction time (Visual and Auditory) with various mobile display and display settings
2. To determine the association between gender and reaction time among the study participants.

## **Methodology**

### ***Study design and setting***

This cross-sectional observational study was carried out among young healthy adults between the age group 18 to 30 years. The present study was conducted in the Department of Physiology of a tertiary care teaching hospital in the district of Puducherry over a period of three months from October 2025 to December 2025.

### ***Study participants, sampling technique, and sample size***

As per the study conducted by Asuthosh Padhya et al., the expected mean reaction time was  $314 \pm 50.8$  with precision of 6 and level of significance of 5% in the formula [5]  $n = \left[ \frac{Z_{(1-\alpha/2)}}{d} \right]^2$ , the minimum required sample size was calculated as 276 participants. The healthy adults aged 18 years to 25 years convenience sampling method. Individuals with Musculoskeletal disorders or recent with normal vision or corrected vision was included in the study. Participants were recruited through convenience sampling method. Participants currently on psychoactive medication, and those who had physical activity within 2 hours were excluded from the study.

### ***Data collection tool and technique***

A proforma was developed for collecting participants information and basic health details. At baseline participants anthropometric measurements such as height and weight were measure to assess the Body Mass Index (BMI). Baseline vitals such as heart rate were measured. Each participant mobile phone type screen type and settings of blue filter and duration phone usage were recorded. After completion of baseline assessments participants visual ad auditory reaction time

were measured. After completion of the procedure, heart rate was assessed.

### **Reaction time apparatus**

Reaction time apparatus gives a simple discriminatory and choice reactions for auditory and visual stimuli with built in chronoscope.

### ***Data analysis***

All the data were collected and was entered in MS Excel 2019. Analysis was done by using SPSS version 22. The qualitative variables were presented in the form of numbers and percentages. Mean, standard deviation/median, and interquartile range were used for quantitative variables. Suitable statistical tests (according to the nature and distribution of data, e.g., chi-square test) were applied to assess the significance of study findings. One-way ANOVA was used to assess the association between screen type and screen settings.  $p$ -value  $< 0.05$  were considered as statistical significance.

### ***Ethical considerations***

Written informed consent was obtained from all the participants who were enrolled in the current study. Research and ethical committee approval were obtained from the Institute Research Committee and the Institute Human Ethics Committee (AV/IHEC/september2025/02) respectively. Data safety and confidentiality were maintained at every step of the study.

### **Results**

A total of 287 young adults participated in the study, aged 18 years to 30 years. The results were described under the following headings:

- Sociodemographic and basic details
- Mobile use and display characteristics
- Comparison of reaction time with display type and blue light filter
- Gender differences in reaction time
- Changes in heart rate before and after reaction time testing

### Sociodemographic and basic details

Among the study participants nearly half of them were females which accounts for about 54.4%. Majority of the study

participants (62.7%) were aged between 20 years to 30 years.

With respect to visual status almost half of the participants had a normal vision without any visual aids (49.8%) and 48.5% were having vision with corrective specs and only 1.7% of the participants were having vision without corrected refractive error. Similarly, around half of the study participants. More than half of the study participants were reported sleep duration of 6 hours or less than 6 hours of sleep at night (Table 1).

Table 1: Basic details of the study participants (N=287)

Characteristics	Frequency (N)	Percentage (%)
<b>Gender</b>		
Male	131	45.6%
Female	156	54.4%
<b>Age category</b>		
18- 20 years	107	37.3%
20-25 years	180	62.7%
<b>Vision</b>		
Normal	143	49.8%
Corrected with specs	139	48.5%
Not corrected	5	1.7%
<b>Sleep Duration</b>		
6 hours and less	152	53.0%
More than 6 hours	135	47.0%

### Mobile use and display characteristics

Table 2 summarizes mobile phone usage patterns and display-related settings among the study participants. Nearly two-thirds of the participants (63.4%) reported using their mobile phone for more than 6 hours per day, whereas only 36.6% used it for 6 hours or less. This shows that consistent high digital among the study participants in similar age groups. Regarding blue-light filter usage, 65.5% of participants was not using the blue light

filter, 30.7% were using the mobile phone with blue light filter all the time and only 3.8% reported partial use (turning on during night time only). With respect to display technology, AMOLED 120 Hz was the most common configuration (37.3%), followed by OLED 60 Hz (23.3%), while other combinations such as AMOLED 90 Hz, LCD 60/90/120 Hz, and OLED 120 Hz were represented in smaller proportions which ranges from 3% to 13%.

Table 2. Details related to mobile phone usage pattern and display settings

Characteristics	Frequency (N)	Percentage (%)
<b>Average mobile usage</b>		
6 hours and less	105	36.6%
More than 6 hours	182	63.4%
<b>Use of Blue Light filter</b>		
On	88	30.7%
Off	188	65.5%
Partially on	11	3.8%
<b>Mobile Display type</b>		
AMOLED 120 Hz	107	37.3%
AMOLED 60 Hz	11	3.8%
AMOLED 90 Hz	21	7.3%
LCD 120 Hz	16	5.6%
LCD 60 Hz	17	5.9%
LCD 90 Hz	10	3.5%
OLED 120 Hz	38	13.2%
OLED 60 Hz	67	23.3%

### Comparison of reaction time with display type and blue light filter

Comparative analysis of reaction time with display type and blue light filter is shown in Table 3. The reaction times such as Discriminatory Auditory Reaction Time (DART), Discriminatory Visual Reaction Time (DVRT), Simple Auditory Reaction Time (SART) and Simple Visual Reaction Time (SVRT) were compared with various display types of the mobile

phone. It was found that there was no statistically significant difference between the display types.

Similarly, the reaction time on comparison with blue light filter status shows significant changes in visual reaction times. The Discriminatory Visual Reaction Time (DVRT) and the Simple Visual Reaction Time (SVRT) were statistically significant with p value of 0.020\* and 0.050\* respectively.

Table 3. Comparison of reaction time with display type and screen display settings

		Sum of Squares	df	Mean Square	F	Sig.
<b>Reaction time with different display types</b>						
DART	Between Groups	.001	7	.000	.810	.580
	Within Groups	.034	279	.000		
	Total	.035	286			

DVRT	Between Groups	.001	7	.000	.609	.749
	Within Groups	.036	279	.000		
	Total	.037	286			
SART	Between Groups	.001	7	.000	.750	.630
	Within Groups	.073	279	.000		
	Total	.074	286			
SVRT	Between Groups	.001	7	.000	.443	.874
	Within Groups	.052	279	.000		
	Total	.053	286			
<b>Reaction time with blue light filter status</b>						
DART	Between Groups	.001	2	.000	2.184	.114
	Within Groups	.035	284	.000		
	Total	.035	286			
DVRT	Between Groups	.001	2	.000	3.982	.020*
	Within Groups	.036	284	.000		
	Total	.037	286			
SART	Between Groups	.001	2	.000	1.529	.219
	Within Groups	.074	284	.000		
	Total	.074	286			
SVRT	Between Groups	.001	2	.000	2.548	.050*
	Within Groups	.052	284	.000		
	Total	.053	286			

*One-way ANOVA was applied \*p value<0.005 was statistically significant*

#### **Gender differences in reaction time**

The mean score of SVRT in male was  $0.144 \pm 0.11$  and female was  $0.145 \pm 0.010$ . This difference was statistically significant with p value of  $0.012^*$ . The mean score of DVRT in males were  $0.127 \pm 0.13$  and in females were

$0.129 \pm 0.014$  respectively. The mean score of SART and DART in males were  $0.146 \pm 0.10$  and  $0.137 \pm 0.16$  and in females were  $0.147 \pm 0.011$  and  $0.139 \pm 0.015$  respectively however there was no statistically significant changes between both genders.

Table 4. Comparison of Gender with Reaction time

Variable	Gender		P value
	Male	Female	
SVRT	0.144±0.11	0.145±0.010	0.012*
SART	0.146±0.10	0.147±0.011	0.065
DVRT	0.127±0.13	0.129±0.014	0.342
DART	0.137±0.16	0.139±0.015	0.677

*Mann Whitney U test was applied, \*p value<0.005 was statistically significant*

**Changes in heart rate before and after reaction time testing**

Heart rate has increased significantly from baseline following reaction time setting among the study participants. The mean heart rate at baseline was 89.52± 12.62 beats per min and has been increased to 95.40±44.178 beats per

min post reaction time testing which was statistically significant. (t = -2.300 , p =0.022) (Figure 1).

Among the study participants 1.70% of participants reported eye strain and 0.30% reported headache (Figure 2).

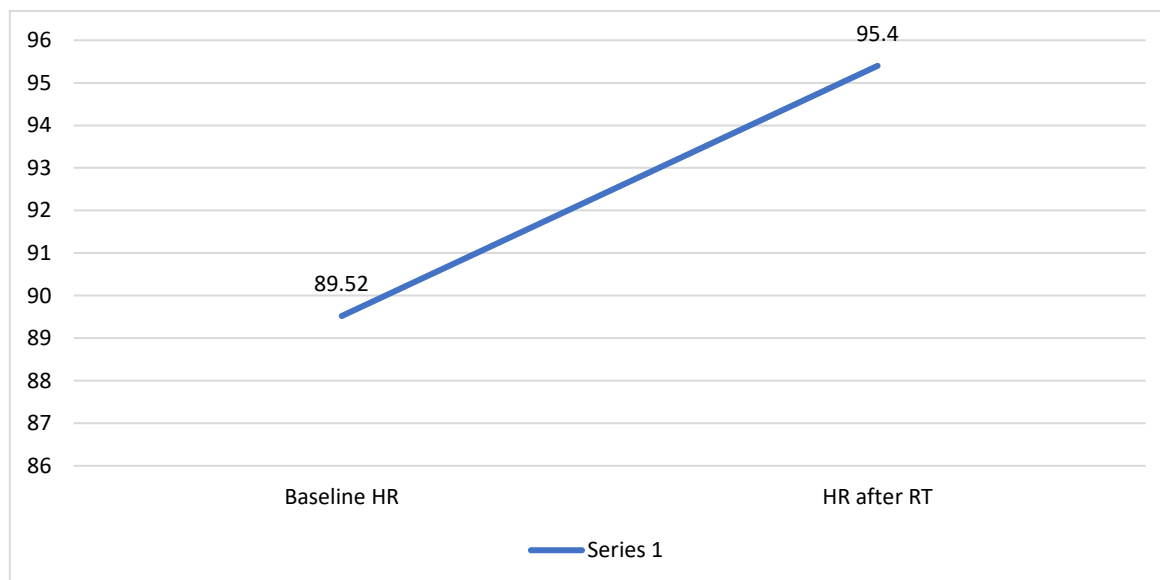


Figure 1. Comparison of change in vital statistics pre and post reaction time:

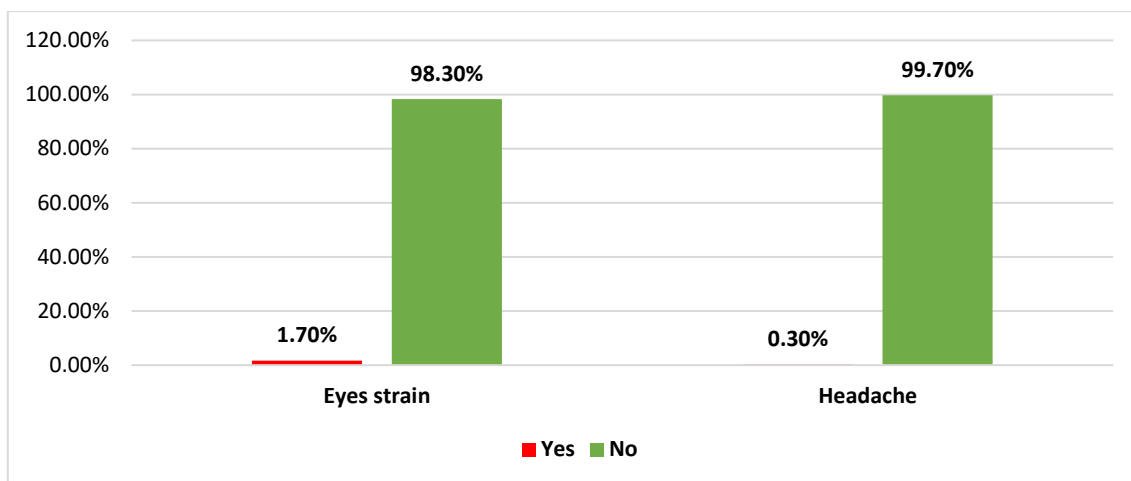


Figure 2. Proportion of participants reported headache and eye strain

## Discussion

The present observational cross-sectional study was conducted among the young healthy adults aged 18 years to 30 years for a period of three months in the Department of Physiology of tertiary care teaching hospital in Puducherry district. The study was aimed to assess the difference in reaction time (Visual and Auditory) with various mobile display and display settings and to determine the association between gender and reaction time among the study participants.

In the current study, nearly half of them were females which accounts for about 54.4%. Majority of the study participants (62.7%) were aged between 20 years to 30 years. Similar findings were reported by Pandey et al., that most of the participants were aged 18 to 23 years with female predominance [2].

With respect to visual status almost half of the participants had a normal vision without any visual aids (49.8%) and 48.5% were having vision with corrective specs and only 1.7% of the participants were having vision without corrected refractive error.

The mean score of SVRT in male was  $0.144 \pm 0.11$  and female was

$0.145 \pm 0.010$ . This difference was statistically significant with p value of  $0.012^*$ . The mean score of DVRT in males were  $0.127 \pm 0.13$  and in females were  $0.129 \pm 0.014$  respectively. The mean score of SART and DART in males were  $0.146 \pm 0.10$  and  $0.137 \pm 0.16$  and in females were  $0.147 \pm 0.011$  and  $0.139 \pm 0.015$  respectively however there was no statistically significant changes between both genders. Concurrent findings were reported by the study conducted by shat et al that the reaction time in male and females does not show any statistical significant [6]. In contrast the study conducted by Panday et al., stated that there was significant difference in reaction time between men and women [7].

The reaction times such as Discriminatory Auditory Reaction Time (DART), Discriminatory Visual Reaction Time (DVRT), Simple Auditory Reaction Time (SART) and Simple Visual Reaction Time (SVRT) were compared with various display types of the mobile phone. It was found that there was no statistically significant difference between the display types.

Similarly, the reaction time on comparison with blue light filter status

shows significant changes in visual reaction times. The Discriminatory Visual Reaction Time (DVRT) and the Simple Visual Reaction Time (SVRT) were statistically significant with p value of 0.020\* and 0.050\* respectively. The study conducted by Usgaonkar et al., stated that blue light filter improves task performance, however participants reported visual fatigue while using the filter [8]. Sirayder et al., in their study assessed the effect of blue and red light on cognitive function it was reported that Blue light exposure led to a significant and large improvement in SRT ( $\Delta = -53.33$  ms;  $p < 0.001$ ,  $\eta^2_p = 0.270$ ) and enhanced dynamic balance [9].

### Strengths and Limitations

This was the first study which compares the real-world mobile configurations including multiple display technologies and use of blue light filter among the participants. This study has few limitations, as it was conducted in a single institute, which may limit the generalisability. And the self-reported screen time and use of blue light filters may leads to recall bias.

### Conclusion

The present study shows that, in healthy young adults with high daily mobile phone use, variation in smartphone display hardware (LCD vs OLED/AMOLED and different refresh rates) does not produce significant differences in simple or discriminatory visual and auditory reaction time. In contrast, visual reaction times varied with blue-light filter status and showed small gender-related differences, while auditory reaction times remained largely unaffected.

### Conflicts of interest

The authors declare that they do not have conflict of interest.

### Funding

No funding was received for conducting this study.

### Ethical Approval

Ethical approval receive from the institute (AV/IHEC/september2025/02).

### Acknowledgement

We acknowledge the co operation of the participants, Department of Physiology, AVMCH, Puducherry for their support to the study

### References

1. Ahmad M, J.S. J, Virk APS. Department of Physiology, Government Medical College, Datia, Madhya Pradesh, India, An update on screen time and choice reaction time among medical college students in India. *Bioinformation*. 2025 July 31;21(07):2096–100.
2. Padhy A, Panda J, Patra S, Acharya S, Mishra S. Duration of screen time and its effect on reaction time in 1st year MBBS students in a medical college of Southern Odisha. *Natl J Physiol Pharm Pharmacol*. 2022;(0):1.
3. Hundekari J, Badjatiya B, Wasnik S, Kaur C, Kot LS, Trankatwar K. Effect of Duration of Exposure to Digital Screen on Visual & Auditory Reaction Time among Undergraduate Medical Students.
4. Zhu C, Li S, Zhang L. The impact of smartphone addiction on mental health and its relationship with life satisfaction in the post-COVID-19

- era. *Front Psychiatry*. 2025;16. Available from: <https://www.frontiersin.org/journals/psychiatry/articles/10.3389/fpsy.2025.1542040/full>
5. S. K. Lwanga and S. Lemeshow. Sample size determination in health studies: a practical manual. Available from: <https://apps.who.int/iris/handle/10665/40062>
  6. Shah C, Gokhale P, Mehta H. Effect of Mobile Use on Reaction Time. *Al Ameen Journal of Medical Sciences*. 2010 Apr 1;3.
  7. Pandey AK, Bajpayee M, Parmar D, Kumar R, Rastogi SK, Mathur N, et al. Multipronged evaluation of genotoxicity in Indian petrol-pump workers. *Environ Mol Mutagen*. 2008 Dec;49(9):695–707.
  8. Usgaonkar UPS, Dessai SP, Shetty A. The effect of blue light filter on visual and task performance. *Indian J Ophthalmol*. 2023 Dec;71(12):3707–10.
  9. Acute effects of blue and red light exposure on cognitive performance, exercise capacity, perceived effort, and dynamic balance: A randomized crossover study. Available from: <https://www.sciencedirect.com/science/article/pii/S1728869X25000620>