

Let's take a closer look

But not too close

COMPUTER VISION SYNDROME (CVS)

SYMPTOMS

- EYE STRAIN
- DRY/IRRITATED EYES
- FATIGUE
- HEADACHES



Computer Vision Syndrome

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CVS is an ocular condition characterized by a set of eye-related symptoms along with other ergonomic conditions that appear to increase during operating or looking at a digital screen

60,000,000

people a suffer from CVS globally

81.9%

Prevalence of CVS among engineering students in Chennai

66%

Test subjects had CVS in a study in Uttar Pradesh

EFFECTS



CAUSES

Poor sitting posture

Improper viewing distance

Lack of lubrication in the eyes

Prolonged use of screen

PROBLEM STATEMENT

Computer Vision Syndrome (CVS), characterized by eye strain and posture-related discomfort from prolonged screen exposure, poses a significant health concern in the digital age.

Our project aims to evaluate the effectiveness of WeCare's personalized reminder system—utilizing real-time posture and eye blink detection—in reducing CVS symptoms among users.

By conducting a controlled experiment comparing health outcomes before and after using WeCare, we seek to determine if proactive digital interventions can promote healthier screen habits and improve user well-being.

POTENTIAL APPLICATION

Tech companies, healthcare, or education



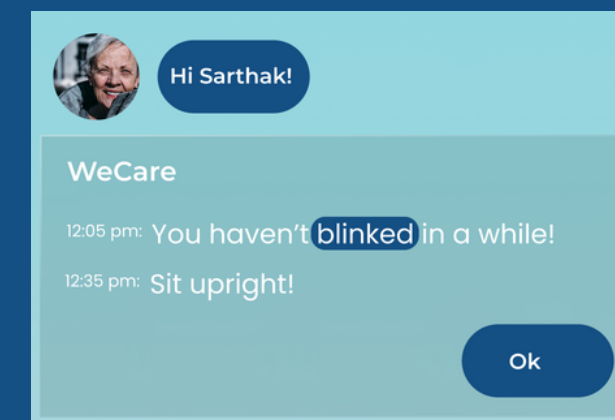
Workplace



Schools/Colleges



WFH Setups



Personalized Health Recommendations

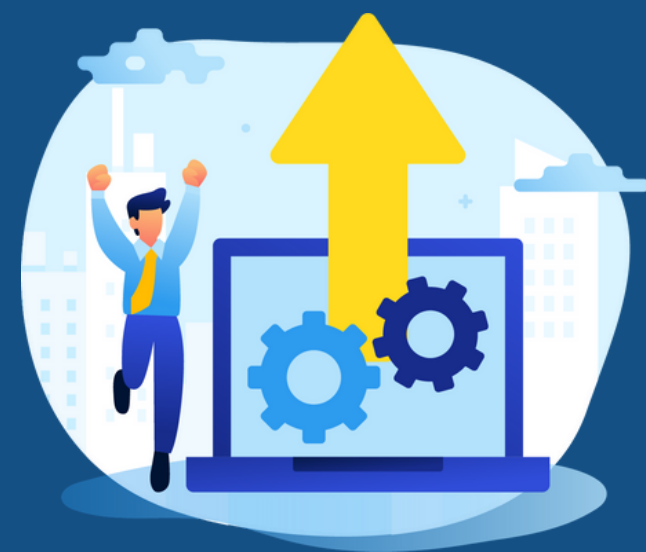
POTENTIAL IMPACT



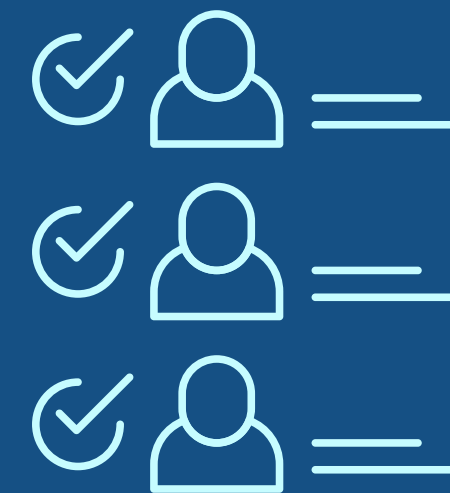
Improved user well-being



Reduction in CVS symptoms



Increased productivity



Lower absenteeism in workplaces

Literature Review

Real-Time Blink Detection as an Indicator of Computer Vision Syndrome (CVS) (Lapa et al., 2023)

Sample characteristics (n = 11).

	Mean ± SD	Min—Max
Age	22.00 ± 1.00	21–25
	Groups	N (%)
Gender	Female	9 (81.8%)
	Male	2 (18.2%)
Glasses	Yes	4 (36.4%)
	No	7 (63.6%)

Through an exploratory approach, this study aimed to determine if blinking data, collected using a computer webcam, can be used as a reliable indicator for predicting CVS in real time, considering real-life settings.

The study involved **13 student participants**, each with software installed on their computers that used a webcam to collect real-time physiological data, specifically focusing on blinking rates. The software unobtrusively monitored their eye behaviour while they used digital devices in real-life settings.

To assess CVS, participants completed the **CVS-Q questionnaire**, which measured the presence and severity of their symptoms. The CVS-Q assesses the frequency and intensity of **16 symptoms related to CVS**.

Symptoms related to CVS (adapted from Blehm et al. [16]).

Category	Symptoms	Causes
Asthenopia	Eyestrain	
	Tired eyes	Binocular vision
	Sore eyes	Accommodation
	Dry eyes	
Ocular surface-related	Irritation	
	Watery eyes	
Visual problems	Blurred vision	Refractive error
	The slowness of focus change	Accommodation
	Double vision	Binocular vision
Extraocular (ergonomic problems)	Back pain	
	Neck pain	
	Shoulder pain	

$$Score = \sum_{i=1}^{16} (\text{frequency of symptom occurrence}) \times (\text{intensity of symptom}_i)$$

Results indicated that decreased blinking rates (9 to 17 per minute during screen usage) are directly associated with higher CVS scores. For every additional blink, CVS severity reduced by 1.26 points.

The experiment confirmed that decreased blink rates during computer tasks are linked to higher CVS symptoms. The study suggests that real-time monitoring of blink rates could be a useful tool in detecting and managing CVS.

Summary of Pearson's correlations.

Measure	M	SD	2	3	4	5	6	7
1. CVS	18.09	6.09	-0.517	-0.870 **	-0.260	-0.357	-0.575	-0.639 *
2. Day1	12.79	5.26		0.323	-0.150	0.479	0.340	0.305
3. Day2	13.92	7.72						0.792 **
4. Day3	11.14	6.49					0.678 *	0.562
5. Day4	13.59	5.47			0.598	0.324	0.360	0.160
6. Day5	13.62	5.35				0.108	0.151	0.609 *
7. Age	22.00	1.00						-0.134

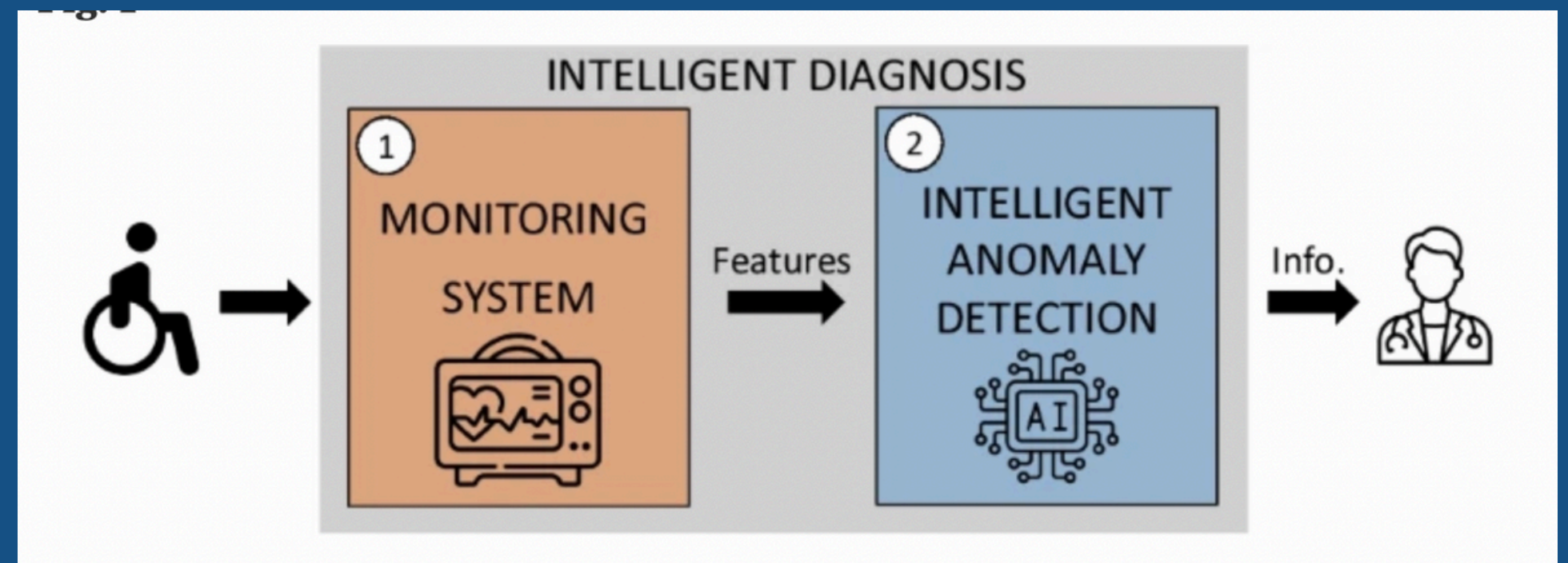
Intelligent systems for sitting posture monitoring and anomaly detection: an overview

Intelligent posture monitoring detects poor posture early, preventing pain and ulcers, and aiding recovery in neurodegenerative disease and stroke patients.

Laptop cameras offer a non-intrusive way to monitor posture by assessing key body parts like the head, shoulders, and hips. They can track multiple users without the need for intrusive sensors.

Camera-based systems can provide real-time feedback, which is useful for immediate posture corrections, but maintaining a constant environment (e.g., stable lighting) is essential for consistent results .

Proper head and neck alignment reduces eye strain. Poor posture leads to bad screen angles, increasing CVS symptoms like blurred vision and headaches. A system promoting good posture can help prevent these issues.



Design Guidelines of a Computer-Based Intervention for Computer Vision Syndrome: Focus Group Study and Real-World Deployment (Hwang, Y., Shin, D., Eun, J., Suh, B., & Lee, J. 2021)

Sound-based alarms, although not always necessary, can complement visual alerts, especially for users who might not be focused on the screen

Notifications in the form of mid-size pop-up windows significantly **boost participation** in eye-resting behavior. The size and frequency of notifications matter: larger windows are more forceful and effective but can feel burdensome. Mid-size windows strike a balance by being noticeable without being overly disruptive

Notification	Size of the window	The size of the popup influenced the forcefulness of the computer-based intervention. The full-screen notification with the high forcefulness was evaluated as most effective, but, at the same time, a high burden. Mid-size notifications positively affected user participation among other options.
Medium	Sound	The social context largely affected the user experience. Most of the participants insisted that it does not need to be in the system.

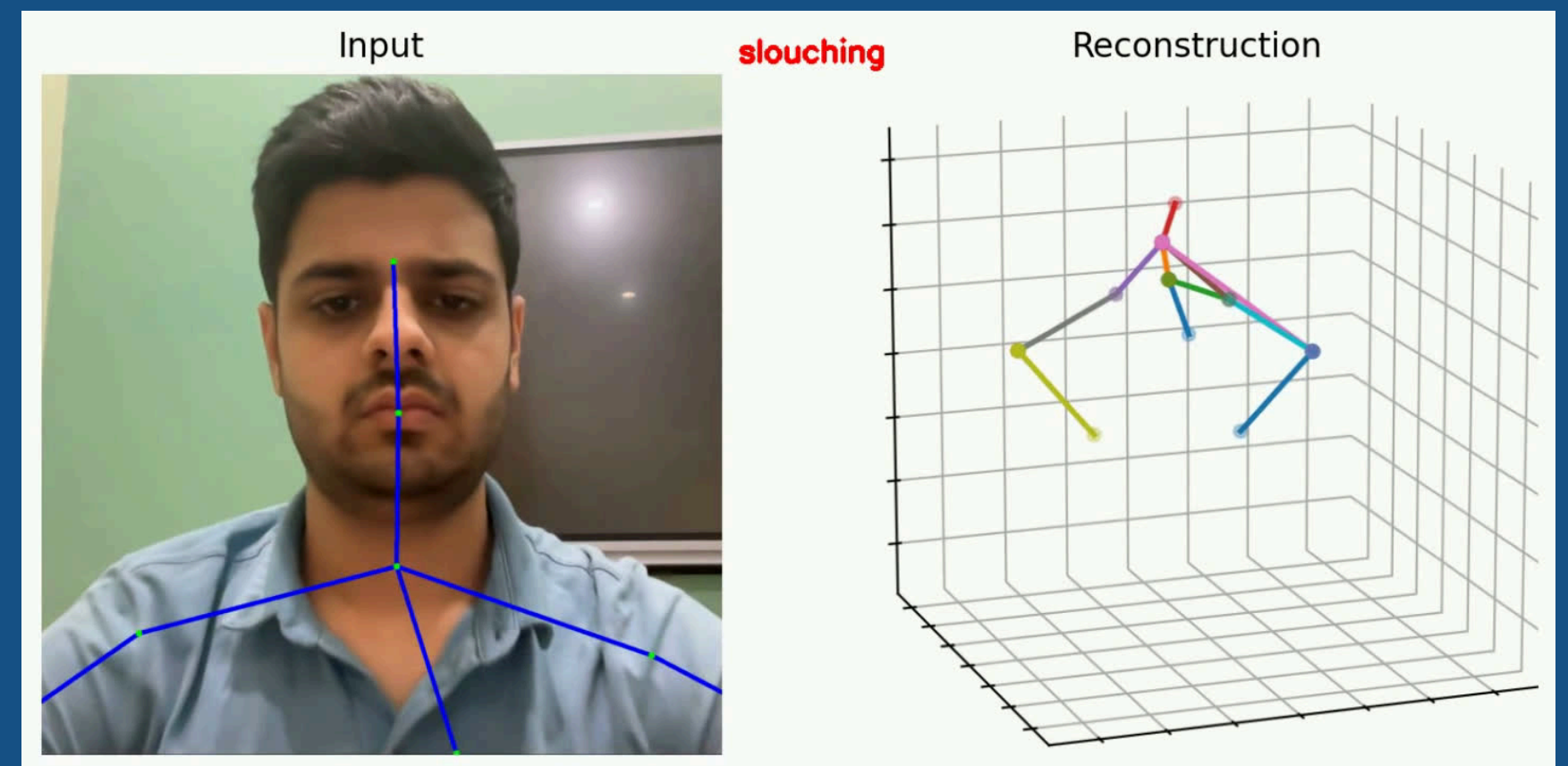
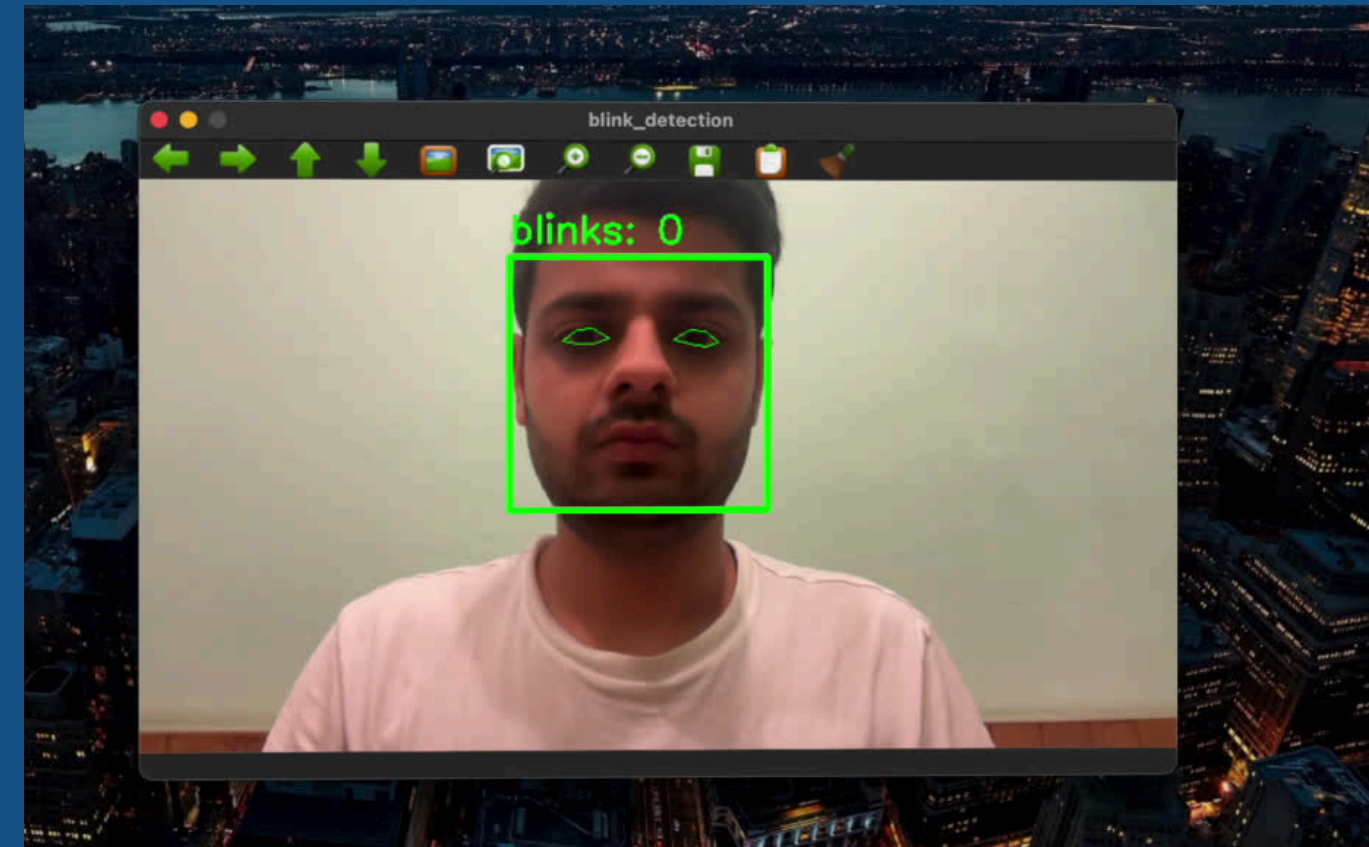
Most users agreed that sound should remain **optional**. In a work environment, sound alarms could be annoying or disruptive, while in quieter settings, it was more acceptable.

WeCare

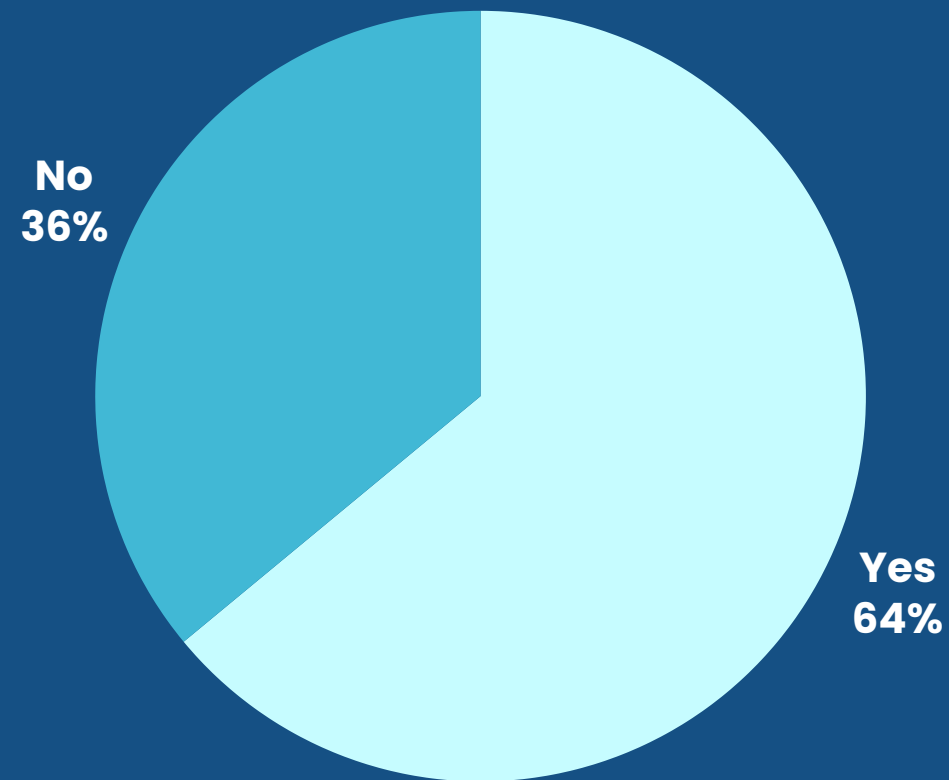
Aanya Patil
Anshul Rana
Sarathak Sachdev

WeCare

- **Real-time** eye monitoring and posture analysis
- **Personalized reminders** for posture correction and eye-blinking intervals
- AI-enabled **posture correction** with **detailed progress tracking**
- **No images** are ever **stored or transferred**, so you can have complete peace of mind.

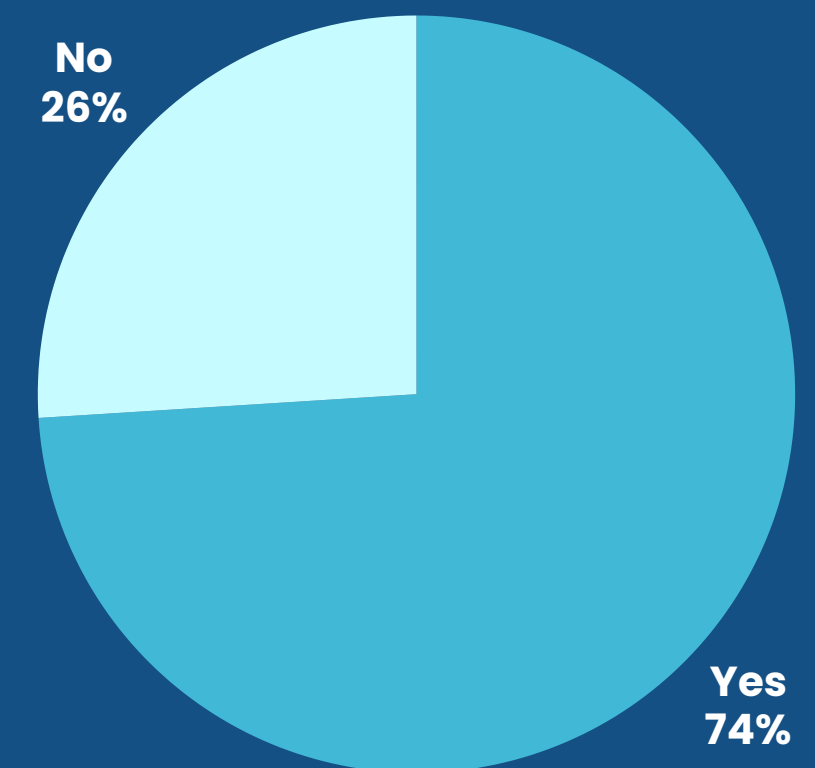
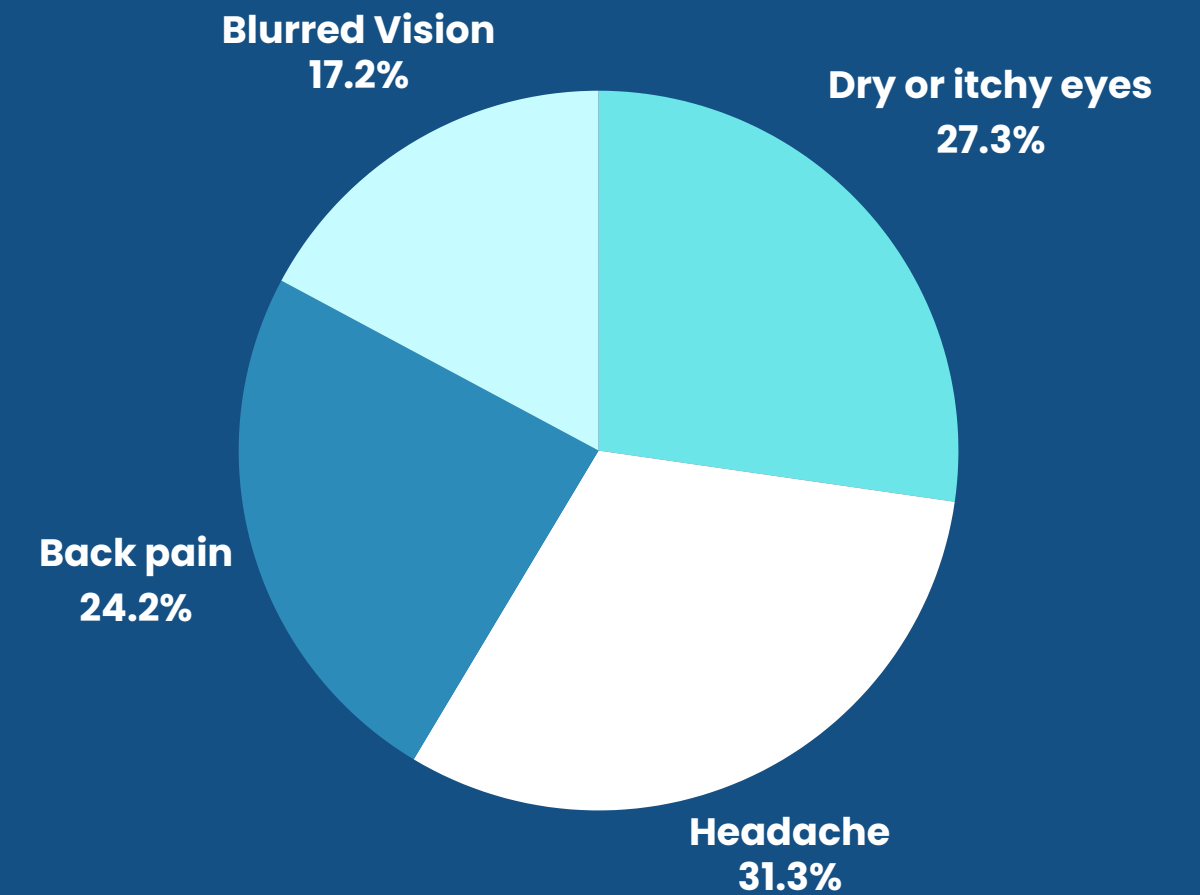


According to our survey (55 responses), **100%** of the respondents face some problem due to prolonged use of laptop or desktop screens



After understanding what CVS is, **64%** of the respondents believe that they suffer from CVS

More than **74%** said that they would be interested in the app



Experiment Protocol

EXPERIMENT DESIGN

Pre-post treatment design to assess the impact of the WeCare app on eye and posture-related metrics

Participants:

20 individuals will be recruited, with no prior exposure to WeCare

Baseline Metrics:

- Blinks per minute
- Number of slouches
- Total slouch duration

Data Collection:

Post-treatment metrics are to be collected and compared with baseline data

Analysis Method:

Paired t-test to analyze significant differences in pre and post-treatment metrics

Trial Testing:

Initial testing was done on a smaller group to refine procedures before full-scale implementation

Privacy and Ethical Concerns:

All data remained on participants' devices with only the metrics being analyzed. Full consent was obtained, and ethical guidelines adhered to

TREATMENT PHASE

- The treatment phase of the experiment involved comprehensive monitoring and intervention while the participants were studying
- For each participant, there were 2 phases, one for posture and one for eyes (in random order)

TREATMENT MODALITIES

- Notifications about Slouching
 - 30% deviation from ideal pose for 5 seconds
- Notifications about Blinking
 - Every second time the person blinks less than 12 times in a minute

IMPLEMENTATION STRATEGY

Randomization of Treatment Order:

Each participant underwent both treatment modalities, but the order in which they received these interventions was randomized. This approach aimed to minimize any potential bias from the sequence of interventions, ensuring that the study results could be attributed to the intervention itself rather than the order of exposure.

Duration:

Each session lasted for a predefined period (one hour)

Data Collection:

Metrics such as the number of slouches, blink rate was recorded during each session. This data was crucial in evaluating the effectiveness of each intervention type.

ANALYSIS PLAN

Hypotheses:

Reminders about Slouching:

Null Hypothesis (H0): There is no difference in the number of slouches per minute before and after the treatment with reminders about slouching

Alternative Hypothesis (H1): There is a significant decrease in the number of slouches per minute after the treatment with reminders about slouching

Reminders about Blinking:

H0: There is no difference in the blink rate per minute before and after the treatment with audio reminders about blinking

H1: There is a significant increase in the blink rate per minute after the treatment with audio reminders about blinking

ANALYSIS PLAN

Statistical Tests:

Post-treatment, paired t-test and Wilcoxon test were used to compare pre and post-intervention metrics. This allowed us to discern the relative effectiveness of reminders on both posture and eye related metrics

Visualization of Data:

The results are visually represented through graphs and charts, illustrating the changes in posture and blink rates

BLINKING

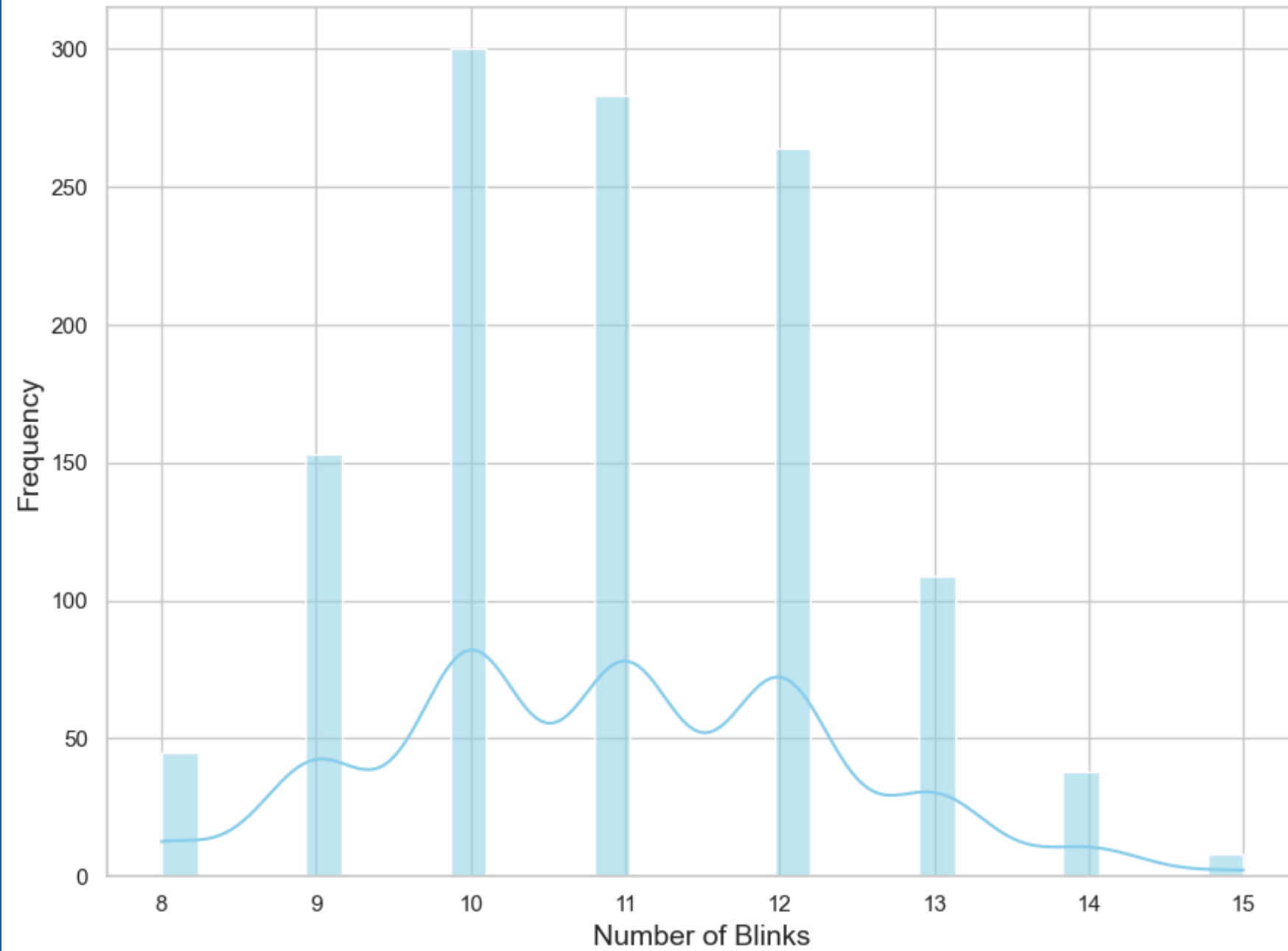
DATA

Statistics	Without Notifs	With Notifs
Mean	10.9	17.8
Std Dev	1.44	1.98

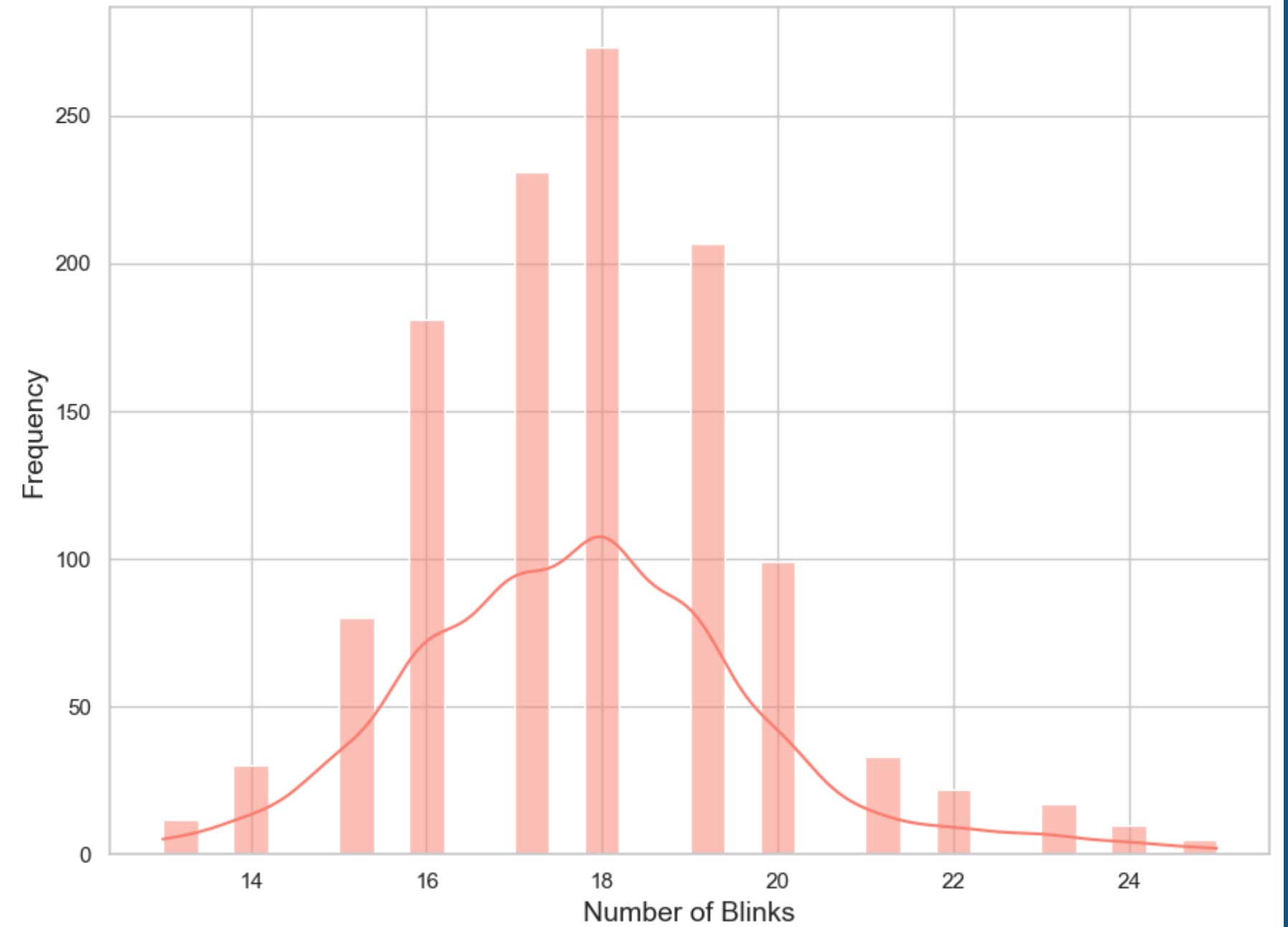
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
9	10	10	11	10	10	9	11	15	10	10	10	11	10	9	11	11	10	10	10
9	10	14	14	9	12	10	12	8	10	10	11	12	12	10	11	14	13	13	13
12	11	12	13	11	10	11	11	11	11	11	11	10	10	10	10	11	10	10	10
9	10	9	10	11	10	11	10	9	10	10	9	12	13	11	12	14	10	10	10
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10	12	9	12	10	8	10	10	8	10	10	12	12	10	12	12	10	10	12	10
9	8	11	13	11	11	10	10	11	9	9	12	9	11	10	11	11	12	12	10
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10	9	11	10	12	9	12	13	13	10	13	10	10	10	13	12	11	9	13	10
10	11	9	13	13	10	11	11	11	10	10	12	12	11	11	10	10	10	13	10
10	9	10	12	11	11	10	10	8	10	10	11	11	11	13	12	12	9	11	9

EDA

Distribution of Pre-Treatment Blinks Across All Individuals

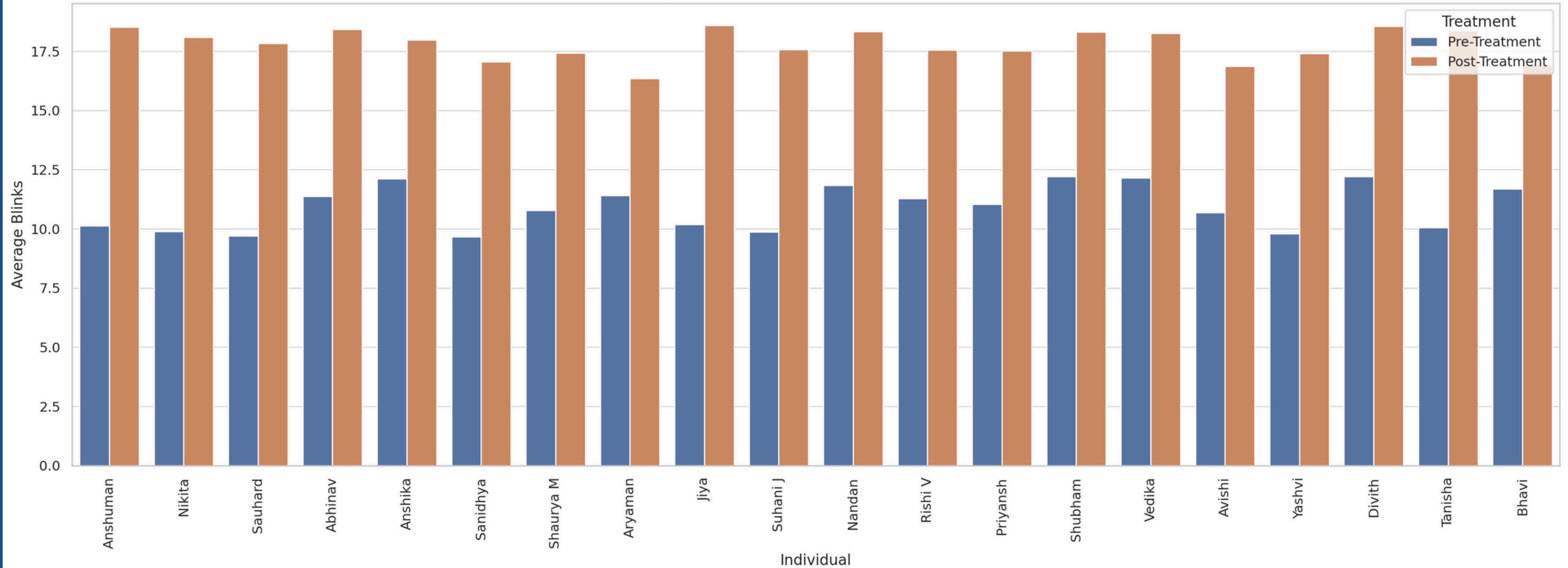


Distribution of Post-Treatment Blinks Across All Individuals

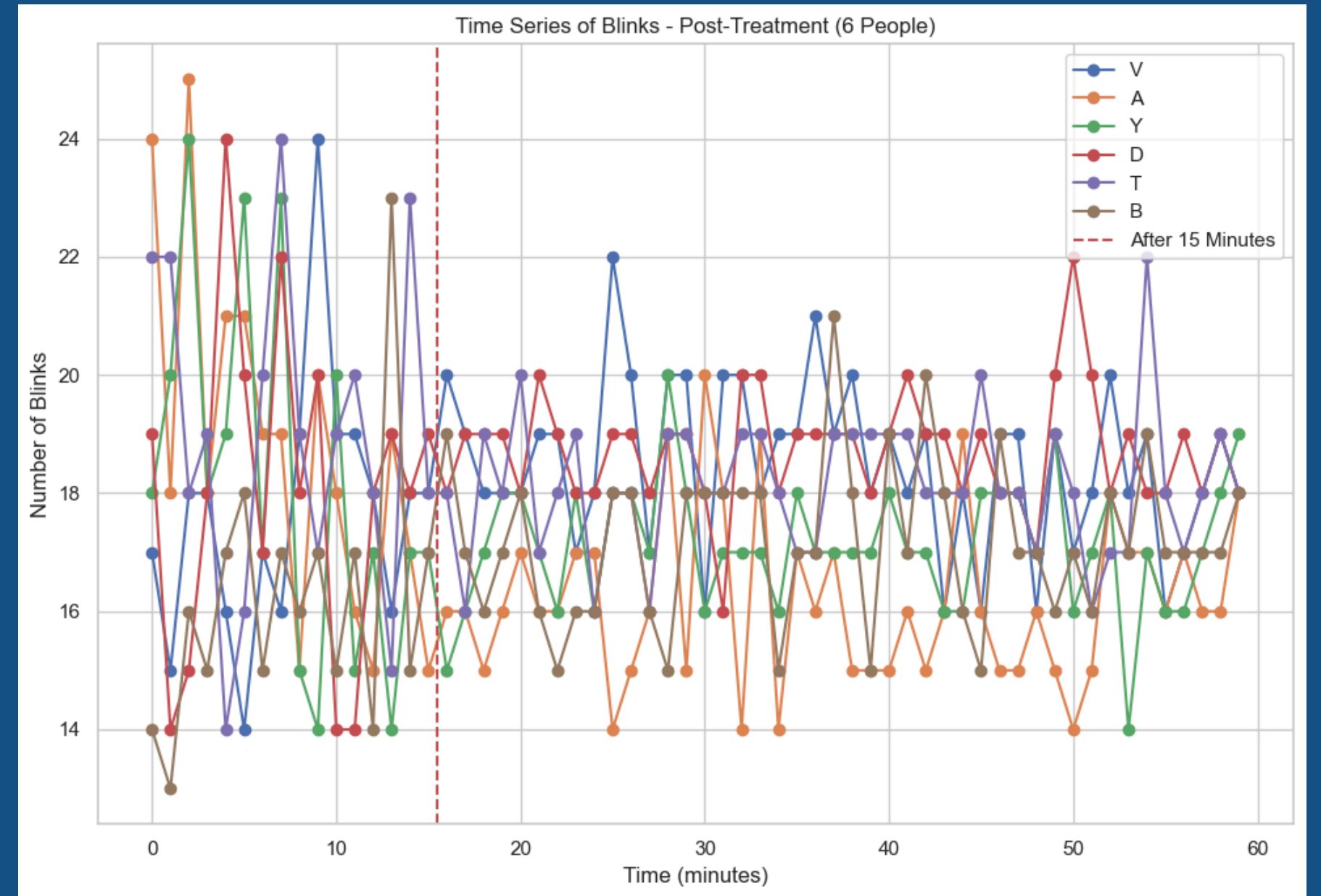
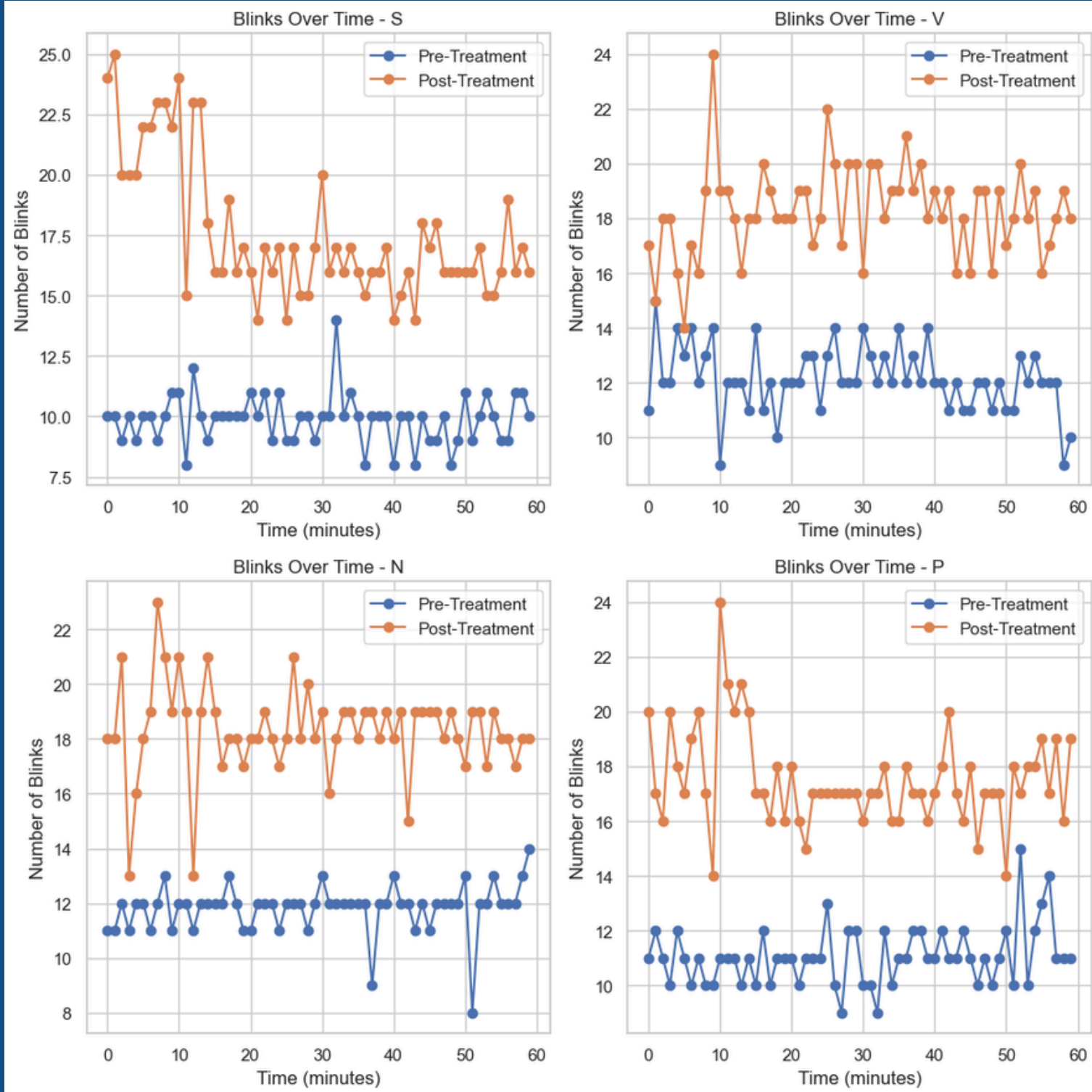


EDA

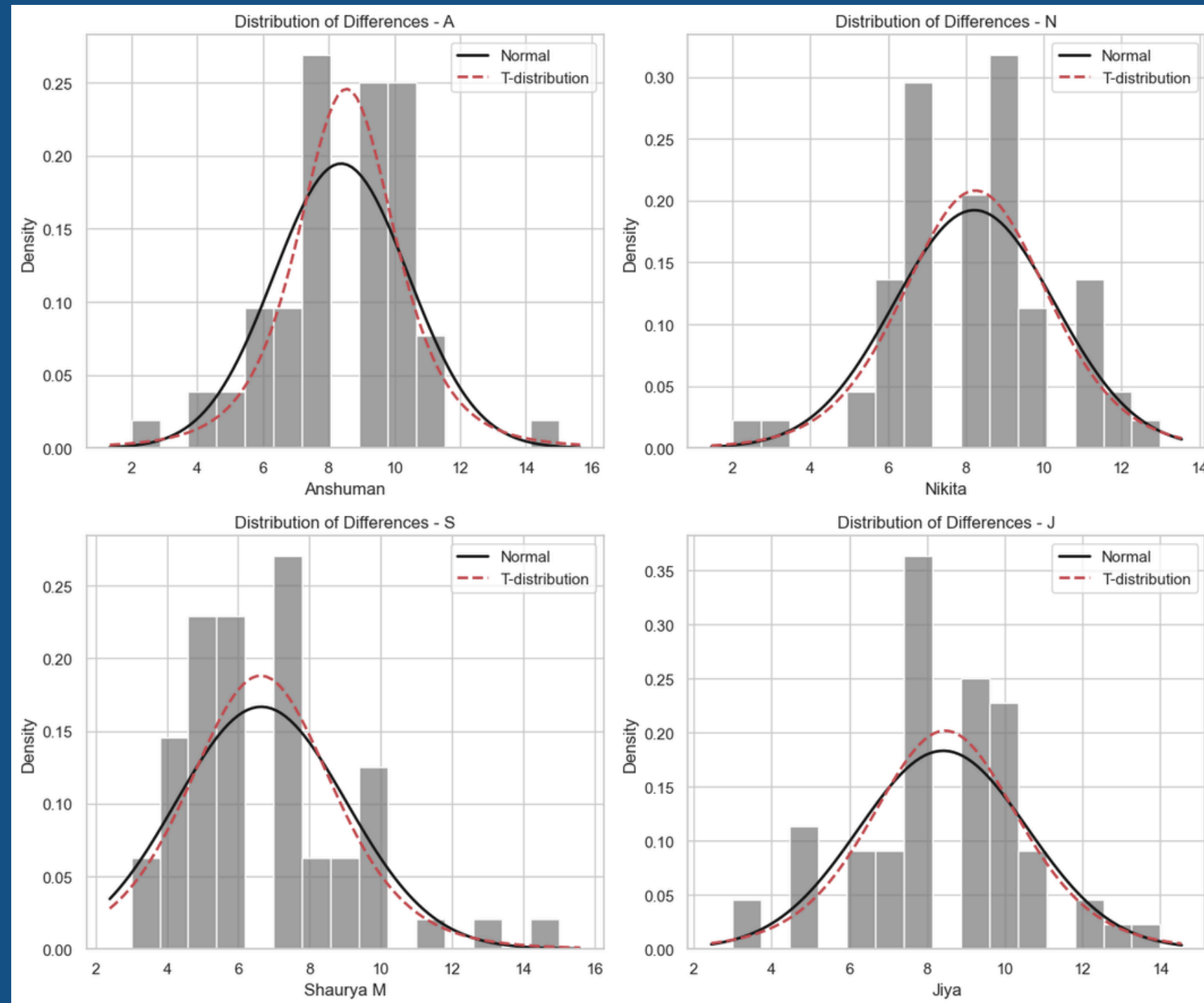
Average Blinks Per Minute Before and After Treatment



EDA



EDA



The data is not normal

ADF Test

Individual	P-Value	Normal (5% Significance)
A	0.002560	False
N	0.079813	True
S	0.034091	False
A	0.018476	False
A	0.035696	False
S	0.017281	False
S	0.000582	False
A	0.000692	False
J	0.079570	True
S	0.000076	False
N	0.012570	False
R	0.000005	False
P	0.025073	False
S	0.004421	False
V	0.014710	False
A	0.000131	False
Y	0.000129	False
D	0.003322	False
T	0.022086	False
B	0.198663	True

Results based on gender

Overall Average Blinks Per Minute Before Treatment

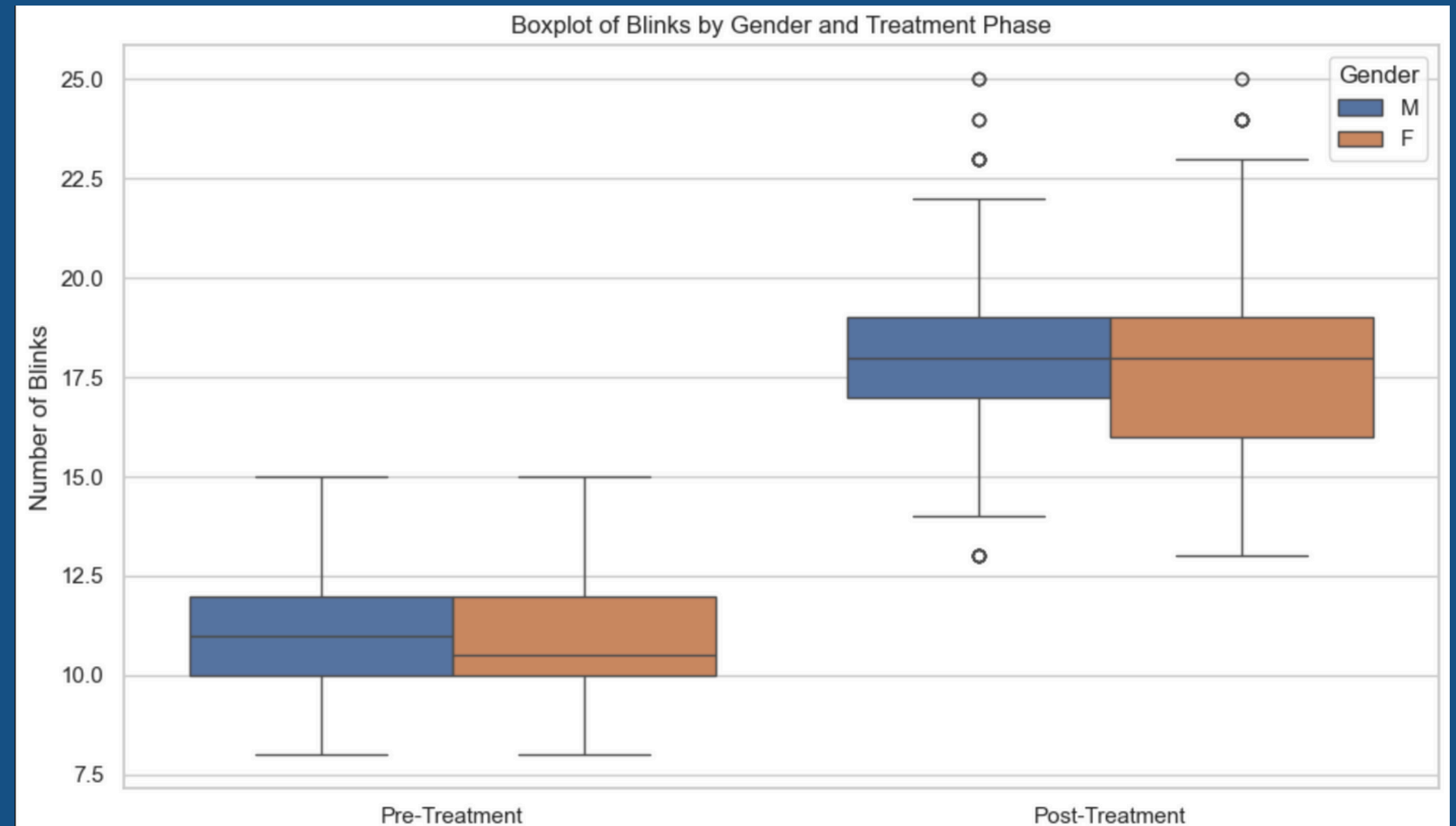
- Men: **11.15** blinks/minute
- Women: **10.88** blinks/minute

Overall Average Blinks Per Minute After Treatment

- Men: **17.85** blinks/minute
- Women: **17.45** blinks/minute

Average Change in Blinks Per Minute

- Men: The average increase is about **6.70** blinks/minute.
- Women: The average increase is about **6.57** blinks/minute.



Paired t-test & Wilcoxon test

Individual	T-Test P-Value	Wilcoxon P-Value
A	1.571411e-38	1.340282e-11
N	9.234506e-38	1.384565e-11
S	2.043152e-36	1.346282e-11
A	1.232043e-34	2.003109e-11
A	2.408874e-30	1.373371e-11
S	1.423662e-34	1.358790e-11
S	1.965061e-29	1.412132e-11
A	8.159168e-29	1.293982e-11
J	3.617599e-37	1.365736e-11
S	5.166591e-29	1.377093e-11
N	1.657461e-35	1.236973e-11
R	4.789701e-24	1.412132e-11
P	1.665063e-32	1.354681e-11
S	1.006741e-32	1.392810e-11
V	4.610868e-31	1.973273e-11
A	3.340991e-25	1.415726e-11
Y	1.178366e-34	1.287370e-11
D	2.797601e-31	1.817972e-11
T	1.658051e-39	1.344351e-11
B	9.757070e-27	1.448674e-11

A **paired t-test** is a statistical method used to compare the means of two related groups to determine if there is a significant difference between them. It assumes that the differences between pairs are normally distributed and uses these differences to calculate a t-statistic, resulting in a p-value. The p-value helps determine whether the observed differences are statistically significant; a low p-value (typically <0.05) suggests that the differences are unlikely to have occurred by chance, indicating a significant effect.

The **Wilcoxon signed-rank test** is a non-parametric statistical method used to compare the medians of two related groups to determine if there are significant differences between them. It does not assume that the differences between pairs are normally distributed. Instead, it ranks the absolute differences, signs them based on the direction of the difference, and calculates a test statistic based on these signed ranks. The resulting p-value helps determine the statistical significance of the observed differences; a low p-value (typically <0.05) indicates that the differences are unlikely due to random chance, suggesting a significant median difference between the groups.

Test for last 45 minutes

Individual	T-Test P-Value	Wilcoxon P-Value
A	4.089213e-38	5.684342e-14
N	1.644004e-30	5.684342e-14
S	4.895408e-33	5.684342e-14
A	1.519213e-30	5.684342e-14
A	2.278834e-28	5.684342e-14
S	3.355087e-28	5.684342e-14
S	3.943294e-28	5.684342e-14
A	5.108366e-24	5.684342e-14
J	8.389342e-33	5.684342e-14
S	3.078333e-30	5.684342e-14
N	7.868663e-30	5.684342e-14
R	1.891612e-25	5.684342e-14
P	3.154802e-28	5.684342e-14
S	5.957779e-31	5.684342e-14
V	1.247106e-28	5.684342e-14
A	1.654126e-21	5.684342e-14
Y	2.090003e-31	5.684342e-14
D	1.529372e-31	5.684342e-14
T	6.006347e-34	5.684342e-14
B	4.119139e-23	5.684342e-14

The effect persists over time

SLOUCHING

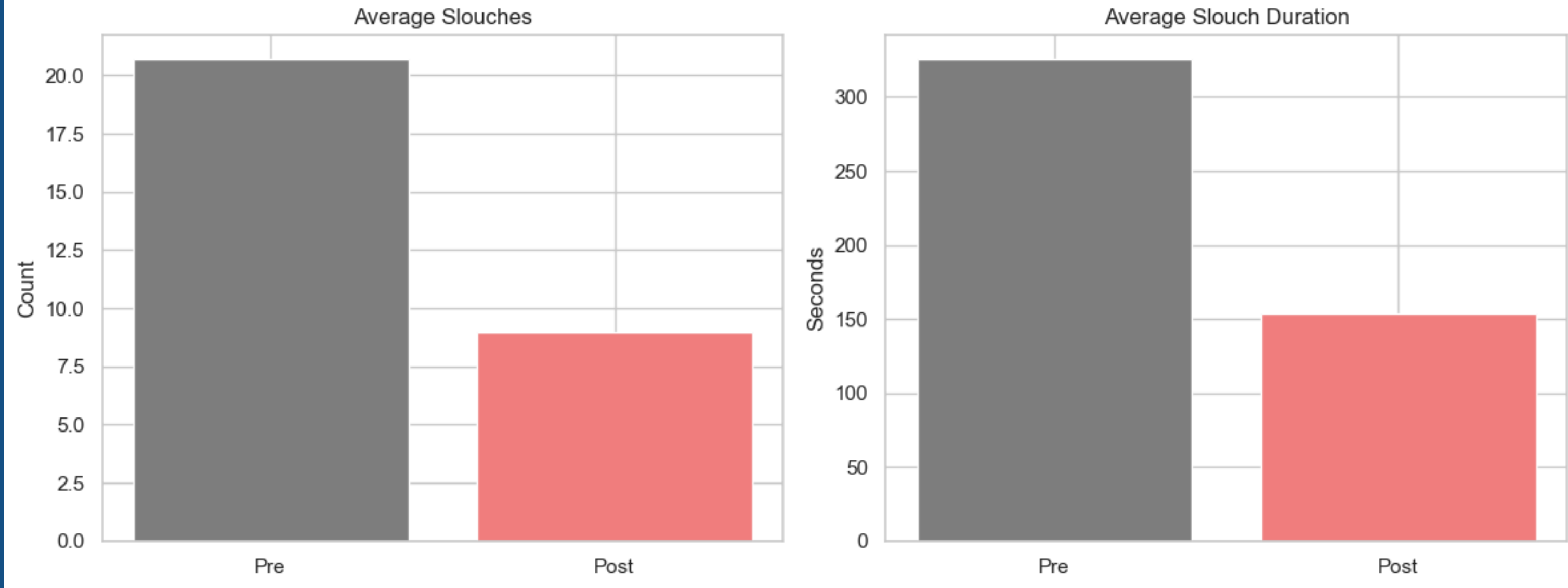
DATA

Name	Slouches Pre	Slouches Post	Total Slouch Time Pre	Total Slouch Time Post
An	24	14	326.777798	157.804962
Ni	29	10	540.857709	252.577715
Sa	16	14	223.572712	117.291263
Ab	33	4	556.528385	284.866512
An	17	9	213.812068	140.257801
Sa	13	12	230.389151	95.592703
Sh	27	10	457.720336	162.243185
Ar	22	11	269.973508	173.054957
Ji	18	4	338.524404	156.098858
Su	19	7	217.307981	118.058136
Na	11	9	198.991898	67.028071
Ri	14	5	271.518386	109.745135
Pr	34	8	628.117479	280.685926
Sh	23	9	463.340924	158.704112
Ve	15	7	198.623072	87.506045
Av	5	8	65.259944	31.823599
Ya	38	7	414.989623	255.630162
Di	26	11	511.707640	185.924169
Ta	18	13	204.713682	154.645733
Bh	12	8	178.199046	92.841634

Without Notifs	Mean	Std Dev
Number of Slouches	20.7	8.55
Slouch Time (seconds)	325.56	154.99

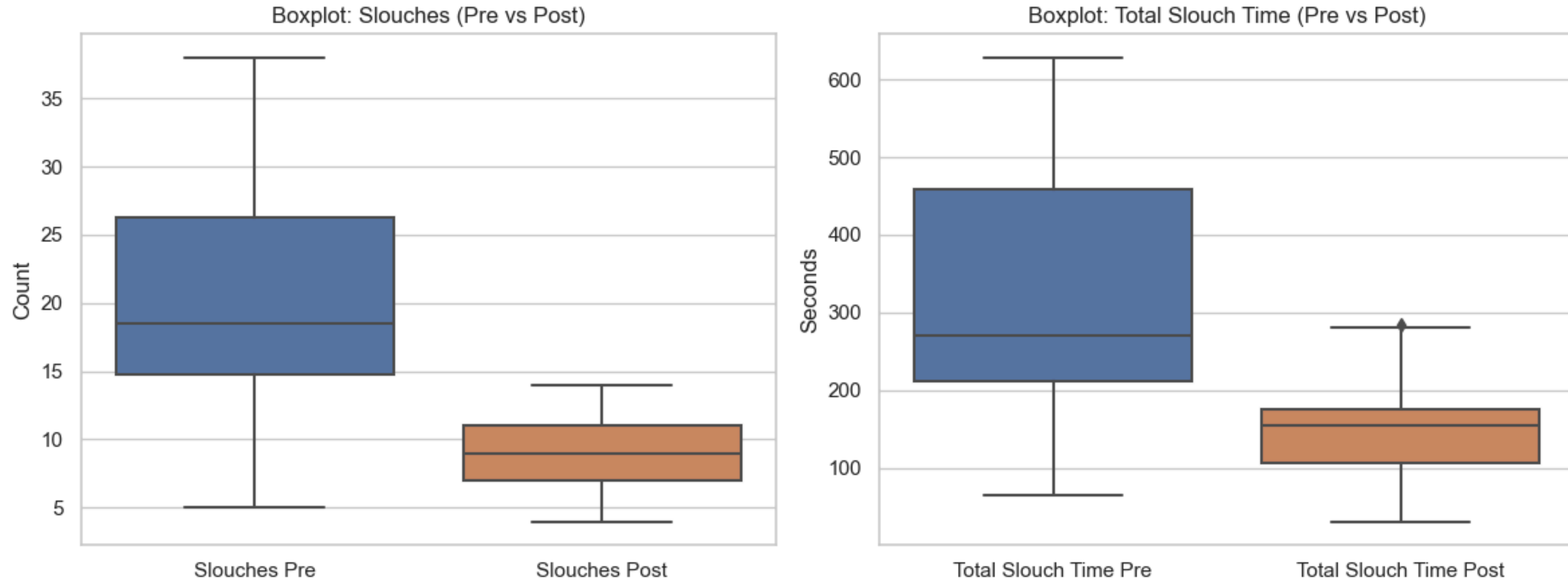
With Notifs	Mean	Std Dev
Number of Slouches	9	2.96
Slouch Time (seconds)	154.12	70.17

Average Slouches and Slouch Duration Comparison



The intervention significantly reduced slouching behavior, with the average number of slouches decreasing from **21 to 8** and slouch duration dropping from **317 to 151 seconds**. This indicates improved posture and reduced slouching time post-intervention.

Boxplots for Pre and Post Slouches and Durations



The boxplots show a significant reduction in both the number of slouches and total slouch time post-intervention, with a **lower median** and **decreased variability**. This highlights consistent improvements in posture across individuals after the intervention.

	Metric	T-test p-value	Wilcoxon p-value
0	Slouches	1.979295e-05	0.000013
1	Total Slouch Time	2.510245e-07	0.000002

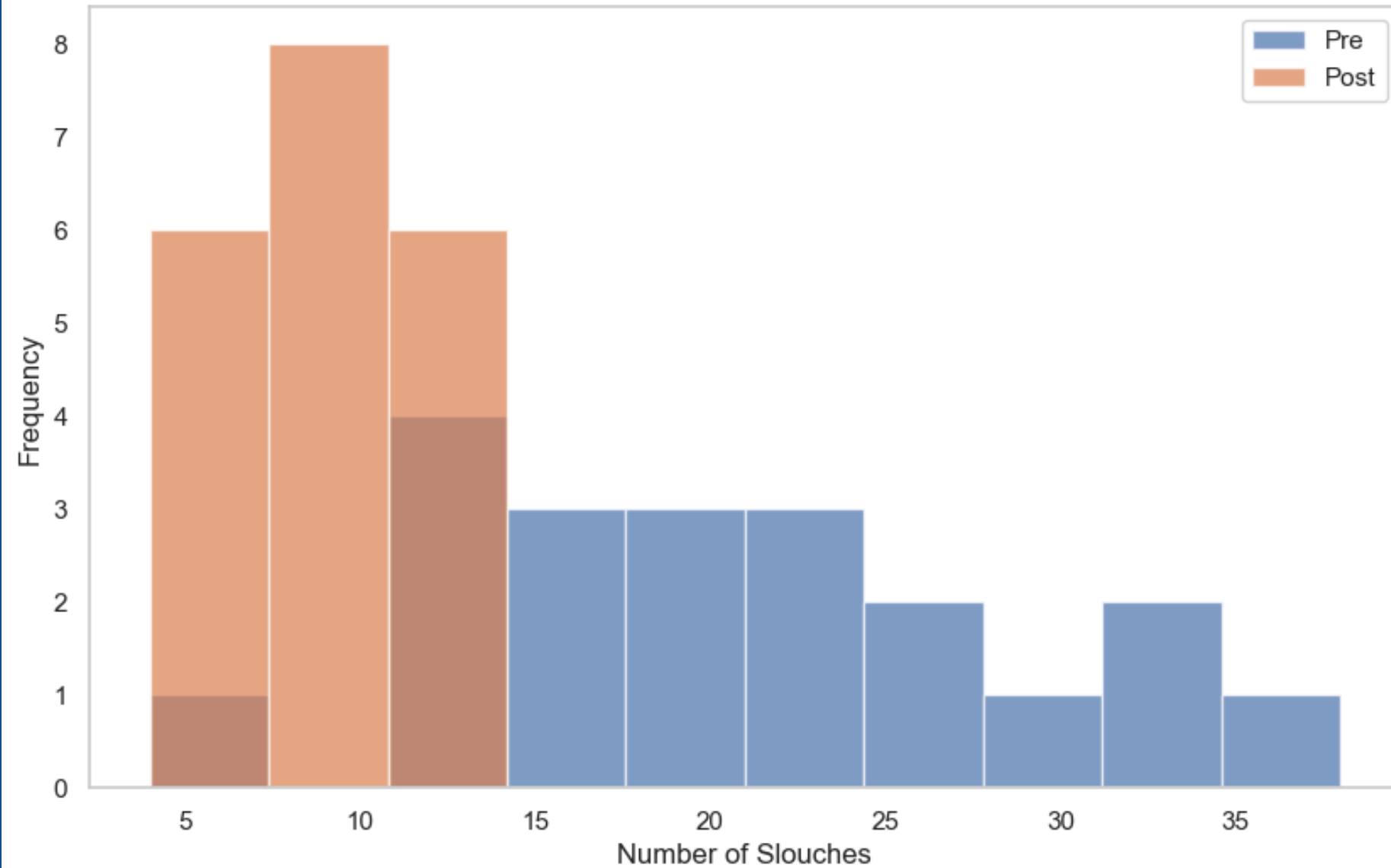
- Both the T-test p-value (1.979e-05) and the Wilcoxon p-value (0.000013) are highly significant, indicating a **statistically significant reduction** in slouches post-intervention.
- The T-test p-value (2.510e-07) and the Wilcoxon p-value (0.000002) confirm a **significant reduction in total slouch time post-intervention.**

RESULT

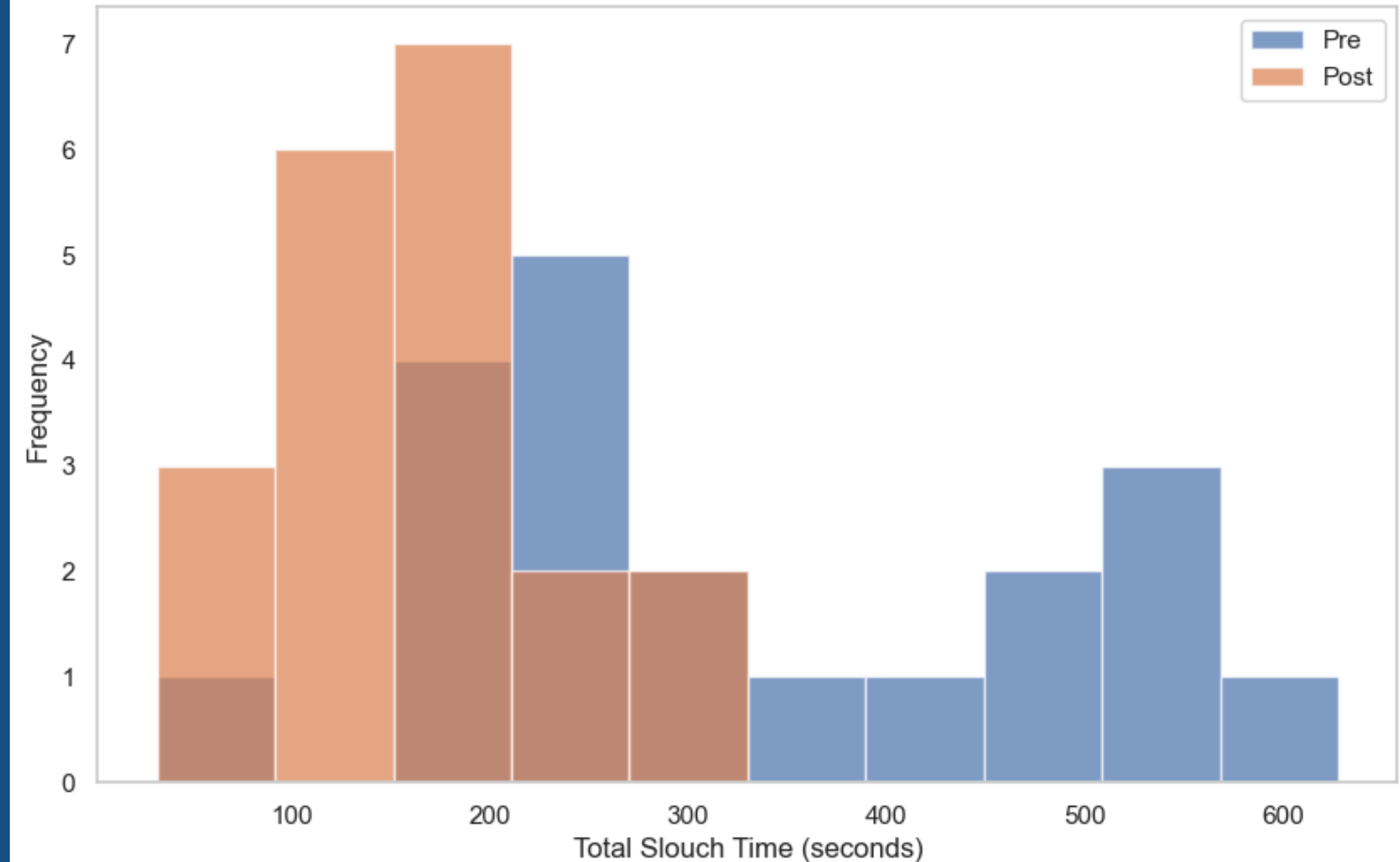
Percentage Improvement:

- Slouches: Improved by **56.52%**.
- Total Slouch Time: Improved by **52.66%**.

Distribution of Slouches (Pre vs Post)



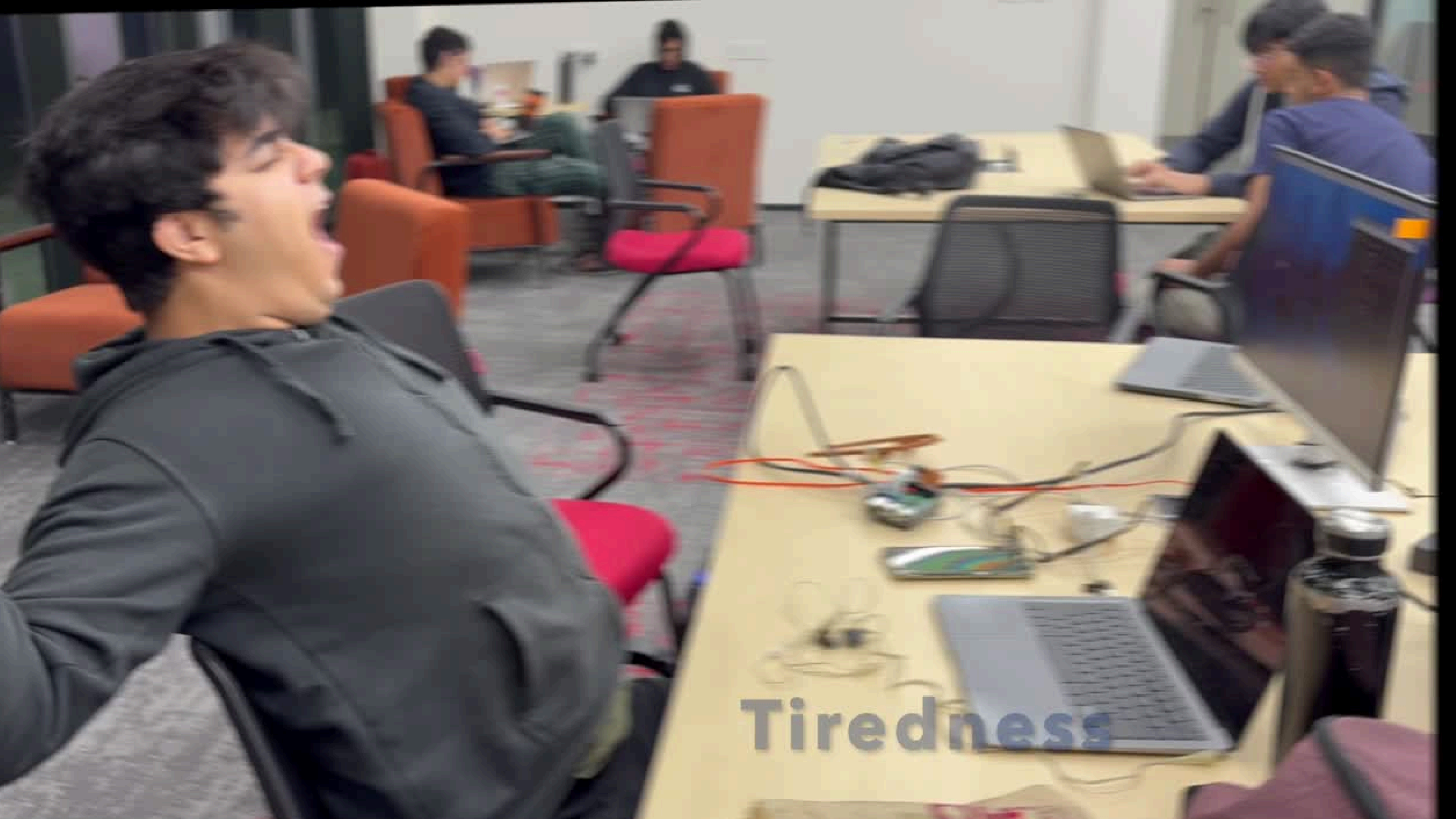
Distribution of Total Slouch Time (Pre vs Post)



CHALLENGES & LIMITATIONS

- Sample size is very small
- Participants not consistently following protocols (e.g., ignoring reminders)
- A fully functioning deployed app is still in progress (due to time constraints)

Impact!



Tiredness

SLOUCHING

Percentage Improvement:

- Slouches: Improved by **56.52%**.
- Total Slouch Time: Improved by **52.66%**.

BLINKING

Percentage Improvement:

- Blinks per minute: Improved by **16.8%**.

Thank You!