

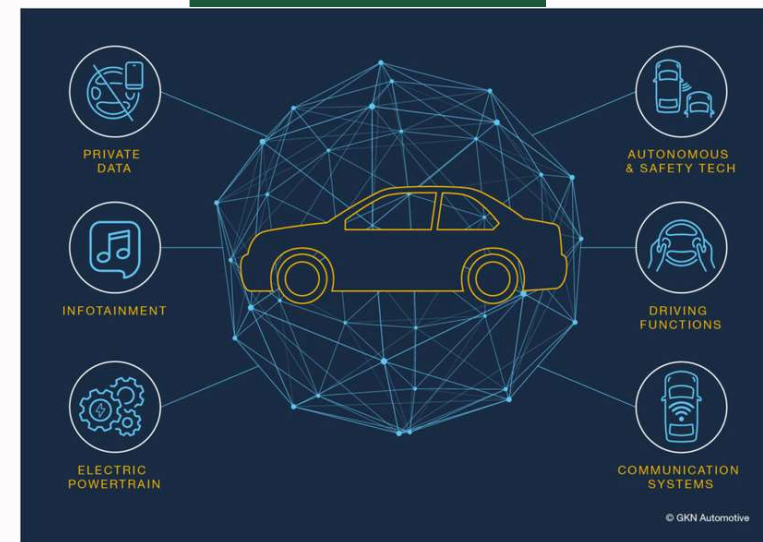


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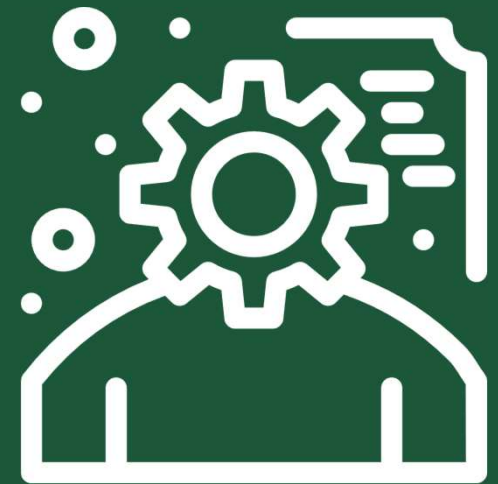
# NAVIGATING THE CYBER HIGHWAY: ASSESSING THE KNOWLEDGE AND AWARENESS OF VEHICLE CYBERSECURITY AMONG LAW ENFORCEMENT OFFICERS (LEOS)

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# Introduction

In an increasingly linked world, the cybersecurity of police enforcement vehicles has become a major issue. Law Enforcement Officers (LEOs) play an important role in public safety, therefore knowing vehicular cybersecurity is critical.

Despite the need of specific cybersecurity training for LEOs, the effectiveness of such programs in raising officers' awareness remains an issue that requires further examination. The purpose of this study is to investigate the relationship between cybersecurity training and LEOs' awareness of vehicular cybersecurity, taking into account demographic characteristics such as age, education, experience, and time spent in police cars. The study aims to determine how these characteristics interact with training levels to impact officers' comprehension, therefore helping to the creation of better training models and tactics for raising cybersecurity awareness in law enforcement.

# Background

The initiative centers on the Law Cybersecurity Survey, an unpublished research undertaken by Nandni Talreja in the Human Performance Lab under the supervision of Professor Shannon Roberts. This study sought to look at the relationship between cybersecurity training and officers' grasp of vehicular cybersecurity. The survey gathered information on demographic characteristics such as age groups, education levels, years of experience, and hours spent in police cars to investigate how these factors interact with the degree of cybersecurity training to impact officers' awareness of vehicular cybersecurity.

# Reasoning

Given the increased integration of technology into police cars, as well as the possible vulnerabilities associated with these systems, it is critical to determine the efficacy of LEO cybersecurity training. This research will undertake a statistical analysis utilizing regression modeling and hypothesis testing to measure LEOs' comprehension of vehicular cybersecurity before and after training. Furthermore, the experiment attempts to investigate the differences in comprehension between two groups: those who got instruction and those who did not (Sham group). The findings of this study will help to improve cybersecurity training models in the Law Enforcement Department, hence increasing officers' cybersecurity knowledge of police vehicle systems.

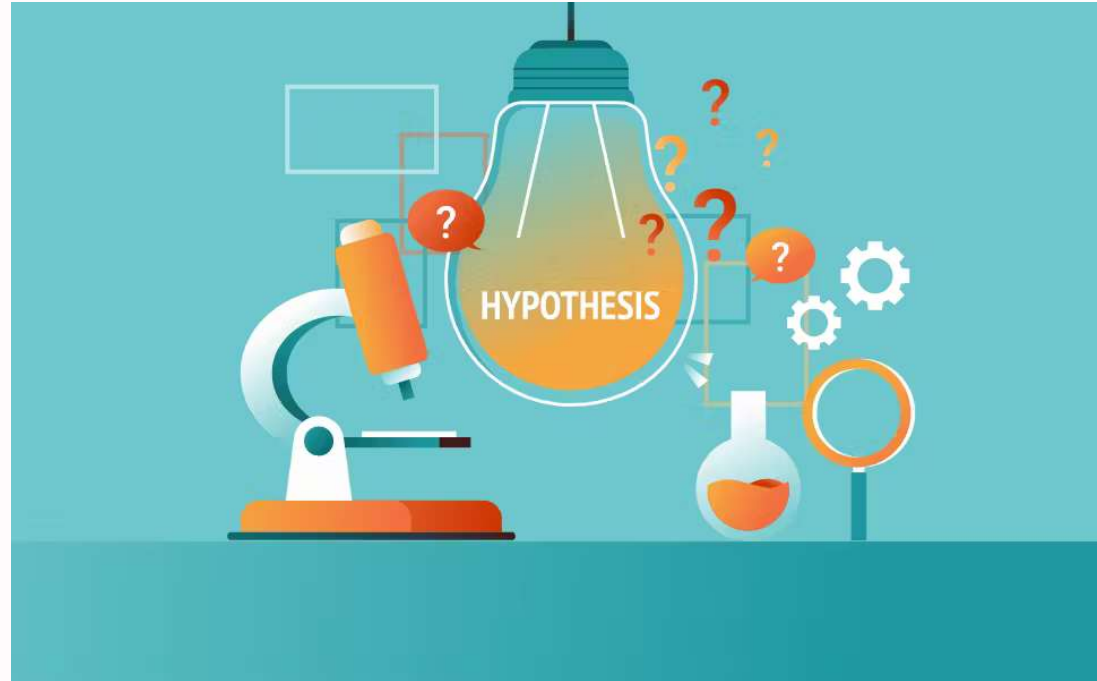
# Research Question and Hypothesis

## Research Question

How do demographic characteristics such as age, education level, years of experience, and hours spent in police cars impact Law Enforcement Officers' awareness of vehicular cybersecurity?

## Hypothesis

- Cybersecurity training greatly enhances LEOs' grasp of vehicular cybersecurity.
- Age, education, years of experience, and hours spent in police cars all have a substantial interaction effect on officers' grasp of vehicular cybersecurity, as does the quality of cybersecurity training.
- The Training group will have a far better awareness of vehicular cybersecurity than the Sham group.





# Process

There were 5 main parts to the study - the Introduction to the car, the Training, the Drives, the Survey, and the Interview.



Introduce the car to the participant and explain how everything works

Give them the training on Vehicle Cybersecurity and explain to them what to do if one is in that situation



Conduct three drives - each with a cybersecurity event occurring, and note the participants' reaction time

Have the participants fill out a survey, collecting information about demographics, cybersecurity knowledge and training, and thoughts on the training provided to them during the study.

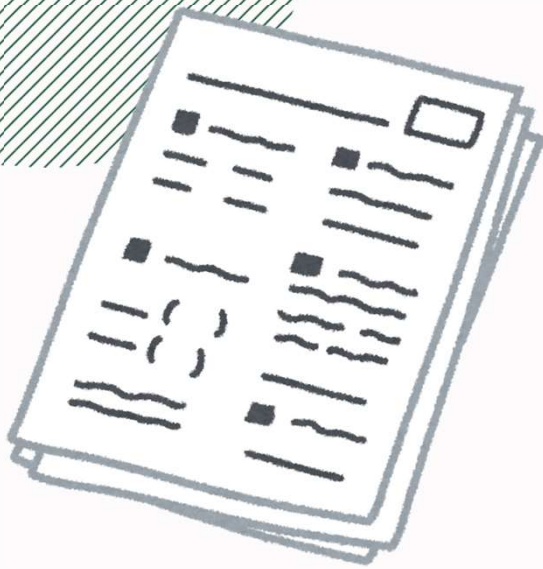


Conduct an interview to understand their thoughts about the study, the training, the drives, and their reactions to the cybersecurity events.



# List of questions used in the survey

The survey had 23 items, of which I used 18 for my research. We also had two groups: Experimental and Sham, into which the participants were split.

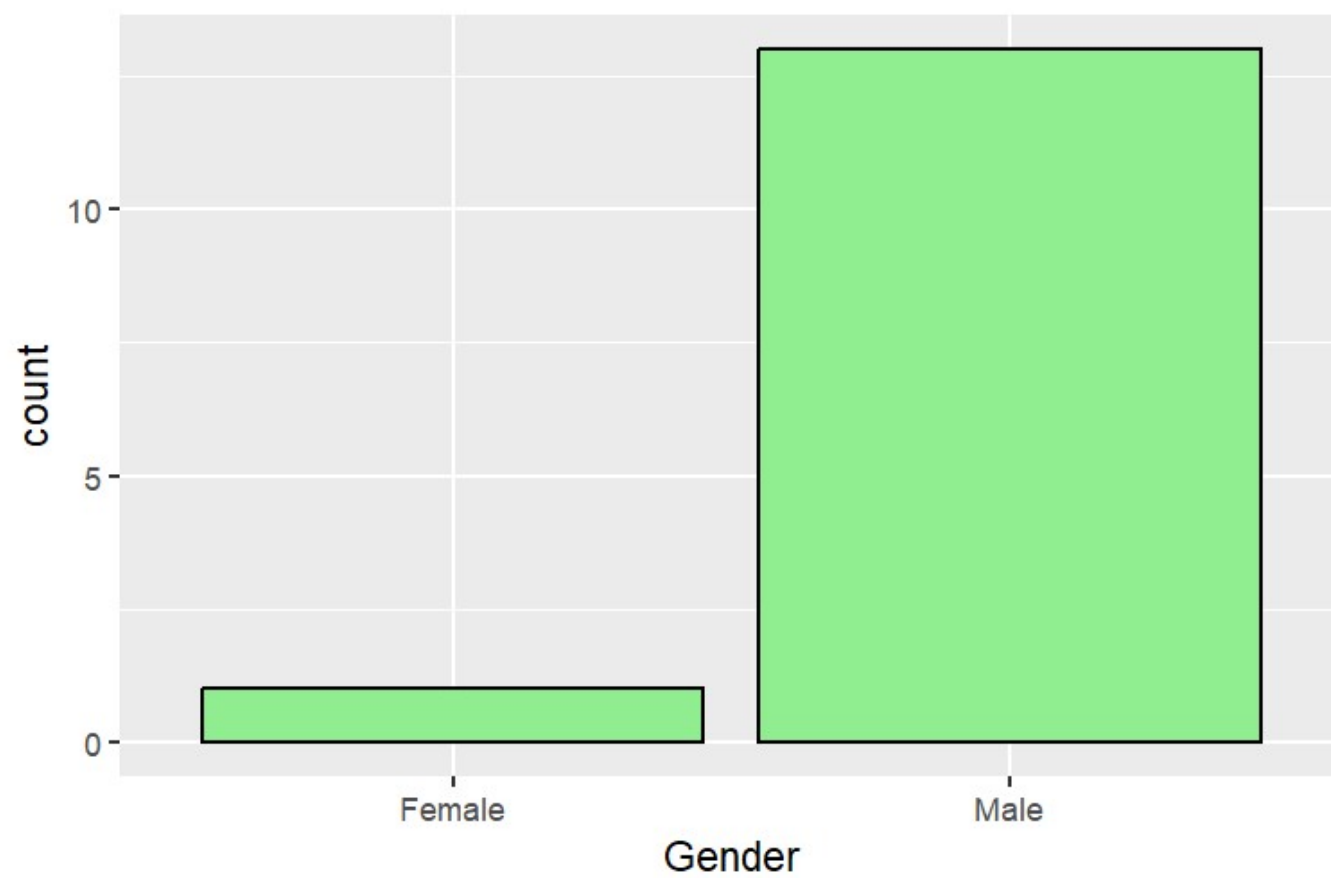


- 1.Age (Q1)
- 2.Gender (Q2)
- 3.Years of Experience (Q6)
- 4.Highest level of Education (Q7)
- 5.Hours spent in Police Vehicle (Q8)
- 6.Military Experience (Q9)
- 7.Cybercrime cases in Police Agency (Q12)
- 8.Cybercrimes unit in Police Agency (Q13)
- 9.Cybercrime training in Police Agency (Q14)
- 10.Worked on a cybercrime case (Q15)
- 11.Experience with Vehicle Cyberattacks (Q16)
- 12.Police vehicle susceptibility to cyberattacks (Q18)
- 13.Are Cyber attacks on police vehicles a serious concern (Q19)
- 14.In-vehicle technology most susceptible to cyber attacks (Q22)
- 15.Vehicle cybersecurity training in Police Agency (Q23)
- 16.Information that would like to be received during training to help preventing or responding to police vehicle cyber attacks (Q25)
- 17.Best method to train officers to react to potential cyber attack (Q28)



A photograph of a modern office interior, overlaid with a semi-transparent green filter. The office features large windows, wooden desks, ergonomic chairs, and numerous potted plants, including a large hanging plant on the left and a planter box on a desk in the foreground. The text "DEMOGRAPHIC PLOTS & STATISTICS" is centered in white, bold, sans-serif font.

# DEMOGRAPHIC PLOTS & STATISTICS

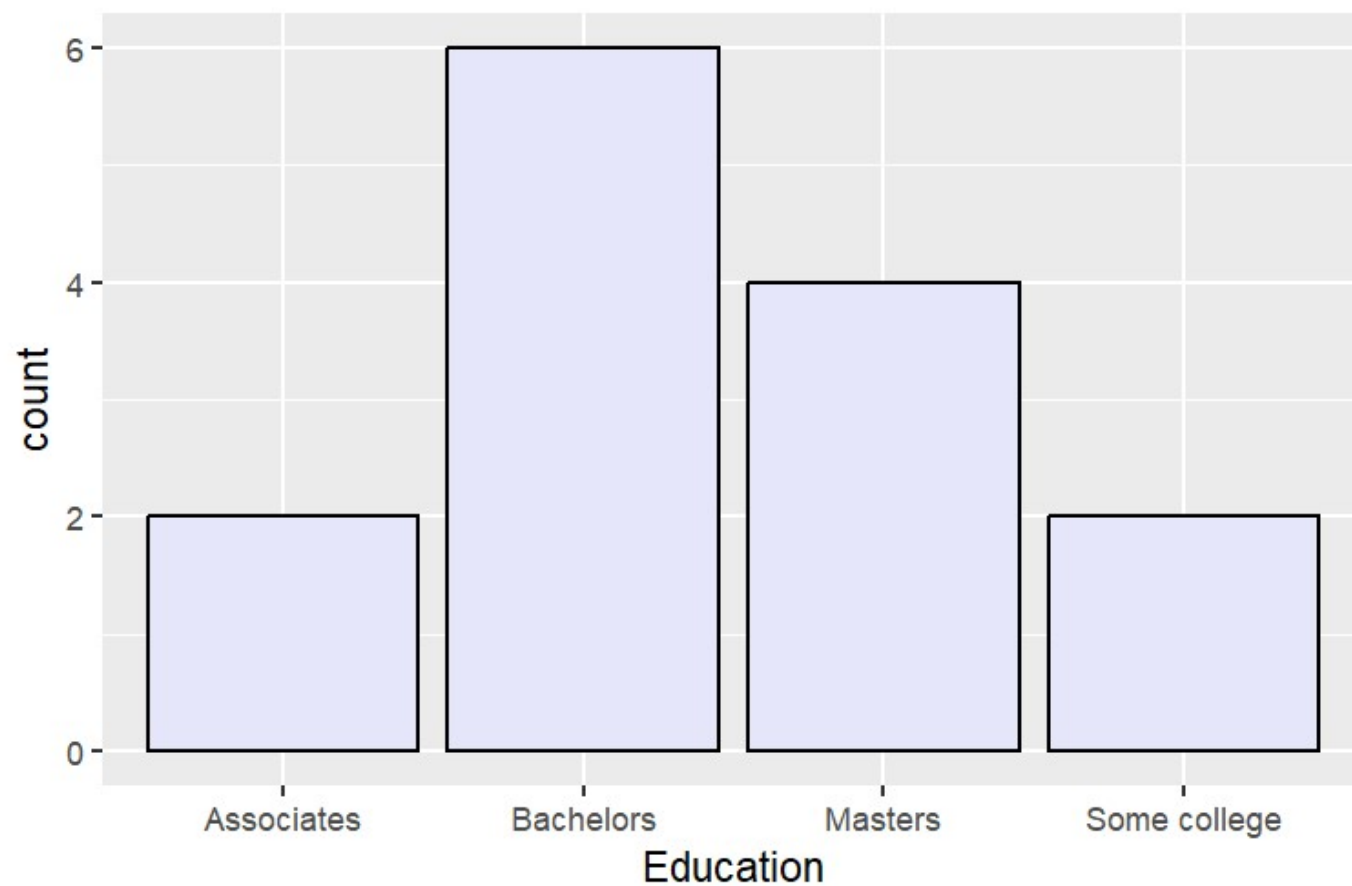


Gender	
Var1	Freq
Female	1
Male	13



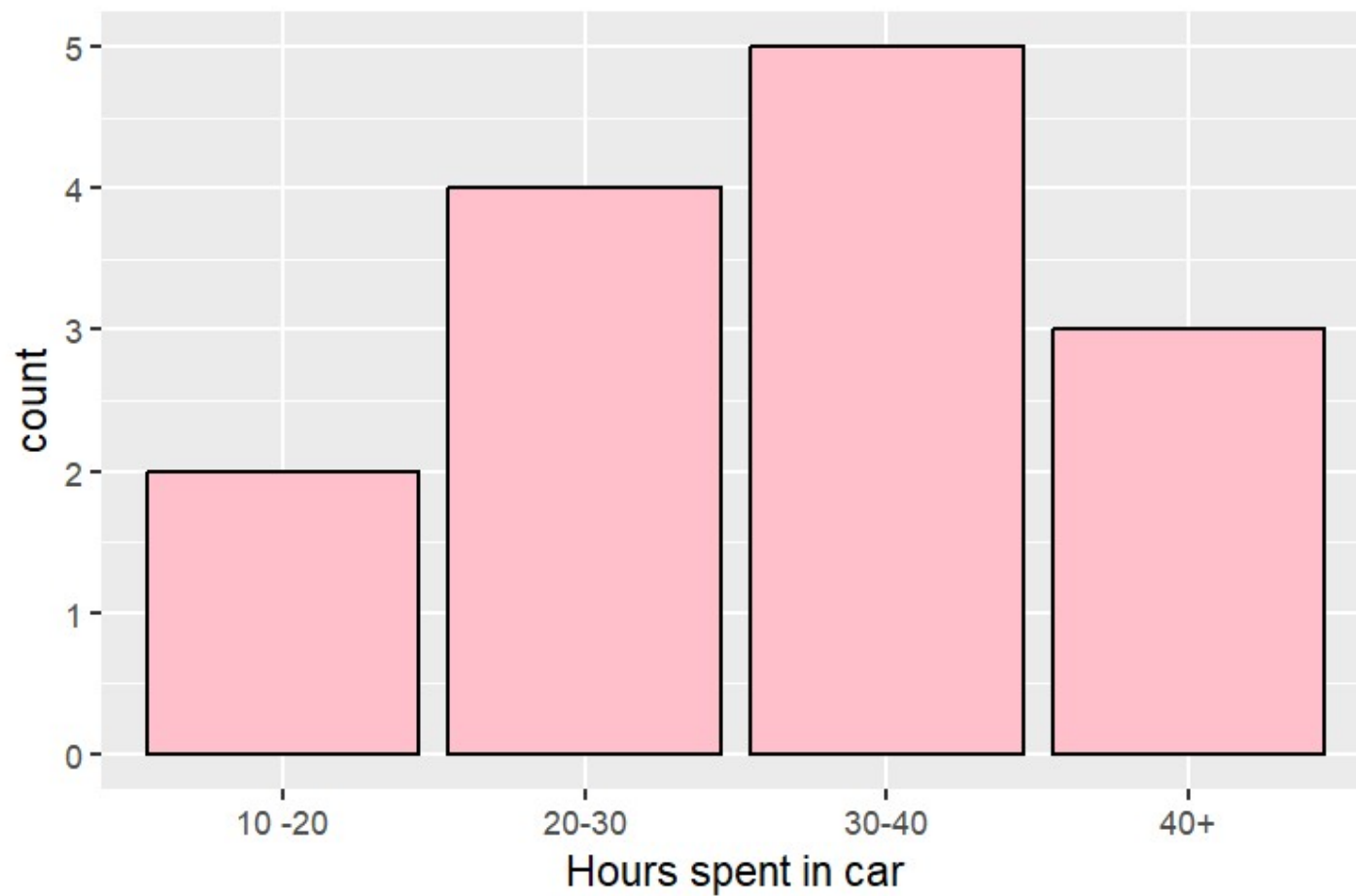
Years of Experience	
Var1	Freq
10-15	3
15-20	3
20-25	2
25-30	3
5-10	2
less than 5 years	1

As we can see, this plot and table is easier to understand and visualize in comparison to the last plot and table.



Highest Education  
Level

Var1	Freq
Associates	2
Bachelors	6
Masters	4
Some college	2

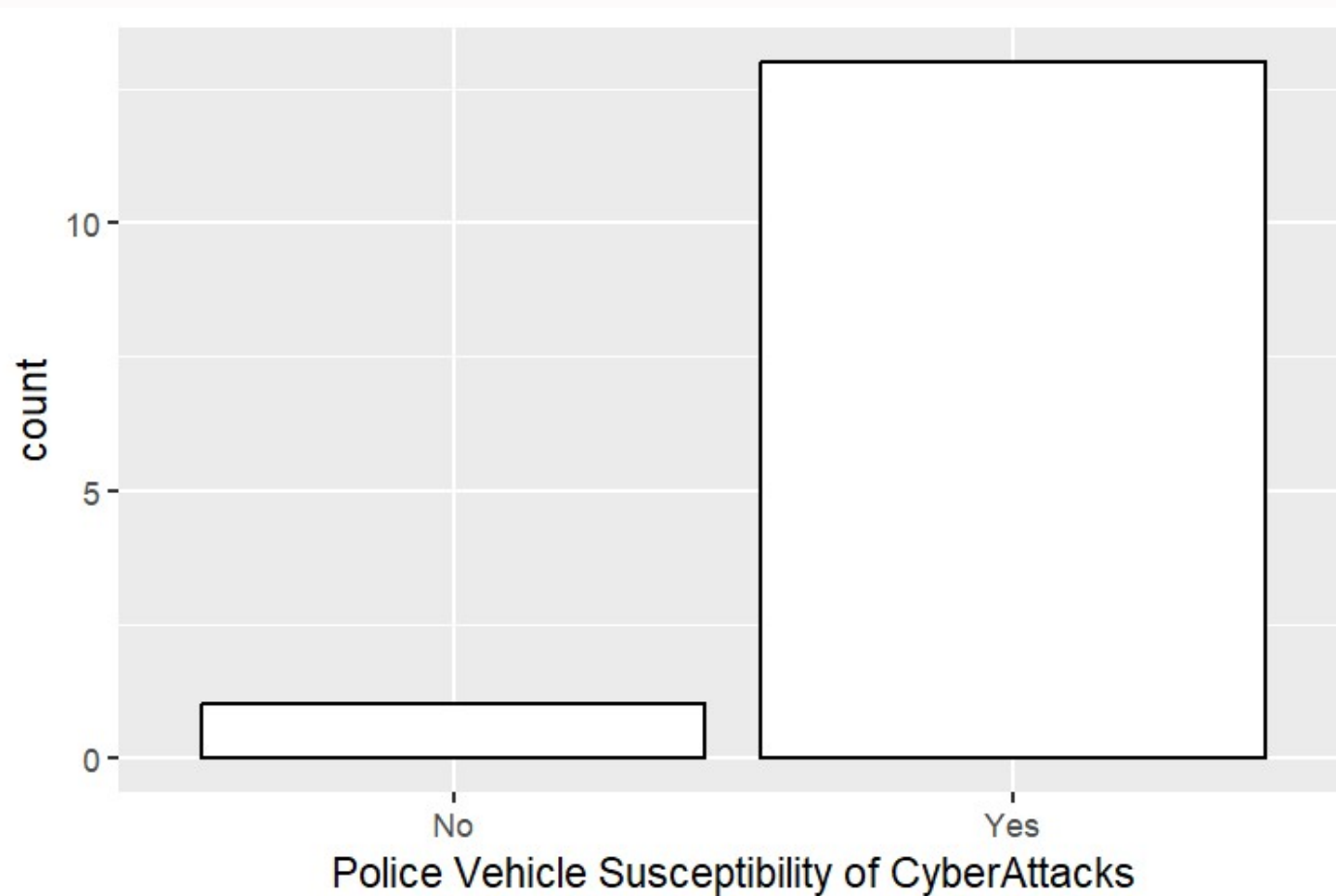


Hours in  
Police  
Vehicle

Var1	Freq
10 -20	2
20-30	4
30-40	5
40+	3

# Other Demographic Questions

Question	Yes	No
Military Experience	2	12
Cybercrime Unit in Police Agency	2	12
Cybercrime Cases in Police Agency	11	3
Cybercrime Training in Police Agency	9	5



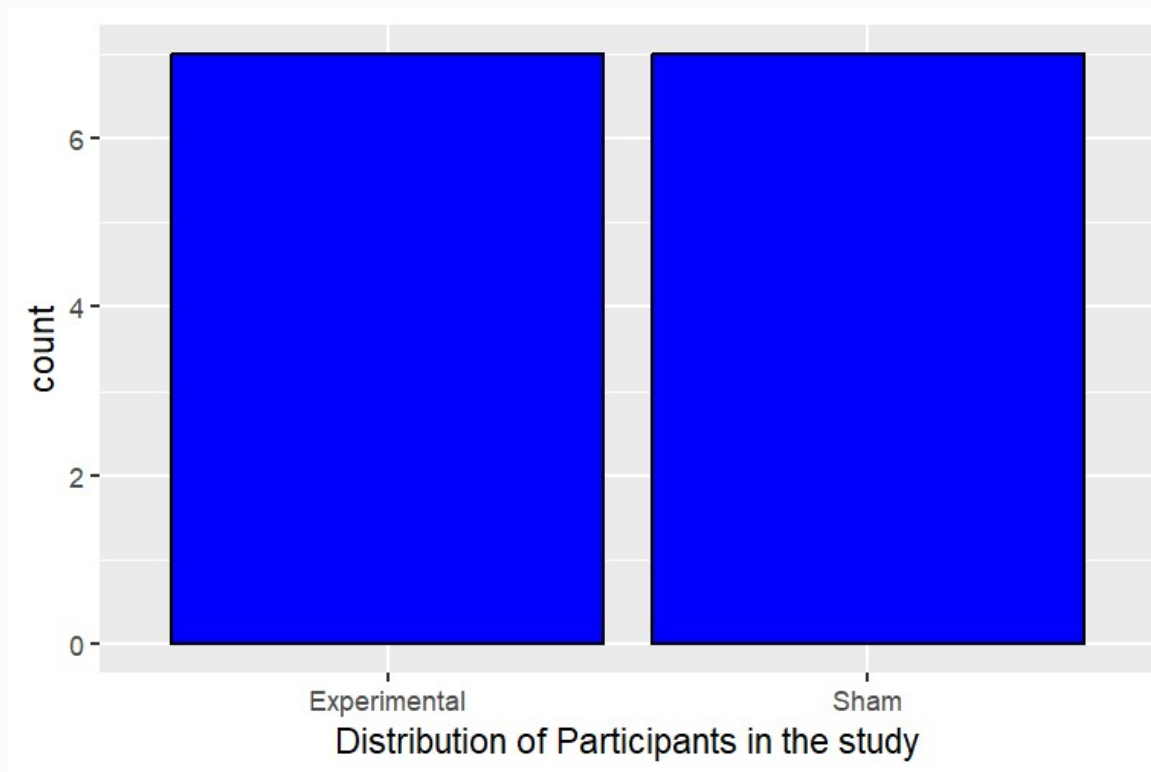
Police  
Vehicle  
Susceptibility  
of  
CyberAttacks

Var1	Freq
No	1
Yes	13



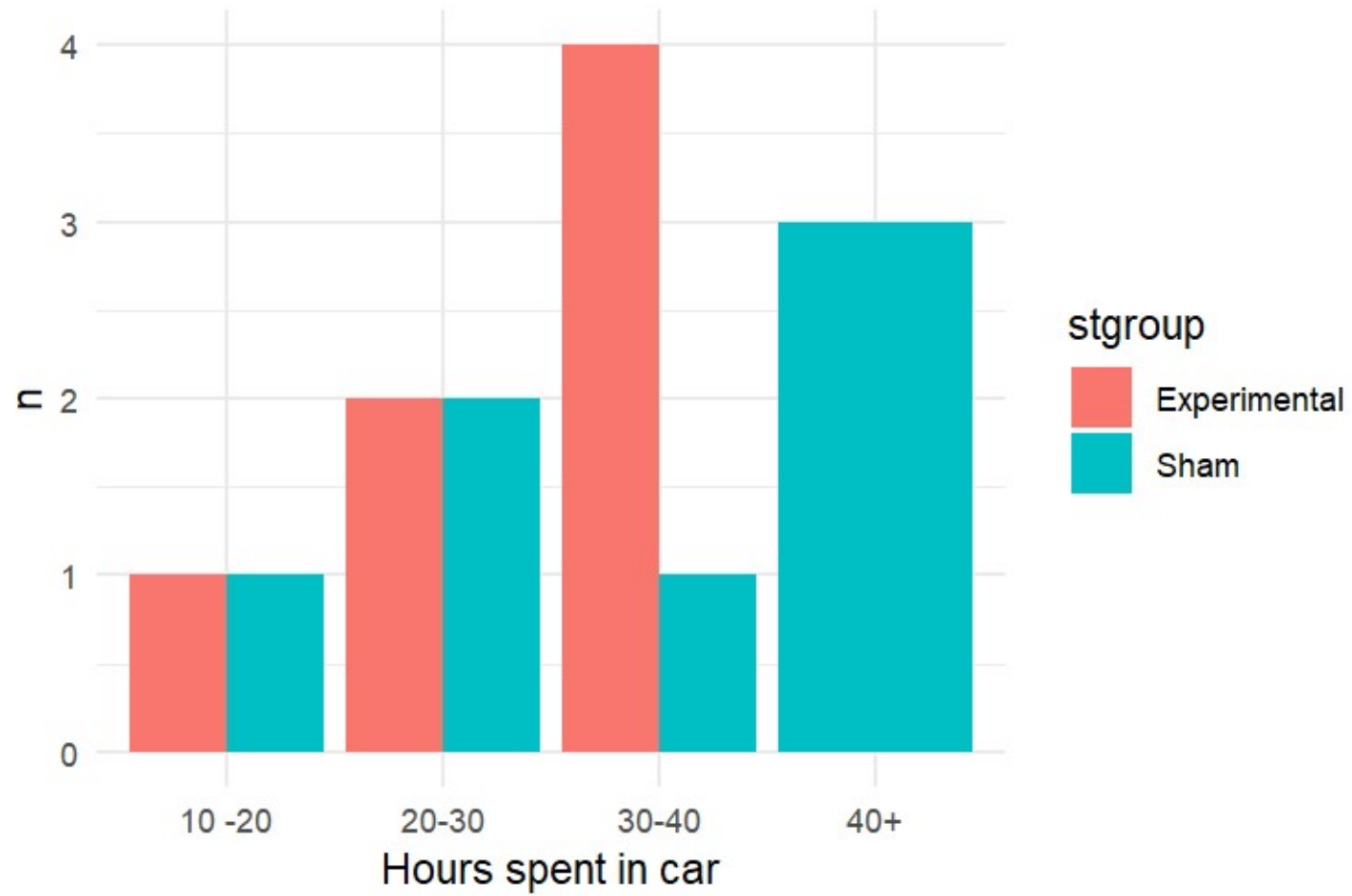
# Experimental and Sham Groups

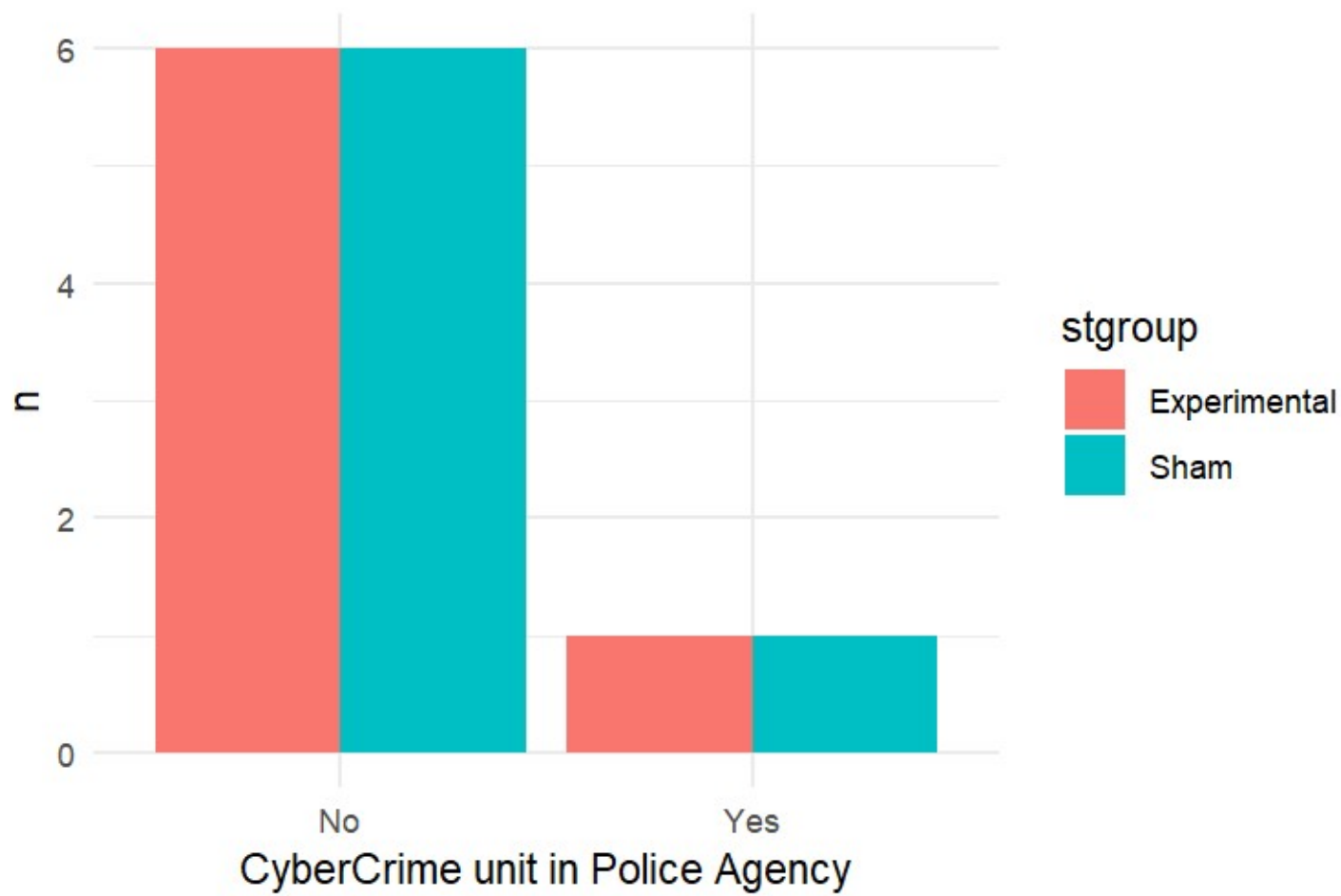
Participants were divided into two groups - Experimental group and Sham group. Training was delivered in the form of a PowerPoint presentation to both treatment groups after their initial baseline drive. The PowerPoint presentation informed participants of what vehicular cyberattacks were, the history of vehicular cyberattacks, as well as contextualizing examples.

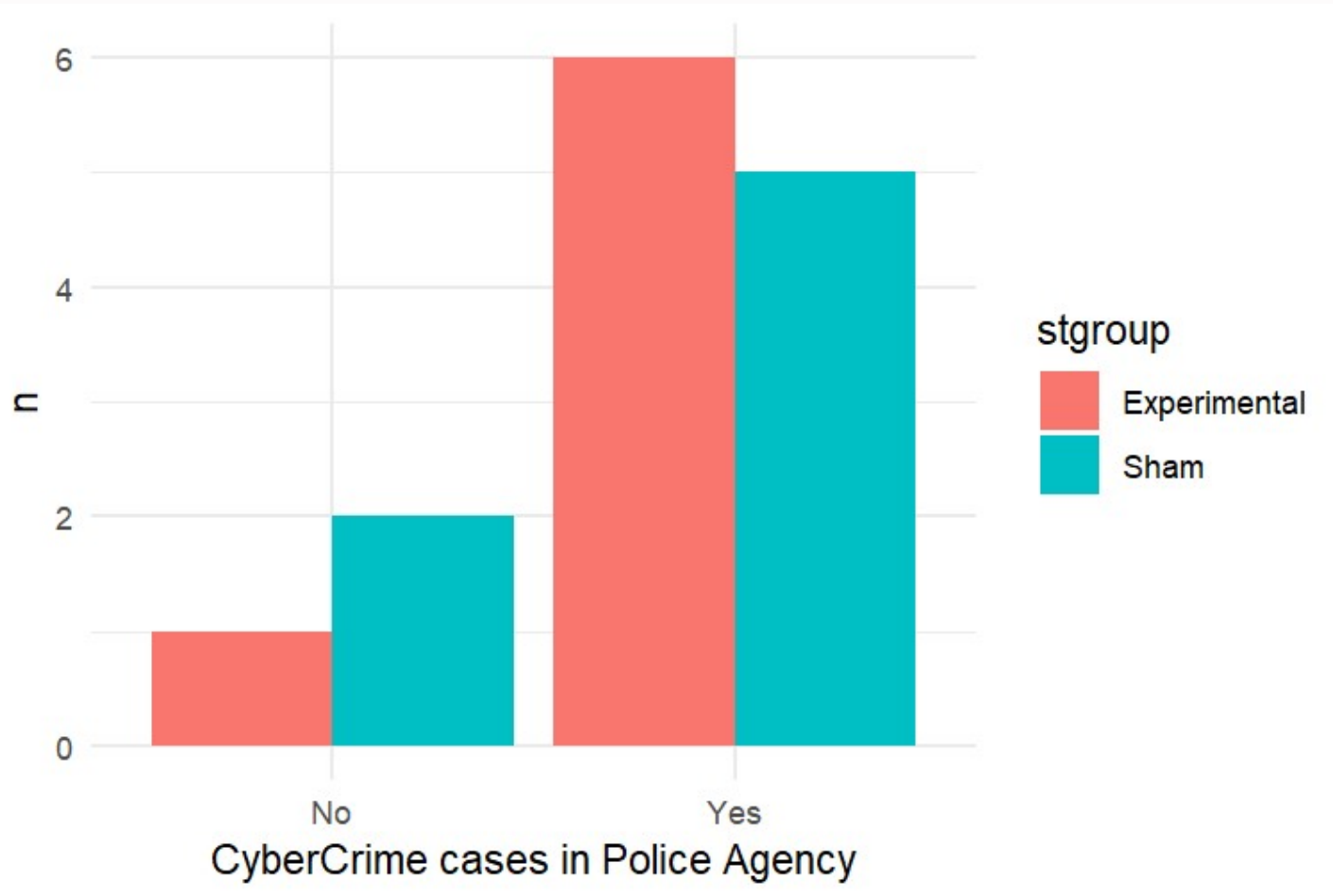


A photograph of a modern office interior, overlaid with a semi-transparent green filter. The office features wooden desks, ergonomic chairs, and several large potted plants. In the background, there are glass-walled rooms and a lounge area with a sofa. The ceiling has exposed concrete beams and industrial-style lighting. The text "EXPERIMENTAL AND SHAM PLOTS" is centered in white, bold, sans-serif capital letters.

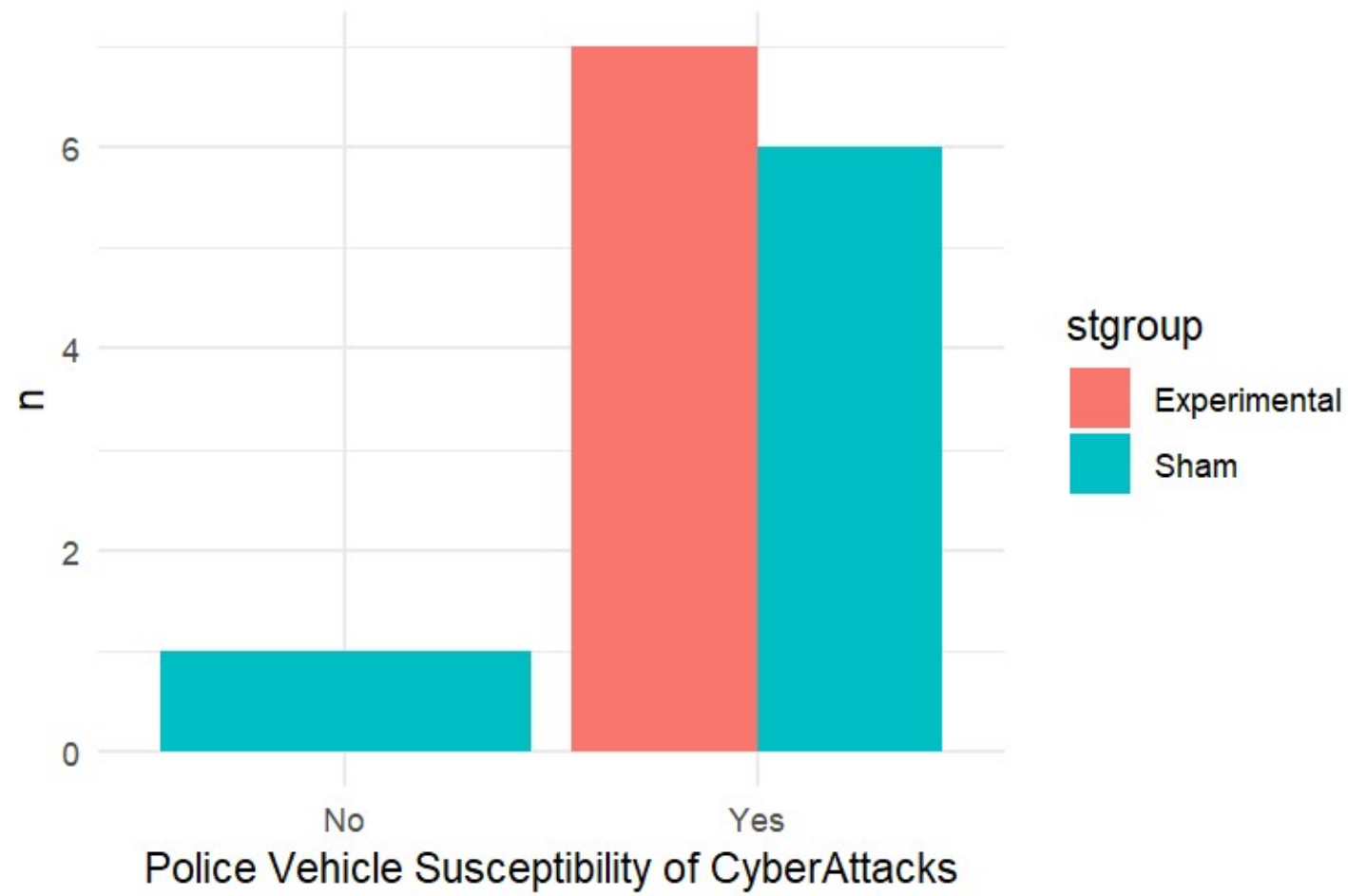
# EXPERIMENTAL AND SHAM PLOTS



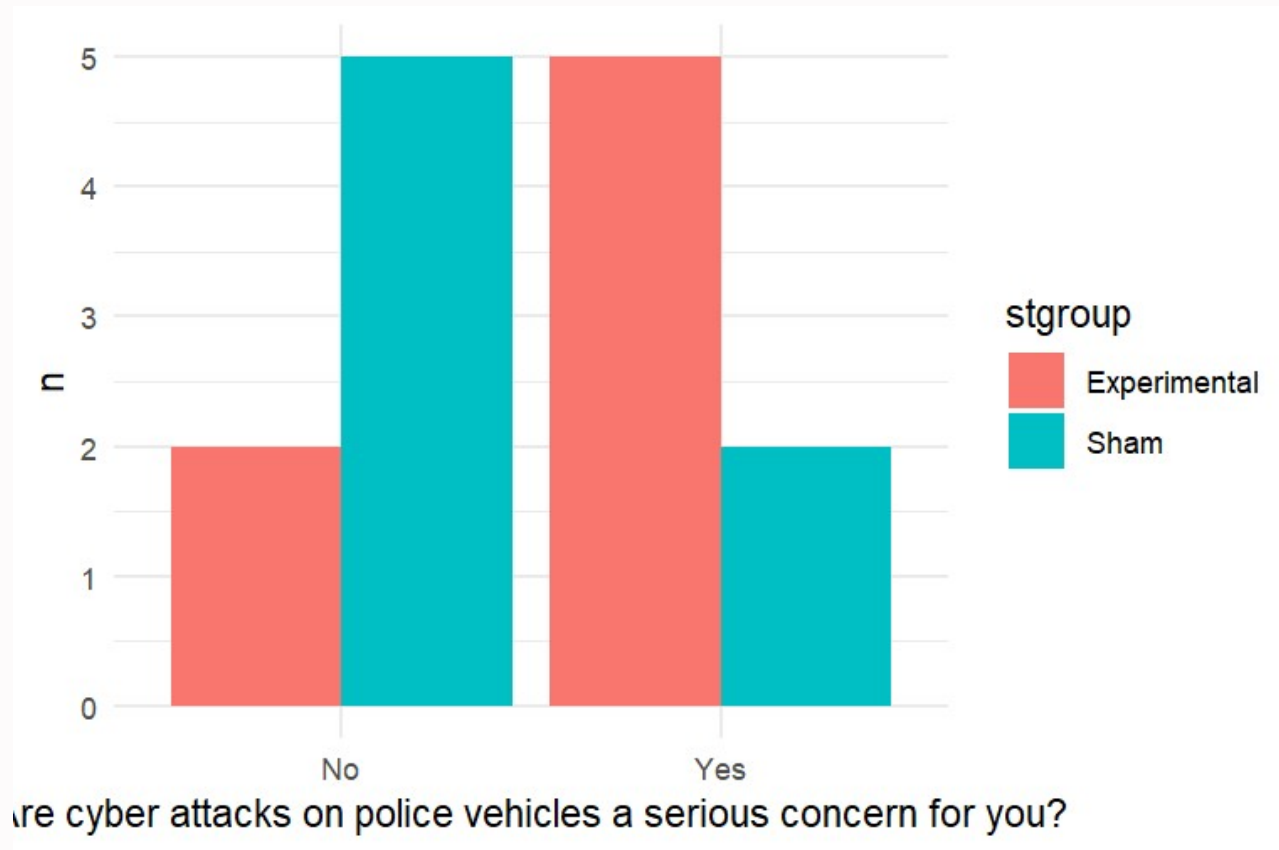












This plot depicts the influence of cybersecurity training on law enforcement officers (LEOs). The Experimental group, which received specialized training, expressed higher anxiety about cyberattacks on police cars than the Sham group. This demonstrates the effectiveness of cybersecurity training in increasing awareness of possible dangers. The statistics confirm the need for increased training programs, as seen in the bar plot, and provide unambiguous proof of training's effectiveness.

A modern office interior with a green tint. The space features large windows, wooden desks, office chairs, and various potted plants. The ceiling has exposed pipes and lights. The overall atmosphere is bright and airy, with a focus on natural elements.

# REGRESSION & CORRELATION ANALYSIS

## Correlation Analysis between all of the questions

	Q1	gender	Q6	time	Q12	Q13	Q14
Q1	1.0000000	-0.18772221	0.8950353	-0.3383844	-0.1413877	-0.4421114	0.1210772
gender	-0.1877222	1.00000000	-0.1624571	-0.4689972	-0.5310850	-0.1132277	-0.3721042
Q6	0.8950353	-0.16245714	1.0000000	-0.3875851	-0.1483135	-0.3152174	0.1217161
time	-0.3383844	-0.46899725	-0.3875851	1.0000000	0.5247362	0.3601801	0.3397579
Q12	-0.1413877	-0.53108500	-0.1483135	0.5247362	1.0000000	0.2132007	0.7006490
Q13	-0.4421114	-0.11322770	-0.3152174	0.3601801	0.2132007	1.0000000	0.3042903
Q14	0.1210772	-0.37210420	0.1217161	0.3397579	0.7006490	0.3042903	1.0000000
Q15	0.1412567	-0.20672456	0.3598564	0.1205593	0.3892495	0.1217161	0.2444444
Q18	-0.3379000	0.07692308	-0.2510701	0.1835207	0.5310850	0.1132277	0.3721042
Q19	-0.4061052	-0.27735010	-0.3372486	0.2205644	0.5222330	0.4082483	0.4472136
	Q15	Q18	Q19				
Q1	0.1412567	-0.33789998	-0.4061052				
gender	-0.2067246	0.07692308	-0.2773501				
Q6	0.3598564	-0.25107012	-0.3372486				
time	0.1205593	0.18352066	0.2205644				
Q12	0.3892495	0.53108500	0.5222330				
Q13	0.1217161	0.11322770	0.4082483				
Q14	0.2444444	0.37210420	0.4472136				
Q15	1.0000000	0.20672456	-0.1490712				
Q18	0.2067246	1.00000000	0.2773501				
Q19	-0.1490712	0.27735010	1.0000000				

### Highlights from the Correlation Analysis

- Gender has negative correlation to the rest of the questions. This was a surprise for us since we didn't think Gender would have any significant correlation to any of the questions.
- Age has a negative correlation to Q18 and Q19, which describes the Police Vehicle susceptibility of cyberattacks and concern for cyberattacks on police vehicle.
- Cybercrime experience and training have a correlation with each other as well as a positive correlation with cybercrime concern, which was expected and noted during interviews.
- Q18 (Police vehicle susceptibility of cyberattacks) and Q19 (Are cyberattacks on police vehicle a serious concern for you?) showed positive correlation to training, which proved our hypothesis.

## Are cyber attacks on police vehicles a serious concern for you? (Q19)

```
glm(formula = Q19 ~ stgroup, family = binomial, data = data)
```

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	0.9163	0.8367	1.095	0.273
stgroupSham	-1.8326	1.1832	-1.549	0.121

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 19.408 on 13 degrees of freedom  
Residual deviance: 16.752 on 12 degrees of freedom  
AIC: 20.752

Number of Fisher Scoring iterations: 4

### Summary of the Regression Analysis

The regression analysis proves 3 points -

- It suggests association between stgroup (Experimental and Sham groups), which was the training we provided during the study, and Q19 (Are cyberattacks on Police Vehicles a serious concern for you?)
- Although it suggests association between the two things, it is not statistically significant at the conventional threshold.
- The suggestion from the previous point is that we need to conduct the study on a larger level, i.e. a substantial participant group. This would give us a better regression analysis.





**THANK YOU!**  
**QUESTIONS?**