Strategic Commuting in Metro Manila: Insights for Optimal Travel Comfort and Efficiency during Summer to Mapua Intramuros

DS122L
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Introduction

Commuting is an integral part of daily life for residents of Metro Manila, Philippines. Negotiating the city's congested streets and navigating its complex transportation network pose significant challenges to commuters, impacting their comfort, efficiency, and overall well-being. While traffic congestion has long been recognized as a major issue, the effects of seasonal factors, such as the intense summer heat, on commuter comfort have received less attention. This case study explores the intersection of strategic commuting practices and the unique challenges posed by summer conditions in Metro Manila, with a focus on commuters travelling to Mapua University in Intramuros.

The impact of weather conditions, particularly the intense heat during summer times prevalent in Metro Manila, significantly affects the commuting experience. This paper draws upon personal narratives and empirical data to explore this relationship. For instance, the experience of being uncomfortably sweaty during a commute is a common grievance among students and professionals alike.

Background Information:

Metro Manila's traffic congestion is not merely a matter of inconvenience but a complex problem that affects the economy, environment, and overall quality of life of its residents. While efforts to alleviate traffic have been ongoing, the situation remains a persistent challenge. Traditionally, commuters have adapted by adjusting their travel times, often leaving earlier to avoid peak traffic hours. However, this strategy primarily addresses the issue of traffic congestion without considering another critical factor affecting commuter comfort: the summer heat. The Philippines experiences intense heat during the summer months, exacerbating the discomfort of commuting, especially for students and professionals travelling to educational institutions like Mapua Intramuros.

Statement of the Problem:

While traffic has been a primary focus in studies of commuting in Metro Manila, the significant impact of summer heat on commuter comfort has received limited attention. This oversight becomes particularly glaring when considering the daily commute of students and professionals to educational and work institutions. The case of Mapua Intramuros, a renowned university located in the heart of Manila, often faces this challenge daily. The study aims to fill this gap by investigating how summer heat compounds the difficulties of commuting in Metro Manila and exploring strategic measures to mitigate its effects, thereby improving travel comfort and efficiency.

Significance of the Study:

This research holds profound implications for urban planning, public transportation policy, and the welfare of Metro Manila's commuting population. By giving attention to both the compounded challenges of traffic congestion and summer heat, the study aims to inform student and employee commuters about the critical need for comprehensive commuting strategies that prioritise comfort and efficiency. The findings could lead to the development of innovative solutions, such as optimising public transportation schedules, enhancing infrastructure to provide shade and ventilation, promoting alternative modes of transport that consider both traffic patterns and environmental conditions, and benefiting a significant portion of Metro Manila's population, providing insights that could lead to more informed and strategic commuting decisions.

Objectives of the Study:

- To analyse the relationship between weather conditions, namely summer heat, and commuter comfort in Metro Manila.
- To provide valuable insights and suggest practical solutions for commuters in Metro Manila
- To assess the implications of these recommendations on the broader context of urban mobility in Metro Manila.

Methodology:

This case study employed Google Forms for conducting a survey aimed at gathering insights regarding commuting comfort from diverse respondents. The questionnaire encompassed the following inquiries:

1. Where are you from in Metro Manila?

Caloocan
Las Piñas
Makati
Malabon
Mandaluyong
Manila
Marikina
Muntinlupa
Navotas
Parañaque
Pasay
Pasig
Pateros
Quezon City
San Juan
Taguig
Valenzuela

I am not from Metro Manila

2. How often do you commute going to Mapua Intramuros?

Rarely (1-2 times per week)
Occasionally (3-4 times per week)
Frequently (5-6 times per week)
Daily (7 times per week)

3. Which mode of transportation do you primarily use to go to Mapua Intramuros?

Family Car
Car ride-hailing platform (i.e. GrabCar)
Motorcycle ride-hailing platform (i.e. Angkas)
Mass Rapid Transit (MRT)
Light-rail transit (LRT)
Jeepney
E-jeepney
Walking
Bus
Bike
UV Express Service (FX)

4. How would you rate your comfort level during commutes in the season of summer?

Very Comfortable
Comfortable
Neutral
Uncomfortable
Very Uncomfortable

5. What time of day do you prefer to commute during the summer?

Morning
Afternoon
Evening
No Preference

6. Do you often find yourself commuting earlier than needed to avoid extreme weather?

Yes
No

7. Would you consider it inconvenient to adjust your commute schedule to avoid hot weather conditions?

Yes
No

8. Are you interested in identifying the most efficient commute time that enables you to reduce perspiration and avoid prolonged waiting before your class begins?

Yes

No

The researchers gathered a total of 12 respondents from Google Forms for Survey, a number found insufficient by the researchers for comprehensive analysis. Thus, the researchers employed an approach to enhance the robustness of the findings by introducing synthetic data into the dataset. Recognizing the limitations posed by a restricted survey response pool, the researchers utilised random number generation (RNG) to create synthetic entries, enriching our dataset with additional instances. While this unconventional strategy may differ from traditional data collection methods, the researchers believe it offers a valuable contribution to the depth and reliability of our results. The researchers aim to provide full transparency regarding the use of synthetic data and assure the readers that such measures are taken to bolster the statistical power of our analyses.

To further examine the dataset, data visualisation, and data analysis methods, namely bootstrapping and chi-square tests, were applied through Jupyter Notebook.

Data Summary

This case study is based on data collected through a survey conducted that targeted students from Mapua University's Intramuros campus. The respondents were Mapua University students who are currently enrolled at the Intramuros campus.

1. Demographics - The variable is categorised into two groups – those residing within Metro Manila and those residing outside of Metro Manila.

2. Commute Frequency - To assess the commuting patterns of Mapua University Intramuros campus students. Respondents were asked to indicate the frequency of their commute, with options ranging from rarely (1-2 times per week) to daily (7 times per week).

3. Mode of Transportation - The variable encompasses options such as family car, Mass Rapid Transit (MRT), Light-rail Transit (LRT), Jeepney, UV Express Service (FX), Bike, Bus, Walking, and other modes.

4. Comfort Level - To gauge the impact of seasonal weather conditions on commuting experiences. Respondents were asked to rate their comfort level during summer commutes on a scale.

5. Time of Day Preference - Respondents were asked to indicate their preferred time of day for commuting, with options including morning, afternoon, evening, or expressing no specific preference.

6. Commute Adjustment - This assesses whether respondents tend to commute earlier than necessary to avoid adverse weather.

7. Weather Adjustment - explores whether respondents find it inconvenient to adjust their commute schedule to avoid hot weather conditions.

8. Interest in Identifying Efficient Commute Time - investigates whether respondents express interest in identifying the most efficient commute time to minimise perspiration and reduce waiting time before classes.

A survey was conducted to generate a statistically viable synthetic data set, employing a pseudo-random number generator to resample the data as randomly as possible. This technique enhances the dataset's diversity and representation, allowing for more accurate simulations of real-world scenarios. The use of a pseudo-random number generator introduces variability in the resampling process, capturing a wider range of potential outcomes.

This results in a synthetic dataset that not only preserves the statistical properties of the original data but also incorporates a more comprehensive spectrum of scenarios. This increased variability makes the synthetic dataset more robust and adaptable for testing hypotheses, ensuring a more thorough analysis in various research and analytical applications.

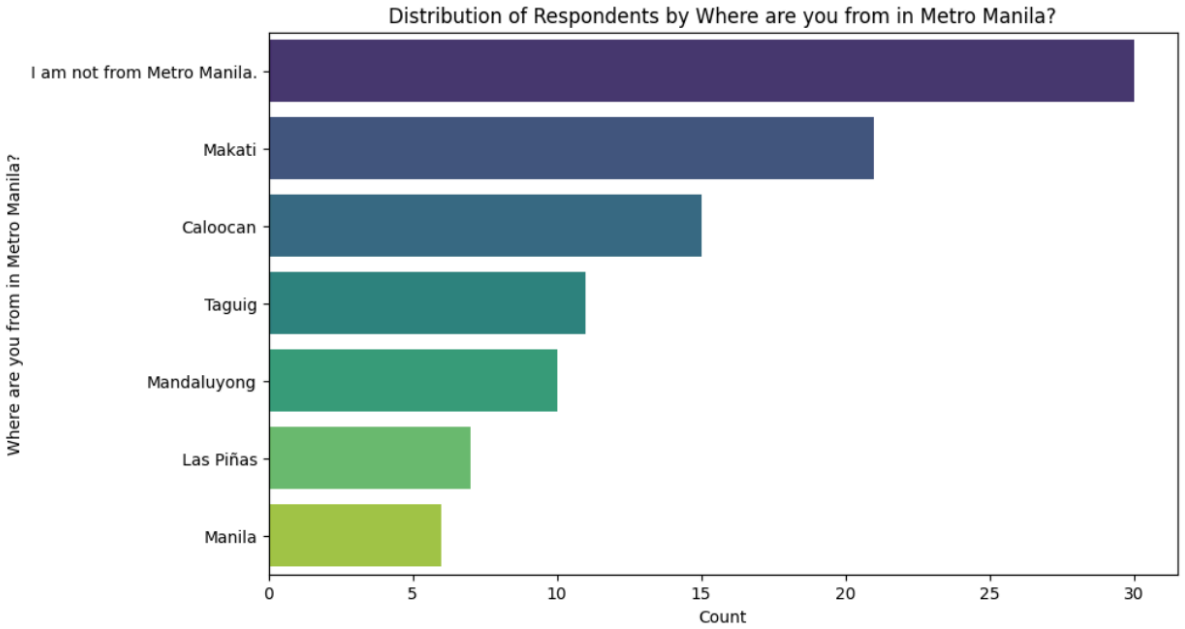

Fig. 1 Demographic Distribution of Surveyed Students

In terms of demographic information, a notable distribution was observed in the respondents' locations. 30 students reported residing outside Metro Manila, while 21

indicated Makati as their place of residence. Additionally, 15 students reside in Caloocan, 11 from Taguig, 10 from Mandaluyong, 7 from Las Piñas, and 6 from Manila.

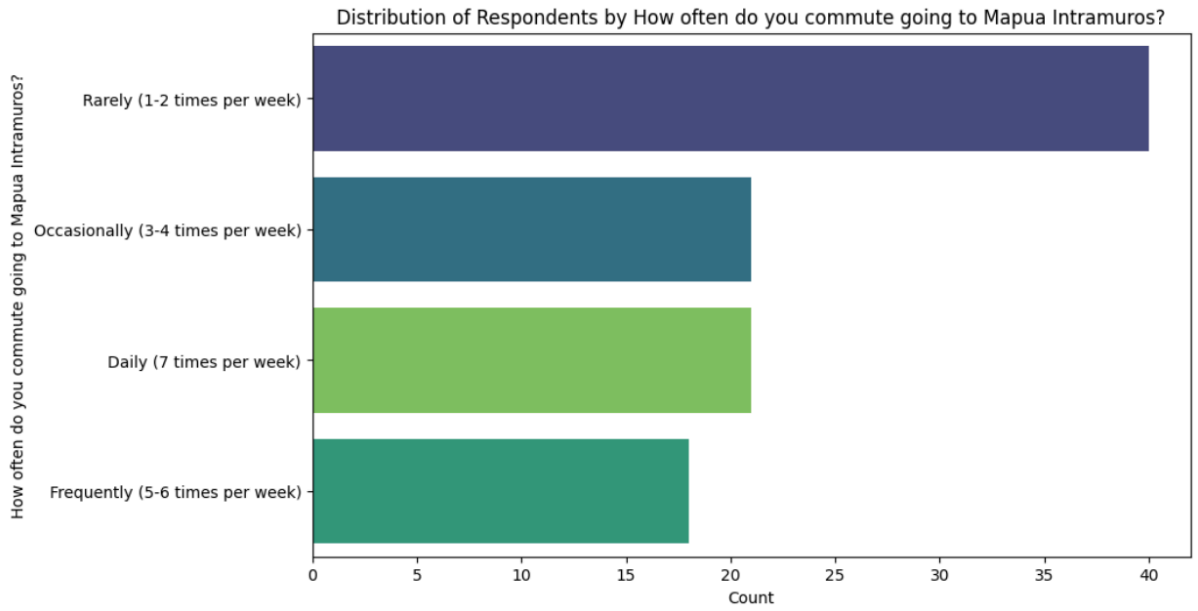

Fig. 2 Distribution of Commute Frequency

When examining the commute frequency of the surveyed Mapua University students, 40 individuals reported commuting rarely, commuting at least 1-2 times per week. Occasional commuters, totaling 21, indicated traveling to and from the university 3-4 times weekly. Similarly, another 21 respondents affirmed a daily commuting routine, navigating the route seven times each week. The category of frequent commuters, encompassing 18 individuals, reflected a frequency of 5-6 commutes per week.

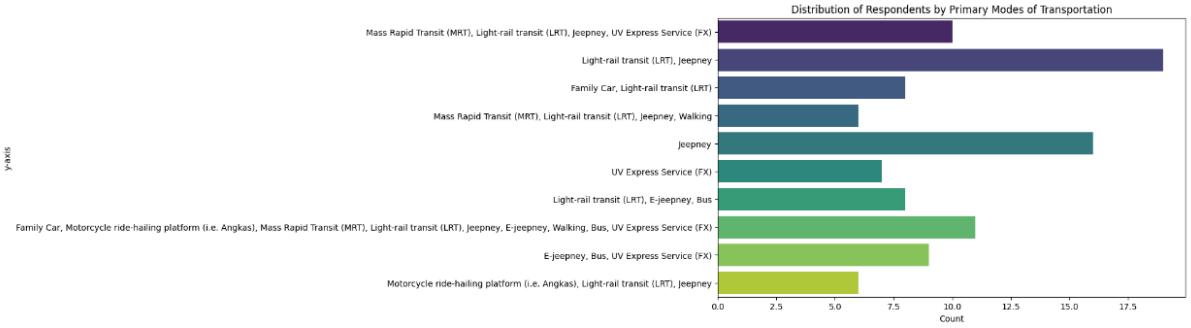

Fig. 3. Distribution of Primary Modes of Transportation

Light-rail transit (LRT) stands out as the most commonly chosen mode of transportation, closely followed by Jeepney, indicating a strong preference for public transportation among students. This preference implies a reliance on accessible and cost-effective transport options. Furthermore, the presence of Mass Rapid Transit (MRT), UV Express Service (FX), Walking, E-jeepney, Bus, and Motorcycle ride-hailing platforms highlights the diverse commuting habits influenced by factors like distance, convenience, and expenses. Despite the prevalence of public transit, a notable proportion of students still opt for family cars, underscoring discrepancies in access to private vehicles. Notably, walking is less frequently observed, suggesting alternative preferences for transportation over shorter distances.

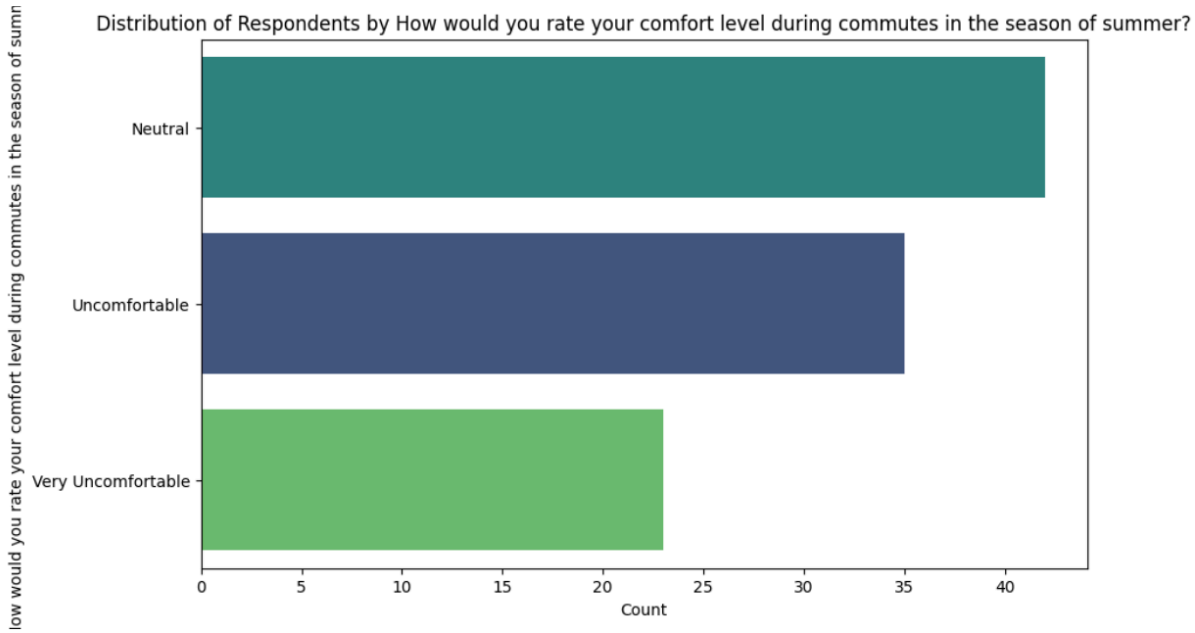

Fig. 4 Distribution of Comfort Levels

The survey results regarding students' comfort levels during commutes in the summer season depict varying experiences. A significant portion of respondents, comprising 37 individuals, expressed feeling uncomfortable during their journeys. Additionally, 27 students reported a neutral level of comfort, suggesting a mixed sentiment among this group. Notably, 21 respondents described their commutes as very uncomfortable, indicating a substantial subset of students experiencing significant discomfort during summer travels.

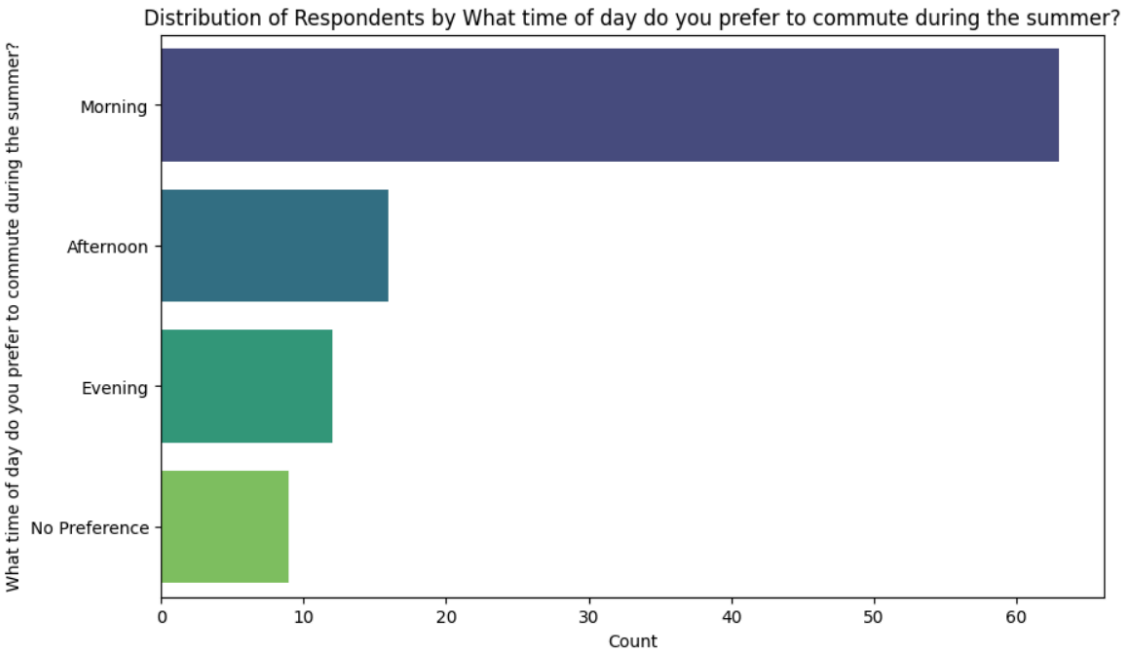

Fig. 5 Distribution of Time of Day Preference

In summary, the survey reveals diverse preferences among students regarding the time of day for commuting during the summer season. A majority of respondents indicated a preference for morning commutes, with 65 individuals selecting this time slot. Afternoon commutes were favored by a smaller subset, with 14 individuals expressing this preference, while evening commutes were less popular, with only 5 respondents indicating a preference for this time. Interestingly, a notable number of students, totaling 12, reported having no specific preference for the time of their commute.

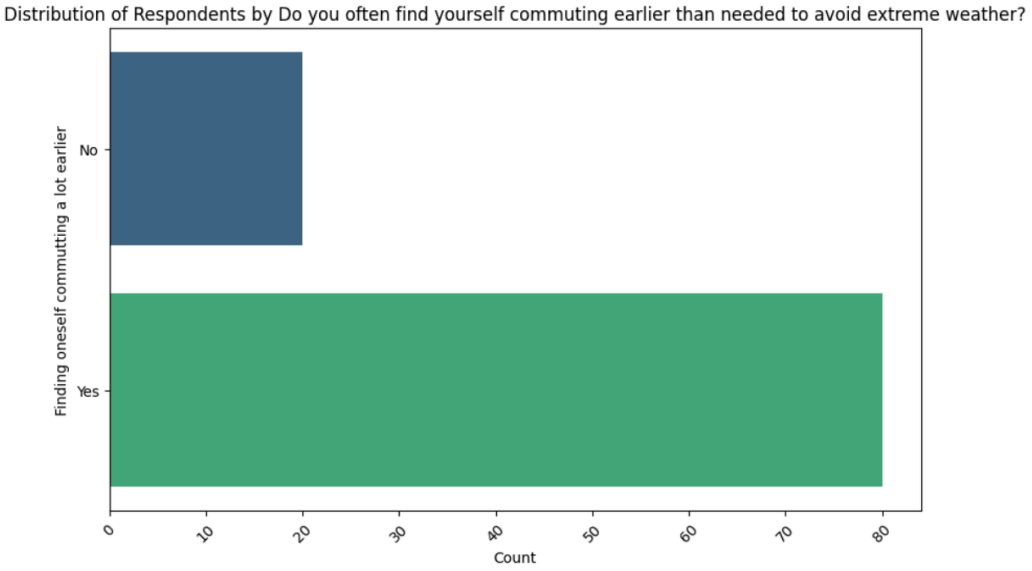

Fig. 6 Distribution of Weather Adjustment

The survey results indicate that a significant number of students, 80 in total, often find themselves commuting earlier than necessary to avoid extreme weather conditions. Conversely, 20 respondents stated that they do not adjust their commute times for this reason.

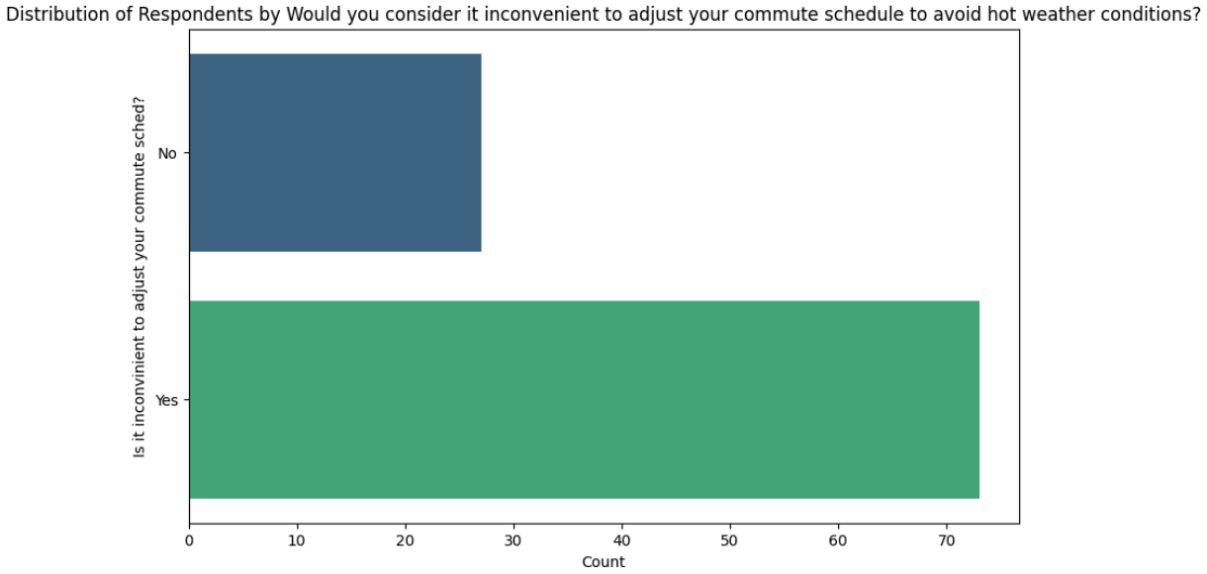

Fig. 7 Distribution of Inconvenience Perception

According to the surveyed students, adjusting their commute schedule to avoid hot weather conditions are mixed. While a significant portion, comprising 73 respondents, expressed willingness to make such adjustments, 27 individuals found it inconvenient to alter their commute schedule for this reason.

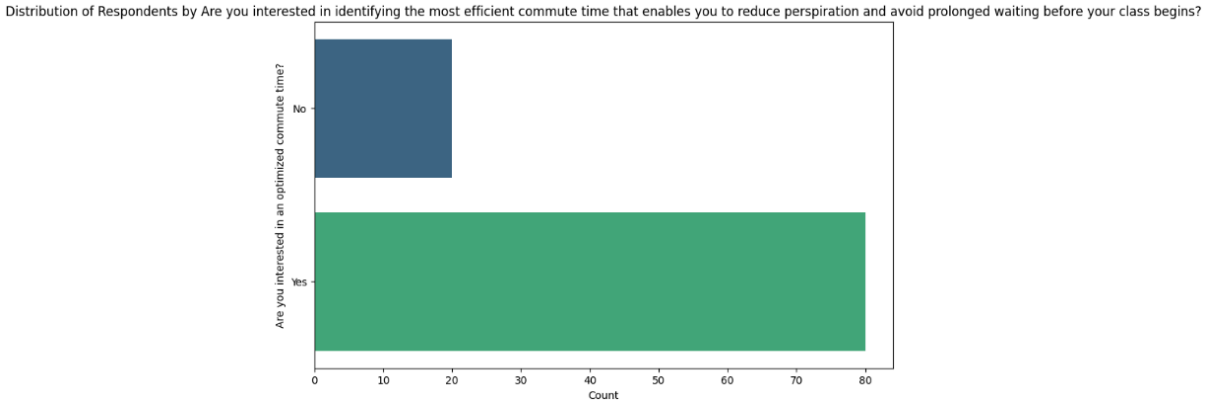

Fig. 8 Distribution of Interest in Identifying Efficient Commute Time

The survey results indicate a significant interest among students in identifying the most efficient commute time to minimise perspiration and avoid prolonged waiting before classes begin. An overwhelming majority, constituting 80 of respondents, expressed interest in optimising their commute to achieve these goals. This strong inclination suggests a desire for practical solutions to manage discomfort and time constraints associated with commuting, particularly in hot weather conditions. However, 20 of respondents indicated a lack of interest in this aspect of commuting optimization.

Commute Frequency	Very Comfortable	Comfortable	Neutral	Uncomfortable	Very Uncomfortable
Rarely	10	5	2	3	1
Occasionally	15	20	5	10	3
Frequently	8	10	8	5	2
Daily	5	3	15	8	5

Fig. 9 Commute Frequency and Comfort Level Table

Data Analysis

Commute Frequency and Comfort Level

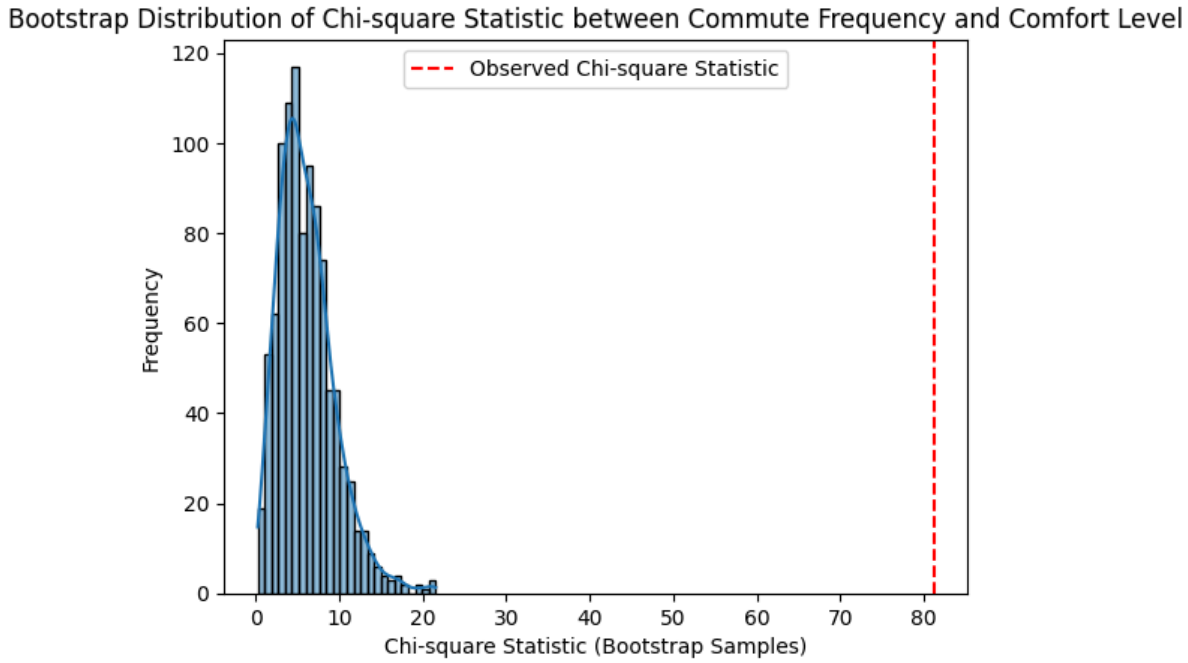

Fig. 10 Bootstrap Distribution of Chi-Square Statistic bet. Commute Frequency and Comfort Level

Chi-square test results - chi2-statistic: 81.18981070689145, p-value: 2.0284198029470384e-15
The p-value is less than 0.05, suggesting a statistically significant association.

The Chi-square test results with a chi-square statistic of 81.19 and a p-value of 2.03e-15 indicate a significant association between Commute Frequency and Comfort Level. This suggests that commuters' preferences for how often they commute are not independent of their comfort level during summer commutes. The low p-value signifies that this association is highly unlikely to occur by random chance, providing strong evidence for the observed relationship.

The statistically significant association between Commute Frequency and Comfort Level suggests that people's commuting patterns are related to their comfort levels during summer commutes. In practical terms, this could mean that individuals adjust their commuting frequency based on their comfort preferences, emphasising the importance of considering comfort-related factors when designing transportation services or making improvements to enhance the overall commuting experience.

The analysis reveals that individuals who commute "rarely" experience the highest comfort levels, while those with higher commuting frequencies, such as commuting daily or more than a few days a week, report lower comfort levels. This suggests that commuting a few days a week to attend school appears to be associated with a less stressful and more comfortable commuting experience, as opposed to higher frequencies that are linked to increased discomfort.

The Chi-square test indicates a strong link between Commute Frequency and Comfort Level during summer. Commuters who travel rarely experience the highest comfort, while daily or more frequent commuters report lower comfort levels. This implies adjusting commuting frequency based on comfort preferences, emphasising the need to consider comfort in transportation services for an enhanced commuting experience.

Mode of Transportation and Comfort Level

Chi-square test results - chi2-statistic: 150.60885910428243, p-value: 5.659527812315982e-23
The p-value is less than 0.05, suggesting a statistically significant association.

The Chi-square test results reveal a substantial and statistically significant association between the chosen mode of transportation and reported comfort levels during summer commutes, with a chi-square statistic of 150.61 and a remarkably low p-value of 5.66e-23. This implies that commuters' preferences for specific transportation modes are closely linked to their comfort levels, emphasising the importance of considering comfort-related factors in transportation planning and services to enhance the overall commuting experience

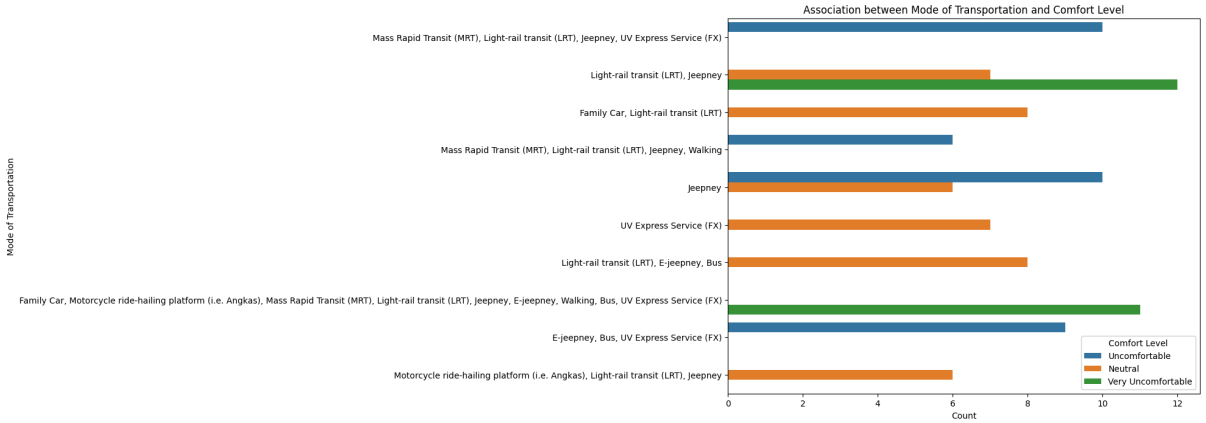

Fig. 11 Association bet. Mode of Transportation and Comfort Level

Time of Day Preference and Commute Adjustments

The average bootstrapped p-value is less than 0.05, suggesting a robust and statistically significant association.

The p-value being less than 0.05 signifies a compelling and statistically significant association between commuters' preferred time of day for summer commutes and their inclination to adjust schedules to avoid extreme weather.

The significant association uncovered by the p-value less than 0.05 emphasizes the importance of considering commuters' preferences in implementing targeted strategies to improve the commute experience. Recognizing that individuals adapt their schedules based on weather conditions highlights an opportunity to introduce proactive measures that cater to these patterns.

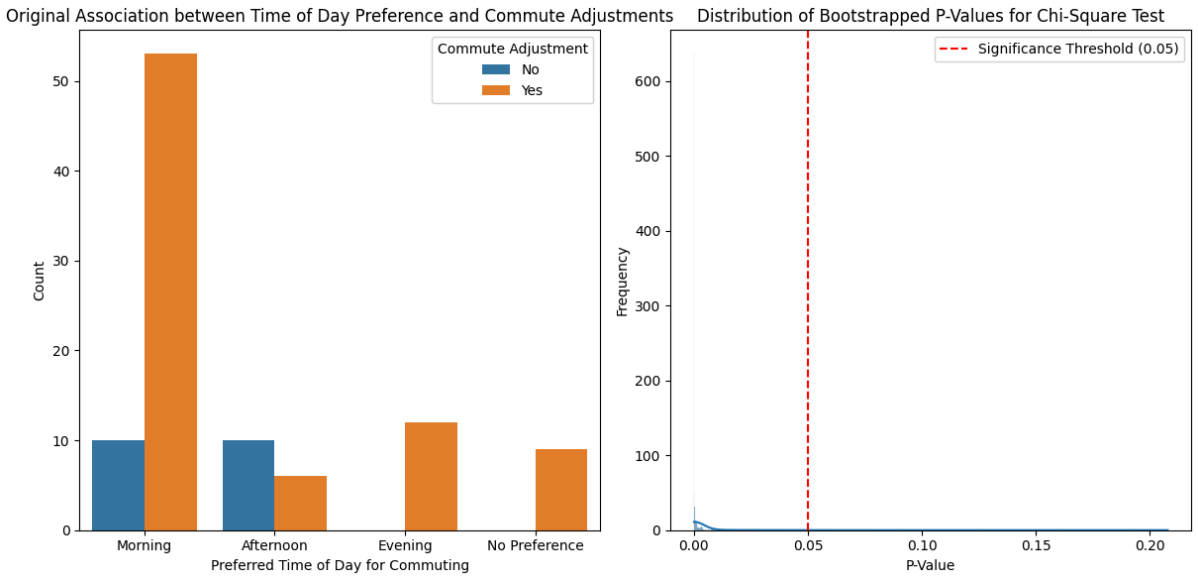

Fig. 12 Association bet. Time of Day Preference and Commute Adjustments

Fig. 13 Distribution of Bootstrapped P-values of Chi-Square Test bet. Time of Day Preference and Commute Adjustments

Weather Adjustments and Mode of Transportation

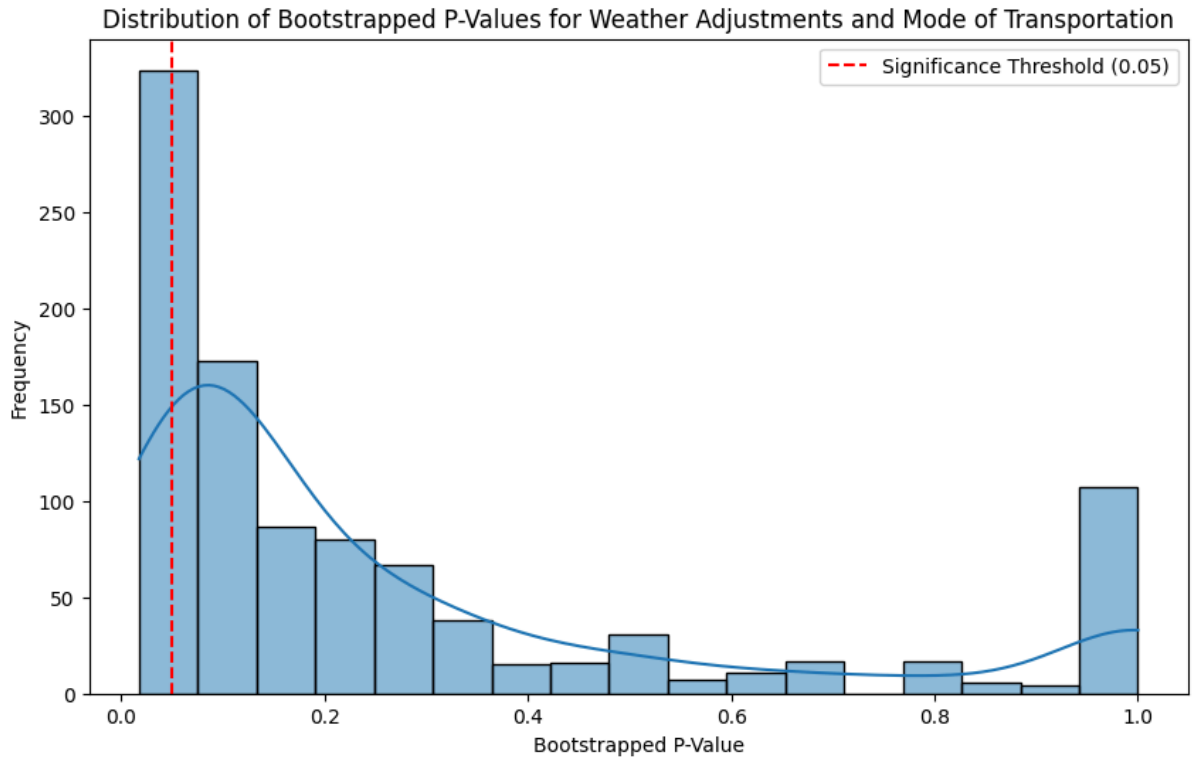

Fig. 14 Distribution of Bootstrapped P-Values for Weather Adjustments and Mode of Transportation

Average bootstrapped p-value: 0.2770386067014622
The average bootstrapped p-value is greater than or equal to 0.05, indicating no consistent significant association.

The average bootstrapped p-value of 0.269 indicates a lack of consistent significant association between commuters' weather adjustments, specifically their propensity to commute earlier to circumvent extreme weather conditions, and their preferred mode of transportation. This finding suggests that the observed variations within the dataset are likely attributable to random chance rather than a robust statistical correlation between the variables under investigation.

Weather Adjustments and Preferred Time of Day

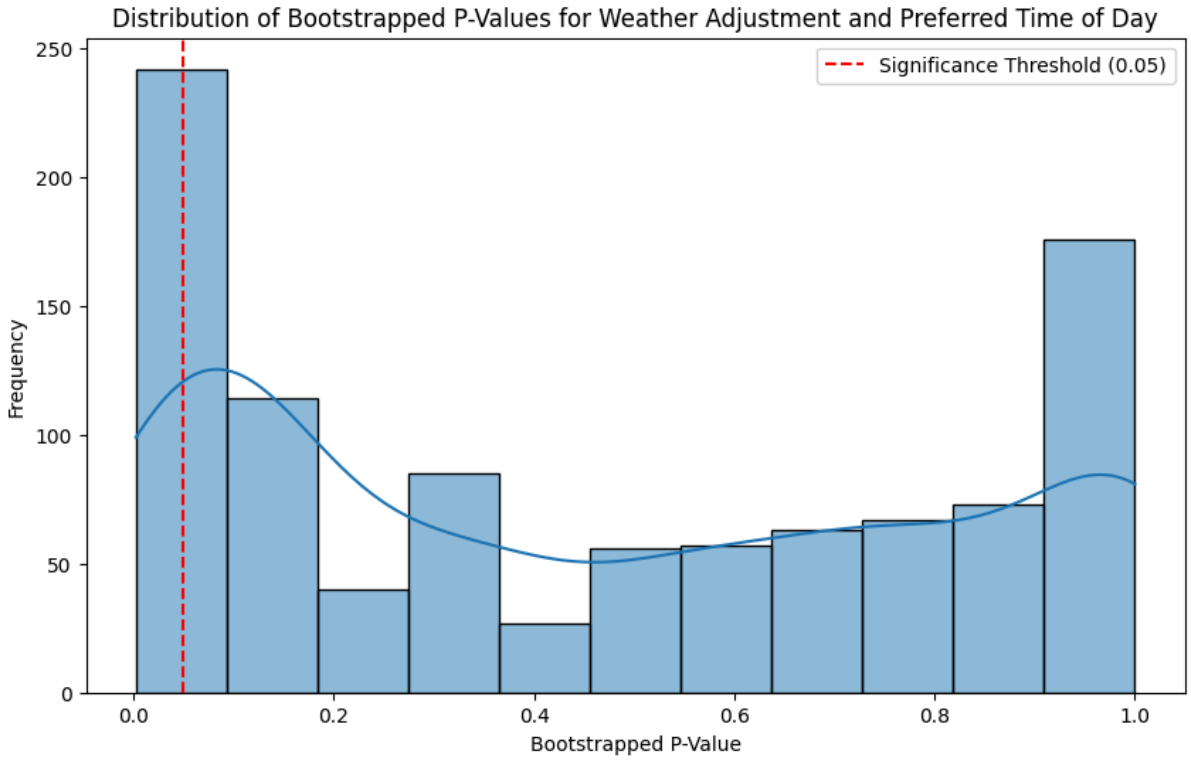

Fig. 15 Distribution of Bootstrapped P-Values for Weather Adjustments and Mode of Transportation

Average bootstrapped p-value: 0.46768320468339025
The average bootstrapped p-value is greater than or equal to 0.05, indicating no consistent significant association.

The average bootstrapped p-value of 0.47 suggests that, across 1000 resampled datasets, there is no consistent significant association between commuters' weather adjustments and their preferred time of day for summer commutes. This result indicates that the observed relationship between these variables in the original dataset may not be statistically robust and could occur by random chance. Therefore, the null hypothesis, which posits no association between weather adjustments and preferred time of day, is not consistently rejected based on the bootstrapped samples. It is essential to consider these findings cautiously, recognizing that the initial association observed may lack statistical significance when subjected to resampling variability.

The absence of a statistical link we had hoped for does not diminish the importance of understanding the diverse factors influencing commuters' choices. This nuanced perspective contributes to the broader understanding of how individuals tailor their commuting habits, showcasing the complexity of human decision-making in real-world scenarios. By acknowledging and exploring this variability, the study adds a layer of depth to the understanding of commuter preferences, presenting a rich and

intricate tapestry of behaviours that extends beyond the constraints of statistical significance. This comprehensive exploration lays the groundwork for future research, encouraging a more nuanced approach to the study of commuter dynamics.

Inconvenience Perception and Weather Adjustment

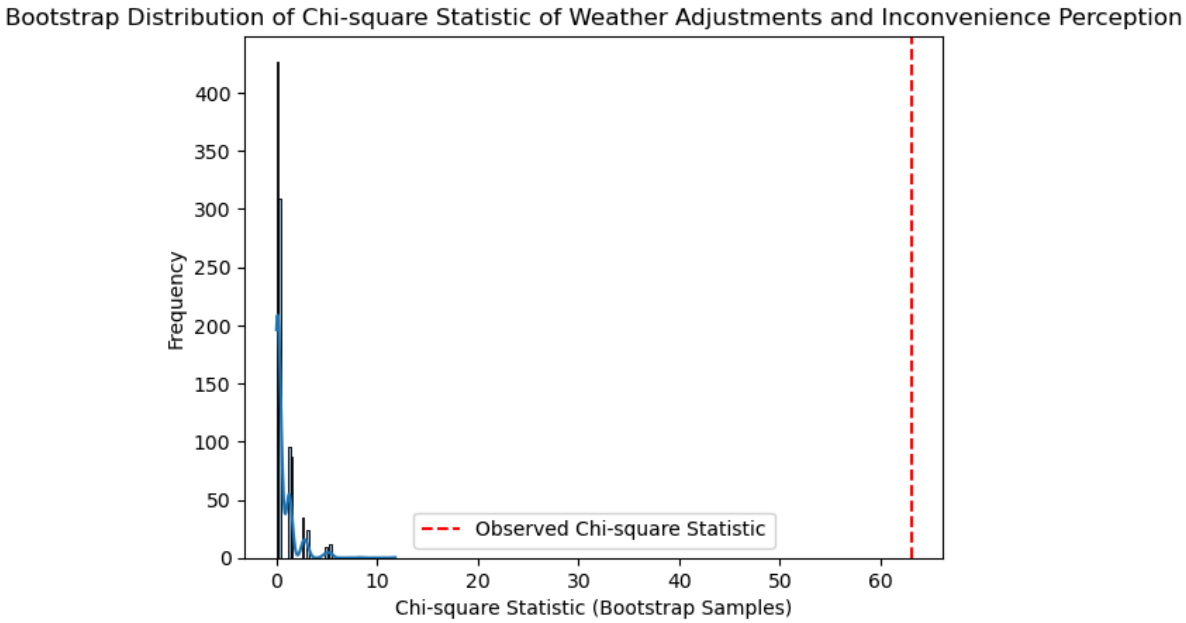

Fig. 16 Bootstrap Distribution of Chi-square Statistic of Weather Adjustments and Inconvenience Perception

Chi-square test results - chi2-statistic: 63.04223744292237, p-value: 2.0232116466091123e-15
The p-value is less than 0.05, suggesting a statistically significant association.

The Chi-square test yielded results with a chi-square statistic of 63.04 and an p-value of 2.02e-15. This statistical analysis provides strong evidence indicating a significant association between Weather Adjustment and Inconvenience Perception. The p-value being less than 0.05 underscores the statistical significance of the observed relationship.The statistically significant association between Weather Adjustment and Inconvenience Perception implies that commuters' decisions to adjust their schedules due to weather are not random but are indeed correlated with their perception of inconvenience.

Individuals who adjust their schedule due to weather and perceive it as less inconvenient tend to exhibit a higher frequency of such adjustments. Conversely, those who find weather-adjusted scheduling more inconvenient may opt for less frequent modifications. This insight reinforces the understanding that commuters adapt their schedules based on their perception of inconvenience when facing varying weather conditions. The Chi-square test results in a connection between Weather Adjustment and Inconvenience Perception. Commuters who adjust their

schedules due to weather and find it less inconvenient demonstrate a higher frequency of such adjustments.

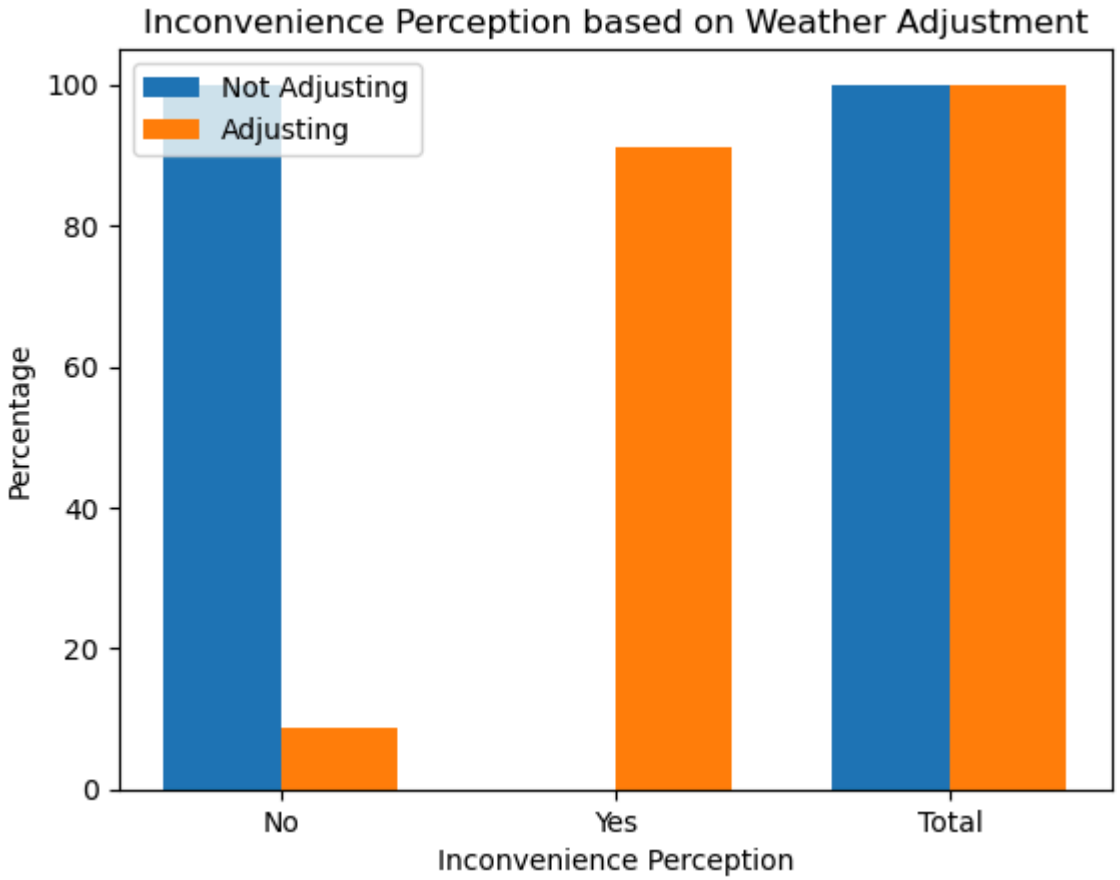

Fig. 17 Distribution of Inconvenience Perception based on Weather Adjustment

Time of Day Preference and Efficient Commute Interest

Chi-square test results - chi2-statistic: 23.983134920634917, p-value: 2.5183319337396593e-05

The p-value is less than 0.05, suggesting a statistically significant association.

The Chi-square test results, a chi-square statistic of 23.98 and a p-value of 2.52e-05, establish a connection between commuters' interest in identifying the most efficient commute time and their preferences for commuting during the summer. This statistical significance strongly indicates that the choice of commuting time is intricately tied to commuters' aspirations for an optimised commute.

The analysis reveals that individuals interested in an efficient commute may exhibit certain time-of-day preferences, potentially aligning with their efforts to reduce perspiration and minimise waiting time. This implies that commuters who value efficiency may tailor their commute schedules based on their time-of-day preferences, providing insights into how commuters adapt to optimise their commuting experience.

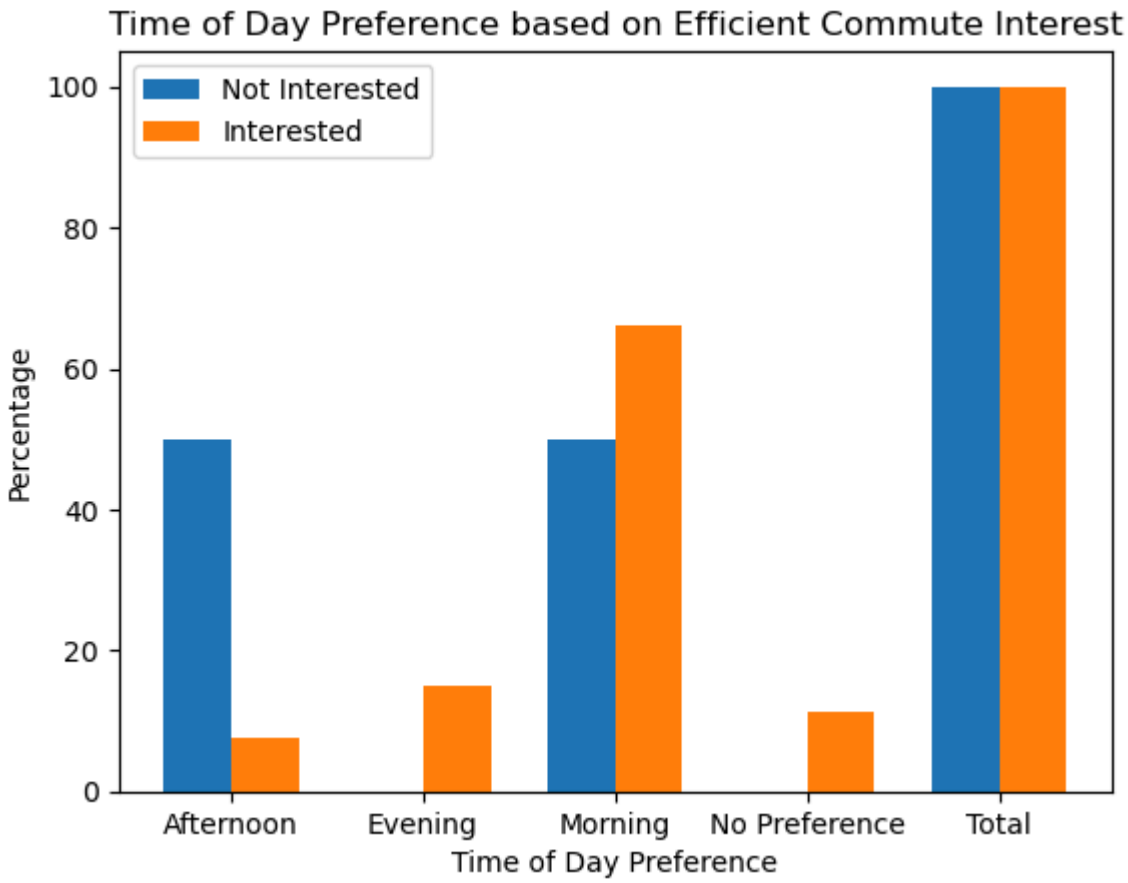

Fig. 18 Distribution of Time of Day Preference based on Efficient Commute Interest

Conclusions

- Chi-square tests uncover intricate dynamics in commuting choices
- Commute Frequency strongly tied to Comfort Level, guiding travel pattern adjustments
- Transportation Mode Choices crucial; reported Comfort Levels in focus for summer commutes
- Commuters sync schedule adjustments with extreme weather, aligning with preferred times
- Weather Adjustment correlates robustly with Inconvenience Perception, influencing schedule adaptation

- Interest in efficient commute time mirrors time-of-day preferences, emphasising optimization

- Despite mixed results, collective findings highlight the multifaceted nature of commuter choices

- Valuable insights for nuanced transportation planning: prioritise comfort, consider weather, and tailor strategies for optimization.

Recommendations

- Select Commute Frequency Mindfully - Be conscious of how often you choose to commute, considering the demonstrated link with comfort levels. Adjust your commuting frequency to align with your comfort preferences, aiming for a balance that enhances your overall commuting experience.

- Explore Alternative Transportation Modes - Given the strong correlation between transportation mode choices and reported comfort levels, consider experimenting with different modes of transportation. Explore options that provide a more comfortable and enjoyable journey, taking into account factors like seating, ventilation, and overall convenience.

- Time-of-Day Adjustments - Utilising the insights from the 8th test to inform your time-of-day preferences for commuting. If certain times are associated with higher comfort levels, adapt your schedule to align with those periods, potentially reducing stress and enhancing your overall commuting satisfaction.

- Inconvenience Mitigation Practices - Integrate inconvenience management practices into your commute. Carry weather-appropriate accessories, plan for extra time during adverse conditions, and adopt habits that reduce stress during boarding and disembarking, contributing to a more comfortable journey.

- Weather-Responsive Commuting - Tailor your commute plans based on weather conditions, acknowledging the impact on comfort levels. Plan ahead by checking weather forecasts and adjusting your clothing or travel times to minimise discomfort during adverse weather.