Journal of Research in Social Sciences (JRSS)
ISSN: 2306-112X(E);2305-6533 (P)

Vol. 13, No.01, Jan 2025
JRSS, pp 24--42

Pandemic-Induced changes in Travel Behaviour: Insights of Pandemic's Lasting impacts on Lahore's Urban Mobility

Dr Hina Saleemi[1] Muhammad Momin Amer[2]Dr. Saadia Tabassum[3]Dr. Sadia Ismail[4]

Article History:

Received:
November 25, 2024
Accepted:
December 31, 2024,
Published:
January 12, 2025

Funding:
This research received no specific grant from any Public, Commercial or not for profit sectors

Abstract

The COVID-19 epidemic spread globally in early 2020 and created an abrupt change in human life. This research shows how this pandemic transformed travel patterns in Lahore, Pakistan. It analyses the surveys conducted to understand people's travel behaviours before, during, and after the pandemic's peak. Factor analysis has determined seven latent variables. The results show a significant change in the travel patterns of individuals. During the pandemic, the use of public transportation fell drastically, this decline persisted longer. As a result, personal car usage was increased. In addition, there was a decline in carpooling and social visits following a subsequent partial recovery. Moreover, the pandemic pushed people towards online shopping and remote working. The research indicates that the adoption of remote-work and virtual communication eventually become standard practices impacting the urban living.

Keywords*:* Travel behaviour, COVID-19 impacts, Urban mobility, Sustainable transportation, Pandemic impacts.

Introduction

The COVID-19 epidemic, beginning globally in early 2020, drastically altered many aspects of human life, particularly their travel patterns using multiple transportation systems. This research analyzes the pandemic's ongoing impact on users' travel patterns in the city of Lahore, Pakistan. This study focuses on the commuters' preferences of using public transportation and change in travel patterns during the pandemic. The objective is to understand the long-term modifications in urban mobility that are affected by some factors e.g. remote working and online shopping.

Lahore has several transportation systems which includes bus rapid transit system, speedo buses and orange line metro train system along with a number of private vehicles on road. The city

[1] Assistant Professor
Department of Transportation Engineering and Management
University of Engineering and Technology
hinasaleemi@uet.edu.pk
[2] Transportation Engineer
Sheher Saaz Pvt. Limited
Muhammad.momin.amer@gmail.com
[3] Assistant Professor
Department of Transportation Engineering and Management
University of Engineering and Technology
saadia@uet.edu.pk
[4] Assistant Professor
Geological Engineering Department
University of Engineering and Technology
sadiaismail@uet.edu.pk

has experienced significant changes in users' travel patterns during the pandemic years. Before pandemic (pre-pandemic) transportation system in Lahore was defined by active streets having various transportation modes throughout the city. The pandemic years brought the lock-downs and restriction of travelling both by public and private transportation modes directing people towards remote works and online activities. Knowing the long-term impacts of COVID-19 pandemic on travel patterns it is important to address the future challenges within the realm of transportation.

The existing body of research on transportation during the COVID-19 pandemic primarily focuses on short-term disruptions in mobility patterns, particularly during the peak lockdown phases. However, there is a noticeable lack of studies that systematically examine the long-term impacts of the pandemic on travel behavior, specifically in the context of developing countries like Pakistan. While much attention has been paid to advanced transportation systems in developed nations, the unique challenges and adaptations of cities like Lahore, with its hybrid public and private transportation modes, remain unexplored.

The COVID-19 pandemic has significantly influenced travel mode choices worldwide, prompting numerous studies to investigate these behavioral shifts. For instance, a study in China explored how the pandemic impacted individuals' travel mode choices and car purchase intentions, revealing substantial changes in travel activities due to COVID-19 (Luan et. al, 2021). Similarly, research in Dalian analyzed commuters' mode choice behavior during the pandemic, utilizing stated preference data to understand the factors influencing these decisions (Bhattarai et. al, 2024). In the United States, a panel study examined the lasting effects of COVID-19 on travel behavior, including telecommuting, mode choice, online shopping, and air travel, highlighting significant observed and expected changes in habits and preferences (Javadinasr et. al, 2021). Additionally, a comparative study between Italy and Sweden assessed changes in mobility choices during the first phase of the pandemic, focusing on the sustainability level of modal choices under different containment policies (Giubergia et. al, 2023). These studies collectively provide valuable insights into the global impact of the pandemic on travel behavior, emphasizing the need for adaptive urban mobility strategies.

Unlike many studies centered around developed nations, this research investigates the interaction between Lahore's distinct transportation systems such as the rapid bus transit system, speedo buses, and the orange line metro train along with private vehicle use in a post-pandemic duration. By examining commuters' preferences and the sustained effects of pandemic related changes like remote working and online shopping, this study fills the gap in understanding whether these shifts represent permanent modifications or temporary disruptions. This research explicitly compares travel patterns across three distinct phases: pre-pandemic, pandemic peak, and post-pandemic. This temporary separation allows for a refined understanding of the evolution in commuters' behavior and the continuity or reversal of observed changes.

The study's social significance lies in its perception of how the COVID-19 pandemic altered travel behavior with long-term implications for public health, urban planning, and sustainability. It focuses on shifts to remote work, homeschooling, and reduced public transport use which guides policymakers in adapting transportation systems for future crises. The study emphasizes the connection between public health and transportation, depicting the measures to restore confidence in public transport. Additionally, the reductions in traffic and environmental benefits suggest that pandemic-driven changes could contribute to more sustainable urban living systems.

By addressing these gaps, the study not only contributes to theoretical knowledge but also provides actionable vision for urban planners and policymakers to accommodate transportation systems to future challenges in cities similar to Lahore.

2. Literature Review

The worldwide happening of the COVID-19 pandemic during the year 2019 has deeply affected the travel behaviour of people which forces them to change their travel preferences. These changes have occurred due to the restrictions by the government, economic instability, technological roles,

social and mental pressure. The researchers based on their studies have revealed a strong impact of this pandemic on travelers while opting their choice of travelling.

Hall et. al. (2020) show a strong relationship between tourism and environmental sustainability within any particular region. In continuation to this many studies have also revealed economic losses in tourism during such pandemics and revealed that such communities required efforts to recover such losses by introducing some specific policies (Ferretti, 2023; Nicola et al, 2020; Lee, 2003). Furthermore, Smith (2006) found out that travel advisories and health regulations also influenced tourism demand and traveller behaviour during pandemics.

Moreover, studies have also discovered some government policies and restrictions that had impacted the socioeconomic aspects of people (Nicola et al, 2020). Some studies have found out that travel restrictions had drastically reduced the international travel to control the spread of the such disease (Chinazzi et al, 2019; Grépin et al., 2023). Throughout the world the environmental impact of pandemic has been notable, a study highlighted the reduction in CO_2 emissions due to decreased human activity during such times (Quere et al, 2020). Many studies showed positive effects on wildlife and ecosystems due to reduced human disturbances (Behera, 2022; Thapa & Diedrich, 2023).

Molloy et al. (2021) highlighted the changes in travel behaviour where people shifts towards remote work and virtual communication was noted, reducing the need for traditional commuting. In addition, researchers revealed an increase in the use of private vehicles based on safety concerns (Du et al., 2024; Audi et al., 2021). The study of Dabadi and Nagarkoti (2021) supports another finding that discovers the increase in domestic travels due to closure of international borders.

Some psychological factors including health fear, life risks and safety concerns have also affected the travel decisions of people (Prideaux, 2020; Borbon & Pulhin, 2023). Rapid advancements in the technologies discouraged the people for business or work travel. Therefore, people relied on telecommunication and virtual working which eventually have benefited the environment. Studies have alsi demonstrated the environmental benefits of telecommuting and virtual conferences (Tussyadiah & Pesonen, 2016;Alanzi & Ratten, 2023; Zhang et al., 2021) .

The literature tells that during the pandemic the main services were continued by keeping the cleaning protocols and contact less payment systems in order to facilitate the people (Brodeur, 2021; Paul, 2022). Moreover, contact less and online shopping had a great impact on travel patterns during this time of restrictions (Gao et al., 2023; Chen & Bashir, 2022).

Socioeconomic factors (age, income, education) had more impact on peoples' behavior while travelling. Nicola et al. (2022) found that aged people showed more caution while travelling and young people were more flexible towards the technology. Moreover, Molloy et al. (2021) showed that people with higher income were more flexible for using private vehicles compared to low income class. Urban residents experienced more significant changes in travel patterns compared to rural dwellers.

The COVID-19 pandemic has importantly influenced travel behavior, with notable variations with in developing countries. Recent studies have highlighted shifts in mode choice behavior, especially in densely populated urban centers where public transport systems faced interruption due to health concerns and lockdown scenarios (Abdullah et al., 2021; Shaheen & et al., 2022). In the context of Pakistan, many researches have examined these dynamics, revealing a noticeable increase in private vehicle usage and a decline in public transport usage due to safety concerns and reduced operational capacities (Iqbal et al., 2023; Khan et al., 2023). Lahore, a major metropolitan city, provides a unique example study where socio-economic factors, informal transport systems, and infrastructure limitations shaped mobility patterns during the pandemic. Insights from these studies emphasize the need to explore adaptive strategies, such as promoting active transport and integrating technology to improve urban mobility resilience in similar developing countries. The findings also emphasize the importance of policy making to address the lasting impacts of the pandemic on travel patterns in Lahore and beyond.

3. Research Methodology

An extended questionnaire survey was conducted to collect data on the pandemic's impact on travel patterns focusing on both public and private transportation. Based on the requirements, the study area was selected. Furthermore, secondary data was collected from the Punjab Mass-Transit Authority (PMA) which was also used in the analyses. The ridership data from PMA (Orange Line Metro Rail (OLMT), Bus Rapid Transit (BRT), and Speedo Bus services) provided a strong foundation for analysis.The questionnaire was designed comprehensively focusing on the changes in travel patterns, their causing factors, and individuals' prospective regarding these changes. The questionnaire was based on the demographic data, travel patterns of three scenarios; pre-pandemic, during-pandemic, and post-pandemic and long-term affects in travel patterns. Surveys were distributed both online and in-person to ensure diverse and accurate results.In total 602 responses were obtained through both online as well as in person surveying.

Descriptive statistics and factor analysis were selected to identify the related factors influencing the travel patterns. The methodology guarantee an extensive perspective of the affects of pandemic on travel patterns in the Lahore city.

4. Data Collection

This study has collected a detailed data about the changes in travel patterns based on three scenarios of COVID 19 pandemic; before i.e. pre-pandemic (September 2018 to February 2020) , during (March 2020 to August 2021), and after i.e. post pandemic (September 2021 till today). The survey questionnaire was designed based on the analysis of PMA data of Lahore's public transportation. Cochran's formula was used to calculate the sample size. Based on the formula and city's population the calculated sample size was 384 which was raised to 602. The responses have received through a combination of in-person visits to offices, universities, and public transportation hubs, as well as online forms. The survey covers the socioeconomic factors including age, education, marital status, employment, and income. It also gets the information regarding transportation modes used by respondents, frequency of public transportation usage and changes in travel patterns based on the three mentioned scenarios. The questionnaire has also covered the information about the long-term changes in travel patterns that continued after pandemic was over e.g: mode shift, carpooling, remote working, online shopping, and sustainable transportation practices. The collected data was analyzed to come across the main factors that plays an important role affecting the travel behaviors.

5. Results and Discussions

5.1 Descriptive Statistics

5.1.1 Public Transport Ridership

Data from PMA revealed significant changes in ridership during the pandemic times. In pre-pandemic situation a stable ridership with some increase in infrequent users has been observed. Whereas, during pandemic a substantial decline (60%) in BRT ridership is observed, while feeder routes witnessed a surprising drop in ridership during this time. The newly introduced OLMRTS had very low ridership as expected. Post-pandemic condition shows a gradual recovery in BRT ridership, though not reaching back to pre-pandemic levels. Feeder routes displayed a significant increase (41%) compared to pre-pandemic levels. OLMRTS ridership surged post-pandemic due to its launch during the pandemic.

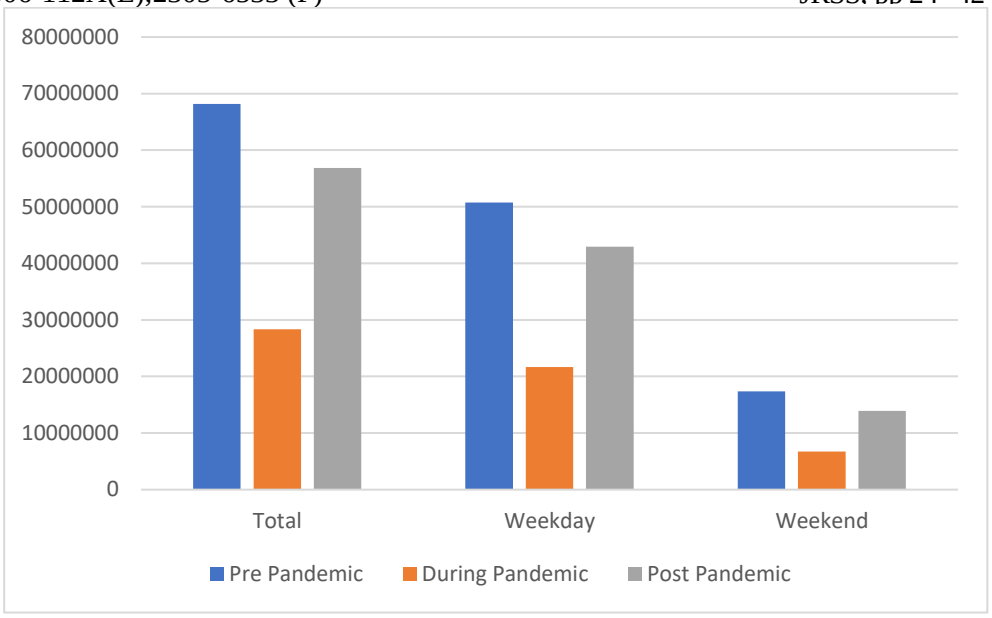

Figure 1: Metro Bus Passenger Ridership

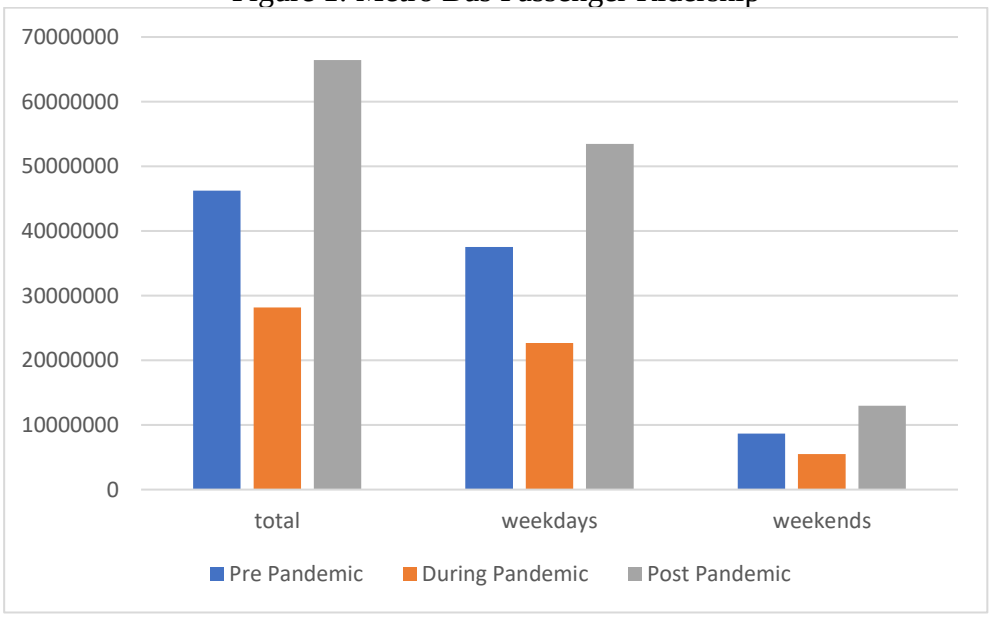

Figure 2: Feeder Route Passenger Ridership

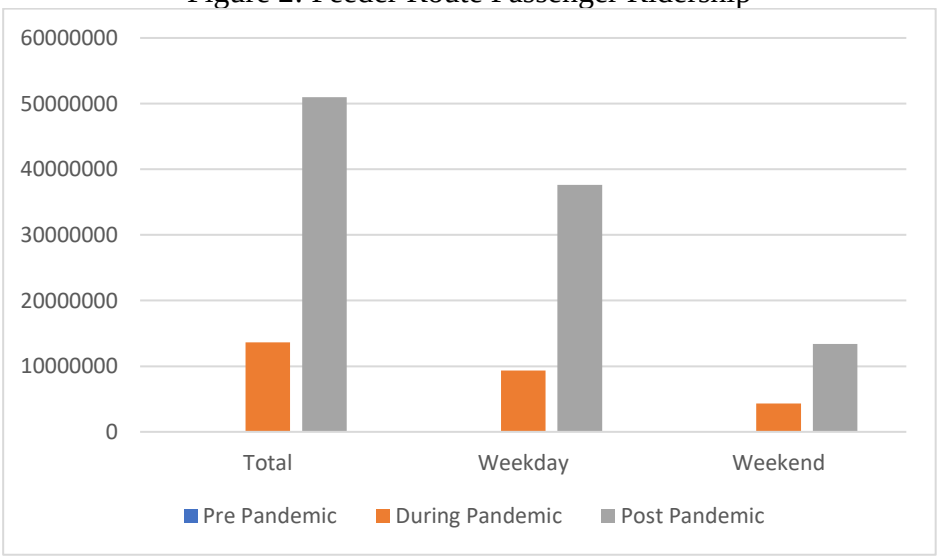

Figure 3: Orange Line Metro Rail Transit Passenger Ridership

5.1.2 Socio Economic Factors

A total of 602 participants completed the survey, representing a diverse demographic profile. The majority of respondents were young adults between 18-25 years (47%), followed by those aged between 25-50 years (30%). The remaining participants were divided between under 18 years (11%) and over 50 years (12%). The survey included a majority of male respondents (55%) and a substantial female participation (39%). A small proportion chose not to disclose their gender (6%).

Moreover, a high proportion of respondents were graduates (61%), followed by those with matriculation (18%). A minor portion reported having no formal education (6%). Nearly half of the respondents were unmarried (47%). The survey captured a diverse occupational background. Employed individuals constituted the largest group (47%), followed by students (41%) and unemployed individuals (12%). A further breakdown of job types showed that two-thirds of employed participants worked for a company (67%), while the remaining were self-employed (33%). Monthly income data displayed a range of earning capacities. With a high proportion of student participants (41%), 34% reported no income. The remaining income brackets included 45k-100k rupees (28%), less than 45k rupees (23%), and over 100k rupees (15%).

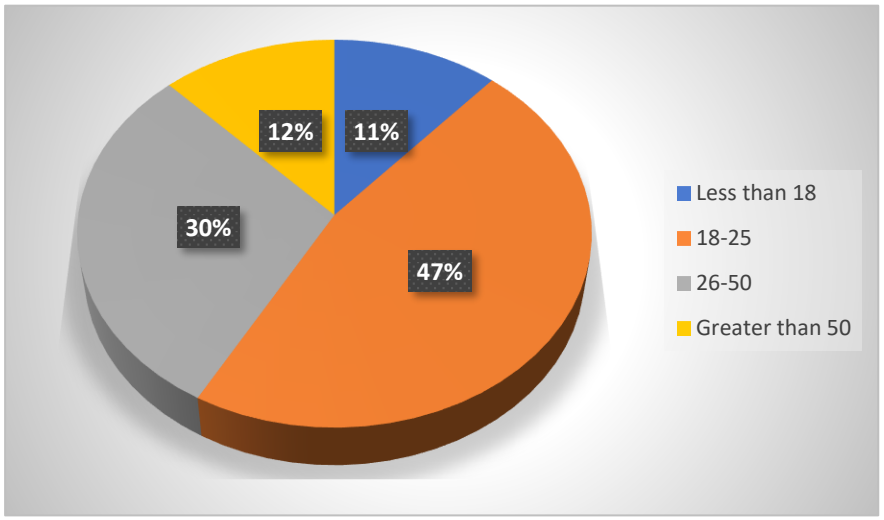

Figure 4: Age Category

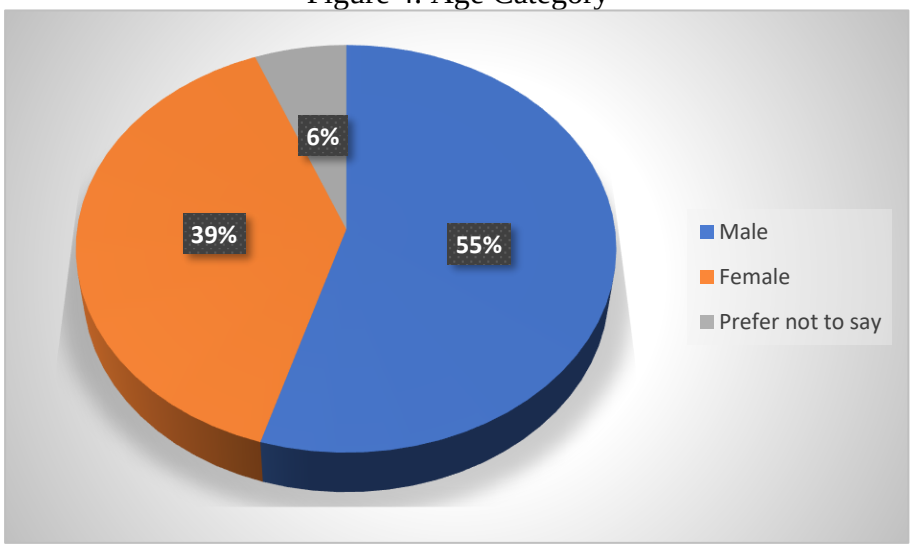

Figure 5: Gender

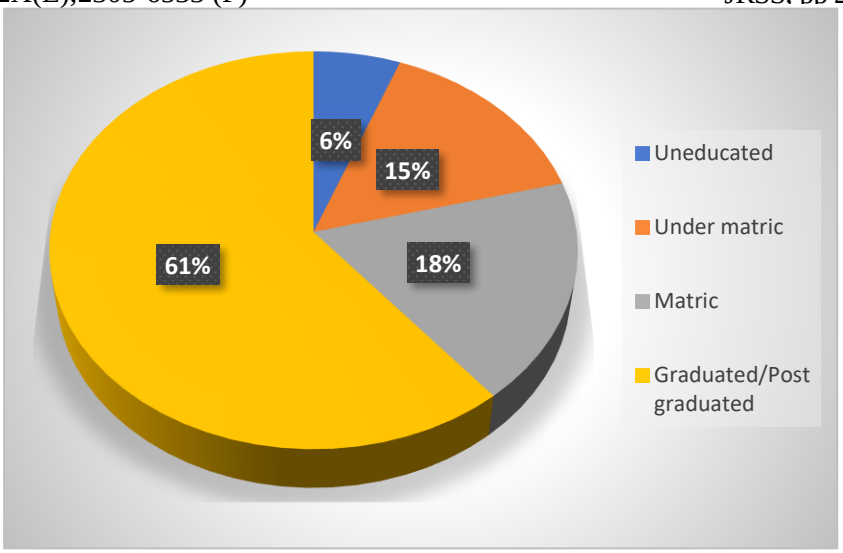

Figure 6: Level of Education

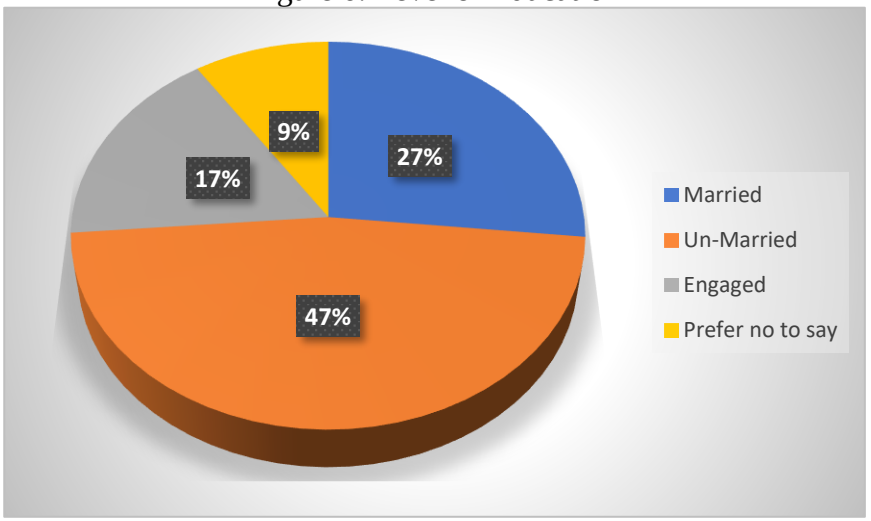

Figure 7: Martial Status

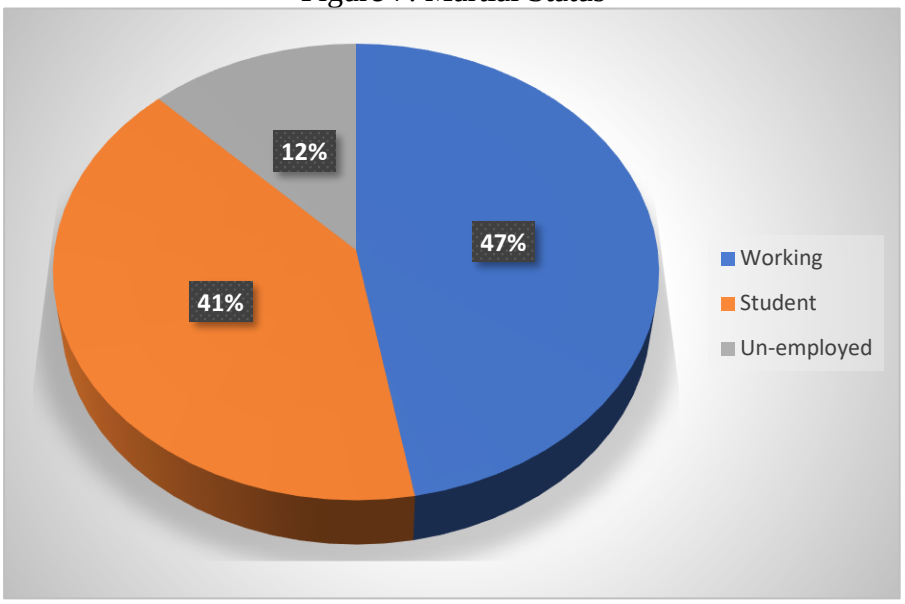

Figure 8: Employment Status

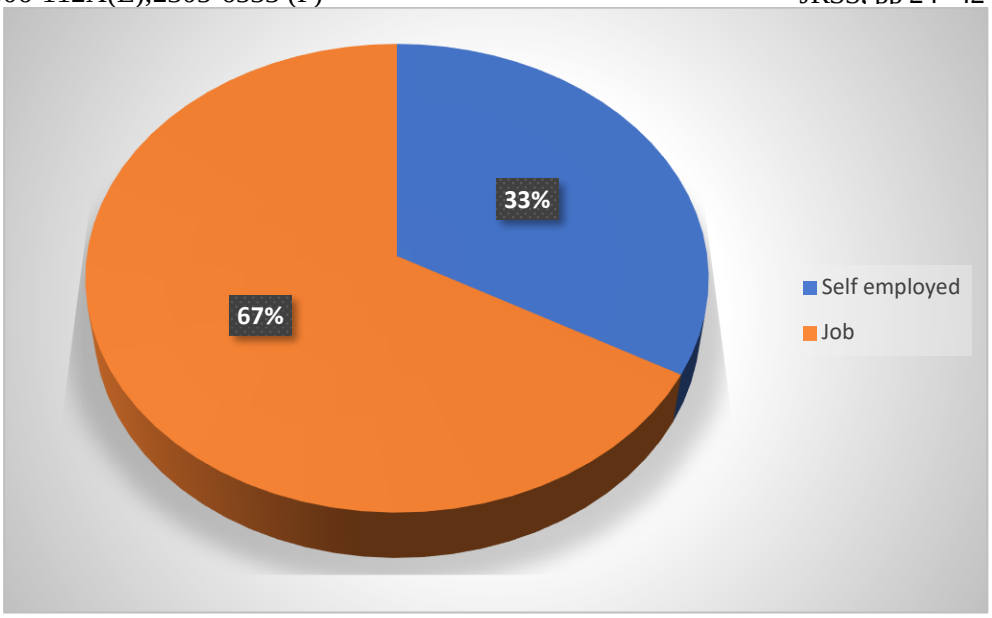

Figure 9: Working Status

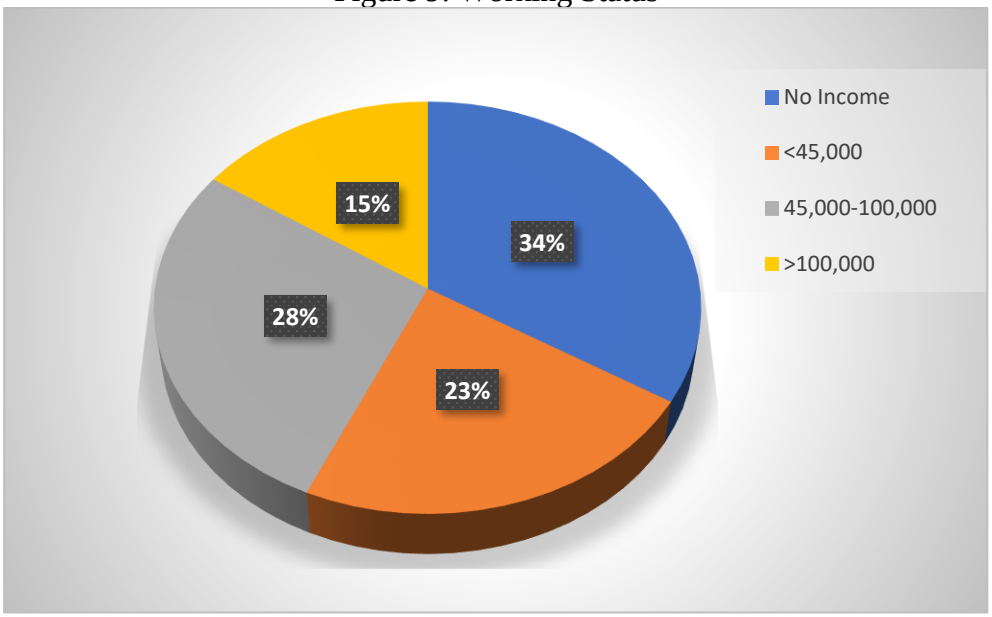

Figure 10: Monthly Income Level

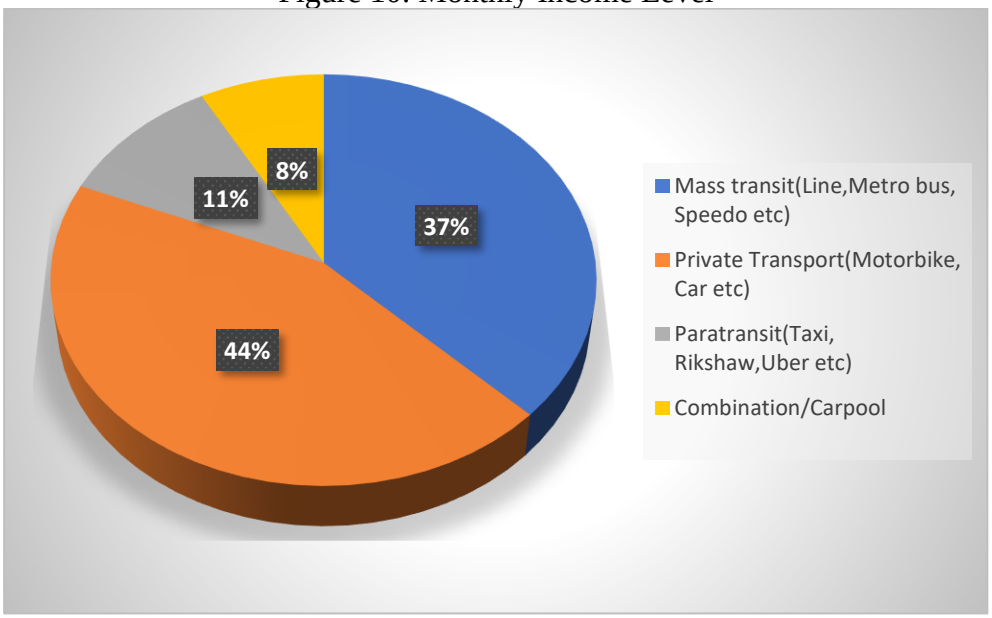

Figure 11: Mode of Transport

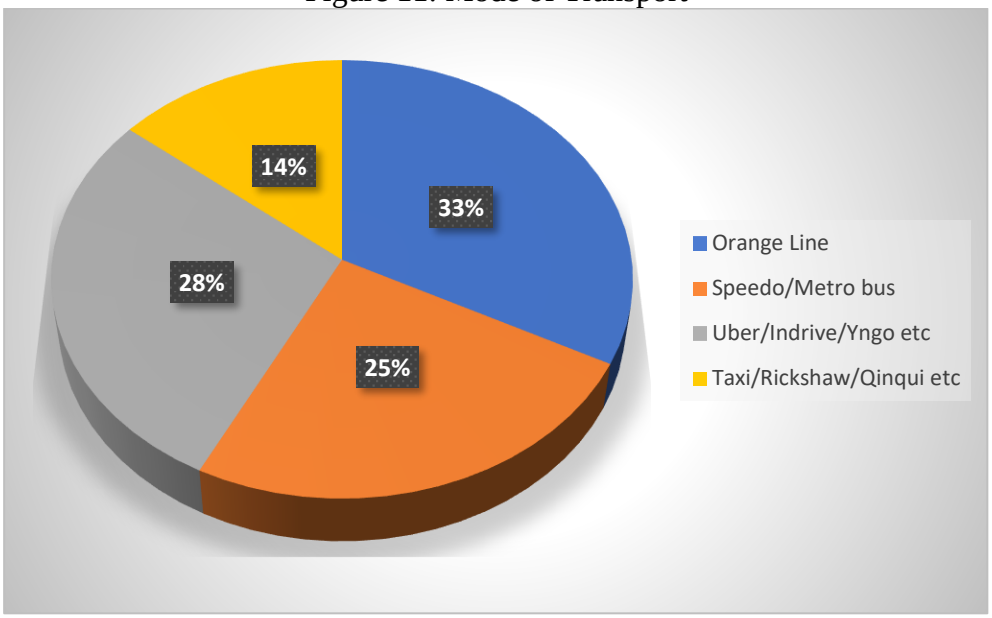

Figure 12: Mode of Public Transport

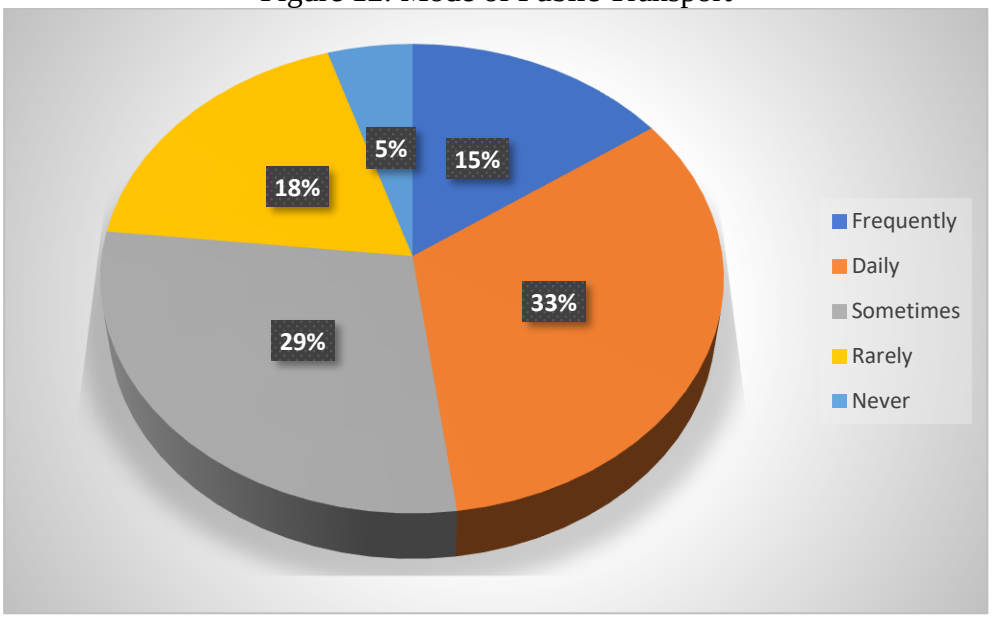

Figure 13: Frequency of Use of Public Transport

5.1.3 Travel Behaviour Comparisons (Pre-Pandemic, During-Pandemic & Post-Pandemic)

Before the pandemic, many people used cars infrequently, walked or cycled often, rarely carpooled, and seldom used ride-share services. During the pandemic, there was an increase in car use among those who rarely drove, a drop in walking and cycling, more carpooling among infrequent users, and a shift toward ride-shares by occasional users. Remote working and schooling became common, with many adopting regular schedules, while short leisure trips and public transport use decreased. After the pandemic, there is a partial return to previous habits; more people are walking, cycling, using cars, ride-shares, and carpooling again, but not as much as before. Visiting friends and family and taking leisure trips have also started to increase but have not fully recovered.

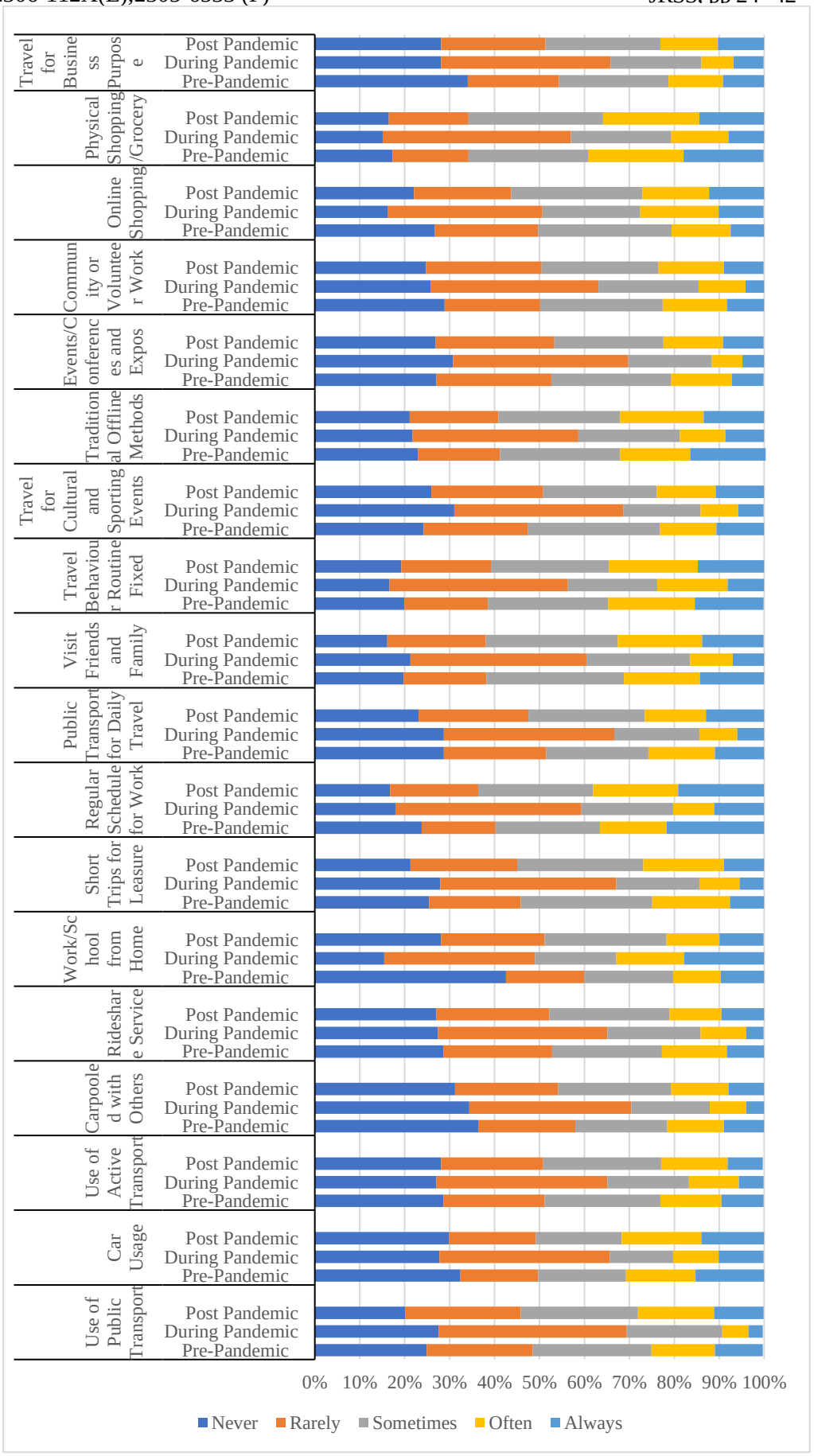

Figure 14: Travel Behaviour Comparison

5.1.4 Long Term Travel Patterns

The survey explored how people think the pandemic will affect long-term travel habits, revealing mixed opinions. For personal car use, 22% doubt it will increase, while 25% believe it will become common, with 31% undecided. A large portion (44%) does not expect a shift to homeschooling, but 24% think it might grow. When it comes to permanent changes in daily travel, 40% are sceptical, 33% think it's likely, and 27% are neutral. For carpooling, 34% are neutral, 24% foresee an increase, and only 16% disagree. Opinions on remote work are varied, with 22% agree, 21% disagree, and 31% are neutral. Sustainable transport, shared mobility services, and remote jobs show similar divisions, with many neutral but some agreeing or disagreeing with the concept. Moving to work closer to home and changes in shopping patterns also brought a mix of opinions, with roughly equal support for and against these shifts and a sizable neutral group in each case.

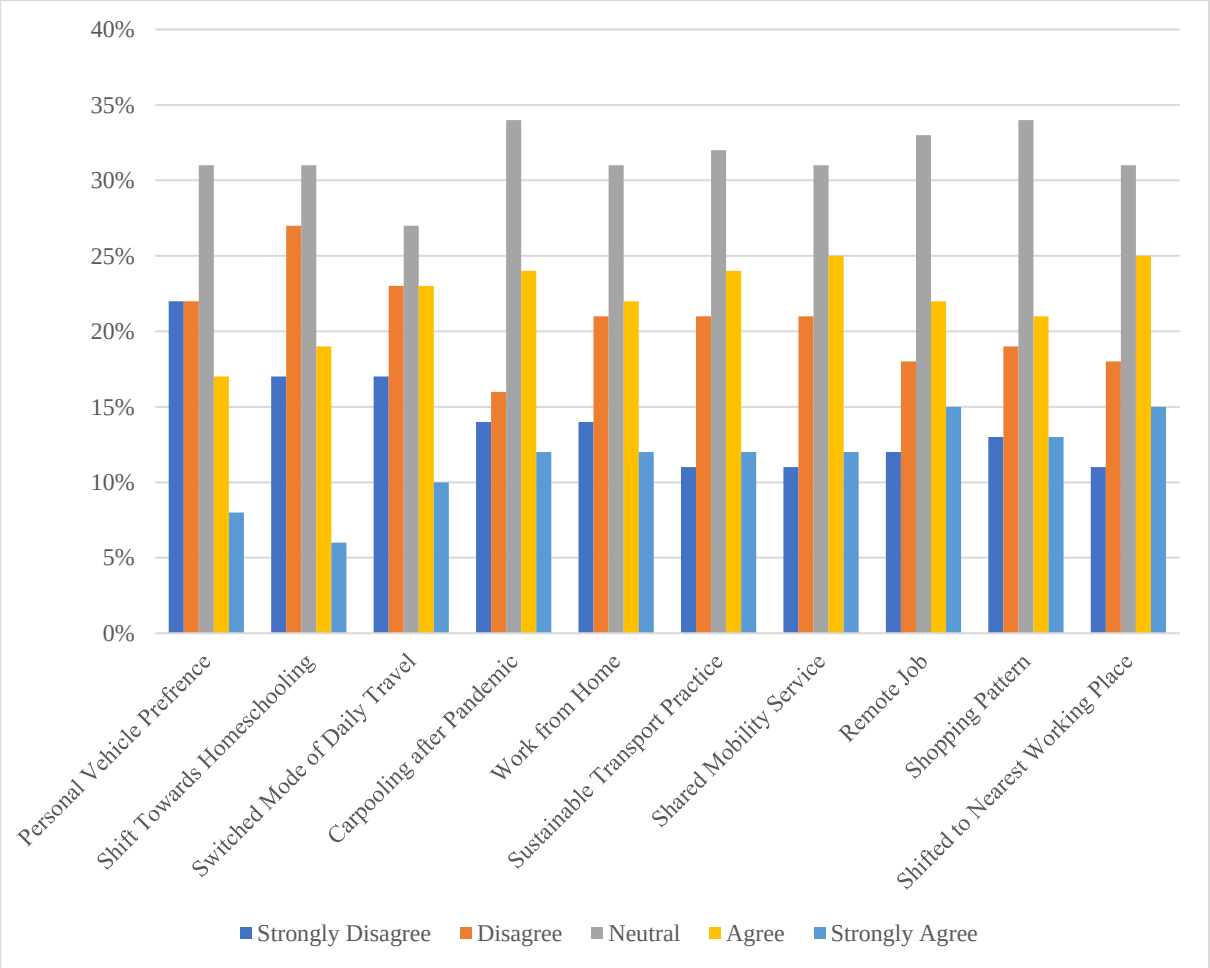

Figure 15: Long Term Travel Behaviour

5.2 Factor Analysis

This study investigated the long-term impacts of the COVID-19 pandemic on travel patterns in Lahore, Pakistan. Factor analysis was employed to identify underlying factors influencing respondents' perceptions and decision making regarding travel before, during, and after the pandemic.

5.2.1 Methodology

Principal factor analysis with varimax rotation was conducted on 70 variables representing travel behaviors. A cut-off of 0.5 was used for factor loading to identify significant associations between variables and latent factors. Table 1 shows the observed variables with their factor loading.

Table 1: Factor Loading in Latent Variables

Observed Variables	Latent Variables						
	1	2	3	4	5	6	7
Regular Schedule for Work/School Travel (Pre-Pandemic)	0.613						
Fixed Travel Behaviour (Pre-Pandemic)	0.564						
Traditional Offline Work/Study Methods (Pre-Pandemic)	0.658						
Physical Shopping/Grocery (Pre-Pandemic)	0.666						
Regular Schedule for Work/School Travel (Post-Pandemic)	0.723						
Fixed Travel Behaviour (Post-Pandemic)	0.662						
Traditional Offline Work/Study Methods (Post-Pandemic)	0.700						
Physical Shopping/Grocery (Post-Pandemic)	0.703						
Short Trips for Leisure (Dur-Pandemic).		0.551					
Travel for Cultural/Sporting Events (Dur-Pandemic)		0.706					
Traditional Offline Work/Study Methods (Dur-Pandemic)		0.588					
Attended Events/Conferences/Expos (Dur-Pandemic)		0.700					
Involvement in Community/Volunteer Work (Dur-Pandemic)		0.641					
Physical Shopping/Grocery (Dur-Pandemic)		0.544					
Travel for Business Purposes (Dur-Pandemic)		0.571					

Permanently Changed Personal Vehicle Use Preference			0.554				
Permanently Shifted from Traditional Schooling to Home Schooling			0.551				
Permanently Switched mode of Daily Travel			0.555				
Carpooling/Drop-off as a Permanent Preference			0.530				
Change from Traditional (Office Only) to Hybrid (Office + Work from Home)			0.567				
Travel only, when Necessary, as a Long-Term Habit			0.544				
Shared Mobility Services as a Long-Term Preference			0.569				
Permanent Change in Work Mode to a Remote Job (IT, Free-Lancing).			0.625				
Permanent Change in Shopping Pattern from Physical to Digital (Online Shopping)			0.551				
Permanently Shuffled/Transferred to nearest working place from Residence			0.577				
Carpooling (Ridesharing) with others for Travel (Pre-Pandemic)				0.700			
Using Taxis/Ride-Share Services (Pre-Pandemic)				0.688			
Carpooling (Ridesharing) with others for Travel (Dur-Pandemic)				0.658			
Using Taxis/Ride-Share Services (Dur-Pandemic)				0.612			
Carpooling (Ridesharing) with others for Travel (Post-Pandemic)				0.763			
Using Taxis/Ride-Share Services (Post-Pandemic)				0.661			
Travel for Cultural/Sporting Events (Pre-Pandemic)					0.613		

Attended Events/Conferences/Expos (Pre-Pandemic)					0.689		
Involvement in Community/Volunteer Work (Pre-Pandemic)					0.692		
Travel for Business Purposes (Pre-Pandemic)					0.568		
Travelled to Work/School by Car (Pre-Pandemic)						0.782	
Travelled to Work/School by Car (Dur-Pandemic)						0.795	
Travelled to Work/School by Car (Post-Pandemic)						0.821	
Travelled to visit Friends/Family (Pre-Pandemic)							0.577
Travelled to visit Friends/Family (Dur-Pandemic)							0.680
Travelled to visit Friends/Family (Post-Pandemic)							0.557

5.2.2 Results and Discussions

The study identified seven latent variables (Table 2) that explain major changes in travel patterns. First, latent variable 'non-pandemic travel patterns (work)' is associated with nine observed variables included regular work commutes, fixed routines, and physical shopping etc. Second variable 'during pandemic travel pattern (work + recreational)' is related with seven observed variables including work and leisure travel, such as short trips, events, shopping, and business activities. Third latent variable 'long term pandemic effects in travel patterns (work and recreational)' covers ten observed variables including personal vehicle use, homeschooling, hybrid work, and sustainable transport. Fourth variable 'ride sharing travel patterns (pre, during and post pandemic)' is associated with six observed variables showing the ride-sharing habits were mostly remained unchanged with a slight drop during restrictions. Fifth variable 'non-pandemic travel patterns (Recreational)' included four observed variables covering activities like events and business trips. Sixth latent variable 'affected private vehicle use (pre, during and post pandemic)' enclosed three variables showing decrease in car use during the pandemic but has slightly returned. Lastly, the seventh latent variable 'affected friends/family meetups (pre, during and post pandemic)' associated with three observed variables showing that visits to friends and family dropped during the pandemic but have partially recovered.

Before the pandemic, people's travel habits were permanent in their daily routines, such as commuting to work and going out for shopping in person. However, during the pandemic, many shifted to online systems for work and education. The data also indicates that a large number of people preferred remote jobs during this duration, a trend that has continued in the long term. After the pandemic, carpooling services gained popularity and remained a preferred option for many users. Additionally, the use of private vehicles increased during the pandemic, mainly due to restrictions limiting public transportation availability. Overall, the findings highlight that the pandemic significantly altered travel behaviors, causing both temporary adjustments and lasting

changes, such as the rise of remote work, a growing interest in sustainable transport options, and a shift toward online shopping.The findings reveal significant impacts of the COVID-19 pandemic on travel patterns. The pandemic triggered short-term adaptations in travel behaviors and led to long-term changes, including a potential rise in remote work, increased adoption of sustainable transportation practices, and a shift towards online shopping.

The rise in trend of remote work and online shopping needs the policies that reduce traffic congestion and support digital infrastructure while encouraging sustainable urban development where urban planners could transform parking areas into recreational or green spaces. To address the long-term shift towards personal vehicle usage, there is need to promote electric vehicles, carpooling, and congestion pricing. Public transportation must prioritize hygiene to rebuild the trust of commuters, whereas, ride-sharing services need to adapt policies ensuring affordability, safety, and reliability. Policymakers should support sustainable practices like shared mobility and hybrid models through subsidies, campaigns, and infrastructure upgradation. The trend toward shorter commutes and localized work spaces underscores the need for mixed-use developments that foster community interactions and reduce travel demand. Moreover, evolving recreational travel patterns highlight the need for safe and accessible community spaces alongside hybrid event formats. By implementing these strategies, decision-makers can create urban mobility systems that are resilient, comprehensive, and sustainable for the post-pandemic future. The study also highlights the need for further research to explore the long-term implications of these changes on urban planning, transportation infrastructure, and social interactions. This study highlights the need for further research to explore the long-term implications of these changes on urban planning, transportation infrastructure, and social interactions.

Table 2: Latent and Observed Variables

Latent Variable	**Observed Variable**	**Factor Loading**	**Cronbach's Alpha**
Non-Pandemic Travel Pattern (Work)	Regular Schedule for work (Pre)	0.613	0.847
	Routine/Fixed Travel Behaviour (Pre)	0.564	
	Traditional Offline method for work (Pre)	0.658	
	Physical Shopping/Grocery (Pre)	0.666	
	Regular Schedule for work (Post)	0.723	
	Routine/Fixed Travel Behaviour (Post)	0.662	
	Traditional Offline method for work (Post)	0.700	
	Physical Shopping/Grocery (Post)	0.703	
During Pandemic Travel Pattern (Work + Recreational)	Leisure	0.551	0.788
	Culture/Sports event	0.706	
	Traditional offline method	0.588	
	Events, expos	0.700	
	Community work	0.641	
	Physical shopping	0.544	

	Business Purpose	0.571	
Long Term Pandemic Effects in Travel Patterns (Work + Recreational)	Personal vehicle preference Traditional to home schooling Switch mode of daily travel Car polling after pandemic Traditional to hybrid Sustainable transport practice Shared Mobility Service Remote jobs Online Shopping Shuffled to nearest working place	0.554 0.551 0.555 0.530 0.567 0.544 0.569 0.625 0.551 0.577	0.765
Ride Sharing Travel Patterns (Pre, During and Post Pandemic)	Car pooled (Pre) Taxi Use (Pre) Carpooled (During) Taxi Use (During) Car pooled (Post) Taxi Use (Post)	0.700 0.688 0.658 0.612 0.763 0.661	0.808
Non-Pandemic Travel Patterns (Recreational)	Culture, sports (Pre) Events, conferences (Pre) Community Work (Pre) Business Purpose (Pre)	0.613 0.689 0.692 0.568	0.740
Affected Private Vehicle Use (Pre, During and Post Pandemic)	Work/ School by car (Pre) Work/ School by car (During) Work/ School by car (Post)	0.782 0.795 0.821	.818
Affected Friends/Family Meetups (Pre, During and Post Pandemic)	Visit to friend and family (Pre) Visit to friend and family (During) Visit to friend and family (Post)	0.577 0.680 0.557	0.739

6. Conclusions and Recommendations

In the city of Lahore, the impact of COVID -19 had significantly changed the travel behaviour of people. The restriction by the authorities and safety concerns by the people had decreased the use of public transportation, as 60% of people stopped using the BRT and 40% stopped using the feeder routes during this time. In comparison to this 41% of individuals revived their use of feeder routes, indicating the post pandemic time which shows their return to public transport. There was also a decrease in the use of personal vehicle as 37% of respondents adopted the shared services and 34% had shifted to remote working which shows the reduction in traffic congestion and improvement in air quality supporting the environmental benefits.

Descriptive statistics and factor analysis discovered important trends in travel patterns. Results show that 47% of respondents were of the age between 18-25 years including 55% of male, indicating a young and predominantly male respondents. Moreover, 25% of respondents shifted to homeschooling, while 34% have adopted the choice of online shopping. As well as, 37% of respondents shifted to remote jobs showing quite a flexibility towards such working options.

The results show that most of the people shifted to online methods of working, schooling and shopping during the COVID-19 showing a drastic decrease in their travels. Analysis also shows that long-term impacts include the adaptability of remote working, carpooling and private vehicle usage. This shift has shown the choices of people during such times which eventually guides the policy makers and urban planners to focus on peoples' choice for future work.

To address these behaviors authorities involvement are necessary to restore public confidence in transportation during such unexpected times. This could be done by adopting some measures including sensitization protocols, ventilation systems, increased service frequency, and options of active mobility during unforeseen situations. Observing and evaluating the effectiveness of these measures based on continuous data collection and analysis can help to address the future challenges in urban mobility.

This study mark the connection between public health and transportation system which recommends the future urban and transportation planning based on these dynamics. The significant trends in travel patterns based on pandemic situations provide guidelines for developing a strong transportation system that can resist future crises while promoting environmental sustainability and public well-being.

The study has several limitations, including a sample that was predominantly young and male, which may not represent the broader population. It focused only on Lahore, limiting the approach to other areas. The research lacked a detailed approach and relied only on self-reported data and have not incorporated qualitative insights. Additionally, external factors like economic shifts or policy changes were also not considered. Environmental benefits were noted but not supported by direct data, and the proposed measures for restoring public confidence in transportation were not assessed for practical effectiveness which is needed to have a detailed analysis for the betterment of developing countries.

7. References

Abdullah, M., Ali, N., Hussain, S. A., Aslam, A. B., & Javid, M. A. (2021). Measuring changes in travel behavior pattern due to COVID-19 in a developing country: A case study of Pakistan. Transportation Policy, 108, 21–33. https://doi.org/10.1016/j.tranpol.2021.04.023

Alanzi, S., & Ratten, V. (2023). The use of technology in facing the COVID-19 negative consequences and the associated opportunity for digital entrepreneurship in KSA. Journal of Trade Science, 11(2/3), 31–44. https://doi.org/10.1108/jts-06-2023-0002

Audi, N., et al. (2021). An audit of the impact of Covid-19 pandemic on the emotional wellbeing of children and parents with problematic severe asthma. Sushruta Journal of Health Policy and Opinions, 14(2), 1–19. https://doi.org/10.38192/14.2.3

Behera, A. K., Kumar, P. R., Priya, M. M., Ramesh, T., & Kalle, R. (2022). The impacts of COVID-19 lockdown on wildlife in Deccan Plateau, India. Science of the Total Environment, 822, 153268. https://doi.org/10.1016/j.scitotenv.2022.153268
Bhattarai, K., Zhao, S., Hou, D., & Joshi, M. (2024). Impact of Pandemic on Commuters' Mode Choice Behavior: A Case Study of Dalian City, China. Transportation Research Record, 2678(8), 979-991. https://doi.org/10.1177/03611981231223753
Borbon, N. M. D., & Pulhin, J. C. B. (2023). Public perception towards traveling: Pre and post COVID-19 tourists' behavior. International Journal of Research Studies in Management, 11(10). https://doi.org/10.5861/ijrsm.2023.1132
Brodeur, A., Clark, A. E., Fleche, S., & Powdthavee, N. (2021). COVID-19, lockdowns and well-being: Evidence from Google Trends. Journal of Public Economics, 193, 104346. https://doi.org/10.1016/j.jpubeco.2020.104346
Chen, M., & Bashir, R. (2022). Role of e-commerce and resource utilization for sustainable business development: Goal of economic recovery after Covid-19. Economic Change and Restructuring, 55(4), 2663–2685. https://doi.org/10.1007/s10644-022-09404-5
Chinazzi, M., et al. (2020). The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. Science, 368(6489), 395–400. https://doi.org/10.1126/science.aba9757
Dabadi, S., & Nagarkoti, A. (2021). Impact of COVID-19 on travelling behaviour of Nepalese domestic tourists. ASEAN Multidisciplinary Research Journal, 8(1), 83–99.
Du, B., et al. (2024). Impact of the COVID-19 pandemic on daily travel: Findings from New South Wales, Australia. Travel Behaviour and Society, 36. https://doi.org/10.1016/j.tbs.2024.100798
Gao, J., Siddik, A. B., Abbas, S. K., Hamayun, M., Masukujjaman, M., & Alam, S. S. (2023). Impact of e-commerce and digital marketing adoption on the financial and sustainability performance of MSMEs during the COVID-19 pandemic: An empirical study. Sustainability, 15(2), 1594. https://doi.org/10.3390/su15021594
Giubergia, D., Bin, E., & Diana, M. (2023). Changes in mobility choices during the first wave of the COVID-19 pandemic: A comparison between Italy and Sweden. arXiv. https://arxiv.org/abs/2303.07803
Grépin, K. A., Aston, J., & Burns, J. (2023). Effectiveness of international border control measures during the COVID-19 pandemic: A narrative synthesis of published systematic reviews. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 381(2257). https://doi.org/10.1098/rsta.2023.0134
Hall, C., Scott, D., & Gössling, S. (2020). Pandemics, transformations and tourism: Be careful what you wish for. Tourism Geographies, 22(4), 577–598. https://doi.org/10.1080/14616688.2020.1759131
Iqbal, R., Ullah, M. U., Habib, G., & Ullah, M. K. (2023). *Evaluating public and private transport of Lahore*. *Journal of World Science*, 2(1), 325–336.
Javadinasr, M., Magassy, T. B., Rahimi, E., Mohammadi, M. (Y.), Davatgari, A., Mohammadian, A. (K.), Salon, D., Bhagat-Conway, M. W., Chauhan, R. S., Pendyala, R. M., Derrible, S., & Khoeini, S. (2021). The enduring effects of COVID-19 on travel behavior in the United States: A panel study on observed and expected changes in telecommuting, mode choice, online shopping, and air travel. Retrieved from https://arxiv.org/abs/2109.07988
Khan, M. A., & Khan, M. F. (2023). Customers' satisfaction and intentions with public transportation in Faisalabad, Pakistan: Implications for a bus rapid transit service. *Transactions on Transport Sciences*, *14*(2), 123–134.
Lee, S. H. (2003). The SARS epidemic in Hong Kong. Journal of Epidemiology and Community Health, 57(9), 652–654. https://doi.org/10.1136/jech.57.9.652
Le Quéré, C., et al. (2020). Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nature Climate Change, 10(7), 647–653. https://doi.org/10.1038/s41558-020-0797-x

Luan, S., Yang, Q., Jiang, Z., & Wang, W. (2021). Exploring the impact of COVID-19 on individuals' travel mode choice in China. Transportation Policy, 106, 271–280. https://doi.org/10.1016/j.tranpol.2021.04.011
Milesi-Ferretti, G. M. (2023). The travel shock. IMF Economic Review, 71(1), 1–29. https://doi.org/10.1057/s41308-023-00224-9
Molloy, J., Schatzmann, T., Schoeman, B., Tchervenkov, C., Hintermann, B., & Axhausen, K. W. (2021). Observed impacts of the Covid-19 first wave on travel behaviour in Switzerland based on a large GPS panel. Transport Policy, 104, 43–51. https://doi.org/10.1016/j.tranpol.2021.01.009
Nicola, M., et al. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. International Journal of Surgery, 78, 185–193. https://doi.org/10.1016/j.ijsu.2020.04.018
Paul, T., Chakraborty, R., & Anwari, N. (2022). Impact of COVID-19 on daily travel behaviour: A literature review. Transport Safety and Environment, 4(2). https://doi.org/10.1093/tse/tdac013
Prideaux, B., Thompson, M., & Pabel, A. (2020). Lessons from COVID-19 can prepare global tourism for the economic transformation needed to combat climate change. Tourism Geographies, 22(4), 667–684. https://doi.org/10.1080/14616688.2020.1762117
Shaheen, S., Martin, E., Cohen, A., Broader, J., & Davis, R. (2022). Managing the curb: Understanding the impacts of on-demand mobility on public transit, micromobility, and pedestrians. Mineta Transportation Institute Publications. https://doi.org/10.31979/mti.2022.1904
Thapa, K., & Diedrich, A. (2023). Beyond conservation: Assessing broader development outcomes of protected areas in Nepal. Journal of Environmental Management, 339, 117890. https://doi.org/10.1016/j.jenvman.2023.117890
Tussyadiah, I. P., & Pesonen, J. (2016). Impacts of peer-to-peer accommodation use on travel patterns. Journal of Travel Research, 55(8), 1022–1040. https://doi.org/10.1177/0047287515608505
Wilder-Smith, A. (2006). The severe acute respiratory syndrome: Impact on travel and tourism. Travel Medicine and Infectious Disease, 4(2), 53–60. https://doi.org/10.1016/j.tmaid.2005.04.004
Zhang, J., Li, H., Lei, M., & Zhang, L. (2021). The impact of the COVID-19 outbreak on air quality in China: Evidence from a quasi-natural experiment. Journal of Cleaner Production, 296, 126475. https://doi.org/10.1016/j.jclepro.2021.126475