6th Conference on Sustainability in Civil Engineering (CSCE'24)
Department of Civil Engineering
Capital University of Science and Technology, Islamabad Pakistan

A Coss-Sectional Analysis of Sustainable Mobility for female university students in Karachi

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Abstract- Limited mobility restricts educational opportunities for female students in Karachi, Pakistan. This study investigates the various factors related to their travel patterns. Safety concerns regarding harassment on public transport and deserted streets are key deterrents. Data was collected through in-person questionnaire survey. It was found that the female students are from diverse backgrounds, which in turn affects their travel pattern and mode choice. This research found that public transport such as bus and chingchi are cost effective as well as sustainable and are also more utilized by female hostel students as compared to car and ride-hailing services. It is recommended that increasing the accessibility and safety of public transport services will not only improve female mobility but also help achieve sustainability.

Keywords- Cost, gender, mobility, public transport, student.

1 Introduction

Karachi's mobility pattern is dominated by cars and bikes, leading to traffic congestion. The public bus system, though present, is limited and often overcrowded. Many citizens are forced to rely on informal options like rickshaws due to a lack of better alternatives. Furthermore, the city lacks sufficient infrastructure for pedestrians and cyclists, making commuting difficult and unsafe for a significant portion of the population. This car-centric approach not only creates congestion but also exacerbates social and economic inequality by limiting mobility options for those who cannot afford private vehicles as indicated in a previous study [1].

There are two main categories of transport: active and inactive transport. Active transport uses your own energy to move, like walking, or cycling. Inactive transport relies on an external power source, like cars, bikes, buses, or trains. Active options offer health benefits, cost savings, and environmental advantages, while inactive modes can be convenient but contribute to traffic congestion and pollution as mentioned in the study conducted by Conor C.O. Reynoldsa et al. [2].

The limited mobility faced by female students in Karachi, Pakistan is a critical issue that motivates this research as indicated in the recent study [3]. Our aim is to analyze data to understand the everyday travel patterns of female students within Karachi and in their hometowns. By examining these patterns, we hope to identify the challenges they face, such as safety concerns on public transport, societal limitations, and economic constraints this is in alignment with previous study [4]. This knowledge will then be used to develop solutions that improve safety, affordability, and accessibility of transportation options. Ultimately, this will empower female students in Karachi to pursue their educational goals, similar to Humayun et al. 2017 [5]. This paper consist of Section 2 which details the study area, section 3 presents descriptive statistics, section 4 analyzes trips within the city, examining how trip purpose and cost influence travel choices, as outlined in a previous study [6]. Section 5 focuses on trips outside the city, analyzing cost comparisons for sustainable vs. non-sustainable travel modes. The paper ends with the conclusions and recommendations for future research.

2 Study Area

This study focuses on the travel patterns of female students at NED University, a prominent institution and one of the largest universities in Pakistan, located in Karachi, as shown in Figure 1. The university caters to a substantial number of undergraduate and postgraduate students. Some undergraduate female students are hostel residents out of which we have conducted survey of 28 students, 4 students are from Sri Lanka and 24 students are Pakistan.

Figure 1: Study location, NED University of Engineering and Technology, Karachi, Pakistan
Source: https://www.openstreetmap.org/#map=15/24.9301/67.1114&layers=TNG (accessed 3rd July 2024)

3 Descriptive Statistics

The data was collected across various modal, geographic, and economic parameters to understand travel patterns in Karachi. Modal Parameters refers to the different modes of transportation used. The data includes categories like Car, Bus, Chingchi (likely referring to rickshaws), Ride Hailing Service, Train, Van, and by Air. Geographic Parameters captures information related to travel distances. It includes "Distance to hometown" categorized by nationality (Pakistani/International) and "Travel Time for intercity journey". Economic Parameters focuses on the financial aspects of travel. The data includes "Average intercity mobility Cost/year" and "Average intracity mobility Cost/year". The table 1 provides additional details with: Nationality; Pakistani or International, Participant's age range, and number of participants in each category. It's important to note that some categories lack minimum, maximum, and mean values, likely due to the nature of the parameter (e.g., nationality might not have numerical values), similar to the presentation of such kind of data in a previous study [7].

Table 1 Descriptive statistics of survey data

Parameters	N	Min	Max	Mean
Nationality:				
Pakistani	24	-	-	-
International	4	-	-	-
Age	28	19	25	21
Distance to hometown:				
Pakistani	24	162.4	1412.1	371
International	4	2769	2769	2769
Average intracity mobility Cost/year	28	2000	10000	5660
Average inter-city mobility Cost/year	28	5000	77206.47	13661
Number of intracity trips/month:				
Chingchi	155	-	-	-
Bus	157	-	-	-
Car	5	-	-	-
Ride Hailing Service	83	-	-	-
Number of inter-city trips/month:				
Bus	10	-	-	-
By Air	4	-	-	-
Van	5	-	-	-
Train	1	-	-	-
Car	7	-	-	-
Travel Time for intercity journey	28	1.5	16.75	5.76

4. Trips within City

4.1 Analysis with respect to Trip Purpose

A comparative analysis of the overall trips made in a month via each mode for a specific purpose is presented in Figure 2. The data is also categorized with respect to sustainable (e.g., bus, chingchi) and non-sustainable options (e.g., car, ride-hailing). Interestingly, sustainable options seem favored by the students. Bus appears to be the most used mode across various trip purposes (shopping, work, medical, recreation). Chingchi, which are three-wheelers and are similar to rickshaws, is the second most used option especially for shopping and recreation as shown in Figure 2. Options like car and cab-service see minimal usage, suggesting they might not be the preferred choice due to factors such as cost, safety concerns, or limited access. These findings are in alignment with a previous study [8].

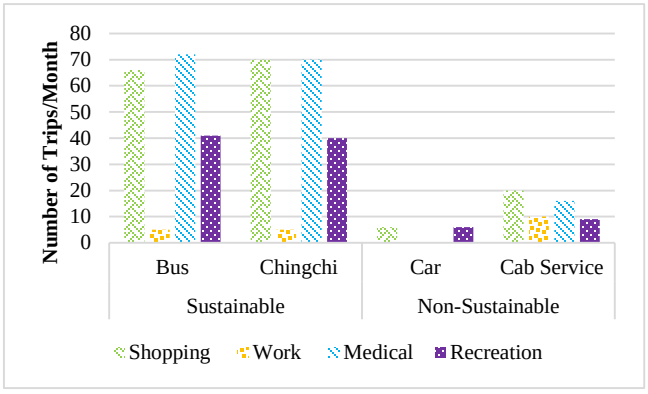

Figure 2: Number of trips produced from different modes

4.2 Analysis with respect to Trip cost

For the trip made within city analysis was performed with respect to cost as well. The data was collected for the total number of trips made during a month and the total cost incurred thereto. This method of analysis is in alignment with a previous study [9]. The exploratory analysis of the data shows is presented in Figure 3. It can be clearly seen that public transport modes, which are bus and chingchi, are more cost effective as compared to private transport modes such as car and cab service.

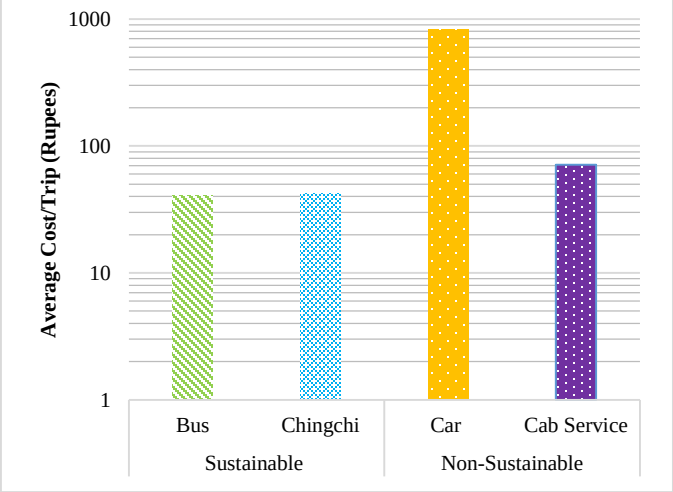

Figure 3: Trip cost with in city travel

5. Trips Outside City

The sole purpose of female hostel students of travelling outside city is to go to their respective hometowns. Therefore, analysis was made with respect to cost only. A comparison of costs for different modes of travel between cities is presented in Figure 4. Trains and vans are the cheapest options for trips within the country based on this information. This makes them a good choice for people who are on a budget. It's important to remember that international students wouldn't be able to use these options and would likely need to travel by air. As indicated in a previous study [9].

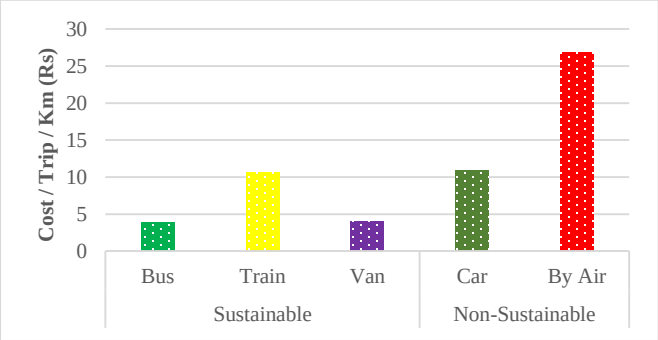

Figure 4: Cost per trip per km for home town travel

6. Conclusion and Recommendation

This study investigates the various mobility patterns of female university hostel students. It was found that transport choices like buses and rickshaws are common since they are accessible and reasonably priced. The usage of rickshaws and ride-hailing services may be restricted due to safety concerns. However, another important factor was cost. It was found that students choose less expensive solutions, such as bus and chingchi, when it comes to mobility. Trains and vans are affordable options for intercity travel. The research concludes that female hostel students mostly prefer public transport for their mobility, which is also a sustainable mode. This is an important finding. The report suggests improving the safety of public transportation, advocating for secure infrastructure like well-lit sidewalks, provision of reasonably priced ride-hailing services or student transportation assistance programs, to enhance accessibility to students belonging to all types of socio-economic background. The ultimate goal is to provide educational opportunities by making the transit network safer and easier to use for everyone.

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