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Examining the Impacts of Restrictions Due to COVID-19 on Mobility of Elderly and Physically Challenged People in Megacities of Pakistan --Manuscript Draft--

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Examining the Impacts of Restrictions Due to COVID-19 on Mobility of Elderly and Physically Challenged People in Megacities of Pakistan

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Abstract: The lack of infrastructural facilities with poor traffic condition in developing countries is one of the biggest challenges for the elderly and disabled people, particularly for poor income groups, due to their dependency on public transport and other people for travel. The COVID-19 has made the situation more difficult for the elderly and disabled people. This research focuses over the transportation and mobility issues faced by elderly and disabled people due to the measures taken to curb the spread of COVID-19 in Pakistan. The data was collected using a household survey technique in two most populous cities of Pakistan, Karachi and Lahore. The results show that there was a significant decrease in the number of trips commuted during the lockdown. The active transportation mode was preferred by respondents in Lahore, whereas about half of the respondents find it difficult to commute through public transport in Karachi.

Keywords: elderly, disabled, travel, mobility, COVID-19.

1. INTRODUCTION

The COVID-19 pandemic has affected millions of lives around the world. The immediate solution to reduce the impacts of the pandemic was considered to make the least human interaction by means of lockdown and self-isolation. The government in different countries have enforced travel restrictions, social distancing, and closure of educational institutions and business activities (Mahdy, 2020). The lockdown situation had caused the life to come to a halt causing a significant impact on travel and mobility of people worldwide.

The lockdown has reduced the spread of the virus, however, negatively impacted various sectors, including transportation due to restricted mobility (Parady, et. al. 2020; Parr, et. al. 2020). Around 40-65% of traffic volume is decreased in US states (Du, et. al. 2020). In Canada, around 50% reduction in outdoor activities is found, and most trips are made for routine shopping (Fatmi, 2020). Around 40% of long-distance travel is made using private

vehicles. Although all transportation modes have been affected due to the restriction on mobility, public transport has been the most affected mode due to its vulnerability for users (Gkiotsalitis & Cats, 2020). A research conducted in the Netherlands shows that around 80% of the people with a higher proportion of elders have restricted the outdoor activities due to pandemic (de Haas, et. al. 2020). A higher preference for the use of private vehicle and cycling modes are observed during COVID-19 (Menon, et. al. 2020; Przybylowski, et. al. 2021). Limitation availability of proper transport facilities has made older and disabled people reluctant to fulfil their personal needs during pandemic (Cochran, 2020).

The biggest challenge of travel and mobility during the COVID-19 was to maintain the provision of adequate public transport and proper enforcement of social distancing. The only way to ensure it was to reduce the loading capacities of public transport and providing a wider space for walkways (Bird, et. al. 2020). With uncertainty in demand, operations at lower loading capacities resulted in higher operational cost, thus making it difficult to maintain sustained supply of public transport.

Pakistan is the 5th most populous country of the world with a total population of 212 million (Ahmad & Ahmad, 2019). The area of the country is 796,096 sq km and divided into five provinces (IAEA, 1998). The economy mainly depends on three major sectors: services, agriculture, and industry contributing 57.7%, 21%, and 20.9% of gross domestic product (GDP), respectively (Anwar, et. al. 2017).

On 26 February 2020, the first case of COVID-19 in Pakistan was reported in Karachi by Health Ministry followed by a second case on the same day in Islamabad. After these initial cases, the pandemic penetrated Pakistan, and within fifteen days, 20 cases were confirmed with 471 suspected cases (Abid, et. al. 2020; Waris, et. al. 2020). Before the outbreak, the government has taken several steps to control the epidemic by presenting the National Action Plan for COVID-19 preparedness and response. Various measures were taken includes the provision of testing facilities in hospitals, developing quarantine centres, and implementation of Standard Operating Procedures (SOPs) for public places (Waris et al., 2020).

The first lockdown was implemented from 23 March 2020 in Sindh province followed by a nationwide lockdown in the country from 1 April 2020, with strict enforcement. This placed low-income groups at high risk of starvation (many of them could not afford food) and economic losses. Therefore, the 'Smart lockdown' was introduced in mid-April by initiating the reopening of Mosques followed by the further opening of various public places with enforcement of SOPs, i.e. physical distancing and usage of masks, the prohibition of entry or access of less immune age groups children and elder people. However, the 'smart lockdown' involved implementing strict lockdown in specific areas with a high amount of COVID-19 positive cases (Asia, 2020). The total confirmed COVID-19 number of positive cases reported in Pakistan up to 31 December 2020 was 482,178, with more than 10,000 deaths. The most affected province was Sindh with 222,999 cases and 3,670 deaths (Board, 2020), with the cases reported in Karachi comprising around 60% of total cases in Sindh province, whilst Lahore had around 50% of the total cases in Punjab province (Department, 2020; Sindh, 2020).

The COVID-19 pandemic has not only caused the loss of life but also affected the overall economy. The GDP growth of Pakistan declined from 1.9% to -1.5% (Bank, 2020); and the economic loss of country is estimated \$16.38 million to \$4.95 billion (Waheed, et. al. 2020).

The implementation of lockdown and SOPs significantly affected the travel demand and transportation network capacity. The literature indicates that the travel restrictions due to COVID-19 has influenced the travel patterns. This study is focused on examining the impacts of the restrictions on the mobility of elder and physically challenged people from two most populous cities of Pakistan. The outcomes of this research will be useful in devising the policy measures to improve the mobility of elders and people with special needs.

2. METHODOLOGY

The impacts on travel needs and facilities for elderly and physically challenged people in this study was examined in two megacities – Karachi and Lahore - of Pakistan. Karachi and Lahore are the two most populous cities of the country with a population of 16.1 million and 12 million respectively (Macrotrends, 2020).

In Karachi, the survey for household data collection was initiated on 3 November 2020, after the preliminary survey conducted to examine the quality of questionnaire. Whereas in Lahore, it was conducted after the first survey in Karachi. The least sample target of 200 respondents was achieved but due to COVID-19 restrictions and limited time, the respondents were not increased.

The data was collected from a household survey covering different socioeconomic and spatial distributions of both cities. Totals of 209 and 237 respondents from Karachi and Lahore respectively were collected and analyzed. The respondents were either elder (more than 60 years of age) or physically challenged persons. The primarily reason was limited research studies conducted in Low Income Countries highlighting the issues of urban mobility of older and disabled people. Other reason was during COVID pandemic this specific group is considered as most vulnerable and may face more difficulties and challenges for travel.

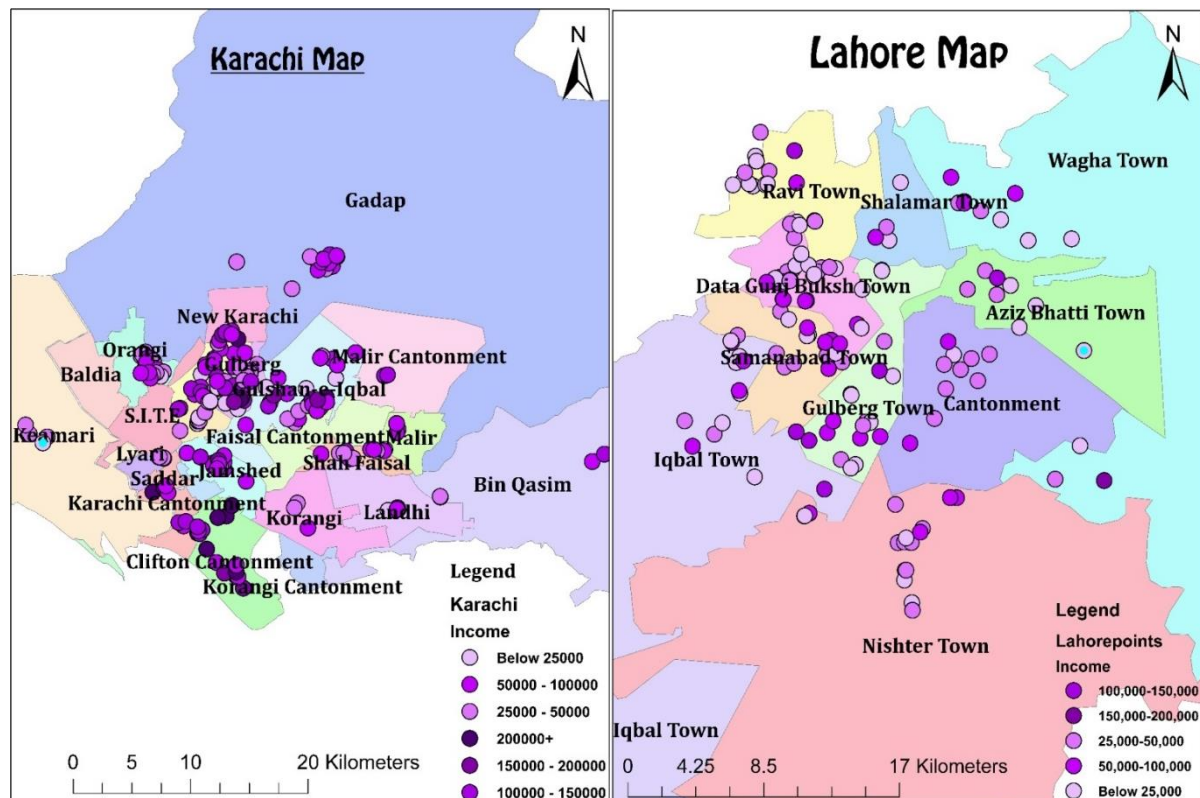


Figure 1. Spatial distribution of respondents Karachi and Lahore

The data collection was stratified on three main characteristics of respondents, including social class, spatial distribution, and disability. The spatial distribution of respondents in Karachi and Lahore is shown in Figure 1. In Karachi, the data are classified based on spatial distribution with respect to income level or social class covering 18 towns and four cantonments. The following social classes were acquired from the JICA report based on income level (Shibuya, 2012). The data collection ensured covering the respondents from all around the city to include respondents from diverse backgrounds, areas, and social classes in the survey. Table 1 shows the socioeconomic distribution of the respondents and compares it with the number of samples needed for each category to make the data representative of the population.

Table 1. Stratification of data for Karachi

Classification	Lower Class	Middle Class	Upper Class	Total Towns
No. of Towns	11	9	2	22
Percentage	50%	40%	10%	100%
Data Required	100	80	20	200
Data Collected	100	89	20	209

3. PROFILE OF THE RESPONDENTS

3.1 Age Group and Disability Types

A large number of respondents are in the age group of 61-70 with smaller numbers in other groups. The majority are males whilst women make up 31% and 26% in Karachi and Lahore respectively. Table 2 briefly delineates the demographic profile of the respondents.

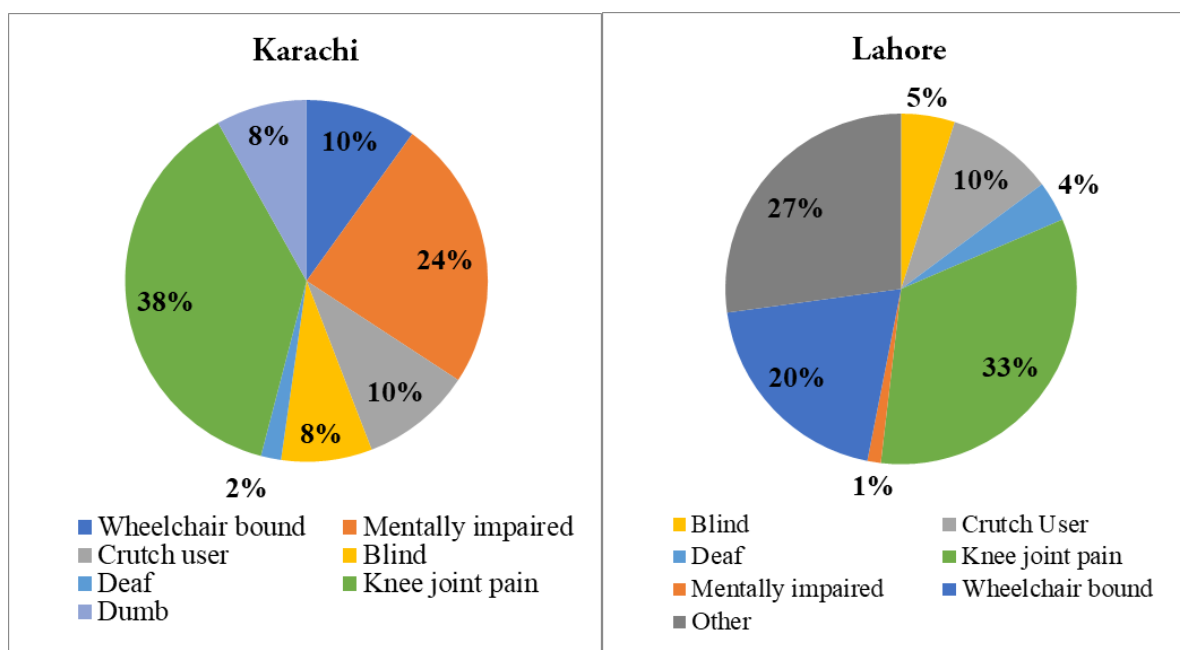
Table 2. Demographics of the respondents from Karachi and Lahore city

Categories	Karachi (N=209)		Lahore (N=237)	
	Number of Respondents	%	Number of Respondents	%
Sample Collected				
Disabled	30	14%	2	0.8%
Physically fit Older	114	55%	156	66%
Older with Disability	65	31%	79	33%
Age Group				
Below 20	17	8%	0	0%
21-40	13	6%	2	1%
41-60	21	10%	68	29%
61-70	123	59%	135	57%
71-80	25	12%	25	11%
Above 80	10	5%	7	3%
Gender				

Male	144	69%	175	74%
Female	65	31%	62	26%

Figure 2 shows that the highest proportion of the disabilities covered in the data concern knee/joint pain because a large amount of data is obtained from the older people and it is the most common problems for elders. The data also covers some other types of disabilities, which include wheelchair-bound, mentally impaired, blind or vision impaired, deaf or with hearing problems, dumb or with speech problems, and crutch users. The percentages for these groups are 10%, 24%, 8%, 2%, 8%, and 10% respectively for Karachi and 20%, 1%, 5%, 4%, 0% and 10% respectively for Lahore.

Figure 2. Disability types of respondents from Karachi and Lahore city



Of the respondents, 57% in Karachi and 62% in Lahore do their daily needs themselves while 43% and 38% respectively are dependent on family members or relatives. Only a small percentage of respondents (0.5%) in Karachi but none in Lahore live alone. In Karachi, 50% of the respondents are from households consisting of 3-5 members, whereas 50% in Lahore belong to households comprising 6-8 members.

3.2 Occupation and Income

Occupation of the respondents are shown in Figure 3. Around 33% of the respondents in Karachi are retired while in Lahore a high proportion of the respondents are workers or day-labors (39%) and unemployed (25%). Figure 4 depicts the monthly household income distribution, showing higher proportions of middle-income people in Karachi and lower-income groups in Lahore. A large proportion of the respondents in both cities have a range of individual expenditure between PKR 2,000 – 10,000 per month for personal use, as seen in Figure 5.

Figure 3. Occupation of the respondents

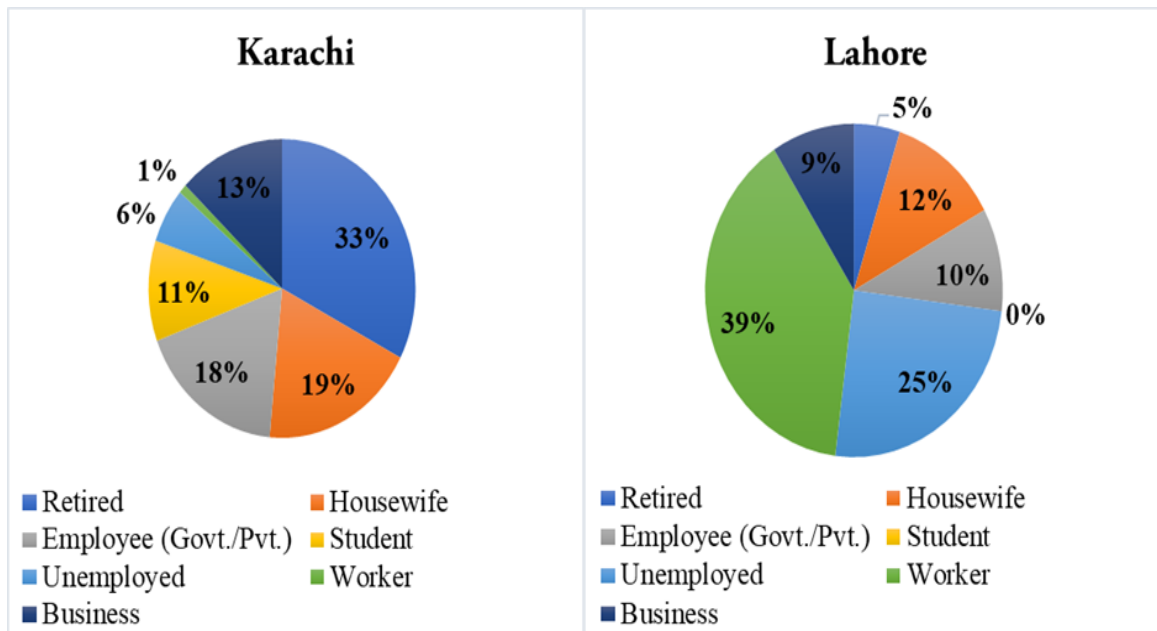


Figure 4. Household monthly income (PKR) distribution of the respondents

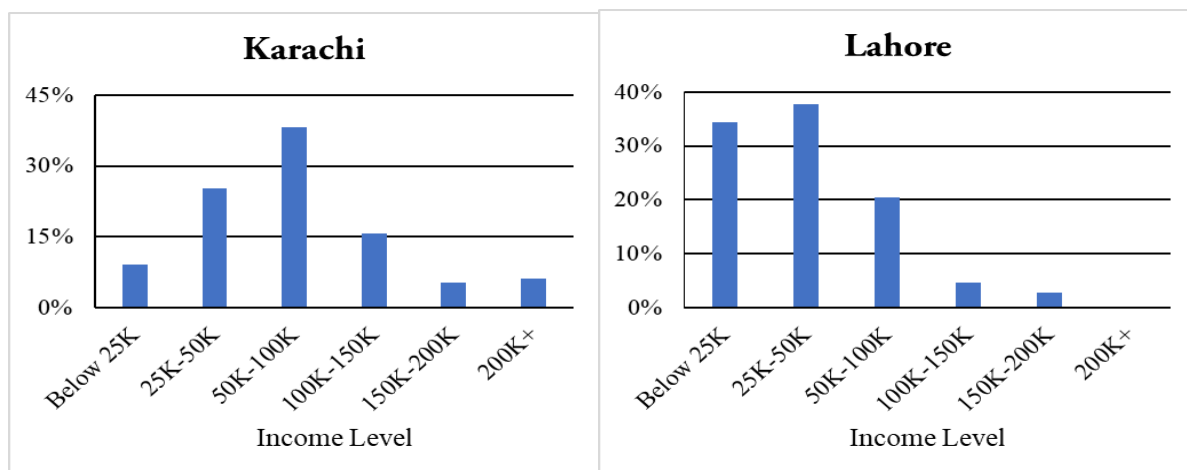
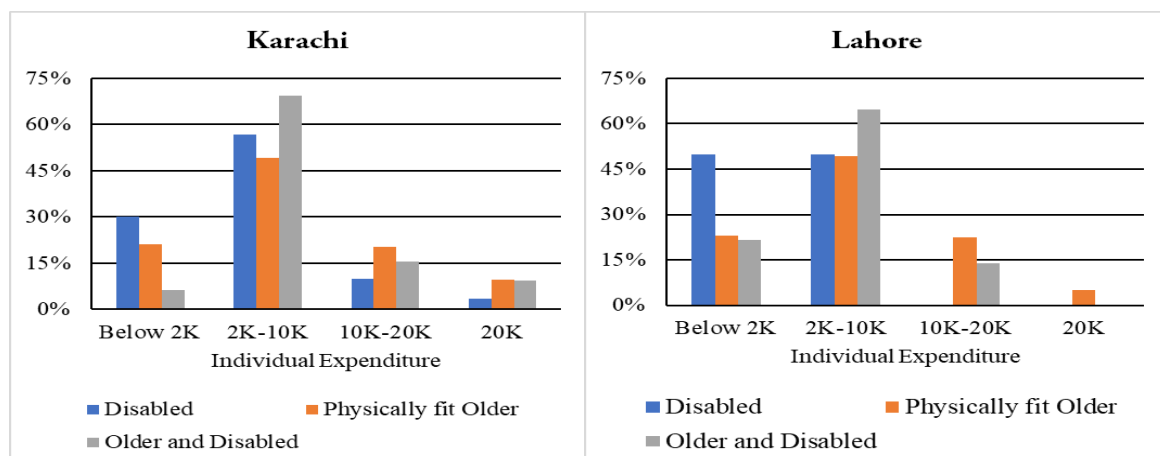


Figure 5. Personal monthly expenditure (PKR/month) of respondents



3.3 Household Vehicle Ownership

Table 3 shows the vehicle ownership of the surveyed households. In both cities, more than half of the households own private vehicles. Ownership of private vehicles is significantly higher in Karachi (82%) as compared to Lahore (52%). This is probably due to the fact that the public transport facilities in Lahore have been improved after the Metrobus system and Orange Line initiatives, which facilitates residents with better public transport (even during the pandemic). These private vehicles consist of cars and motorcycles, with proportions of 56% and 44% respectively for Karachi and 47% and 53% for Lahore. Nevertheless, almost 11% of the respondents in Karachi never have access to the private vehicle owned by the household.

Table 3. Household vehicle ownership of the respondents in Karachi and Lahore city

Vehicle Ownership	Vehicle	Karachi		Lahore	
		Number of Respondents	%	Respondents	%
No		37	18%	99	42%
Yes	Car	97	46	65	27
	Motorcycle	76	36	74	31
	Sub-Total	172	82%	138	58%

4. MOBILITY AND TRIPS DURING COVID-19 (POST-LOCKDOWN)

4.1 Travel Pattern

Almost half of the respondents travel alone though 48% in Karachi and 52% in Lahore travel accompanied or escorted by another person. Table 4 describes the travel patterns of the respondents during COVID-19. In Karachi, a smooth variation can be observed in travel frequency of respondents, with around 20% of the respondents making trips with a high frequency, i.e. more than five trips per week. In Lahore, 46% of the respondents made trips with a frequency of 4-5 trips per week. The physical distancing and Standard Operating Procedures (SOPs) followed by respondents in Karachi is 5% more as compared to Lahore. The major problems considered in travelling during this pandemic situation mentioned by 18% and 10% respondents from Karachi and Lahore respectively include less travel, less availability of public transport with no proper enforcement of social distancing and SOPs.

Table 4. Travel frequency of the respondents in Karachi and Lahore during COVID-19

Categories	Karachi		Lahore	
	Number of Respondents	%	Number of Respondents	%
Travel Frequency				
Few times/year	25	12%	2	1%
Few times/month	20	10%	5	2%
1 trip/month	8	4%	2	1%
1 trip/week	22	11%	52	22%
2-3 trips/week	24	11%	46	19%
4-5 trips/week	34	16%	108	46%
5+/week	41	20%	0	0
Several times/day	35	17%	0	0
Total	209	100%	215	93%

Physical Distancing				
Yes	134	74%	148	69%
No	48	26%	66	31%
Availability of Public Transport				
Yes	79	87%	100	69%
No	12	13%	45	31%
Problems Due to COVID				
Yes	38	18%	22	10%

To understand more detailed travel information, the respondents were asked about their total number of trips during the previous week. As seen in Table 5, in Karachi, the highest travel frequency was 1-2 trips per week, made by 44% of respondents. In Lahore, about 41% of respondents made 5+ trips per week while a very small portion did not travel at all. The latter respondents usually travel just a few times per month or year.

Table 5. Respondents' trips in Karachi and Lahore city during last week

Travel Frequency of Respondents	Karachi		Lahore	
	Respondents	%	Respondents	%
None	44	21%	14	7%
1-2/week	91	44%	75	35%
3-5/week	30	15%	36	17%
5+/week	40	20%	88	41%
Total	205	100%	213	100%

The details of trip characteristics are discussed in the following section.

4.2 Trip Characteristics

Table 6 delineates the characteristics of trips, including purpose, distance, travel time, travel cost, and mode used during COVID-19. In Karachi, the trips were made having the main purpose of work and shopping. Around 42% of the trips are travelled below 1km distance that shows the older people usually make trips within the area close to home. The three major travel modes used for commuting in Karachi during COVID-19 are car, motorcycle and walking with a percentage of 28%, 21%, and 28% respectively. It shows that the most reliable and safe mode for people are private vehicles as the public transport was risky for older people, due to the potential contraction of coronavirus due to less enforcement of proper SOPs and social distancing when travelling by buses and Chinchies. Chinchy is a three wheeler public transport having low capacity with maximum nine passengers (Noman, et. al. 2020).

Table 6. Trip characteristics in Karachi and Lahore during COVID-19

Categories	Karachi		Lahore	
	Number of Trips	%	Number of Trips	%
Trip Purpose				
Grocery	44	19%	19	8%
Personal Need	37	16%	1	0%
Doctor Visits	18	8%	55	24%
Work	65	28%	138	59%

Education	21	9%	4	2%
Social	37	16%	9	4%
Recreation	13	6%	7	3%
Total	235	100%	233	100%
Trip Distance				
Below 0.5	47	20%	20	8%
0.5-1 km	51	22%	26	11%
1.1 – 2 km	21	9%	25	11%
2.1 – 5 km	31	13%	62	26%
5.1 – 10 km	38	16%	47	20%
10.1 – 20 km	28	12%	35	15%
Above 20 km	19	8%	23	10%
Total	235	100%	238	100%
Travel Mode				
Walking	66	28%	44	19%
Rickshaw	22	9%	75	32%
Bus	15	6%	19	8%
Car	66	28%	36	16%
Motorcycle	50	21%	56	24%
Chingchi	8	3%	2	1%
Taxi, Uber/ Careem	6	3%	0	0%
Total	233	100%	232	100%
Travel time				
Below 5 min	58	25%	13	5%
6 – 15 min	85	36%	60	25%
16-30 min	47	20%	106	45%
31-45 min	21	9%	21	9%
46 min -1 hr	12	5%	27	11%
1-2 hr	9	4%	8	3%
2+ hr	3	1%	2	1%
Total	235	100%	237	100%
Trip Cost				
None	70	30%	48	20%
PKR 10	4	2%	0	0%
PKR 11-20	14	6%	7	3%
PKR 21-50	42	18%	56	24%
PKR 51-100	41	17%	52	22%
PKR 101-200	37	16%	35	15%
PKR 201-500	23	10%	26	11%
PKR 500+	4	2%	14	6%
Total	235	100%	238	100%

Whereas in Lahore, around 59% and 24% of trips were made with the major purpose of work and doctor visits respectively. Around 46% of trips are travelled in between 2–10 km distance. The major travel modes used for commuting in Lahore during COVID-19 are rickshaw, motorcycle, and walking with a percentage of 32%, 24%, and 19% respectively. The distance travelled for making most of the trips ranged from 1 to 10 km using the most preferred mode of transport as private vehicles, paratransit and walking with percentages 43%, 29%, and

19% respectively. Travel cost for the majority of respondents in both cities during COVID-19 is between PKR 20 and PKR 200.

5. MOBILITY AND TRIPS DURING LOCKDOWN

5.1 Travel Pattern

During the lockdown, most of the respondents lived in their own house. However, a very few (7% and 5% respectively in Karachi and Lahore) were in other places (e.g. village, another city) before the lockdown and they returned home by aeroplane, bus and personal vehicle during the lockdown. Table 7 shows the travel pattern of the respondents during the lockdown in Karachi and Lahore. A high percentage of the respondents avoided travel during the lockdown and preferred to stay at home. About 70% and 53% of the respondents in Karachi and Lahore respectively did not travel.

Table 7. Travel frequency of the respondents in Karachi and Lahore city during the lockdown

Categories	Karachi		Lahore	
	Number of Respondents	%	Number of Respondents	%
Travel Frequency				
No travel	146	70%	126	53%
Few times/month	5	2%	1	0.5%
1 trip/month	7	3.5%	1	0.5%
1 trip/week	6	3%	60	25.5%
2-3 trips/week	15	7%	15	6.5%
4-5 trips/week	18	9%	18	7.5%
5+/week	11	5%	12	5%
Several times/day	1	0.5%	2	1%
Total	209	100%	235	100%
Physical Distancing				
Yes	47	76%	77	69%
No	15	24%	34	31%
Availability of public transport				
Yes	32	52%	44	40%
No	30	48%	66	60%

In Karachi, the highest 9% had a travel frequency of 4-5 trips per week while in Lahore around 25.5% made one trip per week. Of the respondents who made trips during the lockdown, about 76% of them in Karachi and 69% in Lahore followed the SOPs while travelling during the lockdown. Almost 44% in Karachi mentioned having problems regarding travel, including unavailability of public transport and no proper social distancing maintained in public places. In contrast, in Lahore, only 11% of respondents had mobility problems due to the closure of various roads and public transport and paratransit were difficult to reach.

5.2 Trip Characteristics

Table 8 describes the characteristics of the trips, including purpose, distance, travel time, travel cost, and mode used during the lockdown. In Karachi, most of the trips commuted were necessary trips, i.e. related to work, grocery, and personal needs. In contrast, leisure trips, i.e. social gatherings and recreational trips, were avoided to remain safe from being infected.

Around 65% of the trips were within a distance of 5 km. Three major travel modes used for commuting in Karachi during lockdown were car, walking, and motorcycle with a percentage of 29%, 26%, and 19% respectively. The priority in terms of travel mode is given to private vehicles compared to public transport due to its unavailability during the lockdown.

Table 8. Characteristics of the trips in Karachi and Lahore city during the lockdown

Categories	Karachi		Lahore	
	Number of Trips	%	Number of Trips	%
Trip Purpose				
Grocery	16	25%	13	12%
Personal Need	13	21%	1	1%
Doctor visits	6	10%	45	42%
Work	22	35%	43	40%
Education	0	0%	0	0%
Social	4	6%	0	0%
Recreation	2	3%	6	6%
Total	63	100%	108	100%
Trip Distance				
Below 0.5	10	16%	8	7%
0.5-1 km	11	18%	12	11%
1.1 – 2 km	9	15%	26	24%
2.1 – 5 km	10	16%	35	32%
5.1 – 10 km	7	11%	17	15%
10.1 – 20 km	8	13%	9	8%
Above 20 km	7	11%	3	3%
Total	62	100%	110	100%
Travel Mode				
Walking	16	26%	34	31%
Rickshaw	8	13%	30	28%
Bus	5	8%	2	2%
Car	18	29%	20	18%
Motorcycle	12	19%	23	21%
Qunichi	2	3%	0	0%
Taxi, Uber/ Careem	1	2%	0	0%
Total	62	100%	109	100%
Travel time				
Below 5 min	12	19%	6	5%
6 – 15 min	23	37%	45	41%
16-30 min	13	21%	39	35%
31-45 min	7	11%	12	11%
46 min -1 hr	1	2%	6	5%
1-2 hr	5	8%	2	2%
2+ hr	1	2%	0	0%
Total	62	100%	110	100%
Trip Cost				
None	17	27%	37	34%
PKR 10	1	2%	0	0%
PKR 11-20	6	10%	3	3%
PKR 21-50	9	14%	20	18%

PKR 51-100	10	16%	17	15%
PKR 101-200	10	16%	15	14%
PKR 201-500	8	13%	14	13%
PKR 500+	2	3%	4	4%
Total	63	100%	110	100%

Whereas in Lahore, around 40% and 42% of trips were for work and doctor visits respectively. The distance for about 71% of the trips is between 2 km and 10 km. The major travel modes used for commuting in Lahore during Lockdown were walking, rickshaw, and motorcycle with a percentage of 31%, 28%, and 21% respectively. The distance travelled for most of the trips ranging from 1 to 10 km using the most preferred mode of transport, which was private vehicles, paratransit and walking with percentages 39%, 28%, and 31% respectively. The travel cost during lockdown was between PKR 50-200 for both cities.

6. MOBILITY AND TRIPS BEFORE COVID-19

6.1 Travel Pattern

Before COVID-19, around 51% and 57% of the respondents in Karachi and Lahore respectively travelled alone while the remainder were accompanied or escorted by another person. Table 9 shows the travel frequency of the respondents before the COVID-19 pandemic.

Table 9: Travel frequency of respondents in Karachi and Lahore city before COVID-19

Categories	Karachi		Lahore	
	Respondents	%	Respondents	%
Travel Frequency				
Few times/year	19	9%	2	2%
Few times/month	13	6%	9	8%
1 trip/month	8	4%	2	2%
1 trip/week	15	7%	8	7%
2-3 trips/week	23	11%	19	17%
4-5 trips/week	34	16%	44	39%
5+/week	43	21%	29	25%
Several times/day	53	25%	1	1%
Total	208	100	114	100

Most of the respondents in Karachi made either more than five trips per week (21%) or several times per day (25%), though some travelled only once in a week or month or several times per year. Whereas in Lahore most respondents did not prefer to travel several times daily, the common frequency found 4-5 trips per week (39%) or more than five trips per week (25%).

Almost 73% of the respondents in Karachi and 40% in Lahore mentioned that before COVID-19 there was public transport available for their trips. Only 39% of respondents encountered travel and mobility problems, with the main issues being traffic congestion, pollution, overcrowded buses, high travel costs of fuel, lack of accessibility to bus stops, improper lighting system on roads (causing crimes), lack of pedestrian facilities, lack of parking spaces, and lack of enforcement of traffic rules. Almost 50% of the respondents in both cities mentioned that on a typical day before COVID-19 they usually travelled or went outside their home once. The characteristics of the trips are discussed in the next section.

6.2 Trip Characteristics

Table 10 describes the characteristics of the trips, including purpose, distance, travel time, travel cost, and mode used before COVID-19. In Karachi, the trips before COVID-19 were mainly commuted for the purpose of work, shopping, and social gatherings with a percentage of 23%, 19%, and 23% respectively. It shows that around 42% of the trips were performed for leisure and socialization. The distance travelled before COVID-19 has a smooth variation from below 5 km to 20 km. The most used travel modes are private vehicles and walking, which could be due to the poor condition of public transport and costly travel in paratransit mode. Around 28% are walking trips because most people prefer to walk within the area of residence in order to have a healthy activity and leisure time.

In Lahore, people are more committed to work as 70% of the trips are for the purpose of work. The most used mode of transport is rickshaw and motorcycle for making trips with percentages of 26% and 29% respectively.

Table 10. Trip characteristics in Karachi and Lahore city before COVID-19

Categories	Karachi		Lahore	
	Number of Trips	%	Number of Trips	%
Trip Purpose				
Grocery	57	19%	11	10%
Personal Need	42	14%	1	1%
Doctor visits	20	7%	14	13%
Work	68	23%	79	71%
Education	18	6%	2	2%
Social	69	23%	2	2%
Recreation	24	8%	3	2%
Total	298	100%	112	100%
Trip Distance				
Below 0.5	57	19%	18	16%
0.5-1 km	51	17%	12	10%
1.1 – 2 km	37	12%	10	9%
2.1 – 5 km	43	14%	32	28%
5.1 – 10 km	50	17%	10	9%
10.1 – 20 km	41	14%	15	13%
Above 20 km	21	7%	18	16%
Total	300	100%	115	100%
Travel Mode				
Walking	84	28%	23	20%
Rickshaw	24	8%	30	26%
Bus	19	6%	10	9%
Car	96	32%	17	15%
Motorcycle	56	19%	33	29%
Qunichi	10	3%	1	1%
Taxi, Uber/ Careem	9	3%	0	0%
Total	298	100%	114	100%
Travel time				
Below 5 min	74	25%	6	5%

6 – 15 min	105	35%	26	22%
16-30 min	60	20%	54	47%
31-45 min	34	11%	8	7%
46 min -1 hr	14	5%	14	12%
1-2 hr	10	3%	8	7%
2+ hr	2	1%	0	0%
Total	299	100%	116	100%
Trip Cost				
None	86	29%	27	23%
PKR 10	7	2%	0	0%
PKR 11-20	19	6%	5	4%
PKR 21-50	43	14%	33	28%
PKR 51-100	48	16%	22	19%
PKR 101-200	55	18%	8	7%
PKR 201-500	37	12%	11	9%
PKR 500+	5	2%	10	9%
Total	300	100%	116	100%

7. CHANGES AND PROBLEMS DUE TO COVID-19

7.1 Impacts of COVID-19 on Travel and Mobility

Table 11 shows the trips performed per person before COVID-19 and during COVID-19. In Karachi, the average trip rate before the COVID-19 was 1.43 trips/person, which decreased to 0.3 trips/person during the lockdown. After the lockdown restrictions were eased, the trip rate increased to 1.12 trips/person. This shows that in post-lockdown, the trip rate is slightly lower than in the pre-pandemic situation due to the fact that all the economic and social activities have not been fully restored during the neo-normal situation. The data collected from Lahore shows that the trip rates during lockdown were around 0.46, which increased to 0.98 after the lockdown restrictions were eased out. The trip rate values show that a major reduction in trips was found during lockdown in both cities due to unavailability of public transport, closure of working places, and the initiation of online systems for education and working from home. For example, compared with the before COVID-19 situation, around 80% less trips were produced during lockdown while 22% decrease was observed after lockdown.

Table 11: Trips per person in Karachi and Lahore city

Situation	Trips/respondent in Karachi city	Trips/respondent in Lahore city
During COVID-19 (post-lockdown)	1.12	0.98
During Lockdown	0.3	0.46
Before COVID-19	1.43	0.47

Table 12 describes various factors which contribute to affect mode choice behavior. In general, the commuters before COVID-19 select public transport because it is economical and fares are comparatively cheaper than paratransit for long-distance journeys. The private transport users find it comfortable and faster mode in comparison with public transport modes.

Table 12. Reason for selecting travel mode by respondents in Karachi and Lahore city

Modes of Transportation	Reason in Karachi city	Reason in Lahore city
Public transport	Cheaper	Cheap/ Cost-effective
Private modes	Comfortable, flexible, faster, Personal Mode	Safe, comfortable, cheap, less travel time
Paratransit	Convenient, availability	Comfortable, cheap
Active modes	Healthy lifestyle, Close to home	Near to home

Figure 6. Modal distribution of trips in Karachi and Lahore city during and before COVID-19

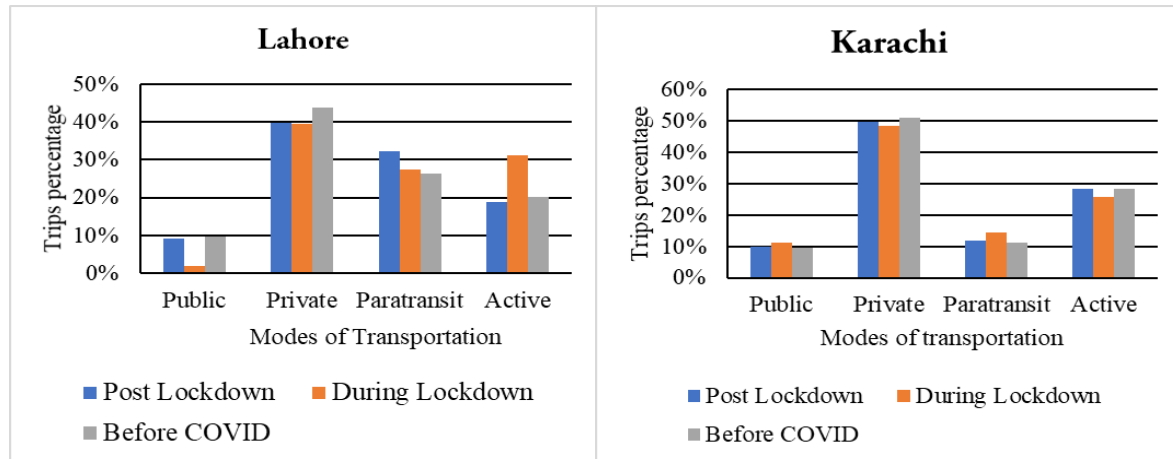


Figure 6 describes the effect of the COVID-19 on the modal distribution of trips in Karachi and Lahore. In Karachi, the usage of each mode was not affected in a long-term sense by the pandemic as the percentages of trips made by any mode before COVID-19 and after the lockdown was approximately the same. During and before COVID-19, the high percentage of trips were by means of private vehicles (i.e. 50% trips on car and motorcycle) and the active transport played a vital role in the lifestyle of elderly and disabled people as the walking is the second most used mode. The respondents preferred to make trips within walking distance of residence to either nearby market for shopping or to socialize for having a recreational activity. Only 10% of the respondents use public transport facilities for their daily needs. Whereas in Lahore, the number of trips is much affected due to COVID-19 as compared with before the pandemic. The usage of active mode and paratransit is comparatively higher in percentage than public transport mode. A significant decrease is observed in the trips commuted using public transport during the lockdown, which indicates that the availability of public transport might have decreased during the lockdown. Furthermore, the elderly people might have avoided the use of public transport to reduce the risk of getting infected from COVID-19 virus. The active transportation and use of paratransit are increased due to this pandemic.

Figure 7 shows the typical travel frequency of the respondents. The lockdown has decreased the trip rate from several trips each day to 1 or 2-3 trips per week. In Lahore, the travel frequency of most of the respondents before the pandemic was 4-5 trips or 5+ trips per week, which is significantly affected during the lockdown. A significant decrease in the number of trips during lockdown is observed as the highest proportion of one trip per week is observed during the lockdown.

Figure 7. Travel frequency of respondents in Karachi and Lahore city during and before COVID-19

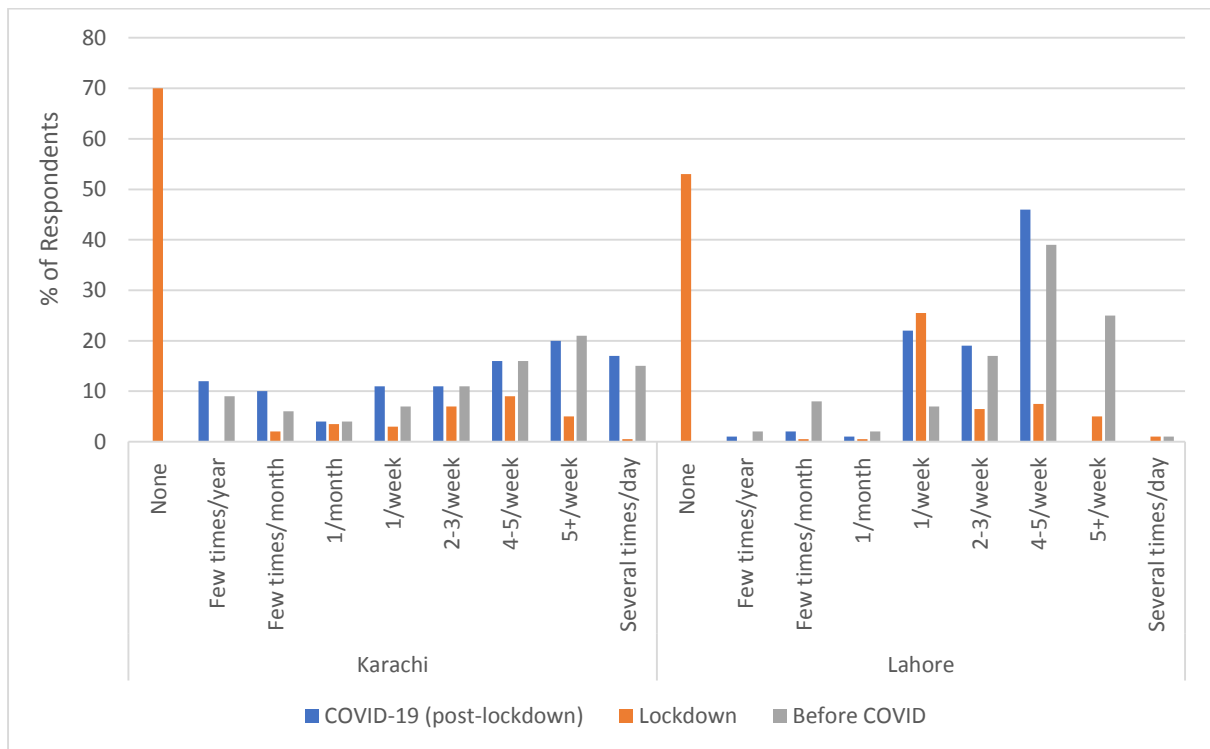


Figure 8. Effect of COVID-19 on travel purpose in Karachi and Lahore city

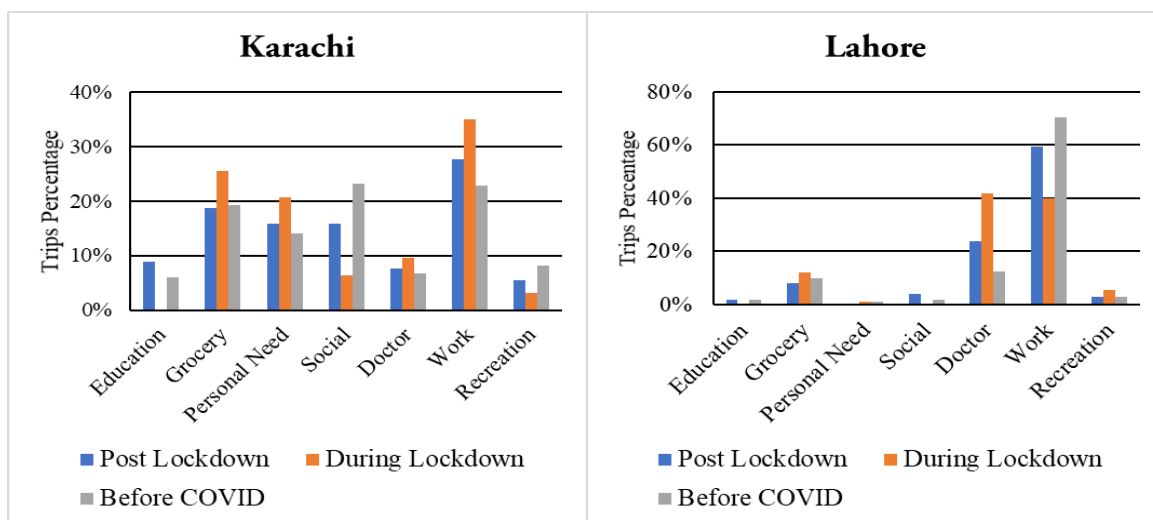
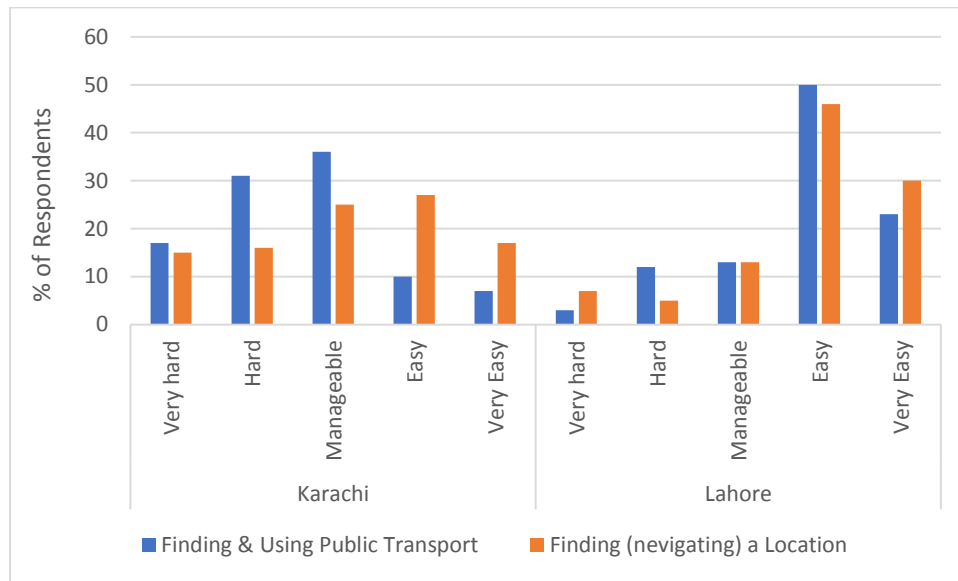


Figure 8 illustrates that the trips made during lockdown mostly consist of the purpose of grocery, work, and doctor visit, which shows that only trips with a necessary purpose were made during the lockdown. It can be interpreted that the situation during COVID-19 and before COVID-19 remained the same for the work in Karachi while for Lahore after lockdown most people travelled for the purpose of work more as compared to before COVID-19 and during the lockdown. On the contrary, the trips of socializing, recreation, and education are most affected by the COVID-19 situation.

7.2 Problems and Expectations

In general, finding public transport for a trip in Karachi and Lahore is not easy. Figure 9 shows that in Karachi people find it very difficult whereas in Lahore most of the respondents find it easy because of recent improvements in public transport infrastructure i.e. Orange Line and Metrobus systems. The respondents in Lahore reported that it was not difficult to identify a location and most of the respondents found it easy and manageable. Whereas, in Karachi, this percentage is slightly less as compare to Lahore and people found it less easy to identify locations. The data presented in Figure 9 shows that approximately half of the respondents find it hard to use public transport.

Figure 9. Level of difficulty in finding public transport and location in Karachi and Lahore city



The respondents were asked if they have faced any particular problem related to travel during and before COVID-19. Only 35% of the respondents in Karachi and 12% in Lahore mentioned that their typical travel and mobility has changed (e.g. travel less, lesser buses are available, changed the route) due to COVID-19. Almost 14% of the respondents mentioned either change in their trip cost or facing additional travel problems due to COVID-19. The reported problems in Karachi and Lahore during COVID-19 and before COVID-19 are:

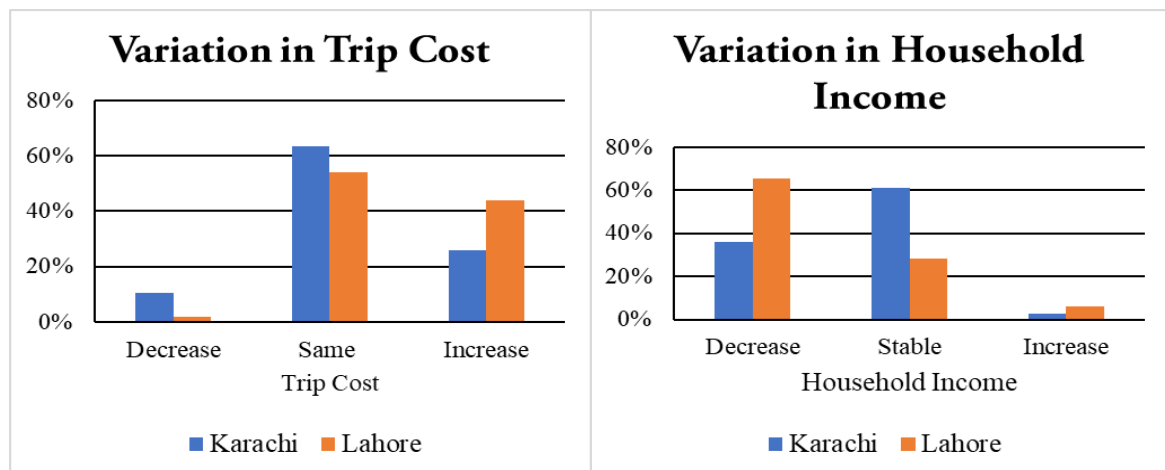
- Less accessibility to bus stops;
- Highly crowded buses and no seats available;
- Uncomfortable public transport;
- Difficult to maneuver wheelchair on road and not accessible to public transport;
- Traffic congestion and high travel time;
- Air pollution;
- Less public transport and poor service, problem in getting into bus (drivers do not stop buses properly), less variety of modes options available;
- Poor infrastructure e.g. road potholes, absent of pedestrian road crossing facilities;
- High fare or cost of fuel;
- Garbage on street or parked cars on footpaths;
- Lack of enforcement of traffic rules;
- Improper lightning at night.

The reported problems by the respondents during COVID-19 are:

- Less availability of public transport;
- Travel cost increase;
- Travel frequency affected - less travel;
- Using mask is uncomfortable (particularly irritates while riding bike);
- SOPs not followed properly in public transport;
- Business affected and less social activity;
- No proper facility for handicapped people;
- Fear of snatching and robbery.

The data collected from the survey shows that 98% and 91% of respondents from Karachi and Lahore respectively had no change in their occupation and the remaining (only 2% and 9% respectively) with changing occupation due to COVID-19. It shows that COVID-19 had no major effect on occupation of older people, as most of them were already not in a regular job. However, Figure 10 shows 36% and 63% of the respondents in Karachi and Lahore respectively reported a decrease in their household income while 25% and 42% respectively found that the trip cost has increased due to COVID-19.

Figure 10. Variation of income and travel cost in Karachi and Lahore city due to COVID-19



Nevertheless, the respondents were asked if they have any expectation or suggestion for improving travel and mobility. Only 19% of the respondents in Karachi but 87% in Lahore provided their suggestions. The expectations and suggestions are almost similar for both cities. These are:

- SOPs must be followed - social distancing should be ensured with proper enforcement;
- Mandatory precautions e.g. distribute mask and sanitizer in public transport, avoid taking sick people in public transport;
- Government should keep fare prices in control, provide subsidize transport or shuttle services during COVID-19;
- Extend the lockdown time;
- Taxi Apps for handicaps;
- Overloading should be avoided;
- More buses should be provided with high frequency;

- Construct more roads; / Improve the construction of roads;
- Providing more rickshaws; /Restrict or avoid chinchis;
- Not to allow trucks operating in narrow streets;
- Built new mass transit projects similar to orange line train.
- Government should decrease fuel cost;
- Providing proper signs and markings in main roads.

8. CONCLUSIONS AND RECOMMENDATIONS

The accessibility and inadequate transport infrastructure with poor traffic conditions in developing countries is quite challenging for a large number of people who live below the poverty line. Karachi is the only metropolitan city in Pakistan with no proper public transport system on which a person can rely. The city is full of problems related to travel and mobility for young and physically fit people including lack of public transport facilities, no proper bus stops, traffic congestion and lack of enforcement of traffic rules. For elderly and disabled people, these problems are aggravated because they need special arrangements for their travel. The situation of COVID-19 has made it worst. Overall, people travelled more before COVID-19 as compared to the trips made after the pandemic.

The data analyzed from this research shows that people have faced difficulty in travelling due to COVID-19 because of unavailability of public transport and no proper enforcement of physical distancing or SOPs during COVID-19 and lockdown. Most of the commuters in Karachi depend on private vehicles for their daily travel needs. So, in general, it can be interpreted that the effects of COVID-19 on mobility was mainly affecting the people who do not own their private vehicle. Another study conducted for Karachi's public transport (Khan et al., 2020) delineates that the two major attributes affecting the choice of public transport are travel time and comfort. The poor quality of public transport facilities compels people to travel on private vehicles. The only reason reported by commuters in Karachi for not using the private vehicle was not having ownership and availability that left the only option to be the use of unreliable and uncomfortable public transport (Ahmed & Noman, 2020). Lahore has a comparatively reliable, safe and comfortable public transit system, which includes Lahore Metrobus and the Orange Line (Ahmed & Azeem, 2015). The ratio of trips per respondents during lockdown was the least showing that most people avoided travelling during COVID-19 to remain safe and healthy.

Active modes have always played a vital role in life of elder and physically challenged people specially when it comes to maintain a healthy lifestyle. The COVID pandemic has increased the active mobility in urban towns around the world due to restrictions of vehicular movements and public transport. From the results of survey, it is deduced that in Lahore during pandemic and lockdown it is used frequently. But due to poor road infrastructure in Karachi the mode has not created that much affect in life of people.

The two major reasons for choosing public transport in Karachi were identified as not having a private vehicle and safer than a motorcycle. The problems associated with the use of public transport are identified as unavailability, problems in accessibility, and it being overcrowded. These problems are more critical for older and disabled people who need special assistance and arrangements for fulfilling their travel needs.

The cities in Pakistan often lack facilities to accommodate elderly and physically challenged people, especially in Karachi. The following recommendations are based on the suggestions provided by respondents, which can be implemented to improve travel of elderly and disabled people.

- Ensure proper social distancing and SOPs in public areas including all travel modes;
- Subsidize transport for older and disabled people;
- Provision of affordable and clean public transport with frequent bus service;
- Provision of pedestrian facilities and proper walkways alongside roads for increasing walkability;
- Provision of first aid and priority seats in public transport for older and disabled people;
- Provision of proper street lighting to save citizens from robbery and snatching;
- Ensure proper enforcement of traffic rules and laws;
- Provision of proper parking spaces for disabled and older people;
- Provision of a separate travel mode for older and disabled people.

ACKNOWLEDGEMENT

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Revision Report

Paper ID: PP2998

Paper title: Examining the Impacts of Restrictions Due to COVID-19 on Mobility of Elderly and Physically Challenged People in Megacities of Pakistan

Corresponding author: Prof. Dr. M. Shafiq-Ur Rahman

Revision report for “Paper Category (A or B)”

	Comments	Response
Reviewer 1		
1.	Reviewer 1 Comments to Author: In general, this article is just an exploratory analysis based on survey results, the authors need to do further analysis to get meaningful information from the data. For example, cross analysis between trip purposes - distance and mode together to give more meaningful analysis.	This is an exploratory research to understand the mobility changes and problems due to COVID-19.
2.	Information about data gathering is limited in Section 2, there is no information about when the data was administered. Time of survey will determined also the response and adjustment their life change due to covid19. Please add information on it and also made analysis based on the date of survey especially in relation with the pandemic episode/period (for example beginning of lockdown, in the mid 2020 or end of 2020 which may give different response and adaptation/adjustment from people in response to the pandemic situations)	Added a section in methodology explained that in November 2020 data were collected.
3.	In section 3.2 (Occupation and Income) page 5 mentioned that figure 4 inform about occupation of respondents, while in page 6 figure 4 explain about expenditure. Please revise it!	A new figure (Figure 3) is included showing occupation of the respondents.
4.	The active mobility is increased as it is also happened around the world during the pandemic. It needs to be explore further especially on the side of facilities to support these new tends. It is mentioned in the conclusions and recommendations but slightly unclear and confusing.	Active mobility is discussed in Section 7 (changes and problems due to Covid-19), not in conclusions and reccomandation. Furthermore, a paragraph is added in conclusions and reccomandations.
Reviewer 2		
1.	Comments to Author: Investigating the influence of COVID-19 on residents' mobiity is very interesting. Some comments can be found as follows.	Mentioned in Introduction that the paper explores the changes due to Covid-19.

	The contribution of this paper is not clear.	
2.	The methods are a bit simple.	Yes. Explaining methods in simple terms is reader friendly.
3.	The reasons of selecting the elderly and physically challenged people are analyzed in this paper are missing.	Because the paper tried to understand the mobility changes of elderly and disabled people. There is very limited research on this topic in developing country contexts.
4.	Section 1, too much background information of COVID-19 is included in this part. however, this part should introduce more information of existing research in the related field.	The existing research related to travel and mobility issues for older and physically challenged people is very limited in the low income countries that's why the major focus in introduction is choose to be as background information
5.	Sample size seems to be not enough.	Because of targeted audience and COVID pandemic restrictions it was even difficult to collect 200 respondents. However, 400 respondents (200 from each city) is good enough to explain the situation.

Examining the Impacts of Restrictions Due to COVID-19 on Mobility of Elderly and Physically Challenged People in Megacities of Pakistan

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Abstract: The lack of infrastructural facilities with poor traffic condition in developing countries is one of the biggest challenges for the elderly and disabled people, particularly for poor income groups, due to their dependency on public transport and other people for travel. The COVID-19 has made the situation more difficult for the elderly and disabled people. This research focuses over the transportation and mobility issues faced by elderly and disabled people due to the measures taken to curb the spread of COVID-19 in Pakistan. The data was collected using a household survey technique in two most populous cities of Pakistan, Karachi and Lahore. The results show that there was a significant decrease in the number of trips commuted during the lockdown. The active transportation mode was preferred by respondents in Lahore, whereas about half of the respondents find it difficult to commute through public transport in Karachi.

Keywords: elderly, disabled, travel, mobility, COVID-19.

1. INTRODUCTION

The COVID-19 pandemic has affected millions of lives around the world. The immediate solution to reduce the impacts of the pandemic was considered to make the least human interaction by means of lockdown and self-isolation. The government in different countries have enforced travel restrictions, social distancing, and closure of educational institutions and business activities (Mahdy, 2020). The lockdown situation had caused the life to come to a halt causing a significant impact on travel and mobility of people worldwide.

The lockdown has reduced the spread of the virus, however, negatively impacted various sectors, including transportation due to restricted mobility (Parady, et. al. 2020; Parr, et. al. 2020). Around 40-65% of traffic volume is decreased in US states (Du, et. al. 2020). In Canada, around 50% reduction in outdoor activities is found, and most trips are made for

routine shopping (Fatmi, 2020). Around 40% of long-distance travel is made using private vehicles. Although all transportation modes have been affected due to the restriction on mobility, public transport has been the most affected mode due to its vulnerability for users (Gkiotsalitis & Cats, 2020). A research conducted in the Netherlands shows that around 80% of the people with a higher proportion of elders have restricted the outdoor activities due to pandemic (de Haas, et. al. 2020). A higher preference for the use of private vehicle and cycling modes are observed during COVID-19 (Menon, et. al. 2020; Przybylowski, et. al. 2021). Limitation availability of proper transport facilities has made older and disabled people reluctant to fulfil their personal needs during pandemic (Cochran, 2020).

The biggest challenge of travel and mobility during the COVID-19 was to maintain the provision of adequate public transport and proper enforcement of social distancing. The only way to ensure it was to reduce the loading capacities of public transport and providing a wider space for walkways (Bird, et. al. 2020). With uncertainty in demand, operations at lower loading capacities resulted in higher operational cost, thus making it difficult to maintain sustained supply of public transport.

Pakistan is the 5th most populous country of the world with a total population of 212 million (Ahmad & Ahmad, 2019). The area of the country is 796,096 sq km and divided into five provinces (IAEA, 1998). The economy mainly depends on three major sectors: services, agriculture, and industry contributing 57.7%, 21%, and 20.9% of gross domestic product (GDP), respectively (Anwar, et. al. 2017).

On 26 February 2020, the first case of COVID-19 in Pakistan was reported in Karachi by Health Ministry followed by a second case on the same day in Islamabad. After these initial cases, the pandemic penetrated Pakistan, and within fifteen days, 20 cases were confirmed with 471 suspected cases (Abid, et. al. 2020; Waris, et. al. 2020). Before the outbreak, the government has taken several steps to control the epidemic by presenting the National Action Plan for COVID-19 preparedness and response. Various measures were taken includes the provision of testing facilities in hospitals, developing quarantine centres, and implementation of Standard Operating Procedures (SOPs) for public places (Waris et al., 2020).

The first lockdown was implemented from 23 March 2020 in Sindh province followed by a nationwide lockdown in the country from 1 April 2020, with strict enforcement. This placed low-income groups at high risk of starvation (many of them could not afford food) and economic losses. Therefore, the 'Smart lockdown' was introduced in mid-April by initiating the reopening of Mosques followed by the further opening of various public places with enforcement of SOPs, i.e. physical distancing and usage of masks, the prohibition of entry or access of less immune age groups children and elder people. However, the 'smart lockdown' involved implementing strict lockdown in specific areas with a high amount of COVID-19 positive cases (Asia, 2020). The total confirmed COVID-19 number of positive cases reported in Pakistan up to 31 December 2020 was 482,178, with more than 10,000 deaths. The most affected province was Sindh with 222,999 cases and 3,670 deaths (Board, 2020), with the cases reported in Karachi comprising around 60% of total cases in Sindh province, whilst Lahore had around 50% of the total cases in Punjab province (Department, 2020; Sindh, 2020).

The COVID-19 pandemic has not only caused the loss of life but also affected the overall economy. The GDP growth of Pakistan declined from 1.9% to -1.5% (Bank, 2020); and the economic loss of country is estimated \$16.38 million to \$4.95 billion (Waheed, et. al. 2020).

The implementation of lockdown and SOPs significantly affected the travel demand and transportation network capacity. The literature indicates that the travel restrictions due to COVID-19 has influenced the travel patterns. This study is focused on examining the impacts of the restrictions on the mobility of elder and physically challenged people from two most populous cities of Pakistan. The outcomes of this research will be useful in devising the policy measures to improve the mobility of elders and people with special needs.

2. METHODOLOGY

The impacts on travel needs and facilities for elderly and physically challenged people in this study was examined in two megacities – Karachi and Lahore - of Pakistan. Karachi and Lahore are the two most populous cities of the country with a population of 16.1 million and 12 million respectively (Macrotrends, 2020). In Karachi, the survey for household data collection was initiated on 3 November 2020, after the preliminary survey conducted to examine the quality of questionnaire. Whereas in Lahore, it was conducted after the first survey in Karachi. The least sample target of 200 respondents was achieved but due to COVID-19 restrictions and limited time, the respondents were not increased.

The data was collected from a household survey covering different socioeconomic and spatial distributions of both cities. Totals of 209 and 237 respondents from Karachi and Lahore respectively were collected and analyzed. The respondents were either elder (more than 60 years of age) or physically challenged persons. The primarily reason was limited research studies conducted in Low Income Countries highlighting the issues of urban mobility of older and disabled people. Other reason was during COVID pandemic this specific group is considered as most vulnerable and may face more difficulties and challenges for travel.

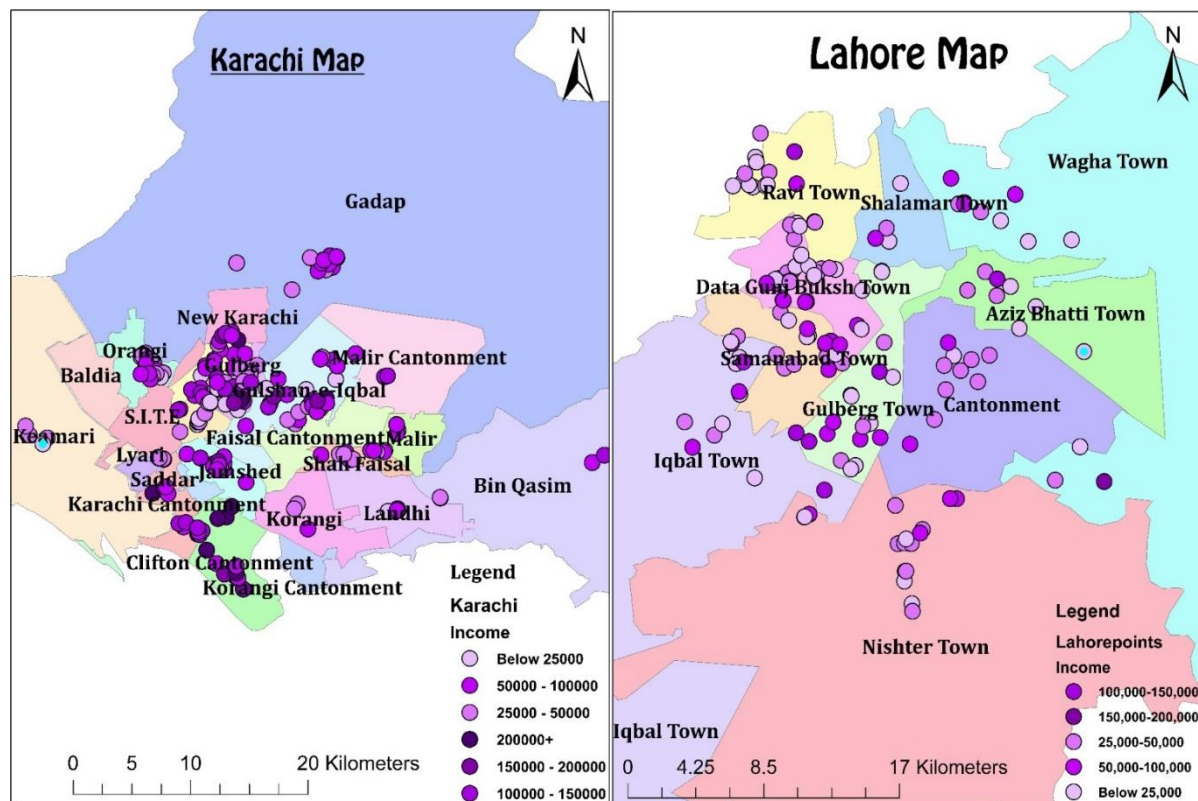


Figure 1. Spatial distribution of respondents Karachi and Lahore

The data collection was stratified on three main characteristics of respondents, including social class, spatial distribution, and disability. The spatial distribution of respondents in Karachi and Lahore is shown in Figure 1. In Karachi, the data are classified based on spatial distribution with respect to income level or social class covering 18 towns and four cantonments. The following social classes were acquired from the JICA report based on income level (Shibuya, 2012). The data collection ensured covering the respondents from all around the city to include respondents from diverse backgrounds, areas, and social classes in the survey. Table 1 shows the socioeconomic distribution of the respondents and compares it

with the number of samples needed for each category to make the data representative of the population.

Table 1. Stratification of data for Karachi

Classification	Lower Class	Middle Class	Upper Class	Total Towns
No. of Towns	11	9	2	22
Percentage	50%	40%	10%	100%
Data Required	100	80	20	200
Data Collected	100	89	20	209

3. PROFILE OF THE RESPONDENTS

3.1 Age Group and Disability Types

A large number of respondents are in the age group of 61-70 with smaller numbers in other groups. The majority are males whilst women make up 31% and 26% in Karachi and Lahore respectively. Table 2 briefly delineates the demographic profile of the respondents.

Table 2. Demographics of the respondents from Karachi and Lahore city

Categories	Karachi (N=209)		Lahore (N=237)	
	Number of Respondents	%	Number of Respondents	%
Sample Collected				
Disabled	30	14%	2	0.8%
Physically fit Older	114	55%	156	66%
Older with Disability	65	31%	79	33%
Age Group				
Below 20	17	8%	0	0%
21-40	13	6%	2	1%
41-60	21	10%	68	29%
61-70	123	59%	135	57%
71-80	25	12%	25	11%
Above 80	10	5%	7	3%
Gender				
Male	144	69%	175	74%
Female	65	31%	62	26%

Figure 2 shows that the highest proportion of the disabilities covered in the data concern knee/joint pain because a large amount of data is obtained from the older people and it is the most common problems for elders. The data also covers some other types of disabilities, which include wheelchair-bound, mentally impaired, blind or vision impaired, deaf or with hearing problems, dumb or with speech problems, and crutch users. The percentages for these groups are 10%, 24%, 8%, 2%, 8%, and 10% respectively for Karachi and 20%, 1%, 5%, 4%, 0% and 10% respectively for Lahore.

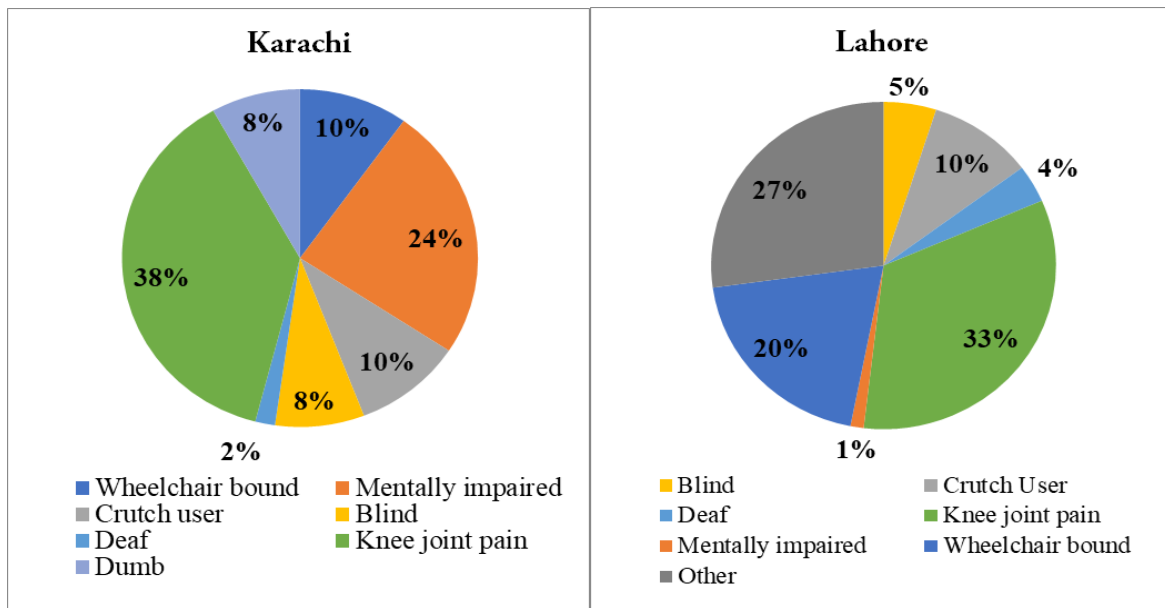


Figure 2. Disability types of respondents from Karachi and Lahore city

Of the respondents, 57% in Karachi and 62% in Lahore do their daily needs themselves while 43% and 38% respectively are dependent on family members or relatives. Only a small percentage of respondents (0.5%) in Karachi but none in Lahore live alone. In Karachi, 50% of the respondents are from households consisting of 3-5 members, whereas 50% in Lahore belong to households comprising 6-8 members.

3.2 Occupation and Income

Occupation of the respondents are shown in Figure 3. Around 33% of the respondents in Karachi are retired while in Lahore a high proportion of the respondents are workers or day-labors (39%) and unemployed (25%). Figure 4 depicts the monthly household income distribution, showing higher proportions of middle-income people in Karachi and lower-income groups in Lahore. A large proportion of the respondents in both cities have a range of individual expenditure between PKR 2,000 – 10,000 per month for personal use, as seen in Figure 5.

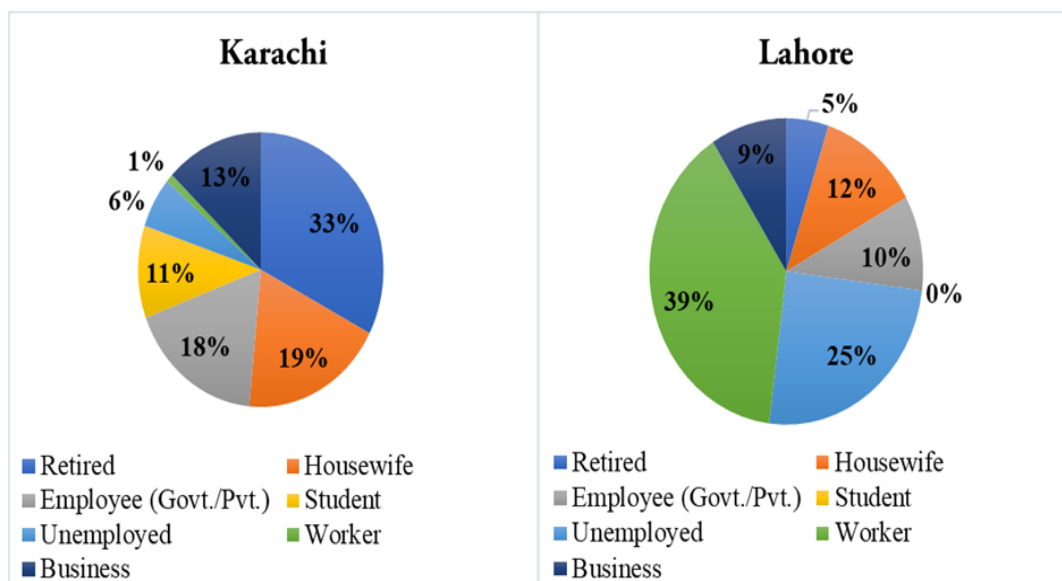


Figure 3. Occupation of the respondents

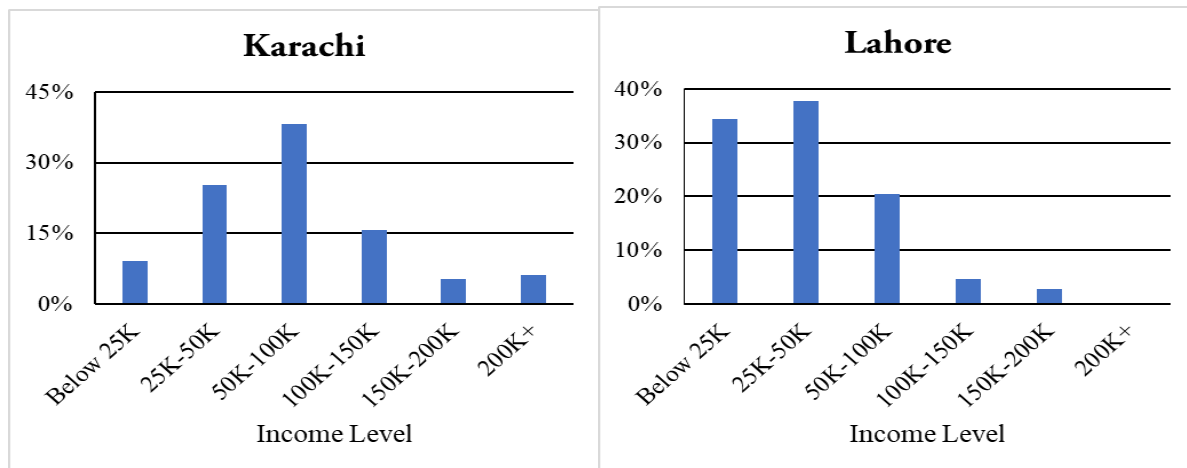


Figure 4. Household monthly income (PKR) distribution of the respondents

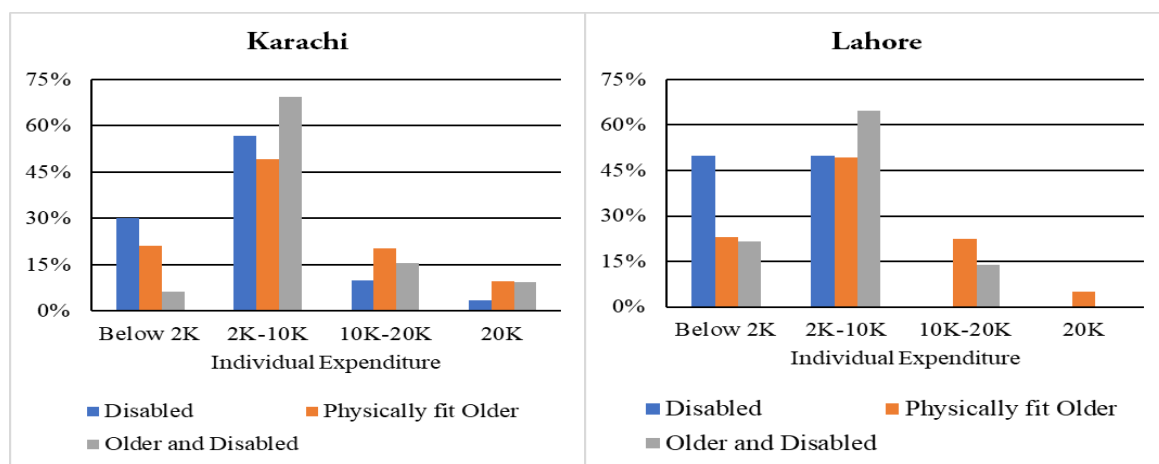


Figure 5. Personal monthly expenditure (PKR/month) of respondents

3.3 Household Vehicle Ownership

Table 3 shows the vehicle ownership of the surveyed households. In both cities, more than half of the households own private vehicles. Ownership of private vehicles is significantly higher in Karachi (82%) as compared to Lahore (52%). This is probably due to the fact that the public transport facilities in Lahore have been improved after the Metrobus system and Orange Line initiatives, which facilitates residents with better public transport (even during the pandemic). These private vehicles consist of cars and motorcycles, with proportions of 56% and 44% respectively for Karachi and 47% and 53% for Lahore. Nevertheless, almost 11% of the respondents in Karachi never have access to the private vehicle owned by the household.

Table 3. Household vehicle ownership of the respondents in Karachi and Lahore city

Vehicle Ownership	Vehicle	Karachi		Lahore	
		Number of Respondents	%	Respondents	%
No		37	18%	99	42%
Yes	Car	97	46	65	27
	Motorcycle	76	36	74	31
	Sub-Total	172	82%	138	58%

4. MOBILITY AND TRIPS DURING COVID-19 (POST-LOCKDOWN)

4.1 Travel Pattern

Almost half of the respondents travel alone though 48% in Karachi and 52% in Lahore travel accompanied or escorted by another person. Table 4 describes the travel patterns of the respondents during COVID-19. In Karachi, a smooth variation can be observed in travel frequency of respondents, with around 20% of the respondents making trips with a high frequency, i.e. more than five trips per week. In Lahore, 46% of the respondents made trips with a frequency of 4-5 trips per week. The physical distancing and Standard Operating Procedures (SOPs) followed by respondents in Karachi is 5% more as compared to Lahore. The major problems considered in travelling during this pandemic situation mentioned by 18% and 10% respondents from Karachi and Lahore respectively include less travel, less availability of public transport with no proper enforcement of social distancing and SOPs.

Table 4. Travel frequency of the respondents in Karachi and Lahore during COVID-19

Categories	Karachi		Lahore	
	Number of Respondents	%	Number of Respondents	%
Travel Frequency				
Few times/year	25	12%	2	1%
Few times/month	20	10%	5	2%
1 trip/month	8	4%	2	1%
1 trip/week	22	11%	52	22%
2-3 trips/week	24	11%	46	19%
4-5 trips/week	34	16%	108	46%
5+/week	41	20%	0	0
Several times/day	35	17%	0	0
Total	209	100%	215	93%
Physical Distancing				
Yes	134	74%	148	69%
No	48	26%	66	31%
Availability of Public Transport				
Yes	79	87%	100	69%
No	12	13%	45	31%
Problems Due to COVID				
Yes	38	18%	22	10%

To understand more detailed travel information, the respondents were asked about their total number of trips during the previous week. As seen in Table 5, in Karachi, the highest travel frequency was 1-2 trips per week, made by 44% of respondents. In Lahore, about 41% of respondents made 5+ trips per week while a very small portion did not travel at all. The latter respondents usually travel just a few times per month or year.

Table 5. Respondents' trips in Karachi and Lahore city during last week

Travel Frequency of Respondents	Karachi		Lahore	
	Respondents	%	Respondents	%
None	44	21%	14	7%
1-2/week	91	44%	75	35%

3-5/week	30	15%	36	17%
5+/week	40	20%	88	41%
Total	205	100%	213	100%

The details of trip characteristics are discussed in the following section.

4.2 Trip Characteristics

Table 6 delineates the characteristics of trips, including purpose, distance, travel time, travel cost, and mode used during COVID-19. In Karachi, the trips were made having the main purpose of work and shopping. Around 42% of the trips are travelled below 1km distance that shows the older people usually make trips within the area close to home. The three major travel modes used for commuting in Karachi during COVID-19 are car, motorcycle and walking with a percentage of 28%, 21%, and 28% respectively. It shows that the most reliable and safe mode for people are private vehicles as the public transport was risky for older people, due to the potential contraction of coronavirus due to less enforcement of proper SOPs and social distancing when travelling by buses and Chinchies. Chinchis is a three wheeler public transport having low capacity with maximum nine passengers (Noman, et. al. 2020).

Table 6. Trip characteristics in Karachi and Lahore during COVID-19

Categories	Karachi		Lahore	
	Number of Trips	%	Number of Trips	%
Trip Purpose				
Grocery	44	19%	19	8%
Personal Need	37	16%	1	0%
Doctor Visits	18	8%	55	24%
Work	65	28%	138	59%
Education	21	9%	4	2%
Social	37	16%	9	4%
Recreation	13	6%	7	3%
Total	235	100%	233	100%
Trip Distance				
Below 0.5	47	20%	20	8%
0.5-1 km	51	22%	26	11%
1.1 – 2 km	21	9%	25	11%
2.1 – 5 km	31	13%	62	26%
5.1 – 10 km	38	16%	47	20%
10.1 – 20 km	28	12%	35	15%
Above 20 km	19	8%	23	10%
Total	235	100%	238	100%
Travel Mode				
Walking	66	28%	44	19%
Rickshaw	22	9%	75	32%
Bus	15	6%	19	8%
Car	66	28%	36	16%
Motorcycle	50	21%	56	24%
Chingchi	8	3%	2	1%
Taxi, Uber/ Careem	6	3%	0	0%
Total	233	100%	232	100%

Travel time				
Below 5 min	58	25%	13	5%
6 – 15 min	85	36%	60	25%
16-30 min	47	20%	106	45%
31-45 min	21	9%	21	9%
46 min -1 hr	12	5%	27	11%
1-2 hr	9	4%	8	3%
2+ hr	3	1%	2	1%
Total	235	100%	237	100%
Trip Cost				
None	70	30%	48	20%
PKR 10	4	2%	0	0%
PKR 11-20	14	6%	7	3%
PKR 21-50	42	18%	56	24%
PKR 51-100	41	17%	52	22%
PKR 101-200	37	16%	35	15%
PKR 201-500	23	10%	26	11%
PKR 500+	4	2%	14	6%
Total	235	100%	238	100%

Whereas in Lahore, around 59% and 24% of trips were made with the major purpose of work and doctor visits respectively. Around 46% of trips are travelled in between 2–10 km distance. The major travel modes used for commuting in Lahore during COVID-19 are rickshaw, motorcycle, and walking with a percentage of 32%, 24%, and 19% respectively. The distance travelled for making most of the trips ranged from 1 to 10 km using the most preferred mode of transport as private vehicles, paratransit and walking with percentages 43%, 29%, and 19% respectively. Travel cost for the majority of respondents in both cities during COVID-19 is between PKR 20 and PKR 200.

5. MOBILITY AND TRIPS DURING LOCKDOWN

5.1 Travel Pattern

During the lockdown, most of the respondents lived in their own house. However, a very few (7% and 5% respectively in Karachi and Lahore) were in other places (e.g. village, another city) before the lockdown and they returned home by aeroplane, bus and personal vehicle during the lockdown. Table 7 shows the travel pattern of the respondents during the lockdown in Karachi and Lahore. A high percentage of the respondents avoided travel during the lockdown and preferred to stay at home. About 70% and 53% of the respondents in Karachi and Lahore respectively did not travel.

Table 7. Travel frequency of the respondents in Karachi and Lahore city during the lockdown

Categories	Karachi		Lahore	
	Number of Respondents	%	Number of Respondents	%
Travel Frequency				
No travel	146	70%	126	53%
Few times/month	5	2%	1	0.5%
1 trip/month	7	3.5%	1	0.5%
1 trip/week	6	3%	60	25.5%

2-3 trips/week	15	7%	15	6.5%
4-5 trips/week	18	9%	18	7.5%
5+/week	11	5%	12	5%
Several times/day	1	0.5%	2	1%
Total	209	100%	235	100%
Physical Distancing				
Yes	47	76%	77	69%
No	15	24%	34	31%
Availability of public transport				
Yes	32	52%	44	40%
No	30	48%	66	60%

In Karachi, the highest 9% had a travel frequency of 4-5 trips per week while in Lahore around 25.5% made one trip per week. Of the respondents who made trips during the lockdown, about 76% of them in Karachi and 69% in Lahore followed the SOPs while travelling during the lockdown. Almost 44% in Karachi mentioned having problems regarding travel, including unavailability of public transport and no proper social distancing maintained in public places. In contrast, in Lahore, only 11% of respondents had mobility problems due to the closure of various roads and public transport and paratransit were difficult to reach.

5.2 Trip Characteristics

Table 8 describes the characteristics of the trips, including purpose, distance, travel time, travel cost, and mode used during the lockdown. In Karachi, most of the trips commuted were necessary trips, i.e. related to work, grocery, and personal needs. In contrast, leisure trips, i.e. social gatherings and recreational trips, were avoided to remain safe from being infected. Around 65% of the trips were within a distance of 5 km. Three major travel modes used for commuting in Karachi during lockdown were car, walking, and motorcycle with a percentage of 29%, 26%, and 19% respectively. The priority in terms of travel mode is given to private vehicles compared to public transport due to its unavailability during the lockdown.

Table 8. Characteristics of the trips in Karachi and Lahore city during the lockdown

Categories	Karachi		Lahore	
	Number of Trips	%	Number of Trips	%
Trip Purpose				
Grocery	16	25%	13	12%
Personal Need	13	21%	1	1%
Doctor visits	6	10%	45	42%
Work	22	35%	43	40%
Education	0	0%	0	0%
Social	4	6%	0	0%
Recreation	2	3%	6	6%
Total	63	100%	108	100%
Trip Distance				
Below 0.5	10	16%	8	7%
0.5-1 km	11	18%	12	11%
1.1 – 2 km	9	15%	26	24%
2.1 – 5 km	10	16%	35	32%
5.1 – 10 km	7	11%	17	15%
10.1 – 20 km	8	13%	9	8%

Above 20 km	7	11%	3	3%
Total	62	100%	110	100%
Travel Mode				
Walking	16	26%	34	31%
Rickshaw	8	13%	30	28%
Bus	5	8%	2	2%
Car	18	29%	20	18%
Motorcycle	12	19%	23	21%
Qunichi	2	3%	0	0%
Taxi, Uber/ Careem	1	2%	0	0%
Total	62	100%	109	100%
Travel time				
Below 5 min	12	19%	6	5%
6 – 15 min	23	37%	45	41%
16-30 min	13	21%	39	35%
31-45 min	7	11%	12	11%
46 min -1 hr	1	2%	6	5%
1-2 hr	5	8%	2	2%
2+ hr	1	2%	0	0%
Total	62	100%	110	100%
Trip Cost				
None	17	27%	37	34%
PKR 10	1	2%	0	0%
PKR 11-20	6	10%	3	3%
PKR 21-50	9	14%	20	18%
PKR 51-100	10	16%	17	15%
PKR 101-200	10	16%	15	14%
PKR 201-500	8	13%	14	13%
PKR 500+	2	3%	4	4%
Total	63	100%	110	100%

Whereas in Lahore, around 40% and 42% of trips were for work and doctor visits respectively. The distance for about 71% of the trips is between 2 km and 10 km. The major travel modes used for commuting in Lahore during Lockdown were walking, rickshaw, and motorcycle with a percentage of 31%, 28%, and 21% respectively. The distance travelled for most of the trips ranging from 1 to 10 km using the most preferred mode of transport, which was private vehicles, paratransit and walking with percentages 39%, 28%, and 31% respectively. The travel cost during lockdown was between PKR 50-200 for both cities.

6. MOBILITY AND TRIPS BEFORE COVID-19

6.1 Travel Pattern

Before COVID-19, around 51% and 57% of the respondents in Karachi and Lahore respectively travelled alone while the remainder were accompanied or escorted by another person. Table 9 shows the travel frequency of the respondents before the COVID-19 pandemic.

Table 9: Travel frequency of respondents in Karachi and Lahore city before COVID-19

Categories	Karachi		Lahore	
	Respondents	%	Respondents	%

Travel Frequency				
Few times/year	19	9%	2	2%
Few times/month	13	6%	9	8%
1 trip/month	8	4%	2	2%
1 trip/week	15	7%	8	7%
2-3 trips/week	23	11%	19	17%
4-5 trips/week	34	16%	44	39%
5+/week	43	21%	29	25%
Several times/day	53	25%	1	1%
Total	208	100	114	100

Most of the respondents in Karachi made either more than five trips per week (21%) or several times per day (25%), though some travelled only once in a week or month or several times per year. Whereas in Lahore most respondents did not prefer to travel several times daily, the common frequency found 4-5 trips per week (39%) or more than five trips per week (25%).

Almost 73% of the respondents in Karachi and 40% in Lahore mentioned that before COVID-19 there was public transport available for their trips. Only 39% of respondents encountered travel and mobility problems, with the main issues being traffic congestion, pollution, overcrowded buses, high travel costs of fuel, lack of accessibility to bus stops, improper lighting system on roads (causing crimes), lack of pedestrian facilities, lack of parking spaces, and lack of enforcement of traffic rules. Almost 50% of the respondents in both cities mentioned that on a typical day before COVID-19 they usually travelled or went outside their home once. The characteristics of the trips are discussed in the next section.

6.2 Trip Characteristics

Table 10 describes the characteristics of the trips, including purpose, distance, travel time, travel cost, and mode used before COVID-19. In Karachi, the trips before COVID-19 were mainly commuted for the purpose of work, shopping, and social gatherings with a percentage of 23%, 19%, and 23% respectively. It shows that around 42% of the trips were performed for leisure and socialization. The distance travelled before COVID-19 has a smooth variation from below 5 km to 20 km. The most used travel modes are private vehicles and walking, which could be due to the poor condition of public transport and costly travel in paratransit mode. Around 28% are walking trips because most people prefer to walk within the area of residence in order to have a healthy activity and leisure time.

In Lahore, people are more committed to work as 70% of the trips are for the purpose of work. The most used mode of transport is rickshaw and motorcycle for making trips with percentages of 26% and 29% respectively.

Table 10. Trip characteristics in Karachi and Lahore city before COVID-19

Categories	Karachi		Lahore	
	Number of Trips	%	Number of Trips	%
Trip Purpose				
Grocery	57	19%	11	10%
Personal Need	42	14%	1	1%
Doctor visits	20	7%	14	13%
Work	68	23%	79	71%
Education	18	6%	2	2%
Social	69	23%	2	2%
Recreation	24	8%	3	2%

Total	298	100%	112	100%
Trip Distance				
Below 0.5	57	19%	18	16%
0.5-1 km	51	17%	12	10%
1.1 – 2 km	37	12%	10	9%
2.1 – 5 km	43	14%	32	28%
5.1 – 10 km	50	17%	10	9%
10.1 – 20 km	41	14%	15	13%
Above 20 km	21	7%	18	16%
Total	300	100%	115	100%
Travel Mode				
Walking	84	28%	23	20%
Rickshaw	24	8%	30	26%
Bus	19	6%	10	9%
Car	96	32%	17	15%
Motorcycle	56	19%	33	29%
Qunichi	10	3%	1	1%
Taxi, Uber/ Careem	9	3%	0	0%
Total	298	100%	114	100%
Travel time				
Below 5 min	74	25%	6	5%
6 – 15 min	105	35%	26	22%
16-30 min	60	20%	54	47%
31-45 min	34	11%	8	7%
46 min -1 hr	14	5%	14	12%
1-2 hr	10	3%	8	7%
2+ hr	2	1%	0	0%
Total	299	100%	116	100%
Trip Cost				
None	86	29%	27	23%
PKR 10	7	2%	0	0%
PKR 11-20	19	6%	5	4%
PKR 21-50	43	14%	33	28%
PKR 51-100	48	16%	22	19%
PKR 101-200	55	18%	8	7%
PKR 201-500	37	12%	11	9%
PKR 500+	5	2%	10	9%
Total	300	100%	116	100%

7. CHANGES AND PROBLEMS DUE TO COVID-19

7.1 Impacts of COVID-19 on Travel and Mobility

Table 11 shows the trips performed per person before COVID-19 and during COVID-19. In Karachi, the average trip rate before the COVID-19 was 1.43 trips/person, which decreased to 0.3 trips/person during the lockdown. After the lockdown restrictions were eased, the trip rate increased to 1.12 trips/person. This shows that in post-lockdown, the trip rate is slightly lower than in the pre-pandemic situation due to the fact that all the economic and social activities

have not been fully restored during the neo-normal situation. The data collected from Lahore shows that the trip rates during lockdown were around 0.46, which increased to 0.98 after the lockdown restrictions were eased out. The trip rate values show that a major reduction in trips was found during lockdown in both cities due to unavailability of public transport, closure of working places, and the initiation of online systems for education and working from home. For example, compared with the before COVID-19 situation, around 80% less trips were produced during lockdown while 22% decrease was observed after lockdown.

Table 11: Trips per person in Karachi and Lahore city

Situation	Trips/respondent in Karachi city	Trips/respondent in Lahore city
During COVID-19 (post-lockdown)	1.12	0.98
During Lockdown	0.3	0.46
Before COVID-19	1.43	0.47

Table 12 describes various factors which contribute to affect mode choice behavior. In general, the commuters before COVID-19 select public transport because it is economical and fares are comparatively cheaper than paratransit for long-distance journeys. The private transport users find it comfortable and faster mode in comparison with public transport modes.

Table 12. Reason for selecting travel mode by respondents in Karachi and Lahore city

Modes of Transportation	Reason in Karachi city	Reason in Lahore city
Public transport	Cheaper	Cheap/ Cost-effective
Private modes	Comfortable, flexible, faster, Personal Mode	Safe, comfortable, cheap, less travel time
Paratransit	Convenient, availability	Comfortable, cheap
Active modes	Healthy lifestyle, Close to home	Near to home

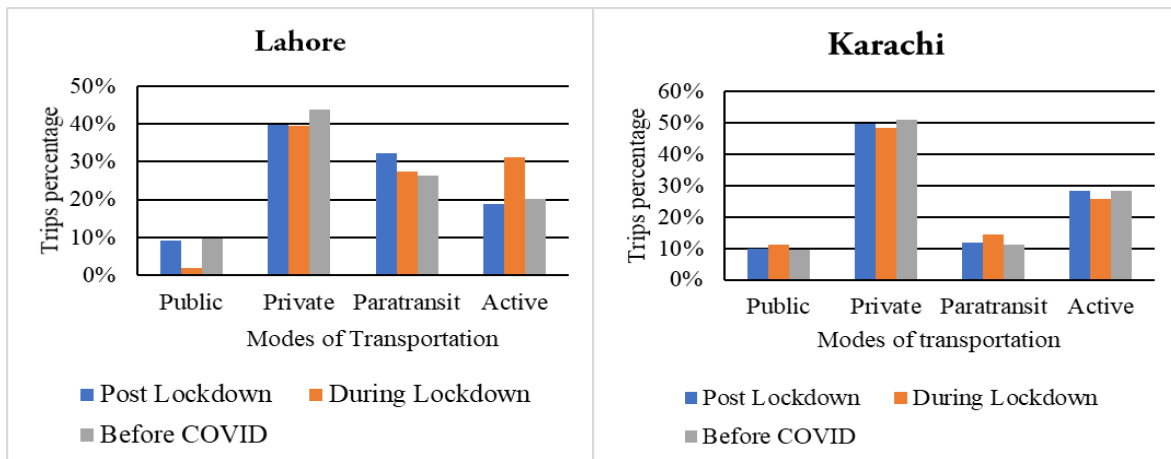


Figure 6. Modal distribution of trips in Karachi and Lahore city during and before COVID-19

Figure 6 describes the effect of the COVID-19 on the modal distribution of trips in Karachi and Lahore. In Karachi, the usage of each mode was not affected in a long-term sense by the pandemic as the percentages of trips made by any mode before COVID-19 and after the lockdown was approximately the same. During and before COVID-19, the high percentage of trips were by means of private vehicles (i.e. 50% trips on car and motorcycle) and the active transport played a vital role in the lifestyle of elderly and disabled people as the walking is the second most used mode. The respondents preferred to make trips within walking distance of residence to either nearby market for shopping or to socialize for having a recreational activity.

Only 10% of the respondents use public transport facilities for their daily needs. Whereas in Lahore, the number of trips is much affected due to COVID-19 as compared with before the pandemic. The usage of active mode and paratransit is comparatively higher in percentage than public transport mode. A significant decrease is observed in the trips commuted using public transport during the lockdown, which indicates that the availability of public transport might have decreased during the lockdown. Furthermore, the elderly people might have avoided the use of public transport to reduce the risk of getting infected from COVID-19 virus. The active transportation and use of paratransit are increased due to this pandemic.

Figure 7 shows the typical travel frequency of the respondents. The lockdown has decreased the trip rate from several trips each day to 1 or 2-3 trips per week. In Lahore, the travel frequency of most of the respondents before the pandemic was 4-5 trips or 5+ trips per week, which is significantly affected during the lockdown. A significant decrease in the number of trips during lockdown is observed as the highest proportion of one trip per week is observed during the lockdown.

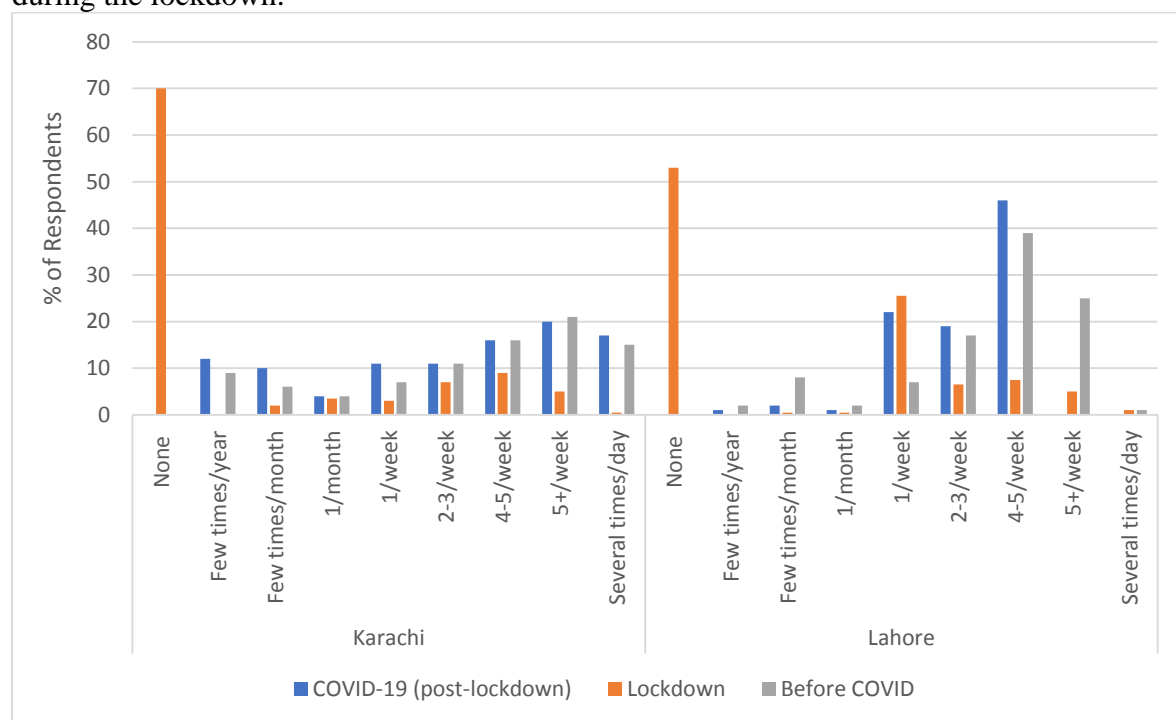


Figure 7. Travel frequency of respondents in Karachi and Lahore city during and before COVID-19

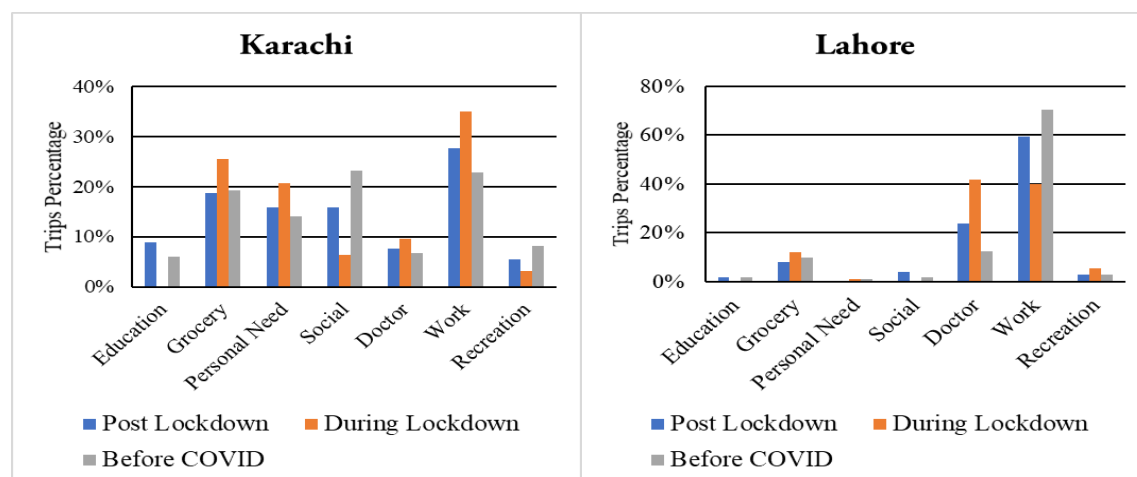


Figure 8. Effect of COVID-19 on travel purpose in Karachi and Lahore city

Figure 8 illustrates that the trips made during lockdown mostly consist of the purpose of grocery, work, and doctor visit, which shows that only trips with a necessary purpose were made during the lockdown. It can be interpreted that the situation during COVID-19 and before COVID-19 remained the same for the work in Karachi while for Lahore after lockdown most people travelled for the purpose of work more as compared to before COVID-19 and during the lockdown. On the contrary, the trips of socializing, recreation, and education are most affected by the COVID-19 situation.

7.2 Problems and Expectations

In general, finding public transport for a trip in Karachi and Lahore is not easy. Figure 9 shows that in Karachi people find it very difficult whereas in Lahore most of the respondents find it easy because of recent improvements in public transport infrastructure i.e. Orange Line and Metrobus systems. The respondents in Lahore reported that it was not difficult to identify a location and most of the respondents found it easy and manageable. Whereas, in Karachi, this percentage is slightly less as compare to Lahore and people found it less easy to identify locations. The data presented in Figure 9 shows that approximately half of the respondents find it hard to use public transport.

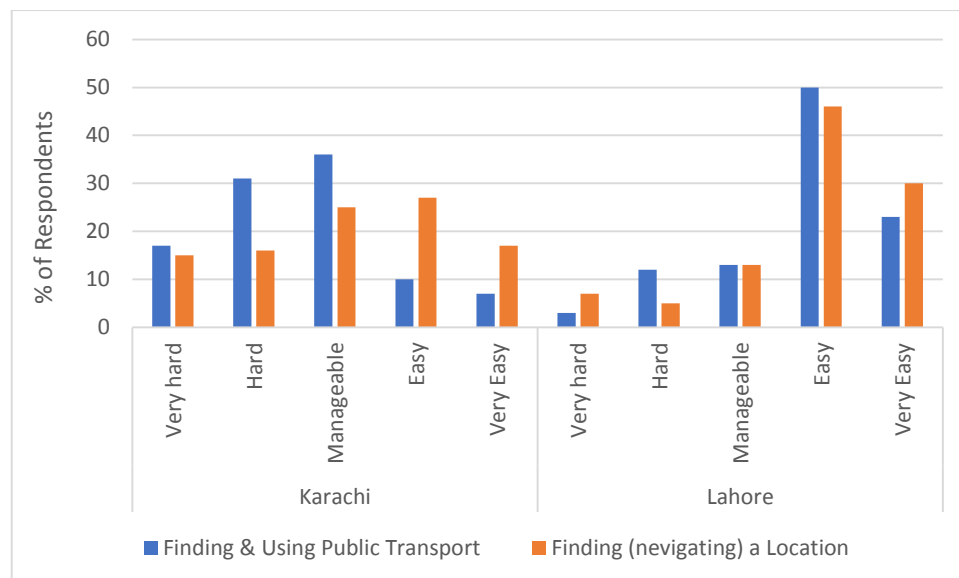


Figure 9. Level of difficulty in finding public transport and location in Karachi and Lahore city

The respondents were asked if they have faced any particular problem related to travel during and before COVID-19. Only 35% of the respondents in Karachi and 12% in Lahore mentioned that their typical travel and mobility has changed (e.g. travel less, lesser buses are available, changed the route) due to COVID-19. Almost 14% of the respondents mentioned either change in their trip cost or facing additional travel problems due to COVID-19. The reported problems in Karachi and Lahore during COVID-19 and before COVID-19 are:

- Less accessibility to bus stops;
- Highly crowded buses and no seats available;
- Uncomfortable public transport;
- Difficult to maneuver wheelchair on road and not accessible to public transport;
- Traffic congestion and high travel time;
- Air pollution;

- Less public transport and poor service, problem in getting into bus (drivers do not stop buses properly), less variety of modes options available;
- Poor infrastructure e.g. road potholes, absent of pedestrian road crossing facilities;
- High fare or cost of fuel;
- Garbage on street or parked cars on footpaths;
- Lack of enforcement of traffic rules;
- Improper lightning at night.

The reported problems by the respondents during COVID-19 are:

- Less availability of public transport;
- Travel cost increase;
- Travel frequency affected - less travel;
- Using mask is uncomfortable (particularly irritates while riding bike);
- SOPs not followed properly in public transport;
- Business affected and less social activity;
- No proper facility for handicapped people;
- Fear of snatching and robbery.

The data collected from the survey shows that 98% and 91% of respondents from Karachi and Lahore respectively had no change in their occupation and the remaining (only 2% and 9% respectively) with changing occupation due to COVID-19. It shows that COVID-19 had no major effect on occupation of older people, as most of them were already not in a regular job. However, Figure 10 shows 36% and 63% of the respondents in Karachi and Lahore respectively reported a decrease in their household income while 25% and 42% respectively found that the trip cost has increased due to COVID-19.

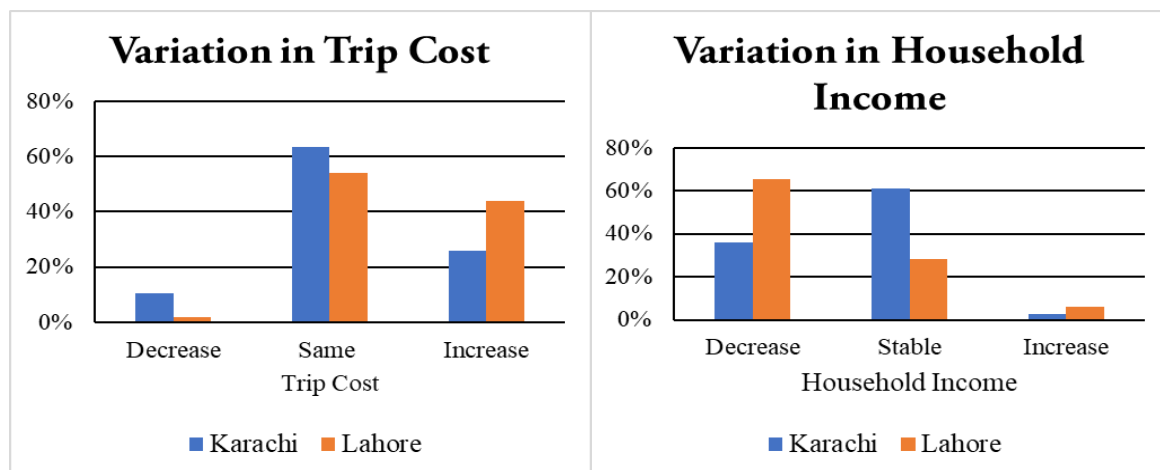


Figure 10. Variation of income and travel cost in Karachi and Lahore city due to COVID-19

Nevertheless, the respondents were asked if they have any expectation or suggestion for improving travel and mobility. Only 19% of the respondents in Karachi but 87% in Lahore provided their suggestions. The expectations and suggestions are almost similar for both cities. These are:

- SOPs must be followed - social distancing should be ensured with proper enforcement;
- Mandatory precautions e.g. distribute mask and sanitizer in public transport, avoid taking sick people in public transport;

- Government should keep fare prices in control, provide subsidize transport or shuttle services during COVID-19;
- Extend the lockdown time;
- Taxi Apps for handicaps;
- Overloading should be avoided;
- More buses should be provided with high frequency;
- Construct more roads; / Improve the construction of roads;
- Providing more rickshaws; /Restrict or avoid chinchis;
- Not to allow trucks operating in narrow streets;
- Built new mass transit projects similar to orange line train.
- Government should decrease fuel cost;
- Providing proper signs and markings in main roads.

8. CONCLUSIONS AND RECOMMENDATIONS

The accessibility and inadequate transport infrastructure with poor traffic conditions in developing countries is quite challenging for a large number of people who live below the poverty line. Karachi is the only metropolitan city in Pakistan with no proper public transport system on which a person can rely. The city is full of problems related to travel and mobility for young and physically fit people including lack of public transport facilities, no proper bus stops, traffic congestion and lack of enforcement of traffic rules. For elderly and disabled people, these problems are aggravated because they need special arrangements for their travel. The situation of COVID-19 has made it worst. Overall, people travelled more before COVID-19 as compared to the trips made after the pandemic.

The data analyzed from this research shows that people have faced difficulty in travelling due to COVID-19 because of unavailability of public transport and no proper enforcement of physical distancing or SOPs during COVID-19 and lockdown. Most of the commuters in Karachi depend on private vehicles for their daily travel needs. So, in general, it can be interpreted that the effects of COVID-19 on mobility was mainly affecting the people who do not own their private vehicle. Another study conducted for Karachi's public transport (Khan et al., 2020) delineates that the two major attributes affecting the choice of public transport are travel time and comfort. The poor quality of public transport facilities compels people to travel on private vehicles. The only reason reported by commuters in Karachi for not using the private vehicle was not having ownership and availability that left the only option to be the use of unreliable and uncomfortable public transport (Ahmed & Noman, 2020). Lahore has a comparatively reliable, safe and comfortable public transit system, which includes Lahore Metrobus and the Orange Line (Ahmed & Azeem, 2015). The ratio of trips per respondents during lockdown was the least showing that most people avoided travelling during COVID-19 to remain safe and healthy.

Active modes have always played a vital role in life of elder and physically challenged people specially when it comes to maintain a healthy lifestyle. The COVID pandemic has increased the active mobility in urban towns around the world due to restrictions of vehicular movements and public transport. From the results of survey, it is deduced that in Lahore during pandemic and lockdown it is used frequently. But due to poor road infrastructure in Karachi the mode has not created that much affect in life of people.

The two major reasons for choosing public transport in Karachi were identified as not having a private vehicle and safer than a motorcycle. The problems associated with the use of

public transport are identified as unavailability, problems in accessibility, and it being overcrowded. These problems are more critical for older and disabled people who need special assistance and arrangements for fulfilling their travel needs.

The cities in Pakistan often lack facilities to accommodate elderly and physically challenged people, especially in Karachi. The following recommendations are based on the suggestions provided by respondents, which can be implemented to improve travel of elderly and disabled people.

- Ensure proper social distancing and SOPs in public areas including all travel modes;
- Subsidize transport for older and disabled people;
- Provision of affordable and clean public transport with frequent bus service;
- Provision of pedestrian facilities and proper walkways alongside roads for increasing walkability;
- Provision of first aid and priority seats in public transport for older and disabled people;
- Provision of proper street lighting to save citizens from robbery and snatching;
- Ensure proper enforcement of traffic rules and laws;
- Provision of proper parking spaces for disabled and older people;
- Provision of a separate travel mode for older and disabled people.

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