



Public transport versus solo travel mode choices during the COVID-19 pandemic: Self-reported evidence from a developing country

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ABSTRACT

A sharp decline in public transport use has been reported worldwide since the outbreak of the COVID-19 pandemic. As the virus spreads through close contacts, particularly in closed environments, public transport vehicles could be considered as hotspots for its transmission. However, public transport operations cannot be entirely stopped as many people in developing countries rely on them for their travel needs. This study aims to provide insights into people's travel mode choices during the COVID-19 pandemic. Data, i.e., 1,516 complete survey responses, were obtained through a questionnaire that was conducted in Lahore, Pakistan. A binary logistic model was developed using the collected data to model the likelihood of choosing solo or public transport modes during COVID-19. The results explained that the respondents preferred solo modes more than the public transport modes during the pandemic. Gender, income, education, profession, trip frequency, car ownership, motorbike ownership, and an underlying factor that was defined as "safety precautions" were found to be significant predictors of the public transport choice relative to solo modes. Females tend to choose public transport modes relative to solo modes as compared to males. Private vehicle (car or motorbike) owners were less likely to use public modes relative to solo modes when compared to those who do not own private vehicles. The outcomes of this study could be important for the government authorities, policymakers, and transport operators to understand the public transport use in developing countries during pandemics. Such information will be useful to devise regulations and preventive measures to control infectious diseases associated with public transport use, particularly in developing countries, where private transport options are limited.

1. Introduction

The eruption of the COVID-19 pandemic has remarkably disrupted public transport operations around the world ([19,50,46]). The virus transmits from a person to another through close contact in a short range (usually 1 m) and by touching contaminated surfaces, particularly inside closed atmospheres. Hence, necessary precautionary measures were recommended by the World Health Organization (WHO) to control the spread of the virus, which included maintaining a social distance, avoiding crowded places, and wearing facemasks [48]. As public transport is often crowded, particularly in developing countries, and it is difficult to maintain social distance under such conditions, public transport vehicles are considered as potential hotspots for virus trans-

mission. The study by Harris [24] concluded that the subway system of New York City was a major transmitter of the COVID-19 infection during the first wave of the epidemic during March 2020. As stated in Nuki and Newey [42], the virus transmission rates could be up to six times higher for the people who use public transport. Therefore, a drastic decline in public transport use was reported around the world during the COVID-19 pandemic. Private transport happened to provide the advantage of social distancing and thus, emerged as one of the safest modes during the pandemic attracting public transport users. Similarly, active modes (walking and cycling) also offered safer traveling alternatives during the pandemic [36,17].

In general, travel restrictions are implemented during outbreaks of infectious diseases to control the virus transmission [37]. These restric-

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tions triggered sudden and massive changes in the traffic pattern and travel behavior of people worldwide (Lee et al., [2, 32]). A study analyzed ten countries on six continents in order to understand the determinants of protective behavior in relation to the transport sector and COVID-19. The outcomes demonstrated huge disruptions for commuting as well as non-commuting trips, showing a significant decline in trip frequencies for all types of trips and the use of all types of modes. Furthermore, inequalities in socioeconomic characteristics and mobility patterns are not only related to actual health risks but also to perceived risks, as demonstrated in the relevant literature [8]. Even before the pandemic, the use of public transport was characterized by a number of critical issues such as psycho-social barriers [7]. In addition, the mechanism of virus transmission, i.e., close contacts in closed environments, indicates that public transport vehicles could trigger the transmission of infectious diseases [28, 34, 38]. Therefore, a significant reduction in public transport use was observed around the world [1, 14]. Maintaining social distance and wearing facemasks have been recognized as effective measures to mitigate the transmission of the virus and thus, public transport users are required to follow these measures [15, 16]. However, it is not certain that to what extent public transport users will follow these protective measures. For instance, it has been reported that facemasks were not being used by all the passengers [22]. Hence, recent studies that used mobility data and passenger counts reported a considerable decline in public transport use in several countries [6, 11, 29]. In addition, the fear of infection [27, 45] and uncertainty about the transit service frequency [9] may also play a role in reduced public transport use. Avoiding public transport was identified as an effective protective method to avoid infections as perceived by the people [49], whereas active transport modes were promoted during the pandemic [5]. As reported by de Haas et al. [19], trips based on public transport were declined by more than 90% during the early days of the COVID-19 outbreak in the Netherlands. The reduction in public transport use caused people to shift towards alternative modes, e.g., private cars and active modes [1]. The use of private and active modes increased during the pandemic since they do not generally require close contact with other people.

Abdullah et al. [3] developed three models to examine the intentions of people to use public transport under three scenarios during COVID-19, i.e., using public transport (i) in general, (ii) while following precautions, and (iii) when having COVID-19 symptoms. However, they did not develop any models for the mode choice behavior during the COVID-19 pandemics. Further, the relative importance and choices of other modes (i.e., travel modes other than public transport modes) were not considered. From travelers' perspective, the travel modes could be classified into two categories, namely solo modes and public modes. Solo modes can be defined as the means of travel used by a single person and sometimes accompanied by a driver such as a private car and, taxi, etc. Whereas public modes can be defined as those alternatives which are used by several people at a time e.g., public buses, trains, and wagons, etc. This study aims at understanding people's mode choices in terms of solo or public modes in Lahore, Pakistan. Choice of public transport could be risky because that could trigger the transmission of the virus. On the other hand, people in developing countries might have limited travel options other than public transport. Therefore, before implementing regulation and restrictions on public transport use, peoples' mode choice behaviors should be comprehensively understood. To explore the choice behaviors of public versus solo travel modes, a questionnaire survey was conducted in Lahore city, Pakistan and 1516 completed responses were obtained. Detailed statistical analyses were carried out to model the likelihood of choosing solo or public transport modes during the COVID-19 pandemic.

The rest of the paper is organized as follows: Section 2 presents the details of the questionnaire survey and analysis methods adopted in this study. This is followed by Section 3 where results are discussed. Finally, discussion and conclusions are presented in Section 4.

2. Methodology

2.1. Study area

Lahore is the second most populous city of Pakistan with a population of more than 11 million people spread in an area of approximately 1772 sq. Km. Lahore is considered as a key center for academic, financial, and social activities. Several transport modes are available in the city such as conventional public transport buses, bus rapid transit (metro bus), an intercity train (metro train), wagons/vans, auto and motorcycle rickshaws, demand-responsive travel modes, and taxi and ridesharing services. The first case of COVID-19 was reported on February 26 in Pakistan. The government then implemented a nationwide lockdown on April 01, 2020, which was eventually lifted on May 09, 2020. However, a partial/smart lockdown was still in place till August 07, 2020. Right before this survey was conducted, about 3.4 Million COVID-19 cases had been reported and 6513 people had died in Pakistan by October 3, 2020 [40].

2.2. Questionnaire design and administration

A questionnaire was designed keeping in view the objectives of the study. The questionnaire contained three sections: (1) socioeconomic and -demographic characteristics (SEDs) such as gender, age, education level, income, profession, and car ownership, (2) mode choice and trip frequency during the pandemic, and (3) likelihood of using public transport if the riders have to comply with the precautionary measures such as wearing face masks, using hand sanitizers and maintaining social distance inside public transport vehicles. The questions about the likelihood of using public transport while obeying the health and precautionary procedures were measured using a 5-point Likert scale (1 = never to 5 = always). Face-to-face interviews, owing to their relatively higher reliability and response rates, were conducted to collect the required data. The questionnaire did not collect any personally identifiable details of the respondents.

A well-educated and properly briefed team of interviewers was formed for data collection purposes. Personal interviews have certain advantages over the self-completion questionnaire, e.g., interviewers can explain the questions to the respondents and higher completion rates can be achieved [43]. The questionnaire was designed and conducted in accordance with the guidelines by the University of Management and Technology, Pakistan. Further, the interviewers were instructed to adhere to the necessary health and safety guidelines while conducting the interviews. A total of 1516 complete survey responses were achieved from the study area. Past studies indicate that, for a large population size, a minimum sample size of 500 is able to produce statistics that are almost representative of the population parameters [13]. The sample size in this study fulfills this requirement. The data was collected using a convenience-based random sampling approach. In this approach, the survey locations were decided based on convenience, whereas the respondents at those survey locations were chosen randomly to minimize the bias. This survey strategy was easier for the surveyors to understand and implement. The data was collected during October and November of 2020. The survey was carried out at several important locations in Lahore city, e.g., Qaddafi Stadium, Racecourse, Mughalpur Railway Station, Liberty Market, Mall Road, Anarkali, and several bus stops.

2.3. Analyses methods

Initially, a descriptive analysis was conducted on the responses of the questionnaire. The items measuring the likelihood of using public transport while adhering to health precautions during the pandemic can be represented by several underlying factors. Exploratory Factor Analysis (EFA) is one such technique to determine those underlying factors. Conducting an EFA generally involves a 5-step procedure: determining

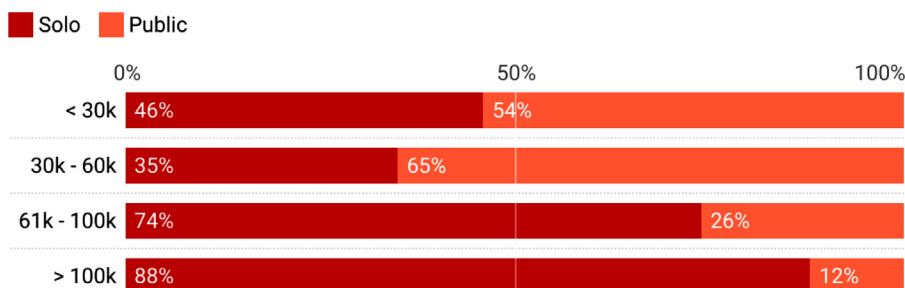


Fig. 1. Influence of income level on solo versus public travel mode choice (1 USD = Approx. 160 PKR).

the suitability of the data, factor extraction method, factor extraction criteria, rotation method, and interpretation and labeling [47]. In this study, the maximum likelihood method and eigenvalue criteria were used as the factor extraction method and factor extraction criterion, respectively. A rotation method was not required because the EFA resulted in a single underlying factor only. The factor scores for the underlying factor were computed using the Bartlett approach, which is a refined method for computing factor scores and produces unbiased estimates of the true factor scores as compared to the other refined methods [21]. A binary logistic regression model was then developed to explore the likelihood of choosing solo and public transport modes during the COVID-19 pandemic. The mode choice variable was entered as the dependent variable, whereas SEDs, trip frequency, and the underlying factor (obtained from EFA) were used as the input variables. The statistical analyses were performed using IBM SPSS Statistics software v. 20.

3. Results

3.1. Descriptive statistics

The descriptive statistics of the responses of the subjects are shown in Table 1. The proportion of males is more than the females and that may be attributed to the fact that the females have a smaller working population in Pakistan [4]. Most of the respondents belonged to the younger (20–40 years old) and well-educated class (bachelors and above). About 70% of the respondents mentioned that their trip frequencies were 5 or more days a week during the pandemic. Most of the respondents mentioned that they will never or rarely choose public transport modes when they have to adhere to the precautionary measures.

The respondents were asked to tick all the travel modes they were using during the pandemic. The travel modes were later classified into two categories, namely solo and public. Solo modes consisted of private car, walking, bicycle, motorbike, auto rickshaw, taxi, ridesharing services and any combinations of these modes. Auto rickshaw, taxi, ridesharing services were classified into solo modes owing to the fact that, generally, only one passenger uses these services along with a driver. In addition, the companies operating these services made it mandatory for their drivers/captains to wear facemasks and use hand sanitizers, hence, these modes can be classified as solo modes. Public modes consisted of public transport (bus, trains), wagons/vans, Qingqi rickshaw and any combinations of these services. It should be noted that the users using a combination of solo and public modes, such as private car as well as public bus, were also classified into the public mode category. About 60% of the respondents used solo modes whereas, about 40% of the respondents used public modes during the pandemic.

Fig. 1 depicts the mode share in terms of solo and public modes depending on the income levels. It can be understood that people belonging to low-income levels tend to use public transport more often as compared to high-income groups. Low-income groups in developing countries have limited private transport options and the travel cost difference between public and shared modes (e.g., taxi) could be significantly different. Therefore, they tend to rely on public transport modes even during pandemics.

Fig. 2 presents the mode share for different genders. As this figure explains, compared to males, females are more likely to use public transport. Several previous studies reported that females tend to use public transport more often and automobiles less often compared to males [10, 12, 30, 44]. Further, there are some cultural dimensions as well, i.e., in developing countries, particularly in this region, females rarely drive [35].

Previous studies (conducted before the COVID-19 pandemic) have explained that there is a negative relationship between public transport use and car ownership [18, 33]. That is, when public transit use increases ownership and usage of cars drop. During a pandemic, the situation could be different, as people would shift to private vehicles simply because of the fear of infection even though public transport options are available.

As shown in Fig. 3, car owners used less public transport compared to non-car owners as expected. However, 12% of car owners declared that they used public transport. This could be due to the characteristic of the trip, user, and destination. For example, if parking spaces are not available at the destinations, considering the security of the vehicle, people might not use cars for some trips.

Fig. 4 compares the share of solo and public transport for motorbike owners. As expected, motorbike owners tend to use less public transport compared to non-motorbike owners. However, compared to car owners (Fig. 3), motorbike owners use public transport more. This could be due to the reason that motorbikes are not suitable for certain types of trips, e.g., long-distance trips. Previous studies have identified that trip distance, duration and purpose can be the key determinants for the shift from private to public transport modes [31]. Further, given the hot weather conditions and dust in South Asian cities, people might not use motorbikes for commuting to their workplaces.

The majority of the respondents declared that they would never or rarely use public transport if they were required to obey the precautionary measures. That is, 66.5%, 49.4% and 57.4% of the respondents stated that they would never or rarely use public transport if they were required to keep a social distance, wear a facemask, and use hand sanitizers or disinfectants, respectively. Distributions of responses for Likert questions are summarized in Figs. 5 and 6, respectively, for public transport and solo transport users.

It can be understood that public transport users were willing to use that mode often or always when they have to comply with precautionary measures as compared to solo travel mode users. In particular, 53% of public transport users declared that they would choose that option often and always if they were required to wear facemasks. However, they place less importance on other precautionary means considered in this study, i.e., social distancing and using hand sanitizers. These findings indicate that if appropriate health precautionary measures are in place, people tend to use public transport.

3.2. Exploratory factor analysis

Exploratory factor analysis (EFA) that used maximum likelihood estimation was carried out on the 3 Likert items measuring the likelihood of using public transport while complying with health and safety

Table 1
Summary of the survey responses.

Variable	Category	Frequency	Percent
Section 1 - SEDs			
Gender	Male	993	65.5
	Female	523	34.5
Age (years)	<20	180	11.9
	21–30	732	48.3
	31–40	467	30.8
	41–50	114	7.5
	>50	23	1.5
Household income (PKR)	<30k	223	14.7
	30k–60k	505	33.3
	61k–100k	477	31.5
	>100k	311	20.5
Education	High School	201	13.3
	FA/FSc	224	14.8
	BA/BSc	690	45.5
	Master and Above	401	26.5
Profession	Student	345	22.8
	Civil Employee	414	27.3
	Private Employee	533	35.2
	Others	224	14.8
Marital status	Single	860	56.7
	Married	656	43.3
Car ownership	Yes	570	37.6
	No	946	62.4
Motorcycle ownership	Yes	937	61.8
	No	579	38.2
Section 2 - Mode choice and trip frequency			
Travel Mode	Solo	910	60.0
	Shared	606	40.0
Trip Frequency	1–2 days a week	179	11.8
	3–4 days a week	283	18.7
	5–6 days a week	655	43.2
	Almost every day a week	399	26.3
Section 3 - Likelihood of choosing public transport modes during COVID-19			
How often would you use public transport while you have to maintain a social distance?	Never	479	31.6
	Rarely	529	34.9
	Sometimes	274	18.1
	Often	186	12.3
	Always	48	3.2
How often would you use public transport while you have to wear a facemask?	Never	322	21.2
	Rarely	427	28.2
	Sometimes	280	18.5
	Often	302	19.9
	Always	185	12.2
How often would you use public transport while you have to use hand sanitizers or disinfectants?	Never	380	25.1
	Rarely	489	32.3
	Sometimes	263	17.3
	Often	231	15.2
	Always	153	10.1

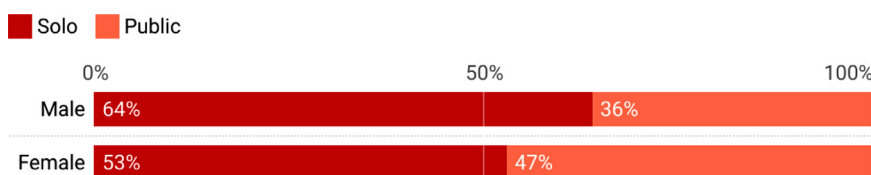


Fig. 2. Influence of gender on solo versus public travel mode choice.

precautions during the pandemic (Section 3 of the questionnaire). A single-factor solution was obtained based on the eigenvalues criterion, i.e., eigenvalue > 1, which explained about 76.118% of the total variance. This means that the responses to the Likert items could be reduced to a meaningful one factor and this factor was labeled as "safety-precautions". As confirmed with the Kaiser-Meyer-Olkin measure (= 0.724), the sampling adequacy was satisfactory. Further, the Bartlett's test of sphericity was significant (0.000) and the determinant of the matrix was 0.130. These statistics indicate that the factor model is meaningful and appropriate. In addition, Cronbach's alpha was excellent, i.e., 0.900, indicating that the items have a high internal consistency. Outcomes of EFA are summarized in Table 2.

3.3. Modeling mode choices

Since the mode choice variable consisted only of two categories i.e., solo and public, it was modeled using a binary logistic model. The general form of the logistic regression model is given as follows;

$$\log \left(\frac{p_1}{1 - p_1} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_j x_j \tag{1}$$

where, p_1 is the probability that one mode (out of two modes) is chosen and $(1 - p_1)$ is the probability that the other mode is chosen, x_1, \dots, x_j are the predictors or explanatory variables, and β_0, \dots, β_j are regression coefficients. The model, i.e., log of (probability of choosing a mode /

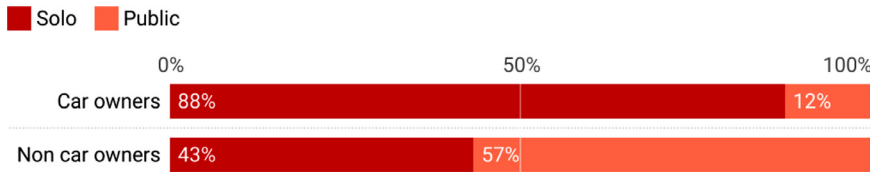


Fig. 3. Influence of car ownership on solo versus public travel mode choice.



Fig. 4. Influence of motorbike ownership on solo versus public travel mode choice.

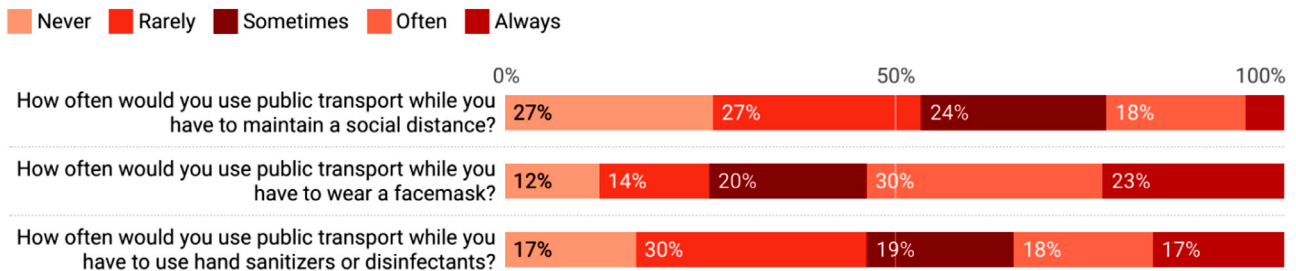


Fig. 5. Distribution of responses for likelihood statements for public transport mode users.

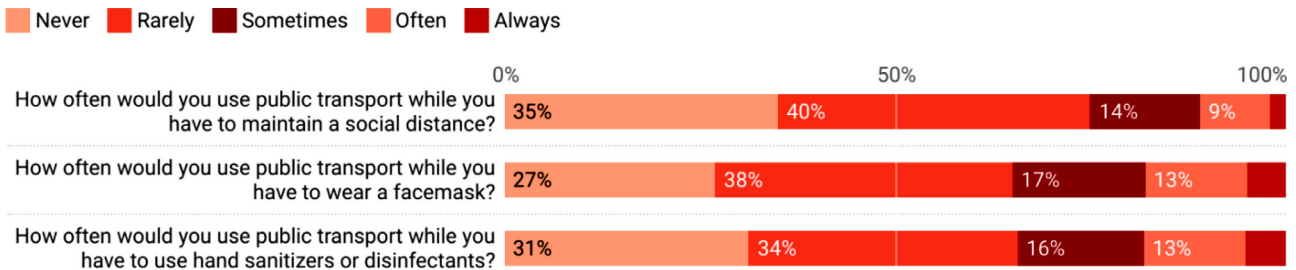


Fig. 6. Distribution of responses for likelihood statements for solo travel mode users.

Table 2
Summary of the exploratory factor analysis of the items in Section 3 of the questionnaire.

Items	Factor loadings Underlying Factor (Safety-precautions)
How often would you use public transport while you have to maintain a social distance?	.939
How often would you use public transport while you have to wear a facemask?	.900
How often would you use public transport while you have to use hand sanitizers or disinfectants?	.770
% of variance explained	76.118
Cronbach's alpha	0.900

probability of not choosing that particular mode), forms a linear combination of the explanatory variables.

The mode choice consisting of two categories (solo mode and public mode) was entered as the dependent variable. The SEDs, trip frequency, and the underlying factor about the likelihood of using public transport while following precautionary measures (namely safety-precautions) were entered as explanatory variables with the first category as the reference category. All the SEDs and trip frequency were entered as categorical variables, whereas the underlying factor (safety-precautions) was entered as a continuous variable. The analysis was carried out using the forward stepwise approach (Wald method). As shown in Table 3, the likelihood ratio test was significant, which indicated that the final model is a significant improvement compared to the intercept-only model. Hosmer and Lemeshow test was non-significant

Table 3
Likelihood ratio test.

	Chi-square	df	Sig.
Step	9.030	3	.029
Block	636.558	16	.000
Model	636.558	16	.000

($\chi^2 = 15.402$, $df = 8$, $p = 0.052$) which explains that the model is a good fit. Cox and Snell, and Nagelkerke R squares were 0.347 and 0.470, respectively. The model correctly classified 78% of the cases. Gender, income, education, profession, trip frequency, car ownership, motorbike ownership, and the score for underlying factor (that was defined

Table 4
Regression coefficients and model fitting information.

Variables	Regression Coefficients	Sig.	Odds Ratio	95% C.I. for Odds Ratio	
				Lower	Upper
Gender (female)	.559	.000	1.749	1.279	2.393
Education		.000			
Education (FA/FSc.)	-1.073	.000	.342	.208	.562
Education (BA/BSc.)	-1.611	.000	.200	.125	.318
Education (Master and above)	-2.092	.000	.123	.070	.217
Profession		.033			
Profession (Civil employee)	.085	.704	1.089	.703	1.687
Profession (Private employee)	.035	.860	1.036	.700	1.534
Profession (Others)	-0.585	.015	.557	.347	.894
Income (PKR)		.000			
Income (30 K–60 K)	.660	.001	1.935	1.302	2.877
Income (61 K–100 K)	-0.081	.735	.922	.575	1.477
Income (>100 K)	.139	.671	1.150	.604	2.187
Car ownership (No)	1.955	.000	7.064	4.724	10.561
Motorbike ownership (No)	.551	.001	1.735	1.255	2.398
Trip frequency		.000			
Trip frequency (3–4 days a week)	1.917	.000	6.798	4.011	11.522
Trip frequency (5–6 days a week)	1.095	.000	2.990	1.758	5.087
Trip frequency (Almost every day a week)	1.211	.000	3.358	1.975	5.710
Underlying factor (Safety-precautions)	.597	.000	1.816	1.581	2.087
Constant	-2.188	.000	.112		

as safety-precautions) were significant variables. Regression coefficients and model fitting information only for significant categories are summarized in Table 4. It was noted that the age and marital status were non-significant. This observation implies that, regardless of the risk (for the age and family members), people tend to use public transport mainly due to the unavailability of alternative travel modes.

The results showed that the females tend to use public transport more frequently relative to solo modes as compared to males. It can be explained by the fact that females rarely drive in Pakistan owing to several social and cultural factors [35]. Hence, they have limited options during the pandemic.

Those with higher educational qualifications are less likely to use public modes relative to solo modes when compared with those having lower educational qualifications. It could be attributed to the fact that the people who have better educational qualifications (bachelor's degree or above) are likely to possess more knowledge about the virus [26, 39]. In addition, the descriptive analysis showed that the people belonging to the higher educational qualification group are more likely to have a higher income and they are more likely to own a car, which promotes the use of solo modes for highly qualified people during the pandemic.

Those belonging to the "other" profession category are less likely to use public modes relative to solo modes when compared to students. The other category mainly contained housewives, and retired personnel who are generally old. Therefore, the less likelihood of using public modes can be explained by the fact that the old people are more vulnerable to the virus and may therefore avoid crowded places during the pandemic. Those belonging to the middle-income category (30 K - 60 K PKR) tend to use public modes relative to solo modes as compared to the lowest income category. This result seems counterintuitive and requires additional studies for a better explanation.

Private vehicle (car or motorbike) owners are less likely to use public modes relative to solo modes when compared to those who do not own private vehicles. This is in line with the published literature [1]. Those with higher factor scores for safety-precautions are more likely to use public modes relative to solo modes. It is intuitive since these are the users, who intend to use public transport more frequently while adhering to the health and safety guidelines.

People with higher trip frequencies tend to choose public modes relative to solo modes when compared to those with the lower trip frequency. Evidence suggests that risk perception decreases with increase in trip frequency [41]. This is particularly dangerous since an

infected high-frequency traveler is likely to spread infectious diseases more rapidly than a low-frequency traveler [25].

The underlying factor, i.e., safety-precautions, was found to be significant, indicating that people, who are willing to use public transport following the safety measures, tend to use public modes relative to private modes during pandemics. In other words, public transport users are willing to follow the health and safety guidelines while using that mode during a pandemic.

4. Discussion and conclusions

Public transport services were significantly interrupted during the COVID-19 pandemic mainly due to the government restrictions and perceived safety hazards by the travelers. On the other hand, the service frequency was reduced by transit service operators due to the reduced demands and income. In developing countries, a significant portion of the population relies on public transport. That is, as the private transport modes are in limited use, people have to choose public transport for travelling purposes even during the pandemics. Nevertheless, public transport modes could trigger the transmission of viruses as safety precautions are not often followed by the transit operators as well as users in developing countries. Thus, regulations and restrictions are needed to control the virus transmission associated with the use of public transport. On the other hand, peoples' travel needs should be satisfied even during the pandemic. For such purposes, understanding the characteristics of travel patterns, in particular, related to different travel modes, is extremely important.

This study explored people's travel mode choices, in particular, the public transport and solo transport modes, during the COVID-19 pandemic. The dataset consisted of 1516 responses achieved through a questionnaire survey conducted in Lahore, Pakistan. A binary logistic regression model was developed to model the likelihood of choosing solo or public transport modes during COVID-19. Gender, income, education, profession, trip frequency, ownership of car or motorbike, and an underlying factor (safety-precautions) were found to be key determinants of the choice of public transport relative to solo modes during the pandemic. In particular, people with lower educational qualifications and higher trip frequencies were more likely to choose public transport modes relative to solo modes when compared with those having lower educational qualifications. This finding highlights the importance of education and awareness programs or campaigns that particularly target

the low education population and frequent travelers. The mode choice model further indicated that the private vehicle, e.g., car or motorbike, owners were less likely to choose public transport modes relative to solo modes when compared to non-private vehicle owners. This outcome is intuitive, because those who own private vehicles tend to use them during pandemics, as these modes are safer. The results of this study will be useful for government authorities, transport planners, and transit operators for planning public transport services and operations during pandemics. Government authorities can play a role to emphasize precautionary measures, e.g., social distancing and use of facemasks inside public transport vehicles. Further, public transport operators may increase the service frequency to minimize delays and to ensure social distancing. Social distancing will decrease the capacity of a public transport vehicle. However, as many people will shift from public transport to other modes, demand will also decrease. Therefore, the service frequency should be increased depending on the new demand levels.

It was also noted that the low-income groups tend to choose public transport modes over solo modes even during pandemics. This could be due to the lack of alternative transport options available for such groups and the cost difference between public and solo travel options. This implies that the need of government intervention to provide transport means particularly for low-income groups. Previous studies conducted before COVID-19 have also highlighted that public transport policies should target the provision for the transportation-disadvantaged groups, i.e., who are unable of owning and operating an automobile [20, 23].

This study had some methodological limitations. It should be noted that the data presented in this study describes mode choice during the pandemic only. It does not draw any comparison with the mode choices before the pandemic. Hence, the results have been interpreted in the context of the pandemic only. In addition, the sample was skewed towards highly educated people. Nonetheless, the current study contributes important insights into the mode choices, in particular related to public transport, during pandemics.

Declaration of competing interest

Authors: Muhammad Abdullah, Nazam Ali, Muhammad Ashraf Javid, Charitha Dias and Tiziana Campisi For the above titled manuscript, the authors declare that there is no conflict of interest.

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