



## Early Responses of Intercity Travelers to The Threat of COVID-19: The Case of Turkey

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### Highlights

- Early response to pandemic was a major reduction in intercity travels in Turkey.
- COVID-19 dropped intercity shared ride modes while increasing private car share.
- Health concern was a major factor for intercity mode choice during pandemic.
- Female travelers were affected more during the pandemic.
- After pandemic, air travel share is expected to recover faster than bus or rail.

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### Abstract

Mobility triggered spread of the COVID-19 pandemic more, thus, an immediate precaution restricted intercity travels. Later, a “New Normal (NN)” concept rose as a new paradigm for travel decision and mode choices with health concerns. Changes in intercity mobility characteristics due to pandemic in Turkey were evaluated via an online survey by the General Directorate of Turkish Highways (GDH) with 1012 participants with intercity travel experience before pandemic. Respondents were investigated for their intercity travel decisions and modes during early restrictions and the NN stages. The main objectives included better understanding of the impacts of the pandemic on current and future travel behavior, activity engagement, and overall trip making. Revealed travel preferences before pandemic, during early restrictions and the NN stages, were evaluated employing non-parametric statistical tests to identify the intercity travel patterns. In-depth analyses were performed comparing the behavior due to the risk perception and explore the relationships between the variables. While 55% of those surveyed had not traveled during the early restrictions stage of COVID-19, this rate dropped to 38% during the NN stage. Results confirmed significant modal shifts to private modes and increased inequality among females and elderly. Air travelers stated a stronger return back to original mode after pandemic, when compared to rail or bus. It is seen that COVID-19 pandemic has not only affected people emotionally and socially, but also changed their mobility behaviors and mode preferences because of both restrictions on intercity travels and health concerns while traveling.

## 1. INTRODUCTION

The first report of a cluster of pneumonia cases in Wuhan, China on 31 Dec 2019, has been the official start date of the currently ongoing pandemic COVID-19 [1]. Setting up a scientific board as the first step in January 2020, Ministry of Health (MoH) in Turkey has been guiding the fight against the pandemic, which included immediate cancellation of flights to/from highly affected countries such as China, Italy, etc. and closing borders with Iran and Iraq [2]. After the first case of COVID-19 in Turkey on March 11, 2020 (70 days after the Wuhan report), Coronavirus easily spread especially in closed or crowded environments, and via surfaces used publicly, which led development of precautions, such as social distancing, use of mask and personal hygiene mainly, to minimize the number of hospitalized cases. However, these simple precautions redefined the social and work life, and service systems.

In transportation, COVID-19 precautions changed not only the travel mode choice decisions but the fundamental decision of whether a trip will be made or not, both personally and from the government side

as mobility itself exacerbated the conditions by carrying infected people to new communities and faster. As a result, official lockdowns and travel restrictions/bans have been employed, but lasted no longer than a few weeks due to the lack of preparedness and economic concerns in our lives; and thus, the “new normal (NN)” concept was brought to the agenda again, which was also used in previous global crises such as bird flu in 2005, [3] to enable the “must” trips to be made in a “safe” way during the pandemic; yet, there are still no clear legal definitions for these concepts in transportation. Despite the obvious relation between mobility and spread of pandemic and threats of new coronavirus mutations and variants, rising socio-economic and educational concerns supported by opportunities in availability and speed of vaccination, most of the societies try to live in the NN condition, because, mobility, an indispensable part of our lives, refers to the movement of people and goods [4]; and it is also a social and psychological need and economic triggering mechanism.

As applied in many countries, Turkey also had taken precautions as lockdowns and travel restrictions; on March 15, 2020 (four days after the first COVID-19 case in Turkey), all schools were shut down, public gathering places were banned, and all events with large groups were canceled (see Figure 1). Flexible working hours and remote working options were announced (mostly for government offices, educational institutions and technology companies, etc.), whereas major sectors (i.e. agriculture, construction, industrial production, etc.) were exempt from these pandemic regulations and restrictions. Intercity mobility restrictions were a major part of the precautions against the spread of the pandemic geographically. The latest lockdown applied between 29 April-17 May 2021, but, number of cases has started to increase after removing restrictions.

Pandemic related intercity travel bans and weekend curfews included many cities that have been major tourism destinations, which directly affected the tourism sector as well as summer vacationing trends generating many intercity travels. In the summer 2020, air service cancellations and perceived risk of air travel affected the sector negatively that global aviation was reduced by 75% [5]. In Turkey, during January-August 2020, there was a 63% decrease in total passenger, whereas Antalya Airport, one of the busiest in Turkey, experienced the highest decrease by 80% compared to the same period of 2019 [6].

Mobility is the inverse of the impedance to the ease of travel [7], i.e., given the lower cost, lower travel time and lower travel inconvenience translate to higher mobility. In addition to well-known cost aspects (i.e. time, cost, comfort, etc.), the recent COVID-19 pandemic has added “health concerns”, creating a new paradigm in travel mode choices, which changed willingness to travel, travel safety perceptions, mode preferences, etc. During pandemic, people minimized their travel demand and avoided shared ride options as much as possible, which decreased shared mobility shares and increased private modes. This, however, brought the issue of inequality in mobility, as access to private car is still very low in Turkey when compared to developed countries. Furthermore, only one fourth of the people with driver license in Turkey is females and many of them do not actively drive. This situation is exacerbated in the intercity passenger transportation (GDH, unpublished report, 2018), which have been mostly vacation and leisure trips, increased significantly with the development of tourism in Turkey after 1980s.

Today, pandemic showed high numbers of fatalities with more 4.94 million deaths globally and 69,112 deaths in Turkey. In the absence of a cure yet, start of COVID-19 vaccinations in December 2020 resulted in 49% of the world population receiving at least one dose [8-10], whereas it reached up to 65% in Turkey as of 26<sup>th</sup> October 2021. While waiting for completion of mass vaccination programs, the world is going to the 5<sup>th</sup> peak (Figure 2), which has experiencing the mobility pattern in the NN and may be even worse in winter, when the new education season is expected to start in a normal “face-to-face” fashion triggering more intercity mobility with the travel of thousands of students across Turkey.

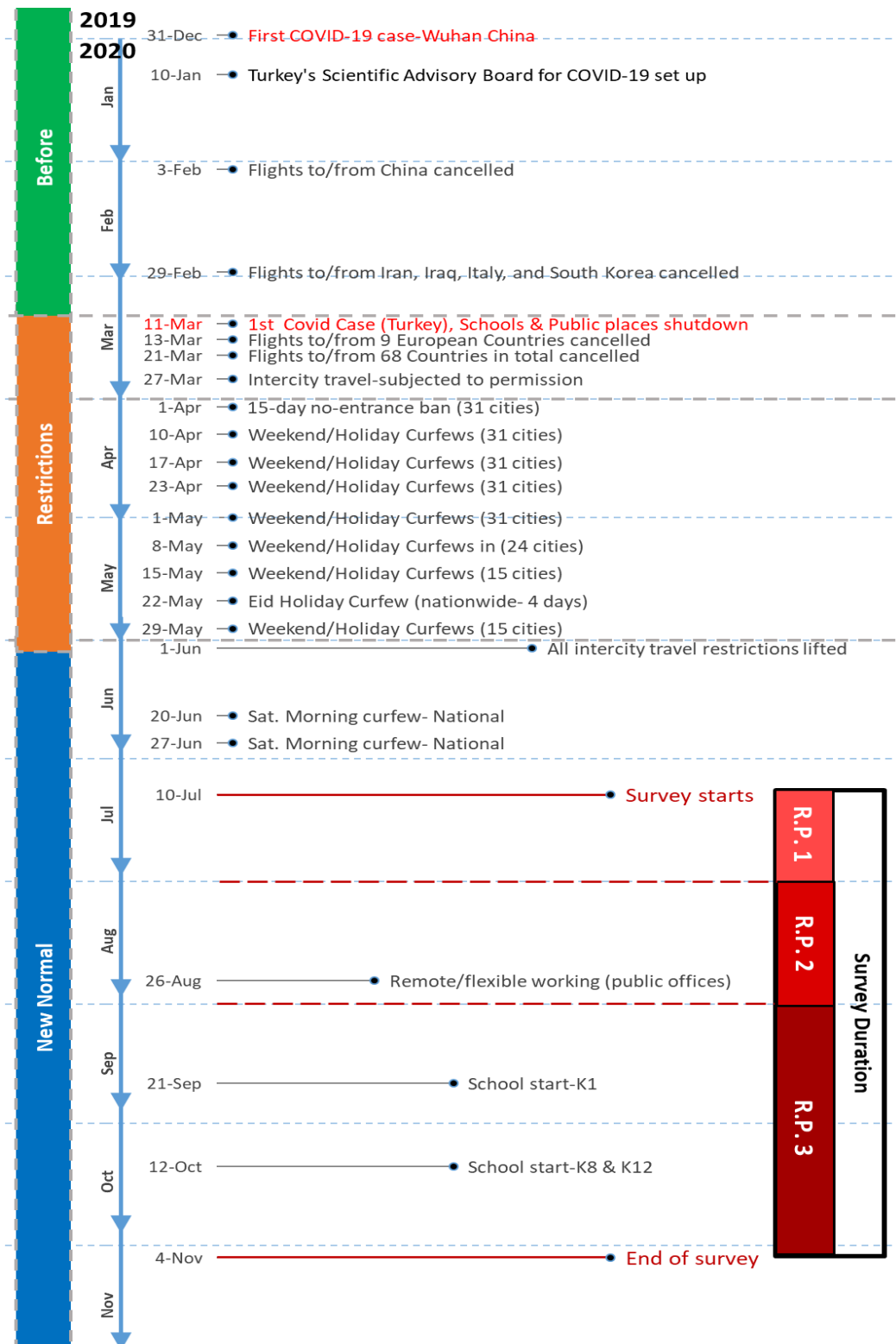
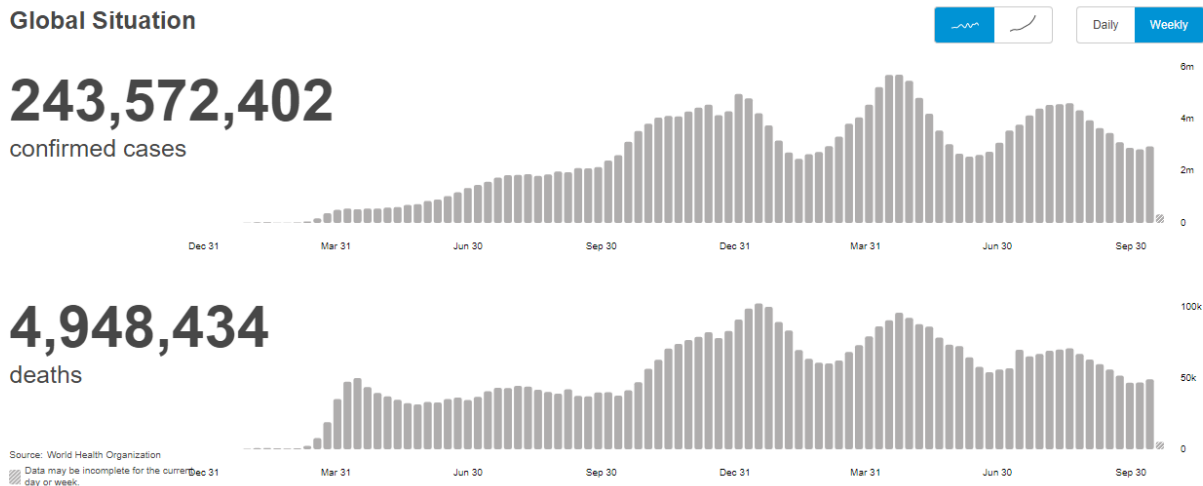


Figure 1. COVID-19 timetable in Turkey

The aim of this research is to reveal how traveler’s behavior, mobility pattern, preferences, social life and psychology will be affected under COVID-19 threat regarding before, restrictions and NN stages. Previous studies [11-13] indicates that females are more likely to concern about the infections during pandemics and complying with restraint measures. By questioning post-pandemic preferences, it is also aimed to see whether travelers will return to their original behavior. To understand the relationship between the COVID-19 travel bans and precautions in a more detailed way, this paper focuses on the early perception and response to COVID-19 Pandemic in Turkey among intercity travelers, who participated in an online survey

conducted by the General Directorate of Highways (GDH), the responsible agency in monitoring and providing infrastructure for intercity travels in Turkey. The analyses include detailed evaluation of the modal shift in the intercity passenger travels between the before conditions and a) the travel restrictions stage and b) the current NN stage. Based on the stated preferences for a future post-pandemic conditions (after the pandemic is over), modal shifts for before choices are also evaluated, as well, shedding light into the modal shifts at different stages of a pandemic.



**Figure 2.** Global situation of COVID-19 as of 26<sup>th</sup> October 2021 (<https://covid19.who.int/>)

## 2. INTERCITY PASSENGER TRANSPORTATION IN TURKEY

In 1950s, road and rail mode shares were very close to each other for passenger transportation as 50% for roads and 42% for rails in Turkey [14]. Over the years, the gap between the two modes has increased resulting in a dominant road transportation with more 95% till 2003 (see Table 1). Current length of intercity road network in Turkey has reached 68,633 km; almost half of it (30,974 km) is registered as state highways, whereas provincial roads are 34,136 km in length and only 3,523 km are tolled motorways [15].

Though small in percentage, air transportation sector has been a fast growing one, not only in Turkey but also in the world. Impact of the deregulations in air transportation in 2000s, caused a significant increase in its modal share in Turkey. In the last 15 years, number of active airports increased from 26 to 55, while domestic passenger number has increased from 8.7 million in 2002 to 109 million in 2017 [16]. In a survey with 400 airlines passengers, 44% of respondents were female and 56% were male; the major travel purposes were detected as holidays (56%) and business (29%).

**Table 1.** Modal shares of domestic passenger transportation in Turkey (%)

Mode	2003 <sup>1</sup>	2011 <sup>1</sup>	2015 <sup>1</sup>	2017 <sup>1</sup>	2018 <sup>1</sup>	2018 <sup>2</sup>	2019 <sup>1</sup>
Road	95.0	90.5	89.2	88.8	88.8	89.7	89.9
Rail	3.4	2.2	1.1*	1.0*	1.0*	1.7	1.0*
Air	1.6	6.7	9.1	9.6	9.4	8.3	8.2
Sea	0.0	0.6	0.6	0.5	0.6	0.3	0.6

<sup>1</sup> Source: Passenger-km statistics by GDH

<sup>2</sup> Source: Mode choice preferences in the Household survey by GDH

\*Passenger transport by suburban lines are not included.

Despite high investments in the high-speed rail (HSR) services operating since 2009, the share of rail has still been decreasing in passenger transportation (only 1% in 2017). As of 2019, 90% of domestic passenger transportation took place on national intercity highways, as the dominating mode of transportation. While the development targets for 2023, were set to overturn this imbalance towards a better level with increased rail and maritime shares, current levels still show a big gap between the plan and current levels. On the other hand, passenger transportation modal shares in EU-28 countries in 2015 were approximately 82%

road, 8% rail and 10% air, leaving a sea transportation share less than 1% [14]. These figures show that air transportation in Turkey has developed and modal share in benefit of air transportation has reached EU level during the last 5-10 years.

**Road User Satisfaction and Awareness Survey by GDH (2018):** Most of the freight and passenger intercity mobility in the country takes place on the roads under responsibility of GDH. As national authority responsible from constructing and maintaining the intercity roads, GDH has been also conducting traffic surveys continuously and monitoring roads to do better planning, traffic management and operation. Not only traffic surveys have been done but also interviews as household surveys, road-side surveys and web-based surveys have been applied to public. These surveys have been done not only to get satisfaction results but also data regarding road user behaviors and awareness.

To study intercity travel behaviors and patterns of Turkish people, the last national household survey was conducted in 2018, with a sample size of 5,400 households were reviewed (GDH, unpublished report, 2018). The questionnaire was filled by 6,018 people who were aged 18 and over. While the majority of the participants were middle aged (ages 25-64), most of them had primary education (up to K12) as shown in Table 2.

**Table 2.** Participant profile of GDH household survey (2018)

Profile	(%)	Profile	(%)	Profile	(%)
<i>Age</i>		<i>Education Level</i>		<i>Work Status</i>	
<25	17.8	K1-K12	77.4	Full Time Worker	40.1
25-44	46.8	Voc. School	5.7	Part Time Worker	4.2
45-64	27.7	University Graduate	16.1	Not Working/Students	44.0
65+	7.7	Postgraduate	0.8	Retired	11.7
<i>Driving Status</i>		<i>Gender</i>		<i>Summer Vacation</i>	
Not Driving	61.6	Male	53.0	Seaside/Home/Other	71.9
Driving	38.4	Female	47.0	Missing/No Vacation	28.1
<i>Driving Frequency</i>		<i>Mode</i>		<i>Intercity Travel Frequency</i>	
Everyday	47.3	Highways	89.7	≥ Once a week	6.9
1-4 in a Week	25.2	Railways	1.7	≥ Once a month	14.1
1-4 in a Month	11.4	Airways	8.3	< 12/year	52.5
Rare	16.1	Seaways	0.3	≤ Once a year	26.5

The major findings of the GDH Road User Satisfaction and Awareness Survey can be summarized as follows:

- The distribution of the frequency of intercity mobility was found as: once in a week or more (7%); once in a month or more (14%); less than once in a month (79%).
- The intercity modal split included 90% by road, 8% by air, 2% by rail, and less than 1% by seaways.
- Reasons behind their modal choices showed that, people chose road and rail transportation mostly because of its economy (42% and 45% respectively), air transportation mostly because of speed (40%), sea transportation for amusement (33%).
- In terms of annual intercity mobility, average was 3,859 km/person/year, where, 77% of the people traveled less than 5,000 km, 4% of them traveled between 5,000-10,000 km and 19% traveled more than 10,001 Km.
- Average intercity passenger travel length on highways was calculated as 560 km per travel per person.
- Purpose of intercity travel on roads was reported as: mainly holiday and visiting relatives/friends (69%), business (12%), health (7%), education (4%) and for other reasons (8%).

- Further investigation of the summer vacation trends showed that share of households not having summer vacation was 28%, visiting seaside/touristic places was 33%, staying at home was 15%, spending summer vacation in other ways was 24%.

### 3. RESEARCH METHODOLOGY

By the declaration of the NN in June, 2020, social and work-related activities were allowed, which in return triggered back the mobility in the Turkish intercity road network. Monitoring the road network mobility, GDH employed an online survey titled “COVID-19 Outbreak and Mobility” designed to further understand the social and mobility impact of the pandemic. The online survey was applied on the official web site of GDH between 10 July and 4 November 2020. A total of 1,012 valid responses collected which was considered statistically acceptable for evaluation of early responses to pandemic, which provided enough number of observations (exceeding 30 cases) in each subgroup (gender based, education levels, etc.). The data was prepared for the analysis by coding variables according to the categories within each question; basis descriptive statistics were performed by using SPSS 26.0 package program. Descriptive analyses were applied to both quantitative and categorical variables by creating frequency tables, histograms, pie and bar charts to summarize the characteristics of respondents and have an idea about the distribution of variables.

The data collection was managed using the Computer Assisted Web Interview (CAWI), which is based on application a web-based questionnaire. CAWI has been increasingly accepted around the world as a cheaper survey method. Furthermore, under COVID-19 conditions, it has become a preferred safe method for collecting data, due to the fear of getting infection and avoid contagion risk. On the other hand, as not everyone has access to the internet due to digital divide, the response rate is limited and include some bias.

Despite the limited sampling power, the target population of the study was defined as the visitors of the GDH’s web page and those invited via email invitations and social media network. Website slider was used to attract users' attention to increase engagement and increase response rate. Additionally, a snowball sampling was achieved by distributing email invitations and social media. Respondents were those who filled in the survey voluntarily. No restrictions such as age, driving license ownership, were applied to filling out the survey, however only those living in Turkey and had intercity travel before pandemic were accepted into the survey. To ensure the quality of the collected data and reduce the nonresponse error (missing value), all survey questions required to be filled before submission to avoid unanswered questions. In addition, measurement error was reduced by testing and revising the questions in the survey, filters are also added to guide the respondents towards the follow-up questions.

#### 3.1. COVID-19 Pandemic and Mobility Survey

The questionnaire of the survey was designed as a nationwide online survey submitted on the GDH web page open to the public. A test survey was conducted on July 7, 2020, based on which the questionnaire was finalized. It was open to be replied by public on 10 July 2020. Question types include nominal, interval and ordinal scales. There were 38 questions of which 21 was directly about COVID-19 and mobility. Other questions which were included to seek information on socio-demographic were designed to collect data on the following aspects (see Table 3). To understand the impact of the pandemic conditions, a series of comparative questions was designed for evaluation of travel during a) before, b) restrictions and c) the NN stages. Later, there were questions regarding the preferred mode of intercity travel under the pandemic conditions, in which mode travelers feel themselves safe, the purpose of their intercity travel, whether they find the precautions sufficient on highways regarding COVID-19, evaluation of road travel precautions and safety concerns and corresponding awareness, and psychological impacts of mobility under pandemic conditions. Finally, due to the dominancy of summer vacation trips among the intercity mobility in Turkey, a series questions were also asked about the general vacation preferences as well as survey year’s plans/experience. The questions regarding urban travel behavior and impacts were kept outside of the scope of this study, to focus on intercity mobility relation to pandemic.

Responses (N=1,012) between 10 July to 4 November 2020 were analyzed under this research. The monthly distribution of the all responses were grouped in three response periods (RP) as follows.

1. **Response Period 1 (RP1):** (10-31 July, 2020): 398 participants (39%)
2. **Response Period 2 (RP2):** (1-31 August, 2020): 238 participants (24%)
3. **Response Period 3 (RP3):** (1 September-4 November, 2020): 376 participants (37%); 90 participants in September, 283 participants in October and 3 participants in early November.

These response periods were decided as 3 different periods. They were determined concerning MADT (Monthly Average Daily Traffic) and the seasonality [17]. The month of August with the highest MADT in Turkey, was followed by the month of July with the second highest, and the months of September and October, in which MADT are almost equal to AADT (Annual Average Daily Traffic), were considered as separate periods. September and October data were merged since there were not enough entries to online questionnaire in these two months and MADT of these months similarly almost equal to AADT.

**Table 3.** Structure of the online COVID-19 pandemic and mobility survey

<b>A) TRAVELER INFORMATION</b>	
<i>A1. Socio-demographic</i>	Gender (Q1), age (Q2), education level (Q3), location of residence (Q4), vehicle usage (Q5), occupancy (Q11), sector (Q12), workplace type (Q13)
<i>A2. Summer vacation</i>	General preferences (Q26-Q27)
<b>B) GENERAL TRAVEL BEHAVIOR (BEFORE COVID-19)</b>	
<i>B1. Intra-city travels</i>	Mobility frequency (Q6), preferred mode (Q9)
<i>B2. Intercity travels</i>	Mobility frequency (Q7), annual road-vehicle mileage (Q8), preferred mode (Q10)
<b>C) TRAVELS DURING COVID-19</b>	
<i>C1. Comparisons among 3-stages: Before- Restrictions- New Normal (NN)</i>	Commute to work (Q14), frequency of work commutes (Q15), Importance of intracity trips (Q18), importance of intercity trips (Q19), psychological status (Q23) and safety perception (Q24) in intercity travels
<i>C2. Travel experience</i>	First travel experience during pandemic (Q20), mode of travel during a) restrictions and b) NN (Q21), if exits; impact level on mobility in urban (Q37) and intercity (Q38) scale
<i>C3. Mode choice</i>	Safest urban (Q30) and intercity (Q31) mode in pandemic
<i>C4. Summer vacation</i>	Current plans (Q28), mode choice for summer vacation (Q29)
<i>C5. Social/ Psychological effects</i>	Mobility restrictions effect on well-being (Q17), awareness of precautions (Q22), perception on adequacy of the precautions (Q25), post-pandemic mode preference (Q32), perception on adequacy (Q33) and safety (Q34) regarding precautions on roadside social/public areas during the NN stage, impact level on social level (Q35) and household income (Q36)

Following Cochran's formula in Equation (1) [18], one of the most common using sampling equation, generally preferred for large populations with scaled or categorical data, for assumption of 99% confidence interval and 5% margin of error, the sample size calculated as

$$n = \frac{(t)^2 \times (p)(q)}{(d)^2} = \frac{(2.58)^2 (0.5)(0.5)}{(0.05)^2} = 665.6 \quad (1)$$

where  $t$  = value of the t distribution for selected alpha level of 0.01  
 $(p)$  = estimate of population proportion  
 $(p)(1-p)$  = estimate of variance  
 $d$  = the margin of error.

It is also recommended to take population proportion 0.5 as it would produce the maximum sample size [19]. For comparative analysis of subgroups, it is suggested a minimum of 100 observations would be needed for each major group or subgroup in the sample and for each minor subgroup, a sample of 20 to 50 observations is necessary [18]. In this study, which aims to cover 3 response periods, the sample size was thus obtained as oversampling. The proportion of gender which is one of the main variables of this study

was managed very similar to the dispersion of web site visitors of GDH (37% female, 63% male) (GDH National Household Survey, unpublished report, 2018). Thus, a sample over 1000 participants was aimed to start the analyses.

### 3.2. Research Questions

The survey responses were analyzed primarily in two dimensions: 1) mode choice changes (including no-travel) and 2) perception of travel conditions in the pandemic. Survey questions directly related to these topics are evaluated at both aggregate level as well as variations among subgroups (gender based, age based, intercity travel frequency based, education level based, etc.), whenever significant changes were detected. Furthermore, investigation of travel behavior among different stages (before, during restrictions, during the NN and post-pandemic) enabled the detection of modal shifts and even fluctuations at personal level as well. Nonparametric statistical tests were used for inferential statistical analyses and comparative analyses were conducted by cross tabulations. For independent observations, Chi-Square, Mann Whitney U and Kruskal Wallis tests were used to detect subgroups of participants behaving differently from others. Also, to compare paired nominal observations, such as intercity travel mode choices before and during COVID-19, McNemar-Bowker tests were applied. In addition, post-hoc tests were performed to detect the significant difference for pairwise comparisons with Bonferroni correction.

To analyze intercity mode choice changes in the pandemic, the questions regarding;

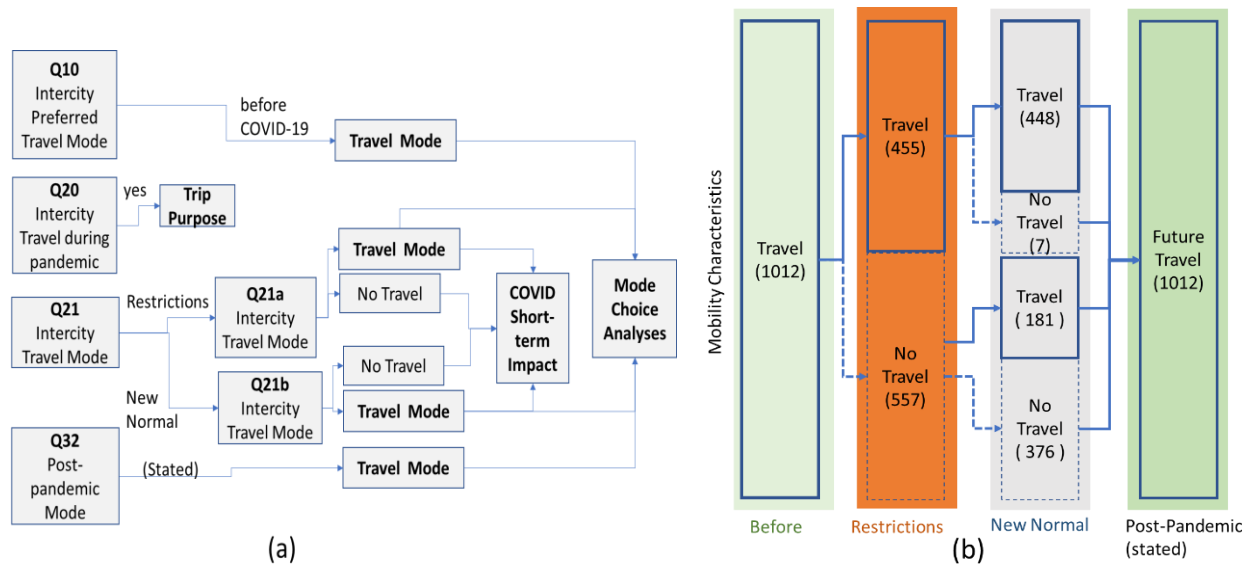
- i. Intercity travel experience under COVID-19 impact (Q20)
- ii. Short term impact of COVID-19 on intercity mode choice preferences
- iii. Stated mode choice preferences for post-pandemic conditions
- iv. Mode choice shifts under COVID-19 Impact.

In part (i), responses to whether a participant traveled during pandemic (Q20) and if yes, trip purpose and mode, were analyzed as a whole (N=1,012). In part (ii), comparison of mode shifts during all three stages as before (Q10), restrictions (Q21-part a) and the NN (Q21-part-b) revealed insights about the dynamics of intercity mode choice preferences of all participants. Evaluation of the responses for stated preferences for post-pandemic mode choices (Q32) showed potential regains in modal splits in the future in part (iii). The framework of these comparisons is summarized in the data flow chart (see Figure 3a) supplemented by a summary of subsets of travelers with different travel experience during different stages in Figure 3b. The sample of participants traveled during the restrictions or the NN (N=455+181=636) was separately studied to detect statistically significant shifts. Travelers who had intercity trips during both the restrictions and the NN (N=448) showed the mode shifts before and under pandemic conditions. Finally, it was also possible to estimate potential mode choice fluctuations for post-pandemic conditions based on stated preferences. Analysis in evaluation of the perception of the travel conditions and COVID-19 impact included the questions regarding COVID-19 impact on intercity mobility (Q38) and perception of the travel conditions during pandemic. Safety of transportation systems under COVID-19 threat were also questioned by asking in which transportation mode travelers feel themselves the safest and how they feel mentally and emotionally before their intercity travel during three different stages as before pandemic, during restrictions and during the NN.

### 3.3. Response Period Effect

Furthermore, effect of response time of the survey was evaluated by studying the responses in three periods (defined as RP1, RP2 and RP3, above), separately, simply to see, if early responses in RP1 (July) and RP2 (August) periods have different statements compared to later ones in RP3 (September-November). It is assumed that COVID-19 has dramatically affected the intercity mobility of people in the beginning of pandemic due to the restrictions and fear of virus. But after a while by the impact of steps to take for NN made some of the people move again like in the flow of normal life. Response period effect is evaluated statistically by non-parametric tests for independent observations such as Chi-Square, Mann Whitney U and Kruskal Wallis tests.





**Figure 3 a) Data Flow Chart of the questions analyzed and b) distribution of the travel experience of participants**

### 3.4. Contribution of the Study

The investigation of the recent studies regarding effect of COVID-19 on travel patterns and transportation showed that they have mostly focused on changes in urban mobility [20-27], which is another crucial aspect for mainly two issues: the pandemic not only changed the commute behavior due to remote work option [28,29], but also the urban travel mode choices due to perceived health risks, especially in shared modes i.e., public transit. This study does not overlap with those as it focuses on the impact of COVID-19 pandemic on passenger intercity mobility and their early reactions. Very few studies on intercity travel patterns during the pandemic included a study of travel pattern changes in the origin-destination (O-D) flows via cellular mobile data in China [30], and a time-series based evaluation of changes in the intercity mobility index in the western part of China [31]. This study provides numerical support for not only the modal shift characteristics due to the changes in the society during the restrictions and the NN, but also, health concerns in the travel decisions, which have not been addressed before.

## 4. RESULTS

### 4.1. Participant Profile and Intercity Travel Characteristics

Basic descriptive statistics presented in Table 4 showed that majority of the respondents were male and between age 25-64 (also parallel to the GDH other online surveys). Education level was predominantly university graduate with bachelor or higher degree (a limitation of the online surveys). Majority of the participants (82%) reported to be driving (Table 4). Among driving respondents only one third were females. Despite the high educational profile of the sample, while 90% of males were driving, only two thirds of females were driving, showing the gender imbalance in private mode mobility in Turkey.

In the intercity scale, mode choice preferences before the pandemic were road-based alternatives (see Table 4). As general behavior of males before pandemic their intercity mobility was found as 73% road-PC, 11% airways, 11% bus and 5% others. On the other hand, this figure for females was as 54% road-PC, 26% airways, 17% bus and 3% others. These results revealed that females are more dependent on public transportation. Also, as general behavior of mobility majority of the participants reported total annual intercity road travel distance less than 2,500 km (37%), followed by a quarter of the participants (25%) traveling 2,500-5,000 km in a year. Findings shown that before pandemic nearly half of the females were traveling less than 2,500 km in a year, while one in third of males were traveling less than 2,500 km. As general behavior more than 20% of males were traveling more than 10,000 km in a year; and this ratio was only 8% for females. Females were lesser mobile than males even before pandemic.

**Table 4.** Traveler profile for the COVID-19 pandemic and mobility survey (N= 1012)

Profile	N	(%)	Profile	N	(%)
<i>Age</i>			<i>Education level</i>		
<25	61	6.1	K1-K12	92	9.1
25-44	471	46.5	Voc. School	97	9.6
45-64	423	41.8	University Graduate	571	56.4
65+	57	5.6	Postgraduate	252	24.9
<i>Gender</i>			<i>Driving Status</i>		
Male	682	67.4	Not Driving	180	17.8
Female	330	32.6	Driving	832	82.2
<i>Employment Status</i>			<i>Driving Frequency (Among Drivers)</i>		
Worker_ Govern.	419	41.4	Everyday	493	59.3
Worker_ Private	391	38.7	1-4 in a Week	280	33.6
Not Working/Students	70	6.9	1-4 in a Month	34	4.1
Retired	132	13.0	Rare	25	3.0
<i>Intercity Mode Choice (Before)</i>			<i>Intercity Travel Frequency</i>		
Road-PC	675	66.7	Once in a Week+	115	11.4
Road-Bus	131	12.9	Once in a Month+	223	22.0
Road-Others (RoadX)	21	2.1	Once in a Year+	610	60.3
Railways	23	2.3	Rare	64	6.3
Airways	159	15.7			
Other	3	0.3			

#### 4.2. Intercity Travel Experiences under COVID-19 Impact

Among the total of 1,012 respondents, 63% (636 participants) made intercity travels under the pandemic either during early restrictions and/or during NN conditions. An overall evaluation of intercity travels under pandemic conditions showed that majority of the respondents suspended their intercity trips during restrictions (with no-travel rate of 55%) but started to have increasing mobility with the start of the NN stage which no-travel ratio dropped to 38% among all the participants (see Figure 4a-c). In both cases, PC mode was the leading modal preference followed by the other road-based alternative (RoadX), while 16% of respondents preferred air travel before the pandemic this ratio abandoned to 3% in the NN stage. Focusing the respondents having intercity travel experience during pandemic (N=636) (see Figure 4d-e), it was 29%, who did not travel during restrictions where this ratio dropped dramatically to 1% during the NN.

COVID-19 impact on intercity mobility vary considerably among subgroups: 67% of the male participants had traveled under pandemic conditions, whereas only 55% of the females had intercity travels, suggesting that females may be more reluctant to travel intercity comparing with males (Table 5). Males were statistically significantly less likely than females to perceive risk to reduce travel. Similarly, while only almost half (51%) of the senior participants (age 65+) had intercity travels, this ratio was around 67% for age group of 25-44. The increased rate of intercity travel experience during pandemic by education level can be explained by increased income levels (which was not investigated directly in this survey). Among the private road mode travelers (PC and RoadX), more than two-thirds of the participants continued to travel, but this rate was much lower for air, bus and rail users. Respondents who travel seldom ( $\leq$  once a year) also did not traveled during pandemic as much as traveler who travels more. Response period effect is also seen in Table 6. This table shows that when time passed during pandemic the mobility rate increased.

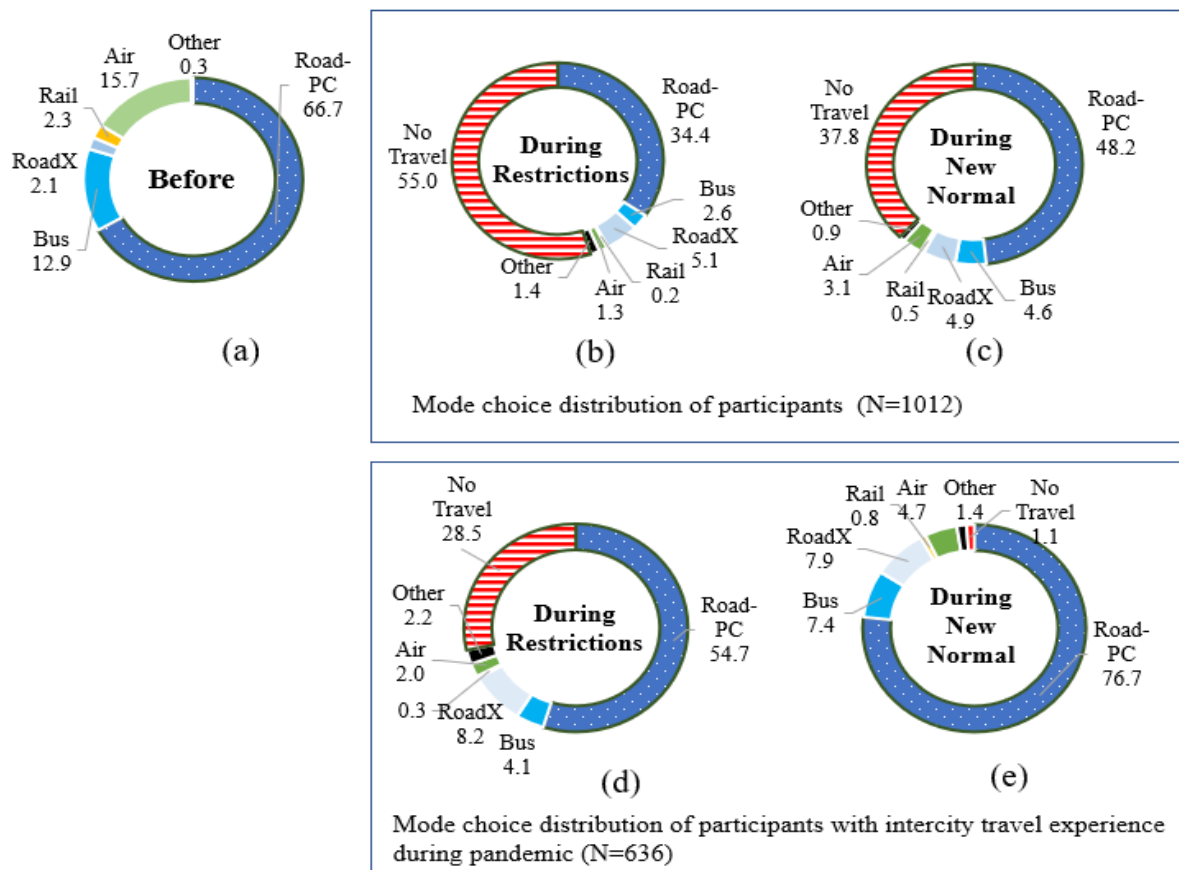


Figure 4. Travel experiences of all respondents (a-c) and pandemic travelers (d-e)

Table 5. Intercity travel experience of all participants by travel and traveler characteristics (N=1012)

	Traveler and Travel Characteristics	Travel (%)	No Travel (%)	Total (%)
By Gender	Male	66.6	33.4	100
	Female	55.2	44.8	100
By Age	< 25	59.0	41.0	100
	25-44	66.5	33.5	100
	45-64	61.0	39.0	100
	65 +	50.9	49.1	100
By Education Level	K1-K12	51.1	48.9	100
	Voc. School	55.7	44.3	100
	Undergraduate	65.7	34.3	100
	Postgraduate	63.5	36.5	100
By Travel Frequency (Before)	≥ Once a week	83.5	16.5	100
	≥ Once a month	74.0	26.0	100
	< 12/year	63.6	36.4	100
	≤ Once a year	40.6	59.4	100
By Preferred Travel Mode (Before)	PC	67.7	32.3	100
	Bus	52.7	47.3	100
	RoadX	66.7	33.3	100
	Rail	43.5	56.5	100
	Air	53.5	46.5	100
	Other	33.3	66.7	100

**Table 6.** Intercity travel experience of all participants by response periods (N=1012)

		Travel	No Travel	Total
<i>Overall</i>	N	636	376	1012
	(%)	<b>62.8</b>	<b>37.2</b>	<b>100</b>
<i>Response Period RP1 (N)</i>	N	186	212	398
	(%)	<b>46.7</b>	<b>53.3</b>	<b>100</b>
<i>Response Period RP2 N</i>	N	164	74	238
	(%)	<b>68.9</b>	<b>31.1</b>	<b>100</b>
<i>Response Period RP3 N</i>	N	287	89	376
	(%)	<b>76.3</b>	<b>23.7</b>	<b>100</b>

Analysis of the pandemic travelers (N=636) who had to/choose to travel despite the pandemic enabled understanding of the need and nature of these “pandemic trips” to some extent. As the survey included questions regarding the first trips during both restrictions and NN stages separately, trip purpose and mode of the intercity trips and the traveler characteristics were investigated for each case separately (see Table 7). Demographic characteristics such as gender, age, travel frequency, mode preference is significantly effective on travel avoidance.

**Table 7.** Cross-Tabulation of intercity travelers’ characteristics by pandemic stages

Traveler/Travel Characteristics		Restrictions (N=455)	New Normal (NN) (N=629)
<i>Trip Purpose Distribution (%)</i>	Business	32.5	25.3
	Health	6.2	4.1
	Vacation/Visit	33.6	60.7
	Education	3.5	2.5
	Others	24.2	7.4
	<i>Total</i>	<i>100.0</i>	<i>100.0</i>
<i>By Gender (%)</i>	Male	75.8	71.5
	Female	24.2	28.5
	<i>Total</i>	<i>100.0</i>	<i>100.0</i>
<i>By Age (%)</i>	<25	5.9	5.7
	25-44	48.4	49.3
	45-64	40.4	40.4
	65+	5.3	4.6
	<i>Total</i>	<i>100.0</i>	<i>100.0</i>
<i>By Education Level (%)</i>	K1-K2	7.7	7.3
	Voc. School	9.7	8.6
	Undergraduate	59.8	58.8
	Postgraduate	22.8	25.3
	<i>Total</i>	<i>100.0</i>	<i>100.0</i>
<i>By Travel Frequency (Before)</i>	≥ Once a week	20.7	15.3
	≥ Once a month	25.5	26.1
	< 12/year	38.6	43.7
	≤ Once a year	15.2	14.9
	<i>Total</i>	<i>100.0</i>	<i>100.0</i>

During restrictions 72% of the pandemic travelers reported that they made an intercity trip, mostly for business or vacation/visit purposes, whereas health and education related trips were very few. Most probably the reason for that people were afraid of going to hospital for their other illnesses and education was given online under COVID-19 conditions. Considering that it still required permission to make intercity trips during this stage, participants must have “valid” reasons even for their vacation trips, such as “driving elderly/relatives” to their hometowns/summer houses, etc. “Other” trip purposes included funeral, safety services, product shipment. As shown in Figure 4d, most of trips were made by PC and RoadX

modes; and majority of the travelers were male. Majority of these travelers were professionals with college degree and in the age of 25-64. Almost 74% of these travelers were using PC before the pandemic in their intercity travels.

During the NN, 99% of the pandemic travelers had at least one intercity trip, a majority of which was for vacation/visit purposes (61%). While gender, age and education level-based characteristics were similar to those traveling during the restrictions, it is seen that more of those seldom travelers (trips less frequently than once in a month) were making intercity trips (44%) during the NN. It is also seen that more of the traditional air travelers were making trips, most likely with a road-based mode.

#### **4.3. Short Term Impact of COVID-19 on Intercity Mode Choice Preferences**

When the modal preferences of the participants are tracked individually through different stages based on the responses to Q10 (before) and Q20-Q21 (pandemic), it was possible to present descriptive statistics showing the changes in the trip generation and mode choice levels visually as shown in Figure 5. Within respondents who were preferring PC for their intercity travels before pandemic, half of them (50%) did not travel during restrictions, whereas almost half of them (43%) kept traveling by PC and 5% shifted to RoadX during restrictions. During the NN, 33% did not travel at all, while 59% kept traveling by PC and 5% shifted to RoadX. Similarly, for bus travelers, 63% did not traveled during restrictions (which dropped to 47% during the NN), 15% kept traveling by bus and 15% shifted to PC during restrictions. During the NN, almost one quarter (23%) kept traveling by bus and 21% shifted to PC. For air travelers, however, 68% did not traveled during restrictions, whereas 5% kept traveling by air and 1/5 (20%) shifted to PC during restrictions. During the NN, half of the regular air travelers (47%) did not travel, while 11% kept traveling by air and 1/3 shifted to PC.

A few travelers using other modes were not included in the figures for the sake of simplifying the graphics; and thus, number of travelers during the restrictions stage may not add-up to the number preferring in the before stage. Secondly, dynamics of travel decision making among few rail users were not graphed. While a no-travel decision was made during the restrictions stage, most of these no-travels continued their no-travel decisions throughout the first 9 months of the pandemic. Those who had traveled via PC even during the restrictions stage, kept traveling via PC. Due to health concern, there has been a shift from bus to PC and air to PC in mode choice preferences during restrictions and NN to avoid infection.

#### **4.4. Stated Mode Choice Preferences for Post-Pandemic Conditions**

For “future” condition of “once the pandemic is over” (Q32), “stated post-pandemic” mode choice preferences are summarized in Table 8. After pandemic, people would be increasingly preferring private and faster modes as before. This increase is even higher among women respondents with 31% compared to 16% among men. Comparing with other ages younger people reported to travel by bus post pandemic at most due to economic concern. According to education level the respondents who stated to travel post pandemic by air is more for the undergraduate and graduate people. PC will still be the dominant mode as before pandemic, but, with a decreased modal share of 64%, where air would be desired with an increased rate of 21%. Bus and rail are stated as preferred choices with 8% and 4%, respectively.

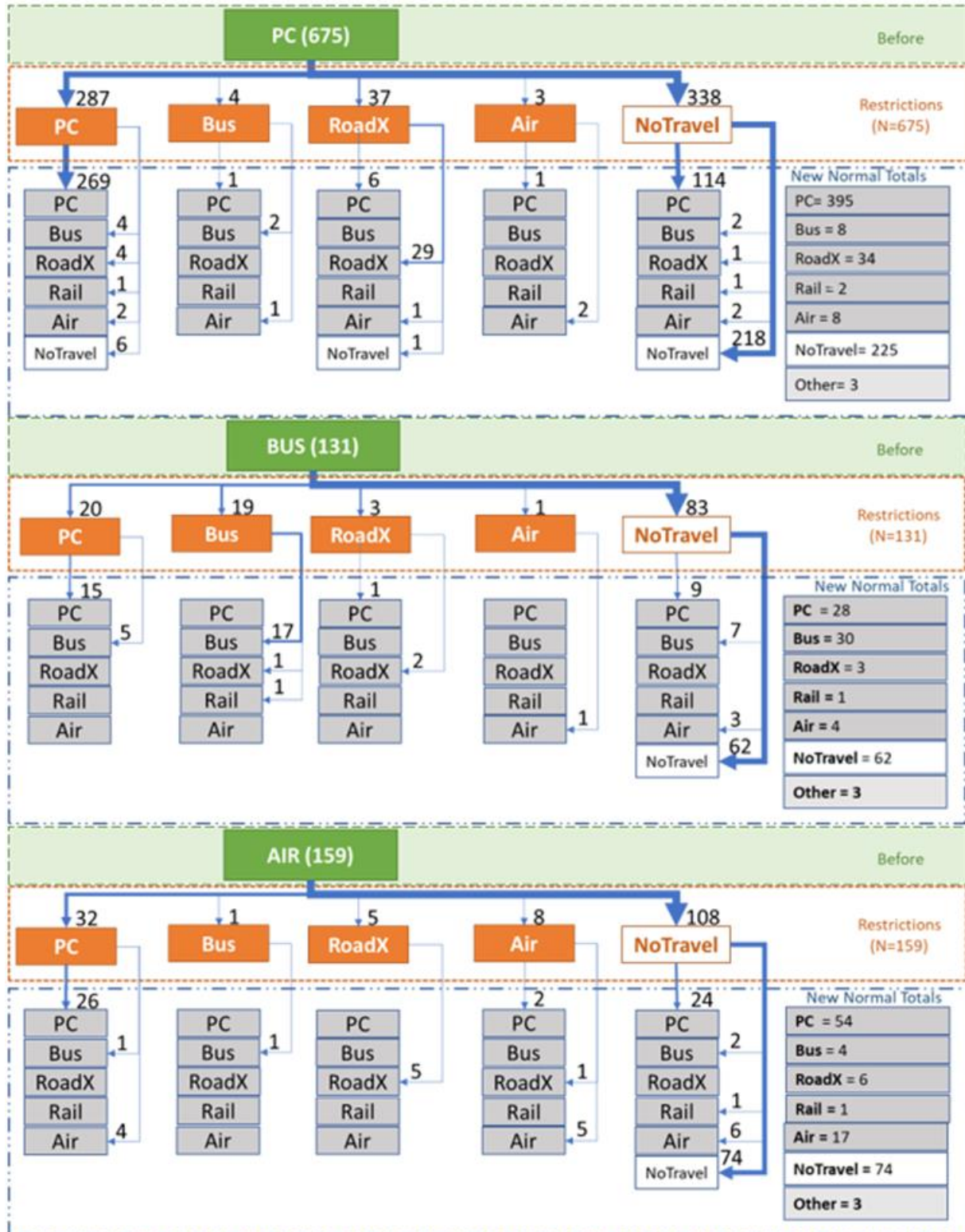


Figure 5. Impact of pandemic on the intercity travel mode choices among a) PC users b) bus travelers and c) air travelers

**Table 8.** Post-pandemic travelers' profiles versus stated mode choices (N=1012)

<b>Post-pandemic Mode Choices</b>							
<b>Travelers' Profile</b>	<b>PC</b>	<b>Bus</b>	<b>RoadX</b>	<b>Rail</b>	<b>Air</b>	<b>Other</b>	<b>Total</b>
<i>Gender-based Distributions (%)</i>							
<i>Male</i>	69.1	7.3	1.9	4.4	16.4	0.9	100
<i>Female</i>	54.8	9.7	0.9	3.0	31.2	0.4	100
<b>Total</b>	<b>64.4</b>	<b>8.1</b>	<b>1.6</b>	<b>4</b>	<b>21.2</b>	<b>0.7</b>	<b>100</b>
<i>Age-based Distributions (%)</i>							
< 25	59.0	18.0	3.3	8.2	8.2	3.3	100
25-44	70.1	8.1	1.5	1.7	18.0	0.6	100
45-64	60.0	6.6	1.4	4.7	27.1	0.2	100
65 +	56.1	8.8	1.8	12.3	19.3	1.8	100
<i>Education Level-based Distributions (%)</i>							
<i>K1-K12</i>	70.6	12.0	3.2	2.2	10.9	1.1	100
<i>Voc. School</i>	66.0	15.5	2.1	4.1	12.2	0.1	100
<i>Undergraduate</i>	65.5	7.7	0.9	3.7	21.5	0.7	100
<i>Postgraduate</i>	59.1	4.8	2.4	5.2	27.7	0.8	100
<i>Frequency of Intercity Travel (%)</i>							
$\geq$ Once a week	68.7	6.1	4.3	1.8	17.4	1.7	100
$\geq$ Once a month	63.2	5.7	1.8	4.0	24.9	0.4	100
< 12/year	65.9	7.0	1.1	4.8	20.5	0.7	100
$\leq$ Once a year	60.7	13.2	0.9	3.4	21.4	0.4	100

#### 4.5. Mode Choice Shifts under COVID-19 Effect

To understand the significant mode choice shifts under COVID-19 effect, McNemar-Bowker statistical tests were conducted to compare;

- a) mode choices before pandemic versus during the NN,
- b) mode choices before pandemic versus post-pandemic.

Before performing tests, it was needed to remove answers of respondents who did not travel intercity during COVID-19 from the analysis to match the pairs of modes. Secondly, the post-hoc tests by Bonferroni correction were additionally done to compare the pairs of modes and see how the intercity travel preferences changed. The results of the tests showed that there was a statistically significant difference between the mode choices of respondents before and the NN and post-pandemic stages ( $p < 0.000$ ). There was a significant shift from Bus, Air and RoadX modes to private car during COVID-19 ( $p < 0.008$ ) as seen in Table 9a. In contrast, for the other modes' respondents' choices did not significantly change during the NN. Also, the pairwise comparisons were done to see the modal shifts before COVID-19 and post pandemic (see Table 9b). McNemar tests by the Bonferroni correction showed that, the mode choices significantly changed from PC to Air and from Bus to Air as well ( $p < 0.008$ ). However, the changes between other modes were not statistically significant ( $p > 0.008$ ).

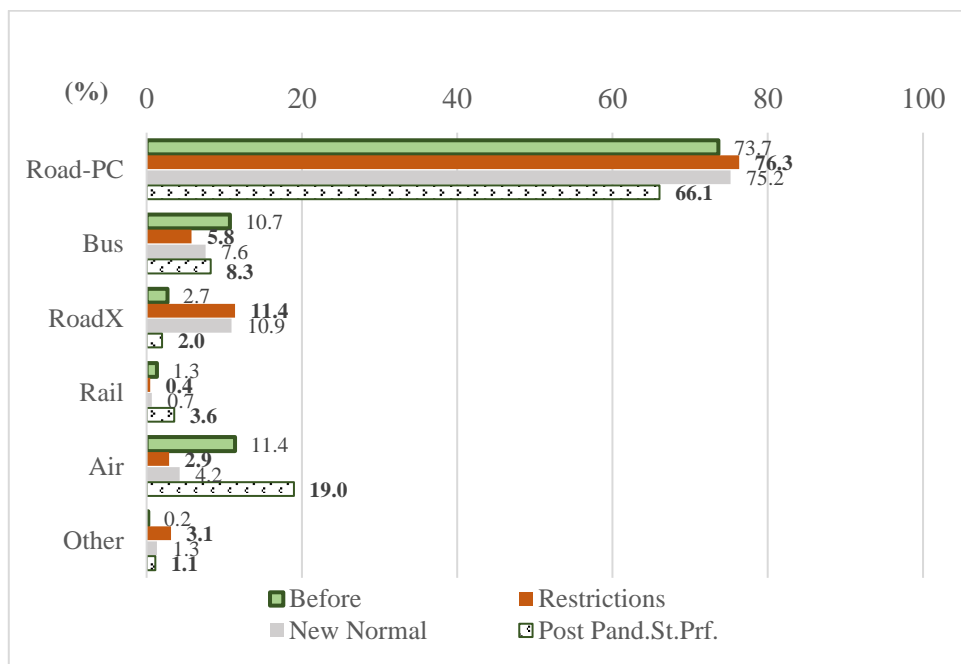
Comparison of the before and post-pandemic modal preferences showed that 550 people are planning to continue traveling with PC, where as 78 people are opting to shift to air. Almost one-third of the air travelers expressed interest in shifting to PC even during the pandemic, which may be due to health concerns included in the decision making. Further investigation of mode choices of travelers who continued having intercity travels during both the restrictions and the NN (N= 448) and also stated modal preferences for post-pandemic stage (see Figure 6), showed an increased use of PC and RoadX during the restrictions, which was mainly due to health concerns. This was simply shifted from shared public mode such as bus and air. A fall in the bus usage (from 11% to 6%) during the restrictions stage was somewhat recovered in the NN and is expected to continue after the pandemic.

**Table 9a.** Pairwise comparisons of intercity mode choices by McNemar test1 (N=629)

		New Normal (NN)							
		PC (423)	Bus (38)	PC (449)	Air (25)	PC (401)	RoadX (39)		
<b>Before Pandemic</b>	PC (403)	<b>395</b>	<b>8</b>	PC (403)	<b>395</b>	<b>8</b>	PC (429)	<b>395</b>	<b>34</b>
	Bus (58)	<b>28</b>	<b>30</b>	Air (71)	<b>54</b>	<b>17</b>	RoadX (11)	<b>6</b>	<b>5</b>
	McNemar Test p-value: 0.001 (Significant)			McNemar Test p-value: 0.000 (Significant)			McNemar Test p-value: 0.000 (Significant)		

**Table 9b.** Pairwise comparisons of intercity mode choices by McNemar test2 (N=1012)

		Post-Pandemic Mode Choice				
		PC (592)	Air (188)	Bus (57)	Air (132)	
<b>Before Pandemic</b>	PC (628)	<b>550</b>	<b>78</b>	Bus (77)	<b>55</b>	<b>22</b>
	Air (152)	<b>42</b>	<b>110</b>	Air (112)	<b>2</b>	<b>110</b>
	McNemar Test p-value: 0.001 (Significant)		McNemar Test p-value: 0.000 (Significant)			



**Figure 6.** Mode choice preference summary for pandemic travelers with stated post-pandemic preference (N=448)

A rather sharp drop in the air usage was revealed due to health concerns and uncertainties in the air transport facilities and vessels, however expected to be changed after pandemic ends. Comparing with before, PC preference increase 3.5% during restrictions and 2.6% during the NN on the other hand post pandemic stated preference decrease 7.6%. Bus preferences during these stages comparing with before decrease as 46% during restrictions, 29% during the NN and 22% stated post pandemic. Whereas the highest preference choice difference occurred for RoadX as 4.2 times increase during restrictions, and 4.0 times increase



during the NN and expected to decrease 26% post pandemic. Another higher modal preference difference occurred for rail 70% decrease during restrictions, 46% decrease during the NN and 2.8 times increase stated post pandemic. One of the highest modal preference choice difference observed on air transportation comparing with before pandemic as 75% decrease during restrictions, 63% during the NN, but increased 1.7 times post pandemic.

#### 4.6. Perception of Intercity Travel Conditions under COVID-19 Threat

Analysis based on survey results revealed that mobility restrictions impact on respondents was at most observed in negative manner. 62% of respondents stated that they were negatively affected on the other hand 30% stated that they were comfortable and calm under mobility restrictions. Just 7% responded the questionnaire as “not affected” (see Table 10). The survey revealed that, nationally, two in three travelers are possibly subject to anxiety and depression. Findings also revealed gender differences to COVID-19 threat. Survey results indicated that among survey respondents, females were more likely affected psychologically and socially. Males who kept their calmness under restrictions of mobility due to COVID-19 are 1.5 times more than females. On the other hand, females who are not affected is half of the males. Negatively affected females are also 1.2 times more than males. Another interesting result revealed that as the education level of the participants increased, their calmness decreased. In addition, among respondents who are younger than 25 age 40% kept their calmness, 13% were not affected. Results indicated that two in three younger respondents kept their calmness during COVID-19 pandemic.

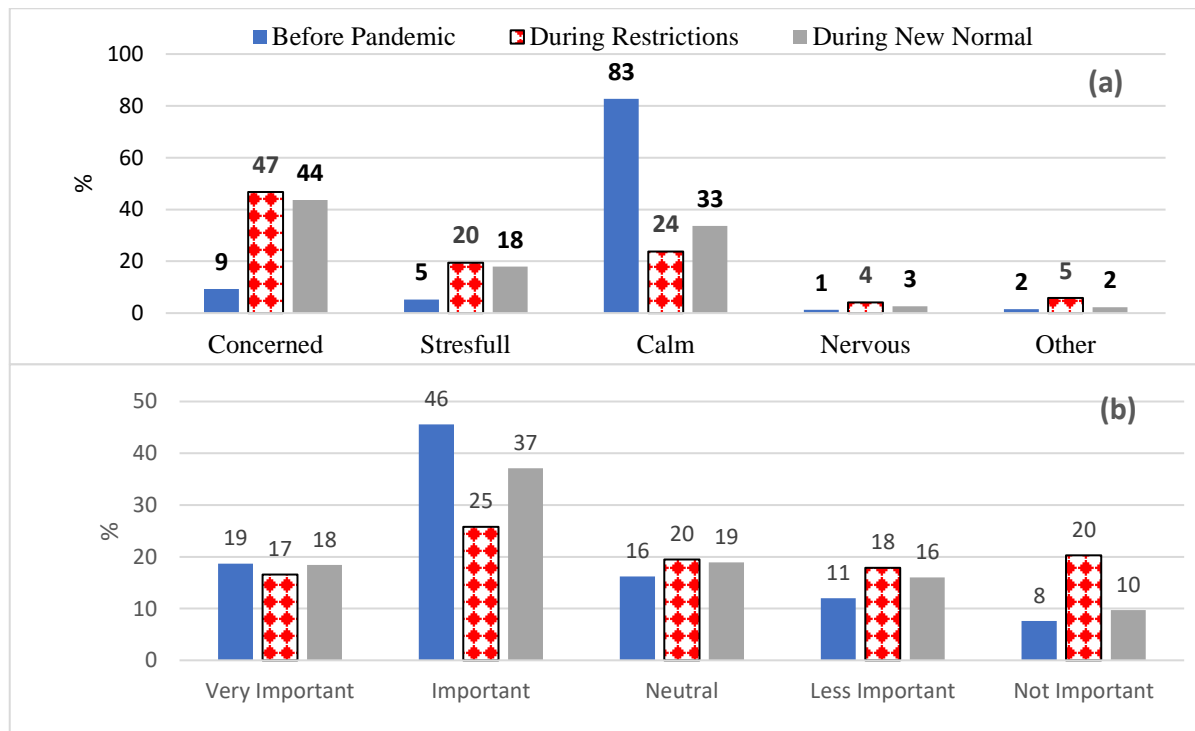
**Table 10.** Effect of COVID-19 on intercity travel patterns (N=1012)

	Overall		RP1		RP2		RP3	
	N	(%)	N	(%)	N	(%)	N	(%)
<b>Mobility Restrictions Impact (Q17)</b>								
<i>Negatively Affected</i>	627	62.0	244	61.3	146	61.3	237	62.0
<i>Stayed Comfortable/Calm</i>	307	30.3	125	31.4	74	31.1	108	30.3
<i>Not Affected</i>	67	6.6	24	6.0	17	7.2	26	6.6
<i>Other</i>	11	1.1	5	1.3	1	0.4	5	1.1
<i>Total</i>	1012	100.0	398	100.0	238	100.0	376	100.0
<b>Feeling of safety during intercity travels happened or going to happen? (Q24)</b>								
<i>Not safe</i>	268	26.5	107	26.9	63	26.5	98	26.1
<i>Partially safe</i>	562	55.5	214	53.8	142	59.6	206	54.8
<i>Safe</i>	145	14.3	59	14.8	25	10.5	61	16.2
<i>No idea</i>	37	3.7	18	4.5	8	3.4	11	2.9
<i>Total</i>	1012	100.0	398	100.0	238	100.0	376	100.0
<b>COVID-19 impact on social life (Q35)</b>								
<i>Not Affected</i>	21	2.1	5	1.3	7	2.9	9	2.4
<i>Partially Affected</i>	308	30.4	120	30.1	79	33.2	109	29.0
<i>Affected</i>	683	67.5	273	68.6	152	63.9	258	68.6
<i>Total</i>	1012	100.0	398	100.0	238	100.0	376	100.0
<b>COVID-19 intercity mobility (Q38)</b>								
<i>Not Affected</i>	76	7.5	30	7.5	17	7.1	29	7.7
<i>Partially Affected</i>	326	32.2	106	26.6	92	38.7	128	34.0
<i>Affected</i>	610	60.3	262	65.9	129	54.2	219	58.3
<i>Total</i>	1012	100.0	398	100.0	238	100.0	376	100.0

Negative effects of mobility restrictions on respondents mentally are as 43% anxious, 9% nervous, 6% fearful and 5% desperate. Majority of the respondents are anxious about mobility restrictions because of Pandemic. COVID-19 has dramatically affected the intercity mobility of people at the beginning of pandemic due to the restrictions and fear of virus. But later in the summer (during RP2 and RP3), the increase in the number of people who declared travelling after pandemic was observed. The Chi-Square test was conducted and the significant difference between the stages ( $p < 0.000$ ) was observed. In addition,

by adjusting p-value for all pairwise comparisons, the intercity mobility of respondents in RP1 after COVID-19 significantly different from those in RP2 and RP3. In addition, by applying Kruskal Wallis test it is observed that the effect of COVID-19 on intercity mobility of respondents differs significantly between stages ( $p=0.022<0.05$ ); especially, after the pairwise comparisons, between the participants who were “Partially affected” and “Affected” in RP1 and RP2.

It is also observed that mental well-being of respondents before their travel was varied as pandemic has proceeded. 83% of respondents stated that they were calm before pandemic, but only one in fourth remained calm during restrictions and one in third during the NN stage. Other emotional changes are given in Figure 7a. This figure shows that people had negative moods due to pandemic before traveling because of suspicion of staying healthy and the risk of social distancing in transportation vehicles. The importance of intercity travel of respondents were also questioned. Figure 7b shows that mobility becomes less important when there is a risk of staying healthy. How safely the respondents were feeling while traveling intercity under COVID-19 impact was also questioned. Among respondents 14% reported that they were feeling “Safe”, 56% were “partially safe” (Table 10). 27% which is more than one in fourth of respondents stated that they were feeling “not safe” during their intercity travel under COVID-19 threat. Respondents also stated that the safest transportation vehicle under COVID-19 threat is PC as 90%. There is no difference by gender.



**Figure 7.** Pandemic impact on traveler psychology a) mood before travels and b) importance of intercity mobility

Importance of intercity mobility of respondents was also questioned by stages of pandemic. Analysis indicated it was also varying by pandemic conditions and stages. 65% of the respondents were reported that intercity mobility was important/very important for them before pandemic but this ratio decreased to 42% during restrictions and 55% during the NN (Figure 7b). The research revealed higher priority during pandemic is staying healthy and observed as canceling or postponing “must not” trips or shifting safer modes. Restrictions stage was the time travelers mostly affected socially and mentally. However, during the NN vacation/visit trips increased more than 80% lead to infer vacation/visit trip is the most probably socially important in humans’ life.

People who have summer vacation did intercity travel during COVID-19 were answered as 64%’s mobility was affected, 30%’s was partially affected and 5%’s was not affected. On the other hand, the people who did not travel intercity after COVID-19 were answered as 42%’s mobility was affected, 41%’s was partially

affected and 17%'s was not affected. Majority of participants as 60% intercity mobility were affected or highly affected on the other hand just 8% of participants intercity mobility were not affected. The Chi-Square test statistics showed that the degree of influence of participants' intercity mobility by COVID-19 pandemic varies significantly according to their gender, age and education level ( $p=0.00$ ,  $\alpha=0.05$ ). In other words, there is a significant relationship between the demographic variables and the effect of COVID-19 pandemic on intercity mobility. Females are more affected than men.

## 5. DISCUSSIONS

The results in the analyses showed that the mobility decreased considerably (more than 50%) during the restrictions stage, and although it tended to increase after the withdrawal of the restrictions during the NN, the mobility was still decreased considerably when compared to pre-COVID stage, and also shifting to private modes. Pandemic has created a new concept should be regarded in modal shift to increase mobility as health concerns. In terms of providing public health safety, travel bans and conditions changed during the pandemic conditions which led to a rather temporary mode choice pattern.

Travel purposes of urban mobility in a way different than intercity mobility and also modes. While the purpose of travel in urban mobility is mostly working trips, the first rank in intercity travels is holidays and visits, although it varies according to the season. COVID-19 pandemic has dramatically changed people life in terms of working, moving, shopping, training. Briefly we may say social and economic life of people changed due to COVID-19 threat. Online working, online shopping, online training entered into our lives as a new life style. This online life due to COVID-19 restrictions had changed mobility patterns and reduced traffic congestion in cities during restrictions [28, 29]. Since online life is not sustainable in terms of human psychology, people get started to move by taking self-precautions. However, at the beginning of the pandemic, no one predicted that the COVID-19 pandemic would last for more than two years.

Under this research intercity mobility of participants living in Turkey were investigated revealing their intercity travel decisions and mode choices pre-covid, during early restrictions and "new normal" stages. Their stated post-pandemic mode preferences also questioned by this research. Like urban travel mobility, studies on intercity mobility showed that travel habits and travel mode preferences changed due to health concern. While there is less research on passenger intercity mobility where first ranked travel purposes of people are vacations and visits, these studies generally showed that intercity mobility also decreased by more than 50% during COVID-19 restrictions stage similar to urban mobility [30, 31]. As mentioned in literature this research also revealed that respondents postponed or avoided their intercity travels due to lockdown measures and/or fear of virus [32-34]. Travelers's profile such as gender, age, travel frequency, mode preference is significantly effective on travel avoidance and mode preferences.

June 1, 2020 was the month when early intercity travel restrictions due to COVID-19 were lifted. As a behavior the summer vacation in Turkey generally starts with the month of June, however travelers increase on the beginning of 3th week of June when the schools are closed. To analyze the behavioral changes during the beginning of the NN, three different periods (10-31 July, 2020; 1-31 August, 2020; 1 September-4 November, 2020) were defined in this study. July and especially August are the most preferred months for summer vacation in Turkey therefore passenger intercity traffic on all modes increases very much i.e., more than 65% of annual average daily traffic on roads [17]. In addition, schools usually open at the beginning of the 3rd week of September and vacation places are preferred by the childless and the elderly. However, in 2020 travelers behaved recessive to go to vacation during early times of COVID-19 and postponed their vacation even till September and October which are seasonally very good times in Turkey.

Most of the intercity travelers in Turkey have been started to travel by PC as becoming the dominant mode; this car culture and usage has been increasing before COVID-19, although intercity bus services are better comparing with many other countries. Employing social distancing in the shared ride modes (bus, trains, airplanes etc.) have been a major challenge in governments attempt to control spreading of COVID-19 via bans/regulations or recommendations as in the NN stages. Travelers's behaviors are significantly changed because of these measures [20-27]. To start the intercity movement under COVID-19 threat, the biggest doubt was the health safety of transportation systems especially public transportation systems [32].

Transportation environments are closed, crowded, and limited social distancing places therefore perceived as one of the risky places by travelers under COVID-19 threat. Survey results show that doubts on health safety combined with restrictions have led to postponing or avoiding intercity travels. A sudden increase was observed in PC usage after pandemic start, which was due to health concerns most likely, as a personal level travel behavior adjustment to COVID-19 pandemic [20-27]. A visible increase in the RoadX alternatives (company car, etc.) also suggests the “safe” perception of car-based travels in the intercity scale.

Intercity travel distance as average is 560 km in Turkey. By the development of air sector long distance travelers have been started to prefer airways. Especially females and elder people were traveling by airways considerably more than younger and males before COVID-19. Under this research it is seen that majority of the air travelers shifted to PC or not to travel during NN. However, travelers stated to return to air mode more than before COVID-19 especially for females. Younger travelers on the other hand stated to return bus post-pandemic most probably due to economic concerns.

As of June 1 (2020), the first day of NN, people were afraid to move between cities unless it was essential trip. However, as time passed and there was less time for summer vacation, people started to move intercity by shifting to safer modes as PC. Traveling ratio increases by response periods as 47% in RP1, 69% in RP2 and 76% in RP3 reveals this behavior. Online shopping, online training and even online working for some sector is possible yet it is not possible to do online vacation. Results also show that some people did not prefer to have summer vacation for 2020. By this survey it was also questioned but the results were not presented under this article.

This research consistent with previously completed researches revealed that females are more worried about diseases and more concerned than men about being infected during pandemic stages [13, 21, 32, 34-36]. Also, if the education level of respondents increases impact level also increase. Research results revealed women’s intercity mobility was more affected than men’s’, those who are older than 65 are more affected than relatively younger and participants whose education level is university or higher are more affected than the others. Furthermore, the COVID-19 effect on intercity mobility was significantly different according to respondents’ intercity travel frequencies and mode choices before the pandemic in addition to their travel experiences after the pandemic ( $p=0.00$ ,  $\alpha=0.05$ ).

Pandemic restrictions on mobility and fear of contracting the virus have caused negative emotions among travelers. Fear, anxiety, stress and worry have turned out to be common and indeed core sensations consistent with researches on COVID-19 [37]. Travelers were highly affected before their intercity mobility. Being calm before travel was four in fifth pre-pandemic, this rate suddenly dropped to one in fourth during the restrictions and rose slightly to one in third during the NN. Even negative emotions were dominant in the majority of men, while those calm were 1.5 times more than women. The social life of women was also more affected than men. In addition, 8% of the participants declared that their intercity mobility was not affected and this ratio did not change to response periods naturally. Another interesting result of research is importance of intercity mobility which changed by pandemic stages to respondents. This finding shows that being healthy is more important than being mobile.

## 6. CONCLUSIONS

COVID-19 pandemic has disrupted every aspects of our lives including transportation. Socio-economic cost of travel bans to keep pandemic under control created a major setback in economy and social lives, which gave birth to the concept of “new normal” that included precautions such as social distancing and use of masks, even during our travels. While waiting for a cure or social immunity by vaccination, modern societies built on high mobility demand have been struggling greatly with health concerns included in travel decision making process as an additional impedance and mode choice parameter.

Start of the NN stage in Turkey has coincided by the start of summer 2020, important period for many intercity travels made for vacationing purposes. To determine the impact of COVID-19 on mobility in Turkey, an online survey was conducted by the General Directorate of Highways, where not only travel

patterns but also modes were investigated for both “restrictions” stage and the declared NN. Furthermore, questions regarding the perception and psychological aspects of intercity travels were included to understand the underlying psychological factors in explaining change of travel decision making among different groups.

The results showed that pandemic has been affecting transportation system user’s willingness to travel. They are more reluctant to move; some people postponed or canceled travels, not only internationally but also in the intercity scale. During the restrictions more than half of the intercity passenger mobility was decreased and during the NN, it was one third (still a high level). During restrictions almost 1/3 of the intercity movements purpose was business, 1/3 was the vacation/visit and 1/4 was others. However, during the “new normal” this ratio was changed on benefit of vacation/visit trips as 61% while business trips decreased to 25% and others to 7%, as NN stated with the start of summer vacationing in Turkey. Early responses also indicated that people are shifting to safer modes which is observed as road-PC. Bus transportation and air transportation, which had a significant share before the pandemic, as well as these transportation modes, which are inevitable for those who do not drive, have decreased considerably due to the impact of COVID-19. This major push to private car-based modes which also creates inequality between males and females, younger and older, rich and poor has not been environmentally sustainable and must be discouraged in policies but it is not clear “how” under pandemic threat. Paying attention to social distance and the use of masks in public transportation do not reduce the preference of travelers to the road based private cars.

Survey results shown that the summer vacation movements increased month by month and it is revealed that response period effect is significant. Because of the risk of shared ride modes, people are preferring private transportation under COVID-19 impact; car-based road modes are highly preferred and perceived as the safest mode of transport. 90% of the respondents reported that the safest mode to travel intercity is PC under COVID-19 impact. Traveling by road-PC is not sustainable because of intercity travel length is pretty much long in Turkey. Already respondents reported that they plan to return their earlier mobility behavior in terms of mode choices.

Pandemic also created equity problem in terms of gender, age, economic situation and education. Survey results revealed that during pandemic times men were more mobile than women not only because of that general mobility trend, but also females were more reluctant to travel. Before pandemic, females were preferring air transportation more than males, and reported to switch back to air after pandemic more than males. Males were statistically significantly less likely than females to perceive risk as well as alter their travel patterns by voluntarily. However, during pandemic air transportation was perceived as risky because of limited social distancing and traveling in a closed area without proper ventilation both by females and by males.

According to early responses of intercity travelers’ mobility and travel behavior is under the effect of COVID-19 as “health concerns”, which made travelers more nervous/stressful when sharing a ride with other people. The mood of travelers during three different stages is researched and obtained as 83% calm before pandemic but this ratio dropped to almost one in fourth during restrictions and one in third during the new normal stage. According to the research the rate of travelers who feel safe during their intercity travels is only 14%, while 4% did not have idea. Additional only 8% of respondents reported that their intercity mobility was not affected. Another interesting survey result is almost two in third of the respondents stated that mobility restrictions affected them in negative manner. Social life of respondents also revealed as negatively affected as 98%. Survey result indicated that not only mobility of travelers was affected but their social life and mental well-being were also highly affected. Another interesting result of the research is revealed although mobility is very important in human life in many aspects as wealth, mental well-being and social, travelers reported their intercity mobility importance as 65% before pandemic, 43% during restrictions and 55% during the NN. Therefore, it is concluded that the rate of importance of intercity mobility is decreasing if there exist health concern risk.

In 2021, due to the absence of a cure and slow progress in mass vaccination programs, it is not clear how people will handle the demand for intercity mobility under the risk of pandemic. This may be a prolonged

challenge in the near future due to potential problems in the receiving and/or effectiveness of vaccination in the light of variants/mutations of the virus. In the continuing NN conditions, it is important to understand the new travel behaviors and psychology, and create digital archives for people's travels, to follow spread of pandemic and take isolation precautions in case of potential virus infections. Monitoring and control of intercity travel permits are expected to continue in Turkey; but, travel bans and restrictions cannot be tolerated for long stages neither socially nor economically, thus, preferability of the private mode travels probably will continue. Controlling and monitoring of intercity mobility and taking precautions if deemed necessary is important, which could have devastated socio-economic and well-being results under COVID-19 impact, especially in the provinces that rely on more tourism sector. Future plans for intercity travels should definitely consider the remaining effect of COVID-19 pressuring the use of private modes.

The major limitation of the study stemmed from the online survey technique, which was a necessity itself due to the health risks during the pandemic. As not everyone has access to the Internet equally, it is not possible to guarantee a random sampling due to digital divide. Therefore, under this research we miss out behavior of older demographics, population with low education level and non-working people. The sample was skewed more educated, working and male population. Secondly, the sample was not equally divided between males and females; however, in the absence of demographics regarding the gender distribution of the intercity traveler population in Turkey, it is not possible to evaluate its limitation. On the hand, this study had not aimed to produce generalized conclusions for the whole population of intercity travelers in Turkey, thus, the results are still capable to portraying the early impact of a pandemic on the traveler behavior changes in the intercity scale. However, for future pandemic related studies, it is highly recommended to differentiate on the purpose of the intercity travels (i.e. business, vacationing, etc.) as the impact and sampling needs may be much different among them.

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#### CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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