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Impact of COVID-19 on the Use of Public Transport Differs According to Social Class: A Case Study of Donostia-San Sebastian City Bus System

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Abstract

Almost three years into the pandemic, COVID-19 continues to have an impact on mobility around the world. Public transport was particularly hindered, since people may perceive it as unsafe and decide to avoid it. Many studies have been conducted on the decline in the use of public transport, but there is no research in the literature related to the use of public transport during the pandemic, according to family income. This study aims to address this gap by focusing on the case of the city of Donostia-San Sebastian. An exploratory study has been carried out using data on the number of monthly passengers throughout 2019, 2020 and 2021. The data have been provided by DBUS, the company in charge of managing urban public transport in the city of Donostia-San Sebastián. On the other hand, the income data have been collected from the city council website. In order to carry out the statistical analysis, descriptive statistics and non-parametric Kruskal Wallis and Mann-Whitney tests have been used. The calculations have been performed using the SPSS 25.0 package. There is income inequality between the three main areas of Donostia-San Sebastián. The results show significant statistical differences in the use of public transport according to income. Thus, the pandemic has brought to light the socioeconomic inequalities that exist in the city.

Subject Areas

Sociology

Keywords

COVID-19, Public Transport, Lockdown, New Normal, Family Income, Mobility Areas

1. Introduction

At the end of 2019, in the city of Wuhan (People's Republic of China) an unknown type of pneumonia was detected (Corman *et al.*, 2020) [1]. The World Health Organization (WHO) named the new disease COVID-19, and the virus causing it was called SARS-CoV-2 (World Health Organization, n.d.) [2]. The virus spread rapidly to other countries, and on 11 March the WHO declared the disease to be a global pandemic (Sun *et al.*, 2020) [3].

In February 2020, the first cases were confirmed in Europe (Spiteri *et al.*, 2020) [4], and in March, Italy and Spain were the European countries hardest hit by the virus. On 17 March, the European Union was closed to all non-essential travel and activities ("WHO Coronavirus (COVID-19) Dashboard|WHO Coronavirus (COVID-19) Dashboard with Vaccination Data", n.d.) [5].

This rapid spread of the virus has placed great strain on national health systems to the point of collapsing ICUs. As a result, governments had to take very tough measures to prevent further spread, including lockdown and the suspension of all non-essential activity (Rahmani & Mirmahaleh, 2021) [6]. This pandemic has affected people's quality of life, limiting freedom and bringing problems such as an increase in the poverty rate and a global labour and financial crisis.

This new situation has also had an impact on traffic in general, and on the use of public transport in particular. By stopping non-essential activities, suspending leisure and limiting mobility, it is expected that the use of public transport will decrease (Zhang, Hayashi, & Frank, 2021) [7]. All the data published and analysed in this regard, concur that mobility decreases with the advance of the virus in all cities around the world ("TomTom Traffic Index—Live congestion statistics and historical data", n.d.) [8] ("The COVID-19 outbreak and implications to sustainable urban mobility—some observations | Transformative Urban Mobility Initiative (TUMI)", n.d.) [9] ("COVID-19—Informes de tendencias de movilidad—Apple", n.d.) [10].

Transport infrastructures that provide inter- and intra-urban connectivity are, in turn, key factors in the spread of infectious diseases, as has been documented (Connolly, Keil, & Ali, 2021) [11] (Cartenì, Di Francesco, & Martino, 2020) [12]. This is why some local governments decide to restrict mobility in order to curb the spread of the virus (Aarhaug & Elvebakk, 2015) [13] (Cartenì *et al.*, 2020) [12] and several studies examined the efficacy of these restrictions in containing the virus in different countries (Kraemer *et al.*, 2020) [14] (Hadjidemetriou, Sasidharan, Kouyialis & Parlikad, 2020) [15].

In cases where limitations have been imposed on the number of trips, the decline in the number of trips has always been greater, in percentage terms, for public transport than for private transport (Aloi *et al.*, 2020) [16] (Wielechowski, Czech, & Grzęda, 2020) [17] (Orro, Novales, Monteagudo, Pérez-López & Bugarín, 2020) [18]. In fact, there have already been reports highlighting the economic consequences this situation could have on service providers due to the huge shift in supply and demand and possible reductions in staff to cope with the current supply adjustment ("Passenger Transport April 2020 Vol 78 No 7", n.d.) [19]. There has also been an increase in modes of transport considered safer for virus transmission, such as cycling and walking (Teixeira & Lopes, 2020) [20] (Bucsky, 2020) [21].

The consequences of this crisis for people's activities and travel behaviour can have a positive outcome, such as total trips decreasing and people preferring cycling and walking, but also negative ones, such as increasing the rejection of public transport and opting for individual modes of travel (Patel *et al.*, 2020) [22] (Baldasano, 2020) [23] (Bao & Zhang, 2020) [24].

To avoid an increase in the use of private vehicles, the public transport system should be reformed by taking measures to minimize the possible risks of contagion and thus regain the users' trust, and more investment should be made in infrastructure for cyclists and pedestrians (Hadjidemetriou *et al.*, 2020) [15] (De Vos, 2020) [25].

Once the decrease in the use of public transport in all the cities of the world in the different phases of the pandemic is verified, it would be necessary to determine whether this decrease has affected the entire population equally, or whether the economic level has had an influence.

This research aims to determine whether the aforementioned decrease in the use of public transport affects all people equally, regardless of their purchasing power. To do so, this paper will study the case of the city of Donostia-San Sebastián, located in the north of Spain. Data regarding the use of public transport at different times of the pandemic and in different areas of the city with different economic levels will be analyzed in order to observe any differences.

The city of Donostia-San Sebastián is divided into different neighbourhoods, which have different socioeconomic levels. This division provides an excellent opportunity to study the impact of the pandemic on public transport use by socioeconomic levels. Data will be analysed from different periods of the pandemic, including the lockdown phase and the transition to the new normal. The study aims to determine whether people with lower incomes have faced greater difficulties in accessing public transport compared to those with higher incomes.

2. Lockdown in Spain

As mentioned above, on 11 March 2020, the World Health Organization (WHO) declared a COVID-19 pandemic. The elevation to pandemic level, together with the rapid spread of the virus, led the central government to announce a state of alert, decreeing a series of extraordinary emergency measures to deal with the economic and social impact of COVID-19. In Spain, a mandatory lockdown was decreed on 14 March to prevent the free movement of persons. One of the main effects of the lockdown was the need for social isolation measures. In fact, public roads could only be used for the following activities ("BOE.es - BOE-A-2020-3692 Real Decreto 463/2020, de 14 de marzo, por el que se declara el estado de alarma para la gestión de la situación de crisis sanitaria ocasionada por el COVID-19.", n.d.) [26]:

- Purchase of food, pharmaceutical products and basic necessities.
- Attending health centres, services and establishments.
- Travel to the place of work to carry out their work, professional or business activities.
- Return to the place of habitual residence.
- Assistance and care for the elderly, minors, dependents, disabled persons or particularly vulnerable persons.
- Travel to financial and insurance institutions.
- Due to force majeure or a situation of necessity.
- Any other activity of a similar nature must be carried out individually, unless accompanied by disabled persons or for other justified reasons.

Any activity or establishment which, in the opinion of the competent authority, could pose a risk of contagion was suspended. The supply of transport was also reduced by 50%.

Seven weeks after the declaration of the state of alert, a period during which the measures taken significantly reduced the spread of the COVID-19 epidemic, a new phase began to initiate the transition to the new normal. In this new transition phase, four phases were established (**Table 1**) ("BOE.es - BOE-A-2020-4792 Orden SND/387/2020, de 3 de mayo, por la que se regula el proceso de cogobernanza con las comunidades autónomas y ciudades de Ceuta y Melilla para la transición a una nueva normalidad.", n.d.) [27]

3. New Normal in the Autonomous Community of the Basque Country (Spain)

Spain is divided into 17 autonomous communities, each of which has its own autonomous government. Once the new normal was declared in Spain, the central government set guidelines to be followed, but each autonomous community took and managed its own measures, taking into account the epidemiological situation at the time.

As the study is carried out in the city of Donostia-San Sebastián, the capital of the province of Gipuzkoa, which belongs to the Autonomous Community of the Basque Country, the following data are relative to this region of Spain.

Once in the new normal, the pandemic was thought to be under control, but time and events have shown that the reality was quite different. In the case of the Autonomous Community of the Basque Country, the virus has left six other

Table 1. Phases up to the new normal.

Phase	New normal	
	Start date	Restrictions lifted
0	**2020/05/04**	Restaurants and takeaway food establishments are allowed to provide food for delivery or take-away from the restaurant or food service establishment. People are allowed to leave their homes in the company of a single cohabitant within a radius of not more than one kilometre
1	**2020/05/11**	Travel is allowed within the municipality where the residence is located, with no limitation on distances ("BOE.es - BOE-A-2020-4911 Orden SND/399/2020, de 9 de mayo, para la flexibilización de determinadas restricciones de ámbito nacional, establecidas tras la declaración del estado de alarma en aplicación de la fase 1 del Plan para la transición hacía una nueva normalidad.", n.d.) [28]
2	**2020/05/25**	Travel is allowed around the whole historical territory. Bars and restaurants are allowed to open indoors with a 50% capacity limit.
3	**2020/06/08**	Travel is permitted with no limitations in the territorial scope of the Autonomous Community of the Basque Country. As for public transport, the frequencies and capacity were recovered at 100% and the use of masks was mandatory throughout the journey, maintaining a physical distance of 2 metres between people ("BOE.es - BOE-A-2020-5469 Orden SND/458/2020, de 30 de mayo, para la flexibilización de determinadas restricciones de ámbito nacional establecidas tras la declaración del estado de alarma en aplicación de la fase 3 del Plan para la transición hacia una nueva normalidad.", n.d.) [29].
New Normal	**2020/06/19**	In state-run public passenger transport services by rail and road subject to a public contract or public service obligations, operators must adjust supply levels to the evolution of the recovery of demand, in order to ensure the adequate provision of the service, facilitating citizens' access to their workplace and basic services, and taking into account the health measures that may be agreed to avoid the risk of COVID-19 infection ("BOE.es - BOE-A-2020-5895 Real Decreto-ley 21/2020, de 9 de junio, de medidas urgentes de prevención, contención y coordinación para hacer frente a la crisis sanitaria ocasionada por el COVID-19.", n.d.) [30]

waves (**Figure 1**). Eighteen months have passed in which different measures have been taken to control the virus, limiting mobility and leisure but without going as far as severe confinement.

The reality has been that as each wave ended and restrictions were relaxed, infections began to rise and with them hospitalizations and deaths. **Figure 2** shows the number of deaths since the pandemic started in the Autonomous Community of the Basque Country:

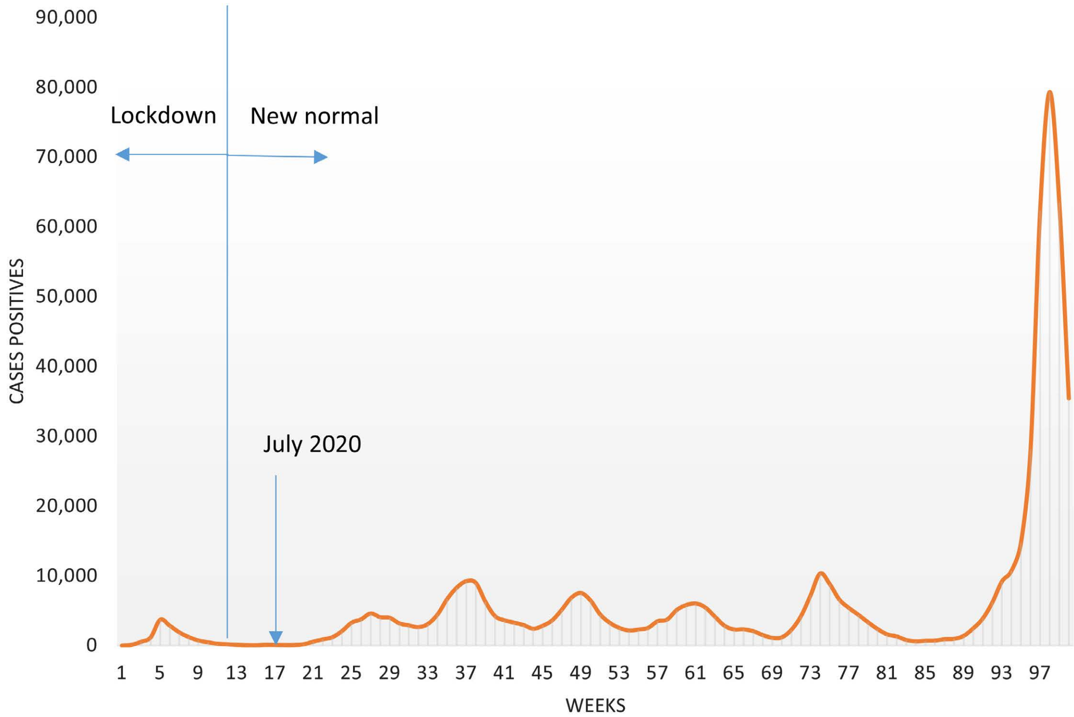

Figure 1. COVID-19 cases per week since March 2020 (Source: Osakidetza).

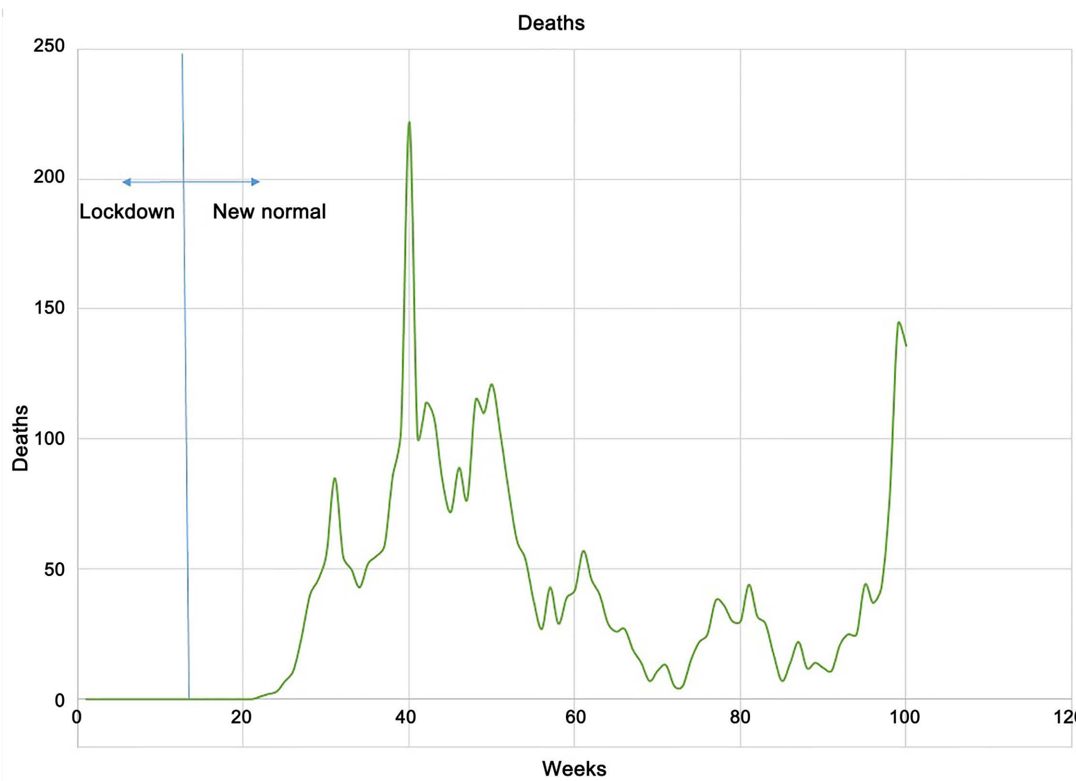

Figure 2. Weekly deaths in the Basque Country (Source: Osakidetza).

After July 2020, successive waves and different variants of the virus start to emerge as shown in **Figure 1**. The latest wave has been caused by the so-called omicron variant, which is highly contagious but not as lethal. As a result, infections are on the rise, but without causing ICUs to collapse. The number of deaths has been high, but in proportion to the number of infected people, not as in the previous waves.

After outlining the phases to reach the new normal and what happens once the so-called new normal has been reached, the geographical area covered by the study, its mobility zones, the distribution of incomes and urban public transport are described. The following is an analysis of whether there is any relationship between public transport use and income in the different areas during the new normal. In order to deduce whether family income has had an influence on the choice of mode of transport for urban journeys and whether the pre-pandemic number of journeys has been achieved once the new normal has arrived.

4. Case Study Analysis

4.1. Geographical Area Covered by the Study

This study focuses on Donostia-San Sebastián, which is located in the province of Gipuzkoa.

Gipuzkoa is a Spanish province and historical territory of the Autonomous Community of the Basque Country. Its capital is Donostia-San Sebastián. It borders with the French Department of Pyrénées-Atlantiques to the northeast, Navarre to the east, Vizcaya to the west, Álava to the southwest and the Bay of Biscay to the north (**Figure 3**).

Figure 3. Location of Gipuzkoa in the Basque Autonomous Community.

Moreover, Gipuzkoa has a population of 727,121 inhabitants according to the National Institute of Statistics (INE) (2020) and an area of 1909 km^2 in which the population density is not concentrated around large nuclei.

According to the data published by the INE on 1 January 2020, the number of inhabitants in the city of Donostia-San Sebastián is 188240.825. The municipality has a surface area of 60.89 km^2 and a population density of 3091.52 inhabitants per square kilometre. The main economic activities are commerce and tourism and it is one of the most popular tourist destinations in Spain.

Since 2003, the city council of Donostia-San Sebastián has officially divided the city into 17 districts (Figure 4).

The population is concentrated in the south and east of the municipality. In terms of distribution, the district of Amara (the most highly populated, with 30,333 inhabitants, 16.3%), Centre (11.7%), Altza (10.9%) and Gros (9.9%) together account for almost half of the population. The least populated are Zubieta (289 inhabitants, 0.15%) and Igeldo (0.57%) (Figure 5).

4.2. Mobility Areas. Significant Inequalities between Districts and Urban Corridors in Income Distribution

The purpose of this point is to analyse whether significant imbalances exist in the situation of the city and its citizens in terms of income and economic position. It aims to detect the disparities and territorial imbalances in the city between the districts and urban corridors that compose it.

Mobility within the municipality has been subdivided into three main corridors and in turn into five areas represented in Figure 6.

Each of the corridors has its own branches and the districts are grouped around the corridor and these ramifications. Table 2 shows the districts that belong to each corridor. The East Corridor, includes the districts of Altza, Miracruz-Bidebieta, Intxaurrondo, Gros, Egia and another area located within this corridor which is Ategorrieta-Ulia. The South Corridor, includes the districts of

Figure 4. Seventeen different sub-zones correspond to the 17 districts of Donostia-San Sebastián. Source: Donostia-San Sebastián City Council ("Donostia.eus - Ciudad", n.d.) [31].

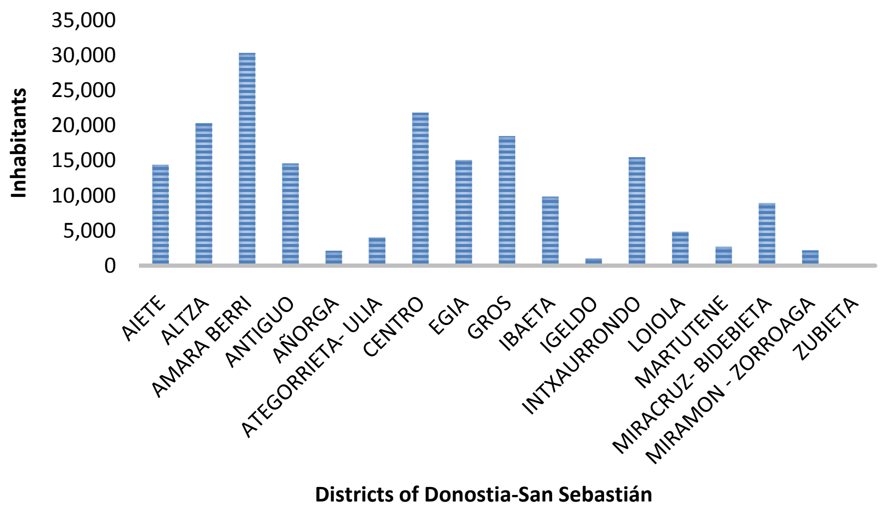

Figure 5. Population by districts.

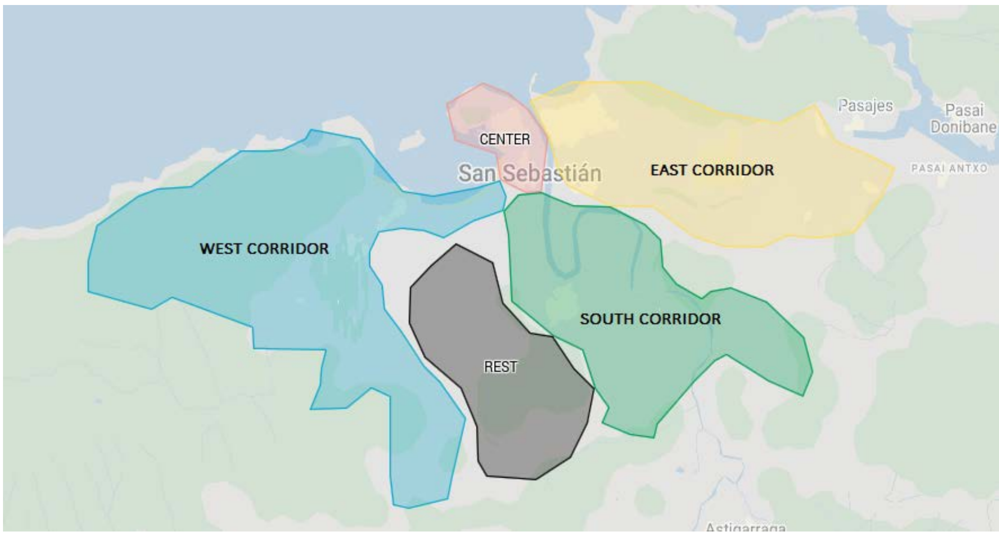

Figure 6. Mobility analysis. Urban corridors. Source: (San Sebastián City Council, Department of Mobility, 2008) [32].

Table 2. Corridors and district relationship.

Districts	Corridors		
	The East Corridor	The South Corridor	The West Corridor
	Alza	Amara	Antiguo
	Miracruz-Bidebieta,	Loiola	Ibaeta
	Intxaurrondo	Martutene	Zubieta
	Gros	Centro	Igeldo
	Egia	Miramón-Zorroaga	Aiete
	Ategorrieta-Ulia		Añorga

Amara, Loiola, Martutene, Centro and another area located within this corridor which is Miramón-Zorroaga. The West Corridor that includes the districts of

Antiguo, Ibaeta, Zubieta and other areas located within this corridor which are the districts of Igeldo, Aiete and Añorga.

As mentioned above, San Sebastián City Council has officially divided the city into 17 districts. The average family income in Donostia-San Sebastián was estimated at €44,134 in 2020.

By neighborhoods, we can observe important differences in the average family income, whereby the income of the richest neighbourhood (Miramón-Zor-roaga, €89,559 in 2020) is 3 times higher than that of the neighbourhood with the lowest income (Altza, €29,831) (**Figure 7**).

Ten neighbourhoods have average family incomes below the municipal average (€44,134): Amara Berri, Añorga, Gros, Intxaurrondo, Egia, Loiola, Miracruz-Bidebieta, Martutene, Zubieta and Altza; while three other neighbourhoods exceed the city's average family income by more than 20% (Miramón-Zorroaga, Aiete and Antiguo) (**Figure 7**). **Figure 7** shows significant inequalities between districts regarding the distribution of income.

Among the elements for analysing inequality in income distribution, the so-called S80/20 ratio (the ratio of total income received by the 20% of the population with the highest income to that received by the 20% of the population with the lowest income) is worth highlighting. The estimate places the S80/20 ratio for Donostia-San Sebastián (2020) at 3.0. (Source: Created by the authors based on EUSTAT personal and family income statistics).

In addition, the income level also shows a certain east-west division (**Figure 8**).

The average family income is calculated by a weighted average taking into account the total population in each corridor. The average household income in the south corridor practically coincides with the average for the municipality. The value of the west corridor is 18% above the average and that of the east cor

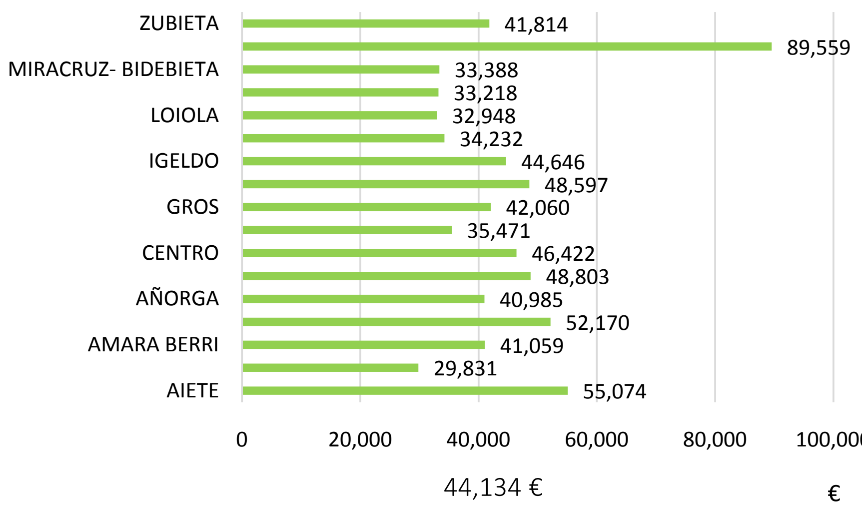

Figure 7. Average family income by district (€). Source: Created by the authors based on EUSTAT family income ("Renta personal media de la C.A. de Euskadi por barrio de residencia de las capitales, según tipo de renta (euros).", n.d.) [33].

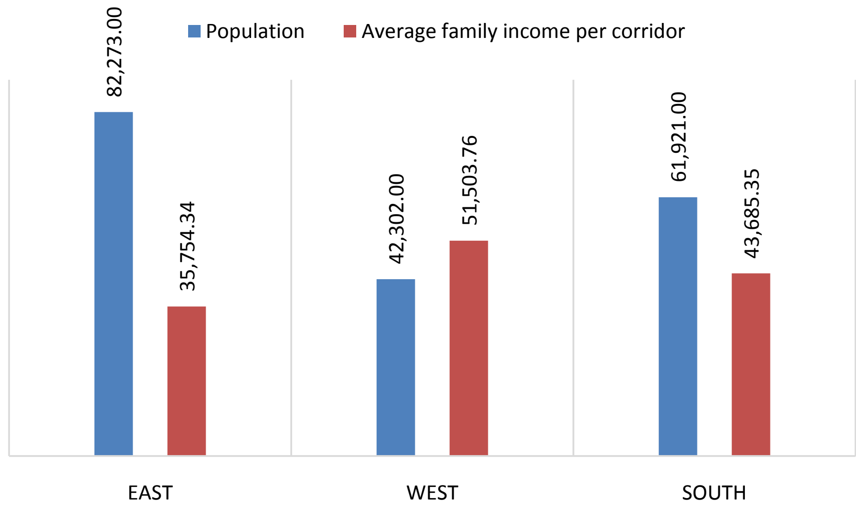

Figure 8. Population and average family income per mobility corridor in Donostia-San Sebastián.

ridor is almost 20% below. The average family income in the west corridor is 44% higher than in the east corridor.

4.3. Urban Transport in Donostia-San Sebastián

Donostia-San Sebastián has a complete fleet of city buses, managed by the DBUS company, which will take you quickly from one end of the city to the other ("DBUS|", n.d.) [34].

The DBUS fleet currently consists of 130 of the most modern and environmentally friendly city buses on the market. Three 9-metre buses, ten minibuses, ninety 12-metre buses (conventional) and twenty-seven 18-metre buses (articulated).

There are 16 urban transport lines operating in the three mobility corridors of Donostia-San Sebastián.

The lines operating in each corridor are as follows:

West Zone Lines: These are lines that run from the city centre to the districts of Antiguo, Aiete (partially), Añorga and Igeldo (**Figure 9**).

05: Benta Berri

16: Igeldo

18: Seminario

25: Benta Berri-Añorga

45: Estaciones Renfe-Bus Geltokiak-Antiguo-Aiete

South Zone Lines: These are lines that run from the city centre to the districts of Aiete, Amara, Miramón-Zorroaga, Loiola and Martutene (**Figure 10**).

19: Aiete-Bera Bera

21: Mutualidades-Anoeta

23: Errondo-Puio

26: Amara-Martutene

28: Amara-Ospitaleak

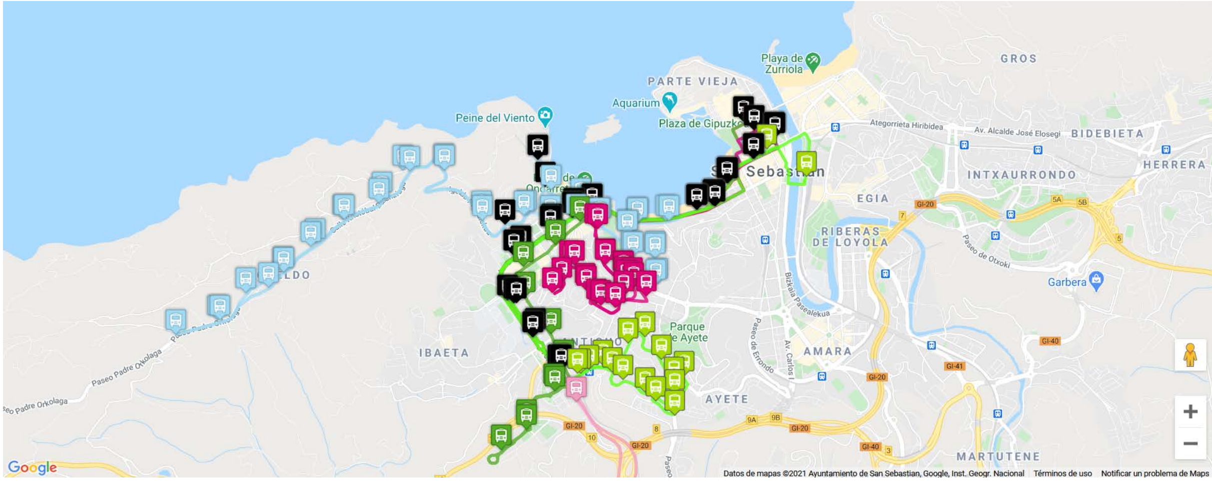

Figure 9. West zone lines.

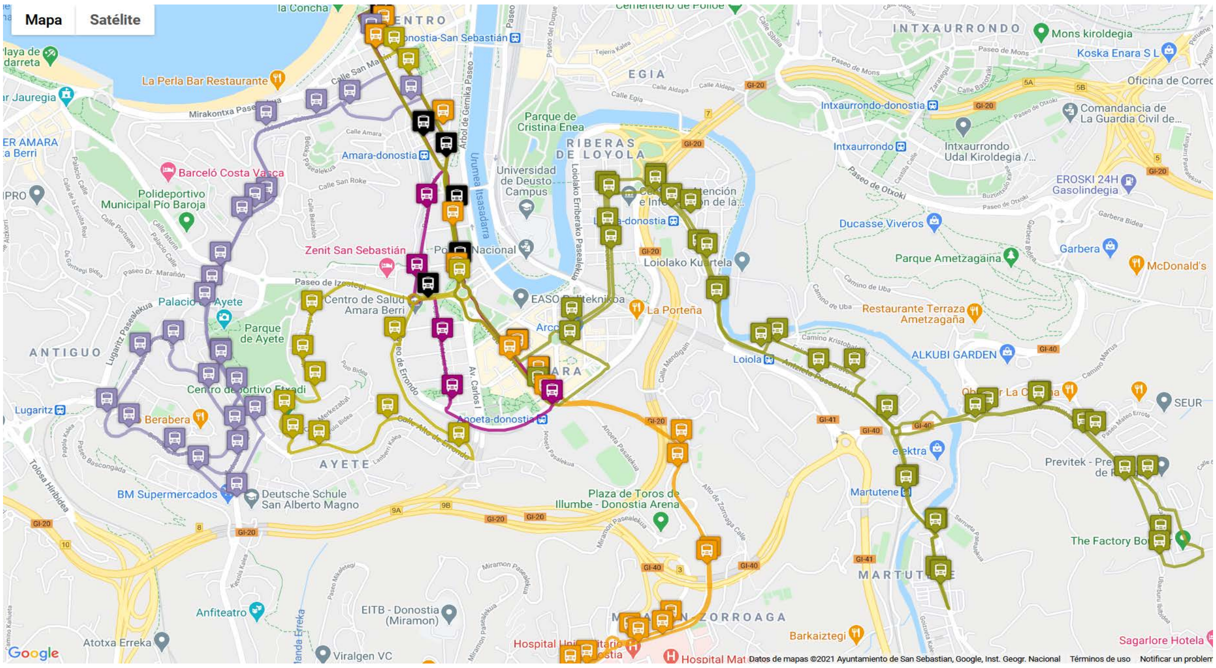

Figure 10. South zone lines.

32: Puio-Errondo

East Zone Lines: These are lines that run from the city centre to the districts of Gros, Egia, Intxaurrondo and Altza (Figure 11).

08: Gros-Intxaurrondo

09: Egia-Intxaurrondo

13: Altza

14: Bidebieta

29: Intxaurrondo Sur

Analysing the journeys made by users, Figure 12 shows the number of monthly passengers per line before the pandemic (from January 2019 to February 2020). It shows that certain lines have a significant increase in the number of passengers

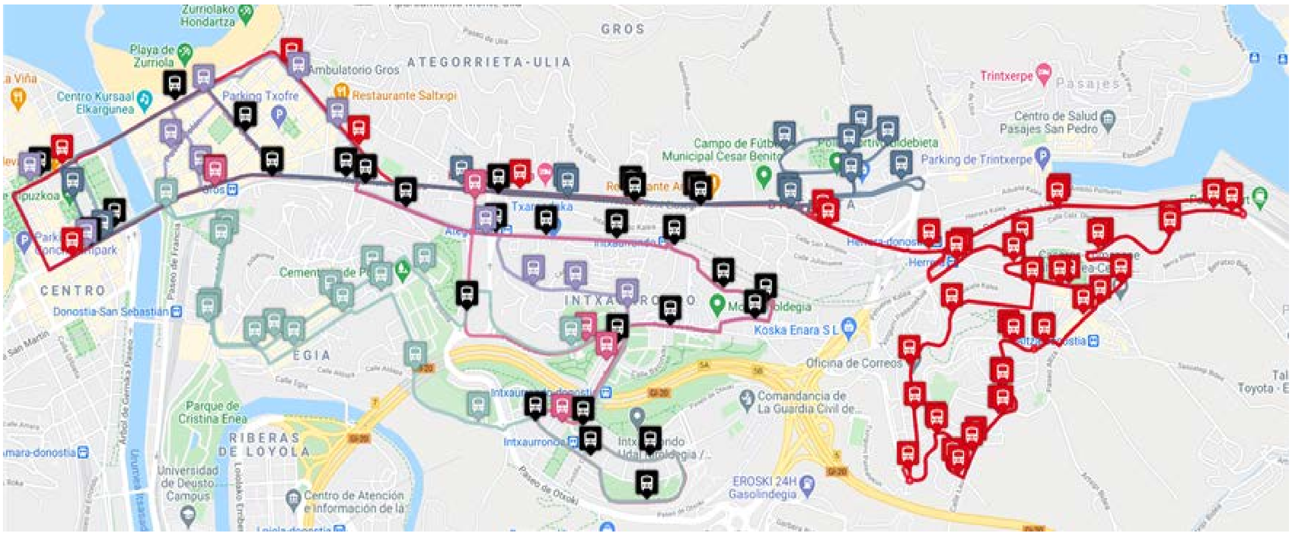

Figure 11. East zone lines.

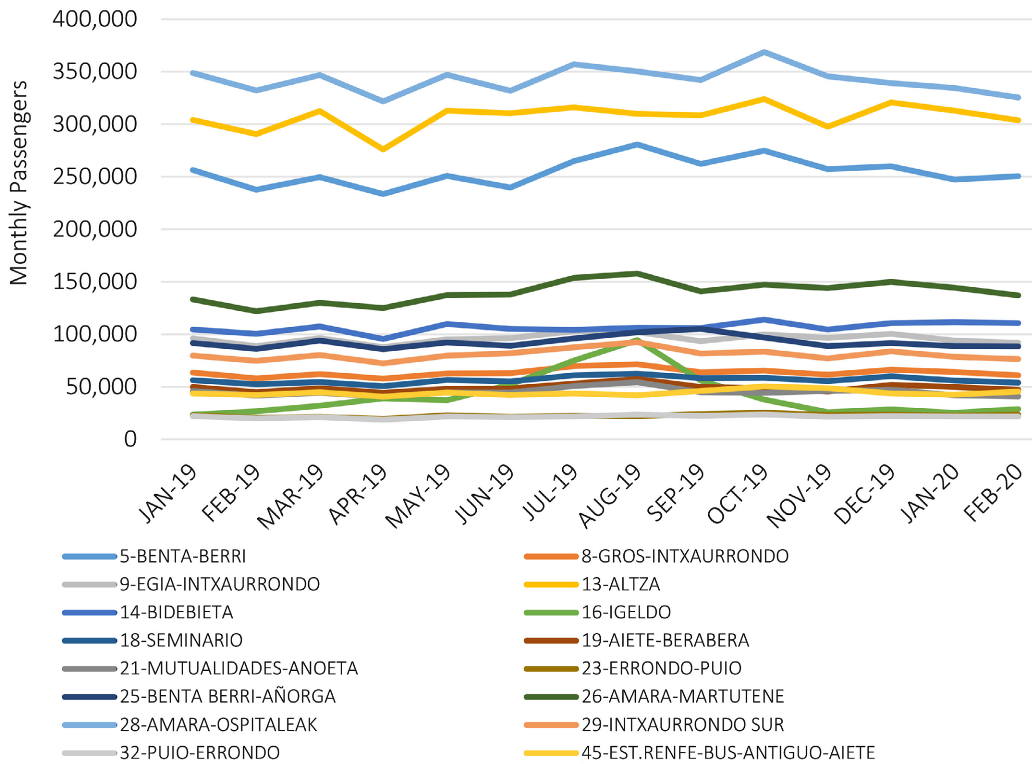

Figure 12. Number of monthly passengers per line before the pandemic.

in May, increasing almost constantly to reach maximum values in August. This trend is most evident on the lines that take us to places of tourist interest in the municipality.

Analysing the journeys made by users according to the corridor in which they live, it should be highlighted that the users who make the most journeys are those who live in the East corridor, followed by those who live in the South corridor. People living in the West corridor make the fewest journeys (Figure 13).

4.4. Evolution of Urban Transport in Donostia-San Sebastián. Lockdown and the New Normal

The decline in public transport use due to indications of physical or social distancing and the fear of contagion has been dramatic all over the world. Although in the midst of the current health crisis, all transport modes have reduced their demand for trips, it is public transport where the decline has been the greatest. (Alejandro Tirachini Hernandez, n.d.) [35]

In the case of Donostia-San Sebastián, the simultaneous closure of education centers and restrictions on mobility were introduced on Saturday, 14 March 2020. The closure was extended 15 days later, allowing only those journeys considered essential. This date is clearly reflected in **Figure 14** and **Figure 15**, representing

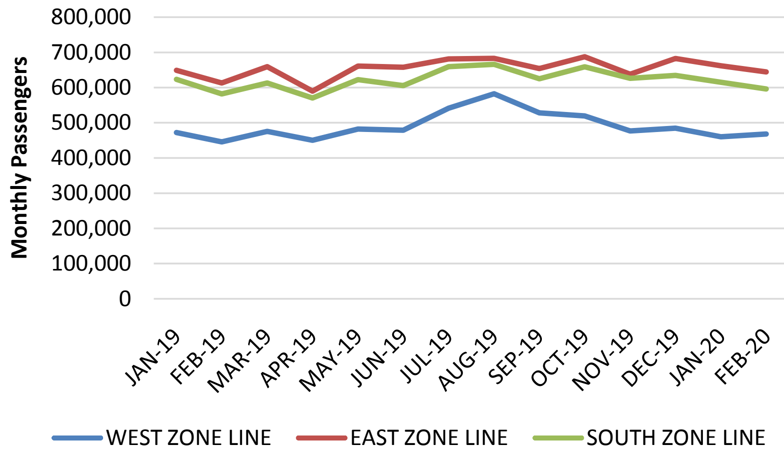

Figure 13. Number of monthly passengers per corridor before the pandemic.

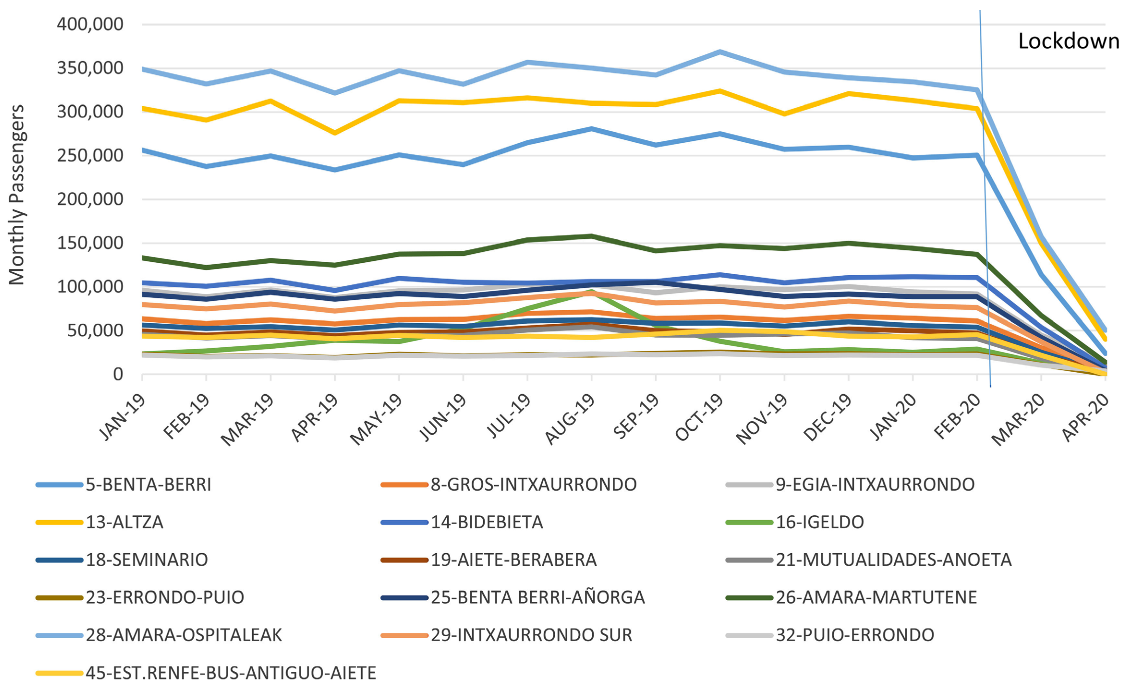

Figure 14. Number of monthly passengers per line before quarantine and in lockdown.

the evolution of public transport use for the municipality's transport lines and for the different corridors of the city. On the 15th a drastic drop in the number of users began, which stabilised approximately one week later.

After the end of the severe lockdown, in May, a de-escalation period begins with 4 distinct phases. In each of them, some restrictions are lifted until the new normal is reached as described in Table 1. From June onwards, with the road-map out of lockdown and the entry of the new normal, a gradual recovery of trips begins (Figure 16 and Figure 17). As can be seen in these figures, the average number of pre-pandemic and new normal monthly passengers is significantly different. The latest data show that 79% of pre-pandemic passengers have been recovered in the western corridor (Figure 18), 91% in the southern corridor (Figure 19) and 82% in the eastern corridor (Figure 20).

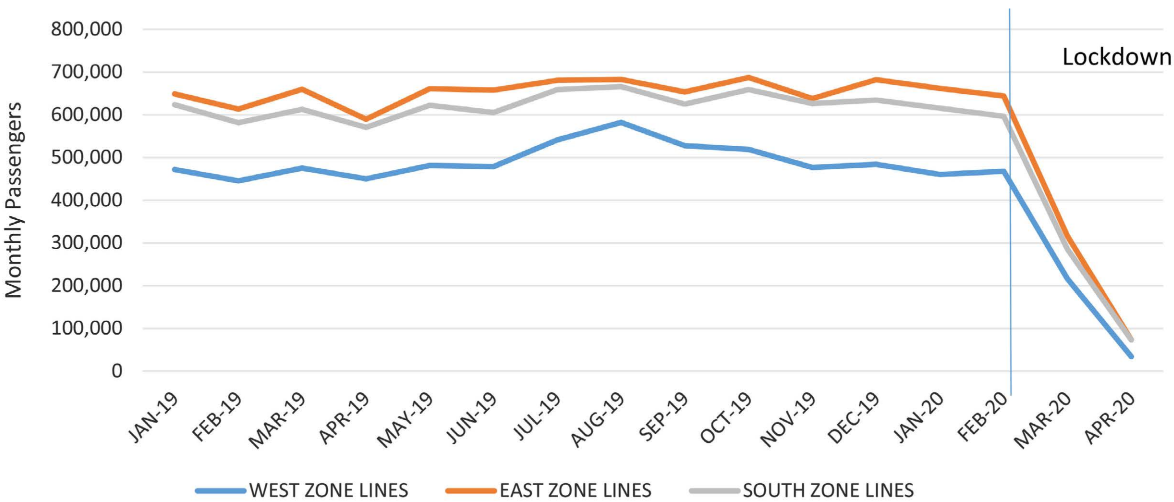

Figure 15. Number of monthly passengers per corridor before quarantine and in lockdown.

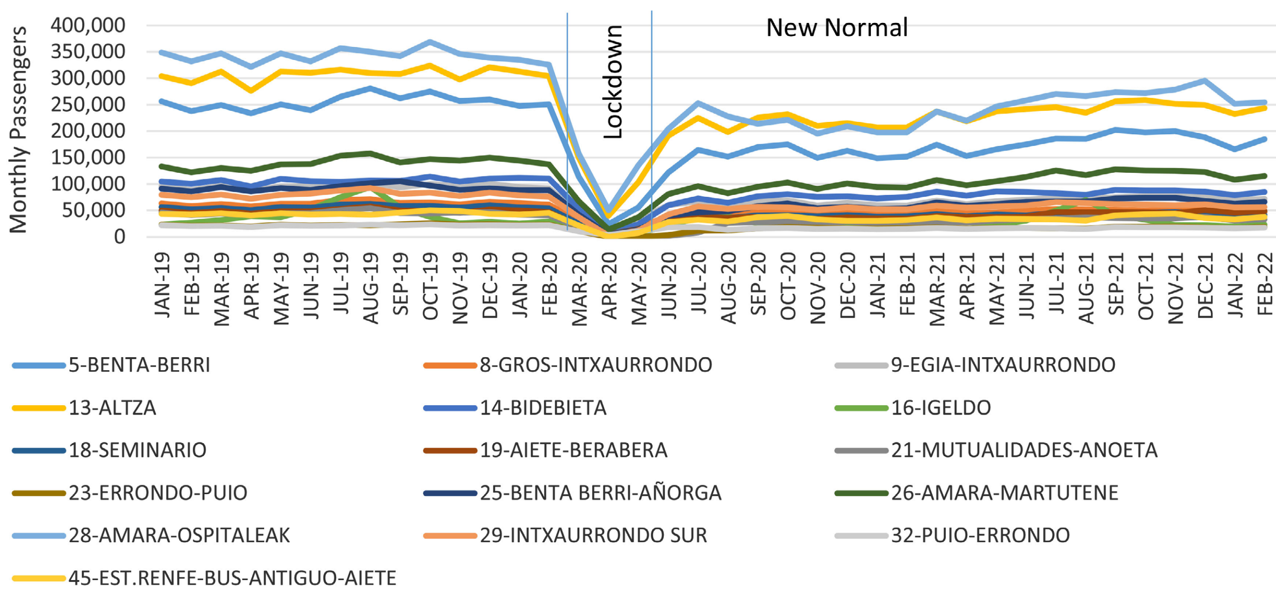

Figure 16. Number of monthly passengers per line before quarantine, in lockdown and in the new normal.

Figure 17. Number of monthly passengers per corridor before quarantine, in lockdown and in the new normal.

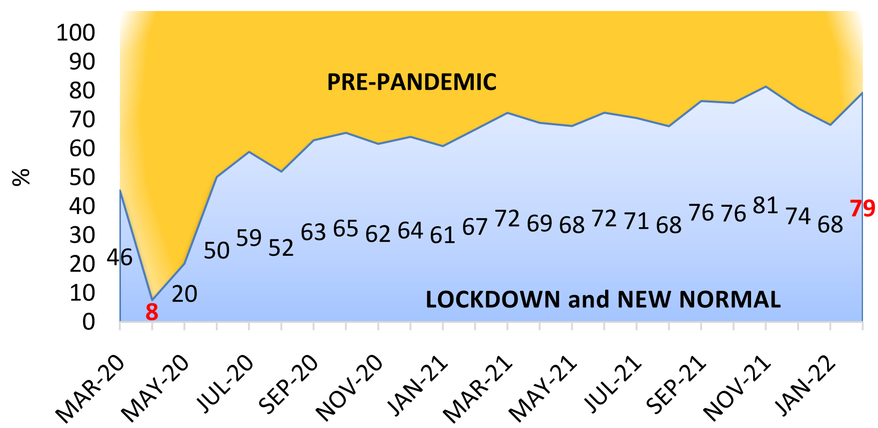

Figure 18. Percentage change of passengers on the West Zone Line.

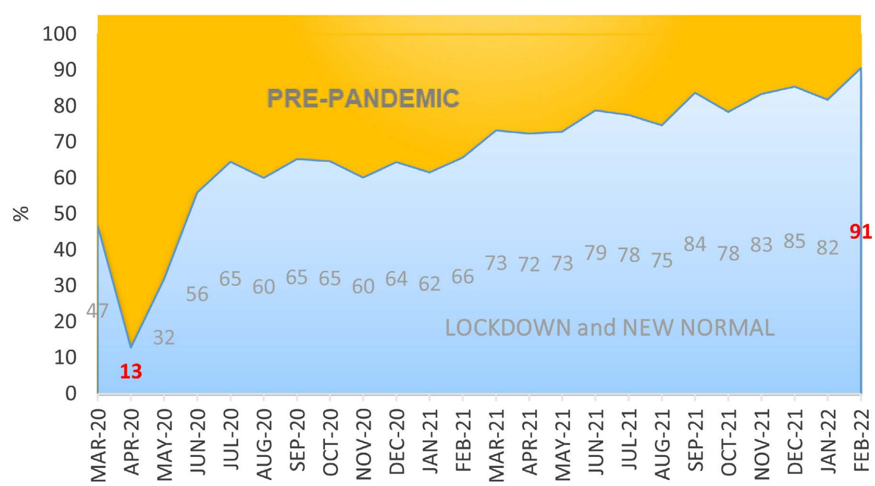

Figure 19. Percentage change of passengers on the South Zone Line.

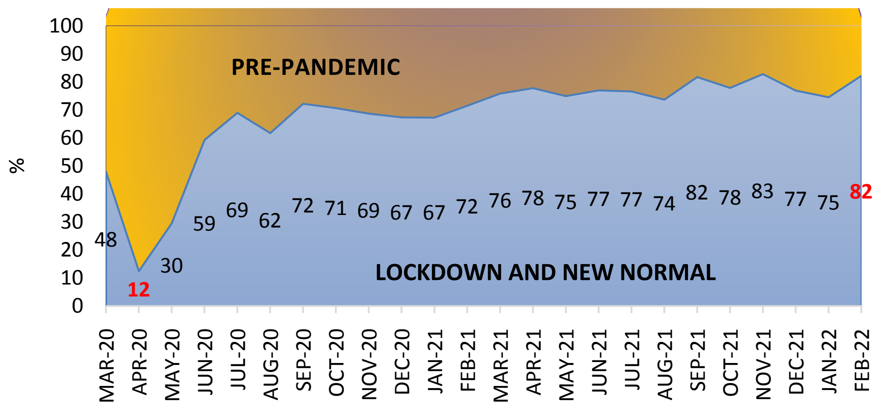

Figure 20. Percentage change of passengers on the East Zone Line.

5. Methodology

This study was conducted during 2019-2021 among the users of urban transport in Donostia-San Sebastian. To achieve the basic objective, it is considered necessary to carry out a complete analysis and diagnosis of the mobility corridors of Donostia San Sebastian. Mobility within the municipality is divided into three mobility corridors.

First of all, the family income of these mobility corridors is analysed. The family income data for the different areas of Donostia-San Sebastián are obtained from the City Council's website

On the other hand, it is analysed the number of passengers carried by the transport lines that operate in each of the mobility corridors in pre-pandemic, lockdown and new normal periods. Data on the number of passengers have been provided by DBUS, the company that manages urban public transport in the city of Donostia-San Sebastián.

As seen in section 3, family income differs between mobility corridors, the use of public transport has decreased, and pre-pandemic figures of use have not recovered. Subsequently, an exploratory study is carried out to evaluate the changes in mobility in new normal, in public transport in Donostia-San Sebastián's mobility corridors as a result of the COVID-19 pandemic. More specifically, the following hypothesis is put forward:

H: *The change in public transport passengers is significantly different according to income level before and after the pandemic.*

The objectives of this study are divided into three parts, as follows:

Objective 1: *To identify if there are significant differences between the change in passenger numbers during the months of June to December* 2019 *and* 2020 *depending on the mobility corridor.*

Objective 2: *To identify if there are significant differences between the change in passenger numbers during the months of June to December* 2020 *and* 2021 *depending on the mobility corridor.*

Objective 3: *To identify if there are significant differences between the change in passengers during* 2019 *and* 2021 *depending on the mobility corridor.*

In order to carry out the statistical analysis, the SPSS 25.0 package has been used. Descriptive statistics is used for data analysis. It shows or summarizes data points in a constructive way such that patterns might emerge that fulfill every condition of the data. It is one of the most important steps for conducting statistical data analysis.

In addition, the non-parametric Kruskal Wallis and Mann-Whitney tests are performed to check whether family income has a significant impact on changes in the use of public transport from the beginning of the pandemic.

The Kruskal-Wallis test is appropriate to be carried out under the following circumstances:

1) Three or more conditions are available for comparison.

2) Each condition is performed by a different group of participants, *i.e.* it has an independent measures design with three or more conditions.

3) The data do not meet the requirements of a parametric test.

The Mann-Whitney test is appropriate to be applied when the above circumstances are met, but two conditions are compared instead of three or more.

In this study, the Kruskal-Wallis test is used to analyse whether there are significant differences in the variation of public transport use in the three areas with differences in family income. The Mann-Whitney test is also used to compare zone by zone whether there are significant differences in the variation of public transport use.

6. Results and Conclusions

The COVID-19 pandemic has had a dramatic impact on society. The lockdown processes have profoundly changed people's mobility. Public transportation has been severely affected in particular, and many people have turned to private vehicles and cycling/walking as safer alternatives (Brough, Freedman, & Phillips, 2021) [36] (De Vos, 2020) [25] (Mayo, Maglasang, Moridpour, & Taboada, 2021) [37].

The data analysed show that, with the COVID-19 pandemic, people have abandoned the use of public transport, but not uniformly: higher income groups have stopped using public transport in greater numbers.

Several calculations have been made to explore the hypothesis: "H: The change in public transport passengers is significantly different according to income level before and after the pandemic". For this purpose, the evolution of the number of passengers in the east, west and south areas between 2019 and 2021 has been analysed. **Figures 18-20** show that due to mobility restrictions adopted as of March 2020, the number of passengers was significantly reduced, and as of June, when the new normal begins, the number of trips made stabilizes in all mobility corridors. These figures analyse the percentage change in bus use in each of the mobility corridors before and during the pandemic. The pre-pandemic period is taken as 100% baseline, when there were no factors influencing the use of public transport.

In order to test the hypothesis a statistical analysis has been made to compare the mobility changes related to the zones. From March 2020 to May 2020 the population was fully confined, comparisons have been made between the months of June to December, as it is in June that the new normal starts. The variation in the number of monthly passengers has been compared between two periods (2019/2020, 2020/2021), between the same months (June to December). It is also compared the number of passengers in 2019 (pre-pandemic period) with those in 2021 (New Normal) in order to test the hypothesis.

For this purpose, the average number of monthly passengers per corridor in the indicated time periods is taken as a starting point in Table 3.

Objective 1: *To identify if there are significant differences between the change in passenger numbers during the months of June to December* 2019 *and* 2020 *depending on the mobility corridor.*

Table 4 shows that the number of passengers has decreased in all zones in the period 2019-2020. The number of monthly passengers has decreased on average by 40.76% in the west zone, 33.01% in the east zone and 37.81% in the south zone. As can be seen in the last column of Table 4, there are significant differences ($p < 0.05$) between the use of public transport and the different urban corridors under study. The decrease in the use of public transport has been smaller in the east, the area with the lowest family income. The biggest decline was in the west, the area with the highest family income. Hypothesis H is therefore confirmed for the period 2019/06-2019/12 vs. 2020/06-2020/12.

An analysis is also carried out to determine whether there are significant differences between zones in pairs between the periods June to December 2019-2020 and 2020-2021.

As can be seen in Table 5 which analyses the period 2019/06-2019/12 vs 2020/06-2020/12, the average rank in the eastern zone is lower in all cases, *i.e.*

Table 3. Average number of monthly passengers per corridor in different periods of time.

Period of time	Mean		
	West	South	East
2019/06-2019/12	515,628	639,309	668,925
2020/06-2020/12	305,429	397,575	448,102
2021/06-2021/12	380,969	512,567	521,968
2019/01-2019/12	494,473	623,842	654,529
2021/01-2021/12	352,645	472,437	498,566

Table 4. Descriptive statistics for mobility changes by year according to zones.

Table Head	Difference in means between periods			SD			Sig. K.Wallis
	West	South	East	West	South	East	P value
2019/06-2019/12 vs 2020/06-2020/12	**40.76 (decrease**	**37.81 (decrease)**	**33.01 (decrease)**	5.54	3.24	4.37	0.043*

Table 5. The relationship between mobility changes in public transport and zone lines between 2019 and 2020 (June to December).

Zones lines	Mann-Whitney U test			
	n	Mean Rank	U	Sig. Bill (p-value)
West	7	8.57	17.0	0.338
South	7	6.43		
East	7	5.43	10.0	0.064
South	7	9.57		
West	7	10.00	7.00	0.025*
East	7	5.00		

the decrease in public transport use is lower in the zone with the lowest family income. Significant differences ($p < 0.05$) are also observed in the comparison of the area with the highest and lowest family income, so hypothesis H is confirmed.

Objective 2: *To identify if there are significant differences between the change in passenger numbers during the months of June to December* 2020 *and* 2021 *depending on the mobility corridor.*

In the period 2020/06-2020/12 vs 2021/06-2021/12, passenger numbers have recovered in all mobility corridors. In the west zone, the use of public transport has increased by 24.73% on average, in the south zone by 28.92% and in the east zone by 16.48% (**Table 6**). Likewise, there are significant differences ($p < 0.05$) between the use of public transport and the different urban corridors under study. Hypothesis H is also confirmed in this period, as the areas with the highest family incomes, the urban corridors that lost the most passengers in the lockdown and the beginning of the new normal, are those with the greatest variation.

Table 7 shows that in the period 2020/06-2020/12 vs 2021/06-2021/12, the mean rank in the eastern zone is lower in all cases. Therefore, the increase in the use of public transport has been lower in the area with the lowest household income, the area that has lost the least number of passengers in the lockdown and the beginning of the new normal. Significant differences ($p < 0.05$) are also observed in the comparison of the west and east zones and in the comparison of south and east zones, thus confirming hypothesis H.

Objective 3: *To identify if there are significant differences between the change in passengers during* 2019 *and* 2021 *depending on the mobility corridor.*

Comparing the number of passengers in 2019 (pre-pandemic period) with those in 2021 (New Normal), it can be seen that the East corridor is the corridor with the mean percentage of passengers closest to pre-pandemic values. The East corridor still has to recover 23.82% of passengers, the South corridor 24.26% and the West corridor 28.68% to reach the pre-pandemic values. (**Table 8**) Hypothesis H is confirmed in this period, as the area with the lowest family income is the one that loses the least passengers in the lockdown and in the new normal as a whole is the one that is closest to the pre-pandemic

Table 6. Descriptive statistics for mobility changes by years according to zones.

Table Head	Difference in means between periods			SD			Sig. K.Wallis
	West	South	East	West	South	East	P value
2020/06-2020/12 vs 2021/06-2021/12	**24.73 (grow)**	**28.92 (grow)**	**16.48 (grow)**	9.72	7.55	6.39	0.024*

Table 7. The relationship between mobility changes in public transport and zone lines between 2020 and 2021 (June to December).

Zones lines	Mann-Whitney U test			
	n	Mean Rank	U	Sig. Bill (p-value)
West South	7 7	6.43 8.57	17.0	0.338
East South	7 7	4.71 10.29	5.00	0.013*
West East	7 7	9.70 5.29	9.00	0.048*

Table 8. Descriptive statistics for mobility changes by year according to zones.

Table Head	Difference in means between periods			SD			Sig. K.Wallis
	West	South	East	West	South	East	P value
2019/01-2019/12 vs 2021/01-2021/12	**28.68 (decrease)**	**24.26 (decrease)**	23.82 (decrease)	5.17	6.84	3.98	0.045*

Table 9. The relationship between mobility changes in public transport and zone lines between 2019 and 2021 (January to December).

Zones lines	Mann-Whitney U test			
	n	Mean Rank	U	Sig. Bill (p-value)
West South	12 12	15.08 9.92	41.0	0.073
East South	12 12	12.38 12.42	71.0	0.954
West East	12 12	16.00 9.00	30.0	0.015*

Table 9 shows that in the pre-pandemic period (2019) and the new normal (2021), the average rank in the eastern zone is lower in all cases. Therefore, the decrease in public transport use has been lower in the area with the lowest family income. Significant differences ($p < 0.05$) are also observed in the comparison of the west and east zones, thus confirming hypothesis H.

The analysis of the data shows that the use of public transport in the area with the highest income, the western area, has had the greatest changes, both in the first phase of the pandemic and in the recovery process. At the beginning of the pandemic, this is the area where public transport use decreases the most, and as the situation normalises, public transport use in this area recovers faster than in the rest.

The results obtained are in line with pre-pandemic studies, such as (Haywood, Koning, & Monchambert, 2017) [38], which indicate that people with higher incomes are more reluctant to travel in crowded vehicles and (Cox, Houdmont, & Griffiths, 2006) [39] which indicate that crowding can accentuate the perception of security risk. In the area under study, Donostia-San Sebastián, the use of public transport in areas with higher income has been lower. Moreover, in a situation of perceived security risk, such as the post-pandemic situation, the decrease in the use of public transportation in areas with higher income has been greater.

These numbers quantify the assertion that the impact on mobility differs according to social class. People who stop using public transport are mainly those who have the option to do so (teleworking, having a private car, being able to pay for trips by other modes of transport, such as taxis, and using online shopping) while those who continue to travel on public transport are, to a greater extent people, on lower incomes.

Thus, the pandemic has brought to light the socioeconomic inequalities that exist in the city. Overcoming these inequalities is critical and must be a priority as cities recover from the pandemic. In this regard, improving public transport is today, more than ever, a matter of social justice.

Conflicts of Interest

The authors declare no conflicts of interest.

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