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IMPACT OF THE COVID-19 PANDEMIC ON CAR-SHARING IN POLAND

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Resume

The number of cars on Polish roads is increasing year by year. Currently, Poland is in second place in Europe in terms of the number of cars per 1000 inhabitants [1]. This causes problems in finding a place to park. In addition, during the pandemic, there was a problem with semis, which caused a sharp increase in the price of used cars and longer waiting times for new vehicles. The aim of this article is to find out the opinion of Polish residents on the Car-Sharing service during the CoVID-19 pandemic and how the pandemic has affected Car-Sharing not only in Poland, but also in Europe as a whole. For this purpose, a survey was conducted.

The research found that about 8% of people in Poland use the Car-Sharing service and that the pandemic had little impact on how this service was used. If someone needed to use this service, the pandemic was not an obstacle for them.

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1 Introduction

The automotive market in Poland is growing year on year. The exception is the year 2020 and the prevailing pandemic. In 2019, the number of registered passenger cars was 23.360.166 units [2]. This compares to 16.079.533 units just 10 years ago. The number of vehicles per 1.000 inhabitants is also increasing year on year. According to ACEA (European Automobile Manufacturers Association) in 2011 Poland was in 15th place in Europe with the result of 470 vehicles per 1000 inhabitants. However, the latest data shows that in 2021 this number will increase to 747 vehicles and Poland will be on the 2nd place in Europe, just behind Luxembourg [3]. Based on ACEA data, the average age of cars on Polish roads exceeds 14 years, with an average of 11.5 years for the whole EU [4].

The large number of vehicles on the roads causes, among others, slowing down traffic, higher risk of accidents and problems with finding a place to park [5-9]. In addition, during the pandemic, there was a problem with semiconductors, which resulted in a sharp increase in the price of used cars and longer waiting times for new vehicles. For this reason, more and more people are starting to use Car-Sharing, the market for shared

mobility. It grew rapidly between 2010 and 2011, when the total number of users exceeded one million. Based on Frost & Sullivan research, 10 million people were already using this service in 2017 [10]. This number is planned to reach 36 million in 2025, with an annual growth of 16.4% (Figure 1). However, these studies are shaken by the COVID-19 pandemic. Currently, the leading markets for shared mobility are Western Europe and the United States, and experts predict that the fastest growth in this area will take place in Asia [11].

COVID-19 is an infectious disease caused by coronavirus 2 of severe acute respiratory syndrome (SARS-CoV-2), the seventh coronavirus that can transmit between humans [12]. 11 March 2020. The World Health Organization (WHO) classified the COVID-19 outbreak as a global pandemic [13]. The new strain of coronavirus has reached the economic and social world on a scale not seen since the Great Depression (1929-1933) and is epidemic in nature compared to the Spanish flu of 1918 [14-15]. The spread of COVID-19 has reduced economic activity and led to a significant threat to the financial stability of many countries [16].

The development of the COVID-19 pandemic caused unprecedented restrictions on human mobility around the world [17]. Unprecedented measures restricting

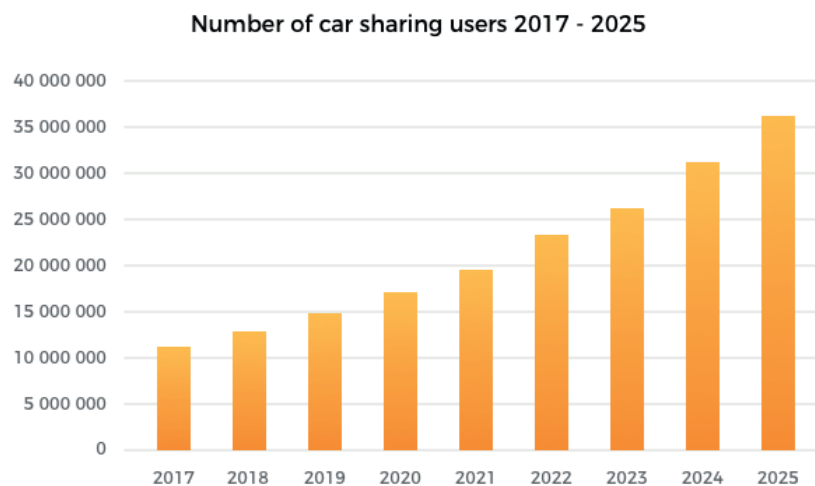


Figure 1 Number of people using Car-Sharing [11]

travel, movement and participation in activities have been introduced in many countries around the world [18]. These include staying at home, remote education, closed public institutions and workplaces, cancelled mass events and public gatherings, and restrictions on public transport, which have affected approximately 90% of the world's population [19-22] indicate a significant link between human mobility and government tightening of restrictions to contain the COVID-19 pandemic. Mobility restrictions vary between nations and regions due to their initial mobility patterns [23]. Schlosser et al [24] found that the COVID-19 pandemic resulted in reduced long-distance travel, which affected the spread process by “flattening” the epidemic curve and delaying spread to geographically remote regions.

The idea of ride-sharing originated in the United States during World War II, but gained particular popularity in the late 1970s. It was mainly used by commuting workers [25]. The idea of Car-Sharing has been considered by many researchers. For example, economic issues related to assets have been considered in works [26-29]. Identification of passenger transport platforms based on the concept of sharing economy and identification of possible space for development of this concept in Slovakia was presented in the work [30]. Mitrega and Malecka [31] presented an analysis of factors influencing the choice of sharing essence. Henrik Becker, Francesco Ciari, Kay W. Axhausen made a comparison of car-sharing systems used in Switzerland [32].

Most car-sharing related studies have focused on car-sharing services at stations, but there are also studies focusing on more advanced forms such as one-way car-sharing [33]. According to studies [34], the most suitable locations for car-sharing at stations are densely built-up urban areas with good public transport, and users are relatively young, affluent and well educated [35]. Considering the impact of car-sharing on the transport system, researchers have been able to confirm several

positive effects, including fewer car trips and lower emissions [36-37], reduced parking demand [38-39], and promotion of the use of public transport and active transport modes [40].

According to a study by Hamari, Sjöklint, Ukkonen [41], there are 254 sharing economy platforms worldwide divided into several categories, of which the rental category includes the largest number of platforms (131 platforms).

2 Research

2.1 Purpose and scope of research

The aim of this article is to find out the transport preferences and the use of Car-Sharing services by the inhabitants of Poland and to try to answer how the pandemic influenced their preferences. Obtained results of the research can be the basis for the adoption of directions for the development of the Car-Sharing service, in case of a similar situation in the future. Due to the prevailing pandemic, the study was conducted using a survey method on a representative group of Polish residents in January 2021. In order to find out the preferences of European residents on the car-sharing service, similar research is being conducted in cooperation with the following research centres: University of Zilina, The Institute of Technology and Business in Ceske Budejovice, Budapest University of Technology and Economic and Ural State University of Economics.

2.2 Methodology of the research

The study was conducted by means of a survey. Firstly, a pre-survey was conducted to clarify the survey

questions and to fully understand the questions asked by the respondents. This was the only possible form of conducting this type of survey during the prevailing COVID-19 pandemic. The survey was conducted in an open manner, maintaining the anonymity of the respondents. The actual survey was conducted via the Internet. The survey was divided into two groups: those who use the car-sharing service and a second group that has never used the service. The survey contained a group of 22 common questions including age, gender, number of inhabitants, place of residence, education level, occupation and employment status. In addition, the survey asked about the Polish residents' destination, means of transport, distance to destination and duration of travel, as well as where they shopped before and during the pandemic. They were also asked about how they work and how they worked before the pandemic, whether they live in a "restricted zone" or near a paid car park, the number of household members and the number of cars in the household.

In the next item, respondents were asked: had they ever used a car-sharing service. Those who answered positively were asked to answer the following questions about car-sharing: how long, how often, when, why, which app they use. The most important question was: Did they use during the pandemic? Those who had not used car-sharing before were asked to indicate factors and reasons why they had not used the service. At the end of the survey, respondents were given the opportunity to give feedback on their experience with car-sharing. For the sake of accuracy, the survey was targeted at different audiences. Incomplete questionnaires were discarded. An important step during the implementation of the survey was the calculation of the research sample. For Poland (38162000 inhabitants), assuming a confidence

level of 90% and a maximum error of 5%, the required number of people in the survey was 384 respondents. Therefore, 596 people participated in the study [42-43].

2.3 Results of tests

The subject of the survey were the inhabitants of Poland taking into account the place of residence, gender, number of inhabitants and their status on the labour market. The survey was conducted on a group of 2492 respondents, but only 596 correctly filled in questionnaires were used for further analysis. Women constituted 55% of respondents, men 34%. 11% of respondents did not answer the question about gender. Most of the respondents are adults. 29% of them are young people aged 18-35. Respondents aged 36-55 made up 58% and over 55 years old 13%. 5% were people under the age of 18. Most women (39%) and men (34%) were aged 36-45.

Most respondents lived in cities with up to 5 thousand inhabitants (38% of respondents) and the second group were people living in cities with 100-200 thousand inhabitants - 13%. 56% of respondents lived in a city and 44% lived in a village. Most women (41%) and men (33%) lived in towns with up to 5 thousand inhabitants (Table 1, 2).

The next question concerned labour market status. Over 89% were employed and almost 4% were self-employed. Among both men and women, 89% were working. The remaining group consisted of, respectively: unemployed, students, working students, pensioners, working pensioners, self-employed and people on maternity, parental and parental leaves.

Among the respondents almost 84% were people with

Table 1 Socio-demographic characteristics of survey respondents - part 1

Category	n	%	Female		Male	
			n	%	n	%
Sex:						
Female	328	55.00	--	--	--	--
Male	201	34.00	--	--	--	--
No answer	67	11.24	--	--	--	--
Age:						
under 18 years	1	0.17	0	0.00	1	0.50
18-25 years	30	5.03	16	4.88	11	5.47
26-35 years	141	23.66	80	24.39	46	22.89
36-45 years	216	36.24	127	38.72	68	33.83
46-55 years	130	21.81	67	20.43	41	20.40
56-60 lat	39	6.54	20	6.10	16	7.96
above 60 lat	39	6.54	18	5.49	18	8.96
Place of residence:						
urban area	337	56.54	170	51.83	129	64.18
rural area	259	43.46	158	48.17	72	35.82

Table 2 Socio-demographic characteristics of survey respondents - part 2

Category	n	%	Female		Male	
			n	%	n	%
Educational level:						
no education	0	0.00	0	0.00	0	0.00
primary	3	0.50	2	0.61	1	0.50
basic vocational	9	1.51	3	0.91	6	2.99
secondary technical	51	8.56	21	6.40	24	11.94
secondary	33	5.54	21	6.40	12	5.97
higher	500	83.89	281	85.67	158	78.61
Status on the labour market:						
Pupil	3	0.50	1	0.30	2	1.00
Student	8	1.34	5	1.52	3	1.49
Working	532	89.26	291	88.72	179	89.05
Self-employed	22	3.69	9	2.74	11	5.47
Unemployed	5	0.84	4	1.22	1	0.50
Pensioner	14	2.35	7	2.13	4	1.99
maternity leave. parental leave. parental leave	8	1.34	8	2.44	0	0.00
other	4	0.67	3	0.91	1	0.50
Number of inhabitants:						
up to 5.000	227	38.09	135	41.16	67	33.33
5.000 - 10.000	77	12.92	49	14.94	17	8.46
10.000 - 15.000	60	10.07	36	10.98	19	9.45
15.000 - 20.000	32	5.37	15	4.57	11	5.47
20.000 - 50.000	38	6.38	15	4.57	19	9.45
50.000 - 100.000	80	13.42	39	11.89	34	16.92
100.000 - 150.000	39	6.54	21	6.40	13	6.47
150.000 - 200.000	43	7.21	18	5.49	21	10.45
200.000 - 500.000	227	38.09	135	41.16	67	33.33
above 500.000	77	12.92	49	14.94	17	8.46
Work done - before the pandemic						
traditionally. at the employer's premises	566	94.97	310	94.51	190	94.53
remotely	6	1.01	3	0.91	2	1.00
hybrid	11	1.85	3	0.91	8	3.98
other	13	2.18	12	3.66	1	0.50
Work done - during the pandemic						
traditionally. at the employer's premises	307	51.51	171	52.13	91	45.27
remotely	50	8.39	20	6.10	26	12.94
hybrid	228	38.26	129	39.33	81	40.30
other	11	1.85	8	2.44	3	1.49

higher education. 86% of female respondents had tertiary education, compared to 79% of male respondents. Before the pandemic, 95% of the respondents worked at their employer's premises, while during the pandemic this

percentage dropped to 52%. On the other hand, during the pandemic 38% of respondents work in a hybrid way. Gender in this case does not matter. Most respondents work in public administration (65%) and education (7%).

When asked: Did your work situation change after the coronavirus outbreak? 85% of respondents answered no.

31% of respondents have four people in their household, 22% have two people and 21.5% have three people. 40% of respondents have one car and 39% have two cars in the household. 30% of women have four family members and one car (36%). Among men the proportions are: 32% and 49%.

Respondents were then asked to indicate the purpose of their daily trips, before and during the pandemic. In this case, respondents were able to choose one of seven answers, specifying the importance of the purpose. In the case analysed: 1 was the most frequent purpose, 5 the rarest and 6 not applicable. Before the pandemic, the most important goal for the respondents was work, followed by shopping, school and doctor. However, during the pandemic, a different hierarchy of respondents' goals emerged. Work and shopping came first, followed by

doctor and social gatherings. The above data corresponds with the previous questions regarding the age and work situation of the respondents. The above data are presented in Figures 2 and 3.

The main purpose of women's trips was work. This was 30% before the pandemic and 25% during the pandemic. The same was true for men: before the pandemic, work accounted for 25% and during the pandemic 19%. This is confirmed by the age of the respondents and also by the fact that 38% of them worked in a hybrid mode (Tables 3, 4).

Respondents were then asked which modes of transport they use. As in the previous case: 1 was the most frequent destination, 6 the rarest. Those asked, before and during the pandemic, used buses and trains most frequently. There was not much change during the pandemic. This may be influenced by the fact that the research was conducted in 2022, when the pandemic

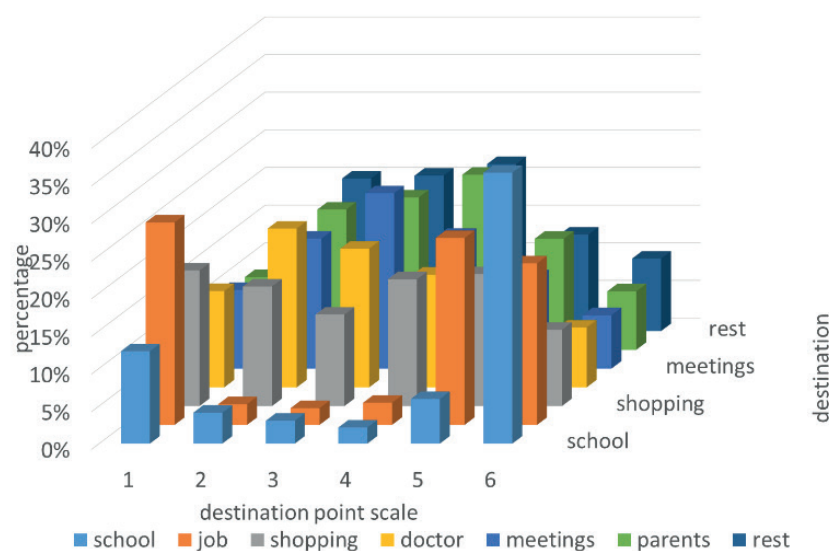


Figure 2 Purpose of daily travel before the pandemic

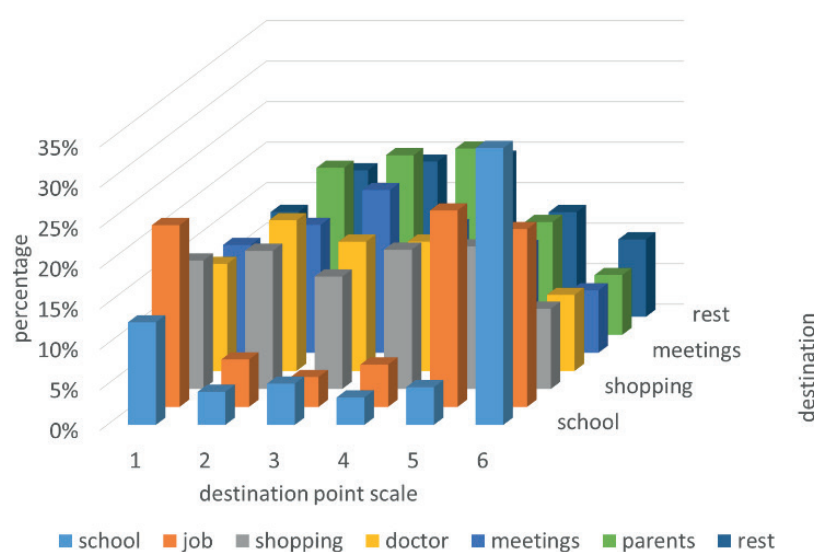


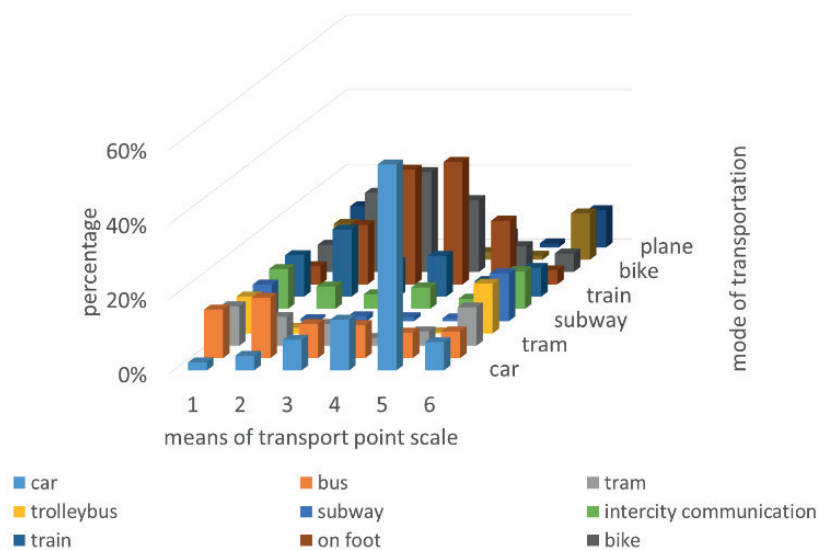
Figure 3 The purpose of daily travel during a pandemic

Table 3 Purpose of women's daily travel before and during the pandemic

Destination	Before the pandemic [%]						During a pandemic [%]					
	1	2	3	4	5	6	1	2	3	4	5	6
school	11.29	4.32	3.31	0.53	6.60	36.20	12.22	3.87	5.24	3.11	4.13	33.62
work	29.12	2.70	2.21	1.59	23.35	18.10	24.66	5.52	2.86	4.15	22.74	18.52
shopping	20.09	17.30	11.76	13.23	16.50	10.39	17.19	18.78	15.24	11.92	17.57	10.54
doctor	9.93	18.92	20.22	19.05	13.71	9.20	9.95	20.44	16.67	19.17	14.73	10.54
meetings	7.90	17.84	23.53	17.46	13.96	8.01	10.86	16.02	20.95	15.54	15.25	8.55
parents	11.29	17.30	19.12	24.87	14.47	8.31	11.54	17.68	21.90	25.39	13.18	8.55
leisure	10.38	21.62	19.85	23.28	11.42	9.79	13.57	17.68	17.14	20.73	12.40	9.69
max	29.12	21.62	23.53	24.87	23.35	36.20	24.66	20.44	21.90	25.39	22.74	33.62

Table 4 Purpose of men's daily travel before and during the pandemic

Destination	Before the pandemic [%]						During a pandemic [%]					
	1	2	3	4	5	6	1	2	3	4	5	6
school	12.00	4.55	2.87	3.57	6.18	34.85	13.17	4.73	4.00	4.21	6.06	35.11
work	24.80	3.03	2.87	4.29	25.48	23.74	19.34	7.10	5.71	8.42	24.24	23.40
shopping	15.60	14.39	12.07	18.57	19.69	10.61	14.40	15.98	10.86	20.00	19.48	10.11
doctor	17.60	24.24	15.52	9.29	9.65	7.07	18.11	17.75	13.14	11.58	12.12	7.98
meetings	14.00	15.15	24.71	17.14	9.65	5.56	16.87	13.02	21.14	15.79	10.39	6.91
parents	7.20	21.21	20.69	25.00	14.29	7.07	7.00	24.26	22.29	20.00	14.29	5.85
leisure	8.80	17.42	21.26	22.14	15.06	11.11	11.11	17.16	22.86	20.00	13.42	10.64
max	24.80	24.24	24.71	25.00	25.48	34.85	19.34	24.26	22.86	20.00	24.24	35.11

**Figure 4** Means of transport before the pandemic

was already at an end. Previous studies by the author, indicate that most people used a car instead of public transport. The above results mainly refer to people's activities such as work or school and shopping. These data are presented in Figures 4 and 5. In the analysed case gender does not matter much. (Table 5, 6).

The next question asked about the distance from home to the destination before and during the pandemic. Most respondents before the pandemic outbreak indicated a distance of more than 20km as their main

travel destination (25%), this is mainly due to their place of work. After the pandemic outbreak, a distance of 1 to 5km emerged as the main travel destination (25%). This is mainly due to commuting to work and shopping. After the pandemic outbreak, respondents abandoned visiting relatives and leisure activities, spending most of their time at home. These data are presented in Figure 6.

The next question asked how long did it take to travel to your main destination before and during the pandemic? In this case, before the pandemic outbreak,

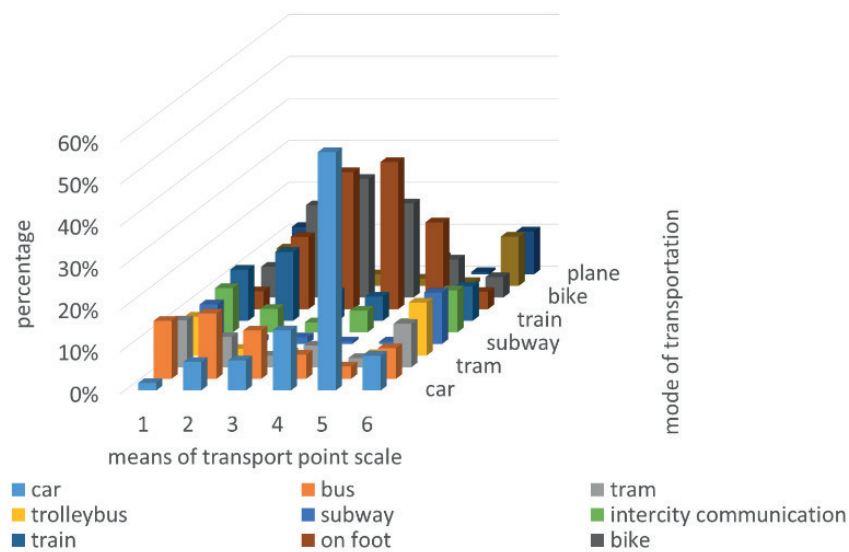


Figure 5 Means of transport during a pandemic

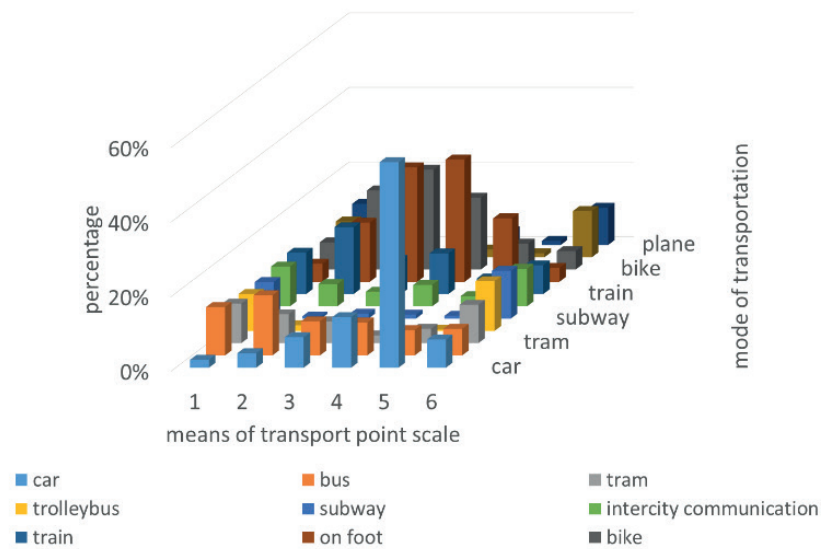


Figure 4 Means of transport before the pandemic

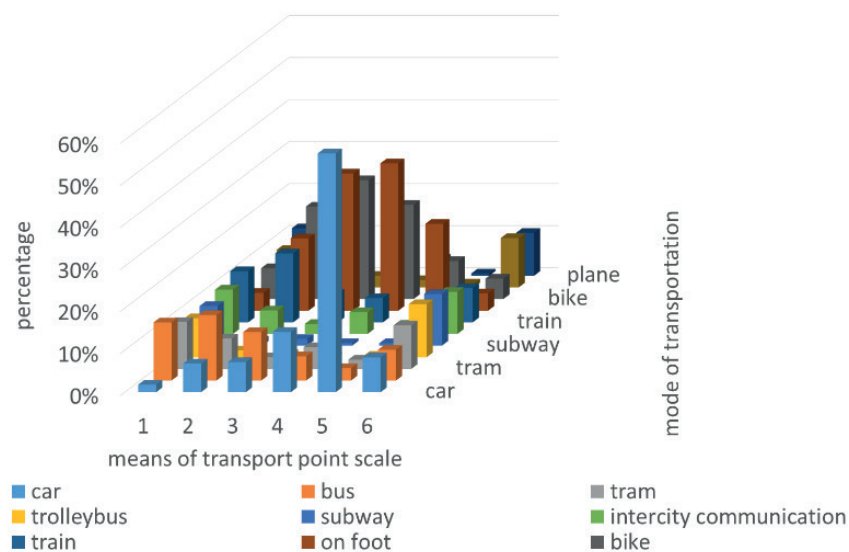


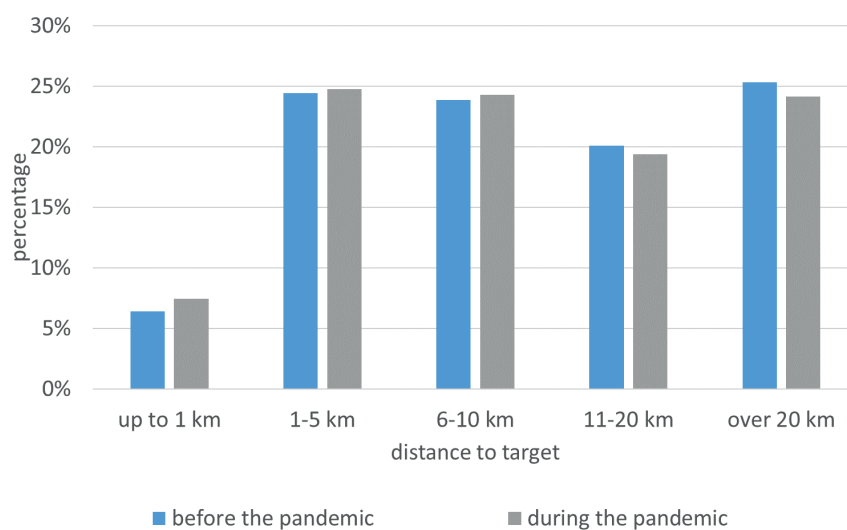
Figure 5 Means of transport during a pandemic

Table 5 A means of transporting women before and during a pandemic

Means of transport	Before the pandemic [%]						During a pandemic [%]					
	1	2	3	4	5	6	1	2	3	4	5	6
car	1.96	3.47	5.81	13.54	55.59	6.78	1.70	4.72	6.35	16.85	58.75	7.55
Bus	12.68	17.34	9.68	7.29	6.39	7.29	14.06	18.90	8.73	2.25	2.31	7.64
Tram	9.80	9.83	5.16	3.13	3.19	10.83	10.51	8.66	2.38	3.37	1.65	10.75
Trolleybus	9.93	1.16	0.00	0.00	0.32	13.36	9.09	1.57	0.79	0.00	0.00	12.64
Metro	9.41	0.58	1.29	2.08	0.96	12.96	8.95	0.79	2.38	1.12	0.33	12.36
Intercity transport	10.59	5.20	5.16	6.25	2.56	10.43	10.37	6.30	2.38	5.62	1.65	10.47
Train	11.63	13.29	9.03	11.46	3.51	8.20	12.36	15.75	4.76	4.49	2.97	8.68
By foot	6.01	17.92	31.61	30.21	18.21	3.14	5.54	17.32	34.13	38.20	21.45	3.30
Bike	7.58	21.97	29.03	21.88	7.03	4.35	7.81	20.47	32.54	22.47	9.57	3.96
Motorbike	9.67	0.58	0.00	0.00	1.60	12.55	8.81	1.57	2.38	0.00	1.32	12.08
Plane	10.72	8.67	3.23	4.17	0.64	10.12	10.80	3.94	3.17	5.62	0.00	10.57
max	12.68	21.97	31.61	30.21	55.59	13.36	14.06	20.47	34.13	38.20	58.75	12.64

Table 6 A means of transporting men before and during a pandemic

Means of transport	Before the pandemic [%]						During a pandemic [%]					
	1	2	3	4	5	6	1	2	3	4	5	6
car	2.70	5.15	11.38	14.29	53.37	7.60	2.13	9.71	10.31	8.96	55.19	8.08
Bus	13.72	14.71	8.13	11.69	7.30	6.71	13.65	11.65	14.43	8.96	3.28	7.07
Tram	11.23	5.88	6.50	1.30	4.49	9.89	11.73	5.83	3.09	7.46	2.73	9.93
Trolleybus	9.77	0.74	0.00	0.00	0.00	13.78	9.38	0.97	0.00	0.00	0.00	13.13
Metro	10.19	0.74	1.63	0.00	0.00	12.90	9.81	1.94	1.03	0.00	0.00	12.46
Intercity transport	10.40	7.35	3.25	6.49	2.81	9.72	10.45	5.83	3.09	5.97	2.19	9.43
Train	10.40	24.26	10.57	7.79	5.62	7.07	11.94	17.48	11.34	5.97	4.37	7.74
By foot	3.74	13.97	27.64	33.77	17.98	4.06	2.99	17.48	27.84	31.34	22.95	4.55
Bike	6.86	19.85	24.39	18.18	7.30	5.30	7.04	23.30	23.71	23.88	8.74	5.56
Motorbike	9.15	1.47	1.63	3.90	0.00	12.72	8.74	1.94	3.09	4.48	0.00	11.78
Plane	11.85	5.88	4.88	2.60	1.12	10.25	12.15	3.88	2.06	2.99	0.55	10.27
max	13.72	24.26	27.64	33.77	53.37	13.78	13.65	23.30	27.84	31.34	55.19	13.13

**Figure 6** Distance to destination before and during a pandemic

most people commuted to their main destination, usually work, within 15-30 minutes (33%). During the epidemic and reduced traffic, this time is up to 15 minutes (36%). This is closely related to the previous question on the distance from home to the main destination and is shown in Figure 7.

Another question concerned the monthly costs spent on the car - before and during the pandemic. In this case, before the outbreak of the pandemic, most people spent up to 250€ (70%); during the pandemic, this value decreased minimally to 68%. This was mainly due to the fact that people started using their own cars instead of public transport (Figure 8).

Respondents were then asked how many kilometres they travelled annually: before and during the pandemic. Based on Table 7, it can be seen that the highest number of respondents travelled a distance of 10-15.000 km before the pandemic (27%), and during the pandemic

and restricted mobility, this value dropped slightly to 5-10.000 km (26%). This is largely due to public fear of contagion and restricted mobility. Considering gender, the pandemic did not change the mobility behaviour of men and women.

The next question asked respondents about the frequency of car use before and during the pandemic. The majority of respondents used the car practically every day before and during the pandemic. The frequency of car use was not significantly affected by the pandemic (Figure 9).

Additionally, respondents were asked if they lived in a restricted traffic zone and in the vicinity of a paid car park. Negative answers were given by (95%) and (92%) of respondents respectively. Another question concerned driving an electric car. Over 90% of respondents, including 95% of women and 84% of men, have never driven an electric car. Among the respondents, 37% park

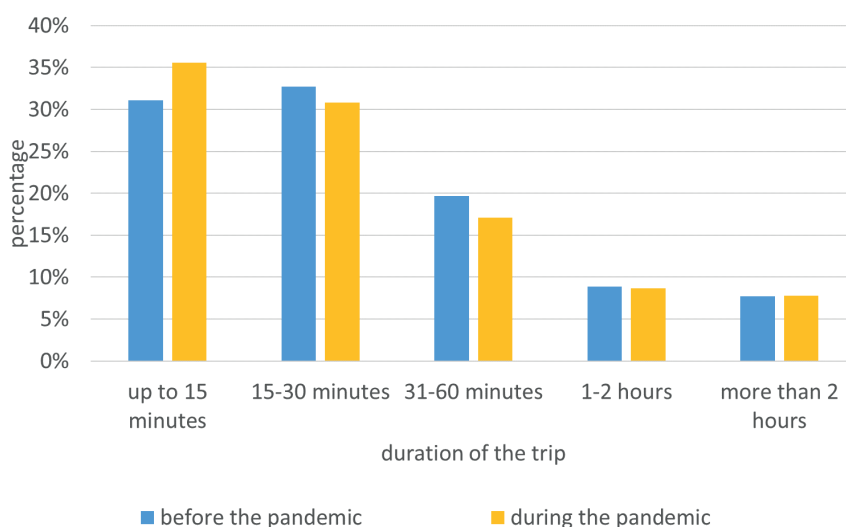


Figure 7 Duration of the trip before and during the pandemic

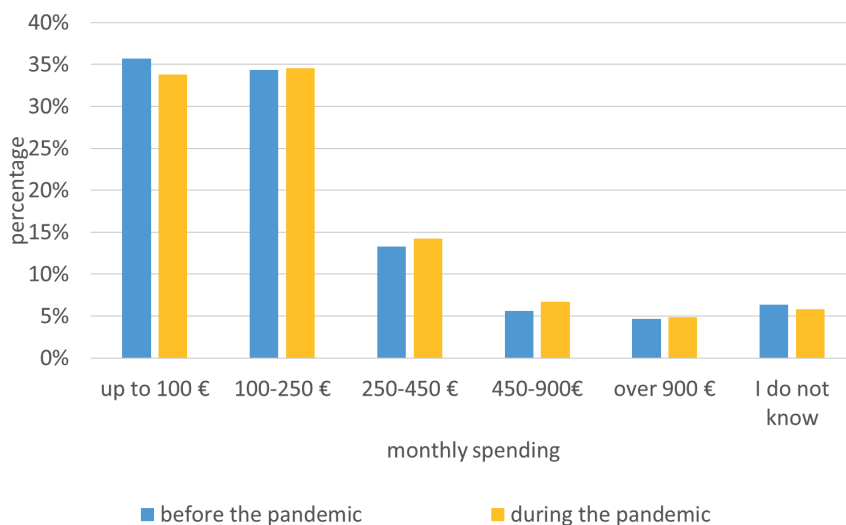
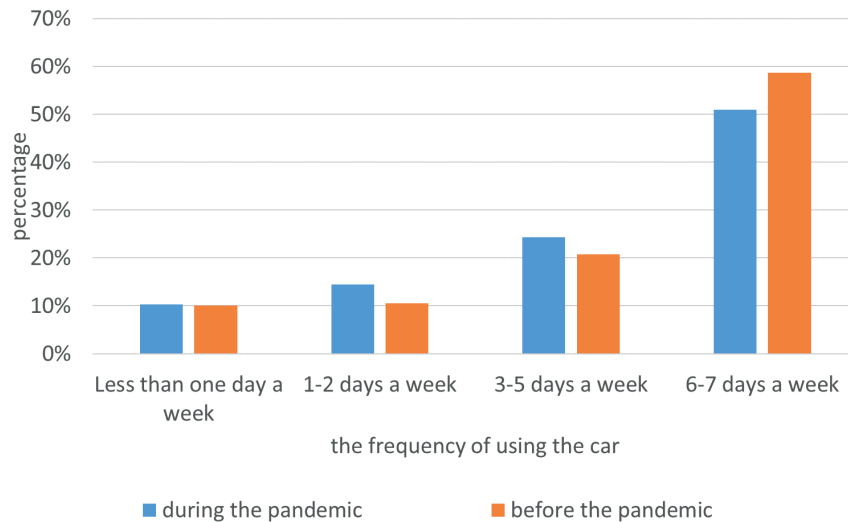


Figure 8 Monthly costs spent on car - before and during the pandemic

Table 7 Number of kilometres travelled annually by respondents

Category	before the pandemic		during a pandemic		before the pandemic		during a pandemic	
	n	%	n	%	Female [%]	Male [%]	Female [%]	Male [%]
Less than 5000 km	109	16.59	135	21.29	21.20	9.00	26.18	13.74
5.001 - 10.000 km	171	26.03	167	26.34	25.92	27.49	27.02	26.07
10.001 - 15.000 km	174	26.48	160	25.24	24.87	28.44	21.73	29.38
15.001 - 20.000 km	115	17.50	100	15.77	15.45	20.38	13.37	19.91
above 20.000 km	88	13.39	72	11.36	12.57	14.69	11.70	10.90

**Figure 9** Frequency of car use**Table 8** Answers given by respondents

Category	n	%	Female		Male		
			n	%	n	%	
Limited traffic zone							
yes	33	5.54	22	6.71	8	3.98	
no	563	94.46	306	93.29	193	96.02	
Paid parking							
yes	50	8.39	24	7.32	21	10.45	
no	546	91.61	304	92.68	180	89.55	
Electric car driving							
Yes. I have one	6	1.01	3	0.91	2	1.00	
Yes. I have owned one in the past	1	0.17	0	0.00	1	0.50	
Yes. I have borrowed one from a friend	51	8.56	14	4.27	29	14.43	
No. never	538	90.27	311	94.82	169	84.08	
Parking place of the car							
On the street	97	16.28	46	14.02	44	21.89	
In a shared garage	45	7.55	27	8.23	15	7.46	
In a fenced area of the property	172	28.86	101	30.79	54	26.87	
In an individual garage	219	36.74	120	36.59	73	36.32	
In a secure car park	11	1.85	4	1.22	4	1.99	
not applicable	52	8.72	30	9.15	11	5.47	

Table 9 Answers given by respondents

Category	n	%	Female [%]	Male [%]
Using Car-Sharing				
yes	48	8.05	5.18	12.94
no	548	91.95	94.82	87.06
How long have respondents been using car-sharing?				
less than 1 year	12	25.00	17.65	20.83
1 to 2 years	13	27.08	17.65	33.33
2 to 3 years	9	18.75	23.53	20.83
more than 3 years	14	29.17	41.18	25.00
Use during a pandemic				
yes	32	66.67	52.94	76.92
no	16	33.33	47.06	23.08
Determinants of car-sharing				
Price of the service	18	29.51	18.52	26.09
Avoiding costs associated with car ownership	14	22.95	29.63	10.87
Accessibility	32	52.46	29.63	50.00
Environmental factor	2	3.28	3.70	2.17
Economic factor	8	13.11	7.41	8.70
Other	5	8.20	11.11	2.17

Table 10 Advantages of Car-sharing

Category	The importance of the advantages of car-sharing [%]									
	1	2	3	4	5	6	7	8	9	10
has a positive impact on the environment	5.05	15.15	11.63	14.29	14.29	8.33	10.00	3.57	8.70	15.25
no need to have your own vehicle	15.15	18.18	11.63	4.76	7.14	4.17	0.00	10.71	13.04	11.86
Guarantees easy access to the vehicle.	9.09	6.06	9.30	11.90	16.67	20.83	35.00	3.57	13.04	3.39
lower costs compared to using your own vehicle	8.08	9.09	9.30	14.29	9.52	16.67	0.00	14.29	21.74	6.78
Possibility of parking in various locations	11.11	15.15	6.98	16.67	4.76	8.33	10.00	14.29	13.04	8.47
Guarantees no parking fees.	15.15	9.09	9.30	16.67	0.00	0.00	10.00	14.29	13.04	10.17
gives the opportunity to use new models of cars of different brands	11.11	12.12	13.95	9.52	7.14	8.33	5.00	7.14	4.35	13.56
reduces the number of other vehicles in the city	10.10	6.06	11.63	7.14	19.05	16.67	5.00	14.29	8.70	6.78
has an easy-to-use application	7.07	9.09	16.28	4.76	19.05	16.67	15.00	10.71	0.00	5.08
my employer pays for the use of Car-sharing	8.08	0.00	0.00	0.00	2.38	0.00	10.00	7.14	4.35	18.64

their car in a garage and 29% park it on the property (Table 8).

The next questions in the survey were about car-sharing. Among the respondents, only 8% used car-sharing. Among them there were 5% women and almost 13% men. Most respondents used the service up to 10

times, which confirms the fact that this service is not very popular in Poland. People who use the car-sharing service most often use it for up to 2 years (52%). Women use the service longer. The pandemic has reduced the use of car-sharing. In addition, 33% of respondents have stopped using the service, this is particularly noticeable

Table 11 *Determinants of not using car-sharing*

Category	n	%	Female [%]	Male [%]
lack of available parking spaces	49	6.14	6.40	4.96
high costs of car-sharing	60	7.52	6.64	9.54
difficulties in car-sharing	94	11.78	12.09	12.60
complexity of finding available cars when needed	36	4.51	3.08	6.11
the service is not available in my area	337	42.23	44.31	39.31
mistrust of unknown cars (reliability, safety, etc.)	78	9.77	9.48	10.69
fear of damaging the rented vehicle	88	11.03	12.80	9.92
lack of need	21	2.63	0.95	4.20
own car	24	3.01	2.37	2.29
lack of information about the service	8	1.00	0.24	0.00

Table 12 *Answers to the question: why have you never used a car sharing service?*

Category	n	%	Female [%]	Male [%]
I have never needed such a service	317	40.54	42.79	40.16
I cannot give up using my private car	45	5.75	3.95	7.48
I am afraid that in case of need I will not find a free car	41	5.24	3.95	7.09
I am not familiar with the service / am not informed	126	16.11	17.44	12.99
The service is not available in my area	209	26.73	26.74	25.98
Risks associated with unknown cars (reliability, safety, etc.)	39	4.99	4.19	5.91
Other	5	0.64	0.93	0.39

among women. Most respondents use the car-sharing service less than once a month or several times a month. They use it mainly when they do not have a car or other means of transport are not available and instead of a private car for short trips. Respondents decided to use car-sharing mainly because of the availability of the service (53%). They also mentioned the price of the service (30%) and the avoidance of costs associated with owning a car (23%). The gender of the respondents did not matter much (Table 9).

Respondents were also given the opportunity to indicate which advantages of car-sharing are most important to them? In this case 1 means the most important and 10 the least important. The most important for the respondents is the possibility not to own a car, the guarantee of free parking and the possibility to park in many places and to use new car models of different brands. Environmental impact and functionality of applications are not considered at all by respondents (Table 10).

Residents in Poland use various car-sharing applications (BlaBlaCar, Bolt, Easyshare, EcoShare, InnogyGO!, Panek CarSharing, Miimove, Traficar, 4mobility). Many of them use at least one of these. Panek CarSharing and Traficar are used by 66% of respondents. On a scale of 1 to 6, respondents rate the performance of the app highly. 37% of respondents rate it 4 and 29% rate it 5. Gender is not important in rating the app's performance. Men and women rate it 4.48.

Another group of questions concerns people who

do not use car-sharing. Respondents were asked why they do not use this service. Respondents were given a choice of multiple answers. Most of them (42%) answered that the service is not available in my area. This is mainly due to the fact that the car-sharing service is still underdeveloped in Poland and available only in bigger cities, and among the respondents there were also inhabitants of small towns. The second answer was that it is difficult for me to share a car (12%). This is a serious problem because it is difficult to change people's mental behaviour. Everyone wants to have their own car and does not want to share it. In this case it will be difficult to convince such people to use this service. Another answer given was the fear of damage to the rented vehicle (11%). Although the cars are insured and with proper use nothing should happen to them, people are afraid to use them. (Table 11).

Respondents were then asked why they had never used a car sharing service? The majority of respondents said they did not need such a service (41%). This question is consistent with ACEA data, which confirms that there are more and more cars in Poland. For this reason everyone drives their own car and there is no need to rent one. Respondents also stated that the service is not available in my area (27%) and they do not know what car-sharing is and how it works (16%). It shows that the car-sharing service is poorly developed and poorly advertised in Poland (Table 12).

The last question, for all, concerned other comments on the functioning of car-sharing in Poland not mentioned in the survey. Respondents pointed out above all the

limited access to the car-sharing service and its high cost. People using the service also pointed out that there are vehicles damaged by other users, e.g. jammed handbrake or incomplete equipment, as well as dirty cars inside.

3 Conclusions

After the COVID-19 outbreak, the mobility of the Polish population changed, especially in cities where public transport existed and people stayed at home or started using their own cars. In smaller towns and villages, where there is no public transport, people still mainly use cars because they are dependent on it. Research has found that around 8% of people in Poland use car-sharing. The pandemic has caused a decrease in the use of car-sharing. More than 30% of those surveyed have given up using it because of health concerns. In addition, limited availability is an obstacle to the use of this service. It is mainly developed in big cities, while in smaller towns people do not even know about its

existence. The number of vehicles in Poland, which is growing year on year, confirms the fact that Poles prefer to use their own car rather than a car driven by other people. This may change in the future, as the growing number of cars in cities makes it difficult to find parking spaces, and it is very often the case that car-sharing companies have spaces purchased for this purpose. In addition, a large proportion of car-sharing cars are electric, which means that in some cities there is the possibility of using bus lanes.

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