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## BUS COMMUNICATION BEFORE AND DURING A PANDEMIC

**A b s t r a c t:** This article presents and compares the use of city buses before and during a pandemic. Crisis management of public transport during a pandemic was also discussed. A survey was conducted to check the behavior of travelers at that time. The methods of managing public transport in several Polish cities were compared. Economic aspects such as ticket revenues are considered, and social aspects such as the traveller's approach to imposed restrictions or the use of precautionary measures.

**K e y w o r d s:** buses, public transport, public transport management, crisis management, COVID-19, pandemic

**J E L C o d e:** R41

### INTRODUCTION

At the end of 2019, the COVID-19 pandemic began in China. The virus was quickly transferred to Europe and caused the death of many people, and thus paralysis of European countries. The introduced restrictions and the residents' fear in a particular way contributed to a significant reduction in the number of passengers in public transport vehicles. However, as shown by a study by the German Institute of Robert Koch, only 0.2% of infections are caused by public transport, which, for example, compared to the workplace (10.6%), shows that public transport is a relatively safe place under the restrictions that are followed. The Polish authorities have imposed a number of restrictions, thanks to which, while fully complying with them, they minimize the risk of contracting the virus in public space. As the research conducted by Dr. Konrad Maj and

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prof. dr hab. Krystyna Skarżyńska from SWPS University show, 82.4% of the society complies with the restrictions imposed by the government, but the remaining 17.6% ignore the imposed restrictions.

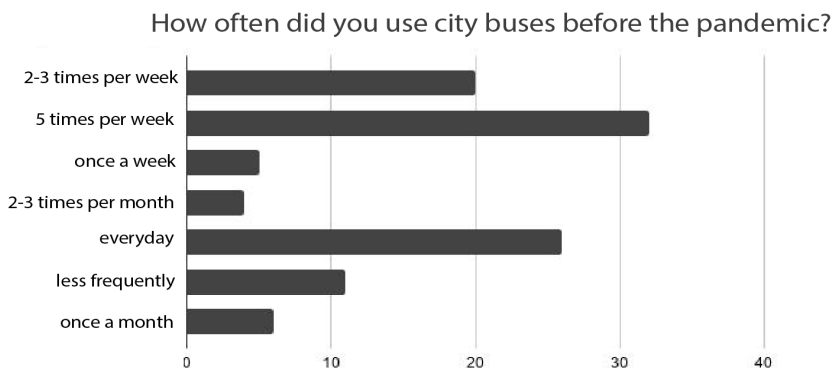
Mobility management is all activities related to planning, organizing, coordinating and controlling the transport of society and goods. Public transport management uses the available personal, financial, material and information resources to influence communication standards and behaviors, and thus to form the demand for means of transport alternative to passenger cars. Mobility management uses a number of instruments, resources, equipment and strategies that have multiple specific impacts, especially we should distinguish methods for managing during epidemiological crises [Nosal, Starowicz, 2010].

### THE FREQUENCY OF USING THE BUSES

The SARS-CoV-2 virus pandemic had a direct impact on the functioning of public transport. The transport industry has been especially suffering, given the way mass transit gathers large numbers of people in one place, contributing to the spread of the virus.

A large part of the society abandons urban transport in favor of cars due to the desire to isolate themselves. The need to transport has been minimized due to the fact that schools, universities and many enterprises have changed the mode of operation to remote.

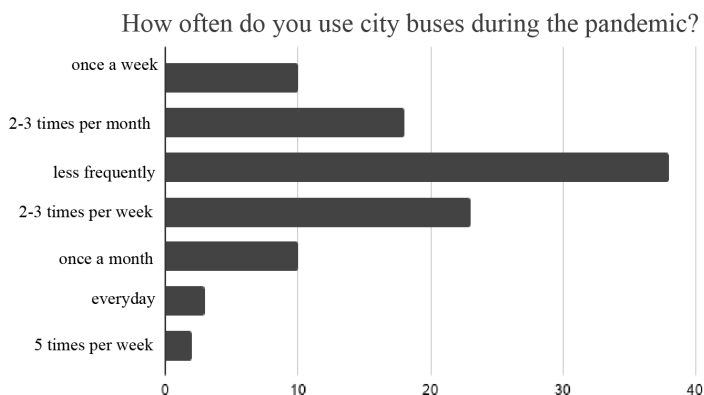
In a survey conducted for the purposes of the article in April 2021, a group of 104 respondents from the Tri-City and the surrounding area answered questions related to transport before and during the pandemic.



Picture 1 the frequency of using the buses before the pandemic

Respondents were asked about the frequency of bus use before the pandemic. According to the survey, 79.8% of participants used this mode of transport

5 times a week or more. The largest group that can be observed are people driving buses 5 times a week (30.8%).



Picture 2 the frequency of using the buses during the pandemic

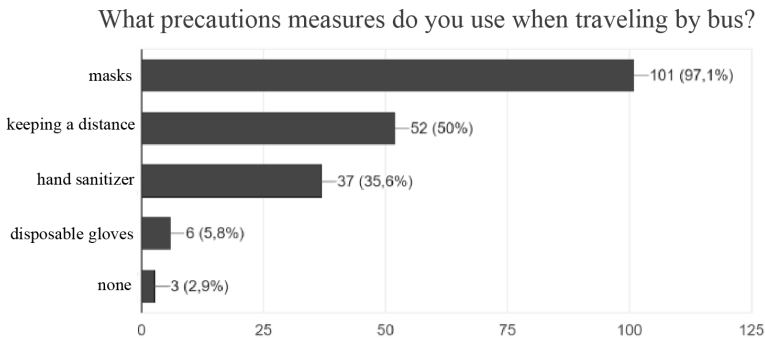
In Picture 2, it can be seen that the situation has changed. There has been a significant decrease in the frequency of the use of city buses. As many as 63.4% of respondents use buses up to 3 times a month. The largest group in this case are people who travel by bus less than once a month, which, compared to Picture 1, is a completely opposite phenomenon.

According to a study conducted in March 2020 by Dr. Maria Baran, Dr. Katarzyna Hamer, Dr. Marta Marchlewska on a sample of 1098 people 85% of Poles limit staying outside the home, which contributes into a reduction in the number of people involved in transport.

## PRECAUTIONS

With the appearance of the virus in Poland, the government is gradually introducing restrictions to prevent the spread of the virus, for this purpose it is recommended to use masks, disinfectants, disposable gloves and to keep a distance from fellow passengers.

The survey asked respondents about the precautions they use when traveling by bus.



Picture 3 precautions

The most frequently used precautionary measures are: masks (97.1%), keeping distance (50%), the use of disinfectant (35.6%) and disposable gloves (5.8%). Only 2.9% of the respondents do not comply with any precautionary measures, and 97.1% use at least one of the above-mentioned measure of protection against the virus.

## PUBLIC TRANSPORT MANAGEMENT DURING A PANDEMIC

The principle of limiting slots in public transport has been introduced throughout Poland. Following the recommendations of global public transport organizations, a number of measures have been taken to prevent the spread of the virus. Crisis management during an epidemic was established a few years earlier in the event of an epidemic such as seasonal flu [Fletcher, Kim, Amarakoon, Shanika, Haskell, Jacqueline, Penn, Paul, Wilmoth, Megan, Matherly, Deborah, Langdon, Neeli, 2014]. Along with the development of the epidemiological situation in the country, cities gradually took the following steps to reduce the risk of disease among citizens:

On March 19, ZKM Gdynia changed the current timetables of bus and trolleybus lines to those of the weekend days. From June 1, drivers were obliged to open all doors (except the front door, which are now out of use), resigning from using the existing. From now on, vehicles had to be aired in bus depots, and the use of heating and air conditioning devices was banned while driving, thus reducing the internal air circulation in the passenger section. On November 19, the vehicles also had separated zones for drivers and the inability to buy tickets in the vehicle. All means of transport are disinfected daily to the highest sanitary standards. Additionally, the vehicles are ozonized every two weeks. Bus stops

are also subject of regular disinfection.

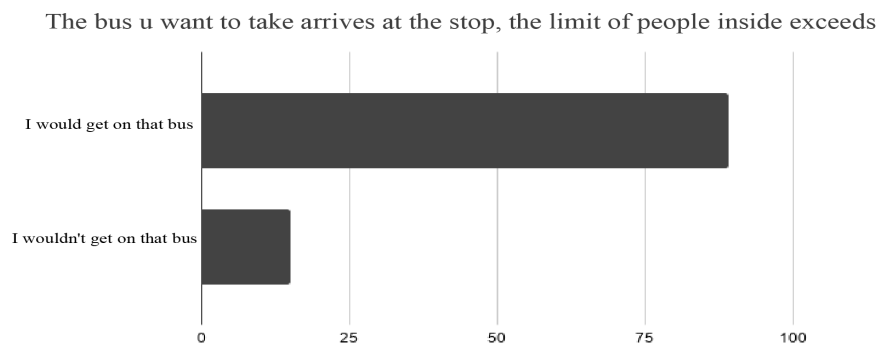
Many cities, in addition to the above-mentioned preventive measures, appeal to passengers in its vehicles through posters that ask to keep away from fellow passengers, and on monitors spots promoting compliance with the restrictions and with the most important information on safe travel in times of a pandemic have started being displayed. Some cities around the world use mass media to educate the public about epidemiological safety [Bacha Kebede Debela, 2020].

In addition, from October 19, during rush hours, the capital has released the maximum number of bus fleet to the streets (1,560 buses - more by approx. 40-50 vehicles in the morning rush hour) [Redakcja transport-public, 2020].

### FAST TRAVEL TIME AND COMFORT BEYOND SAFETY

Public transport has the ability to move many people in one vehicle. Due to epidemics, this fact becomes problematic when it is necessary to reduce the number of people in one closed space without air circulation.

To see if travel speed and convenience are prioritized over safety, the respondents were asked the following question:



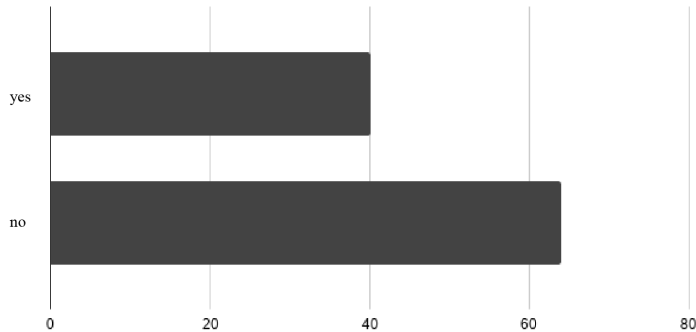
Picture 4 bus with exceeded passenger limit

The chart shows that as many as 85% of respondents would board a bus with exceeded passenger limit.

61.5% of the respondents declare that in order to shorten the travel time they are able to ignore the risk of infection. This is illustrated by the fact of ignoring the risk of traveling by bus with exceeded passenger limit. Restrictions limiting the number of passengers reduce the transport capacity of carriers, but passengers are willing to bend them in order to reach their destination comfortably and in a shorter time. The graphs show that on routes with a short travel time (up to

10 minutes), more people are likely to choose to travel on foot than on routes where the travel time is not specified.

Knowing that you have a distance of more than 30 minutes to cover on foot, would you reduce this time to 10 minutes?



Picture 5 bus with exceeded passenger limit - time is set

## RISK OF INFECTION IN PUBLIC TRANSPORT

According to Italian Transport Minister Paola De Micheli, all international studies show that the rate of infection in transport is very low. Airplanes, ships, buses, local and long-distance trains account for 0.1 percent. infections [Redakcja Forsal, 2020].

According to research in France, only 1.2 percent of virus infections recorded in May 2020 occurred in public transport. Such a low percentage results from the compliance of passengers with the restrictions and prevention measures taken by the state.

According to research by Dr. Julian Tan from the University of Leicester, the precautions taken have made public transport “the safest place on earth”. Hong Kong, one of the cities with the highest population density, has only 68 cases due to public transport out of 100,000 cases of infection. In the USA, it was 2,198 cases out of 100,000, and in Spain, 1,602 cases out of 100,000 infections.

This difference may result from the attitude of a given society to the imposed restrictions. In China, the population applies the restrictions imposed by the state, which results in the lowest percentage of infections in public transport [Redakcja Nakolei, 2020].

## EARNINGS FROM PUBLIC TRANSPORT TICKETS

Due to the decline in interest in public transport as a consequence of the global pandemic, ticket revenues in 2020 decreased drastically compared to 2019.

The statistical data from the Warsaw annual report prepared by the ZTM show that during the pandemic there was 40% decrease in the number of passengers in public transport. In 2019 it was 1.2 billion passengers, where in 2020 it was already around 726 million. Following the drop in passengers, ticket revenues also fell by 40%. Warsaw recorded an inflow of tickets in the amount of 601,027,773 PLN for 2020, where the previous year brought profits of 994,588,849 PLN. This translated into the purchase of a total of 58,548,041 tickets of all types, compared to over 85 million a year earlier. Interestingly, the interest in short-term tickets, especially 20-minute tickets, has increased. It is related to the lower need to move and the reduced interest in public transport [Transport-public office, 2021].

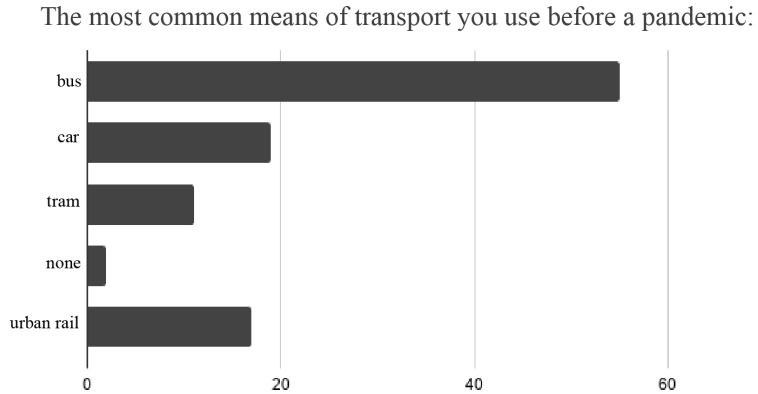
As a result, 22 percent of the proceeds were allocated to start-up costs in 2020. Over 2.6 billion PLN was allocated for the purchase of transport services, of which 75% was co-financed from the budget of the city of Warsaw. The percentage of people traveling without tickets remained unchanged (2.65%). [Editorial public transport, 2021].

ZTM Gdańsk recorded losses of 27.6 million PLN compared to the previous year in the period from January to October. The increase in ticket prices did not help the, which oscillated between 5-18%. In March, the number of passengers decreased by a third, comparing the data with the previous year [Gawlik, 2021].

In comparison with the preceding carriers, ZTP Kraków recorded the largest decrease in ticket revenues. In January and February 2020, i.e. just before the outbreak of the pandemic, the revenues were higher than in 2019, while in March the situation reversed. The biggest drop was recorded in April, the difference was as much as 19.6 million PLN, then in May the income drop was 16.3 million PLN. In June, July and August, the difference was approximately 9 million [Urbanowicz, 2020].

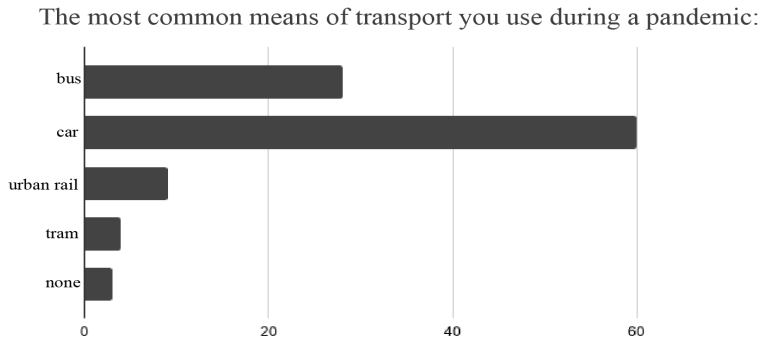
In Gdynia, the situation is similar. During the pandemic, a 40% decrease in ZKM Gdynia bus travelers is registered, and thus the income from ticket sales decreased by approximately 34%. The difference in income to travelers is due to the fact that people that are exempt from fees have given up on transport. These are children and school-age adolescents due to the introduction of distance learning and seniors who limit their mobility due to being in a high-risk group [Fiszer, 2021].

The decrease in the number of people traveling by bus does not mean the renouncement from using transport. To answer this question, respondents were asked about the means of transport they most used before and during the pandemic.



Picture 6 preferred mean of transport before the pandemic

The graph shows that 79.8% of the respondents most often used public transport, including 52.9% of the buses, and only 18.3% of the respondents traveled by car.



Picture 7 preferred mean of transport during pandemic

The situation changed dramatically during the pandemic. During the pandemic, the most frequently used mean of transport by the respondents is the car (57.7%), which is a significant difference compared to the situation before the pandemic (18.3%). It can be concluded that this is due to the lack of willingness to expose oneself to being in a group of people.



Comparing the months from January to October - the revenues from the sale of tickets that went to ZTM in 2020 were lower by 27.6 million PLN compared to 2019. In ten months, ZTM earned 84 100 277 million PLN on tickets in 2019 and a year later 56 437 835 million PLN. Despite the new ticket prices (valid from April 1 this year), which included both short-term tickets (price increase between 7.69-18.57%), monthly (price increase between 4.6-16.82%) and semester tickets (increase prices between 5.03-9.31%), the drop in revenues from ticket sales is significant.

As much as 27.6 million PLN less was transferred to the cash desk of the Public Transport Authority in the period from January to October 2020 compared to the corresponding months of 2019. This is the result of a much lower number of passengers due to the epidemic. Already in March, the number of people traveling by city buses and trams was one third less than the year before. The following months brought similar results, or even worse. Despite this, ZTM does not plan to eliminate the courses [Fischer, 2021].

## CONCLUSION

In the transport industry, the pandemic has caused great losses. The frequency of use of buses by passengers decreased by about 40%, as a consequence of reducing the flow of tickets by about 40%. Managers during the epidemiological crisis had to adapt quickly to the situation using a series of procedures related to crisis management during a pandemic. The data presented in the article show that the population complies with the prescribed restrictions, thus ensuring the safety of travel by public transport. The exception was the situation in which approximately 85% of the respondents would decide to use an overcrowded bus. Research has proven a low chance of getting sick in public transport thanks to the preventive measures taken by the city. There were also trends for the public to change their preferred mode of transport during a pandemic.

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