# Potential of ridesharing concept for improving accessibility and mobility of persons with disabilities

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## Abstract

Persons with disabilities face numerous barriers in their everyday life. In the key documents of the United Nations and the European Commission, transportation accessibility was pointed out as one of the most significant problems. The fact that persons with disabilities made up to 30% fewer daily trips compared to the rest of the population clearly highlights this problem. One of the ways to improve the mobility of persons with disabilities is to ridesharing with passenger car drivers. The paper aims to explore the intention of drivers without disabilities to share their driving with persons with disabilities. In order to obtain more specific findings, the observed population was divided into three groups: persons with physical disabilities, persons with hearing impairments, and persons with visual impairments. In general, drivers had the same intention to share their rides despite disability status of passengers. However, drivers would prefer to share rides with persons with hearing impairments compared to other groups. The results of the study can be beneficial to create and implement policies that will improve the mobility of persons with disabilities.

***Keywords***: *persons with disabilities, accessibility, mobility, ridesharing,*

## 1 Introduction

Persons with disabilities constitute a significant part of the worldwide population. According to recent estimates by the World Health Organization [1], 1.3 billion people live with some type of disability, which is about 16% of the entire population. A substantial share of persons with disabilities in society was recorded in the European Union [2] and the United States [3]. Based on these estimations, every fourth person was a person with a disability.

Persons with disabilities face various barriers in their daily lives. One of the most significant barriers is hindered transportation accessibility [4–6]. The key barriers are inaccessible infrastructure, an adaptation of private vehicles, travel costs, the process of obtaining a driver's license, bus stop equipment, the suitability of public vehicles, the attitudes and knowledge of public vehicle drivers, operational problems, etc. [7–12]. As a consequence, persons with disabilities made up to 30% fewer trips compared to the rest of the population [13]. In addition, the mobility satisfaction of persons with disabilities was relatively low (about 63% on a five-point Likert scale) [14,15].

There are many suggestions for solving the abovementioned problems. For example, appropriate activities related to participation in traffic as a driver can be found in the following studies [11,16,17]. These measures include improving the driving training process, appropriate vehicle adaptations, increased awareness about road safety, and support for persons with disabilities who want to drive. Also, measures to improve accessibility to public transport [7–9] and facilitate non-motorized trips [12] have been qualitatively analyzed in previous studies. This research emphasizes ridesharing's potential to improve the mobility of people with disabilities.

According to [18] ridesharing can be defined as "*facilitates formal or informal shared rides between drivers and passengers with similar origin-destination pairings*". The key motivations for ridesharing are savings in travel costs (fuel

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costs), time flexibility (compared to public transport), and the ability to do other activities.

Considering the concept of sharing, persons with disabilities are more interested in microtransit, robotaxis, and ridesharing compared to motorcycle taxis, e-scooter sharing, and bike sharing [19]. In general, persons with disabilities have a lower intention to participate in ridesharing than persons without disabilities [20]. However, persons with disabilities who adopt the ridesharing concept have a higher rate of trips in this way compared to persons without disabilities. Therefore, it can be assumed that the implementation of the ridesharing concept has great potential to improve the mobility of persons with disabilities.

The paper aims to explore the willingness of drivers without disabilities to share their driving with persons with disabilities. Depending on the type of disability, persons with physical disabilities, persons with hearing impairments, and persons with visual impairments were considered. In addition, the willingness of drivers without disabilities to generally participate in the concept of ridesharing was also observed. The additional aim of the paper is to point out the directions of actions to define measures related to the introduction of the ridesharing concept among persons with disabilities.

## 2 Methodology

### 2.1 Data

A questionnaire consisting of two parts was created for the research purposes. The first part included questions related to demographic, socio-economic, and mobility features. The second part included questions related to the constructs that were the subject of research in previous studies [21–25]. In this paper, the emphasis is placed primarily on the driver's intention to share the ride with other road users. Two items measured this construct:

- *I have an intention to share my ride with a person with physical disabilities/ hearing impairments/ visual impairments/ without disabilities in the future;*
- *I would make the choice to share a ride with a person with physical disabilities/ hearing impairments/ visual impairments/ without disabilities).*

Before starting the research, a short pilot study was conducted among twenty drivers. Drawing from insights gleaned during the pilot study, we defined the final version of the questionnaire and clarified the research procedure. This process encompassed structuring the sequence of questions and adding any required clarifications.

Data collection was performed through an online questionnaire. The research was carried out in March 2024 in Serbia. A total of 1,583 respondents participated in the survey. By checking the validity of the answers, 1,270 respondents were assessed as valid, which is 80.2% of the total sample. As potential participants in the ridesharing concept, we separated drivers who traveled a minimum of 5,000 kilometers per year. This additional condition was met by 655 drivers, i.e., 51.6% of the valid respondents.

Table 1 shows the basic demographic, socio-economic, and mobility features of the respondents. The dominant categories of respondents in the sample are men (58.5%), people living in urban settlements (43.5%), highly educated (bachelor's degree or higher) (52.8%), and employees (60.6%). The average age of the respondents is 32.6 years, the average driving experience is 12.6, and the average mileage is over 23,000 kilometers.

**Table 1.** Sample profile

| | | Total | % |
|---|---|---|---|
| Gender | | | |
| | Males | 383 | 58.5 |
| | Females | 272 | 41.5 |
| Age | | | |
| | Mean | 32.6 | |
| | St. Deviation | 13.7 | |
| Residence type | | | |
| | Urban | 285 | 43.5 |
| | Suburban | 124 | 18.9 |
| | Small town | 151 | 23.1 |
| | Rural | 95 | 14.5 |
| Education | | | |
| | <= High school | 309 | 47.2 |
| | > High school | 346 | 52.8 |
| Employment status | | | |
| | Unemployed | 258 | 39.4 |
| | Employed | 397 | 60.6 |
| Driving experience | | | |
| | Mean | 12.6 | |
| | St. Deviation | 11.8 | |
| Driving annual mileage | | | |
| | Mean | 23,437 | |
| | St. Deviation | 44,888 | |

## 2.2 Analysis

The collected data were analyzed using basic statistical tools. The level of statistical significance was set at 95%. The statistical tools used in this research are as follows:

- *Wilcoxon signed-rank test* – comparing two groups of population (intention to share rides with persons with disabilities vs. intention to share rides with persons without disabilities);
- *Friedman test* – comparing three or more groups of the population (differences in intention to share rides between disability types);
- *Mann-Whitney U Test* – comparing two independent categories (e.g., differences in intention to share rides depending on gender);
- *Kruskal-Wallis H test* – comparing three or more independent categories (e.g., differences in intention to share rides depending on age categories);

# 3 Results

Differences in the intention to participate in ridesharing are analyzed in two parts. First, the differences between the intention to participate in ride sharing with persons with disabilities and persons without disabilities were considered. Furthermore, the differences between the intention of sharing a ride with three characteristic groups of persons with disabilities were analyzed.

## 3.1 Persons with disabilities vs. persons without disabilities

Applying the Wilcoxon signed-rank test, we did not find significant differences between drivers' intention to share their ride with persons with disabilities compared to persons without disabilities ($z = -0.582$, $p = 0.561$, $r = 0.023$). The average values of respondents' answers are presented in Fig. 1.

Four of the seven variables had statistically significant differences by category. All observed differences were recognized among ridesharing with persons with disabilities. Young (up to 25 years) were identified as the least interested category of drivers who would like to share a ride with persons with disabilities (compared to 25-34: $U = 10{,}921$, $z = -1.965$, $p = 0.049$; 35-49: $U = 20{,}322$, $z = -3.523$, $p < 0.001$; 49<: $U = 12{,}379$, $z = -2.972$, $p = 0.003$).

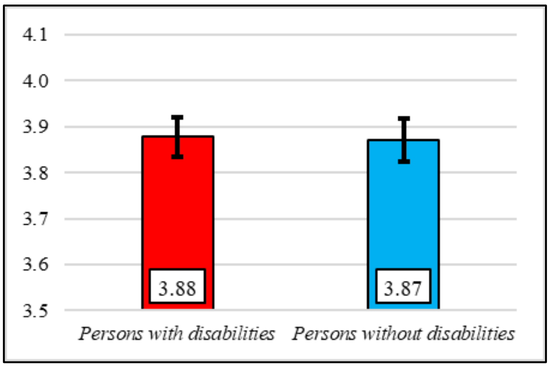


**Fig. 1.** Intention to participate in ridesharing concept – dependence on the disability's existence

**Table 2.** Intention to participate in ridesharing concept – disability's existence and basic sample features

| | PwD[2] | PwoD[3] |
|---|---|---|
| Gender | | |
| Male | 3.84 | 3.86 |
| Female | 3.94 | 3.89 |
| Age | | |
| <25 | 3.69 | 3.84 |
| 25-34 | 3.94 | 4.05 |
| 35-49 | 4.06 | 3.83 |
| 49< | 4.07 | 3.85 |
| Residence type | | |
| Urban | 4.00 | 3.86 |
| Suburban | 3.79 | 3.89 |
| Small town | 3.89 | 3.90 |
| Rural | 3.61 | 3.84 |
| Education | | |
| <= High school | 3.78 | 3.86 |
| > High school | 4.04 | 3.89 |
| Employment status | | |
| Unemployed | 3.80 | 3.81 |
| Employed | 3.92 | 3.91 |
| Driving experience | | |
| <5 | 3.76 | 3.92 |
| 5-9 | 3.71 | 3.71 |
| 10-14 | 3.92 | 3.93 |
| 15-19 | 4.04 | 3.72 |
| 20-24 | 4.25 | 4.02 |
| 24< | 3.94 | 3.83 |
| Driving annual mileage | | |
| 5000-9999 | 3.82 | 3.89 |
| 10000-19999 | 3.93 | 3.83 |
| 20000-29999 | 3.83 | 3.83 |
| 29999< | 3.88 | 4.00 |

Furthermore, the urban population was more interested in ridesharing with persons with disabilities, especially compared to drivers from

[2] Persons with disabilities

[3] Persons without disabilities

rural areas (U = 11,079, z = -2.711, p = 0.007). Regarding education level, more educated drivers showed greater interest in the mentioned concept (U = 44,665, z = -2.584, p = 0.010). The intention to participate in ridesharing with persons with disabilities increased with a higher level of driving experience. Statistically significant differences were observed between drivers with experience between 20 and 24 years and those youngest (<5: U = 6,704, z = -3.017, p = 0.003; 5-9: U = 1,825, z = -2.600, p = 0.009).

### 3.2 Among persons with disabilities

Comparing the intention of drivers to share the ride with different groups of persons with disabilities, we found statistically significant differences (Friedman test – $\chi^2$ (2, n = 655) = 44.845, p < 0.001). Additional Wilcoxon signed-rank tests were used to determine which groups the drivers were more willing to offer a ride to. These tests found that drivers are more willing to share their rides with persons with hearing impairments than with persons with physical disabilities (z = -4.775, p < 0.001, r = 0.187) and persons with visual impairments (z = -3.996, p < 0.001, r = 0.156). On the other hand, the differences between persons with physical disabilities and persons with visual impairments are not statistically significant (z = -1.175, p = 0.240, r = 0.046). Fig. 2 presents average values of intention to participate in the ridesharing concept dependent on disability type of passengers.

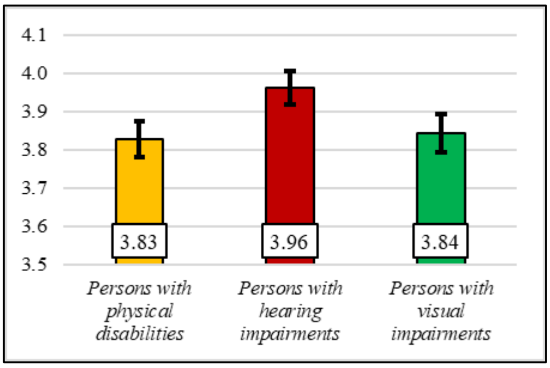


**Fig. 2.** Intention to participate in ridesharing concept – dependence on the disability's types

All variables that had a statistically significant impact on the general population of persons with disabilities also influenced at least two groups. For the variable Age, the differences are identical to those in the general population among categories of persons with physical disabilities and persons with hearing impairments. On the other hand, we did not note differences between the categories of drivers aged up to 25 years and 25-34 for persons with visual impairments. In the group of persons with physical disabilities, no differences were observed regarding Residence type. In the remaining two groups, the influence of the urban category is dominant. Specific, category smaller cities were emphasized for persons with hearing impairments. Education level showed the same influence in all categories of potential users of the mentioned concept.

**Table 3.** Intention to participate in ridesharing concept – disability's types and basic sample features

| | PD[4] | HI[5] | VI[6] |
|---|---|---|---|
| Gender | | | |
| Male | 3.77 | 3.91 | 3.83 |
| Female | 3.91 | 4.03 | 3.87 |
| Age | | | |
| <25 | 3.63 | 3.78 | 3.65 |
| 25-34 | 3.92 | 4.09 | 3.80 |
| 35-49 | 4.02 | 4.10 | 4.07 |
| 49< | 3.99 | 4.17 | 4.08 |
| Residence type | | | |
| Urban | 3.92 | 4.08 | 3.98 |
| Suburban | 3.75 | 3.87 | 3.77 |
| Small town | 3.84 | 3.97 | 3.85 |
| Rural | 3.63 | 3.68 | 3.52 |
| Education | | | |
| <= High school | 3.74 | 3.87 | 3.72 |
| > High school | 3.97 | 4.11 | 4.04 |
| Employment status | | | |
| Unemployed | 3.74 | 3.90 | 3.78 |
| Employed | 3.88 | 4.01 | 3.88 |
| Driving experience | | | |
| <5 | 3.68 | 3.88 | 3.73 |
| 5-9 | 3.72 | 3.82 | 3.59 |
| 10-14 | 3.89 | 4.04 | 3.84 |
| 15-19 | 4.04 | 4.01 | 4.08 |
| 20-24 | 4.23 | 4.21 | 4.30 |
| 24< | 3.89 | 4.03 | 3.92 |
| Driving annual mileage | | | |
| 5000-9999 | 3.74 | 3.93 | 3.79 |
| 10000-19999 | 3.85 | 4.01 | 3.92 |
| 20000-29999 | 3.87 | 3.87 | 3.74 |
| 29999< | 3.88 | 3.96 | 3.80 |

The driving experience variable did not show any influence in persons with hearing impairments. The dominant category of drivers

[4] physical disabilities
[5] hearing impairments
[6] visual impairments

interested in transporting persons with physical disabilities had driving experience from 20 to 24, and persons with visual impairments from 15 to 24.

## 4 Discussion

Drivers' intention to ridesharing did not depend on whether the potential passenger had a disability. Although it could be expected that drivers would be more restrained due to possible problems with accessibility, communication, and time inefficiency, this is not the case. We assume that the drivers' altruism covered these problems, namely, the fact that they are doing a good deed.

By comparing the drivers' intention to share their rides with different types of persons with disabilities, we found that the most attractive category was persons with hearing impairments. Although there is a real problem of driver communication with persons with hearing impairments, these persons do not require additional assistance when getting into/out of the vehicle. Potential problems that have a negative effect on the transportation of persons with physical disabilities are the lack of vehicle adaptation [20], time inefficiency, and the drivers' training to assist in getting into/out of the vehicle. Further, potential problems related to persons with visual impairments may be the driver's concerns regarding exiting passengers and imprecise communication.

The differences between categories were observed in four variables. In terms of Age, drivers over 35 are dominantly interested in ridesharing with persons with disabilities. These results specify the target group of participants in the presented concept, which, according to [20] was under 45 years old. This age range should be the target group for drivers in future activities. Additionally, the finding that the most interested drivers have driving experience between 20 and 24 years supports the setting of the upper limit of the age range. In addition, it should be noted that young drivers (under 25 years old) have a very low intention of ridesharing with persons with disabilities.

Drivers who live in urban areas are particularly interested in ridesharing with persons with disabilities. This finding is especially noticeable when considering persons with hearing impairments and persons with visual impairments. We assume that the mentioned problems related to persons with physical disabilities are particularly pronounced in urban areas. A higher level of education is positively associated with a higher intention to share a ride with people with disabilities. This finding is in accordance with [20].

Three variables did not have statistically significant differences related to intention to ridesharing. In the observed sample, the categories of the variables Gender, Employment, and Driving annual mileage did not note substantial differences in the intention of ridesharing.

## 5 Conclusions

In this paper, the intention to share their driving with persons with disabilities of 655 drivers in Serbia was analyzed. By applying appropriate statistical tools, the most important findings are:

- There are no differences in the intention to share the ride depending on the existence of a disability.
- Drivers would prefer to share the ride with persons with hearing impairments.
- Drivers who are more willing to participate in ridesharing with persons with disabilities are:
    - Age – 35-45
    - Residence type – Urban
    - Education – highly educated (bachelor's degree or higher)

Based on the key findings, basic recommendations can be proposed to decision-makers regarding the target group to implement ridesharing with persons with disabilities.

Certain limitations were also observed in the study. First, there was a slight imbalance in the sample compared to the general population of drivers. Further, this research did not take into account whether persons with disabilities are interested in sharing the ride with others.

In future research, it is necessary to describe the characteristics of drivers in more detail through various constructs (e.g., attitudes, trust, altruism, etc.). In addition, it is necessary to apply more advanced statistical tools that will provide more detailed and reliable results. Future research should also consider the intention of persons with disabilities to participate in ridesharing with others. It would be desirable to implement the results of this and future research into the real transportation system and measure the effects of improving the mobility of persons with disabilities.

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