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Public Bus Transportation Systems During the Pandemic: Barriers For Passengers with Disabilities

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Abstract

Participation in employment, education and social life is a critical challenge for people with disabilities. In order to identify the difficulties that disabled people face throughout the day, it is necessary to understand their characteristics and problems realistically. In this study, the obstacles experienced by disabled passengers who prefer bus transportation to meet their transportation needs, especially in physically accessing the transportation system and obtaining information, were examined and focused on how these obstacles took shape during the pandemic period. In the study, within the framework of a semi-structured survey, 43 disabled passengers were asked to describe the entire process of bus services, from the stage of obtaining information about the journey to reaching the final destination. It was focused on what kind of additional obstacles were created to the experiences and difficulties experienced by disabled passengers during the pandemic precaution measures implemented in Istanbul. It has been determined that the pandemic period and subsequent measures have revealed many additional obstacles, such as psychological distress, for disabled passengers, and that the society should be made aware of the unique characteristics of disabled people (for example, disability is not just a physical issue) and other concerns. One of the results of the study is that service providers and decision makers should consider a more detailed approach depending on the type of disability in the decision-making process.

Keywords: *Public transportation, disabled passengers, semi-structured Interviews, transportation barriers, pandemic*

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Pandemi Süresinde Halk Otobüsü Sistemleri: Engelli Yolcular İçin Bariyerler

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Öz

İstihdama, eğitime ve sosyal hayata katılım, engelliler için kritik bir zorluktur. Engellilerin gün boyunca karşılaştıkları zorlukları tespit etmek için, onların özelliklerini ve sorunlarını gerçekçi bir şekilde anlamak gerekmektedir. Bu çalışmada, ulaşım ihtiyaçlarını karşılamak için otobüsle ulaşımı tercih eden engelli yolcuların özellikle ulaşım sistemine fiziksel olarak erişme ve bilgi edinme konusunda yaşadıkları engeller incelenmiş ve bu engellerin pandemic döneminde nasıl şekil aldığına odaklanılmıştır. Çalışmada yarı yapılandırılmış bir anket çalışması çerçevesinde 43 engelli yolcudan otobüs seferleri hakkında, yolculuğa dair bilgi edinme aşamasından nihai varış noktasına varana kadar tüm süreci nitelendirmeleri istenmiştir. İstanbul'da uygulanan pandemi önlem tedbirleri esnasında engelli yolcuların yaşadıkları deneyim ve zorluklara ne tür ek engeller yarattığı üzerinde durulmuştur. Pandemi dönemi ve müteakip tedbirlerin engelli yolcular için psikolojik sıkıntı gibi birçok ek engeli ortaya çıkardığı ve toplumun engelli kişilerin kendilerine özgü özellikler (örneğin engelliliğin sadece fiziksel yani dışlarından görünen bir konu olmadığı) ve diğer endişeleri konusunda bilinçlendirilmesi gerektiği tespit edilmiştir. Hizmet sağlayıcı ve karar vericilerin, karar verme sürecinde engellilik türüne bağlı olarak daha ayrıntılı bir yaklaşımı göz önünde bulundurması gerektiği de çalışmanın sonuçlarındandır.

Anahtar Kelimeler: *Toplu Taşıma, Engelli Yolcular, Yarı Yapılandırılmış Anket, Ulaştırma Bariyerleri, Pandemi*

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Introduction

Public transportation is an important service for everyone as it plays a crucial role in daily activities and frequently affects users' social well-being. Studies have shown that access to public transportation enhances the quality of life for individuals dealing with mobility issues (Banister, D., & Bowling, A., 2004). Therefore, ensuring accessible transportation modes for elderly passengers and those with disabilities is crucial. To enhance accessibility during trips, it is imperative to clearly identify and address the barriers faced by travelers with mobility impairments on a case-by-case basis for each mode of transport. The accessibility requirements for disabled passengers differ based on the individual, service time, and transportation mode. For instance, the needs of a visually impaired passenger may vary between a bus stop and a train station. Additionally, different bus lines may have frequent stops, unlike various train lines. Therefore, not meeting specific accessibility requirements increases the likelihood of a visually impaired person boarding the wrong bus.

Istanbul, straddling Europe and Asia across the Bosphorus, is Turkey's most populous city, encompassing 5,461 sq. km and over 18 million residents. In line with the World Health Organization's International Classification of Functioning, Disability and Health (ICF) (WHO, 2001), Turkey defines individuals with disabilities as those with a functional impairment of 40% or more. Participants in this study were selected from individuals holding disability cards issued by the Turkish Ministry of Family and Social Policies, representing this 40%+ group. As a significant policy, Turkey provides free urban public transportation to its disabled citizens.

Public bus transport in Istanbul, overseen by the Istanbul Electric Tramway and Tunnel Administration (IETT), saw a stark decline during the pandemic's initial three months. Despite averaging 46,000 trips, daily ridership plummeted from 2 million to 500,000 between March and May 2020 (IETT, 2020). This dramatic drop underscores the unique accessibility challenges faced by disabled passengers amidst COVID-19 restrictions (IETT, Istanbul Electric Tram and Tunnel Administration, 2020).
COVID-19 protective measures were initiated in Turkey on January 10, following the identification of the first case on March 11. Curfews were implemented as a precaution, temporarily reducing the number of passengers on public transportation systems (PTS), as depicted in Figure 1.

On March 23, 2020, the Ministry of Interior issued a directive, limiting the passenger capacity of all urban and intercity public transportation vehicles in Istanbul to 50%. Social distancing measures required passengers to maintain a certain distance from each other. From March to July 2020, everyone faced a partial curfew (all day on weekends and 21:00 to 05:00 on weekdays). "Disabled," "chronically ill," and "individuals over 65" were restricted from working or going out, except for emergencies. However, this curfew overlooked the unique circumstances of individuals with disabilities. After realizing the potential negative impact on their physical and mental health, restrictions were slightly eased, permitting individuals with mental disabilities and their companions to go out between 05:00 and 21:00. Identifying and addressing environmental, physical, and psychological barriers, particularly during a pandemic, is crucial to enhance accessibility and mobility.

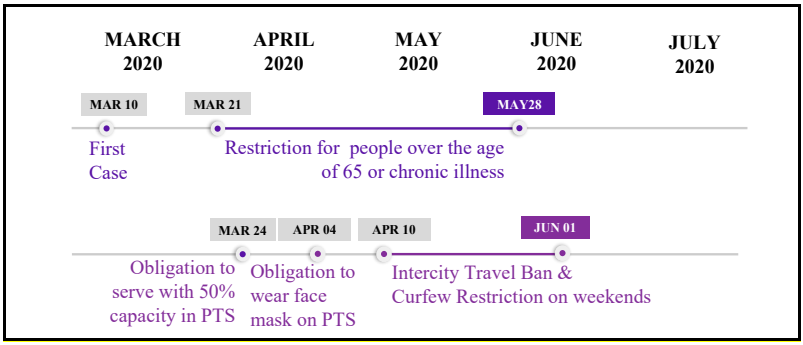


Figure 1. Timeline for Covid-19 in Istanbul regarding public transportation

In this July 2020 study, employing structured interviews, transportation barriers arising from the COVID-19 pandemic were explored, investigating their impact on disabled passengers alongside general transportation challenges. The post-pandemic phase revealed increased restrictions for individuals with disabilities and/or chronic illnesses, similarly aged 65 and over, during quarantine and subsequent limited opening phases. Semi-structured interviews with disabled passengers were conducted post-pandemic, coinciding with widespread vaccination implementation, allowing them to resume travels without constraints. The research provides insights into the experiences of disabled passengers who either worked or relied on bus transportation during the pandemic and documents post-pandemic travel preferences. It's essential to note that the

study did not specifically inquire about bus travel experiences related to ongoing or post-pandemic measures. The primary focus is on investigating novel transportation barriers experienced by disabled passengers, addressing disruptions in their socialization processes throughout the pandemic, with some semi-structured interviews conducted online upon participants' request.

The article is structured for a comprehensive understanding, starting with an 'Introduction' to contextualize the research. The second section, 'Literature Review,' reviews prior research. The 'Data and Method' section outlines the employed methodology. The fourth and fifth sections, 'Results' and 'Discussion,' respectively, present key findings and analyze collected data. The final section, 'Conclusion,' briefly outlines outcomes and offers recommendations based on research findings.

Literature

Various classifications and definitions have been proposed regarding the barriers faced by passengers with disabilities. Based on the interviews conducted in Velho's (2016) study, three intuitive categories were created regarding the barriers mentioned by wheelchair users: spatial barriers (personal or maneuverable space use), technological barriers (defective mechanical ramps), and social barriers (isolation) (Velho, R., Holloway, C., Symonds, A., & Balmer, B., 2016). Bromley et al. (2007) found that communities with disabilities need to generate a shared understanding of the barriers they encounter with decision makers in the commercial and governmental sectors. For instance, a study conducted in the United Kingdom found that 62% of people with disabilities felt alienated, and their needs were neglected (F Bromley, R. D., Matthews, D. L., & Thomas, C. J., 2007). Mayers et al. (2002) classified disabilities into internal (e.g., illness, fitness conditions), interpersonal (e.g., rudeness, lack of help from others) and external disabilities (e.g., deficiencies in walking paths (Meyers, A. R., Anderson, J. J., Miller, D. R., Shipp, K., & Hoenig, H., 2002). Similarly, Aldersey et al. (2018) classified barriers for wheelchair users into three main groups: internal barriers (e.g., type and rate of disability), behavioral barriers (e.g., rudeness, lack of support from other passengers), and external barriers such as roads, sidewalks, and ramps (Aldersey, H. M., Quadir, M. M., Akter, S., Mozumder, R. H., Nazneen, N., & Nuri, R. P., 2018).

Studies have also been conducted to identify the barriers affecting the travel preferences and accessibility of disabled passengers (Jansuwan, S., Christensen, K. & Chen, A., 2013) (Bezyak, J. L., Sabella, S. A., & Gattis, R. H., 2017) (Anaby, D., Hand, C., Bradley, L., DiRezze, B., Forhan, M., DiGiacomo, A., & Law, M., 2013) (Rosenbloom, 2007). To enhance quality of life and promote socialization, it is necessary to incorporate the demands of individuals with disabilities into the process of designing the current environment. The effect of accessible design on travel behavior was determined using the criteria proposed by Jansuwan et al. (2013). The study discovered that designing accessible transportation stations/bus stops significantly improves individuals' perceptions of safety and service. Environmental conditions, such as walking capabilities, were also found to affect disabled and elderly passengers' satisfaction, perceived safety, and security levels (Jansuwan, S., Christensen, K. & Chen, A., 2013).

The findings indicate that environmental barrier research mainly focuses on two distinct impairment groups: the visually impaired and physically impaired. It is reasonable to presume that the barriers to participation in these two focus groups are larger than those encountered by passengers with other disabilities. Bezyak (2017) analyzed different categories of disability and discovered that visually impaired individuals had many more environmental limitations. Additionally, those with physical impairments reported increased rates of difficulty in public transportation, whereas those with mental impairment declined (Bezyak, J. L., Sabella, S. A., & Gattis, R. H., 2017). Anaby et al. (2013) highlighted barriers to participation for children and teenagers with disabilities, such as the accessibility of buildings, public transport systems, ramps, elevators, and a shortage of wheelchair parking. Disappointment with public transport was also identified as a barrier to participation (Anaby, D., Hand, C., Bradley, L., DiRezze, B., Forhan, M., DiGiacomo, A., & Law, M., 2013).

The barriers found in abovementioned studies could be applicable to all age groups. Mobility barriers are also related to an individual's economic condition. Transportation limitations are much less prevalent among people with higher incomes and among those who are not disabled (Rosenbloom, 2007). Environmental barriers are frequently described in isolation from the modes of transport. Previous studies have classified data on transportation barriers that affect different groups of people with disabilities. Jenkins (2015) asserted that visually impaired individuals referred to four barriers: 1) inadequate lighting and low-contrast signs might

be perplexing for visually impaired passengers; 2) loud, persistent sounds and obscure target signals affect orientation and mobility for the visually impaired; 3) fall hazards caused by uneven ground surfaces; and 4) environmental design that is not deemed a safety hazard for the visually impaired (Jenkins, G., Yuen, H., & Vogtle, L., 2015). However, disabled passengers encounter barriers when utilizing transportation services and participating in social activities. For instance, Mafatlane et al. (2014) evaluated barriers encountered by wheelchair users during grocery shopping. According to the findings of the study, key barriers include the loss of freedom/independence to shop, insufficient facilities for the disabled, and insensitivity to disabled parking places (Mafatlane, G. R., Fidzani, L. C., & Gobotswang, K. S., 2014). All of these barriers may exist even though environmental, social, and other aspects are considered to define barriers, and barriers may also be specified by gender. According to research performed with wheelchair users in Bangladesh, some participants considered wheelchair users to be more vulnerable to violence (Aldersey, H. M., Quadir, M. M., Akter, S., Mozumder, R. H., Nazneen, N., & Nuri, R. P., 2018). All these studies revealed that people with disabilities face different barriers owing to their characteristics and common problems (Park, J., & Chowdhury, S., 2017) (Babinard, Wang, R. Bennett, & Mehndiratta, S., 2012). According to Rantakokko (2012), mobility is defined as the independent and safe transportation of a person from one location to another, and it declines with age, pathology, individual deficiencies, and environmental barriers (Rantakokko, M., M. Manty, and T. Rantanen, 2012).

In Turkey, accessibility studies, particularly those focused on inclusive urban design, highlight disability as a crucial human rights issue. According to the Erten etc.'s study argues that accessibility deficiencies act as constraints, impeding individuals with disabilities from fully exercising their rights in various domains (Erten, Ş. & Aktel, M., 2020). While the research recognizes the prevalence of inclusive urban design in developed countries, it also acknowledges barriers in implementation. Conversely, in the Turkish context, there is insufficient embrace of the disability concept, attributed to a lack of societal awareness. The study poses a research question about the potential disparity between regulatory frameworks for transportation systems and the diverse approaches of decision-makers in accessibility assessments, which is thoroughly explored in this research.

People's experiences with transportation systems have also changed because of the pandemic. Shakibaei et al. (2020) investigated the travel behavior of residents of Istanbul following pandemic restrictions. Data were gathered for a paper-based panel study to better understand the effects of these measures. The survey was divided into three phases: 1) "Total disregard for the virus in Türkiye," 2) "Increased sensitivity to the virus risk based on Iran and Italy's experiences," and 3) "Actual engagement with Türkiye's pandemic challenges." Between Phases 1 and 2, only private car use increased, whereas other means of travel (walking, cycling, and public transportation on the road, rail, and car-sharing) decreased. Between Phases 2 and 3, restrictions increased, although there was a minor decline in comparison to Phase 3, while individuals continued to prefer private cars, presumably because of health concerns. (Shakibaei, S., de Jong, G. C., Alpkökin, P., & Rashidi, T. H., 2021)

As stated in the study by Shakibaei et al. (2020), many studies have been conducted on the effects of COVID-19 on transportation, including analysis of teleworking, online shopping, and airplane travel in Chicago (Shamshiripour, A., Rahimi, E., Shabanpour, R., & Mohammadian, A. K., 2020); examination of outdoor activities, work, and education (de Haas, M., Faber, R., & Hamersma, M., 2020); analysis of public transport and ridership (Jenelius, E., & Cebecauer, M., 2020); and research on overall travel, travel by mode, travel by purpose, teleworking, shopping (Beck, M. J., & Hensher, D. A., 2020a) (Beck, M. J., & Hensher, D. A., 2020b).

This article presents the findings of an interview conducted with passengers with disabilities who regularly use bus services in Istanbul. During the COVID-19 pandemic, there is a noticeable absence of scholarly research examining the unique experiences and barriers encountered by these passengers while traveling by bus. The primary objective of this study is to identify the barriers that service providers should address to improve accessibility for passengers with disabilities.

Building on existing research, including several master's theses examining accessibility challenges for disabled passengers on Istanbul's urban buses, this study employed semi-structured interviews with 16 individuals representing diverse disabilities (hearing and visual impairments, mobility challenges, learning and cognitive disabilities, and chronic conditions). Participants detailed their entire bus trip experiences, from decision-making to arrival. The analysis revealed four key barrier categories: vehicle design, environmental obstacles, service provider shortcomings,

and overall accessibility deficits. This detailed breakdown of passenger experiences provides valuable insights for targeted interventions to improve public bus accessibility in Istanbul.

1. Vehicle-related barriers defined by disabled passengers are as follows:
- the speed of the vehicle,
- the driver's frequent braking,
- inability to hear the audible notifications owing to the background noise of the vehicles,
- the crowdedness of the vehicles,
- quick opening/closing of the doors,
- the use of only one of the double-wing bus doors,
- the priority seats reserved for the disabled passengers being full,
- the air conditioning/ventilation system not working, and
- inability to use wheelchair connection equipment.

2. Environmental conditions barriers are defined as:
- not being able to access the time schedules at the stops,
- the stop not being enclosed/sheltered,
- the bus not being able to approach the station,
- the lack of a ramp from the stop,
- the absence of a traffic light - pedestrian crossing near the stop
- the absence of a sitting bench at the open stops.

3. Service provider barriers are defined as:
- ignoring the disabled individuals in the route-time planning of the vehicles,
- the inconclusiveness of complaints,
- the request for the door number in complaints made to the call center (especially, visually impaired passengers stated that the call center requests the door number of the bus to put their complaints into the process),
- staff not knowing sign language,
- the negative attitude of the driver,
- ignoring the needs of disabled passengers, and dissatisfaction with passengers carried free of charge.

4. Accessibility barriers are defined as:
- the inability to access the STOP button,
- the in-vehicle audio notification systems not working, and
- the difficulty of transferring between transport types.

Several transportation barriers were identified as common for passengers belonging to various disability categories during the pre-pandemic interviews. For example, while a visually impaired passenger stated that he was unable to reach the bus stop button, another disabled passenger with difficulty in grasping identified the same issue as a barrier.

Identifying the disabilities encountered by passengers during the pandemic is critical for establishing solutions that address sustainability, accessibility, and equality. Cochran (2020) examined the impact of the COVID-19 pandemic on disabled passengers. According to in-depth interviews with 21 disabled passengers, the epidemic exacerbated barriers to transportation (Cochran, 2020). These barriers include a lack of reliable and safe transportation, updated information, and necessary assistance, all of which contribute to difficulties in daily life. The respondents reported that the likelihood of exposure to further infection while using public or shared transportation services increased their health concerns because of their failure to attend routine hospital/doctor appointments. Depending on others and lacking access to modern communication makes traveling more arduous.

Data and Method

Date Collection Methodology & Techniques

Semi-structured interviews are a widely used qualitative research method offering flexibility and systematization in data collection across various academic fields. Unlike fully structured interviews, semi-structured interviews employ open-ended questions or themes, providing a framework for guided yet participant-driven conversations. Researchers typically prepare key questions and prompts, allowing for flexibility to explore unforeseen patterns. This approach enables a nuanced understanding of participants' perspectives, facilitating data comparison across participants. Semi-structured interviews excel in obtaining detailed, thematically specific information, making them suitable for studies seeking comprehensive qualitative data.

The “semi-structured interviewing” technique was used in this study, in which certain questions did not guide participants. Semi-structured interviews are used to address frequent concerns about study phenomena,

while allowing participants to contribute new ideas to the research (Galletta, 2013). Instead of responding to the prepared questions, users were requested to explain the complete procedure throughout the service. The most advantageous feature of the semi-structured interview was the interactive sharing of participants' feedback and experiences with the variables. Additionally, the data acquired during the semi-structured interviews were organized and analyzed using a theme analysis technique. Thematic analysis is a technique used to identify, interpret, and document datasets (Braun, V., & Clarke, V., 2006) (Rubin, H., & Rubin, I., 2005) (Choak, 2011). After collecting the data from the participants, the common characteristics of the data are established. At the beginning of the interviews, respondents signed an informed consent form and were informed that they could terminate the session at any moment.

In the process of establishing the sample size for this study, we followed a methodological framework. Guest, Bunce, and Johnson (2006) collected data from a total of 60 participants. Remarkably, it was observed that 97% of the study's primary findings were discerned within the first 12 interviews (Guest, G., Bunce, A., & Johnson, L., 2006). In semi-structure method, following the conclusion of the first 12 interviews, the next 12 yielded no new information. Additionally, it was determined that 8 and 16 interviews were adequate to obtain 80% and 90% of the overall data, respectively. According to Namey et al. (2016), between three and five distinct focus groups are necessary for each demographic class to capture 90% of the total data (Namey, E., Guest, G., McKenna, K., & Chen, M., 2016). Park and Chowdhury (2018) interviewed 32 disabled participants using a semi-structured method and identified barriers through in-depth interviews. Based on information gathered from the literature, it was determined that 43 samples were sufficient for gathering sufficient data for the study (Park, J., & Chowdhury, S., 2017).

Snowball sampling is a method used by qualitative researchers to recruit participants for semi-structured interviews, particularly beneficial when studying hard-to-reach or marginalized communities. The process begins with a "seed" volunteer, and referrals are sought after interviewing this initial participant. The chain referral strategy expands the participant pool, capturing unique insights from individuals with insider perspectives not easily reached through traditional methods. This approach eases the identification of additional research-engaged participants, enhancing

the inclusion of valuable insights. Referrals from trusted individuals increase the likelihood of participation, fostering trust and rapport development.

This study employed semi-structured interviews in conjunction with snowball sampling. The choice of these methodologies was purposeful and aligned with our study's specific requirements. Semi-structured interviews offered a flexible framework for collecting comprehensive participant data, facilitating an in-depth exploration of their experiences. Utilizing referrals from initial participants, we identified individuals with accessibility barriers and a profound understanding of the subject.

The decision to include 43 participants was informed by prior research utilizing semi-structured interviews, where data saturation tends to occur around the 30th interview. This suggests that additional interviews beyond this point may yield redundant information without introducing novel insights. Therefore, a sample size of 43 was deemed adequate, following established field practices, and ensuring sufficient data for a comprehensive understanding of the subject matter.

Data

Disability, as per the World Health Organization (WHO), is a comprehensive term covering impairments, activity limitations, and participation restrictions resulting from health conditions and environmental factors (WHO, 2001). It emphasizes the interaction between an individual's health condition and their surroundings.

According to the 2011 Turkish Statistical Institute Population and Housing Census survey, the total number of disabled individuals living in Istanbul is approximately 670,000, accounting for 5.2% of the total population. The disability types of the participants in this study were classified using the Türkiye National Disability Data System of the Ministry of Family, Labor, and Social Services:

1. Visual impairment: Partial or complete vision loss, despite corrective lenses or aids.
2. Hearing impairment: Partial or complete hearing loss, despite audiological assistive devices.
3. Communication and speech impairment: Difficulties with expressive or receptive communication, including lisps and stuttering.
4. Grasping impairment: Difficulty or inability to grasp, hold, or manipulate objects.

5. Walking impairment: Difficulty walking or climbing stairs.
6. Impairment in intellectually: Challenges acquiring or recalling information.
7. (Chronic) Disease-associated disability: Functional limitations resulting from chronic diseases requiring ongoing care

This study prioritizes representing all disability groups, distinct from prior literature that primarily focused on the accessibility of visually and physically impaired individuals. The primary aim is to enhance inclusivity and equality by involving passengers from all disability communities. Recognizing varying sizes and levels of participation among these groups, the semi-structured interviews explore shared barriers experienced by diverse disability groups. Furthermore, the research identifies key barriers for removal that would yield the greatest benefit to the disabled community.

The study comprised a diverse sample of individuals with various disability characteristics. In terms of specific disabilities, the distribution was as follows: 11 individuals (26%) with visual impairments, 4 (9%) with hearing impairments, 3 (7%) with speech impairments, 9 (21%) with walking impairments, 3 (7%) with grabbing impairments, 5 (12%) with learning-remembering impairments, and 8 (19%) with chronic diseases.

In this study, the physical disability group has been delineated into two distinct categories, as defined by the Turkey National Disability Data System: 'Grabbing Impairment' and 'Walking Impairment.' It has been considered significant to differentiate individuals with physical disabilities based on the specific physical activities with which they encounter accessibility barriers, given the potential variations in transportation barriers they may face.

Uniquely, 12% of the study sample consists of individuals classified as intellectually disabled. This group encompasses individuals with learning and memory impairments, excluding autism spectrum disorders, and those with a loss of work capacity due to psychiatric diagnoses. To gain a comprehensive understanding of the experiences of participants with learning, remembering impairments, and speech difficulties, insights were also collected from legal caregivers who were present during bus trips.

Regarding gender representation, the sample consisted of 22 males (51.2%) and 20 females (46.5%). Additionally, there was one participant (2.3%) whose gender identification was categorized as 'Other/Unidenti-

fied.' This diverse demographic composition was integral to the comprehensive examination of accessibility issues encountered by individuals with disabilities.

In view of the findings of the previously mentioned studies, 43 disabled passengers were interviewed who had to travel by bus in Istanbul for the past 30 days about their bus transportation experiences during the pandemic. In the case of multiple mobility limitations, individuals with impairments are classified according to their disability status define by them.

The demographic characteristics of the passengers are summarized in Table 1.

Table 1. The demographic characteristics of the respondents

Characteristics	Statistics
Gender	22 Male (51,2%), 20 Female (46,5%), 1 (%2,3) Other/Unidentified
Age	18-25 (20.9%), 26-35 (30.2%), 36-45 (16.3%), 46-55 (18.6%), 56-65 (14.0%)
Disability Types	11 Visual (26%), 4 Hearing (9%), 3 Speech (7%), 9 Walking (21%), 3 Grabbing (7%), 5 Learning (12%), 8 Chronic Disease (19%)
Qualification	Primary school graduate (30.2%), High school graduate (20.9%), Associate Degree or equivalent (18.6%), Bachelor's Degree (20.9%), Postgraduate Degree (9.3%)
Marital Status	Single (65.1%), Married (34.9%)
Household Income	1000-2000 (11.6%), 2001-3000 (20.9%), 3001-5000 (44.2%), 5001> (23.3%) Turkish Liras*
Number of Household Member	1 (14.0%), 2 (25.6%), 3 (20.9%), 4 (27.9%), 5 (7.0%), 5> (4.7%)
Distance to the Nearest Bus Stop	< 100 m. (39.5%), 100 m – 250 m (39.5%), 250 m- 500 m (11.6%)
Usage of Mobility Aid	Wheelchair (11.6%), white cane or crutch (25.6%)
Car ownership	Have own car (7.0%), have a family car (7.0%), have not car (86.0%)
Driver's License ownership	Have license (44.2%), do not have a license (55.8%)
*** At the time of the study, 1 US dollar was worth approximately 7.5 Turkish Lira.**	

The periods when the participants used bus services during the day were obtained separately for weekdays and weekends. Accordingly, on weekdays, the time intervals for the participants to use the bus service were as follows: 21 passengers (48%) between 06:00 and 09:00, 8

(18%) between 09:00 and 13:00, 10 (23%) between 13:00 and 18:00, and 4 (9%) between 18:00 and 22:00. On the weekend, 15 (35%) participants stated that they were using the system between 09:00 and 13:00, 19 (44%) between 13:00 and 18:00, and 9 (20%) between 18:00 and 22:00. Among the 43 participants in the study, in response to a question about the types of bus trips they engage in, 20 respondents mentioned commuting to their workplace, five indicated trips to shopping centers, three reported hospital visits, nine specified journeys to educational institutions, three mentioned trips to public venues, and three referred to transportation to places of worship. Notably, 30 participants stated they could travel independently, while 13 frequently required assistance from fellow passengers or bus drivers during their trips.

Results

The barriers obtained as a result of the research were identified by categorizing them into five groups, namely vehicle-related, environmental, service-related, accessibility, and psychological, based on the data obtained from the participants. The discovered types of these barriers and the frequencies reported by the participants are presented in Table 2 and Figure 2.

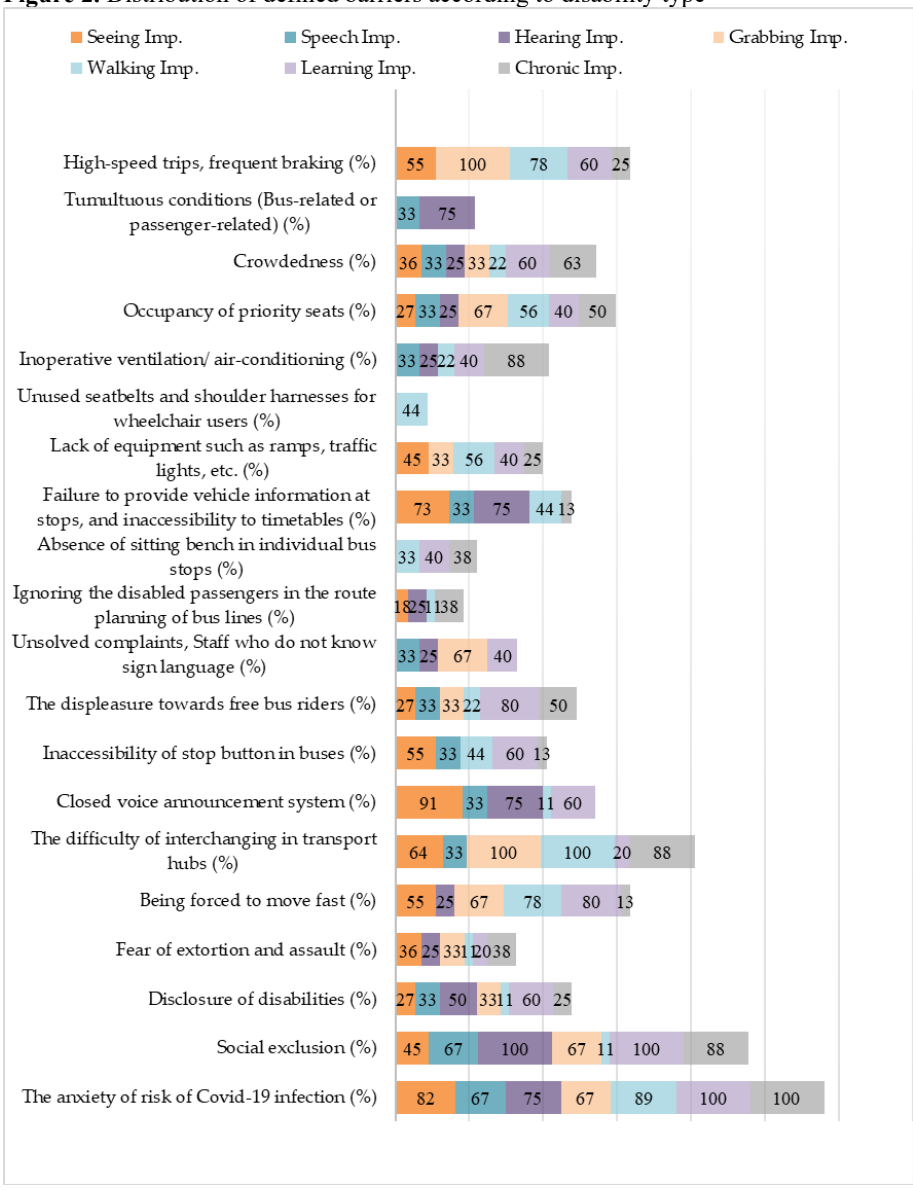
Table 2. Distribution of barriers according to disability type in the pandemic study

Barriers	Definition	Total	Seeing	Speech Imp.	Hearing	Grabbing Imp.	Walking Imp.	Learning Imp.	Chronic Imp.
Vehicle-Related Barriers	High-speed trips, frequent braking	**49%**	55%	-	-	**100%**	78%	60%	25%
	Tumultuous conditions (Bus-related or passenger-related)	9%	-	33%	**75%**	-	-	-	-
	Crowdedness	40%	36%	33%	25%	33%	22%	60%	**63%**
	Occupancy of priority seats	42%	27%	33%	25%	**67%**	56%	40%	50%
	Inoperative ventilation/ air-conditioning	30%	-	33%	25%	-	22%	40%	**88%**

Barriers	Definition	Total	Seeing	Speech Imp.	Hearing	Grabbing Imp.	Walking Imp.	Learning Imp.	Chronic Imp.
	Unused seat-belts and shoulder harnesses for wheelchair users	9%	-	-	-	-	**44%**	-	-
Environmental Barriers	Lack of equipment such as ramps, traffic lights, etc.	35%	45%	-	-	33%	**56%**	40%	25%
	Failure to provide vehicle information at stops, and inaccessibility to timetables	**40%**	73%	33%	**75%**	-	44%	-	13%
	Absence of sitting bench in individual bus stops	19%	-	-	-	-	33%	**40%**	38%
Service Provider Barriers	Ignoring the disabled passengers in the route planning of bus lines	16%	18%	-	25%	-	11%	-	**38%**
	Unsolved complaints, Staff who do not know sign language	14%	-	33%	25%	**67%**	-	40%	-
	The displeasure towards free bus riders	**35%**	27%	33%	-	33%	22%	**80%**	50%
Accessibility Barriers	Inaccessibility of stop button in buses	35%	55%	33%	-	-	44%	**60%**	13%
	Closed voice announcement system	42%	**91%**	33%	75%	-	11%	60%	-
	The difficulty of interchanging in transport hubs	**65%**	64%	33%	-	100%	100%	20%	**88%**

Barriers	Definition	Total	Seeing	Speech Imp.	Hearing	Grabbing Imp.	Walking Imp.	Learning Imp.	Chronic Imp.
Psychological Barriers	Being forced to move fast	49%	55%	-	25%	67%	78%	**80%**	13%
	Fear of extortion and assault	26%	36%	-	25%	33%	11%	20%	**38%**
	Disclosure of disabilities	30%	27%	33%	50%	33%	11%	**60%**	25%
	Social exclusion	60%	45%	67%	100%	67%	11%	**100%**	88%
	The anxiety of risk of COVID-19 infection	**86%**	82%	67%	75%	67%	89%	**100%**	**100%**

Figure 2. Distribution of defined barriers according to disability type



Following the COVID-19 outbreak and the period of normalization, disabled passengers were also questioned in interviews about their preferred means of transportation. Table 3 outlines the types of transportation that are favored over city bus services. None of them indicated a preference for car sharing or a rapid bus system.

Table 3. Disabled passengers' transport preference mode, instead of inner-city bus system during COVID-19 period

Disability Type	Taxi Cab	Subway, Train, Tramway	Own Car	Ferryboat	Bicycle	Walking
Listening Imp.	-	-	2 (29%)	-	1 (14%)	**4 (57%)**
Seeing/Speech Imp.	3 (27%)	3 (27%)	-	-	-	**5 (46%)**
Learning	1 (20%)	-	-	1 (20%)	-	**3 (60%)**
Climbing /walking	4	**5 (42%)**	2	1 (8%)	-	-
Chronic Disease	2	**4 (50%)**	2	-	-	-

Throughout the COVID-19 period, all participants said that they preferred other modes of transport to the city bus system. The study revealed that disabled passengers began to prefer alternative transportation systems for various reasons, including restrictions on disabled and elderly passengers traveling during rush hour, inadequate ventilation in buses owing to the pandemic, and the need for assistance from other passengers.

Discussion

Individuals with disabilities, according to the World Health Organization (2020), are at an elevated risk of COVID-19 infection. The barriers faced by disabled passengers during the pandemic include limited access to hygiene facilities in transportation, reliance on physical contact for assistance, and difficulties in accessing essential locations. From January 15, 2021, onwards, quarantined passengers encountered obstacles in public transportation due to digital pairing of travel cards with QR codes based on COVID-19 test results.

Local government measures have introduced additional transportation barriers, leading to psychological issues for disabled passengers. Forced use of inaccessible public transport, difficulty in complying with social distancing, social isolation, and anxiety were reported. Barriers such as unwanted assistance, dependence, vulnerability to harassment, and difficulty accessing information were also noted, particularly for visually impaired passengers.

Ensuring accessibility for individuals with disabilities is crucial during COVID-19 measures, encompassing public health information, buildings, transportation, communication technologies, goods, and services. Accessibility measures should address diverse needs, considering barriers like difficulty in using face masks due to medical issues.

Out of 43 participants, 37 expressed concerns about the pandemic, while six remained unaffected, attributing it to strict social isolation. Some participants adopted online alternatives, adhering to local directives, with 34 experiencing anxiety related to social restrictions. Social pressure, fear of abuse, and public disclosure of disabilities were barriers faced by disabled passengers. Approximately 60% felt social pressure and isolation due to free-boarding passes and the associated COVID-19 risk. The bus travel experience was compromised for most disabled passengers due to social distancing, insufficient support, reduced capacity, and infection risk.

Conclusions

Ensuring access to various public services for individuals with disabilities is crucial, especially it is highlighted during the ongoing pandemic. The study reveals that current solutions in public transportation systems inadequately address anxiety among disabled passengers, stemming from barriers beyond individual control. Collaborative efforts involving individuals with disabilities, service providers, and legal authorities are essential to overcome persistent psychological barriers. Raising societal awareness can mitigate the perception of social exclusion, ultimately enhancing the sense of independence for people with disabilities.

During the pandemic, passengers with disabilities face reduced travel demands due to difficulties in securing assistance from others. Despite the prevalence of city bus systems, these individuals resort to less accessible alternatives like subways or costlier taxis, fearing infection. In Istanbul, most disabled individuals lack private cars or driver's licenses, warranting comprehensive studies to assess the COVID-19 measures' applicability in public transport for this demographic. Measures aimed at infection risk mitigation should be reassessed considering the unique needs of passengers with disabilities. For instance, the universal mask-wearing mandate may not consider those with chronic illnesses unable to comply. Addition-

ally, pandemic-related curfews posed barriers for daily activities of disabled passengers. Concerns about COVID-19 procedures were notably expressed by individuals with visual, learning, and/or walking disabilities, while those with disabilities from chronic diseases exhibited a moderate level of negativity.

Throughout the pandemic, participants did not report experiencing favorable circumstances, highlighting the inadequacy of individual solutions during such times. Individuals with disabilities face barriers in decision-making and implementing necessary safety measures when they encounter barriers in accessing public health information, buildings, transportation systems, communication technologies, goods, and services.

Service personnel play a crucial role in improving accessibility for disabled passengers in public transportation. Updating job descriptions for bus drivers and other personnel, emphasizing empathy, and addressing the basic physical and psychological needs of disabled passengers are essential steps. The inclusion of people with disabilities in public service employment can enhance overall service quality.

Prejudices towards individuals with disabilities can lead to isolation, particularly evident in the scrutiny and harassment faced by disabled passengers using travel cards for free public transport. Public awareness campaigns should highlight the social welfare implications of free transportation for disabled passengers, discouraging isolation and emphasizing the importance of social inclusion by explaining the characteristics of disability in society.

Considering the findings discussed above, it is important to consider the following set of measures and recommendations to address the increased barriers faced by passengers with disabilities during the COVID-19 pandemic in case of the possible next outbreak.

1. **Enhancing Accessibility Measures:** Recommendations include improving accessibility with handwashing facilities, sanitized vehicles, and prioritized information dissemination, especially for visually impaired passengers, to enhance safety during the pandemic.
2. **Psychological Support for Passengers**: Recommendations include addressing the psychological impact of forcing individuals with disabilities to use inaccessible public transportation, which leads to heightened social isolation and anxiety. It is imperative to provide

psychological support services for this vulnerable group, assisting them in overcoming barriers of anxiety and social isolation.

3. **Training for Service Personnel:** Recommendations include updating the job descriptions of bus drivers and service personnel to encompass training on effectively assisting passengers with disabilities. Incorporating empathy training is advised to cultivate a more inclusive and supportive atmosphere, thus mitigating the vulnerability and harassment experienced by disabled passengers.
4. **Public Awareness and Inclusion:** Recommendations include addressing prejudices and promoting social inclusion, emphasizing the importance of public awareness campaigns. These campaigns can educate society about the significance of free travel cards for disabled passengers, ultimately reducing interrogation, harassment, and feelings of isolation among passengers with non-visible disabilities.
5. **Reevaluation of COVID-19 Measures:** Recommendations include reevaluating measures introduced during the pandemic, such as mask mandates and curfews, with a focus on the specific needs of passengers with disabilities, particularly those with chronic diseases. These measures should prioritize inclusivity, ensuring that all passengers can adhere to safety regulations without encountering undue barriers.
6. **Community Involvement:** Recommendations include fostering collaboration among individuals with disabilities, service providers, and legal authorities to address disabled passengers' unique barriers. Disabled community involvement in decision-making processes is encouraged to collectively create more inclusive and accessible transportation systems.
7. **Comprehensive Studies:** Recommendations include conducting comprehensive studies to assess the applicability of COVID-19 measures implemented in public transport systems to individuals with disabilities, considering their reduced travel demands during the pandemic. This will facilitate the reconsideration of measures to better cater to the specific needs of this group.

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