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Travel-Limiting Disabilities in the United States: Why Accessibility Matters?

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Abstract

This study evaluates the distribution of travel-limiting disabilities across genders and geographic locations in the United States. This study aims to describe and compare the socioeconomic and demographic variables of the people with and without travel-limiting disabilities across geographic locations and gender. The study further evaluates the trip purpose and impact of Covid-19 fourth wave pandemic on the use of public transit and travel to physical workplace for the people with and without travel-limiting disabilities across gender and geographic locations. The study uses the 2022 weighted National Household Travel Survey dataset and employs descriptive statistics. Results reaffirm the findings from previous literature that there are more people with travel-limiting disabilities in urban areas and among women. Over 50 percent of people aged 65 and above have a form of travel-limiting disabilities. The most trip for people with travel-limiting disabilities is made for shopping and medical purposes. Across all categories, rural areas, urban areas, male and female for the people without travel-limiting disabilities, COVID-19 fourth wave did not change the pattern of trips made to physical workplace as pre-COVID-19 era. This pattern is also observable for the people with travel-limiting disabilities in rural and urban areas. Females with travel-limiting disabilities reported making less trips to physical workplaces while male reported doing the same as before COVID-19 era. The study concludes that the quantification of travel-limiting disabilities across geographic location and gender is vital in disability study and could drive policy implementation for improved accessibility for the vulnerable population.

Keywords

National Household Travel Survey, United States, Travel-Limiting Disabilities, Descriptive Statistics, Covid-19, Disability Study

1. Introduction

Transportation is particularly important for the sustenance of life and as such is one of the key areas of geography and urban planning. People get by through transportation, regardless of its modes. People live in different places and work in another place, often in different counties or even states, and transportation is the means to bridge the gap. From the 1960s to the early 2010s, there was a massive decentralization in job opportunities from central cities to the suburbs in the US and because of this, people in large cities become unemployed if they cannot afford to move daily to access their jobs in the suburbs which ultimately led to spatial mismatch [1]-[4].

Consequent of the foregoing, mobility and accessibility are two of the key areas in geography and planning. It is also an integral aspect of health sciences to measuring accessibility to health care. There have been issues of continued inequalities in mobility and accessibility of people with disabilities [5]. In the U.S., according to the Centers for Disease Control and Prevention (CDC), the estimated number of people affected by disability was 61 million in 2016 and in 2024, one in every four adults have some forms of disability [6]. Globally, it is estimated that disability affects more than one billion people [6]. In 2022, [7] categorized disabilities into six domains: seeing, hearing, mobility, cognition, self-care, and communication. In 2024, according to CDC, there are 12.1% mobility related, 12.8% cognition related, 7.2% independent living related, 6.1% hearing related, 4.8% vision related and 3.6% self-care related disabilities. CDC also reported in 2024 that persons with disabilities have higher prevalence of obesity, heart disease, and diabetes compared to the people without disabilities. The leading causes of disability in the U.S are Arthritis, back problem, and heart diseases [8]. COVID-19 first and second wave altered the lives of majority of the global population, and this also had significant impact on the people with disabilities [9].

There has been a growing need to include people with disabilities in global health programs, especially bridging the inequality in accessibility to health care which can be attained through synergy of social, technological, and political factors [10]. With the improvement of medical technologies such as reproduction of artificial limbs, eyeglasses, hearing aids, and others, people with disabilities, especially those with congenital disabilities can live longer with their disabilities leading to improved mobility and accessibility.

[11] indicates that there is a need for global indicators that are consistent in disability studies. Global data for the people with disabilities is quite difficult to access and most international surveys do not have global disability indicators because of the varying definition of disabilities by countries which could prove problematic for disability studies. [12] compares two countries with conflicting disability data obtained from Demographic and Health Survey (DHS) and discusses the quality of global disability data. The author concludes that there are significant inconsistencies when the same survey questions are used by another

data collection agency within the same population. The implication of this inconsistent disability data is that it can greatly bias analysis and as such, there is a need for accurate quantification of people with disabilities.

[12] investigate the lives and circumstances of people with disabilities in developing countries and indicate that there is a need to quantify and understand disability statistics. Some types of disabilities are visible, hence, easier to quantify while others are invisible, and difficult to notice. [13] report that employers are less likely to employ people with visible disabilities. Invisible disabilities are difficult to measure and as such [12] present data on poverty and employment status of the people with disabilities in developing countries by exploring intellectual disabilities. The argument put forward by the authors is that it is not just enough to quantify disabilities but what is more important is what the numbers are used for. They also support the claims of [11] that in measuring disabilities, physical and cultural environment plays a big role thereby making the definition of disabilities different from place to place.

[5] argue that there is a correlation between proportion of people with disabilities, especially adults with cognitive and physical disabilities and higher rate of chronic diseases like high blood pressure, cardiovascular diseases, and diabetes. The study investigates the trend of chronic diseases among the U.S. adult population from 1998 to 2011. Seven chronic disability measures namely movement, sensory, emotional, cognitive, self-care limitation, social limitation, and work limitation were constructed using self-reported information. Unrestricted trend analysis shows that all the seven chronic disability indicators increased from 1998 to 2011 with movement difficulty coming on top with an increase of over 13 million people. When age, race and BMI are adjusted for, six disability types increase, except sensory difficulty, and over time, poor education, poverty, and unemployment correlate with disability [14] [15].

[16] investigates disability policies and raises concerns about the growing U.S. population aging with disabilities with the goal of identifying areas to study to reduce, if not eliminate, the disparities between elderlies with disabilities and those without disabilities. She highlights six areas: improvement in quality of life, supporting independent living, participation in daily activities, performing daily activities, the role of families, and medical care that requires further research for better policies and programs for people with disabilities. With the U.S. population still increasing [16], there is an increasing need to bridge the equity gaps between people with disabilities and people without disabilities through collaborative efforts and adequate understanding of the needs of the vulnerable population living with disabilities. Society also must work together to create an inclusive environment. All of these would be achievable by accurately quantifying the number of people with disabilities in a timely fashion.

The drive for equity has been aided by the global Disability Rights Movement which began in the 1970s and has been implemented in over 170 countries. There have also been new innovative methods to collect data on people with

disabilities to understand their status in the society and compare them to their non-disabled counterparts [10]. However, the issue of inequity in access to education and employment still leaves a big gap to be bridged which can only be understood through evidence-based disability studies. To bridge the existing gap between people with disabilities and people without disability in their accessibility to opportunities (jobs, healthcare etc.), there is a need to understand the spatial distribution of people with disabilities and their travel patterns and compare it with that of the people without disabilities. Much has been done in the areas of mobility of people with disabilities and their accessibility to food, public transport, and health care. However, not a lot has been done to describe travel-limiting disabilities in the post-COVID-19 pandemic era. Travel-limiting disabilities refer to those disabilities that make travelling difficult from the perspective of the respondent. It could be visible disabilities or invisible disabilities. This paper intends to investigate travel-limiting disabilities in the United States using the National Household Travel Survey (NHTS) data. The study aims to validate the status of the people with travel-limiting disabilities in the US with the objectives of describing their socioeconomic and demographic characteristics across geographic locations and gender. This study will also investigate the travel pattern and trip purpose of the people with travel-limiting disabilities, the impact of COVID-19 fourth wave on their mobility, and their use of public transit across geographic locations and gender. This study also compares these socioeconomic, demographic and trip related variables of the people with travel-limiting disabilities across geographic locations and gender with that of the people without travel-limiting disabilities.

2. Data and Methodology

2.1. Data

The study data uses the 2022 NHTS dataset for local and long-distance travel. This survey is usually conducted, compiled, and released for public use every five to eight years beginning from 1969 with the goal of understanding travel pattern and behavior of noninstitutionalized households and individuals. The 2022 dataset was released in March 2024, and it captures travel behavior from January 2022 to January 2023. The dataset only includes details of trips taken within 24 hours by household members aged five years and older. It cuts across both the rural and urban regions of U.S., capturing information about purpose of the trip, the means of transportation, travel time, time of the day, and day of the week. The dataset has four main files: household, person, trip, and vehicle. Household file contains data about the household every individual included in the survey belongs to, person file highlights details about each person in the survey and their unique attributes, trip file contains information about the characteristics of the trip that individuals in the survey underwent during the reporting period, and the vehicle file accommodates details pertaining to the mode of transportation during the survey period. For the period under survey, the NHTS included

27,290 representative households using stratified random sampling by employing the Address Based Sample (ABS), which is a nationally representative sample of addresses derived from the United States Postal Service (USPS). Each household was selected and interviewed using a mail-push-to-web recruitment strategy while the choice for a paper-based interview was also made available to respondents as shown in the ABS Data Flow Sample in Figure 1.

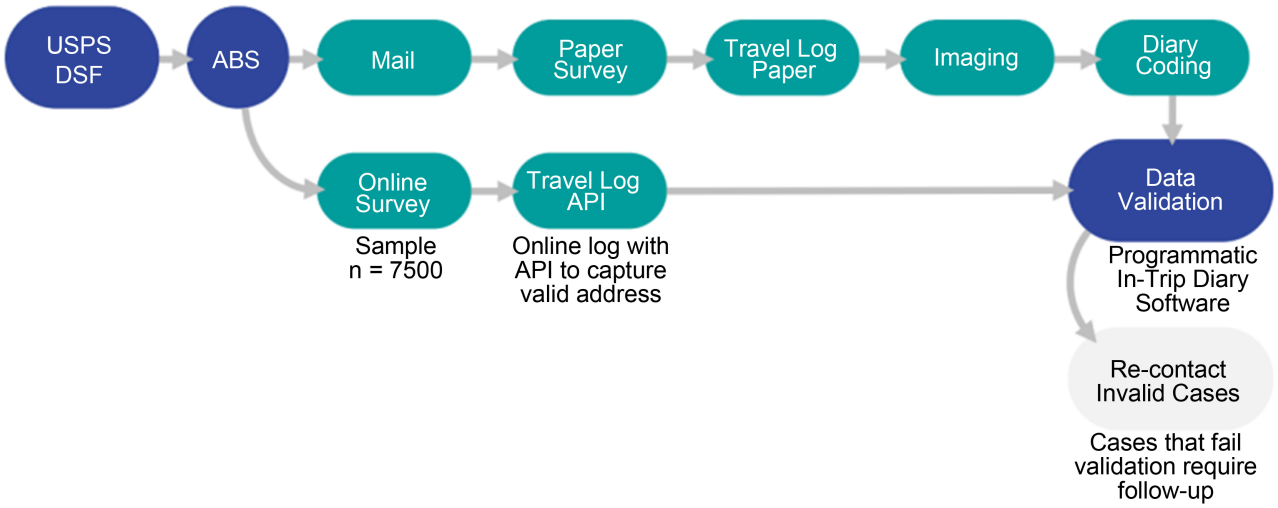

Figure 1. ABS sample data flow. Source: National Household Travel Survey User Guide (2022).

This study focuses on people with travel-limiting disabilities, their attributes, and the way their travel behavior differs from that of the people without travel-limiting disabilities. The paper uses the data obtained from the person file and the trip file. To get a single database, the trip file was merged with the person file using the HOUSEID and PERSONID keys as shown in Table 1 and the relational schema in Figure 2.

Table 1. Data files and their descriptions.

File	Record Level Description	ID Variable
HOUSEHOLD	One record per HH unit (only one value for all the members of a single household).	HOUSEID
VEHICLE	One record per HH Vehicle (if present). There will be as many entries as vehicles available in the household.	HOUSEID VEHID
PERSON	One record per HH member. Every member of the household gets an entry in the database.	HOUSEID PERSONID
TRIP	One record per HH member's travel day trip (if at least one trip is made)	HOUSEID PERSONID TRIPID

Source: National Household Travel Survey User Guide (2022).

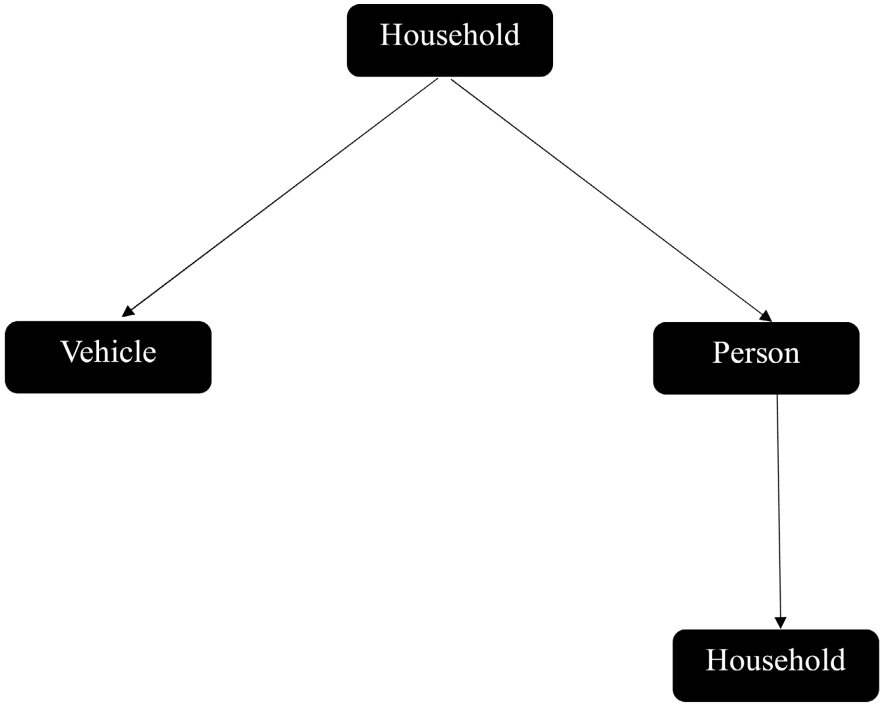

Figure 2. Relational schema of NHTS data files. Source: National Household Travel Survey User Guide (2022).

The final database contains 176 variables on both person characteristics and their corresponding trip attributes. The database consists of varying types of data that include mostly numerical and nominal variables. Some of the numerical variables in the dataset are age, total trip miles, vehicle miles travelled, household size, number of drivers in household, etc. Nominal variables include household income, race, gender, education level, etc. The study further divided the database into two other databases: one for people with travel-limiting disabilities and the other for the people without travel-limiting disabilities. The total weighted sample size for the people with travel-limiting disabilities is 18,647,931 and the people without travel-limiting disabilities is 271,575,864.

2.2. Methodology

The objective of this study is to understand the travel behavior of people with travel-limiting disabilities as well as people without travel-limiting disabilities. To do this, the study starts with a brief description of the overall U.S. population, looking at selected socioeconomic and demographic characteristics, and then proceed to the description of the people with travel-limiting disabilities. The statistical method used in this study is descriptive. To ensure comparability of different groups, the descriptive analysis was done independently for the weighted sample sizes of the two separate groups.

Comparative descriptive statistics like percentages, averages and bar charts are employed to describe the socio-economic variables, demographic variables, the trip purposes, and travel patterns. For the descriptive statistics, the study sepa-

rates each dataset into two groups: rural versus urban and male versus female to understand how they differ across groups. Statistical Package for the Social Sciences (SPSS) version 29 was employed to produce the descriptive statistics of the entire weighted US population and Python statistical package was used to produce graphical representations of the datasets.

3. Results and Discussion

This section is divided into six subsections. The first section is concerned with the description of the socio-economic and demographic variables of the entire U.S. population. The second section dived into the distribution of travel-limiting disabilities by gender and geographic locations as well as distribution of socioeconomic and demographic characteristics of the people without travel-limiting disabilities by gender and geographic locations. The third section consists of description of driving ability across geographic locations and gender for the people with travel-limiting disabilities and people without travel-limiting disabilities. The fourth section presents the description of trip purposes while the fifth section shows the impacts of COVID-19 fourth wave on the use of public transit. The last section presents the impact of COVID-19 fourth wave on travels to physical workplaces.

3.1. Description of Socioeconomic and Demographic Variables of the U.S. Population

Figure 3 presents the income distribution of the entire U.S. population in 2022. It can be inferred from the chart that most of the population's annual renumeration is between $50,000 and $200,000. The income class with the most people is $50,000 - $74,999 with 16.2%, representing approximately 33.2 million of the total U.S. population. This is closely followed by $75,000 - $99,999 income class that includes 13.9% of the U.S. population. For the entire U.S., 11.2% of the population have income below $25,000, which can be considered low income. Only 16% of the entire population have an income between $25,000 and $49,999, 30.1% belong to $50,000 - $99,999, while 42.7% of the population have annual income of $100,000 or more.

Figure 4 presents the distribution of the highest education level of the entire U.S. population as of 2022. The figure shows that a good portion of the U.S. population are well educated with 32% having a bachelor's degree or higher. The education level that has the highest proportion of the people is high school graduate with diploma, standing at 25.8%. The educational level with the lowest percentage of the people is doctorate and professional degrees that only accounts for 4.1% or approximately 10.8 million people. The proportion of the population with an associate degree and a master's degree are 10.8% and 10.2% of the population, respectively. Only 5.0% of the population, which is equivalent to about 14 million people, have less than a high school degree.

Figure 5 shows the racial distribution of the entire U.S. population in 2022.

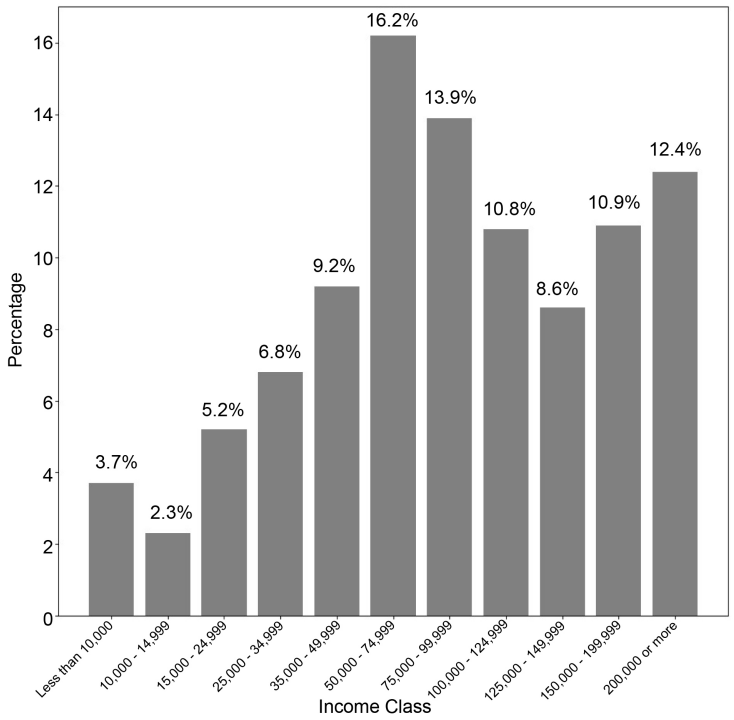

Figure 3. Distribution of income of the entire U.S. population, 2022.

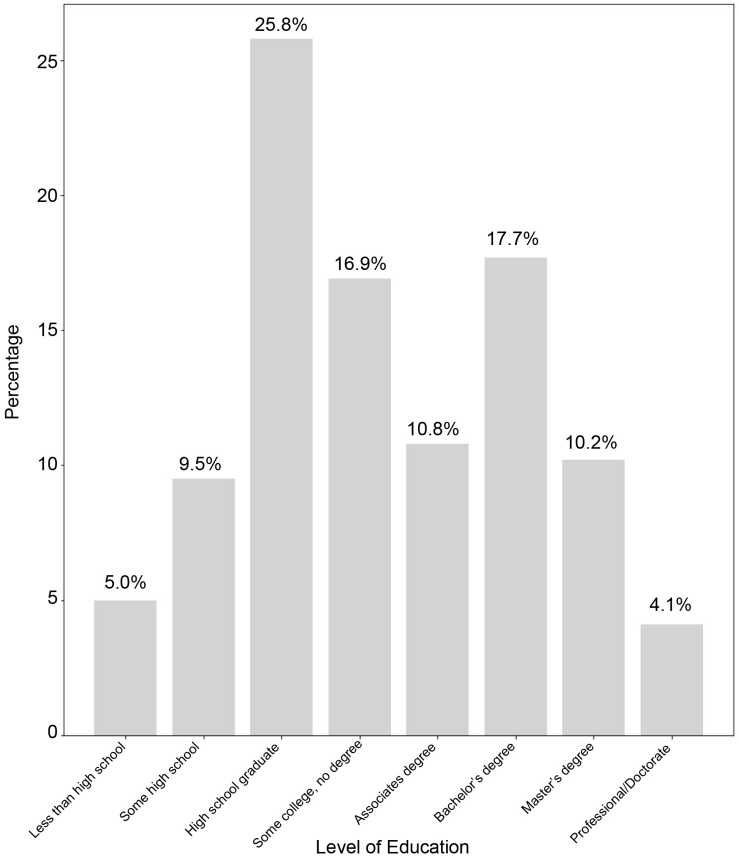

Figure 4. Distribution of educational level of the entire U.S. population, 2022.

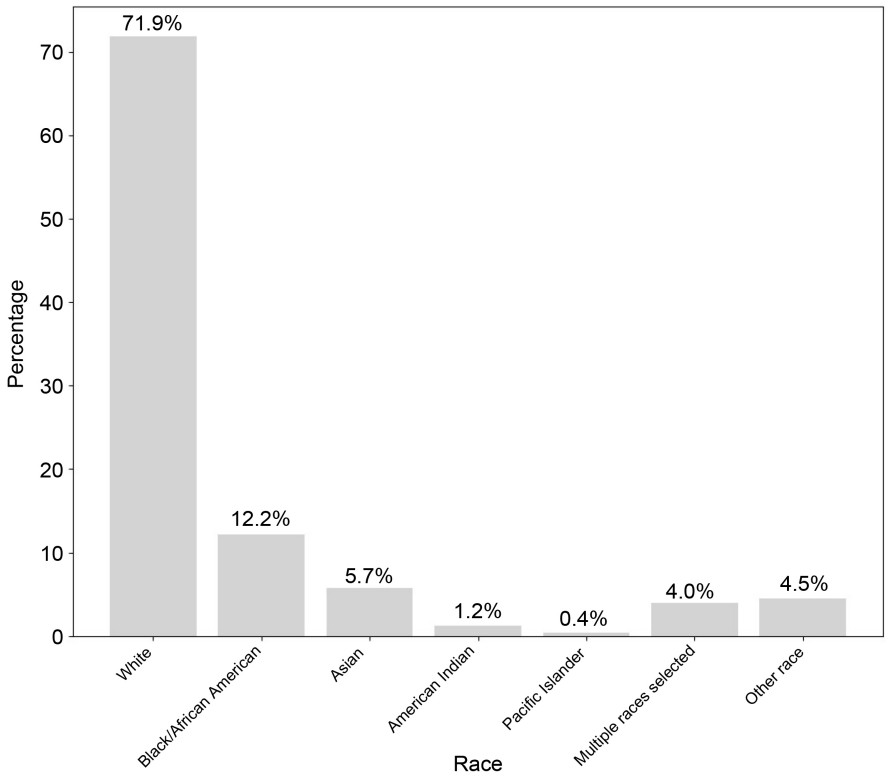

Figure 5. Racial distribution of the entire U.S. population, 2022.

The racial group dominating the population representing a staggering 71.9% of the population is White, which is equivalent to approximately 218 million people. The second highest group is Blacks/African Americans which accounts for 12.2% of the entire population. The smallest racial group is Native Hawaiian/Pacific Islander representing only 0.4% of the total population. Approximately 13 million people (4.0%) reported to be of multiple races and 14.2 million (4.5%) people reported to belong to other races not captured by the survey. A little over one out of each 20 people are Asian in the U.S., 1.2% of the population are American Indian, and 0.4% are Pacific Islander. The NHTS survey sought to quantify the number of Hispanics and the result indicates that there are over 41 million Hispanic people in the United States.

Table 2 presents the descriptive statistics of the continuous socioeconomic variables of the entire US population in 2022. It can be deduced from the table that the age of the people included in the survey ranges from 5 years to 92 years. In urban areas, the average age of the population is 40.77 years compared to 44.09 in rural areas. In the same vein, the average number of vehicles in rural areas is higher (2.52 per household) compared to urban areas (2.07 per household). This could be because urban areas are more packed and access to public transport is better than that in the rural areas. Household size ranges from 1 to 10 both in rural and urban areas. The average household size of the entire population is 3.22, but it is higher in urban areas compared to the rural areas with values of 3.25 and 3.19, respectively. The average number of adults at least 18

years old is also higher in urban areas (2.26 per household) than in rural areas (2.21 per household).

Table 2. Locational distribution of socioeconomic variables.

Geographic Location	Variable	Minimum	Maximum	Mean	Standard deviation
Urban	Age	5	92	40.77	21.550
	HHSIZE	1	10	3.25	1.624
	HHVECNT	0	14	2.07	1.186
	NONHHCNT	0	98	0.40	3.082
	NUMADLT	1	8	2.26	0.970
Rural	Age	5	92	44.09	22.261
	HHSIZE	1	10	3.19	1.551
	HHVECNT	0	11	2.52	1.299
	NONHHCNT	0	43	0.61	3.700
	NUMADLT	1	7	2.21	0.783

NOTE: HHSIZE = Total number of people in household. HHVECNT = Total number of vehicles in household. NONHHCNT = Number of non-household members on trip. NUMADLT = Count of adult household members at least 18 years old.

3.2. Distribution of Travel-Limiting Disabilities by Gender and Geographic Locations

To understand the peculiarities and nuances associated with people with travel-limiting disabilities, there is a need to understand their spatial distributions and the length of their disabilities. Table 3 explores that the proportion of people with travel-limiting disabilities in urban areas is four times higher than their rural counterparts. In terms of gender, 56.9% of the people with travel-limiting disabilities are female and the rest (43.1%) are male. These results support the findings of [5] [8] [17].

Table 3. Distribution of travel-limiting disabilities by geographic locations and gender.

Location	Frequency	Percent (%)
Rural	3,642,630	19.5
Urban	15,005,301	80.5
Total	18,647,931	100
Gender	**Frequency**	**Percent (%)**
Male	8,034,308	43.1
Female	10,613,623	56.9
Total	18,647,931	100

The total number of people living with travel-limiting disabilities in the U.S. as of 2022 is over 18.6 million. Out of this population, 7.5% reported to have the

disabilities of six months or less, a staggering 73.4% reported their disabilities to be for more than 6 months in length, and approximately one out of every five people with travel restricting disabilities indicate they have been living with it their entire life. Figure 6 and Figure 7 show the comparative distribution of the length of travel-limiting disabilities by geographic locations and gender, respectively. Figure 6 shows that both in rural and urban areas, the majority, that is approximately three out of every four people report that they have had travel-limiting disabilities for more than six months. However, in rural areas, the proportion is higher (78.5%) compared to their urban counterparts (72.1%). The converse is true for congenital travel-limiting disabilities, with 20.8% and 12.6% of the people with travel restricting disabilities in urban and rural areas, respectively.

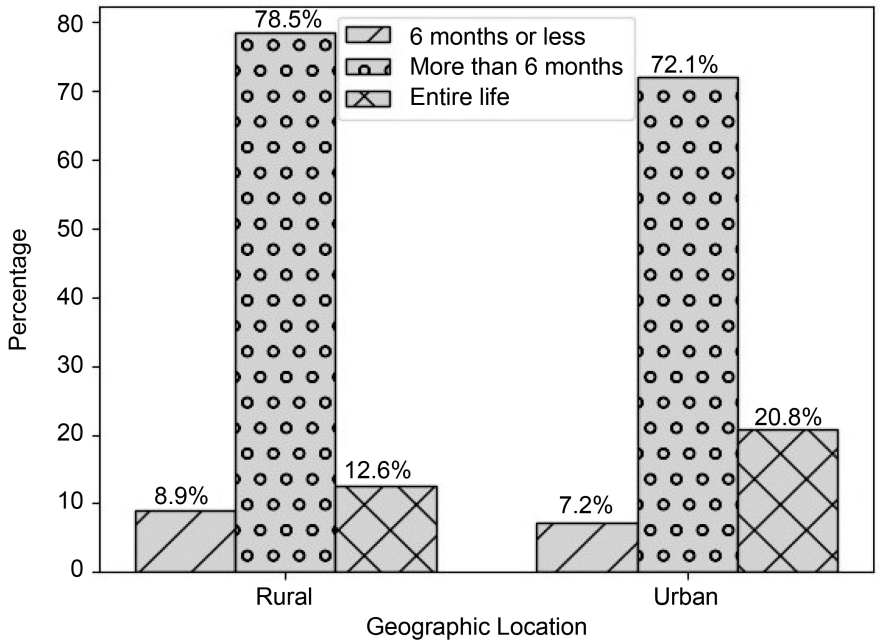

Figure 6. Distribution of length of travel-limiting disabilities by geographic locations.

When the same comparison is looked from the gender lens (Figure 7), it is evident that there is a higher percentage of females (75%) having travel-limiting disabilities of more than six months compared to the males (71.4%), but males have higher percentage (23.3%) of congenital disabilities compared to females (15.8%).

It can be deduced from Table 4 that the older a person is, the higher the percentage of travel-limiting disabilities, especially in rural areas. Existing studies have buttressed this assertion [8] [14] [17] [18]. In rural areas, one in every two people with travel-limiting disabilities is 65 years or older while in urban areas, it drops to 38.3%. Also in rural areas, 44.7% of the people with travel-limiting disabilities belong to the working demographic, *i.e.*, ages 16 - 64 years. This proportion is a little higher than one in every two people in urban areas (56.9%). On

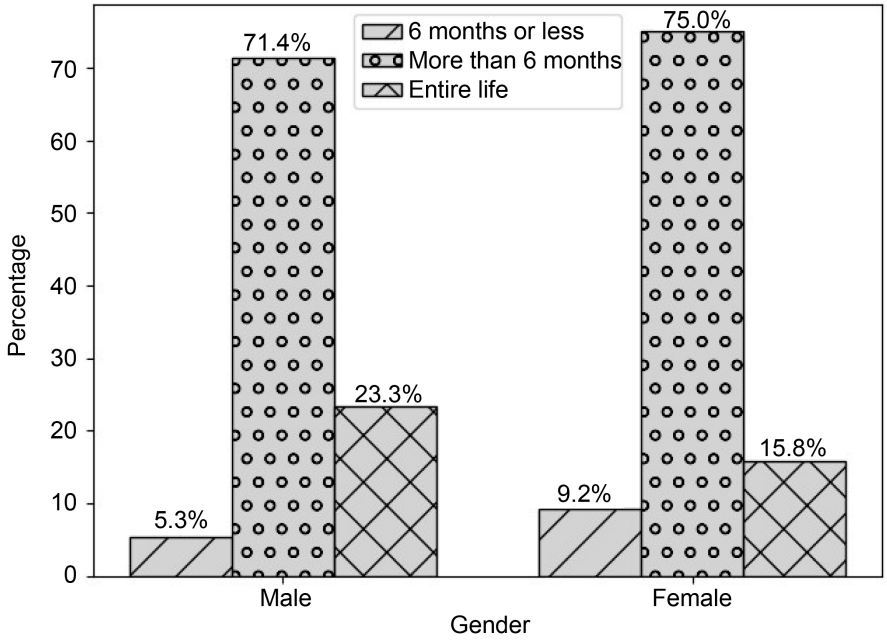

Figure 7. Distribution of length of travel-limiting disabilities by gender.

the contrary, the converse is true for the people without travel-limiting disabilities in both rural and urban areas with the working population having the higher percentages of 65.2 and 68.5, respectively. In terms of education level, majority of the population's highest level of education is high school diploma with 32.1% and 33.2% of the people with disabilities in rural and urban areas, and 30.6% and 24% of the people without travel-limiting disabilities in rural and urban areas, respectively. Only a small proportion have a doctorate or professional degree with only 1.5% of people with disabilities getting to that level of education in rural areas and 2.5% in urban areas. These percentages are higher for people without travel-limiting disabilities with 2.5% and 4.6%, respectively. Across groups and locations, White is the common race. Almost 87 out of 100 people with disabilities in rural areas are White but it falls to 72.1% in urban areas. For the people without travel-limiting disabilities, the proportions drop to 81.6% and 69.4% in rural and urban areas, respectively. The race with the lowest rate of disabilities is Native Hawaiian/Pacific Islander with no record of disabilities in rural areas and only 0.6% in urban areas. This is not surprising as it is also the group with the lowest population. The highest proportion of household income group of the people with travel-limiting disabilities in rural and urban areas is $50,000 to $74,999, closely followed by $15,000 to $24,999. However, for the people without travel-limiting disabilities, one out of every 5 people earn between $75,000 and $99,999 in rural areas and 15.6% earn between $50,000 and $74,999 in urban areas.

Table 5 presents the comparative descriptive statistics of the socioeconomic and demographic variables of the people with and without travel-limiting disabilities by gender. It can be inferred that for the working population of ages 16

Table 4. Description of socioeconomic and demographic variables by geographic locations.

Socio-demographic variables		People with disability		People without disability	
		Rural (%)	Urban (%)	Rural (%)	Urban (%)
Age (years)	1 - 15	2.4	4.8	15.4	16.2
	16 - 64	44.7	56.9	65.2	68.5
	65 and above	53.0	38.3	19.4	15.2
Education level	Less than high school	9.1	9.8	5.4	4.5
	Some high school, no diploma/GED	11.6	11.1	8.4	9.6
	High school graduate	32.1	33.2	30.6	24.0
	Some college, no degree/some trade school	25.3	19.3	18.8	16.0
	Associates degree (2-year)/trade school certificate	10.9	9.0	12.9	10.5
	Bachelor's degree	6.7	9.5	14.4	19.3
	Master's degree	2.8	5.9	7.0	11.4
	Professional/Doctorate degree	1.5	2.3	2.5	4.6
Race	White	86.9	72.1	81.6	69.4
	Black or African American	6.2	12.5	8.9	13.1
	Asian	0.0	3.2	2.8	6.6
	American Indian/Alaska Native	0.8	2.6	0.6	1.3
	Native Hawaiian/Pacific Islander	0.0	0.6	0.6	0.4
	Multiple races	1.1	0.0	3.6	4.4
	Other race	5.0	9.1	1.9	4.8
Household Income ($)	Less than 10,000	5.0	9.6	2.6	3.5
	10,000 - 14,999	7.7	9.6	1.9	1.8
	15,000 - 24,999	18.1	12.4	5.9	4.4
	25,000 - 34,999	10.1	10.8	7.0	6.5
	35,000 - 49,999	12.5	9.8	9.1	9.2
	50,000 - 74,999	19.6	17.0	18.1	15.6
	75,000 - 99,999	11.9	9.8	20.0	12.8
	100,000 - 124,999	3.6	6.0	11.0	11.3
	125,000 - 149,999	4.4	5.6	7.6	9.1
	150,000 - 199,999	4.4	5.2	7.0	12.4
	200,000 or more	2.6	4.2	9.9	13.6

Table 5. Description of socioeconomic and demographic variables by gender.

Socio-demographic variables		People with disability		People without disability	
		Male (%)	Female (%)	Male (%)	Female (%)
Age (years)	1 - 15	6.1	3.0	16.3	15.8
	16 - 64	57.6	52.2	67.6	68.2
	65 and above	36.2	44.8	16.1	16.0
Education level	Less than high school	10.0	9.4	5.2	4.2
	Some high school, no diploma/GED	10.4	11.8	8.8	9.9
	High school graduate	36.0	30.8	25.9	24.7
	Some college, no degree/some trade school	18.4	22.0	17.4	15.8
	Associates degree (2-year)/trade school certificate	7.7	10.6	10.3	11.6
	Bachelor's degree	9.1	8.7	18.1	18.6
	Master's degree	5.7	5.0	9.5	11.5
	Professional/Doctorate degree	2.7	1.6	4.8	3.6
Race	White	74.6	75.2	72.9	70.6
	Black or African American	8.5	13.4	11.9	12.7
	Asian	2.9	2.3	5.9	5.9
	American Indian/Alaska Native	3.4	1.3	1.1	1.1
	Native Hawaiian/Pacific Islander	0.3	0.7	0.3	0.6
	Multiple races	0.0	0.4	3.4	5.1
	Other race	10.3	6.7	4.5	4.0
Household Income ($)	Less than 10,000	9.6	5.0	3.0	3.6
	10,000 - 14,999	9.6	7.7	1.6	2.1
	15,000 - 24,999	12.4	18.1	4.0	5.4
	25,000 - 34,999	10.8	10.1	6.2	6.9
	35,000 - 49,999	9.8	12.5	8.5	9.8
	50,000 - 74,999	17.0	19.6	16.0	16.2
	75,000 - 99,999	9.8	11.9	14.3	14.1
	100,000 - 124,999	6.0	3.6	11.6	10.8
	125,000 - 149,999	5.6	4.4	9.1	8.5
	150,000 - 199,999	5.2	4.4	11.5	11.1
	200,000 or more	4.2	2.6	14.1	11.6

to 64, there are more people with travel-limiting disabilities, with 57.6% males and 52.2% females. For the people without travel-limiting disabilities, there is also a higher percentage of people in the working population category with 67.6% males and 68.2% females. In terms of education, for the people with and without travel-limiting disabilities, high school graduates take the top spot for both males and females with 36.0% and 30.8%, respectively, for the people with travel-limiting disabilities and 25.9% and 24.7%, respectively, for the people

without travel-limiting disabilities. This is closely followed by the people who have some college or trade school education. It is also revealed that for the people with travel-limiting disabilities, after bachelor's degree, the higher the level of education, the lower the prevalence of disabilities across genders. The same trend is also observed for the people without travel-limiting disabilities. As the level of education increases, the lower the percentage of people in that bracket. A little over 7 out of every 10 people with travel-limiting disabilities are White. Similar trend is also observed for Whites without travel-limiting disabilities. Black/African are second on the list with 8.5% of females with travel-limiting disabilities and 13.4% are males, while 11.9% of the people without travel-limiting disabilities are males and 12.7% are females. The race with the lowest prevalence of travel-limiting disabilities for males and females is Native Hawaiian/Pacific Islander with 0.3% and 0.7%, respectively. The highest proportion of household income group of people with and without travel-limiting disabilities for males and females is $50,000 to $74,999 with 17.0% and 19.6%, respectively, for the people with travel-limiting disabilities and 16.0% and 16.2%, respectively, for the people without travel-limiting disabilities. Prevalence of travel-limiting disabilities decreases as the household income group hits $50,000 to $74,000 and above for males. However, for people without travel-limiting disabilities, the proportion of males and females does not reduce as the income group gets to $50,000 to $74,999.

Table 6 presents the description of household sizes of people with travel-limiting disabilities in rural areas and compares it to the people with travel-limiting disabilities in urban areas, and people without travel-limiting disabilities in rural areas to the people without travel-limiting disabilities in urban areas. The results show that for the general population with travel-limiting disabilities, the household size ranges from 1 to 10 with a mean size of 2.74 compared to the average household size of 3.28 for the population without travel-limiting disabilities. For both groups, the average household size is higher in urban areas. For the people without travel-limiting disabilities, the household size also ranges from 1 to 10 and in the rural areas with an average household size is 3.23, while in urban areas, it is 3.29. For the people with travel restricting disabilities, the average household size in rural areas is 2.60 while it is 2.77 in urban areas.

Table 6. Household size for people with and without travel-limiting disabilities.

	Minimum		Maximum		Mean		Standard deviation	
HHSIZE	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
With Travel-limiting Disabilities	1	1	7	10	2.60	2.77	1.269	1.626
Without Travel-limiting Disabilities	1	1	10	10	3.23	3.29	1.561	1.618

NOTE: HHSIZE = Household Size.

3.3. Driving Ability

Table 7 presents the driver status of the people with and without travel-limiting disabilities across geographic locations and gender. Results reveal that the proportion of people who drive but have travel-limiting disabilities is higher in rural areas (68.1%) than urban areas (60.2%). The same patterns are visible for the people without travel-limiting disabilities in rural and urban areas who drive: 95.1% rural people and 89.3% urban people. This is not a coincidence as people with travel-limiting disabilities in rural areas have an average Vehicle Miles Travelled (VMT) of 6.644 compared to 2.861 for the people with travel-limiting disabilities in urban areas. It can also be deduced from the table that for the people with travel-limiting disabilities, males are attached to 4.2% higher rate of driving compared to the females. This trend is also observable for the people without travel-limiting disabilities.

Table 7. Driving ability of the people with and without disabilities by gender and location.

Drives	People with Disability		People without Disability	
	Rural (%)	Urban (%)	Rural (%)	Urban (%)
Yes	68.1	60.2	95.1	89.3
No	31.9	39.8	4.9	10.7
	Male (%)	Female (%)	Male (%)	Female (%)
Yes	64.2	60.0	91.6	89.3
No	35.8	40.0	8.4	10.7

3.4. Trip Purpose

Table 8 presents the analysis of trip purpose for any 24-hour window during the survey period. It explores that shopping or errands constitute the highest proportion of trips made by the people with travel-limiting disabilities in both rural and urban areas with 32.7% and 34.2%, respectively. For the people without travel-limiting disabilities, the purpose that constitutes the highest percentage of trips in rural and urban areas is work with 32.0% and 27.1%, respectively. This leads us to think if there are more people with travel-limiting disabilities working from home compared to their counterparts. For the people with travel-limiting disabilities, trips for medical purposes come second while for the people without travel-limiting disabilities, it is shopping or errands. This is not also surprising because the people with travel-limiting disabilities are probably more prone to health concerns, [19] indicate that the people with disabilities have higher propensity to engage in preventive measures of diseases compared to the people without disabilities. People with travel-limiting disabilities in rural areas transport others more than the people with travel-limiting disabilities in urban areas with 10.8% trips made in rural areas versus 6.4% trips in urban areas. For the people with and without travel-limiting disabilities, the proportion of trips taken for meals is higher in urban areas with 15.5% and 10.4%, respec-

tively, compared to 7.2% and 6.5% in rural areas, respectively. The proportion of trips made for social/recreational purposes for the people with travel-limiting disabilities is a little higher in rural areas (9.3%) compared to urban areas (9.2%). The converse is true for the people without travel-limiting disabilities with 14.8% of the trips made for social/recreational purposes in urban areas and 11.6% trips in rural areas.

Table 8. Description of trip purpose for the people with and without disabilities by geographic locations.

Trip purpose	People with Disability		People without disability	
	Rural (%)	Urban (%)	Rural (%)	Urban (%)
Home	7.1	3.3	4.8	4.4
Work	5.3	7.5	32.0	27.1
School/Daycare/Religious	7.4	6.1	10.5	12.3
Medical/Dental services	17.9	16.0	3.3	3.5
Shopping/Errands	32.7	34.2	21.6	18.5
Social/Recreational	9.3	9.2	11.6	14.8
Transport Someone	10.8	6.4	7.2	7.6
Meals	7.2	15.5	6.5	10.4
Something Else	2.2	1.7	2.4	1.3

However, some of these trends are very different across the gender groups (Table 9). For the people with travel-limiting disabilities, in the male subgroup, shopping or errand take the top spot with 28.4% while meals take the second spot with 18.0% of their trips. The table also explores that social and recreational trip purpose constitutes 14.0% of the trips made by males and 4.9% of the trips made by females. For the people without travel-limiting disabilities, for both males and females, trips made to commute to work take the top spot with 32.1% and 24.0%, respectively. Shopping or errands take the second spot with males constituting 16.6% of their trips and females constituting 21.7% of their trips. When the people with travel-limiting disabilities are compared to the people without travel-limiting disabilities in terms of trips made for medical/dental purpose, results show that females make more trips compared to their male counterparts. For the people with travel-limiting disabilities, 19.6% of the trips made by the females are for medical/dental purpose while 12.9% of the trips are made by the males. Across the two groups, females transport someone more than males with 10.0% of trips made by females with travel-limiting disabilities compared to 4.4% of the trips made by the males. For the people without travel-limiting disabilities, 4.2% of the medical/dental trips are made by the females while 2.8% are made by the males.

Table 9. Description of trip purpose for the people with and without disabilities by gender.

Trip purpose	People with Disability		People without Disability	
	Male (%)	Female (%)	Male (%)	Female (%)
Home	5.7	2.7	5.2	3.8
Work	6.1	7.8	32.1	24.0
School/Daycare/Religious	9.5	3.6	11.2	12.7
Medical/Dental services	12.9	19.6	2.8	4.2
Shopping/Errands	28.4	39.0	16.6	21.7
Social/Recreational	14.0	4.9	14.0	14.4
Transport someone	4.4	10.0	6.6	8.5
Meals	18.0	10.0	9.8	9.4
Something else	1.1	2.4	1.7	1.4

3.5. Impacts of COVID-19 Fourth Wave on the Use of Public Transit

Another objective of this study is to understand how the fourth wave of COVID-19 pandemic has impacted the use of public transit and travel pattern to different destinations across geographic locations and gender for the people with and without travel-limiting disabilities. For the people with disabilities, there are twice more women using public transit compared to men [20]. The results of this study (Table 10) explore that for the people with travel-limiting disabilities, 70.0% in rural areas and 61.9% in urban areas use less public transit than in the pre-COVID era. This could be attributed to the increase in the use of rideshare services like Uber and Lyft [21] because of lingering presumed risks of getting in contact with COVID-19 virus in public transit. Only a small proportion of the people with travel-limiting disabilities in both rural and urban areas use more public transit. For the people without travel-limiting disabilities, both in rural and urban areas, high percentages of people reported using public transit the same as pre-COVID-19 era with 70.5% and 57.9%, respectively. Across gender, for the people with travel-limiting disabilities, a higher proportion of the population report using less of public transit than the pre-COVID-19 era with 60.6% males and 65.1% females, respectively. However, for the people without travel-limiting disabilities, a higher proportion report using public transit the same as pre-COVID-19 period with 60.1% males and 59.7% females, respectively.

3.6. Impacts of COVID-19 Fourth Wave on Travelling to Physical Workplaces

Table 11 depicts the impacts of COVID-19 fourth wave on travelling to physical work locations. The first and second wave of COVID-19 pandemic impacted people's lives negatively, which necessitated a shift from in-person to remote

Table 10. Impact of COVID-19 fourth wave on use of public transit by the people with and without travel-limiting disabilities by location and gender.

Criterion	Trip Frequency	People with Disability		People without disability	
		Rural (%)	Urban (%)	Rural (%)	Urban (%)
Geographic Location	Do more often than before	4.5	5.4	2.8	5.3
	Do the same as before	25.5	32.7	70.5	57.9
	Do less often than before	70.0	61.9	26.7	36.7
		Male (%)	Female (%)	Male (%)	Female (%)
Gender	Do more often than before	5.4	5.1	4.4	5.5
	Do the same as before	34.0	29.7	60.1	59.7
	Do less often than before	60.6	65.1	35.5	34.8

Table 11. Impact of COVID-19 on travel to physical work locations by the people with and without travel-limiting disabilities by location and gender.

Criterion	Trip Frequency	People with Disability		People without Disability	
		Rural (%)	Urban (%)	Rural (%)	Urban (%)
Geographic Location	Do more often than before	7.1	2.5	9.4	7.8
	Do the same as before	64.8	50.3	72.1	61.0
	Do less often than before	28.1	47.2	18.5	31.1
		Male (%)	Female (%)	Male (%)	Female (%)
Gender	Do more often than before	4.5	1.7	6.8	9.6
	Do the same as before	65.1	41.3	66.3	59.7
	Do less often than before	30.4	57.0	27.0	30.7

online system of working with over half of those employed in pre-COVID era transitioning to online work [22]. However, the impacts of third and fourth waves are not so detrimental. Nearly 65% of the people with travel-limiting disabilities in rural areas reported the same level of travelling to physical work locations during the fourth wave of COVID-19 pandemic as that of pre-COVID-19 era. In urban areas, one in every two people with travel-limiting disabilities report that they follow the same travel pattern as pre-COVID-19 era. This is because as the pandemic transitioned to endemic with the advent of vaccines and steady ease into normalcy, some people started going back to in-person work and a huge percentage of the labor force maintained the hybrid form of work due to the perceived benefits by hiring managers [23]. A little over seven in every ten people without travel-limiting disabilities in rural areas reported no change in travel pattern to physical work locations but this proportion is lower in urban areas (61%) than rural areas (72.1%). Only a small portion of the people reported travelling more to physical work locations for the people with and without travel-limiting disabilities. For the people with travel-limiting disabilities, more males (65.1%) reported similar travel pattern to physical work locations

compared to females (41.3%), while more females (57.0%) reported travelling less to physical work locations compared to the males (30.4%) in post-COVID-19 era compared to the pre-COVID-19 era. However, for the people without travel-limiting disabilities, approximately two in three males and three in five females reported making similar travel pattern to work locations in the post-COVID-19 era as they did in the pre-COVID-19 era. A small proportion of people with and without travel-limiting disabilities report travelling to physical work locations more than pre-COVID-19 era across gender with 4.5% and 1.7%, respectively, for males and females with travel-limiting disabilities and, 6.8% and 9.6%, respectively, for the males and females without travel-limiting disabilities.

4. Conclusions and Policy Implications

In this study, we employed various descriptive analytical techniques to comparatively explore the 2022 NHTS dataset to understand the distribution of people, their socioeconomic and demographic aspects, and their travel pattern during a 24-hour survey period. The main objective of this study is to extract and describe selected variables for the people with travel-limiting disabilities in rural and urban areas across gender and geographic locations and compare the results to that of the people without travel-limiting disabilities. The main findings of this study are that there are more females with travel-limiting disabilities in the U.S. compared to men, people aged 65 years and above have over 50% travel-limiting disabilities in rural areas and generally, the number of people with travel-limiting disabilities in urban areas is more than four times higher compared to rural areas. The study also explores that during the COVID-19 fourth wave era, a high proportion of people with travel-limiting disabilities reported a reduction in their use of public transit while people without travel-limiting disabilities reported using public transit the same as pre-COVID-19 era. Finally for the impacts of COVID-19 pandemic on travel to physical work locations, we found that across locations, people with and without travel-limiting disabilities reported the same travel pattern as pre-COVID era. On the other hand, across gender, more females with travel-limiting disabilities travel to physical work locations less often than pre-COVID-19 era (57.0%) and more males without travel-limiting disabilities (66.3%) travel the same as before pre-COVID-19 era.

The study reveals how the usage of public transit has reduced, even for the people with travel-limiting disabilities which can greatly impact accessibility to essential services and employment opportunities. This would necessitate the need for policy development to help the vulnerable population group with travel-limiting disabilities. Firstly, there is a need for a better and more accessible public transit system that is user-friendly for the people with travel-limiting disabilities to disincentivize them from driving or using rideshare services. There should also be interventions targeted at females with travel-limiting disabilities in urban areas, the most vulnerable group to address their mobility concerns. Furthermore, there should be collaborations between rural communities and

government agencies to subsidize public transit systems in rural areas for the people with travel-limiting disabilities. There should also be synergy between communities and employers to foster inclusivity for the people with travel-limiting disabilities which will culminate into equity in mobility, access to work, and other opportunities. While this study describes the socioeconomic, demographic and travel related factors of the people with travel-limiting disabilities, there is a need for future studies to isolate, quantify, and describe the six domains of disabilities recognized by the CDC for the people with travel-limiting disabilities. This limitation of this study is due to the aggregation of travel-limiting disabilities by the NHTS survey data that we hope that the future surveys will address.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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