Travel Behavior and Mobility of Transportation-Disadvantaged Populations: Evidence from the National Household Travel Survey

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December 2012

Acknowledgements

This research was sponsored by the Federal Transit Administration, United States Department of Transportation, and conducted by the Small Urban & Rural Transit Center within the Upper Great Plains Transportation Institute at North Dakota State University. The author thanks Jana Lynott from the AARP Public Policy Institute and Steve Polzin from the Center for Urban Transportation Research for their comments on a previous version of the paper. Responsibility for any remaining errors belongs to the author. The guidance of Jill Hough, Director of the Small Urban & Rural Transit Center, and Jarrett Stoltzfus, FTA Project Manager for the project, is also acknowledged.

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ABSTRACT

Older adults, people with disabilities, individuals in low-income households, and those living in rural areas can face significant mobility challenges. This study examines travel behavior and mobility of these transportation-disadvantaged groups by analyzing data from the National Household Travel Survey (NHTS). NHTS data on driving, trip frequency, staying in the same place all day or week, miles driven per year, mode choice, use of public transportation, trip purpose, trip distance, and issues and concerns regarding transportation are highlighted. Differences are shown by age group, gender, household income, whether a person has a disability or condition affecting ability to travel, and whether the individual lives in a rural or urban area. Differences between 2001 and 2009 are documented to identify trends in travel behavior. A binary logit model is used to estimate whether an individual took a trip during the day or week. For those who have not taken a trip for more than a day, a negative binomial logit model is used to estimate the number of days since the last trip. For those who have not taken a trip in more than a week, a binary logit model is used to identify the characteristics of those who would like to get out more often. Lastly, cluster analysis was used to identify transportation disadvantaged groups. NHTS survey respondents were clustered into 12 groups based on household income, age, gender, household size, and if they had a medical condition affecting their ability to travel, and the travel behavior of each cluster was analyzed.

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1. INTRODUCTION

Older adults, people with disabilities, individuals in low-income households, and those living in rural areas can face significant mobility challenges. This study examines travel behavior and mobility of these transportation-disadvantaged groups by analyzing data from the National Household Travel Survey (NHTS).

The age structure of the U.S. population is projected to change significantly over the next few decades, which will present many transportation challenges. It is estimated that the number of adults 65 or older in the United States will double from 2010 to 2040, and the percentage of the population represented by that age group will increase from 13% to 20% (Vincent and Velkoff 2010). Meanwhile, the population aged 85 or older is projected to increase 2.5 times over this period (Vincent and Velkoff 2010). The trend has already begun, as 2010 U.S. Census data showed a 15% increase in the 65 and older population and a 30% increase in the 85 and older population from 2000 to 2010. The fastest growing age group over this period was those aged 60 to 64.

A result of the growing elderly population is an increase in transportation needs for older adults. As Lynott and Figueiredo (2011) showed, the number and share of miles of travel by older Americans continues to increase. Aging baby boomers may also be more active and have greater demand for transportation than previous generations (Coughlin 2009). However, many older adults cannot drive or have limited driving abilities, and research has shown a reduction in quality of life for older adults who cease driving (Oxley and Whelan 2008).

There is also a trend toward aging in place, which can result in greater challenges for seniors, especially those living in rural areas where travel distances are longer and fewer transportation options are available. The *Rural Transit Fact Book* (Small Urban & Rural Transit Center 2012) shows significant differences between urban and rural residents in terms of trips taken, average trip distance, and mode choice. An increase in the population of older adults will also lead to an increase in the number of people with disabilities. Previous research has documented transportation challenges for people with disabilities (Mattson et al. 2010).

1.1 Objectives

The objectives of this study are to identify transportation-disadvantaged populations; quantify differences in travel behavior and mobility based on age, disability, household income, geography, and ability to drive; estimate the impact of transit use on trip-making ability; and identify trends between 2001 and 2009.

1.2 Methods

This study was conducted by analyzing data from the NHTS. The NHTS is a periodic national survey sponsored by the Bureau of Transportation Statistics and the Federal Highway Administration (FHWA). The most recent NHTS was conducted in 2009. Prior to 2009, the most recent survey was in 2001. The 2009 NHTS dataset contains data for 150,147 households, 308,901 individuals, and 1.1 million trips, while the 2001 NHTS dataset contains data for 69,817 households, 160,758 individuals, and 642,292 trips. To produce valid population-level estimates, the FHWA calculated weights for each observation (U.S. Department of Transportation 2004, 2011). These weights are used in the analysis.

NHTS data on driving, trip frequency, staying in the same place all day or week, miles driven per year, mode choice, use of public transportation, trip purpose, trip distance, and issues and concerns regarding transportation are examined. Differences are shown by age group, gender, household income, whether a person has a disability or condition affecting ability to travel, and whether the individual lives in a rural or urban area. Differences between 2001 and 2009 are documented to identify trends in travel behavior. Previous research by Collia et al. (2003) highlighted travel patterns of older adults using 2001 NHTS data, and Lynott and Figueiredo (2011) highlighted data from the 2009 NHTS. This study updates and expands upon the previous research.

A number of differences between urban and rural areas are highlighted in the analysis. The urban and rural classifications are based on the definitions used in the NHTS. Urban is defined to include an urban cluster, an urbanized area, or an area surrounded by urbanized areas. Urbanized areas have 50,000 or more people and urban clusters have at least 2,500 people but less than 50,000 people, and both areas have a core area with a density of at least 1,000 people per square mile. All other areas are defined as rural. The 2009 NHTS includes responses from 216,518 individuals living in urban areas and 92,381 individuals from rural areas.

Regression analysis is conducted to estimate impacts of demographic, socioeconomic, and geographic factors on travel behavior and desire to get out more often. A binary logit model is used to estimate whether an individual took a trip during the day or week. For those who have not taken a trip for more than a day, a negative binomial logit model is used to estimate the number of days since the last trip. Finally, for those who have not taken a trip in more than a week, a binary logit model is used to identify the characteristics of those who would like to get out more often.

Lastly, cluster analysis is used to identify travel behavior for similar groups of individuals. Cluster analysis can be used to identify transportation-disadvantaged groups. NHTS survey respondents were clustered into 12 groups based on household income, age, gender, household size, and if they had a medical condition affecting their ability to travel. Travel behavior of each cluster is analyzed. Using cluster analysis to identify transportation-disadvantaged groups in an inductive manner rather than through a priori definitions is useful for understanding the transportation disadvantaged (Dodson et al. 2010).

1.3 Organization

The paper is organized as follows. Section two provides data from the NHTS on people with disabilities or conditions affecting their ability to drive, describing how those conditions increase with age and how they impact ability to make trips. Travel behavior data for different subgroups are presented in section three, and transportation issues and concerns are discussed in section four. Regression analysis is presented in section five and cluster analysis in section six. Conclusions are presented in the final section.

2. AGING AND DISABILITIES

The NHTS asks respondents if they have a temporary or permanent condition or handicap that makes it difficult to travel outside the home. The survey does not ask for the type of condition or if the respondent has a disability, but the response to this question is likely correlated to having a disability. As you would expect, the response is highly correlated with age. Half of those aged 85 or older reported having a condition that makes it difficult to travel (Figure 2.1).

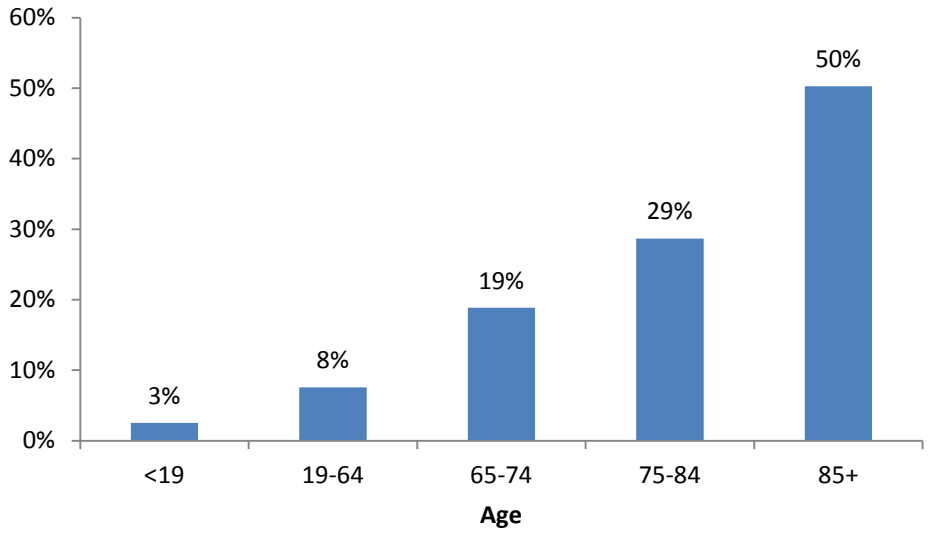

Figure 2.1 Having a Condition that Makes it Difficult to Travel, by Age Group

Of those who have a medical condition making travel difficult, 82% reduce their day-today-travel, 60% ask others for rides, 44% limit driving to daytime, 34% give up driving, 23% use public transportation less frequently, 14% use special transit services, and 6% use reduced-fare taxi (Table 2.1).

Table 2.1 Impact of Condition on Ability to Make Trips

	Total[a]	Geography		Age			
		Urban[a]	Rural[a]	19-64	65-74	75-84	85+
	----------Percentage----------						
Medical condition results in limiting driving to daytime	44	44	46	43	42	50	43
Medical condition results in using bus/subway less frequently	23	26	11	24	23	19	21
Medical condition results in asking others for rides	60	60	58	61	53	58	67
Medical condition results in giving up driving	34	36	27	28	32	41	62
Medical condition results in using special transit services	14	15	7	14	13	13	14
Medical condition results in using reduced fare taxi	6	7	3	7	6	6	6
Medical condition results in reduced day-to-day travel	82	82	81	81	83	84	87

Source: 2009 National Household Travel Survey, Person File
[a]Age 19+

Those in rural areas are less likely to use special transit services or reduced-fare taxi, likely because of reduced availability of these options. Rural residents are also less likely to give up driving as a result of a medical condition, which could be because there are fewer available options. The likelihood that a person with a medical condition would give up driving increases significantly with age, from 28% of those 19-64 to 62% of those 85 or older.

3. TRAVEL BEHAVIOR DATA

3.1 Driving

The percentage of individuals who drive is shown to decrease with age and is higher for males and those in rural areas (Table 3.1). Driving rates tend to be higher in rural areas, likely because of fewer alternative transportation options, but also possibly due in part to racial ethnic differences. For all age groups, both rural and urban, men are more likely to be drivers than women. The difference between men and women increases significantly with age. For those aged 19-64, the difference between men and women is slight (in urban areas, 93% of men drive and 90% of women drive, and the difference is almost non-existent in rural areas). However, for those 85 or older, 68% of men in urban areas and 64% of men in rural areas drive, compared to just 38% of women in urban areas and 41% of women in rural areas.

Table 3.1 Percentage who Drive, by Age, Geography, and Gender

	Urban		Rural	
Age	Male	Female	Male	Female
19-64	93.2 (0.11)	89.6 (0.12)	95.6 (0.13)	95.0 (0.13)
65+	87.3 (0.20)	70.5 (0.24)	92.8 (0.24)	82.0 (0.34)
65-74	91.7 (0.23)	82.0 (0.29)	96.2 (0.23)	91.1 (0.32)
75-84	86.3 (0.35)	67.0 (0.41)	90.9 (0.48)	74.9 (0.67)
85+	68.4 (0.91)	38.3 (0.75)	63.6 (1.77)	40.9 (1.45)

Note: Standard errors are in parentheses
Source: 2009 National Household Travel Survey, Person File

Comparing data from the 2009 NHTS with those from the 2001 NHTS shows there has been little change in driving rates over this period (Table 3.2). The one notable change is an increase in women 85 or older who drive, from 32% in 2001 to 39% in 2009. Although there is still a large gap in driving between older men and women, the gap has decreased since 2001. This trend is likely to accelerate as the baby boom generation enters retirement. Unlike previous generations, driving licensure rates for men and women of the baby boom generation have been very comparable. It is expected that women who have been driving their whole lives will likely continue doing so in retirement, resulting in a much smaller gap between older men and women who drive (Coughlin 2009, Rosenbloon and Herbel 2009).

Table 3.2 Percentage who Drive, by Age and Gender, 2001 and 2009

	Male		Female	
Age	2001	2009	2001	2009
19-64	94.8 (0.11)	93.8 (0.09)	91.3 (0.13)	90.9 (0.09)
65+	89.5 (0.29)	88.6 (0.16)	71.8 (0.38)	72.8 (0.20)
65-74	93.6 (0.30)	92.9 (0.18)	82.4 (0.44)	84.1 (0.23)
75-84	86.8 (0.56)	87.3 (0.29)	67.0 (0.67)	68.4 (0.35)
85+	67.7 (1.78)	67.7 (0.80)	32.1 (1.30)	38.6 (0.66)

Note: Standard errors are in parentheses
Source: 2001 and 2009 National Household Travel Survey, Person File

3.2 Trip Frequency

The average number of trips taken per day for all modes is shown in Table 3.3. Trip frequency is shown to vary by age, household income, and medical condition, and it differs between urban and rural residents. Urban residents were found to take, on average, 3.8 trips per day, compared to 3.6 trips per day for those living in rural areas.

The number of trips taken per day peaks at age 34-49 (4.4 for urban and 4.0 for rural) and declines to 2.7 trips per day for those aged 75 or older.

A clear relationship between trip frequency and household family income is also found. The table shows a few different income groups, and the number of trips per day is shown to increase from 2.8 for the lowest income group to 4.4 for the highest income group in urban areas and from 2.9 to 3.9 in rural areas. The disparity between low-income and high-income households is greater in urban areas.

The number of trips by individual modes also differs between income groups. While low-income groups take the fewest number of total trips, they take more transit trips and walk trips than those with higher income in urban areas. In rural areas, the relationship between transit and walk trips and income is less clear.

Those who have a medical condition making it difficult to travel, including people with disabilities, take significantly fewer trips. In both urban and rural areas, these individuals take, on average, 2.6 trips per day, compared to 4.1 and 3.8 trips per day for those without such conditions in urban and rural areas, respectively. Note that the conditions that make it difficult to travel also make it difficult to participate in the activities one is traveling to. Therefore, while part of the reduction in travel for those with such conditions is because of the challenges of traveling, part of it could also be because of the challenges in participating in the activity.

Table 3.3 Average Number of Trips per Day per Person, by Groups, 2009

	Urban	Rural
Age		
<19	3.30 (0.01)	3.13 (0.02)
19-33	3.91 (0.02)	3.63 (0.03)
34-49	4.38 (0.01)	4.01 (0.02)
50-64	4.10 (0.01)	3.90 (0.02)
65-74	3.71 (0.01)	3.46 (0.02)
75+	2.68 (0.01)	2.71 (0.03)
Household Family Income		
<$5,000	2.83 (0.04)	2.94 (0.07)
$15,000-$19,999	3.25 (0.03)	3.30 (0.04)
$30,000-$34,999	3.78 (0.03)	3.50 (0.04)
$45,000-$49,999	3.80 (0.03)	3.69 (0.03)
$60,000-$64,999	3.82 (0.04)	3.61 (0.06)
$75,000-$79,999	4.19 (0.03)	4.11 (0.04)
$100,000+	4.39 (0.01)	3.93 (0.02)
Gender		
Male	3.80 (0.01)	3.59 (0.01)
Female	3.89 (0.01)	3.66 (0.01)
Medical Condition		
Yes	2.60 (0.02)	2.60 (0.03)
No	4.13 (0.01)	3.84 (0.01)

Note: Standard errors are in parentheses
Source: 2009 National Household Travel Survey, Person File

Figures 3.1 and 3.2 show differences in trips per day (urban and rural combined) between the working-age population (19-64), the young-old (65-74), and the older-old (75-84 and 85 or older), by gender and presence of a medical condition or disability. The results of a t-test show that the differences between men and women and between those with a medical condition and those without are statistically significant at the 1% for each age group shown.

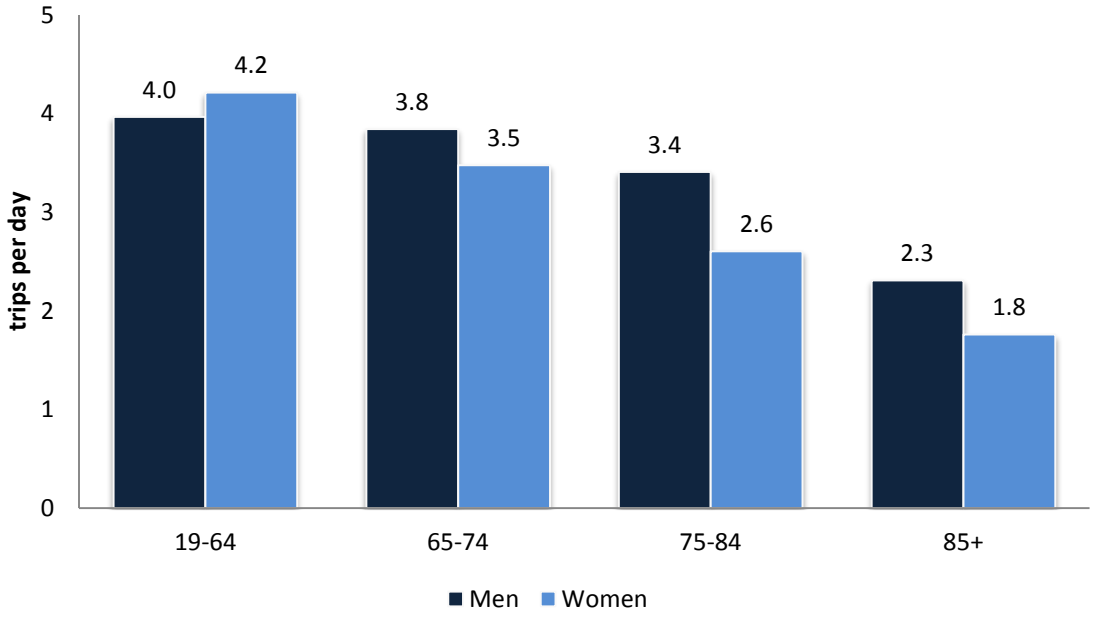

Figure 3.1 Average Number of Trips per Day per Person, by Age and Gender

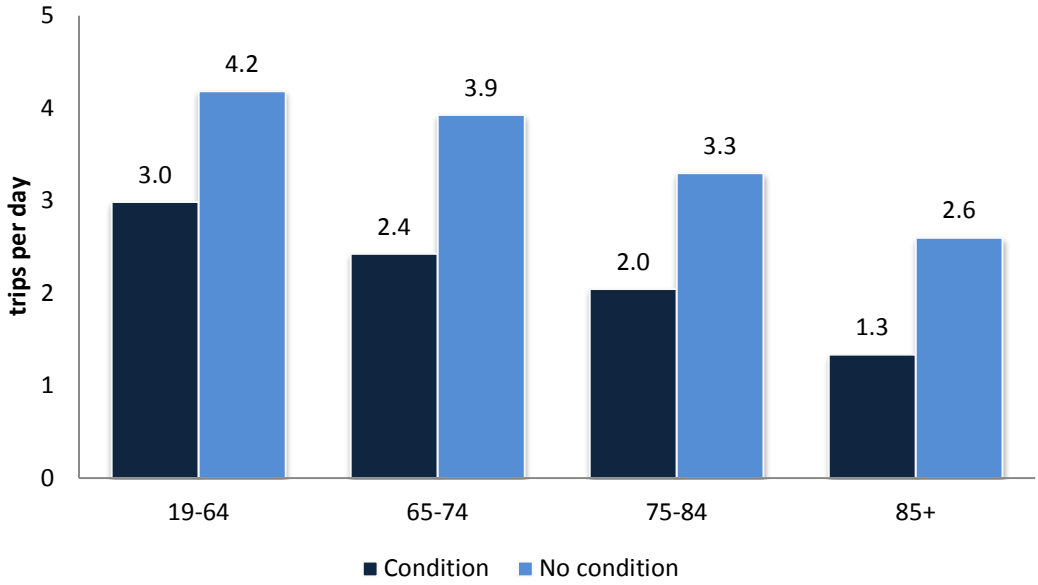

Figure 3.2 Average Number of Trips per Day per Person, by Age and Medical Condition/Disability

The ability to drive has a significant influence on the number of trips taken (Table 3.4 and Figure 3.3). Male drivers aged 19-64 take 4.1 trips per day, while male non-drivers in that age group take just 2.4. A similar difference exists for females. Those 85 or older who can drive take 2.8 trips per day, while male non-drivers take 1.3 trips and female non-drivers take 1.1 trips. The results of a t-test show that the difference in number of trips taken between drivers and non-drivers is statistically significant at the 1% level.

Table 3.4 Average Number of Trips per Day per Person for Drivers vs. Non-Drivers, by Age and Gender, 2009

	Male		Female	
Age	Driver	Non-driver	Driver	Non-driver
19-64	4.07 (0.01)	2.44 (0.04)	4.38 (0.01)	2.58 (0.03)
65+	3.80 (0.02)	1.59 (0.04)	3.52 (0.01)	1.44 (0.02)
65-74	4.00 (0.02)	1.78 (0.07)	3.84 (0.02)	1.58 (0.04)
75-84	3.67 (0.02)	1.60 (0.06)	3.07 (0.02)	1.59 (0.03)
85+	2.78 (0.05)	1.32 (0.06)	2.82 (0.05)	1.09 (0.03)

Note: Standard errors are in parentheses
Source: 2009 National Household Travel Survey, Person File

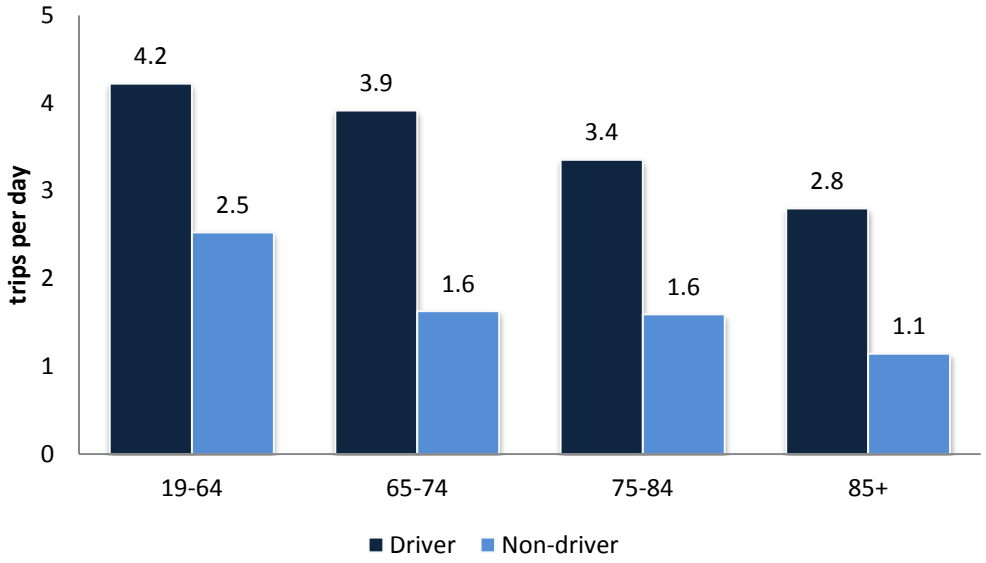

Figure 3.3 Average Number of Trips per Day per Person, by Age, Drivers vs. Non-Drivers

Comparing these numbers with those from the 2001 NHTS shows that the number of trips made per person has decreased for nearly all groups (Table 3.5). For older adults in rural areas, the number of trips per day was largely unchanged from 2001 to 2009, but trip rates for the elderly declined somewhat in urban areas. Trip rates decreased both for low-income and high-income households and for both people with or without medical conditions. While the total number of trips per day declined from 2001 to 2009, the number of bike or walk trips increased.

Table 3.5 Average Number of Trips per Day per Person, by Groups, 2001

	Urban	Rural
Age		
<19	3.53 (0.01)	3.44 (0.02)
19-33	4.30 (0.02)	4.08 (0.04)
34-49	4.73 (0.02)	4.41 (0.03)
50-64	4.30 (0.02)	4.03 (0.03)
65-74	3.96 (0.03)	3.55 (0.05)
75+	2.86 (0.03)	2.74 (0.06)
Household Family Income		
<$5,000	3.02 (0.06)	2.21 (0.11)
$15,000-$19,999	3.64 (0.04)	3.55 (0.07)
$30,000-$34,999	4.03 (0.04)	3.99 (0.06)
$45,000-$49,999	4.20 (0.03)	4.16 (0.05)
$60,000-$64,999	4.33 (0.05)	4.44 (0.08)
$75,000-$79,999	4.37 (0.04)	4.09 (0.07)
$100,000+	4.54 (0.02)	4.18 (0.05)
Gender		
Male	4.07 (0.01)	3.82 (0.02)
Female	4.08 (0.01)	3.88 (0.02)
Medical Condition		
Yes	2.75 (0.03)	2.65 (0.05)
No	4.43 (0.01)	4.17 (0.02)

Note: Standard errors are in parentheses
Source: 2001 National Household Travel Survey, Person File

Differences in trip rates between 2001 and 2009 for working age, young-old, and old-old groups are shown in Figure 3.4 for men and Figure 3.5 for women. The results of a t-test show that for all age groups shown for women and for men 19-64 and 64-74, the differences in trip rates between 2001 and 2009 are statistically significant at the 1% level. For men 85 or older, the difference is statistically significant at the 5% level, and for men 75-84, the difference is statistically insignificant.

Among these different cohorts, the only one that took more trips per day in 2009 was women 85 or older. Possible reasons for the decrease in travel from 2001 to 2009 include higher gasoline prices and an economic downturn when the 2009 survey was conducted. Working-age cohorts were more affected by the economic downturn, which could explain a larger decrease in travel among these groups. Younger individuals are also more likely to take advantage of technology as a substitute for travel.

The figures still show decreases in trips with age and a significant gap between older men and older women. Women 19-64 take more trips per day than their male counterparts, but older men are shown to take more trips than older women, and that difference increases with age. However, Figure 3.5 shows that women 85 or older are making more trips than previously and are narrowing the gender gap.

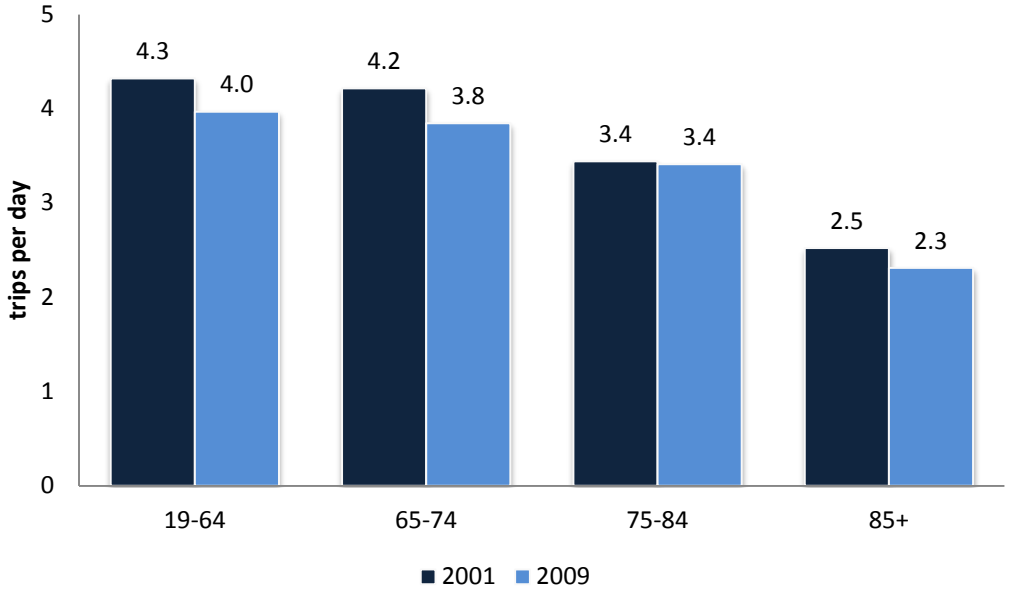

Figure 3.4 Average Number of Trips per Day per Person, by Age, 2001 and 2009, Men

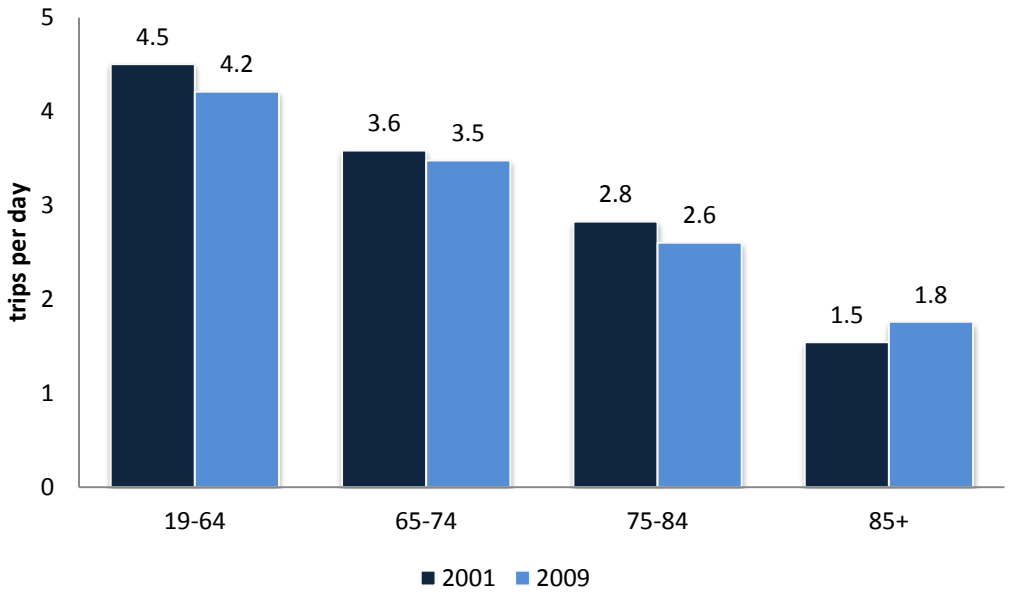

Figure 3.5 Average Number of Trips per Day per Person, by Age, 2001 and 2009, Women

Figure 3.6 shows differences in trips per day between 2001 and 2009, by age group, for those who can drive, and Figure 3.7 shows the same for those who do not drive. The figures demonstrate the significant difference in trips taken between those who drive and those who do not. However, among these cohorts, the only one that took more trips in 2009 than 2001 was non-drivers aged 85 or older. The results show that while a substantial gap in trips taken exists between older drives and older non-drivers, older adults who do not drive are becoming more mobile.

The differences in trip rates between 2001 and 2009 was found to be statistically significant at the 1% level for all age groups of drivers and for non-drivers 19-64 and 85 or older. The differences for non-drivers aged 64-74 and 75-84 are not statistically significant.

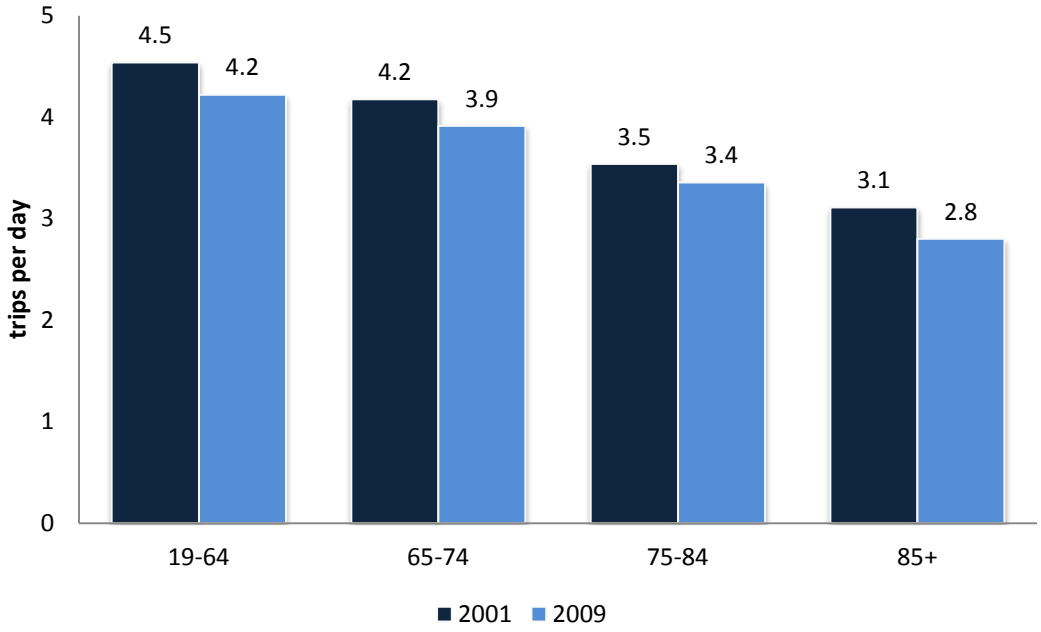

Figure 3.6 Average Number of Trips per Day per Person, by Age, 2001 and 2009, Drivers

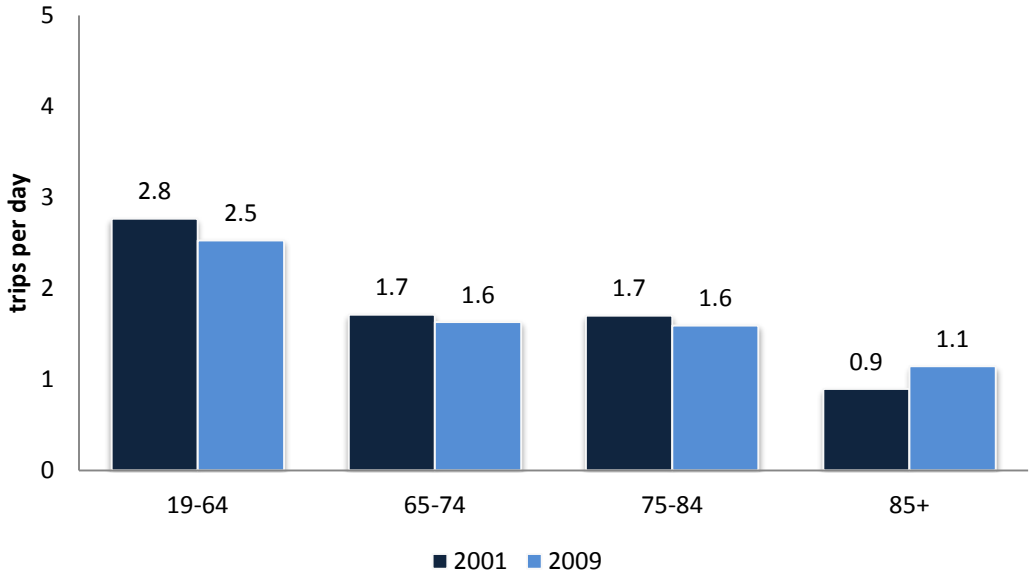

Figure 3.7 Average Number of Trips per Day per Person, by Age, 2001 and 2009, Non-Drivers

3.3 Stayed in Same Place

Fifteen percent of the survey respondents had not taken any trips during the survey day, meaning they stayed in the same place all day. After weighting the data, the results indicate that 13% of individuals do not make any trips in a given day. For those who had not taken a trip during the day, the median number of days since the last trip taken was two days. Twenty-five percent of these respondents had not taken a trip within the previous four days, and 10% had not taken a trip in 10 days. Twelve percent of those who had not taken a trip during the day had not taken a trip in more than a week. Overall, the results show that 1.5% of the population had not taken a trip during the past week, and 0.4% had not taken a trip in the past month.

The data show that those who stayed in the same place were more likely to be older, female, have a medical condition or disability making travel difficult, and have lower income (Table 3.6). The average age of those who stayed in the same place all day was 45.6 and the average age for those who had not traveled in more than a week was 58.4, compared to the average age of 39.2 for those who had made at least one trip during the day. Of those who have not traveled in more than a week, 61% were female and 61% also had a medical condition or disability making travel difficult. Average household income was $50,000-$54,999 for those who had made at least one trip during the day, $40,000-$44,999 for those who had stayed in the same place all day, and $25,000-$29,999 for those who had stayed in the same place all week. Household size is also smaller, on average, for those not making any trips.

Table 3.6 Characteristics of those Making a Trip vs. those Not Making a Trip

	Took at least 1 trip during day	Stayed in same place all day	Stayed in same place all week
Age (mean)	39.2	45.6	58.4
Male (%)	49.7%	45.5%	38.6%
Medical condition (%)	7.5%	28.3%	60.8%
Rural (%)	23.4%	26.3%	20.6%
Household income (mean)	$50,000-$54,999	$40,000-$44,999	$25,000-$29,999
Household size (mean)	3.3	3.2	2.8

Source: 2009 National Household Travel Survey, Person File

Table 3.7 shows the percentage of people on average who take a trip on a given day, categorized by age, gender, and if they have a medical condition. The likelihood of taking a trip decreases with age, is slightly lower for women, and is significantly lower for those with a medical condition. Just 38% of women 85 or older with a medical condition took a trip during the day.

Table 3.7 Percentage who Took Trip on Travel Day, by Age, Gender, and Medical Condition

	Does not have medical condition		Has medical condition	
Age	Male	Female	Male	Female
< 19	86	89	71	80
19-64	91	91	71	71
65-74	87	82	67	60
75-84	85	73	62	53
85+	68	65	50	38

Source: 2009 National Household Travel Survey, Person File

Figures 3.8–3.11 show the percentages of the population that spend the entire day or entire week in the same place, without making any trips. Differences are shown by age, gender, and whether they have a medical condition or disability affecting their ability to travel. Again, people with a condition or disability are found to be substantially more likely to stay in the same place.

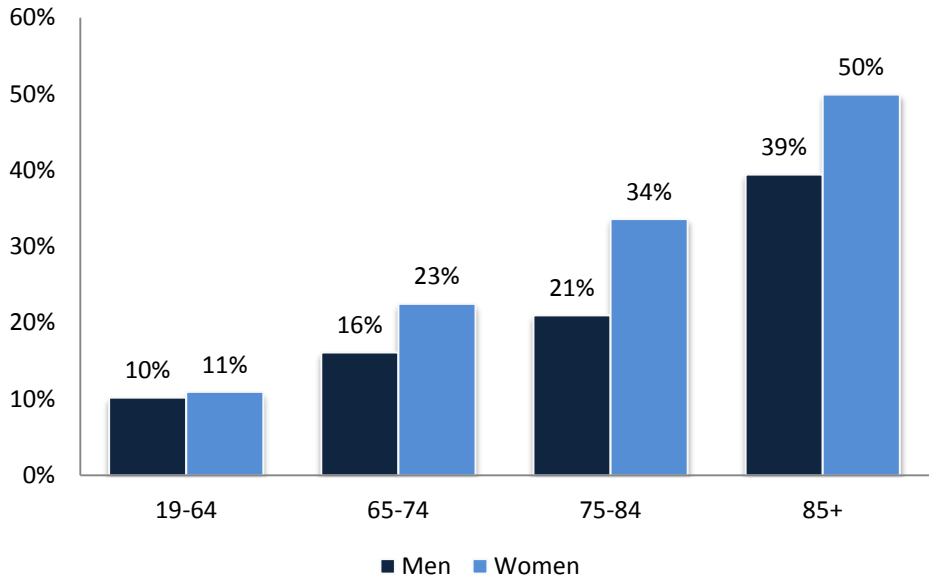

Figure 3.8 Percentage Who Stayed in Same Place all Day, by Age and Gender

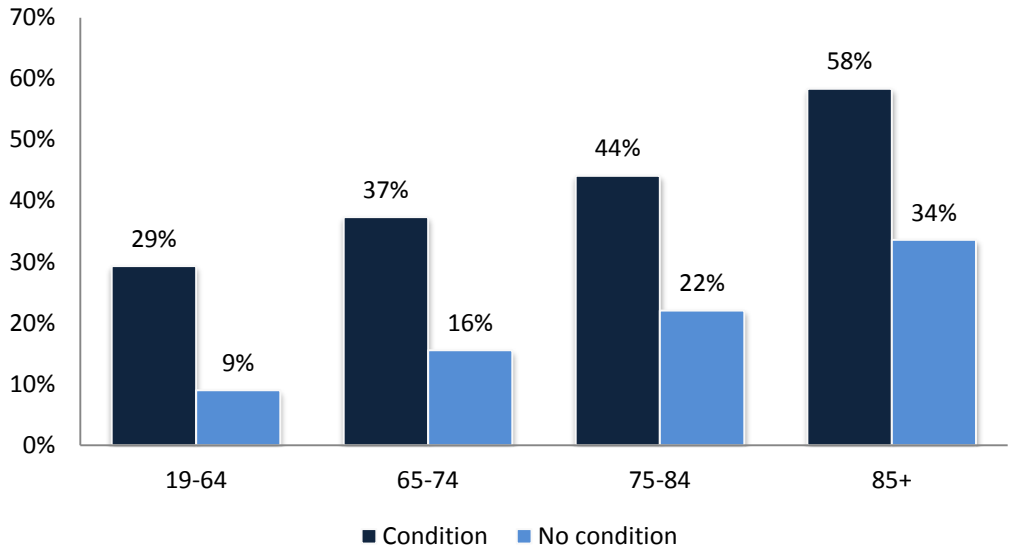

Figure 3.9 Percentage Who Stayed in Same Place all Day, by Age and Presence of Medical Condition or Disability

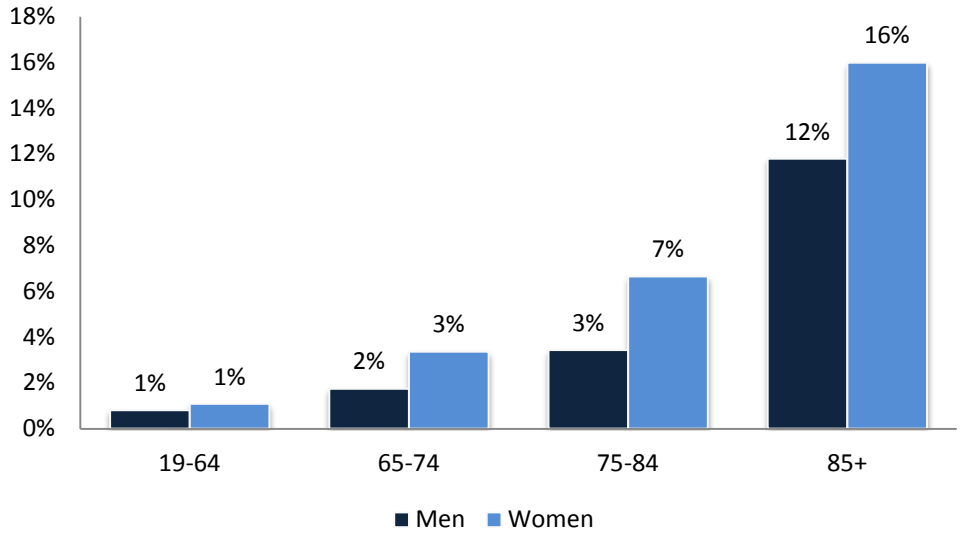

Figure 3.10 Percentage Who Stayed in Same Place all Week, by Age and Gender

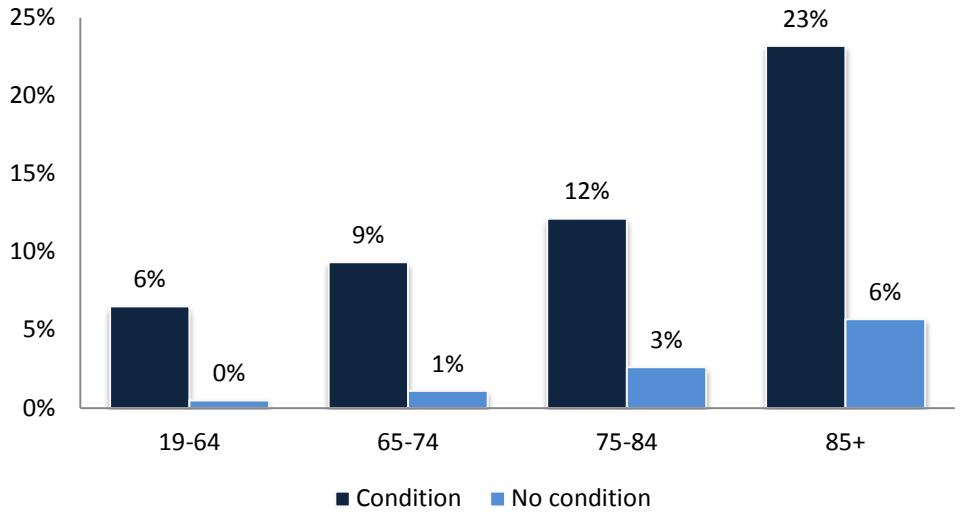

Figure 3.11 Percentage Who Stayed in Same Place all Week, by Age and Presence of Medical Condition or Disability

Those who had not taken a trip in more than a week were asked if they would like to get out more often. Results showed that 59% of those who had not taken a trip in the past week would like to get out more often. Those with a medical condition or disability were more likely than those without to say they would like to get out more often, suggesting their condition is a major limiting factor for the number of trips they take (Table 3.8). Younger respondents and those living in urban areas were more likely to want to get out more often. For all age groups, those with a medical condition were significantly more likely to want to get out more often than those without a condition. There were not any significant differences between income groups in the desire to get out more often, while men were more likely than women to want to get out more often.

Table 3.8 Percentage Among Those Not Making Trip in Last Week Who Would Like to Get Out More Often

	Geography		Medical Condition	
	Urban	Rural	Yes	No
Age				
19-33	78.9 (2.9)	59.4 (5.4)	80.2 (4.5)	70.4 (3.2)
34-49	71.7 (2.4)	51.3 (4.0)	75.8 (2.8)	59.1 (3.0)
50-64	69.3 (1.7)	56.6 (2.4)	75.0 (1.7)	54.3 (2.3)
65-74	54.9 (1.6)	50.2 (2.4)	58.7 (1.8)	48.9 (2.0)
75+	49.3 (1.0)	46.0 (1.7)	55.0 (1.1)	38.6 (1.5)
Gender				
Male	67.3 (1.1)	57.1 (1.7)	70.3 (1.2)	55.9 (1.6)
Female	56.1 (0.9)	50.3 (1.4)	60.9 (1.0)	49.1 (1.2)
Medical Condition				
Yes	67.0 (0.9)	52.9 (1.5)	-	-
No	51.1 (1.2)	52.4 (1.7)	-	-

Note: Standard errors are in parentheses
Source: 2009 National Household Travel Survey, Person File

3.4 Vehicle Miles Driven

While rural residents generally take fewer trips overall, they drive more than their urban counterparts because of longer travel distances and fewer trips taken by public transportation. Table 3.9 shows the differences between urban and rural residents in annual vehicles miles driven per person, or per capita vehicles miles traveled (VMT), with differences shown for age, income, gender, and medical condition.

Overall, urban residents aged 19 or older were found to drive an average of 8,803 miles per year in the 2009 NHTS, while their rural counterparts drove 12,981 miles on average. Miles driven was highest for working-aged adults (especially those 34 to 49), higher-income individuals, men, and people without a medical condition. Average per capita VMT for those aged 75 or older was 3,459 in urban areas and 5,535 in rural areas. Per capita VMT for those in the highest income groups was twice that for those with household income under $20,000. Self-reported data on miles driven over the previous year also shows that median miles driven for those with a medical condition was half of that for those without such a condition.

Table 3.9 also shows the decline in travel from 2001 to 2009. As previous tables and figures in section 3.2 showed a decrease in daily trips taken from 2001 to 2009, this table details the decrease in miles driven per person.

Table 3.9 Average Annual Vehicle Miles Driven Per Person, Urban and Rural

	Urban		Rural	
	2001	2009	2001	2009
Age				
19-33	10,571	7,898	14,313	12,246
34-49	12,035	10,999	16,903	15,079
50-64	10,785	9,412	14,404	13,862
65-74	7,283	6,458	8,835	9,735
75+	3,656	3,459	6,036	5,535
Household Family Income				
<$5,000	2,191	2,404	5,173	4,852
$15,000-$19,999	5,307	4,004	8,821	6,792
$30,000-$34,999	7,506	6,823	9,715	10,986
$45,000-$49,999	7,514	6,983	11,713	11,716
$60,000-$64,999	9,290	7,394	11,539	11,202
$75,000-$79,999	8,942	8,693	11,291	12,464
$100,000+	9,374	9,431	13,389	12,396
Gender, Age 19+				
Male	13,428	11,129	17,654	15,855
Female	7,220	6,650	10,650	10,085
Total, Age 19+	10,286	8,803	14,118	12,981

Source: 2001 and 2009 National Household Travel Survey, Travel Day Trip File

Much of the overall decrease in driving from 2001 to 2009 was due to working-aged men (those who drive the most) driving less. Table 3.10 shows differences in miles driven per capita between 2001 and 2009 by age and gender. Comparisons can be made between the working-aged, the young-old, and the old-old. For all age cohorts, men drive more than women. Most of these cohorts drove fewer miles in 2009, but women aged 65 or older, and also women aged 85 or older, were found to drive more miles in 2009.

Table 3.10 Average Annual Vehicle Miles Driven Per Person, by Age and Gender

	Men		Women	
Age	2001	2009	2001	2009
19-64	15,233	12,947	9,112	8,361
65+	9,789	8,572	3,422	3,614
65-74	11,752	10,165	4,398	4,993
75-84	7,702	7,446	2,646	2,499
85+	3,439	3,047	907	993

Source: 2001 and 2009 National Household Travel Survey, Travel Day Trip File

3.5 Mode Choice and Use of Public Transportation

For those who do not drive, public transportation may provide needed mobility. Analysis of NHTS data shows that use of public transportation is much higher in urban areas than in rural areas. Further, people from lower-income households, especially those in urban areas, are more likely to use public transportation, as are people with medical conditions (Table 3.11).

Table 3.11 Percentage Used Public Transportation on Travel Day

	Urban		Rural	
	2001	2009	2001	2009
Age				
19-33	8.0	7.8	0.9	1.0
34-49	5.3	5.9	1.7	0.7
50-64	4.6	5.6	0.9	0.8
65-74	4.1	4.0	0.7	0.4
75+	3.9	3.8	1.4	0.7
Household Family Income				
<$5,000	15.6	15.9	1.5	1.8
$15,000-$19,999	9.8	8.2	1.7	1.1
$30,000-$34,999	4.5	5.2	1.7	1.4
$45,000-$49,999	4.4	3.7	2.0	0.4
$60,000-$64,999	4.0	3.2	1.8	0.2
$75,000-$79,999	3.8	3.2	2.0	0.9
$100,000+	5.1	4.1	1.7	1.5
Gender				
Male	5.2	5.4	2.0	0.9
Female	6.0	5.7	1.7	0.8
Medical Condition				
Yes	7.2	7.8	2.1	1.9
No	6.0	5.9	1.2	0.8

Source: 2001 and 2009 National Household Travel Survey, Person File

As shown in Table 3.12, 85% of all trips were taken by private automobile (car, van, SUV, or pickup truck), 2.3% by transit, 0.7% by bicycle, 10% by walking, and the remainder by some other mode (such as taxi, motorcycle, RV, airplane, etc.), according to the 2009 NHTS.[1] As expected, the mode share for automobile is higher in rural areas and mode shares for transit, bicycling, and walking are higher in urban areas. Mode shares for transit are 2.4% of trips by those aged 19 to 64, then decreasing to 2.0% for those 65-74 and increasing to 2.9% of trips for those 85 or older. Automobile mode share is not found to decrease with age, remaining at 85% for those 85 or older. Women are shown to be more likely than men to use transit.

Table 3.12 Mode Shares, 2009

	Auto	Transit	Bicycle	Walking
	----------Percentage----------			
Total[a]	85.1 (0.04)	2.3 (0.02)	0.7 (0.01)	10.0 (0.03)
Geography[a]				
Urban	83.6 (0.04)	2.9 (0.02)	0.8 (0.01)	11.0 (0.04)
Rural	90.3 (0.06)	0.4 (0.01)	0.5 (0.01)	6.4 (0.05)
Age				
19-64	84.9 (0.04)	2.4 (0.02)	0.7 (0.01)	10.2 (0.07)
65-74	87.1 (0.08)	2.0 (0.03)	0.6 (0.02)	8.9 (0.07)
75-84	86.8 (0.11)	2.2 (0.05)	0.6 (0.02)	8.4 (0.09)
85+	85.1 (0.26)	2.9 (0.12)	0.1 (0.03)	9.7 (0.22)
Gender[a]				
Men	84.3 (0.05)	2.2 (0.02)	1.2 (0.02)	9.8 (0.04)
Women	85.9 (0.04)	2.5 (0.02)	0.3 (0.01)	10.2 (0.04)

[a]Includes ages 19 and older
Note: Standard errors are in parentheses
Source: 2009 National Household Travel Survey, Travel Day Trip File

[1] Transit is defined to include local public bus, commuter bus, charter/tour bus, city to city bus, shuttle bus, Amtrak/intercity train, commuter train, subway/elevated train, street car/trolley, ferry, and special transit for people with disabilities.

A notable shift in mode share is found when comparing these results to those from the 2001 NHTS (Table 3.13). Mode share for transit, bicycling, and walking increased from 1.8%, 0.4%, and 7.7%, respectively, in 2001 to 2.3%, 0.7%, and 10.0%, respectively, in 2009, while automobile use decreased from 88.6% of trips in 2001 to 85.1% of trips in 2009. This shift in mode shares was found in both urban and rural areas, among all age groups, and for both men and women.

Table 3.13 Mode Shares, 2001

	Auto	Transit	Bicycle	Walking
	----------Percentage----------			
Total[a]	88.6 (0.05)	1.8 (0.02)	0.4 (0.01)	7.7 (0.04)
Geography[a]				
Urban	87.6 (0.05)	2.3 (0.02)	0.5 (0.01)	8.4 (0.05)
Rural	92.4 (0.08)	0.3 (0.01)	0.3 (0.02)	5.0 (0.06)
Age				
19-64	88.5 (0.05)	1.9 (0.02)	0.5 (0.01)	7.5 (0.04)
65-74	89.3 (0.13)	1.3 (0.05)	0.4 (0.03)	8.2 (0.12)
75-84	88.4 (0.19)	1.7 (0.08)	0.3 (0.03)	8.9 (0.17)
85+	87.2 (0.53)	2.9 (0.27)	0.1 (0.06)	9.4 (0.46)
Gender[a]				
Men	88.3 (0.07)	1.6 (0.03)	0.6 (0.02)	7.2 (0.05)
Women	88.8 (0.06)	2.0 (0.03)	0.3 (0.01)	8.1 (0.05)

[a]Includes ages 19 and older
Note: Standard errors are in parentheses
Source: 2001 National Household Travel Survey, Travel Day Trip File

Figures 3.12 and 3.13 illustrate changes in automobile and transit mode shares by age group from 2001 to 2009. Transit mode share increased by 62% for those aged 65-74 (from 1.3% to 2.0%) and by 31% for those aged 75-84 (from 1.7% to 2.2%). The decrease in automobile mode shares from 2001 to 2009 is statistically significant at the 1% level for all age groups shown in Figure 3.12, as is the increase in transit mode shares shown in Figure 3.13 for the 19-64, 65-74, and 75-84 age groups. As Lynott and Figueiredo (2011) found, older adults took more than 1 billion trips on public transportation in 2009, which was a 55% increase over trips recorded in 2001.

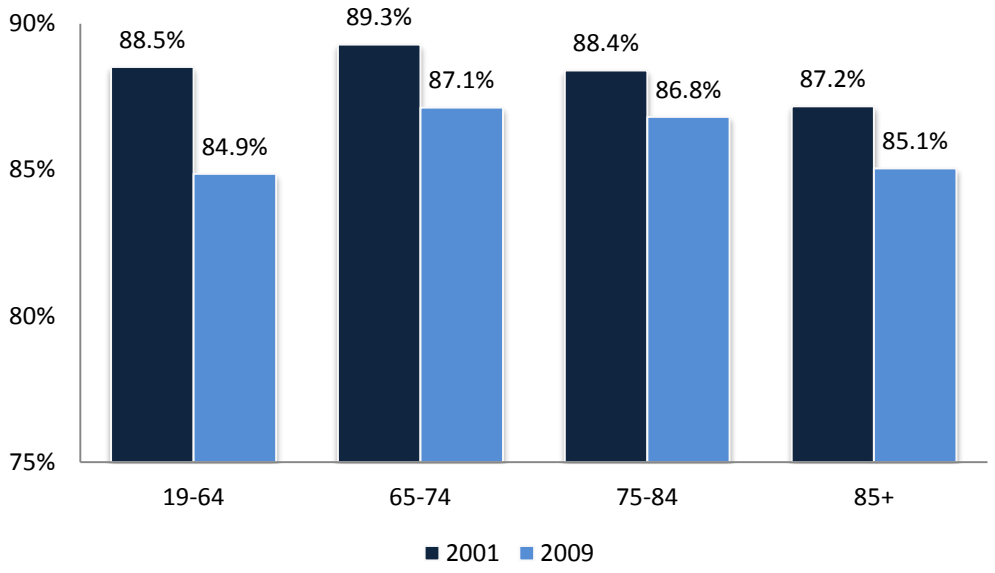

Figure 3.12 Automobile Mode Shares by Age Group, 2001 and 2009

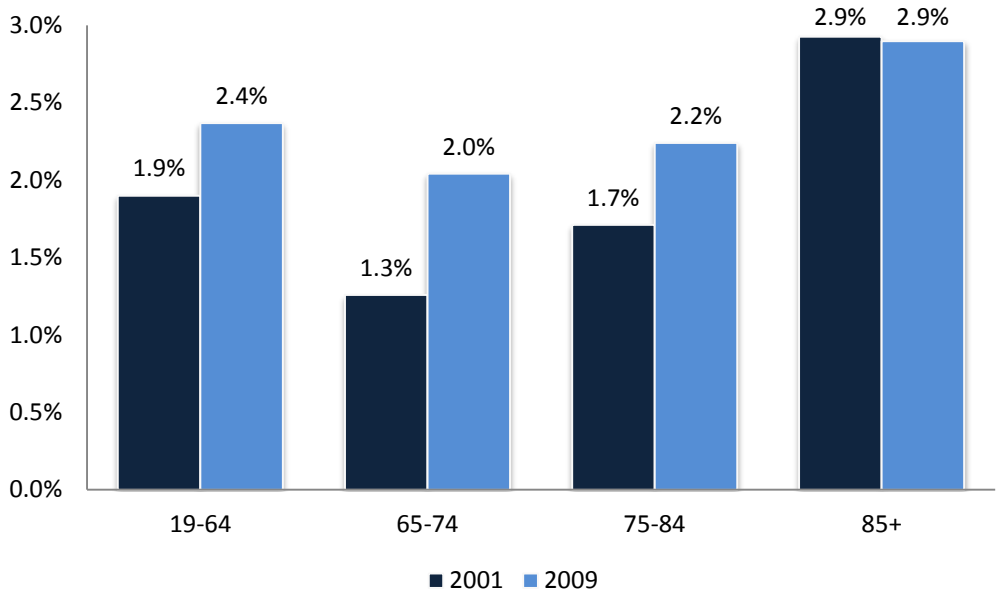

Figure 3.13 Transit Mode Shares by Age Group, 2001 and 2009

Figure 3.14 shows how the percentage of trips made by public transportation increases from rural to larger urban areas. In non-metro areas, just 0.4% of trips are made by public transportation, while 4.6% of trips are made by public transportation in metro areas with a population of 3 million or more.

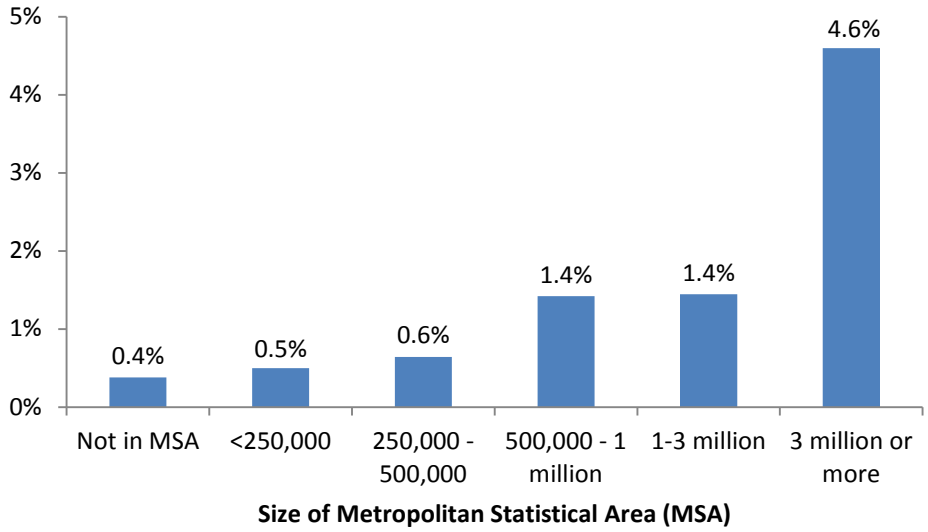

Figure 3.14 Percentage of Trips by Public Transportation, by Size of Metro Area
Source: 2009 National Household Travel Survey

Trips taken by automobile include those in which the traveler was driving as well as those in which he or she was a passenger. Although automobile mode share remains high for older adults, the number of trips taken as a passenger increases with age and is higher for women (Table 3.14). Men are drivers in 93% of all private automobile trips that they take, compared to 81% for women.

Table 3.14 Percentage of Private Vehicle Trips Taken as a Driver, Age 19 or Older

	Men	Women	Total
	----------percentage----------		
Total	93	81	87
Geography			
Urban	93	82	87
Rural	92	79	86
Age			
19-64	93	83	87
65-74	93	77	85
75-84	90	71	81
85+	83	65	74

Source: 2009 National Household Travel Survey, Travel Day Trip File

For men, the percentage of automobile trips taken as a driver decreases from 93% for those aged 19-64 to 83% for those 85 or older. Meanwhile women 19-64 are drivers in 83% of their automobile trips, and women 85 or older are drivers in 65% of those trips.

3.6 Summary of Age, Gender, and Disability Impacts on Mobility

Differences in trip frequency, miles driven, and likelihood of not making a trip by age group, gender, and medical condition are shown in Table 3.15. Changes between 2001 and 2009 are also illustrated.

Table 3.15 Travel Behavior by Age, Gender, and Medical Condition, 2001 and 2009

	2001		2009		2001		2009	
	Men	Women	Men	Women	Condition	No condition	Condition	No condition
Number of Trips per Travel Day								
19-64	4.3	4.5	4.0	4.2	3.3	4.5	3.0	4.2
65+	3.8	3.1	3.6	3.0	2.0	3.9	2.0	3.6
65-74	4.2	3.6	3.8	3.5	2.4	4.2	2.4	3.9
75-84	3.4	2.8	3.4	2.6	2.0	3.5	2.0	3.3
85+	2.5	1.5	2.3	1.8	1.1	2.6	1.3	2.6
Yearly Miles Driven								
19-64	15,233	9,112	12,947	8,361	-[a]	-[a]	-[a]	-[a]
65+	9,789	3,422	8,572	3,614	-[a]	-[a]	-[a]	-[a]
65-74	11,752	4,398	10,165	4,993	-[a]	-[a]	-[a]	-[a]
75-84	7,702	2,646	7,446	2,499	-[a]	-[a]	-[a]	-[a]
85+	3,439	907	3,047	993	-[a]	-[a]	-[a]	-[a]
Stayed in Same Place All Day								
19-64	8%	10%	10%	11%	26%	8%	29%	9%
65+	19%	29%	20%	30%	47%	18%	45%	19%
65-74	16%	23%	16%	23%	41%	15%	37%	16%
75-84	23%	31%	21%	34%	45%	20%	44%	22%
85+	39%	56%	39%	50%	67%	35%	58%	34%
Stayed in Same Place All Week								
19-64	1%	1%	1%	1%	5%	0%	6%	0%
65+	3%	4%	3%	6%	11%	2%	13%	2%
65-74	2%	3%	2%	3%	8%	1%	9%	1%
75-84	4%	5%	3%	7%	10%	2%	12%	3%
85+	7%	12%	12%	16%	18%	4%	23%	6%

[a]Not calculated

Source: 2001 and 2009 National Household Travel Survey, Person File and Travel Day Trip File

3.7 Trip Purpose and Distance by Age Group

Trip purposes are shown to differ between age groups (Table 3.16). As you would expect, work trips decrease for those over age 65. Medical trips increase from 2% of trips for those under age 50 to 7% of trips for those 75 or older. The percentage of trips made for shopping or errands also increases with age. Social and recreational trips account for 15-18% of trips for all ages above 18. However, because older adults take fewer trips overall, they also take fewer social or recreational trips.

Table 3.16 Trip Purpose by Age Group

	Age					
Trip Purpose	<19	19-33	34-49	50-64	65-74	75+
	----------Percentage----------					
Work	3	23	24	23	10	5
School/Daycare/Religious	29	7	3	3	4	5
Medical/Dental	2	2	2	3	5	7
Shopping/Errands	17	24	26	31	38	40
Social/Recreational	28	18	15	16	18	18
Family Personal Business/Obligations	3	4	5	6	7	7
Transport Someone	7	10	13	7	7	5
Meals	9	11	10	10	11	13
Other	2	1	1	1	1	1

Source: 2009 National Household Travel Survey, Travel Day Trip File

Older adults were previously shown to make fewer trips overall, and they also make shorter trips. Average trip distance decreases from 10-11 miles for those aged 34 to 64 to 8.5 miles for those 65 to 74 and 7 miles for those 75 or older (Table 3.17).

Table 3.17 Trip Distance by Age Group

Age	Mean	5th Percentile	Median	95th Percentile
19-33	9.8	0.2	4	31
34-49	11.0	0.2	4	33
50-64	10.2	0.2	4	33
65-74	8.5	0.2	3	28
75+	7.1	0.2	3	25

Source: 2009 National Household Travel Survey, Travel Day Trip File

4. ISSUES AND CONCERNS

The NHTS asked respondents their opinions on different transportation issues, such as safety (defined as worrying about being in an accident), congestion, price of travel, availability or access to public transit, and lack of walkways or sidewalks. Respondents were asked to rate each of these as either a little issue, a moderate issue, or a big issue.

Results from the 2009 NHTS show that, overall, the population has a number of transportation concerns. All of these issues were rated as being a big issue by more than 40% of respondents, and price of travel and availability of public transit were rated as a big issue by more than 50% of respondents. People of all ages, income levels, medical conditions, and geographic location have many of the same transportation concerns, although some differences exist between these different population groups.

People with medical conditions and those in lower-income groups were more likely to indicate that safety concerns are a big issue. Rural residents tended to be slightly less likely to answer that safety concerns are an issue. Congestion is also less of an issue in rural areas, though many rural respondents still consider it a big issue. Middle-aged or working-aged individuals were most likely to view congestion as an issue, likely because they drive more than others, especially in peak period traffic.

The price of travel is a big issue for a majority of individuals and, not surprisingly, lower-income individuals were most likely to report it as a big issue. It was also found to be a bigger issue for rural residents, working-aged individuals, and those with a medical condition. Price of travel may be more important for rural residents and working-aged individuals because they travel more and, therefore, are more affected by changes in costs.

Figures 4.1-4.4 show differences in responses between urban and rural respondents, those with or without a medical condition affecting their ability to travel, select age groups, and select income groups.

Survey respondents were also asked to identify which of these six transportation issues they view as being most important. Price of travel was most often considered the most important issue, regardless of geography, medical condition, age, or even income. While price of travel was an important issue for all demographic groups, the issue was of greater importance for rural, younger, and lower-income individuals.

Forty-four percent of rural respondents considered price of travel to be the most important issue, compared to 32% of urban respondents. On the other hand, rural respondents were less likely than their urban counterparts to consider highway congestion to be the most important issue (13% vs. 19%). People with medical conditions or disabilities were more likely than those without to consider access to transit, lack of adequate walkways, and safety as being the most important issue, while they were less likely to view highway congestion as the most important. Older adults were more likely than those under age 75 to view safety as the most important issue, while they were less likely to cite price of travel as the most important. As might be expected, high-income individuals were less likely than others to consider price of travel to be most important, though it was still cited as the most important issue more often than other issues. High-income individuals were more likely than others to view highway congestion as the most important issue, as it was cited nearly as often as price of travel by those making more than $100,000.

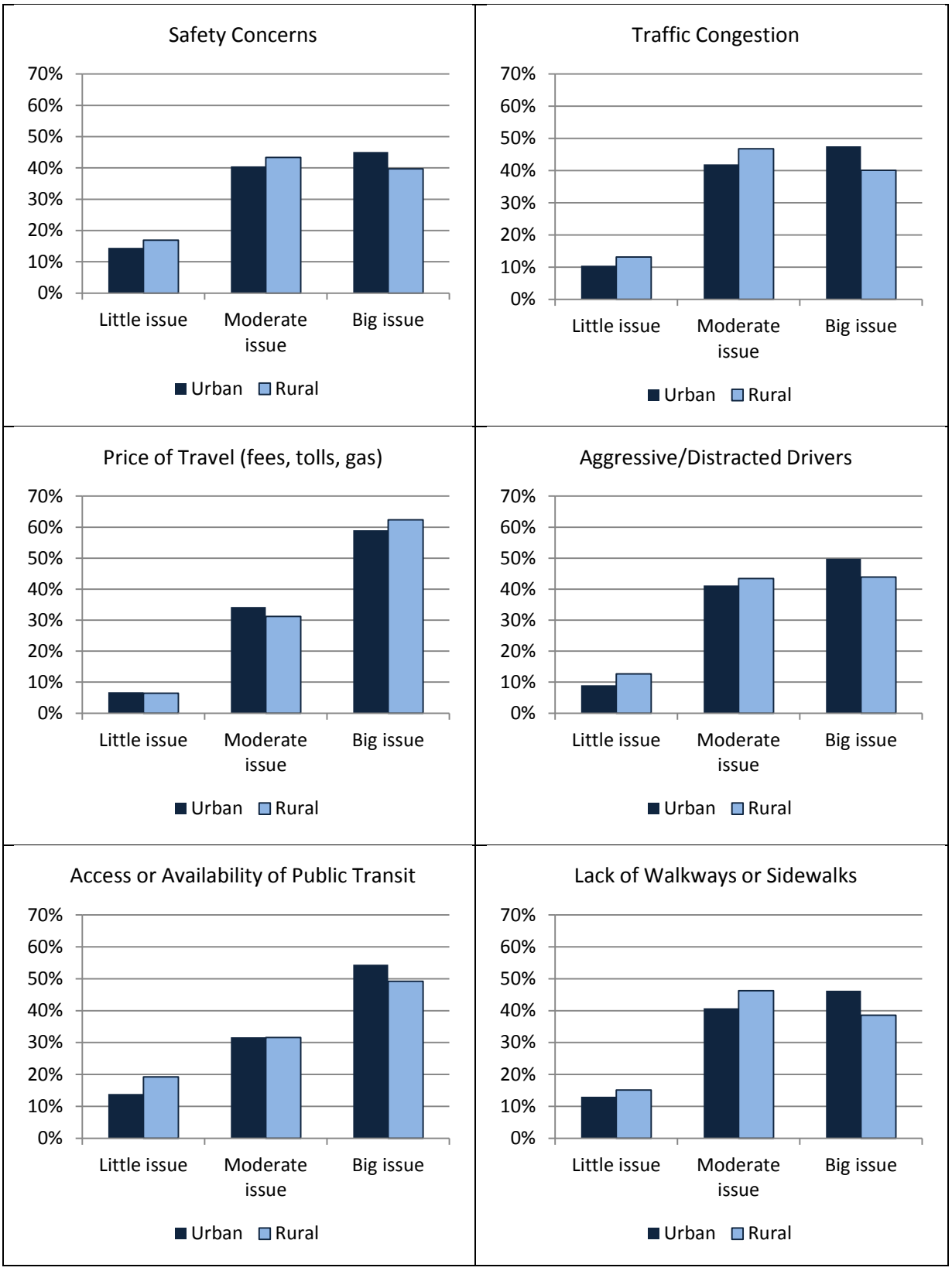

Figure 4.1 Views on Transportation Issues, Urban vs. Rural

Figure 4.2 Views on Transportation Issues, those with a Medical Condition/Disability vs. those Without

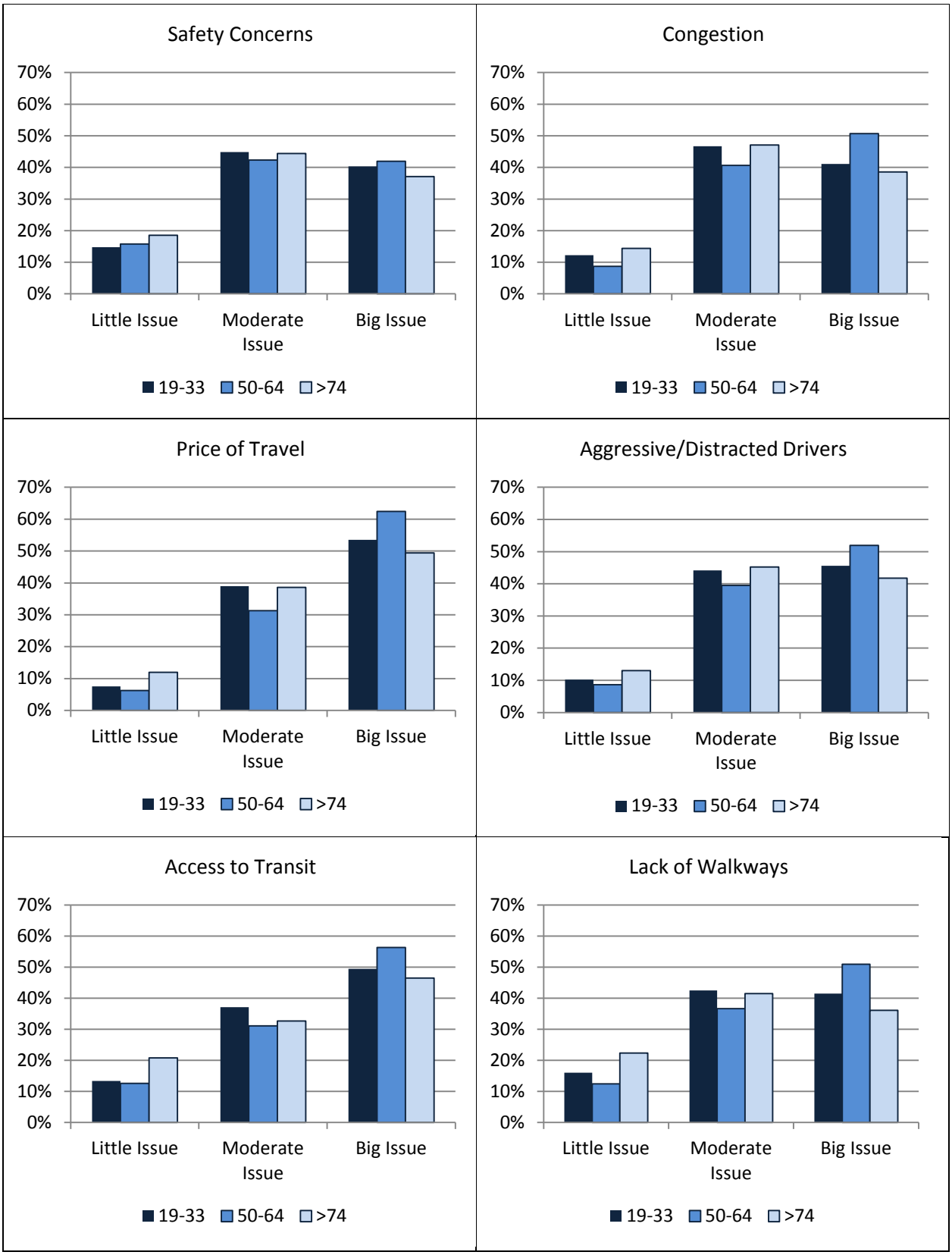

Figure 4.3 Views on Transportation Issues, by Age Groups

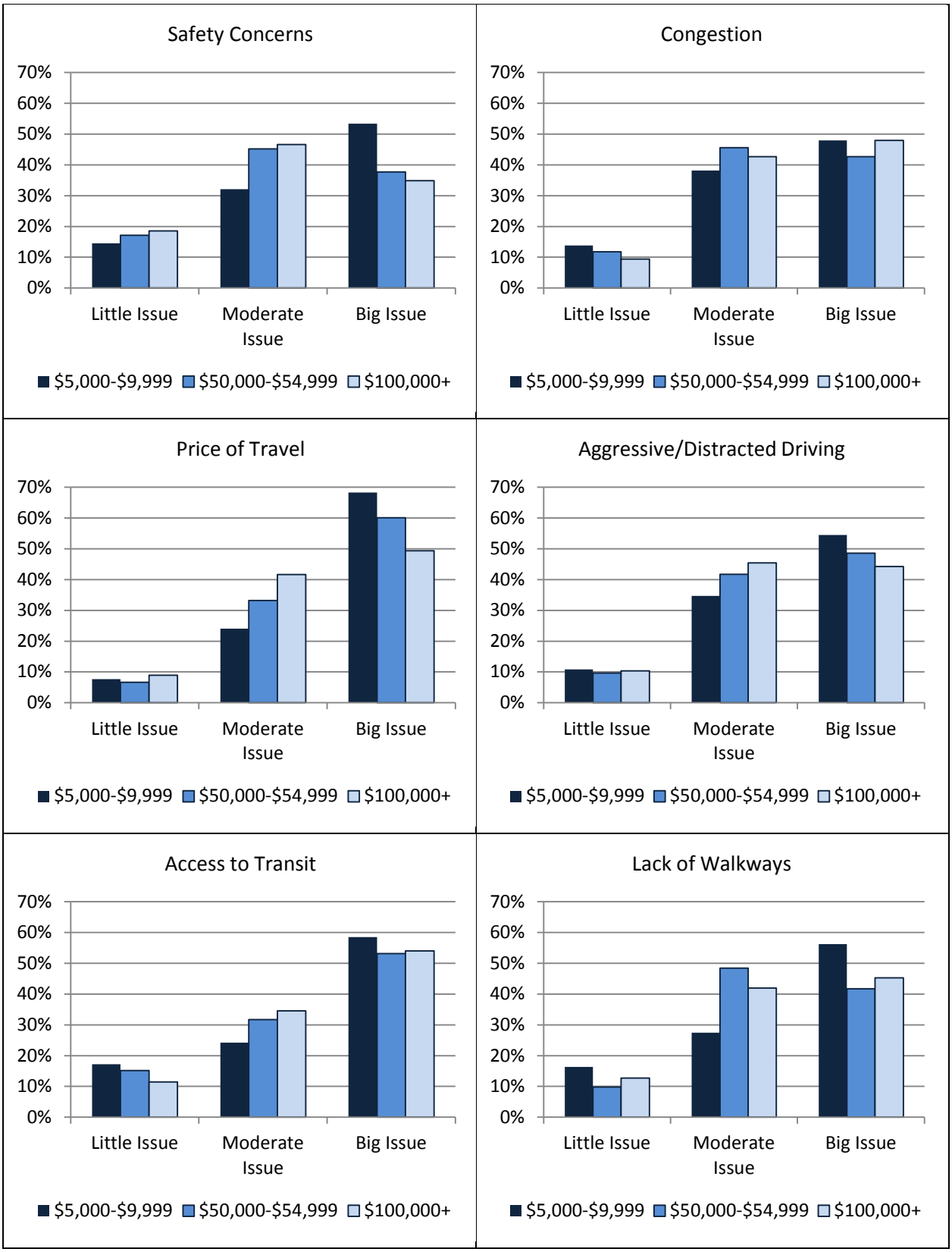

Figure 4.4 Views on Transportation Issues, by Income Groups

5. REGRESSION ANALYSIS

The descriptive statistics showed that older adults and people with medical conditions or disabilities were more likely to stay in the same place during the day. Regression analyses were conducted to better estimate the impact of these and other factors on whether a person makes a trip and their desire to get out more often. The benefit of regression analysis is that it isolates the effects of individual factors.

The likelihood of an individual making a trip on a given day is likely to be influenced by factors that enable or impede the person's ability to make a trip as well as his or her predisposition to travel or need to make a trip. Factors that enable or impede the ability to make a trip may include travel distance (those in rural areas must travel longer distances to reach activities), income, ability to drive, access to transit, whether or not the person has a condition hindering the ability to travel, and possibly household size. Age, gender, and household size could influence a person's need or predisposition to travel.

Binary logit models were estimated to determine the impacts of age, gender, medical condition, geography, household size, household income, ability to drive, and use of transit on whether an individual stayed in the same place all day or all week. For those who stayed in the same place all day, a negative binomial model was used to estimate the impacts of these factors on the number of days since the individual last made a trip. For those who have not made a trip in more than a week, a binary logit model was estimated to find the relationships between these variables and the likelihood that an individual would like to get out more often.

5.1 Stayed in Same Place

The first model estimated is a binary logit model where the dependent variable is a binary variable equal to 1 if the individual did not make a trip and 0 if he or she did. The model was estimated twice. In the first, the dependent variable indicates if the individual did not make a trip during the day; and in the second, the dependent variable indicates if the individual did not make a trip during the week.

The explanatory variables are age, gender, medical condition/disability, whether the individual lives in an urban or rural area, household size, household income, ability to drive, and use of transit. Medical condition, geographic location, income, ability to drive, and use of transit are factors that enable or impede ability to make trips, while age, gender, and possibly household size are factors that could influence an individual's predisposition or need to travel.

Use of transit is a dummy variable equal to 1 if the individual used transit within the last month and 0 if not. It is hypothesized that older adults, those with a medical condition or disability, those living in rural areas, and those from lower-income households are more likely to have not taken a trip. It is also hypothesized that those who can drive or who have used transit within the last month are less likely to have not taken a trip. Household size could have either effect. Those in a larger household are more likely to have someone else in the household to provide transportation, so they may be less likely to stay home. On the other hand, those living alone or in a small household may have a greater need or desire to make a trip, either for social interaction or to make necessary trips, such as shopping, when there is no one else available in the household to make the trip.

Because the transit user variable is defined as someone who has taken a transit trip within the last month, it is known that these individuals have taken a least one trip during this period, which could create an endogeneity problem. To eliminate this problem, individuals who had not taken any trips within the previous 30 days were excluded from the analysis. Individuals under age 18 were also excluded.

Male (equal to 1 if male), medical condition (equal to 1 if they have a medical condition making travel difficult), rural (equal to 1 if living in rural area), driver (equal to 1 if they can drive), and transit user (equal to 1 if used transit within last month) are all dummy variables. Age is measured in years, household size is the count of all household members, and household income is a categorical variable measured along a scale of 1 to 18. Survey respondents were classified into one of 18 income groups with a higher number indicating higher income. Results are shown in Table 5.1.

Table 5.1 Logit Model Results: No Trips During Travel Day or Week

	Day		Week	
Variable	OR	95% CI	OR	95% CI
Age	1.015***	1.01-1.02	1.023***	1.02-1.03
Male	0.809***	0.79-0.83	0.926**	0.86-1.00
Medical condition	2.499***	2.42-2.58	5.027***	4.62-5.47
Rural	1.301***	1.27-1.34	1.229***	1.14-1.34
Household size	1.037***	1.03-1.05	1.125***	1.09-1.16
Household income	0.957***	0.95-0.96	0.929***	0.92-0.94
Driver	0.337***	0.33-0.35	0.261***	0.24-0.28
Transit user	0.667***	0.64-0.70	0.552***	0.47-0.64

Note: OR = odds ratio; CI = confidence interval.
*$p < .10$ **$p < .05$ ***$p < .01$

The results from the model are presented as odds ratios. The odds ratio is a way of comparing whether the probability of an event is the same for two groups of people. The odds of an event happening is equal to the probability of it happening divided by the probability of it not happening. An odds ratio is calculated by dividing the odds in group 1 by the odds in group 2. An odds ratio of 1 indicates the event is equally probable for the two groups, while an odds ratio greater (less) than 1 indicates the event is more (less) likely among the first group. If the odds ratio is greater than 1 for a group of people (males, those with a medical condition, those in rural areas, those who can drive, transit users) it indicates the probability of not making a trip is greater for that group. Because age is measured in years, household size in number of persons, and household income by a 1-18 scale, the odds ratios for these variables is the estimated change in the odds of not making a trip with a one unit increase in the variable.

Results show that these factors all significantly influence the likelihood of an individual not making a trip. All variables are statistically significant at the 1% level, except gender, which is significant at the 5% level in the model for travel in the past week. The results also confirm the hypotheses. Older adults, women, people with conditions or disabilities, those in rural areas, those with lower household income, those who do not drive, and those who do not use transit were found to be more likely to not make any trips. Individuals from larger households were also found to be more likely to stay in the same place.

As age increases by one year, the odds of not making a trip during the day or week increase by 2%. Women have 19% greater odds of not making a trip during the day and 7% greater odds of not making a trip during the week than do men, holding other variables constant. Those with a medical condition or disability are 2.5 times more likely than those without to stay in the same place all day and 5.0 times more likely to stay in the same place all week, everything else equal. Women, older adults, and people with conditions or disabilities are also less likely to drive, further increasing the likelihood of them not making trips.

Individuals living in rural areas were found to be 1.3 times more likely to not make a trip during the day and 1.2 times more likely to not make a trip during the week. The likelihood of not making trips was found to increase with increases in household size and decrease with increases in income.

Findings demonstrate the importance of being able to drive and use of transit on the likelihood of making a trip. Those who drive have 66% lower odds of staying home for the day and 74% lower odds of staying home all week. Those who have used transit within the last month were 32% less likely to stay in the same place all day and 45% less likely to stay in the same place all week. These results show how use of transit increases the number of trips taken and provides rides to individuals who would otherwise not make a trip.

5.2 Number of Days Since Last Trip

For those who had not taken a trip during the travel day, a negative binomial regression was estimated to determine the relationship between individual and household characteristics and the number of days since the last trip was made. For this model, the dependent variable is the number of days since the last trip, which is count data. A Poisson regression model is often used for count data, but because of its implicit restriction on the distribution of observed counts – the variance of the random variable is constrained to equal the mean – more general specifications such as the negative binomial model are generally used (Greene 2008). Because the variance of the dependent variable is significantly greater than the mean, a negative binomial model is more appropriate than the Poisson model.

Results show that the number of days since the last trip increases as age increases and is also greater for women, those with a medical condition or disability, those living in rural areas, those from a larger household, and those with lower household income (Table 5.2).

Table 5.2 Results from Negative Binomial Model: Number of Days Since Last Trip

Variable	Estimate
Age	0.022***
Female	0.0843***
No medical condition	-1.106***
Urban	-0.197***
Household size	0.167***
<$5,000	1.45***
$5,000-$9,999	0.89***
$10,000-$14,999	0.61***
$15,000-$19,999	0.42***
$20,000-$24,999	0.31***
$25,000-$29,999	0.17***
$30,000-$34,999	0.37***
$35,000-$39,999	0.20***
$40,000-$44,999	0.14***
$45,000-$49,999	0.28***
$50,000-$54,999	-0.24***
$55,000-$59,999	0.36***
$60,000-$64,999	-0.29***
$65,000-$69,999	0.20***
$70,000-$74,999	-0.13*
$75,000-$79,999	-0.13**
$80,000-$99,999	-0.22***

*$p < .10$ **$p < .05$ ***$p < .01$

5.3 Desire to Get Out More Often

For those who have not made a trip in more than a week, a binary logit model is used to estimate the relationships between individual characteristics and the desire to get out more often. The dependent variable is a dummy variable equal to 1 if the individual would like to get out more often and 0 if not. Two variables are found to be statistically significant at the 1% level: age and medical condition (Table 5.3). Age was found to have a negative effect. Older adults are significantly more likely to have not taken a trip in the past week, but of those who have stayed in the same place more than a week, younger individuals are more likely to say they would like to get out more often. As age increases by one year, the likelihood of wanting to get out more often declines by 19%.

The model also found that those with a medical condition are significantly more likely to desire to get out more often. They are found to be 2.29 times more likely than those without a medical condition to desire

to get out more. As shown previously, there is a strong correlation between age and having a medical condition that limits travel.

Table 5.3 Results from Binary Logit Model: Would Like to Get Out More Often

Variable	OR	95% CI
Age	0.981***	0.98-0.98
Male	1.005	0.90-1.13
Medical condition	2.29***	2.04-2.57
Rural	0.999	0.88-1.13
Household size	0.960*	0.92-1.01
Household income	0.993	0.98-1.01

Note: OR = odds ratio; CI = confidence interval.

*$p < .10$ **$p < .05$ ***$p < .01$

6. CLUSTER ANALYSIS

Cluster analysis can also be used to identify transportation disadvantaged groups. Cluster analysis is a method that can be used to assign individuals into groups, called clusters, so that individuals in the same cluster are more similar to each other than to those in other clusters. Cluster analysis is useful for identifying transportation-disadvantaged groups through inductive means rather than a priori definitions.

Dodson et al. (2010) employed cluster analysis in their study of household travel survey data for a metropolitan area in Australia. They used the method to identify socially disadvantaged households. Their analysis identified the differences in the travel behaviors between six clusters. They argued that such an analysis is powerful because it "helps to inductively construct meaningful subcategories of individuals and households out of a larger population set." As they noted, cluster analysis has commonly been used in social sciences and occasionally used in transportation research, mostly for market segmentation, but rarely for the analysis of the transportation disadvantaged.

Following Dodson et al. (2010), this study assigned survey respondents into different clusters based on individual characteristics, and the clusters generated by the analysis were used to identify differences in travel behavior.

NHTS survey respondents were clustered based on the following socioeconomic characteristics: household income, age, gender, household size, and if they had a medical condition or disability affecting their ability to travel. These factors were found to have the greatest explanatory power segmenting the respondents. Each of the clusters was further divided into rural and urban groups to identify differences in travel behavior between urban and rural areas.

The PROC FASTCLUS procedure in SAS was used to conduct the analysis. PROC FASTCLUS is designed to be used with very large data sets, such as the data set used for this analysis (Thompson 1998). The procedure uses an algorithm that minimizes the sum of squared distances from the cluster means. In conducting the analysis, some extreme values were removed, and the data were standardized to have a mean of 0 and standard deviation of 1, as recommended by Thompson (1998). The data were standardized so that variables with larger variance would not have more effect on the cluster results.

The analysis resulted in 12 clusters. The number of clusters chosen is somewhat arbitrary but is also based on some statistical measures such as the cubic clustering criteria, pseudo f statistic, and distance between cluster centroids. Having two few clusters results in too much variation within the group, while too many clusters results in fewer individuals in each group and provides an overwhelming amount of data.

The 12 clusters were further divided into rural and urban, because travel behavior differs between urban and rural areas. The socioeconomic characteristics of the clusters can be summarized as follows:

- *Cluster 1:* Middle-to-higher income, older, average household size of two people, mostly women, with a medical condition or disability affecting ability to travel

- *Cluster 2:* Middle-to-lower income, middle-aged, average household size of two people, women, no medical condition limiting travel

- *Cluster 3:* Middle income, middle-aged, average household size of 2-3 people, mostly men, with a medical condition or disability affecting ability to travel

- *Cluster 4:* Low income, older, small household size, mostly women, no condition or disability affecting ability to travel

- *Cluster 5:* Middle-to-lower income, middle-aged, large household size, mostly women, with condition or disability affecting ability to travel

- *Cluster 6:* Higher income, middle-aged, average household size of 2 people, women, no condition or disability affecting ability to travel

- *Cluster 7:* Higher income, younger, larger household size, women, no condition or disability affecting ability to travel

- *Cluster 8:* Higher income, younger, larger household size, men, no condition or disability affecting ability to travel

- *Cluster 9:* Middle-to-higher income, middle-aged to older, average household size of 2 people, men, no condition or disability affecting ability to travel

- *Cluster 10:* Lower income, younger, larger household size, half men and half women, no condition or disability affecting ability to travel

- *Cluster 11:* Low income, older, small household size, half men and half women, with condition or disability affecting ability to travel

- *Cluster 12:* Middle income, younger, very large household size, majority men, no condition or disability affecting ability to travel

The demographic characteristics of the clusters are shown in Tables 6.1 and 6.2.

Table 6.1 Demographic Characteristics of Clusters: Rural

Cluster	Percentage of respondents belonging to cluster	Median Household Income (thousands)	Age		Household Size		Gender	Medical Condition
			Average	Standard deviation	Average	Standard deviation	(Percentage male)	(Percentage with condition)
1	3%	$60-$65	69	11.9	2.1	0.6	9%	100%
2	9%	$35-$40	51	9.7	2.1	0.6	3%	0%
3	3%	$40-$45	50	12.3	2.6	0.8	80%	100%
4	14%	$20-$25	73	7.4	1.7	0.6	21%	0%
5	1%	$35-$40	56	17.2	5.1	1.1	28%	100%
6	15%	$80-$100	56	9.7	2.2	0.5	0%	0%
7	9%	$80-$100	39	9.9	4.2	0.8	0%	0%
8	11%	$80-$100	41	10.2	3.6	0.9	100%	0%
9	23%	$55-$60	63	9.4	2.0	0.5	100%	0%
10	5%	$25-$30	37	12.0	3.9	0.9	53%	0%
11	6%	$15-$20	71	11.0	1.8	0.6	46%	100%
12	2%	$55-$60	41	12.6	6.9	1.4	68%	1%

Table 6.2 Demographic Characteristics of Clusters: Urban

Cluster	Percentage of respondents belonging to cluster	Median Household Income (thousands)	Age		Household Size		Gender	Medical Condition
			Average	Standard deviation	Average	Standard deviation	(Percentage male)	(Percentage with condition)
1	4%	$65-$70	72	11.9	2.0	0.7	11%	100%
2	8%	$35-$40	49	10.5	2.0	0.7	4%	0%
3	2%	$45-$50	49	13.0	2.5	0.8	77%	100%
4	14%	$25-$30	75	7.7	1.6	0.6	17%	0%
5	1%	$35-$40	56	16.8	5.0	1.1	24%	100%
6	16%	$80-$100	57	10.6	2.2	0.6	0%	0%
7	9%	$80-$100	39	10.2	4.2	0.8	0%	0%
8	12%	$80-$100	41	10.5	3.6	0.9	100%	0%
9	21%	$65-$70	64	10.3	2.0	0.5	100%	0%
10	5%	$25-$30	36	11.8	4.0	1.0	51%	0%
11	6%	$15-$20	73	11.6	1.7	0.6	41%	100%
12	2%	$55-$55	41	13.4	6.9	1.1	66%	1%

It is expected that clusters with individuals having lower household income, are older, or who have a condition or disability making travel difficult are most likely be transportation disadvantaged and, therefore, make fewer trips and drive fewer miles. Further, the previous analysis shows that men drive more than women and older men make more trips than older women.

Clusters 1, 3, 5, and 11 consist of individuals with conditions that make travel difficult. Clusters 1 and 11 also consist mostly of older adults, as does cluster 4. The average age in these clusters is in the 70s. Clusters 4, 10, and 11 consist of low-income households, and clusters 4 and 11 have the smallest household size, including many who live alone. Clusters 4 and 11 are especially of interest because they are both low-income, older adults, mostly women, in small households. Cluster 11 is the lowest income cluster and also consists of people with medical conditions or disabilities.

The travel behavior for each cluster was analyzed by calculating average trips per day, bicycle trips per week, walking trips per week, transit trips per month, whether public transit was used on the survey day, and miles driven per year. For this analysis, miles driven per year is derived from the survey question asking respondents to identify how many miles they had driven over the previous year. These data differ from the VMT numbers presented in section 3.4, which were derived from actual trip data reported to the NHTS. The difference is that the miles driven reported in this section are likely to be less accurate and higher than actual VMT, because individuals might not accurately remember how many miles they have driven, and they often over-estimate their VMT. Nevertheless, the data are useful for identifying differences between clusters.

The monthly average number of items purchased from the Internet and delivered to home was also calculated. Internet deliveries can partially compensate for reduced mobility and reduce the number of trips needed.

The results are shown in Tables 6.3 and 6.4. Clusters 1 and 11 were found to be the most transportation disadvantaged, taking the fewest trips and driving the fewest miles, followed by clusters 3, 4, and 5. Cluster 11 takes an average of 2.2 trips per day in rural areas and 2.3 trips in urban areas, while cluster 1 takes 2.3 and 2.4 trips per day in rural and urban areas, respectively. Cluster 11 also drove the fewest miles, 5,882 in rural areas and 4,782 in urban areas. Cluster 11 consists of low-income older individuals with disabilities or medical conditions living in smaller households.

The most mobile clusters, the ones making the most trips and driving the most miles, are clusters 6-9 and 12. These tend to be high-income or younger clusters comprised of people without disabilities or medical conditions that hinder travel. Cluster 7, which consists of young, high-income women with larger household sizes and no disabilities that limit travel, took the most trips per day – 4.5 in rural areas and 5.0 in urban areas.

Table 6.3 Travel Behavior of Clusters: Rural

Cluster	Trips per day	Bike trips per week	Walk trips per week	Transit trips per month	Used transit on travel day	Miles driven last year	Internet deliveries per month
1	2.3	0.03	3.1	1.7	0.01	7,097	4.2
2	3.7	0.11	5.2	2.3	0.01	12,006	2.7
3	2.8	0.09	4.9	1.4	0.01	11,947	3.4
4	3.2	0.08	4.5	1.2	0.00	7,560	2.7
5	2.6	0.06	4.1	1.2	0.01	11,298	3.2
6	4.0	0.12	4.8	1.8	0.01	12,970	3.4
7	4.5	0.15	4.4	1.8	0.01	15,281	3.5
8	4.0	0.25	4.7	2.2	0.01	21,747	3.0
9	3.9	0.19	5.7	1.7	0.00	17,220	2.9
10	3.6	0.20	5.0	2.0	0.01	15,847	2.9
11	2.2	0.05	3.4	1.8	0.01	5,882	2.6
12	3.9	0.23	4.8	2.7	0.01	19,807	3.3

Table 6.4 Travel Behavior of Clusters: Urban

Cluster	Trips per day	Bike trips per week	Walk trips per week	Transit trips per month	Used transit on travel day	Miles driven last year	Internet deliveries per month
1	2.4	0.03	2.2	0.8	0.02	5,647	3.8
2	4.1	0.17	4.3	2.4	0.04	9,575	2.7
3	3.0	0.19	3.9	2.5	0.05	9,817	3.4
4	3.5	0.10	3.6	1.1	0.02	5,853	2.5
5	2.8	0.07	3.1	1.7	0.05	7,587	3.6
6	4.4	0.13	4.1	1.7	0.02	10,388	3.3
7	5.0	0.19	3.8	1.6	0.02	12,020	3.5
8	4.3	0.37	4.1	2.4	0.03	16,798	3.1
9	4.2	0.27	4.5	1.5	0.02	13,597	2.8
10	3.9	0.29	4.1	2.8	0.05	12,261	2.8
11	2.3	0.08	2.8	1.4	0.04	4,782	3.0
12	4.2	0.25	3.5	2.2	0.04	14,906	3.2

Miles driven varies significantly between the clusters and is also shown to be higher in rural areas. In cluster 8, which consists of high-income, younger men without disabilities, the average miles driven was 21,747 in rural areas and 16,798 in urban areas, nearly four times greater than the miles driven by cluster 11.

Bicycle trips tend to be higher among clusters that are younger and consist of men. Walk trips are lower among clusters with older adults that have disabilities or medical conditions. In urban areas, transit use tends to be higher among clusters with lower income.

Internet deliveries were found to be highest among cluster 1, which is among the most transportation-disadvantaged clusters. This group consists of middle-to-higher income, older women with a disability or condition making travel difficult. Among the twelve clusters, they take the second fewest trips and get the most Internet deliveries per month. This finding suggests they are able to offset some of their mobility disadvantage by making purchases through the Internet. Other transportation-disadvantaged groups with lower income make fewer Internet purchases.

7. CONCLUSIONS

This study examines data from the National Household Travel Survey on travel behavior and mobility of transportation-disadvantaged populations, including older adults, people with disabilities, and those with lower income. Comparisons are made between urban and rural areas, and differences between the 2001 and 2009 survey data are identified. Main findings from the descriptive analysis include the following:

- Disabilities and medical conditions increase significantly with age. Half of those 85 or older have such a condition affecting their ability to travel. For most of them, it results in reduced day-to-day travel.
- A gap exists between older men and women in terms of driving and trips, as older men are more likely to drive and take more trips. However, the gap is narrowing as the percentage of women 85 or older driving has increased and the number of trips taken by this cohort has increased.
- While overall per capita VMT decreased from 2001 to 2009, per capita VMT for older women slightly increased.
- Despite a small increase in travel by older women, there is still a significant decline in travel, in terms of number of trips and trip distance, with age.
- Individuals with medical conditions or disabilities and those who do not drive make significantly fewer trips per day.
- The number of trips by non-drivers 85 or older, while low, increased from 2001 to 2009.
- Older adults, women, and those with a medical condition or disability are more likely to stay in the same place all day or week.
- Individuals from rural areas and those with lower household income are also more likely to stay in the same place, while being a driver or a transit user significantly decreased the likelihood of not making a trip.
- Of those not making a trip in the last week, younger individuals and those with medical conditions or disabilities are more likely to want to get out more often; though large percentages of all groups say they would like to get out more.
- Automobile mode shares for all age groups decreased from 2001 to 2009.
- Transit mode shares for nearly all age groups in both urban and rural areas increased from 2001 to 2009.
- Concerns about getting into an accident, congestion, price of travel, aggressive or distracted drivers, access to transit, and lack of walkways are important issues for a large percentage of the population, but they tend to be more important for people with disabilities or medical conditions and low-income individuals.

A binary logit model was estimated to determine the impacts of individual characteristics, ability to drive, and use of transit on whether an individual stayed in the same place all day or all week. Results show that older adults, women, people with conditions or disabilities, those in rural areas, individuals from larger households, those with lower household income, those who do not drive, and those who do not use transit were significantly more likely to not make any trips.

Findings demonstrate the importance of being able to drive and use of transit on the likelihood of making a trip. Those who drive have 66% lower odds of staying home for the day and 74% lower odds of staying home all week. Those who have used transit within the last month were 32% less likely to stay in the same place all day and 45% less likely to stay in the same place all week. These results show how use of transit increases the number of trips taken and provides rides to individuals who would otherwise not make the trip.

Results from a negative binomial regression show that for those who did not take a trip during the day, the number of days since the last trip increases with age and is also greater for women, those with a medical condition or disability, those living in rural areas, those from a larger household, and those with lower household income. Among those who have not taken a trip in more than a week, results from a binary logit model show that younger adults and people with a medical condition or disability are most likely to want to get out more.

Cluster analysis was used as an additional tool for identifying transportation-disadvantaged groups. Such an analysis can identify these groups through inductive means rather than a priori definitions. NHTS survey respondents were clustered based on the following socioeconomic characteristics: household income, age, gender, household size, and if they had a medical condition or disability affecting their ability to travel. Each of the clusters was further divided into rural and urban groups to identify differences in travel behavior between urban and rural areas. The travel behavior for each cluster was analyzed by calculating average trips per day, bicycle trips per week, walking trips per week, transit trips per month, whether public transit was used on the survey day, and miles driven per year.

The most transportation-disadvantaged clusters were found to be those with a higher percentage of older adults, especially women, who have a medical condition or disability. Some of these transportation-disadvantaged individuals are able to partially offset their lack of mobility through use of Internet deliveries. The group consisting of middle-to-higher-income older women with a disability or condition took the second fewest trips among the twelve clusters but also had the most Internet deliveries.

Overall, the results demonstrate the differences in mobility between different population groups. The strong desire to get out more often by those not making a trip within the last week shows the importance of mobility on quality of life. People with disabilities or medical conditions are shown to make significantly fewer trips than others, while expressing a desire to get out more often. Trends from 2001 to 2009 show increased use of transit. Older women are driving more and making more trips, slowly closing the gap between older men and women. These trends may continue as the active baby boom generation retires and expects to maintain their mobility.

8. REFERENCES

Collia, Demetra V., Joy Sharp, and Lee Giesbrecht. (2003). "The 2001 National Household Travel Survey: A Look into the Travel Patterns of Older Adults." *Journal of Safety Research* 34: 461-470.

Coughlin, Joseph F. (2009). "Longevity, Lifestyle, and Anticipating the New Demands of Aging on the Transportation System." *Public Works Management & Policy* 13 (4): 301-311.

Dodson, Jago, Matthew Burke, Rick Evans, Brendan Gleeson, and Neil Sipe. (2010). "Travel Behavior Patterns of Different Socially Disadvantaged Groups: Analysis of Household Travel Survey Data for a Dispersed Metropolitan Area." *Transportation Research Record: Journal of the Transportation Research Board* 2163: 24-31.

Greene, William. (2008). "Functional Forms for the Negative Binomial Model for Count Data." *Economic Letters* 99: 585-590.

Lynott, Jana and Carlos Figueiredo. (2011). "How the Travel Patterns of Older Adults are Changing: Highlights from the 2009 National Household Travel Survey." AARP Public Policy Institute. Fact Sheet 218, Washington, DC.

Mattson, Jeremy, Jill Hough, and Al Abeson. (2010). "Assessing Existing and Needed Community Transportation for People with Disabilities in North Dakota." Department Publication No. 231, Upper Great Plains Transportation Institute, North Dakota State University.

Oxley, Jennifer, and Michelle Whelan. (2008) "It Cannot Be All about Safety: The Benefits of Prolonged Mobility." *Traffic Injury Prevention* 9 (4): 367-378.

Rosenbloom, Sandra, and Susan Herbel. (2009). “The Safety and Mobility Patterns of Older Women: Do Current Patterns Foretell the Future?” *Public Works Management & Policy* 13 (4): 338-353.

Small Urban & Rural Transit Center. (2012). "2012 Rural Transit Fact Book." Upper Great Plains Transportation Institute, North Dakota State University.

Thompson, Mark E. (1998). "The Science and Art of Market Segmentation using PROC FASTCLUS." PNWSUG 1998 Conference Proceedings. Pacific Northwest SAS Users Group.

U.S. Department of Transportation, Federal Highway Administration. (2004). 2001 National Household Travel Survey User’s Guide (Version 3).

U.S. Department of Transportation, Federal Highway Administration. (2011). 2009 National Household Travel Survey User’s Guide (Version 2).

Vincent, Grayson K., and Victoria A. Velkoff. (2010). "The Next Four Decades: The Older Population in the United States 2010 to 2050." Current Population Reports, U.S. Census Bureau.