Realized Travel Demand and Relative Desired Mobility of Elderly Women in Rural and Small Urban North Dakota

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Disclaimer

ABSTRACT

Mobility for the aging is a topic of paramount importance around the world and in the United States. The population of elderly is increasing. The future aging population is used to higher levels of mobility than the past aging populations. Further, a trend of aging in place may impose more stress upon the less densely populated regions that tend to have fewer mobility options. Women may face the greatest mobility challenges because of their tendency to live longer than men, to have more health-related problems than men, and to stop driving earlier than men. Therefore, it is important to better understand the met and unmet mobility needs of women age 65 and older. This study applies a multi-level conceptual ecological model to improve our understanding of women's realized travel demands (RTD – current level of trips) and their relative desired mobility (RDM – desire for more or fewer trips). We used 1,021 responses of women age 65 and older living in rural and small urban North Dakota collected by a telephone survey in August 2006 for this study. We investigated the level of trips and the desire for more or fewer trips for nine trip types (doctor, store, pharmacy, hair salon, eating out, visiting friend, attending church, exercise, and no particular destination). Bivariate and multivariate analyses were used to identify the significant variables categorized within the individual level (self-efficacy, physical limitations, etc.), social environment (family, friends, neighbors, etc.), and physical environment (rural vs. urban) that impact the current level of trips and the desired trips. We found that women with higher levels of self-efficacy and cognitive abilities have higher RTD and lower RDM while women with physical limitations make fewer trips and desire to make more trips. Women with larger social networks (family, neighbors, etc. to provide rides) have higher RTD and lower RDM. Further, women living in rural environments make fewer trips than women in urban areas, but are equally happy with their trips.

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It was once said that the moral test of government is how that government treats those who are in the dawn of life, the children; those who are in the twilight of life, the elderly; and those who are in the shadows of life, the sick, the needy and the handicapped.

− Hubert H. Humphrey

1. INTRODUCTION

Advances in medicine and a declining birth rate are resulting in an aging U.S. population. In 1970, only about 10 percent of the U.S. population was older than age 65. In 2000, 35 million Americans (12.4 percent) were age 65 and older (U.S. Census Bureau 2005). It is estimated that by 2010 the 65 and older population will total more than 40 million or 13 percent of the population. By the year 2030, this estimate increases to more than 71 million or 19.7 percent of the population (U.S. Census Bureau 2005). With this shift in population distribution by age, the service needs of the expanding elderly population will grow; but fewer young people will be available to pay for them.

There is a tendency toward aging in place. The elderly populations are dispersed throughout the United States with 23 percent living in rural areas; 21 percent living in center city; and 56 percent living in the suburbs (Lavada Desalles 2002 as cited in Rosenbloom 2003b). Frey (2000) found that 31 percent of the suburban population was between 35 and 54, and that most plan to remain in the suburbs as they grow older. Census data revealed that one-year and five-year moving rates are the lowest among individuals 65 and older and have been declining. Rosenbloom (2003b) found that Americans age 65 and older are only one-fourth as likely to move after they retire as compared to the elderly Americans 30 years ago. Therefore we can expect the elderly population living in rural areas to remain in their homes as long as possible.

North Dakota has experienced an aging population and an out-migration of the young. North Dakota is a rural state with 53 counties. The population in 2000 was 633,840, with 94,478 seniors. North Dakota has not experienced the trend that young families moved into the rural areas as some rural states have experienced. The out-migration translates into a lower tax base as well as fewer young people available to provide support to the elderly people. In addition, North Dakota has been a predominately agricultural-based state with shifts to manufacturing and services. Many farmers hold off-farm jobs to meet financial obligations. There is a love of the land among many rural residents in North Dakota and the elderly people do not want to leave homes where they have lived for decades and raised their families. However, the challenges that lie ahead may make it difficult for the elderly people to remain in their rural homes.

Individuals aging in rural areas may face greater challenges than their peers aging in larger urban locations. The trends occurring in rural areas, with the exodus of the young, reduced tax base, and aging infrastructure, may deplete or greatly reduce the availability of resources necessary for the elderly population in rural areas to remain in their homes. One trend is a consolidation of services, resulting in fewer locations where services are found and longer distances to reach those locations on average. The trend of removing services (for example, fewer clinics) from rural areas produces challenges for the elderly people who tend to need medical services more frequently as they age. Another trend is increasingly difficult driving conditions on the way to these more distant destinations. North Dakota has more roads per capita than any other state in the nation. The state, counties, and townships face challenges maintaining their roads and in some instances have declared some roads “minimum maintenance,” meaning they are rarely serviced and do not have winter service such as snow removal. The elderly women that are still able to drive may find it extremely difficult to purchase groceries or to travel to

medical services because of the changing characteristics of rural areas. The rural elderly people have to travel farther to reach medical services and purchase groceries and often travel on poorer roads. As they age, those who once drove will eventually have to give up their driver's licenses because of safety reasons. These challenges may become even greater for women who live in rural locations because of the distances to services.

The challenges for women are even greater than those for men. Studies show that women tend to live longer than men, and many of widowed women live alone (Arber and Ginn 1991). Also, women tend to have more health related problems which impact their driving/mobility than men (Arber and Cooper 1999; Leveille, et al. 2000). Some rural elderly women have never driven because they relied on their husbands for their travel needs. When these women become widowed, their travel choices narrow. These women who either never learned to drive or do not feel comfortable driving on rural roads (particularly as the women age) must find someone to help them travel to their appointments, buy groceries, and travel to social events. Some of the rural areas have public transportation service, but often these services are limited at best. The limited services may include a weekly or monthly trip to a major medical facility. Therefore, the ability of rural elderly women to have a ride when it is needed or desired is being challenged. On the other hand, the elderly women can choose to move into an urban area where they will be closer to services. However, they may find moving to town to be much more expensive than their current living situation and may not feel they can afford the change in location.

Limited travel data exists for the rural elderly population, therefore little is known about their travel behaviors. The National Household Travel Survey (NHTS) is an important source of travel behavior studies. However, there is no data available for the rural states of North Dakota, South Dakota, Montana, or Wyoming although data are available for the nearby states of Minnesota, Illinois, Iowa, and Michigan. Therefore, the studies that have been conducted using NHTS data do not adequately address the travel behaviors of the rural states.

It is important to better understand the elderly women's mobility needs and even more importantly their unmet needs. If we do not know what needs are going unmet for elderly women, we are less able to improve their quality of life or facilitate their economic contributions to society. For example, individuals that do not have their driver's license but want to go to certain locations such as shopping would have unmet mobility needs. However, no studies were found that specifically addressed the unmet mobility needs of elderly women.

The purpose of this study is to better understand the current level of mobility (realized travel demand) and the unmet mobility needs (relative desired mobility) of the women age 65 and older living in rural and small urban North Dakota, and how these two are influenced by the individual level, social environment, and physical environment using a multi-level conceptual ecological model. The major research questions we addressed were:

- What is the current realized travel demand for aging women in rural and small urban North Dakota?
- What is the relative desired mobility for aging women in rural and small urban North Dakota?
- How do the ecological factors (individual level, social environment and physical environment) influence realized travel demand and relative desired mobility for women more than 65 years that are living in rural and small urban locations.

This study brings attention to the data requirements necessary to evaluate the realized travel demand and relative desired mobility of elderly women living in rural and small urban environments. It provides a stronger basis on which to establish policies and design programs to address realized travel demand for rural and small urban elderly women. Findings can be generalized to North Dakota and other neighboring states: South Dakota, Minnesota, Montana, and Wyoming. Further, the results can be generalized to rural states in the United States, although culture may be an issue.

The organization of this dissertation is as follows. In Chapter 2 we present a review of relevant literature on the elderly and mobility, elderly women, and elderly rural women. Chapter 3 contains an overview of the conceptual multi-level-based ecological model used in this study. The methodology used in this study is described in Chapter 4. Chapters 5 and 6 include the results of descriptive analyses and multivariate analyses, respectively. Finally, Chapter 7 includes the summary of major findings and the discussion on policy implications.

2. LITERATURE REVIEW

The elderly are receiving more attention in the United States and in other counties because of the increasing number of people that will reach age 65 and live many more years as seniors as a result of increased life expectancy (Mercado, et al. 2005). At the same time, our society has a high reliance on the automobile (Newbold, et al. 2005; Pucher and Renne 2005, Wasfi and Levinson 2006). The popularity of the auto is primarily because of the independence that private vehicles allow us to go where we want when we want (Newbold, et al. 2005; Rosenbloom 2004). In 1983, the elderly age 70 and older took more than three out of four trips by auto, either as a driver or a passenger; by 1995 individuals age 70 and older took about nine out of ten trips by auto as a driver or a passenger. These numbers show that the elderly are aging without giving up mobility, and become even more dependent on autos (Rosenbloom 2004).

It is uncertain how this reliance on the auto will impact the mobility of seniors in the coming years as they continue to age and encounter changes in health and income. As people age, health issues become more of a problem and can reduce mobility options such as driving. In addition, the elderly who live on fixed incomes may find it difficult to cover the expenses of travel and auto ownership (Metz 2003). It is less clear what mobility needs the aging population will have or what unmet needs they may have. Further, women are more likely to suffer from health conditions that hinder mobility as they age (e.g., Arber and Cooper 1999; Leveille, et al. 2000), they live longer than men, and they tend to live alone with lower levels of income (1997 Bureau of the Census Report).

There has been a lack of attention to the study of elderly women's mobility (Fortuijn 1999). Siren (2005) pointed out that society's ageist and sexist views could be a contributing factor to the lack of attention to elderly women's mobility needs. Society may view the elderly as naturally homebound, and women as connected to their home surroundings (Siren, et al. 2001). There has been limited research conducted on aging women, and little is known about their mobility needs, especially those living in rural environments. Further, little to nothing is known about their unmet mobility needs.

Further, rural residents may be facing additional challenges because of limited activity opportunities in rural areas. However, little research regarding rural aging has been conducted so that disciplines such as social gerontology have to rely upon findings from unrelated and often non-comparable past studies (Marcellini, et al. 2007).

It is necessary to have a better understanding of the mobility needs of the elderly and their unmet mobility needs as we move into the higher portion of aging population. Understanding these needs will help policy makers do a better job of addressing these needs.

This chapter is comprised of three main sections. First, we will review the endemic issue of aging and mobility. Second, we present several studies that address elderly women's mobility, including their mobility needs and unmet travel demand, and evaluate contribution and shortcomings of these studies. Third, we discuss the unique issues of the rural environment and elderly women's mobility. Another shortcoming in the aging literature is lack of guiding theory when exploring aging mobility needs. Using disaggregate data of aging women in rural and urban North Dakota, this study seeks to address this gap by incorporating a multi-level conceptual ecological model, which is discussed in Chapter 3, into aging mobility research.

2.1 Aging and Mobility

Much attention has been drawn to the large elderly population the United States and other countries. The 2000 Census revealed that 35 million people age 65 and older live in the United States: 14.4 million men and 20.6 million women (U.S. Department of Commerce 2001). According to the 2000 Census Data, Americans age 65 and older will more than double by the year 2030. That means that one in five, or 20 percent of Americans, will be over the age of 65 (U.S. Census Bureau 2005).

National associations and organizations in the U.S. are drawing attention to the issues of aging by commissioning work and reports that address the needs of the elderly, including mobility. For example, the American Association of Retired Persons (AARP) has several resources to assist seniors and inform legislators about aging concerns; the Community Transportation Association of America (CTAA) has published reports on the senior population including *Transportation Innovations for Seniors* (in conjunction with the Beverley Foundation). *Aging Americans: Stranded Without Options* was published by the Surface Transportation Policy Program's (STPP) authored by Bailey (2004). Further, the White House sponsors a "White House Conference on Aging" (WHCoA) every decade to address the current needs and anticipated needs of the elderly. In 2005, the number three ranking resolution accepted by the delegates reads: "Ensure that Older Americans Have Transportation Options to Retain Their Mobility and Independence" (White House Conference on Aging 2005).

The Transportation Research Board of the National Academies of Science sponsored the conference "Transportation in an Aging Society: A Decade of Experience" in 1999, with the conference proceedings available in 2004. Although the proceedings contained several important studies, the research focused on characteristics of the older drivers, driver programs, highway design, and vehicle design rather on mobility needs. Rosenbloom (1999) did discuss the good news and bad news of mobility of the elderly when she set the stage by addressing the travel patterns of the elderly based on 1995 National Personal Travel Survey (NPTS) data. Although the study gives us a reference point and good information, there is no information on the unmet travel needs.

Wachs (1979) conducted some of the earliest research on travel behavior of the elderly. He analyzed data from the Los Angeles Regional Transportation Study (LARTS) on elderly residents in Los Angeles. Using Census data, he classified the elderly into seven lifestyle groups. The travel behaviors were compared among these groups to determine if transportation needs were being met. None of the groups were identified as necessarily mobility impaired, but individuals in "institutionalized" (living in a nursing home, etc.) and "central city dweller" groups did have some transportation disadvantages. The percentage of institutionalized elderly individuals comprised less than one percent of Los Angeles County, so they were not analyzed. The central city dwellers depended on public transportation more than anyone else as they rode the bus nearly twice as much as those living in the Los Angeles County. Wachs (1979) indicated the critical question was not how frequently the elderly people travel (realized travel demand), but whether or not mobility limitations restrict their freedom of choice (unmet travel demand) and therefore, their quality of life.

Similarly, Hildebrand (2003) assigned older individuals to one of six lifestyle groups based on socio-demographic variables. One-half of these groups were found to have transportation disadvantages. First, less than 50 percent of "granny flats," the label for those who live with their children, could drive and more than 30 percent were disabled; second, more than 25 percent of "mobility impaired," referred to individuals that did not have a driver's license and were disabled; and third, none of "disabled drivers," referred to individuals with a driver's license that could actually drive. All three groups ranged in number of trips from 0.6 to 1.4 daily trips (Hildebrand 2003).

Wachs (1988) used 1977 Nationwide Personal Transportation Study (NPTS) to study population travel patterns. Wachs' findings pointed to the changes during a person's lifecycle. For example, in the age group of the 20s, travel contains about four trips per day for a total of 36 miles; 30s with children make about a dozen trips per day totaling about 100 miles and the very old in their 80s make about one trip per day totaling three miles. However, the findings do not necessarily mean any group has travel deprivation; travel differences reflect differences in activity patterns.

The 1995 NPTS data revealed that older people make 3.43 trips per day or 22.4 percent fewer than those under age 65. It is possible the reduction in travel is self-imposed, but it may also be due to lack of mobility options (USDOT 1997). Using the 2001 National Household Travel Survey (NHTS), Pucher and Renne (2005) found that people travel at different frequencies and for a variety of reasons. Nationally, people make an average of 4.1 trips per day. Daily trip counts vary by age and a person's status as a licensed driver. People age 25-54 make an average of 4.6 trips per day while people age 65 and older average 3.4 trips per day, which is comparable to the 1995 NPTS data results.

Although mobility declines as people age, travel activity increased for aging Americans by cohort. For example, the elderly in 1995 made 77 percent more vehicle trips and spent almost 40 percent more time driving and drove 99.6 percent more miles than the elderly in 1983 (Rosenbloom 2004 as computed from 1995 NPTS Summary of Travel Trends Table 29). In other words, a 70 year old today travels more than a 70 year old 20 years ago.

The Oregon Department of Transportation (ODOT) conducted a study in 1999 to examine the State's mobility needs. They collected data via telephone survey on the elderly and disabled across the state, including rural and urban. They found eight percent of households in the state have mobility-challenged individuals. Over 90 percent of the mobility impaired individuals make a minimum of one trip per week away from their home. On average, individuals made 3.62 weekly trips from their home. The most frequent trips' purposes were 68 percent for grocery shopping, 61 percent for medical appointments, 44 percent for entertainment, and 42 percent for visiting family or friends. This study also found those who have access to public transit traveled more days than those who do not have transit service available. However, 75 percent of the mobility impaired would have difficulty using fixed route public transit (ODOT 1999).

Further, the ODOT study asked respondents about trips they would like to take but were unable due to mobility challenges. Forty-one percent of the mobility impaired individuals indicated that they have unmet demand -- there are trips they would like to take but are unable to because they do not have transportation. It was found that 60 percent would like to make more entertainment/recreational trips, 30 percent would like to do general shopping more often, and 24 percent would like to visit family and friends more often. These types of trips would be considered to add to quality of life (Metz 2000). However, this study did not differentiate the elderly and the disabled in mobility impaired analysis. Therefore we cannot disentangle specific patterns unique to the elderly.

Using Bureau of Transportation Statistics data from the 2002 *Transportation Availability and Use Survey*, Sweeney (2004) studied the travel patterns of the elderly by comparing disabled seniors to non-disabled seniors. The disabled elderly on average left their homes about four times per week, which was less than the elderly non-disabled who left their home on average 5.6 days per week. About 32 percent of the elderly disabled needed special assistance or equipment to travel away from their home (Sweeney 2004).

Schmocker, et al. (2004) analyzed data from the 2001 London Area Travel Survey (LATS) which contains 67,252 individuals within 29,973 households. Data were stratified to compare individuals age 65 and older and those younger than 65 with health problems that affected their mobility, referred to as the young-disabled. The study estimated total trips and specific trips. Not surprisingly, this study found that

as one ages, the number of trips decreases and the travel distance also decreases. The researchers found that various demographic characteristics including retirement status, household structure, car ownership, possession of a driver's license, and income levels have an effect on the number and distance of trips taken. The researchers also found that different types of disabilities have different impacts on travel. For example, those with vision impairment or hearing loss or wheelchair bound had a reduced number of trips, but not reduced distance.

There are substantial differences in the number of trips taken by those with a driver's license and those without a driver's license (Wachs 1979; ODOT 1999; Burkhardt 2000; Rosenbloom 2004). For example, females between 65 and 69 with a license took 4.0 trips while females in the same age category without a driver's license took 2.4 trips, a 66.7 percent difference in number of trips (Rosenbloom 2004). Although many seniors do have a driver's license, there are some who keep their driver's license but have mobility challenges that prevent them from driving (Wasfi and Levinson 2006).

Bailey (2004) reported that there are more than 50 percent of non-drivers age 65 and older that stay home on any given day partially because they lack transportation options, and that residents of rural communities and sprawling suburbs, households without a car, older African-Americans, Latinos, and Asian-Americans are the most likely to be affected.

Cohort analysis has also been used to study seniors' travel behavior. Bush (2003) forecasted travel demand for Boomers, who are and will continue to turn 65 for several years to come, using NPTS data from 1977, 1983, 1990, and 1995 at the individual level. She conducted a cohort analysis for age groups and generations using joint discrete choice analysis to forecast the total number of sojourns (or trips); total person miles traveled; number of sojourns by type; sojourn by activity type; trip chaining on travel day; transit usage on travel day; biking/walking mode usage on travel day. Socio-demographics with precedence in previous studies were the primary explanatory variables. Models were developed for trips for personal business, medical/education, religious trips, recreation and work among years 1995, 2000, 2010, 2020, and 2030. Some variables including education, employment status, and children in household appear significantly across all the models. The study projected that the average number of trips would increase by 17 percent for women, but only seven percent for men with the average number of person miles increasing one percent for women and five percent for men. Projections also include a 134 percent increase in total number of daily trips for those age 65 and older with a projection of 117 percent total daily person miles. These increases are primarily due to increases in total travel because of population increase rather than due to increases in total travel for individuals. The census projects the 65 and over population to increase by 107 percent between 1995 and 2030. Average person miles are projected to decrease between 2020 and 2030 due to changes in the age distribution.

Newbold, et al. (2005) applied pseudo-cohort methods to study the changing driving behavior among Canadians using 1986, 1992, and 1998 General Social Surveys. Different groups of people made up each cohort group each year so the same groups of people were not tracked overtime which would have allowed identification of changes in individual travel behavior. They categorized age cohorts into six groups. The two oldest groups were of importance for this study: the 'transitional old', who were between age 55 and 64 in 1986 and 'old', who were 65 plus, in 1986. Therefore, individuals who were age 65 and older in 1986 were age 70 and over for the 1992 surveys and over 75 for the 1998 survey. The authors found the mean number of trips to remain relatively constant for over the 12 year period with 3.8 trips per day in 1986 and 3.4 trips per day in 1992 and 1998 for all groups combined. However, there were greater differences across the cohort groups studied. They found that among the transitional old, the number of work trips declined significantly while trips related to the purchase of goods and services along with other tasks increased in importance over time. Their overall number of trips decreased as did the duration of trips. The cohorts categorized as old made fewer trips of shorter duration and fewer trips as the car driver. Their trips of highest importance were for entertainment, to purchase goods and services or to attend

religious and volunteer organizations. The oldest cohort group decreased their number of trips as the driver.

Using data from Toronto's Transport Tomorrow Survey, Paez, et al. (2007) investigated trip generation based on demographic and spatial analysis of the Hamilton metropolitan area. One of the demographic characteristics they investigated was age-cohort: 20-34; 35-50; 51-64; and 65 and older. The results confirm the negative relationship between increasing age and trip frequency. The results provide a further detailed specification of how automobile dependent the elderly are and the serious lack of mobility the elderly have when they do not have access to a vehicle or if they are unable to drive.

Using data of 1,357 workers in three San Francisco Bay Area neighborhoods, Choo, et al. (2005) studied objective and subjective mobility to address the circumstances where people want to travel more or less than they currently do, referred to as "Relative Desired Mobility" (RDM). RDM was measured on a five-point ordinal scale ranging from "much less" to "much more." The explanatory variables include two groups: objective mobility and subjective mobility. The objective mobility variables measured distance and frequency of trips (given trip purpose), and mode of transportation. The subjective mobility explanatory variables measured perceptions such as rating amount of travel (on a five point scale ranging from "none" to "a lot." Results revealed that RDM was negatively associated with the current level of mobility. In other words, the more they travel for certain trips, the less they want to travel for these kinds of trips.

2.2 Elderly Women

There is a growing interest in female mobility as evidenced by the increased studies conducted by Siren (2005); Fortuijn (1999); Rosenbloom (1999, 2004, and 2006); Oxley (2004). A trend called the "feminization of aging" can be characterized by comments in the 1997 U.S. Department of Commerce, Bureau of the Census report:

> *Women are the majority of the older population in virtually all nations and face different circumstances and challenges than men as they age. Older women are more likely to be widowed, to live alone and to live in poverty. Older women tend to have lower educational attainment, less formal labor force experience and more family care-giving responsibilities than do older men.*

Much of the research conducted on women has pertained to driver cessation. Women tend to voluntarily stop driving earlier than men (Hakamies-Blomqvist and Wahlstrom 1998; Jette and Branch 1992). Furthermore, they tend to stop driving prematurely while they are still fit to drive (Eberhard 1996; Hakamies-Blomqvist and Wahlstrom 1998; Siren, et al. 2004). Siren and Hakamies-Blomqvist (2005) found that driving cessation is a highly gender-related phenomenon. In Finland, individuals reaching 70 years of age are required to take a test to renew their license. They found that in the 1990s, about 30 percent of women did not renew their driver license at age 70, whereas only 5 percent of men did not renew their license. It is known that older women are the ones more in need of cars for their personal mobility (Rosenbloom 2004). However, none of these studies addressed women's unmet mobility needs.

Rosenbloom (2004) found that older men are more likely to make work or work-related trips than are older women, but older women make a larger percentage of trips for shopping than do men, but only until age 80. After shopping, the next most important type of trip, for both genders, is family and personal business. This type of trip becomes more important as people get older. Recreation/social trips are also important for the elderly as these trips account for 25 to 30 percent of total trips. Medical trips have the

next highest percentage of total trips accounting for roughly three to six percent of total trips. The elderly over age 85 make nearly twice as many trips for medical purposes as those between 65 to 69 years old (Rosenbloom 2004).

Mercado and Paez (2006) used data from the Transportation Tomorrow Survey (TTS), which is a comprehensive travel survey in Canada since 1986, to investigate the mobility of Canadian elderly within the Hamilton Census Metropolitan Area. The authors used a multilevel model to estimate the relationship between the mean trip distance and individual and neighborhood level variables. The study highlighted the decline in trip frequency, length and duration as individuals age. The authors found that men travel farther and for longer distances than women, but that women take more trips on average. They contend the difference between men and women's amount of travel vanishes among the elderly. Yet, men do drive as long as possible whereas women tend to rely on being a passenger in alternatives such as taxi when they age.

Non-driving older adults tend to be most dependent on friends and family for transportation (Eberhard, et al. 2006). This poses additional challenges in the future, particularly because fewer women in child-bearing years are having children. This may become a major issue in the coming decades when the elderly population increases. Those who will be 85 in the next couple of decades will have fewer people, particularly family to provide assistance. In addition, there will be less overall societal support because younger employed people will be falling as the number of seniors or retirees increases. This can be detrimental to elderly women who are less likely to drive, have fewer financial resources, and potentially more health issues. Women without children may have a reduced social network to provide rides for them.

2.3 Elderly Rural (Women)

The rural elderly literature lacks an empirical base and warrants the development of a new research agenda (Phillipson and Scharf 2005). Today, approximately 23 percent of the American population lives in rural or non-metro areas. These areas have experienced profound societal changes including population out-migration in the 1980s, but in-migration in the 1990s (USDA 2002, 2004). In the 1990s, in the rural or non-metro areas, many individuals moved to smaller-scale places for non-economic quality-of-life reasons. Some of them were retired (Rogers 1999a and 1999b; Fagan and Reeder 1996; Stallman and Siegel 1995; Snyder 1994), but several were working-age raising children (USDA 2004). Rural or non-metro areas tend to have a higher proportion of older residents (20 percent) than their urban counterparts (15 percent) (Rogers 2002).

Rural or non-metro areas in the Midwest are reported to have the largest proportion of a population age 85 and older (USDA 2002). Growing numbers of older people are living in rural areas and in the suburbs. This trend is largely a continuation of the aging-in-place phenomenon that has been going on for the past five decades where people moved to the suburbs and have remained in the homes where they raised their children even long after their children became adults. It has been argued the United States should develop a national policy designed to move the older people back to city centers (USDOT 1997). However, it would take incredible incentives because elderly are the least likely to move. Further, their likeliness to move has decreased over the last two decades (Rosenbloom 2004). Older people are only one-fourth as likely to move as those ages 30 to 44 and one-half as likely as those 45 to 64 years. It is reported that when the elderly move, 60 percent of those age 65 and older moves within the same county as their previous home (U.S. Department of Commerce 1998).

The rural elderly are less healthy than their urban counterparts (Coward and Lee 1985). Rural elderly tend to be more vulnerable to health problems such as hypertension, arthritis, and rheumatism (Coward, et al. 1993; Rogers 2002). Further, the rural elderly tend to experience more functional limitations (Center for Rural Health 2003). The 2001 Current Population Survey (CPS) data support the claim that rural elderly health status tends to decrease with age (Rogers 2002). Few, if any, studies reveal how these health trends impact mobility of the elderly living in rural areas.

Rural areas are less affluent than urban areas (Enders and Seekins 1999; Marcellini 2007) and rural residents are at greater risk to live in poverty than their urban counterparts (Golant 2004), 21 percent versus 12 percent, respectively (Center for Rural Health 2003). Elderly women living in rural areas make up a large proportion (20 percent) of people living in poverty (Mulder, et al. undated). Unfortunately, these women may have problems meeting their mobility needs due to minimal income to cover travel expenses. Part of the poverty can also be related to the lower levels of formal education, including high school and beyond (Enders and Seekins 1999). Marcellini, et al. (2007) found that older people living in rural areas are significantly less well educated than those in urban areas.

Support systems are an important factor among the rural elderly. Coward (1991) found that rural families have less support because of a tendency for children to move away from parents, thus minimizing opportunities for interaction, while residents of large cities are most likely to have at least one child residing within a 10-mile radius. However, it is not clear how social networks vary between rural and urban environments for the elderly (e.g., do the rural have closer social networks than urban?), and how the networks influence mobility of seniors.

Further, many rural areas are limited in their service delivery options, which require residents living in these areas to go without the services or to seek them in the urban locations. The limitations can occur for a number of reasons: geography of rural areas which could include barriers such as mountains, desert, extreme cold, extreme heat, vast distances, and poor roads. Even when elderly live in areas with these geographic challenges, they may not want to move to major service centers (with health care facilities, etc.). Some trained service providers, e.g., doctors, pharmacists, etc. choose to live in rural areas. However, rural locations with depressed economies and few residents have a difficult time attracting these trained providers. Therefore, physical environment in rural areas may hinder the mobility of seniors. The poor access the seniors have to services in rural areas reveals the greater need for mobility.

There are a few empirical studies on rural mobility, although they are from other countries rather than the United States. Marcellini, et al (2007) examined the urban-rural differences in Italy using data collected from the European funded MOBILATE 2000 project, carried out in Finland, The Netherlands, Hungary, Germany, and Italy. The Italian sample was 600 subjects divided between rural and urban areas and stratified according to gender and age. Findings revealed a higher percentage of car ownership for both rural and urban households than in the past. Interestingly, availability of car was 91 percent in urban areas for the 55 to 74 year olds, and 89 percent for the rural of the same age. However, at age 75 and older the availability of cars decreased to 62 percent in urban locations and 69 percent in rural. Households were also asked to rank the availability and importance of services (including shops, chemists, doctor's, banks, postal service, bus stops, churches, cemeteries, hairdressers, libraries, and parks) in urban and rural areas that were no more than 15 minutes away. The availability of these services was high for both rural and urban areas [residents]. However, interestingly, church and cemetery were more important than bus stops, and libraries were rated the least important service.

Fortuijn (1999) studied the participation in social activities by elderly women in rural areas in the eastern part of The Netherlands. Data contained 506 women in a survey with quotations taken from 28 in-depth interviews of women over age 55 (nursing home residents were excluded) from 23 villages of various sizes. The primary focus was to investigate the participation in social activities by age, household

composition, health condition, income, car availability, and type of village (small or large). The findings highlighted the importance of personal autos: 48 percent of the women indicated they tend to ride at least once a week as a passenger in a car. Women without a car tend to pool together more frequently than women with a car. The article articulated several types of networks elderly women rely on for their needs (including mobility): children, domestic help, nurses, neighbors, church, and grocery deliveries. With advancing age and reduced participation in social activities, elderly women become more and more dependent on others for several kinds of care: domestic tasks, repairs, administration, etc. Older single women, and women with health problems get more paid help as well as informal help than younger women, women with a partner, or women in good health. Low-income women are more dependent on informal support network than women with higher incomes.

Hildebrand, et al. (2004) conducted the study, *Understanding the Travel Behavior of the Rural Elderly*, using Global Positioning System (GPS) units to collect precise and comprehensive travel data on rural and urban older drivers (65+) in New Brunswick. The variables evaluated include: trip, trip link, trip length, start times, passenger trips, and trip purposes. Data revealed that urban seniors engage in on average 2.1 trips per day, while rural seniors performed 1.7 trips per day. Although the rural elderly made fewer trips, they tended to link more stops [5] into each trip. Findings illustrate that rural seniors traveled with one or more passengers for 39 percent of trips compared to 24 percent for urban seniors. The most frequent life maintenance trip for both groups was shopping followed by personal errands such as banking. Urban seniors had higher frequency of shopping trips, but this may be due to their proximity to shopping and less propensity to chain activities together. All participants said they would be affected if they could not drive. The urban seniors identified alternative modes that they could use for trips, such as bus or taxi, but rural seniors indicated that they would need to rely more on family members or even relocate to an urban area. The major shortcoming of this study was the use of a small convenience sample. The authors note that because of the small sample, the differences between urban and rural elderly drivers in the study could not be expressed with statistical significance.

Pucher and Renne (2005) used 2001 National Household Travel Survey to compare rural and urban mobility in the United States. They compared number of trips and miles traveled by urban/rural, income, age group, and mode of transportation. The study focused on trips of 75 miles or less. They found that rural and urban elderly make nearly the same number of trips per day while the rural do cover more miles. The rural elderly take 3.2 trips and travel on average 26 miles per day while the elderly living in urban locations take 3.4 trips and travel 18.7 miles. The authors pointed out that this field needs more detailed research, including surveys that measure not only actual travel behavior but also travel needs.

Using the 2001 NHTS data, the Surface Transportation Policy Project (2004) conducted an analysis ranking the worst areas for isolation of older non-drivers in the United States. Many of these locations are in the rural areas of the United States. The worst ranked area where over two-thirds of older non-drivers stay at home on a given day was East South Central (Alabama, Kentucky, Mississippi, and Tennessee) followed by West South Central (Arkansas, Louisiana, Oklahoma, and Texas), with the West North Central (North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, and Missouri) ranking third. Note that this study may not properly portray the worst areas for isolation since North Dakota, South Dakota, and Nebraska were not included in the NHTS 2001 data set.

2.4 Summary

Several countries are experiencing an increasing elderly population and are addressing aging issues, including mobility. Society has a high reliance on the automobile because of the independence it allows. However, as we age, certain factors can limit our mobility, primarily health and income. Some health conditions reduce or eliminate the ability to drive, which requires reliance on other alternatives such as public transportation or other people (social network) to provide rides, and may also result in unmet travel needs. Further, some elderly do not have the income to sustain the costs associated with auto ownership and must rely on other transportation alternatives and may have unmet mobility needs. Statistics reveal that aging individuals make on average approximately three trips per day primarily for shopping and medical. Studies have shown that the number of trips taken and the distance traveled declines with age. Only one study, conducted by the ODOT, addressed the unmet travel needs of the aging. Unfortunately, the study did not differentiate between the aging and the disabled.

Women live longer than men and are more prone to health issues that impact their mobility. Further, study findings reveal that women give up driving earlier than men and often prematurely. It is not clearly understood how these women are meeting their mobility needs. Consequently, their unmet mobility needs are also not understood.

The elderly who live in rural and urban locations have notably different travel patterns. Study findings reveal that rural elderly make fewer trips than urban elderly. Research conducted using 2001 NHTS data does not include rural states of North and South Dakota, Montana, or Wyoming. Therefore, rural states are left out of relevant analysis differentiating rural and urban travel patterns of the elderly. Consequently, it is not clear what unmet mobility needs may exist in the rural or urban areas for our aging population. Research is needed to address these gaps.

3. CONCEPTUAL MODEL

In the absence of a theoretical framework for mobility of the elderly, a multi-level conceptual ecological model, originating in the public health literature, is used to explore the mobility of women age 65 and older living in rural and small urban North Dakota. In this chapter, we introduce the multi-level conceptual ecological model and apply it to our mobility questions about the aging. First, we provide a description of the dependent variables: Realized Travel Demand (RTD) and Relative Desired Mobility (RDM). In this section we also discuss levels of travel demand. Second, we provide a general background and description of the ecological model. Third, we describe the explanatory variables in the model which are categorized into individual level, social environment, and physical environment. Fourth, we provide a summary of our study hypotheses.

3.1 Dependent Variables

The two dependent variables are RTD and RDM. The RTD refers to the amount of travel in which an individual participates, which can be obtained from common travel diaries. The RDM refers to the amount of travel she wants to do relative to the amount she currently travels. Choo, et al. (2001, 2005), cited in Chapter 2, studied relative desired mobility among individuals. They indicated that "Relative Desired Mobility refers to how much a person wants to travel compared to what she is doing now" (Choo, et al., 2001 p.7).

What is the relationship between RTD and RDM? Now, we introduce another concept: ideal travel demand (ITD). ITD refers to the amount of travel an individual would like to conduct, which is not affected by any limitations (such as income) or obligations (such as chauffeuring). ITD constitutes two components: realized travel demand and desired travel demand. For example, if the ITD for an individual is 10 trips per week and she travels only 6 trips due to economic or time constraints, her desired travel demand will be 10 - 6 = 4 trips (Figure 3.1). That is, she wants four more trips and her RDM is 4/6. On the other hand, if she travels 12 trips, then her desired travel demand is 10 -12 = -2 trips. In other words, she wants two fewer trips and her RDM is -2/12. Of course, it is possible that the RTD of an individual equals her ITD and hence her RDM is 0, i.e., the same as her current travel. Therefore, RDM is a continuum ranging from negative infinity to positive infinity. Choo, et al. (2005) measured the RDM on a five-point scale (much less, less, about the same, more, and much more), which converts the continuum into ordinal categories.

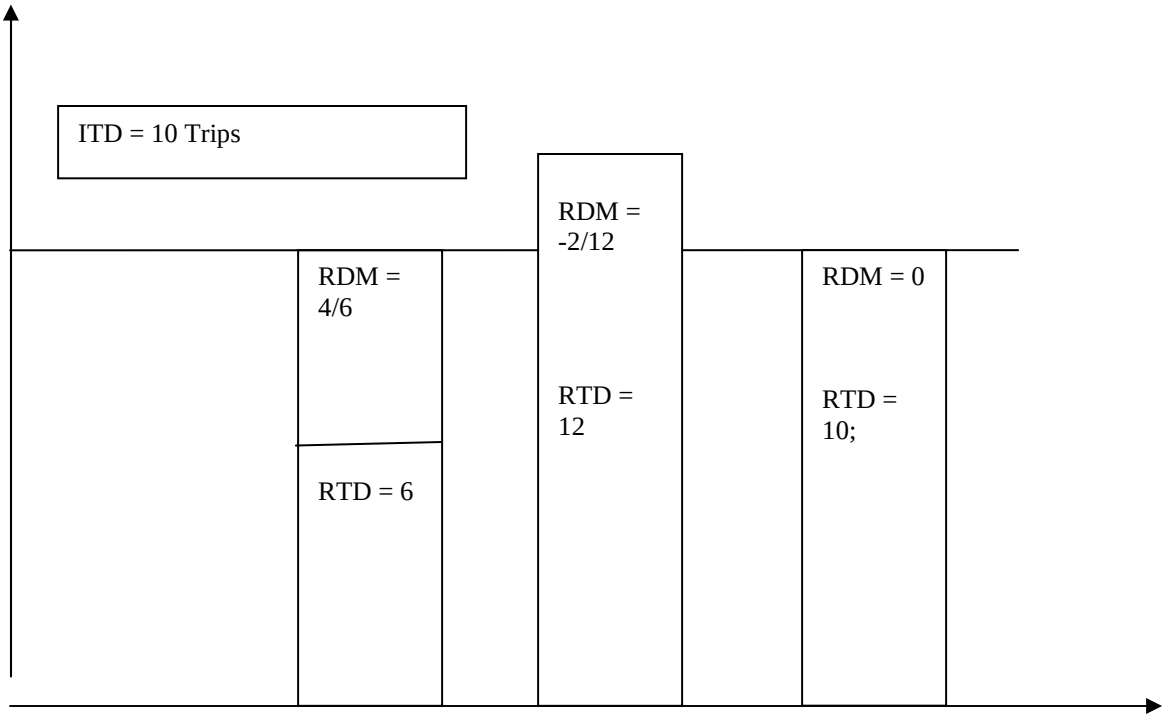


Figure 3.1 Example of Ideal and Realized Travel Demand and Relative Desired Mobility

The concept closest to RDM in the literature is “unmet demand” which was identified by Gillan and Wachs (1976). They explored the lifestyles and transportation needs of the elderly in Los Angeles. While examining data from trip logs, they found that 27 percent of the elderly did not travel on the day they were to log their trips, and as age continued to increase, the percentage of the elderly not traveling also increased. The article seemed to imply that elderly people had unmet demand given that there were days they did not travel. Yet days with no travel may be attributed to a ‘soft-response,’ or other words, not leaving on a given day or not reporting leaving on a given day (Madre, et al. 2007).

3.2 General Background / Description of Ecological Model

This study applied ecological models to examine RTD and RDM. What are ecological models? Biological science defined the term *ecology* as the interrelations between environments and the organisms that live within them (Stokols 1992, 1996). Researchers in behavioral sciences and public health have developed an ecological perspective that focuses on people's dealings with their physical and sociocultural surroundings (Stokols 1992). Therefore, the term *ecological* is used to describe models, frameworks, or perspectives that take into account these surroundings.

In ecological models of behavior, the term *environment* means the space outside of the person (Sallis and Owen 2003). The environmental domain distinguishes ecological models from other behavioral models and theories. Sallis and Owen (2003) referred to McLeroy, et al. (1988, p. 366) when stating that "The purpose of an ecological model is to focus attention on the environmental causes of behavior and to identify environmental interventions." For example, if sidewalks are found to encourage people to walk along the street, adding sidewalks to the existing street network (such as in the Safe Routes to School program (Boarnet, et al. 2005)) will become an intervention to the physical environment and hence change individuals' walking behavior.

A general ecological model is presented in Figure 3.2. The model illustrates three levels or environments that may impact behavior: individual level, social environment, and physical environment. Essentially, the individual level refers to one's ability to act, make decisions, and take part in an activity (which could include traveling to and/or from the location where an activity takes place). The social environment refers primarily to the relationships with other people that individuals have within their surroundings or within a specific proximity. The physical environment of the multi-level conceptual ecological model refers to the external environment of an individual such as the built environment, (e.g., sidewalks), accessibility to facilities, and availability of services.

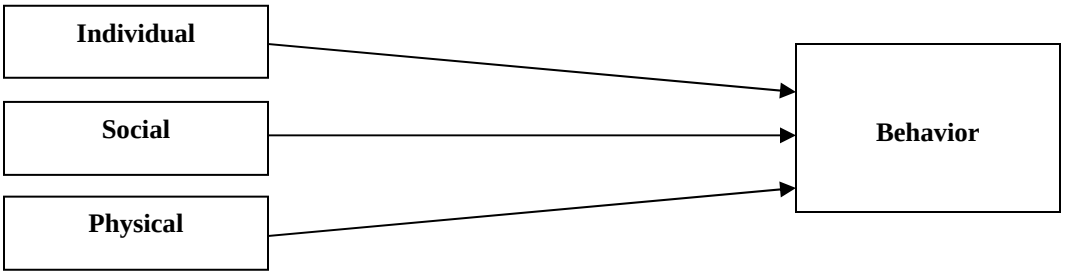


Figure 3.2 Multi-Level Conceptual Ecological Model

This study uses a multi-level conceptual ecological model to investigate the influence the individual level, social environment, and physical environment factors have on RTD and RDM of rural and small urban elderly women living in North Dakota.

3.3 Explanatory Variables

There are three primary explanatory variable categories, which include the individual level, social environment, and the physical environment as presented in Figure 3.3.

3.3.1 Individual Level

In this study, we consider the individual-level factors that impact an elderly person's trips. A trip would include movement from one location to another desired location (e.g., home to store, home to medical facility, etc.). Three factors that may affect an individual's mobility include: self-efficacy, mental ability (also referred to as cognitive ability), and physical limitations.

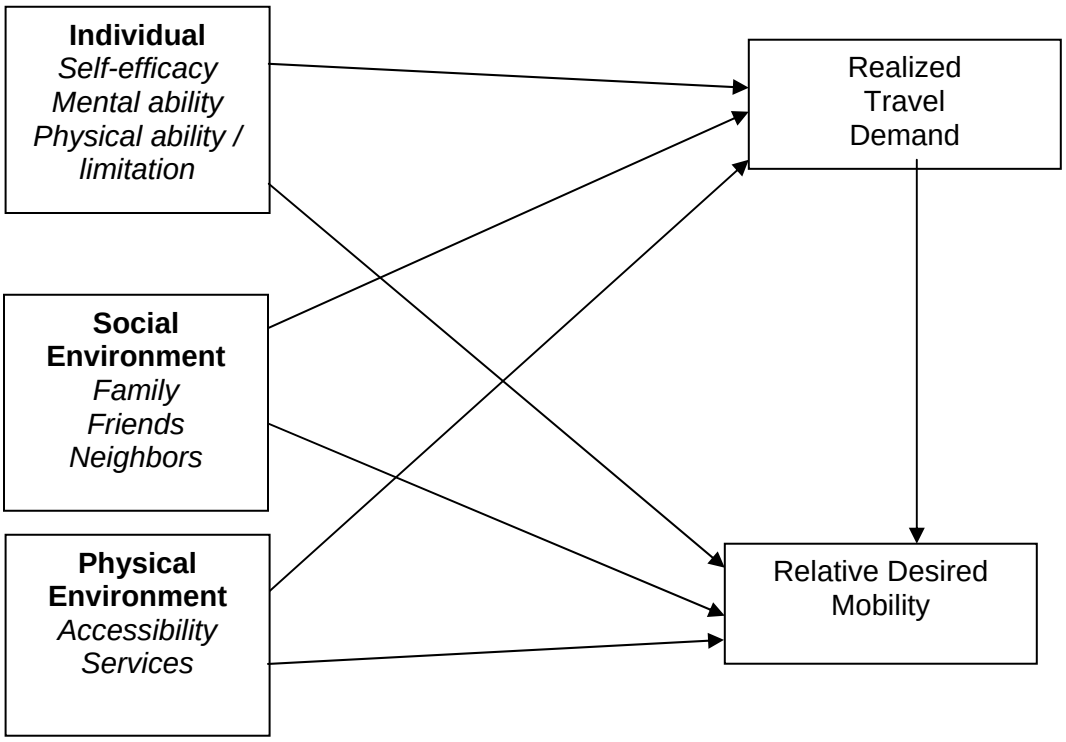


Figure 3.3 Conceptual Multi-level Ecological RTD and RDM Models for Rural and Small Urban Women over 65

Self-efficacy refers to individuals' perception of or confidence in their capability to successfully carry out a course of action (Satariano and McAuley 2003; Bandura 1997). Bandura and colleagues (Bandura 1977, 1978, 1982, 1986, 1997) found that self-efficacy is the most important prerequisite for behavior change. It was a primary predictor of intention to engage in eight healthy dietary practices among office staff (Sheeshka, et al. 1993) and of healthy food choices among third-grade and fourth-grade students (Parcel, et al. 1995). It has also been a consistent predictor of success in quitting smoking and of maintaining other healthful behavior changes (Baranowski, et al. 2002).

Self-efficacy is important for the elderly because if they do not have confidence that they can do something, they will most likely bypass the opportunity. For example, if a senior does not feel confident driving, she may reduce her driving or carefully plan out her trips. Rosenbloom (2003) indicated that some elderly women drivers make only right hand turns because they do not feel confident in making left hand turns. They may seek another way to reach a destination such as public transportation or a ride from someone. However, if these alternatives are not available or convenient, they may be trapped at home, resulting in low RTD and a greater level of RDM, or unmet mobility.

Self-efficacy may be important for the seniors in North Dakota because of the vast distance they may be required to travel to reach some activities such as medical appointments. For example, individuals living in rural communities without medical service may take a bus (where available) to a major medical center serving the state. Some communities offer a bus to seniors once a month to travel to major medical facilities. However, if a senior does not have confidence to take this bus to a medical appointment, she must find another alternative.

The second and third factors are disabilities/limitations, mental and physical. The term disability refers to the inability to perform specific social roles in everyday life because of health or physical problems (Satariano and McAuley 2003; Verbrugge and Jette 1994). Mental ability or disability relates to the concept of behavioral capability in social cognitive theory. Behavioral capability refers to having the knowledge and skill to perform a given behavior (Baranowski, et al. 2002). An example of behavioral capability as related to mental ability to ride public transportation can be explained using an example of Jamestown, N.D. Jamestown is a community of nearly 16,000 people. It has one of the largest populations of disabled individuals (mental and physical) in North Dakota and is home to the state hospital. Jamestown's paratransit system, *James River Transit*, experienced increased ridership and number of miles covered so it wanted to implement a modified fixed-route system. Peterson, et al. (2004) examined the development of such a route. Alternative routes were identified; however, focus group meetings and surveys revealed the complications a fixed route could present to individuals with mental disabilities. Some of those with mental disabilities may be able to learn how to ride the fixed route through observational learning, which occurs by watching the actions and outcomes of others' behavior (Baranowski, et al. 2002). Yet, if the bus reroutes or modifies its schedule for some reasons such as an accident, these individuals may experience a difficult time adjusting. Others may simply not be able to make the switch to the fixed route because observational learning was not possible for them and they would need to continue to ride the paratransit system or use other transportation alternatives.

The third factor is physical limitation, which refers to a physical impairment or limitation that keeps individuals from a particular activity or possible mode of travel. An individual has the cognitive or mental ability to participate, but simply cannot participate because of her physical constraints. A wheelchair-bound individual may find travel more complicated or have more limited choices. For example, if this individual does not have access to a wheel-chair accessible vehicle, she may have more difficulties getting to her destination.

Hypotheses regarding the influence of the individual level on RTD and RDM include:

- Women age 65 and older with high self-efficacy have greater RTD than women with lower self-efficacy; those with high self-efficacy have lower RDM.
- Women age 65 and older with greater cognitive abilities have greater RTD than woman with lower cognitive abilities; those with greater cognitive abilities have lower RDM than women with lower cognitive abilities.

3.3.2 Social Environment

The social environment may include family members, friends, peers at work, and so on (Baranowski, et al. 2002). Baranowski (1996) addressed the pattern of interactions between family members and provided the example that if a family has conflict, family members may need to find others outside the family to support their needs. Further, Gottlieb (1981 as in Kaye 1995) defined a social system as "structured human attachment among kin, neighbors, friends, and members of voluntary associations, in fact, may be said to represent the largest form of health care in this country." In the context of aging, such networks have been considered particularly crucial in providing a buffer against the negative consequences of aging. Social support is reported as helping with promoting physical, social, and emotional well-being (Kaye 1995).

The strength of the relationship the rural elderly woman has with a neighbor, friend, or relative may have an influence on her RTD. For example, if the relationship is strong, the associate may be more willing to provide longer or more frequent rides. Further, the cost of these rides may be of less concern to the individual, provided the relationship is strong between the elderly person and the friend, neighbor, or relative.

The National Academy on Aging is concerned about the changing family structure. They report complicated changes occurring in the structure of household and kinship roles and relationships with more single-parent households, blended families, and high incidence of divorce and remarriage. There is an increased proportion in men age 75 and older living alone from 19.1 percent in 1970 to 23.1 percent in 2004, whereas this proportion increased for women age 75 and older from 37 percent in 1970 to 49.9 percent in 2004 (Federal Interagency Forum, 2006). The National Academy on Aging is alarmed because family members provide at least 80 percent of all long-term care and support to older persons and generally do not receive compensation. The family is also often in charge of finding and managing services from paid service providers. Seeman and Berkman (1988) found that ties with children were most strongly related to aspects of instrumental support, while ties with close friends and relatives were more strongly related to aspects of emotional support.

Alternatively, Bowling (1991) pointed out that a number of studies in the USA exist on attitudes toward informal care – it has been documented that older people report more satisfaction with life if help is received from formal agencies rather than from informal network members, particularly children. The underlying reasons are two fold: conflict is more likely to happen when children provided much of the help; and elderly people, as do others, place value on independence and autonomy, which is apparently threatened less by dependence on formal than on informal service providers.

Wenger (1980) reported that the rural elderly in the United Kingdom (UK) relied on neighbors, voluntary association membership, and contact with clubs and the clergy rather than totally on their families for social support, while urban elderly were more dependent on their families. However, satisfaction with social contacts appeared to be higher among elderly people in rural rather than urban areas possibly because it was characterized by support from a wide variety of sources, and involved greater involvement and participation in the community resulting in more independence (Bowling 1991).

Socialization is important for elderly, again as for others, as exemplified by their proneness to depression when isolated. Elderly individuals, particularly women, may view some activities as social opportunities. Older people who maintain higher rates of social interaction are more likely to obtain help, when needed, from informal sources and less likely to obtain help from services (Bowling 1991).

The social environment network of the rural or small urban elderly women may impact their ability for RTD (reduced RDM). In rural settings where family and friends are present and devoid of serious conflict, the rural elderly person may be guaranteed a ride anytime it is needed or desired. On the other hand, rural elderly individuals who do not have a social network or are in conflict with family or community members may find they have limited RTD or high RDM. The widow who lives on a farmstead in rural North Dakota would typically find her RTD greatly hindered if there are no friends or relatives who can provide transportation for her.

Hypotheses regarding the influence of the social environment on RTD and RDM include:

- Women with a spouse, relatives, friends, and neighbors that provide rides have a greater RTD (lower RDM) than those without these people.
- Women who belong to clubs have greater RTD (lower RDM) than women who do not belong to clubs.

3.3.3 Physical Environment

The physical environment, for this study, refers to the location where seniors live: rural or urban, the infrastructure in place (built environment/land use) e.g., condition of the roads, sidewalks, etc., and the services available that aid the mobility of seniors, e.g., public transportation. The physical environment is crucial because more than 50 percent of non drivers age 65 and older stay home on any given day partially because they lack transportation options and those most affected live in rural and sprawling suburbs (Bailey 2004). Moreover, the physical environment may carry some of the components of the social environment. For example, the rural areas have fewer people out and about so there are fewer opportunities for interaction or social activity. Further, the rural areas have fewer facilities to which people make trips and interact with others at those locations compared to the urban areas where there are more stores, churches, restaurants, etc., and hence more people with whom to interact.

Lynott (2006) investigated senior travel and land use by differentiating between types of communities where the elderly lived and found the built environment influences mode choice and travel of the aging. Findings reveal community type impacts how much seniors drive or use alternative modes of travel. Seniors who live in urban areas where public transportation is available make more trips each week than seniors who live in rural areas. Also, seniors who live in urban (walkable, mixed-use) communities were found to have been a passenger in a private auto more often than those from the suburb or rural areas. The study found no differences in level of satisfaction for mobility among seniors within the three communities, but they did find that seniors from walkable, mixed use locations were more likely to get out of their house and take more trips by walking or using public transportation each week than seniors from the rural areas.

Seniors that live in rural areas and continue to drive may have limited mobility due to the condition of the rural roads. Rural roads often receive less maintenance than urban roads which may limit the comfort of some senior drivers. For example, North Dakota has more roads per capita than any other state in the nation and 80 percent of the rural surfaces are gravel (NDDOT 2007). Maintenance of gravel roads are prioritized by traffic volume and seniors living near low traffic volume roads may be required to travel on less comfortable roads, due to a lower level of maintenance.

Hypothesis regarding the influence of the physical environment on RTD and RDM is:

- Women living in rural locations have a lower RTD (higher RDM) than women living in small urban locations.

3.4 Summary

Research on the mobility of aging women has no existing theoretical framework. To address this issue, a multi-level conceptual ecological model, developed within the public health literature, is used for this study. The multi-level conceptual ecological model is used to investigate the influence the individual level, social environment, and physical environment have on RTD and RDM. RTD captures the level of travel the aging women have and RDM captures if women want to travel less, the same, or more than their current level. The explanatory variables examined in the model capture different environments that may impact aging women's RTD and RDM.

The first level of the framework includes the individual level, which includes three aspects that may impact aging women's RTD and thus RDM. These aspects include self-efficacy (confidence level of the woman); mental or cognitive ability; and physical ability or limitations. The second level of the framework is the social environment, which considers the relationships of the aging women, predominately family, friends, and neighbors. Women who no longer drive may be more reliant upon their social network to provide trips. The third level of the framework is the physical environment, which addresses the location where the individuals live: rural versus small urban as well as services available such as public transit. Further, the physical environment addresses the built environment such as condition of the rural roads, etc. This chapter set forth the hypotheses that are tested within each category of the multi-level conceptual ecological model. Table 3.1 contains the summary of these hypotheses.

Table 3.1 Summary of Hypotheses

Hypotheses	Expected RTD	Expected RDM
Individual level		
Women age 65 and older with higher self-efficacy (SEI) have greater RTD than women with lower self-efficacy; those with higher self-efficacy have lower RDM.	+	-
Women age 65 and older with greater cognitive abilities have greater RTD to those with lower cognitive abilities; those with greater cognitive abilities have less RDM than women with lower cognitive abilities.	+	-
Women age 65 and older that have greater physical limitations have lower RTD than those without lower physical limitations; those with greater physical limitations have greater RDM than those women with lower physical limitations.	-	+
Social Environment		
Women with a spouse, relatives, friends, and neighbors that provide rides have a greater RTD (lower RDM) than those without these people.	+	-
Women who belong to clubs have greater RTD (lower RDM) than women who do not belong to clubs.	+	-
Physical Environment		
Women living in rural locations have a lower RTD than women living in small urban locations; women living in rural locations have a higher RDM than women living in small urban locations.	-	+

4. METHODOLOGY

The goals of this study were to determine if, how, and why realized travel demand (RTD) and relative desired mobility (RDM) differ between rural and small urban elderly women in general, as well as between those who drive and those who do not drive. We tested if and how the explanatory variables – individual level, social environment, and physical environment of our multi-level conceptual ecological model – influence RTD and RDM of rural and small urban elderly women. In this chapter we first describe the research design of the study, followed by a description of the survey and data. The final section contains a description of the variables.

4.1 Research Design

Our research was a cross-sectional, non-experimental study that used data collected by a telephone survey. Statistical tests were performed on the data to determine whether there is an association between explanatory variables (individual level, social environment and physical environment) and dependent variables (RTD and RDM).

Given that little is known about RTD or RDM for rural and small urban elderly women, this cross-sectional study provides an important starting point. A longitudinal study would provide stronger evidence of causality by establishing time order, for example, changes in RTD or RDM that occur following a cessation in driving. This study could be used as a first point in a longitudinal study. The study results provide a basis on which to develop future research.

4.2 Survey and Data

Our study population consists of the 53,366 women age 65 and older living in North Dakota's rural and small urban landscape (1% PUMS). A data set was purchased from the company COMPUSTAT, as recommended by the American Association of Retired Persons (AARP). COMPUSTAT had a database of 32,000 women over the age of 65 living in North Dakota. They drew a random sample of 4,000 women and provided us with their contact information. We stratified these 4,000 contacts by rural and small urban assuring we would have at least 500 respondents from rural and 500 respondents from urban locations. Given there were no consistent definitions of rural and urban, we based our categories on the population of the city in which the women reside: rural was classified as populations equal to or less than 6,800 people, and populations greater were classified as small urban. The population of 6,800 was selected because of North Dakota's regional make-up. The state is categorized into eight planning regions that are used to make many decisions such as road care, and so on. Each region contains a city that provides major services such as hospital care. The smallest population of these eight cities is 6,800.

Several of our survey questions were taken from pre-existing questionnaires developed by Prof. Mokhtarian (e.g., Choo, et al. 2005), Handy, et al. (2004), and Jerusalem and Schwarzer (1979). Advantages of using pre-existing questions and indexes include that they often have undergone reliability testing, are widely accepted as valid, are widely used, or at least provide the opportunity to compare results to those of previous studies using the same questions. Once developed, we had several experts review the survey: Dr. Helen Kerschner, CEO and Director of the Beverley Foundation, which specializes in addressing mobility needs of the aging; Dr. Joseph Coughlin, Director of the AGELab at MIT; and Ms. Carol Wright, former manager of James River Senior Transit Service in North Dakota. Surveys were pre-tested on 10 elderly women in North Dakota and revised before the survey was administered to the sample.

The survey received approval from the Institutional Review Boards at UC Davis and North Dakota State University. Approval from both Universities was required because the study was being conducted by a doctoral student within the Transportation Technology and Policy Program at UC Davis, but being funded by North Dakota State University and conducted in North Dakota. Universities conducting federally funded research using humans as research participants are required by federal law to establish a committee responsible for reviewing such proposed research to ensure that the rights and welfare of the participants are protected (NDSU 2005).

The surveys were administered by telephone through a subcontractor, the National Agricultural Statistics Service at North Dakota State University in Fargo, during August 2006. A call back procedure was used to minimize non-response bias. We used a telephone survey for several reasons. First, telephone saves time over face-to-face interviews or mail surveys which take time to administer, code and enter the data. Second, telephone surveys are less expensive (45 to 64 percent) than face-to-face interviews. In addition, coders can be eliminated because the responses can be entered into the database as the telephone survey is being administered. Further, the response rates tend to be higher with telephone surveys than mail surveys so there is less chance of bias (Singleton and Straits 1999; Schutt 2004). Also, a telephone survey would be easier for the elderly group to complete than a mail survey so the response rate should be higher and there should be less non-response bias. To provide incentive for participation in the survey, we offered all interested respondents an opportunity for the chance to win one of five $100 prizes.

Our sample frame consisted of 4,000 names of rural and small urban elderly women in North Dakota. Of these, 1,942 women were called, 1,021 were qualified respondents, 749 women refused to participate, while 172 were not qualified to participate because they were not 65 years or over. The final sample size was 1,021, for a response rate of 57.7 percent.

Comparing some of the variables of the sample characteristics to the population characteristics we found similarities (Table 4.1). Compared to the population, the elderly women of our sample tend to be younger and live in a smaller household although the differences are not substantial. Further, they are more likely to have a driver's license. This reflects a bias toward the more active, mobile segment of the population and hence univariate descriptive statistics will be similarly biased (e.g., they probably overestimate RTD and underestimate RDM in the population as a whole). However, it is not expected to influence the results of multivariate analyses where we explain the relationship of RTD and RDM with other variables instead of describing their distributions (Babbie 1998).

Table 4.1 Sample vs. Population Characteristics

	Sample Characteristics	**Population Characteristics**
HH Size	1.59	1.62***
Age (mean)	75	76.7***
Income (median)	$15,000-24,999	24,985***
Education (median)	High school	High school*
Driver's License (%)	87	78**
ND Women age 65 and older	1,021	53,366***

Source: * U.S. Census Bureau, 2000; ** North Dakota Department of Transportation; ***1% PUMS.

4.3 Variables

The survey captured measures for the dependent variables (RTD and RDM) and the explanatory variables (individual, social, and physical environments). These measures were used to identify differences in RTD and RDM between rural and small urban women age 65 and older living in North Dakota and to test the hypotheses identified in Chapter 3.

4.3.1 Dependent Variables

The dependent variables: RTD and RDM were obtained by asking how frequently the respondents made trips to certain locations (questions were borrowed from Handy, et al. (2004)). RTD was measured using responses with a six-point ordinal scale: never, less than once per month, once or twice a month, about once every two weeks, about once a week, or two or more times a week. We also identified what method of transportation they most often take for the trip type by asking them to select from: auto, ride in automobile (with friend, family, neighbor), bus, taxi, or walking. To measure RDM, the respondents were asked if they would like to travel more or less than they currently do for that specific trip type, using the same list of trip types. The responses for RDM were measured on a five-point scale which included: much less, less, about the same, more, or much more (questions were adapted from the Mokhtarian survey).

4.3.2 Explanatory Variables

Questions for several of the explanatory variables were drawn from previous studies and had previously been tested. In some cases, these studies used indexes created from a set of survey questions as a measure of the variable. Although the previous indexes were not necessarily created for the purpose of studying mobility, they provide insight into the condition of the respondents that may help us to understand their mobility better.

Individual Level

The individual level comprised three categories of variables: self-efficacy, cognitive limitations, and physical limitations. Questions on self-efficacy, which addresses or measures an individual's ability to address daily disturbances or obstacles, were taken from the General Self-Efficacy Scale (GSE) developed by Jerusalem and Schwarzer (1979) and available in 27 languages (http://userpage.fu-berlin.de/~health/engscal.htm, accessed 20 March 2006). The specific questions are listed in Appendix A. An example question was "I am confident that I could deal efficiently with unexpected events." To create the self-efficacy index, 10 questions were asked with each requiring a response on a 4-point scale ranging from: not at all true, somewhat true, mostly true, and entirely true. The responses to the ten questions were averaged to develop a composite score ranging between 1 and 4. Higher scores indicate higher self-efficacy. The reliability of the self-efficacy survey questions were measured using Cronbach's alpha, which is "a generalized measure of the internal consistency of a multi-item scale" (Peterson 1994). Generally, acceptable levels for Cronbach's alpha range between 0.7 to 0.95 (Murphy and Davidshofer 1988, p. 89; Nunnally 1978, p. 245-246). The Cronbach's alpha for this study of 1,021 elderly women was 0.89, indicating that interitem reliability of this index is acceptable.

Cognitive limitations questions were based on the Short Portable Mental Status Questionnaire (SPMSQ) (see Pfeiffer 1975). Four of the original 10 questions were eliminated due to the security aspect of the questions, e.g., mother's maiden name, resulting in six actual questions to measure cognitive limitations. The questions are listed in Appendix A. The responses were combined to develop a composite score to identify if respondents had cognitive limitations. Further, we asked 10 questions using the Functional Activities Questionnaire (FAQ) by Pfeffer, et al. (1982), which measures social function and cognitive status. Questions covered the ability of conducting activities such as writing checks, playing a game of

skill, etc. Each of the ten questions allowed an answer from four choices: does with no difficulty; does by self, but with difficulty; requires assistance; or dependent on someone. Composite scores were calculated by averaging the responses. Low scores specify independence while high scores identify moderately or severely affected or total dependence. Our Cronbach's alpha was 0.795, indicating acceptable reliability.

Physical limitation questions were based on the Mokhtarian survey. The questions included limitations on ability to drive during the day, drive at night, drive on highways, drive on gravel roads, walk, ride a bicycle, or take public transportation. Respondents could select from three options for each question: No limitations, limits how often or how long, or absolutely prevents. Composite scores were developed by averaging the responses to identify individuals with physical limitations. The questions used to measure the physical limitations have a Cronbach's alpha of 0.716, indicating acceptable reliability.

Social Environment

Several questions were asked to better understand the social environment of the aging women. A few of these questions were adapted from Berkman and Syme (1979) (they indicated these were important; however, their exact questions were not used), to identify the proximity to the nearest family member, nearest friend, and nearest neighbor. Respondents could select one of the four alternatives: less than one mile, 2-4 miles, 5-10 miles, or more than 10 miles. Each of the proximity measures was followed by revealing the strength of the relationship, which ranged from: very close, close, somewhat close, or not very close. In addition to understanding the strength of the relationships, respondents identified if that particular person would provide a ride if it was needed, by selecting one of three responses: yes, no, or limited.

Physical Environment

Questions regarding the physical environment were taken from Handy, et al. (2004). These questions ask if sidewalks are present, if the neighborhood is safe, if taxi service and public transit service are available. Each of these questions was designed to indicate if the environment enables or encourages modes of transportation other than driving. In addition, the survey included a question on the quality of roads in the area, in particular, whether they are paved or not. See Appendix A for survey questions.

Socio-demographics

The survey also measured socio-demographic variables including age, income, education level, employment status, household size, driver's license, and so on. Note that our data have a large number of item non-responses for income: 436 (42.7 percent) women did not report their income. Since it is evident that income has an important influence on individuals' mobility, imputation of missing income data is in order. Several imputation methods including overall mean imputation and class mean imputation can be used to complete empty cells. We conducted a regression imputation to estimate the missing values because this method can use the information of other related variables (Richardson 2000). The predictors for income imputation included age, education level, employment status, auto ownership, and household size. The initial mean value of income was 4.329 (category $15,000-24,999) and the median was 4, the standard deviation was 1.676. After the income imputation the mean value was 4.32, the median was 4, and the standard deviation was 1.384. The R^2 for the imputation equation was 0.205.

4.4 Analysis Methods

The statistical techniques selected for analyses include correlation analysis, t-tests, analysis of variance (ANOVA), and ordered probit. The techniques were chosen based upon the nature of the dependent and explanatory variables. As shown in Table 4.2, if both dependent and explanatory variables are continuous, Pearson correlation analysis is used to examine their association; if the dependent variable is continuous but the explanatory variable is discrete, ANOVA is applied. Note that if the explanatory variable constitutes only two categories (e.g., male and female, rural and urban), ANOVA becomes a t-test. On the other hand, if the dependent variable is discrete, chi-square tests and logit/probit models are used depending on the nature of explanatory variables. In this study, the dependent variables, RTD and RDM, were measured on an ordinal scale, which can also be treated as a continuous scale. For the descriptive analysis presented in Chapter 5, the measurements of RTD and RDM were considered continuous. Therefore, we selected the statistical techniques primarily based on the classification of explanatory variables. In particular, we applied correlation analysis to investigate the relationship between RTD/RDM and variables within the individual level, because self-efficacy index, cognitive index, dependence factor, and physical limitations are measured on a continuous scale to determine the influence of social environment on RTD/RDM, ANOVAs (or t-tests) were applied because variables within social environment (such as spouse at home and relatives providing ride) are discrete; t-tests were employed to investigate the association between physical environment (rural vs. small urban) and RTD/RDM. For multivariate analyses in Chapter 6, the dependent variables were treated as continuous and discrete, respectively, and then linear regression and ordered probit models were applied to understand RTD and RDM. After comparing both sets of models, we choose to present the results of ordered probit models in Chapter 6. A description of ordered probit techniques in our context is discussed in detail in Chapter 6.

Table 4.2 Statistical Techniques Selected Based Upon Variable Measurement

		Dependent Variable	
		Discrete	Continuous
Explanatory Variable	Discrete	Chi-Square Test	T-Test (binary category) ANOVA (multiple categories)
	Continuous	Logit or Probit Model	Correlation Analysis

5. DESCRIPTIVE ANALYSES

In this chapter we present descriptive analyses of the responses received from the phone questionnaire of women age 65 and older living in rural and small urban North Dakota. Various statistical techniques were used to analyze the responses. As explained in Chapter 4, our measurements of RTD and RDM are considered continuous; therefore, we selected the statistical techniques primarily based on the classification of explanatory variables. We applied correlation analysis to investigate the relationship between RTD/RDM and variables within the individual level, because self-efficacy index, cognitive index, dependence factor, and physical limitations are measured on a continuous scale; to determine the influence of social environment on RTD/RDM, ANOVAs (or t-tests) were applied because variables within social environment (such as spouse at home and relatives providing ride) are discrete; t-tests were employed to investigate the association between physical environment (rural vs. small urban) and RTD/RDM.

The frequency with which women take trips varies substantially by trip type, as presented in Table 5.1. The store represents the trip type with the highest weekly frequency (86.5 percent); second is trips to church (77.3 percent); third is visiting friends (57.2 percent) and fourth is eating out (56.7 percent). Nearly 43 percent of women visit the pharmacy once or twice a month while 71.4 percent of women visit the doctor less than once per month. Exercise trips (76.8 percent) and trips with no particular destination (47.8 percent) had the highest percentage of women indicating they never take these types of trips.

Table 5.1 RTD of Trips, by Percentage

Trip Type	N	Never	Less than once per month	Once or twice a month	About once every two weeks	About once a week	Two or more times a week	Total
Doctor	1021	2.2	71.4	19.6	2.1	3.1	1.7	100
Store	1021	2.9	2.0	3.5	5.1	38.6	47.9	100
Pharmacy	1016	22.2	23.1	42.5	4.2	6.2	1.7	100
Hair	1016	12.6	49.8	20.0	2.6	14.6	0.5	100
Eat	1020	8.0	11.4	17.7	6.2	21.9	34.8	100
Friend	1019	4.9	11.2	19.5	7.2	24.8	32.4	100
Church	1019	8.2	5.7	6.5	2.3	62.1	15.2	100
Exercise	1021	76.8	1.5	0.9	0.3	1.9	18.7	100
No Particular Place	1021	47.8	12.7	8.9	2.7	6.9	21.0	100

Similarly, the RDM varies by trip type. In general, the vast majority of women reported they wanted the same frequency of trips (Table 5.2), suggesting a relatively high level of met needs. However, 28 percent indicated they would like to make fewer trips to the doctor, while 15 percent wanted to make fewer trips to the pharmacy. Further, 16.2 percent wanted to visit friends more frequently, nearly nine percent wanted to make more trips with no particular destination and about 8 percent wanted to attend church more often. These findings highlight that to some extent, the desirability of and constraints on the activity are being confounded with travel needs – i.e. wanting to go to the doctor less is probably not a travel issue but a desire for better health such that “so many” trips would not be necessary. By the same token, an unmet need for eating out may reflect a budget constraint rather than mobility limitations, and the desire to visit friends more may reflect a desire for more friends nearby rather than an inability to get to them if they were there.

Table 5.2 RDM of Trips, by Percentage

Trip Types	N	Much Less	Less	Same	More	Much More	Total
Doctor	1021	6.2	21.8	70.9	1.1		100
Store	1021	0.8	5.2	88.4	4.8	0.8	100
Pharmacy	1016	3.8	11.2	84.1	0.9		100
Hair	1016	1.1	1.7	91.7	5.5		100
Eat	1021	0.6	1.4	86.9	9.7	1.5	100
Friend	1021	0.3	0.6	83.0	14.1	2.1	100
Church	1019	0.6	0.5	91.9	7.3	0.6	100
Exercise	1021	3.7	1.3	88.1	6.7	0.2	100
No Particular Place	1020	2.8	2.1	85.9	8.5	0.7	100

Table 5.3 contains a description of the continuous measures of the individual indexes.

Table 5.3 Description of Individual Indexes

	N	Minimum	Maximum	Mean	Std. Deviation
SEI	1021	1.0	4.0	2.902	.537
CI	946	0	4	3.71	.56
PHYSABLT	1020	0	2	.34	.44
DEPEND	1020	1.0	3.9	1.144	.316

In this sample, 889 (87 percent) women have a driver's license. However, many of them are still dependent on others for travel. Of those who have a driver's license, 6 women do not own an automobile; six percent have limitations for driving during the day; 26.2 percent have limitations for driving at night; seven percent have limitations for driving on the freeway; 6.4 percent have limitations for driving on gravel. Therefore, although a large percentage of women do have a driver's license, many still have limitations for their driving.

5.1 Individual Level

The variables within the individual level include self-efficacy index (SEI), the cognitive index (CI), physical limitations, and dependence. Using correlation analysis, we first identified the statistically significant (at the .10 level) relationships between these variables and RTD. Senior women with high self-efficacy tend to have higher RTD than women with low self-efficacy for all purposes of trips except doctor and pharmacy (Table 5.4). Senior women with high cognitive abilities have higher RTD for trips to the store, eating out, visiting friends, and going to church than their counterparts with lower cognitive abilities. Senior women with physical limitations have lower RTD for all trips but going to the doctor as do senior women that are dependent upon others. Overall, the results for the individual-level variables are consistent with our expectations.

Table 5.4 Realized Travel Demand and Individual-Level Variable Correlations

Trip Type	SEI	P-Value	CI	P-Value	Physical Limitation	P-Value	Depend	P-Value
Doctor	-.016	.614	-.006	.848	.129	.000	.087	.006
Store	.151	.000	.085	.009	-.397	.000	-.426	.000
Pharmacy	.014	.646	.021	.517	-.130	.000	-.188	.000
Hair	.093	.003	.001	.987	-.077	.014	-.105	.001
Eat	.138	.000	.117	.000	-.212	.000	-.173	.000
Friend	.130	.000	.070	.032	-.283	.000	-.244	.000
Church	.063	.043	.104	.001	-.273	.000	-.205	.000
Exercise	.097	.002	.046	.155	-.119	.000	-.079	.012
No Particular Place	.192	.000	.022	.492	-.099	.001	-.056	.075

The relationships between the individual-level variables and RDM illustrate mixed responses for the senior women (Table 5.5). All else equal, women with higher self-efficacy tend to want more trips to the doctor and pharmacy. Yet, women with higher self-efficacy tend to want fewer trips to the store, eating out, visiting friends, attending church, and no particular place. Cognitive ability has a positive association with RDM for only one trip type: no particular place, while women with physical limitations had positive association with RDM for seven of the nine trip types. Women highly dependent upon others also had positive association with RDM for five of the trip types: store, eat out, visit friends, go to church, and also with no particular destination in mind (Table 5.5).

Table 5.5 Relative Desired Mobility and Individual Level Variable Correlation

Trip Types	SEI	P-Value	CI	P-Value	Physical Limitation	P-Value	Depend	P-Value
Doctor	.102	.001	.014	.669	.052	.098	.050	.112
Store	-.055	078	.038	.244	.132	.000	.112	.000
Pharmacy	.055	.078	.016	.623	.059	.062	.039	.215
Hair	-.027	.390	.009	.779	.047	.137	-.003	.935
Eat	-.053	.089	-.003	.920	.141	.000	.093	.003
Friend	-.108	.001	-.029	.380	.075	.016	.060	.057
Church	-.104	.001	-.044	.172	.087	.005	.081	.009
Exercise	-.008	.786	-.039	.234	.028	.368	-.010	.752
No Particular Place	-.066	.036	.063	.053	.091	.003	.076	.015

5.2 Social Environment

It is expected that women who have a larger social network have higher RTD and lower RDM. In this section we investigate various social network indicators including spouse, relative, friend, and neighbor. We inquired about the distance the women live from their nearest relative, neighbor, and friend. Further, we asked about the strength of these relationships and the ability of these people to provide rides. We also wanted to understand the relationship between club membership and RTD (as well as RDM). We expect club members to provide rides for the senior women.

5.2.1 Spouse

Five hundred forty-nine women reported they lived with their spouse. We did not ask about the closeness of this relationship due to the delicate and personal nature of this question. However, we did ask if the spouse would be able to provide a ride. Overall, 8.6 percent of women said their spouse would not be able to provide a ride, 3.3 percent indicated limited rides, and 88 percent said their spouse could provide a ride. Therefore, a spouse tends to be a very reliable source when women need mobility help. Spouse ride was significantly associated with the RTD for four trip types including store, eating out, visiting friends, and attending church. Generally, if spouse cannot provide a ride, women tend to have a lower RTD (Table 5.6).

When examining the relationship between spouse ride and RDM we found spouse ride had a statistically significant association with the RDM for trips to the hair salon, eating out, church, and exercise (Table 5.7). Generally, women whose spouse can provide a ride tend to have a lower RDM.

Table 5.6 RTD and Spouse Provide Ride – ANOVA

		N	Mean	P-Value
Doctor				
No		44	2.64	
Limited		17	2.35	.263
Yes		448	2.41	
	Total	509	2.43	
Store				
No		44	5.05	
Limited		17	5.71	.022
Yes		448	5.38	
	Total	509	5.36	
Pharmacy				
No		44	2.64	
Limited		17	2.65	.998
Yes		447	2.63	
	Total	508	2.63	
Hair				
No		44	2.50	
Limited		17	2.35	.579
Yes		447	2.61	
	Total	508	2.59	
Eat				
No		44	3.91	
Limited		17	4.06	.061
Yes		447	4.46	
	Total	508	4.49	
Friend				
No		44	3.34	
Limited		17	4.18	.000
Yes		446	4.43	
	Total	507	4.33	
Church				
No		44	3.98	
Limited		17	4.76	.004
Yes		447	4.66	
	Total	508	4.60	
Exercise				
No		44	2.02	.697
Limited		17	2.53	
Yes		448	2.17	
	Total	509	2.17	
No Particular Place				
No		44	2.52	
Limited		17	2.47	.621
Yes		448	2.77	
	Total	509	2.75	

Table 5.7 RDM and Spouse Provide Ride - ANOVA

		N	Mean	P-Value
Doctor				
No		44	2.75	
Limited		17	2.71	.465
Yes		448	2.64	
	Total	509	2.65	
Store				
No		44	3.00	
Limited		17	3.00	.661
Yes		448	2.95	
	Total	509	2.96	
Pharmacy				
No		44	2.77	
Limited		17	2.71	.558
Yes		447	2.82	
	Total	508	2.81	
Hair				
No		44	3.14	
Limited		17	3.12	.074
Yes		447	3.03	
	Total	508	3.04	
Eat				
No		44	3.27	
Limited		17	2.94	.006
Yes		448	3.09	
	Total	509	3.10	
Friend				
No		44	3.14	
Limited		17	3.35	.246
Yes		448	3.18	
	Total	509	3.18	
Church				
No		44	3.16	
Limited		17	3.06	.095
Yes		447	3.05	
	Total	508	3.06	
Exercise				
No		44	3.00	.075
Limited		17	3.24	
Yes		448	2.97	
	Total	509	2.98	
No Particular Place				
No		44	3.14	
Limited		17	3.18	.166
Yes		447	3.03	
	Total	508	3.04	

5.2.2 Relative

We explored the relationship among proximity to the nearest relative, the strength of the relationship, and the probability that the relative can provide a ride. Of 1,017 women, 39 percent lived less than 1 mile from a relative; 19 percent lived between 1-4 miles; 9 percent lived 5-10 miles and 32.5 percent lived more than 10 miles away. Of the nearest relatives, 78.7 percent would provide a ride; 8 percent can provide limited rides; and 12.7 percent would not be able to provide rides. Using ANOVA, we found that relatives who provide rides live much closer than the relatives who do not provide rides (Table 5.8).

Table 5.8 Association between Distance and Relative Provide Ride

Provide Ride	N	Mean Dist.	P-Value
No	130	3.31	
Limited	82	3.10	.000
Yes	804	2.12	
Total	1016	2.35	

A majority of women felt they had close relationships with their nearest relative. Nearly 82 percent reported their relationship with their nearest relative was very close; 14.7 percent reported close; 2.8 percent reported somewhat close and 0.2 percent reported the relationship was not close. As shown in Table 5.9 women with close relationships to their nearest relative can receive more frequent rides.

Table 5.9 Association between Relationship and Relative Provide Ride

Provide Ride	N	Mean	P-Value
No	130	3.66	
Limited	82	3.73	.002
Yes	804	3.82	
Total	1016	3.79	

Examination of RTD and relatives ride revealed statistical significance at the .10 level for trips to the store and to visit friends. That is, the senior women whose relatives may provide a ride tend to have higher RTD for trips to the store and to visit friends (Table 5.10). The RDM values presented in Table 5.11 illustrate the women who may receive rides from relatives are more likely to have lower RDM for trips to the store, to eat out, to visit friends, to church, and no particular place.

Table 5.10 RTD and Relatives Provide Ride

Variable		N	Mean	P-Value
Doctor				
No	0	130	2.44	
Limited	1	82	2.37	.627
Yes	2	803	2.36	
	Total	1015	2.37	
Store				
No	0	130	4.90	
Limited	1	82	5.21	.011
Yes	2	804	5.22	
	Total	1016	5.18	
Pharmacy				
No	0	129	2.47	
Limited	1	81	2.72	.313
Yes	2	801	2.53	
	Total	1011	2.54	
Hair				
No	0	129	2.50	
Limited	1	81	2.57	.646
Yes	2	801	2.60	
	Total	1011	2.59	
Eat				
No	0	130	4.36	
Limited	1	82	4.37	.702
Yes	2	803	4.25	
	Total	1015	4.28	
Friend				
No	0	130	4.12	
Limited	1	82	4.12	.094
Yes	2	802	4.39	
	Total	1014	4.33	
Church				
No	0	130	4.41	
Limited	1	82	4.65	.493
Yes	2	802	4.50	
	Total	1014	4.50	
Exercise				
No	0	130	2.16	
Limited	1	82	1.73	.274
Yes	2	804	2.07	
	Total	1016	2.06	
No Particular Place				
No	0	130	2.88	
Limited	1	82	2.61	.564
Yes	2	804	2.70	
	Total	1016	2.72	

Table 5.11 RDM and Relatives Provide Ride

Variable		N	Mean	P-Value
Doctor				
No		130	2.68	
Limited		82	2.78	.182
Yes		804	2.65	
	Total	1016	2.67	
Store				
No		130	3.08	
Limited		82	3.04	.013
Yes		804	2.98	
	Total	1016	3.00	
Pharmacy				
No		129	2.83	
Limited		81	2.88	.526
Yes		801	2.81	
	Total	1011	2.82	
Hair				
No		129	3.00	
Limited		81	3.05	.582
Yes		801	3.01	
	Total	1011	3.02	
Eat				
No		130	3.19	
Limited		82	3.15	.015
Yes		804	3.08	
	Total	1016	3.10	
Friend				
No		130	3.34	
Limited		82	3.24	.000
Yes		804	3.14	
	Total	1016	3.17	
Church				
No		130	3.16	
Limited		82	3.07	.004
Yes		802	3.05	
	Total	1014	3.07	
Exercise				
No		130	3.00	
Limited		82	3.06	.269
Yes		804	2.97	
	Total	1016	2.98	
No Particular Place				
No		130	3.13	.007
Limited		82	3.10	
Yes		803	3.00	
	Total	1015	3.02	

5.2.3 Friend

Sixty-three percent of the women lived less than one mile from their nearest friend; an additional 21 plus percent lived within one to four miles; 7.5 percent lived within five and 10 miles from their nearest friend, and nearly eight percent of the women's nearest friends lived more than 10 miles away. These women were asked if their nearest friend would be able to provide a ride for them. Interestingly, 82.5 percent indicated their nearest friend would not be able to provide a ride and 17.5 percent reported their nearest friend would have limited ability to provide a ride, no one reported their friend would be able to provide a ride. These friends may not be able to drive or they may not be able to provide rides, whether or not the relationship is strong. There was no statistically significant association between the proximity of the nearest friend and their ability to provide a ride (Table 5.12).

Table 5.12 Association between Distance and Friend Provide Ride

Provide Ride	N	Mean Dist.	P-Value
No	796	1.59	.907
Limited	169	1.60	

When asked about the strength of the relationship with this nearest friend, fifty-six percent reported they had a very close relationship; 31.5 percent reported a close relationship; 10.7 percent said somewhat close; and 1.3 percent indicated the relationship was not close. Even though the relationships with the friends are close, there is no statistical significance at the .10 level between the ability to provide a ride and the strength of the friendship (Table 5.13).

Table 5.13 Association between Relationship and Friend Provide Ride

Provide Ride	N	Mean	P-Value
No	796	3.44	.243
Limited	169	3.37	

The relationships between RTD and the nearest friend providing a ride are statistically significant at the .10 level for all purposes of trips except doctor, hair, and no particular place (Table 5.14). However, the results seem to be counter-intuitive because we would expect that friends, particularly those within close proximity and those with close relationships, can provide rides and hence lead to higher RTD for senior women.

Table 5.14 RTD and Friend Provide Ride

Variable	N	Mean	P-Value
Doctor			
No	797	2.37	.299
Limited	171	2.44	
Store			
No	798	5.37	.000
Limited	171	4.60	
Pharmacy			
No	793	2.60	.026
Limited	171	2.36	
Hair			
No	793	2.63	.480
Limited	171	2.56	
Eat			
No	798	4.46	.000
Limited	170	3.80	
Friend			
No	798	4.66	.000
Limited	171	3.78	
Church			
No	796	4.66	.000
Limited	171	4.18	
Exercise			
No	798	2.20	.000
Limited	171	1.57	
No Particular Place			
No	798	2.77	.411
Limited	171	2.63	

The association for RDM and friend providing a ride are positive and statistically significant at the .10 level for store, pharmacy, hair, and eating out (Table 5.15). Once again the results are counter-intuitive because we would anticipate the RDM to be lower when friends can provide limited rides.

Table 5.15 RDM and Friend Provide Ride, TTEST

Variable	N	Mean	P-Value
Doctor			
No	798	2.66	.104
Limited	171	2.74	
Store			
No	798	2.98	.027
Limited	171	3.07	
Pharmacy			
No	793	2.80	.041
Limited	171	2.88	
Hair			
No	793	3.01	.027
Limited	171	3.08	
Eat			
No	798	3.09	.037
Limited	171	3.16	
Friend			
No	798	3.17	.796
Limited	171	3.18	
Church			
No	796	3.07	.557
Limited	171	3.08	
Exercise			
No	798	2.98	.295
Limited	171	3.02	
No Particular Place			
No	798	3.01	.309
Limited	171	3.06	

5.2.4 Neighbor

Neighbors may play an important role in a social network given their proximity, particularly if the relationship is close. Ninety-two percent of the respondents live less than one mile from their nearest neighbor; 7.1 percent live 1-4 miles; less than one percent live 5-10 miles, and the other small percentage live more than 10 miles. The respondents indicated that 78.2 percent of the neighbors would be able to provide a ride, 6.9 percent would be able to provide limited rides, and 14.7 percent would not be able to provide a ride for them. The ANOVA revealed that there is no significant association between the proximity of the neighbor and their ability to provide a ride (Table 5.16).

Table 5.16 Association between Distance to Nearest Neighbor and Provide Ride

Provide Ride	N	Mean Dist.	P-Value
No	150	1.11	
Limited	70	1.06	.502
Yes	798	1.09	
Total	1018	1.09	

Overall the respondents had close relationships with their neighbors as indicated by 30.3 percent reporting a very close relationship and 32.7 percent reporting a close relationship with their neighbor. Meanwhile, 24.3 percent indicated their relationship with their neighbor was somewhat close and 12.6 percent were not close. The association between the strength of the relationship and the ability to provide a ride is statistically significant at the .01 level (Table 5.17). As anticipated, women with a closer relationship with their neighbors are more likely to receive a ride when needed.

Table 5.17 Association between Relationship with Neighbor and Provide Ride

Provide Ride	N	Mean	P-Value
No	150	2.25	
Limited	70	2.21	.000
Yes	798	2.96	
Total	1018	2.81	

Using ANOVA, we investigated the relationship of the neighbor being able to provide a ride along with the respondents' RTD. Differences are statistically significant at the .05 level for all trip types with the exception of exercise and no particular place (Table 5.18). Overall, the women experienced higher RTD when their neighbors are able to provide a ride, with the exception of doctor trips.

Table 5.18 RTD and Neighbor Provide Ride

		N	Mean	P-Value
Doctor				
No		150	2.53	
Limited		70	2.30	.049
Yes		797	2.35	
	Total	1017	2.37	
Store				
No		150	4.73	
Limited		70	5.20	.000
Yes		798	5.26	
	Total	1018	5.18	
Pharmacy				
No		149	2.26	
Limited		70	2.53	.006
Yes		794	2.60	
	Total	1013	2.54	
Hair				
No		149	2.42	
Limited		70	2.29	.013
Yes		794	2.64	
	Total	1013	2.59	
Eat				
No		149	3.74	
Limited		70	3.60	.000
Yes		798	4.44	
	Total	1017	4.28	
Friend				
No		150	3.91	
Limited		70	4.14	.001
Yes		796	4.43	
	Total	1016	4.33	
Church				
No		150	4.07	
Limited		70	4.44	.000
Yes		796	4.59	
	Total	1016	4.50	
Exercise				
No		150	1.93	
Limited		70	1.90	.518
Yes		798	2.09	
	Total	1018	2.05	
No Particular Place				
No		150	2.47	
Limited		70	2.53	.167
Yes		798	2.78	
	Total	1018	2.72	

Further, we investigated the relationship between the RDM of women and their neighbors' ability to provide a ride for them. The findings reveal statistical significance at the 0.10 level for trips to the store, eat, church, and for trips with no particular place in mind. Generally, women whose neighbor can provide a ride have lower RDM to these destinations (Table 5.19).

Table 5.19 RDM and Neighbor Provide Ride

		N	Mean	P-Value
Doctor				
No		150	2.74	
Limited		70	2.71	.212
Yes		798	2.65	
	Total	1018	2.67	
Store				
No		150	3.07	
Limited		70	3.01	.032
Yes		798	2.98	
	Total	1018	3.00	
Pharmacy				
No		149	2.85	
Limited		70	2.79	.684
Yes		794	2.82	
	Total	1013	2.82	
Hair				
No		149	3.03	
Limited		70	2.94	.155
Yes		794	3.02	
	Total	1013	3.02	
Eat				
No		150	3.19	
Limited		70	3.11	.025
Yes		798	3.08	
	Total	1018	3.10	
Friend				
No		150	3.23	
Limited		70	3.13	.220
Yes		798	3.16	
	Total	1018	3.17	
Church				
No		150	3.17	
Limited		70	3.01	.000
Yes		796	3.05	
	Total	1016	3.07	
Exercise				
No		150	3.01	
Limited		70	3.00	.762
Yes		798	2.98	
	Total	1018	2.98	
No Particular Place				
No		150	3.10	
Limited		70	3.03	.106
Yes		797	3.01	
	Total	1017	3.02	

5.2.5 Club

We anticipated that women who belong to clubs would likely have a larger social network and experience higher RTD. In this data, 64.5 percent of women belong to clubs and 35.4 percent do not. Table 5.23 illustrates the t-test results for RTD of women who belong and who do not belong to clubs. Doctor and pharmacy were the only types of trips that were not significantly associated with club membership. As expected, women belonging to clubs tend to have a higher RTD. The t-tests revealed there was no significant difference in RDM for women who belong to clubs and those who do not (Table 5.21). From these finding we could conclude that women who belong to clubs do travel more, but given the RDM is equal there are different kinds of people with different preferences who belong to the clubs.

Table 5.20 RTD for Women who Belong and who Do Not Belong to Club, TTEST

	N	Mean	P-Value
Doctor			.873
No club	361	2.37	
Club	658	2.38	
Store			.000
No club	361	4.85	
Club	659	5.36	
Pharmacy			.128
No club	359	2.46	
Club	656	2.58	
Hair			.000
No club	359	2.40	
Club	656	2.68	
Eat			.000
No club	361	3.74	
Club	658	4.56	
Friend			.000
No club	360	3.83	
Club	658	4.60	
Church			.000
No club	359	4.01	
Club	659	4.76	
Exercise			.000
No club	361	1.66	
Club	659	2.27	
No Particular Place			.005
No club	361	2.48	
Club	659	2.84	

Table 5.21 RDM for Women who Belong and who Do Not Belong to Club, TTEST

	N	Mean	P-Value
Doctor			
No club	361	2.66	.725
Club	659	2.67	
Store			
No club	361	3.01	.619
Club	659	2.99	
Pharmacy			
No club	359	2.82	.923
Club	656	2.82	
Hair			
No club	359	3.02	.671
Club	656	3.01	
Eat			
No club	361	3.10	.945
Club	659	3.10	
Friend			
No club	361	3.17	.955
Club	659	3.17	
Church			
No club	359	3.07	.772
Club	659	3.07	
Exercise			
No club	361	2.99	.589
Club	659	2.98	
No Particular Place			
No club	361	3.01	.528
Club	658	3.03	

5.3 Physical Environment

Women living in rural or small urban locations may have different mobility as a result of where they live. This section investigates the role that the physical environment plays in RTD and RDM. T-tests were applied to compare the mean values for RTD trips for women who live in rural areas to those who live in small urban areas. The same procedure was used to test associations with RDM. Table 5.22 illustrates the RTD values for women who live in rural and small urban areas. There were differences with statistical significance at the 0.10 level for trips to the hair salon, to eat out, to attend church, and to exercise. The values indicate women living in small urban areas may have higher RTD for these trips. These findings are consistent with our expectations.

Table 5.22 RTD for Women in Rural and Small Urban Locations TTEST

	N	Mean	P-Value
Doctor			
Small Urban	511	2.39	.521
Rural	509	2.36	
Store			
Small Urban	512	5.20	.690
Rural	509	5.17	
Pharmacy			
Small Urban	509	2.49	.177
Rural	507	2.59	
Hair			
Small Urban	509	2.66	.031
Rural	507	2.50	
Eat			
Small Urban	512	4.43	.003
Rural	508	4.11	
Friend			
Small Urban	512	4.38	.340
Rural	507	4.28	
Church			
Small Urban	512	4.41	.053
Rural	507	4.59	
Exercise			
Small Urban	512	2.41	.000
Rural	509	1.69	
No Particular Place			
Small Urban	512	2.62	.171
Rural	509	2.80	

As shown in Table 5.23, women in rural and small urban locations had different RDM for church trips. Otherwise, there are no statistical differences in RDM for women in rural areas compared to those in small urban areas. It appears that women in rural areas are equally happy with less travel than women in urban areas. This could be a result of residential self-selection – those who want an active lifestyle outside the home are likely to live where there are more destinations to conveniently travel to.

Table 5.23 RDM for Women in Rural and Small Urban Locations TTEST

	N	Mean	P-Value
Doctor			
Small Urban	512	2.69	.327
Rural	509	2.65	
Store			.999
Small Urban	512	3.00	
Rural	509	3.00	
Pharmacy			.235
Small Urban	509	2.80	
Rural	507	2.84	
Hair			.779
Small Urban	509	3.01	
Rural	507	3.02	
Eat			.809
Small Urban	512	3.10	
Rural	509	3.10	
Friend			.209
Small Urban	512	3.15	
Rural	509	3.19	
Church			.062
Small Urban	512	3.09	
Rural	507	3.05	
Exercise			.107
Small Urban	512	3.01	
Rural	509	2.96	
No Particular Place			.805
Small Urban	512	3.03	
Rural	508	3.02	

5.4 Summary

In this chapter we found results consistent with our expectations for variables within the individual level. Women with higher self-efficacy and cognitive abilities had higher RTD. Women with physical limitations and who were more dependent upon others had lower RTD. The social environment variables including spouse, relative, friends, and neighbors were consistent with hypotheses that women with greater social networks have higher RTD. The results for friends were counter-intuitive and could warrant further investigation at a later date. The physical environment upheld expectations that women in rural areas would have lower RTD than small urban women.

Interestingly, the results for RDM were mixed when examining the individual-level explanatory variables. Women with higher self-efficacy tended to want more trips to the pharmacy and doctor, but wanted fewer of the other trips. Women with high cognitive abilities tended to want more trips with no particular destination. The women with physical limitations had tended to want more of seven out of the nine trip types (doctor, store, pharmacy, eat out, visit friend, attend church, and no particular place). Dependence had a positive association with RDM for five of the trip types (store, eat out, visit friend, attend church, and no particular place). In general, women with larger social networks have lower RDM. There was no statistical significance in the RDM between women living in rural or small urban locations indicating each are equally happy (or unhappy) with their mobility.

In the next chapter we investigate how RTD and RDM for each trip type are influenced by the individual level, social environment, and physical environment using multivariate analysis.

6. MULTIVARIATE ANALYSIS

Mobility is an inherent need for everyone. Women may find their mobility needs challenged as they age because of the tendency for women to live longer than men and also to live alone, as described in Chapter 2. Making necessary trips to the doctor or pharmacy or simply visiting friends may be reduced due to mobility limitations. Senior women, particularly those who no longer drive, may depend on their social networks for rides. Alternatively, some women may rely on public transportation, walking, or biking when possible and appropriate.

In this chapter we examine the relationships between explanatory variables that are categorized as individual level, social environment, and physical environment (as explained in Chapter 3) and the dependent variables, Realized Travel Demand (RDM) and Relative Desired Mobility (RDM), for nine types of trips, using data from elderly women in North Dakota. First, we explain the model framework along with the specifications and procedure used for the ordered probit models. We applied the ordered probit because the dependent variables were measured on ordinal scales. Second, we present and interpret the results for the nine RTD models. Third, we discuss the results for the nine RDM models. Finally, we summarize the major findings of the chapter.

In this study, Realized Travel Demand was measured on a six-point ordinal response scale to the question "How often do you make trips to" nine types of locations such as doctor: "Never", "Less than once per month", "Once or twice a month", "About once every two weeks", "About once a week", and "Two or more times a week". Relative Desired Mobility was measured on a five-point-ordinal response scale to the question "Would you like to travel more or less than you currently are to" the same nine types of locations: "Much less", "Less", "About the same", "More", and "Much more". Using SPSS 14.0, we developed nine ordered probit models for RTD and nine ordered probit models for RDM.

The ordered probit model was selected over linear regression, Ordinary Least Squares (OLS), for two primary reasons as described in Daykin and Moffatt (2002). First, the differences between each pair of sequential ordinal categories of dependent variables are not necessarily the same; potentially non-uniform differences are an implicit assumption in ordered probit, but OLS requires uniform differences. Second, the ordered probit model assumes an unobserved propensity underlying the observed responses, and an observed category is corresponding to a range of unobserved propensity (as discussed later); two respondents with the same observed categorical response do not necessarily have the same unobserved propensity. That is, although their unmeasured attitudes differ somewhat, they may still choose the same category. This is impossible under the assumption of linear regression.

The ordered probit technique does not model the observed dependent variable directly; instead, we assume that there is a latent (unobserved) variable underlying an individual's response. The latent variable represents an individual's propensity to conduct or desire (relative to current levels) travel (depending on the context of observed dependent variables). The equation for the latent variable is expressed as:

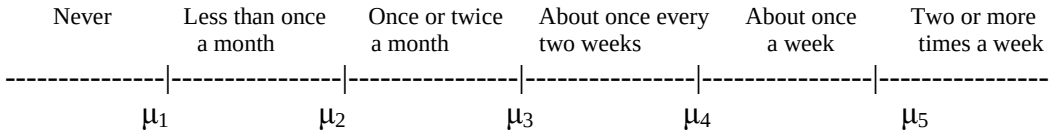
$$y^*_i = x_i'\beta + \varepsilon_i, \text{ where } i = 1, \ldots, n;$$
$$\varepsilon_i \sim N(0,1).$$

where y^*_i is the unobserved variable; x_i represents the vector of explanatory variables, which help explain the propensity of the respondent; β is a vector of parameters (without an intercept) being estimated that are interpreted similarly to the slope parameters identified in linear regression, and ε_i is the error term. For RTD, the relationship between *Observed* RTD variable y_i and latent propensity y^*_i is specified as (Figure 6.1):

y_i = 1 (Never), if $-\infty = \mu_0 < y^*_i \leq \mu_1$,
y_i = 2 (Less than once per month), if $\mu_1 < y^*_i \leq \mu_2$,
y_i = 3 (Once or twice a month), if $\mu_2 < y^*_i \leq \mu_3$,
y_i = 4 (About once every two weeks), if $\mu_3 < y^*_i \leq \mu_4$,
y_i = 5 (About once a week), if $\mu_4 < y^*_i \leq \mu_5$,
y_i = 6 (Two or more times a week), if $\mu_5 < y^*_i < \mu_6 = +\infty$,

where the μ_1 through μ_5 represents the threshold parameters that are simultaneously estimated with β.

Figure 6.1 Threshold Parameters with Underlying Continuous Scale for RTD



When estimating parameters, some software (such as Limdep) assumes that the first threshold is zero so that the model will estimate J-2 thresholds (where J is the number of categories of the dependent variable) and a constant term, while other software (such as SPSS) treats J-1 thresholds as free parameters so that the constant term is absent because of perfect collinearity (Daykin and Moffatt 2002). This study used SPSS to estimate ordered probit models. Therefore, no constant term will be reported in these models; instead, J-1 thresholds are reported. In some cases, we report only certain thresholds in the model because of the absence of responses in some categories. For example, if a model for RTD reports only μ_2, μ_3, and μ_4, then no respondents choose the categories "never" and "two or more times a week" (Figure 6.1).

SPSS automatically reports the McFadden ρ^2 as the goodness of fit (GOF) indicator for the models. The McFadden ρ^2 is also called McFadden Likelihood Ratio Index (LRI). The McFadden LRI is calculated as follows:

$$\rho^2 = 1 - [LL(\beta) / LL(c)],$$

where LL(c) is the log-likelihood for the model where all coefficients but the J-1 thresholds are restricted to zero (equivalent to a constants-only model), and LL(β) is the log-likelihood at convergence (i.e., the final model).

Veall and Zimmermann (1992) examined several GOF measures for ordinal probit models, and found that the McKelvey and Zavoina R^2 is the best, and followed by the normalized Aldrich-Nelson R^2 (or called Veall-Zimmermann R^2) and Cragg-Uhler R^2. The calculation of the McKelvey and Zavoina R^2 requires the predicted values for the latent variable. Since SPSS does not provide these values, we cannot conveniently compute the McKelvey and Zavoina R^2. Therefore, we chose to report the Veall-Zimmermann R^2 (R^2_{vz}). The R^2_{vz} is calculated as follows:

$$R^2_{vz} = \frac{[LL(\beta) - LL(C)][N - 2LL(C)]}{-LL(C)[N + 2LL(\beta) - 2LL(C)]}$$

where N is the number of observations in the model. The R^2_{vz} ranges from 0 to 1. In this study, the R^2_{vz} is a better choice for GOF measure of our models than McFadden ρ^2 because the McFadden ρ^2 is more

suitable for ordinal categories with three or fewer categories (Veall and Zimmermann 1996), and we have six categories for RTD and five categories for RDM. Therefore, we chose to report R^2_{vz} for each model.

Each of the models contains explanatory variables that make statistically significant contributions toward explaining the variations in these frequency measures. When developing the RTD models, we first entered the variables regarding the individual level (e.g., physical limitations, etc.) into the ordered probit model. We kept the variables that were significant at the 0.1 level and conceptually plausible. Then, the variables regarding the social environment (e.g., a member of a club, etc.) were entered into the model. Once again, the variables that were significant and had conceivable explanations were kept. This process continued with physical environment variables and then demographic factors.

We used the same process to estimate the nine RDM models. Note that the RDM variables were measured on a five-point rather than six-point ordinal scale; hence the models have one fewer threshold parameter than the RTD models. In addition, the initial RDM models for each purpose included RTD for that purpose to account for the possibility that the desire to travel more or less depends on the current frequency of travel.

Multivariate models contain several variables in the models. So multicollinearity may be a concern. To address this concern, we conducted two types of tests to check for multicollinearity among the explanatory variables in all of the models. First, we used a simple correlation which showed the largest correlation to be 0.60 (which was between dependence and physical limitations) and no other variables had correlations greater than 0.40. Generally, multicollinearity is not a concern unless the correlations reach levels of 0.7 or 0.8. Second, we ran a linear regression model and had SPSS calculate the variation inflation factors (VIFs) of the explanatory variables. VIFs are calculated for linear regression models to show the potential of multicollinearity. None of the VIFs calculated with linear regression were larger than 2. Multicollinearity is a concern when the VIFs reach 4. Our ordered probit models are non-linear; we could not directly calculate VIFs for these models. Thus, this test provides informal evidence. Further, multicollinearity may not be a problem because our sample size was quite large (greater than 1,000).

6.1 Realized Travel Demand Models

This section presents RTD models for nine types of trips. These trips include: going to the doctor, pharmacy, store, hair salon, eating out, visiting a friend or relative, going to church, going to exercise, and no particular destination in mind. The RTD models had R^2_{VZ} ranging between 0.06 for doctor trips and 0.29 for store trips. Therefore, these models do provide insightful information on understanding aging women's mobility patterns, and they are in line with results for some other disaggregate travel behavior studies.

6.1.1 RTD for Doctor Trips

The final RTD model for doctor trips included four variables statistically significant at the 0.05 level (Table 6.1), from the categories of individual level, social environment, and demographics. The variable physical limitation, an individual-level variable, was positively associated with RTD for doctor trips. This relationship is plausible because women who have physical limitations may need to see the doctor more frequently and therefore have a higher RTD for doctor visits. The second significant variable was spouse at home, which belongs to the category of social environment. This variable is understandable given that the spouse may provide the ride and a woman with a spouse at home may have more of a desire to maintain better health to live longer with her companion. Further, two demographic variables were found significant. Women with a higher education level had a higher RTD for trips to the doctor. This positive association may be a result of more highly educated women being more cognizant of symptoms or the

need for routine medical exams. Women who work part-time had a lower RTD, identified as a negative relationship. The negative relationship may be due to working women having less time for doctor visits or not needing to go to the doctor as frequently. In the latter case, working part time is acting as a proxy for being in reasonably good health, which is the true cause of lower RTD for doctor visits.

Table 6.1 Realized Travel Demand for Doctor Trips

Variables	B	p-value
Individual		
Physical limitation	.389	0.000
Social		
Spouse at home	0.212	0.007
Demographics		
Work part-time	-0.264	0.052
Education	0.083	0.015
Threshold parameter 1	-1.635	0.000
Threshold parameter 2	1.065	0.000
Threshold parameter 3	1.952	0.000
Threshold parameter 4	2.140	0.000
Threshold parameter 5	2.608	0.000
Number of observations	1013	
Log-Likelihood at constants	-405.883	
Log-Likelihood at convergence	-389.829	
R^2_{VZ}	0.06	

6.1.2 RTD for Store Trips

The RTD model for store trips had eight variables statistically significant at the 0.05 level and two at the 0.10 level (Table 6.2). Four of the variables were categorized within the individual level: driver, SEI, physical limitation, and dependence. Women who drive, as well as women who have higher levels of self-efficacy (SEI), tend to have higher RTD for trips to the store (in Chapter 5 we saw that women who drive have higher levels of SEI). This result is plausible because women who drive and women with higher self-efficacy may be more active due to their ability and confidence. The variables physical limitation and dependence are negatively associated with RTD. These results are reasonable given that women with physical limitations and those who are more dependent on others are unable to travel independently when they want, therefore exhibiting lower RTD. The social environment variables, clubs and spouse at home, are also plausible. Women who belong to clubs tend to have larger social networks. These women may be able to receive a ride from other club members and therefore go out and about to locations other than club meetings. Further, women who have a spouse at home may have the shopping responsibilities of the household, and therefore shop more frequently, whether they drive or if their spouse provides a ride. Two physical environment variables, rural and distance to the store, had negative associations with RTD for store trips. In other words, women in rural areas have lower RTD for store trips compared to women in urban areas, presumably due to the more limited availability of shopping facilities. Moreover, women who have to travel farther to the store are less likely to go to the store as often as someone who lives closer to the store. The significant demographic variables reveal that the older a senior woman, the less likely she is to go shopping, but women with higher education tend to have a higher RTD for trips to the store.

Table 6.2 Realized Travel Demand for Store Trips

Variables	B	p-value
Individual		
Driver	0.456	0.001
Physical limitation	-0.189	0.081
SEI	0.117	0.099
Dependence	-0.677	0.000
Social		
Clubs	0.302	0.000
Spouse at home	0.201	0.012
Physical		
Rural	-0.204	0.010
Distance to store (grocery)	-0.104	0.000
Demographics		
Age	-0.025	0.000
Education	0.070	0.040
Threshold parameter 1	-4.212	0.000
Threshold parameter 2	-3.871	0.000
Threshold parameter 3	-3.498	0.000
Threshold parameter 4	-3.157	0.000
Threshold parameter 5	-1.807	0.588
Number of observations	1013	
Log-Likelihood at constants	-1181.400	
Log-Likelihood at convergence	-1052.560	
R^2_{VZ}	0.290	

6.1.3 RTD for Pharmacy Trips

Four variables were found significant for trips to the pharmacy (Table 6.3). Individual level, social environment, and physical environment each had variables statistically significant at the 0.10 level. The individual level had two variables that were significant in the model: women who can drive and women who are more dependent upon others for activities. Women who drive may be able to make more frequent trips to the pharmacy while those who are dependent upon others have a low level of RTD. Further, women who have a spouse that can provide a ride tend to have more frequent trips to the pharmacy. The physical environment can be an impediment: women who live farther from the pharmacy tend to make fewer trips to the pharmacy.

Table 6.3 Realized Travel Demand for Pharmacy Trips

Variables	**B**	**p-value**
Individual		
Driver	0.516	0.000
Dependence	-0.564	0.000
Social		
Spouse provide ride	0.062	0.077
Physical		
Distance to pharmacy	-0.053	0.006
Threshold parameter 1	-1.108	0.000
Threshold parameter 2	-0.411	0.094
Threshold parameter 3	0.903	0.000
Threshold parameter 4	1.149	0.000
Threshold parameter 5	1.866	0.000
Number of observations	1006	
Log-Likelihood at constants	-486.947	
Log-Likelihood at convergence	-449.863	
R^2_{VZ}	0.140	

6.1.4 RTD for hair salon trips

In addition to receiving a service, women may feel that the hair salon provides them a level of socialization. In the RTD model for hair salon trips, we found five statistically significant variables (Table 6.4). Within the individual level, self-efficacy has a positive association with RTD to the hair salon. However, women who require assistance due to their level of dependence upon others have a lower level of RTD to the hair salon. When examining the social environment, we find that women who belong to clubs have a higher number of trips to the hair salon. Women who belong to clubs may have larger social networks to draw on for rides, and may make hair salon trips a priority. Likewise, women with higher incomes also go to the salon more frequently, because women with higher incomes can afford to go to salons as well as pay for transportation if they do not drive. Women who live in rural areas do not get their hair fixed as often as women in urban areas. Women in rural areas may have a more difficult time getting to the hair salon if the distances are greater.

Table 6.4 Realized Travel Demand for Hair Salon

Variables	**B**	**p-value**
Individual		
SEI	0.101	0.125
Dependence	-0.409	0.001
Social		
Clubs	0.221	0.003
Physical		
Rural	-0.119	0.084
Demographics		
Income	0.147	0.000
Threshold parameter 1	0.891	0.078
Threshold parameter 2	2.420	0.000
Threshold parameter 3	3.066	0.000
Threshold parameter 4	3.175	0.000
Threshold parameter 5	4.776	0.000
Number of observations	1009	
Log-Likelihood at constants	-1333.66	
Log-Likelihood at convergence	-1294.56	
R^2_{VZ}	0.10	

6.1.5 RTD for Eating Trips

The RTD model for trips to go out and eat had eight variables statistically significant at the 0.10 level (Table 6.5). Four of these variables belong to the individual level. Women who drive as well as women with high self-efficacy and those without cognitive problems tend to have higher levels of RTD for going out to eat. Women with physical limitations have lower frequencies of eating out. Within the social environment, women who belong to clubs go out to eat more often as do women who have a neighbor that gives them a ride. With respect to the physical environment, women who live in rural environments do not go out to eat as often as women in urban environments. Women with higher incomes do go out to eat more frequently than those with lower incomes, most likely because of affordability.

Table 6.5 Realized Travel Demand for Eat Trips

Variables	**B**	**p-value**
Individual		
Driver	0.285	0.000
Physical limitation	-0.167	0.088
SEI	0.149	0.028
CI	0.166	0.009
Social		
Clubs	0.421	0.000
Neighbor ride	0.099	0.051
Physical		
Rural	-0.319	0.000
Demographics		
Income	0.124	0.000
Threshold parameter 1	0.468	0.163
Threshold parameter 2	1.097	0.001
Threshold parameter 3	1.700	0.000
Threshold parameter 4	1.877	0.000
Threshold parameter 5	2.492	0.000
Number of observations	942.000	
Log-Likelihood at constants	-1511.900	
Log-Likelihood at convergence	-1436.500	
R^2_{VZ}	0.181	

6.1.6 RTD for Visiting Friends or Relatives Trips

Individual, social, and physical environment as well as demographics all contained variables statistically significant at the 0.10 level in the model of RTD trips for visiting friends or relatives (Table 6.6). Within the individual level, women with physical limitations and those more dependent upon others had less frequent trips to visit friends or relatives. One can hope that friends and family come to the homes of women who have physical disabilities or are highly dependent upon others for mobility. Further, senior women with high self-efficacy make more trips to visit friends or relatives. Socially, women who belong to clubs as well as those who have a relative who can provide a ride make more trips to visit people. Within the physical environment, we find that women who live in the rural areas make fewer trips to visit friends and family as compared to those in urban areas. Women with higher incomes tend to make more of these types of trips than women with lower incomes.

Table 6.6 Realized Travel Demand for Visit Friend Trips

Variables	**B**	**p-value**
Individual		
Physical limitation	-0.451	0.000
SEI	0.129	0.050
Dependence	-0.234	0.089
Social		
Clubs	0.401	0.000
Relative provide ride	0.081	0.098
Physical		
Rural	-0.130	0.058
Demographics		
Income	0.065	0.012
Threshold parameter 1	-1.236	0.000
Threshold parameter 2	-0.496	0.127
Threshold parameter 3	0.185	0.569
Threshold parameter 4	0.385	0.235
Threshold parameter 5	1.063	0.001
Number of observations	1009	
Log-Likelihood at constants	-1601.72	
Log-Likelihood at convergence	-1530.75	
R^2_{VZ}	0.162	

6.1.7 RTD for Church Trips

The RTD model for church trips had six statistically significant variables at the 0.10 level (Table 6.7). Within the individual level, the negative coefficient of physical limitation indicates that women with physical limitations have lower RTD for church attendance. However, women with fewer cognitive limitations have higher frequencies of church attendance. Further, women who belong to clubs as well as those who have a spouse that provides a ride for them have higher frequencies of church attendance. Often, church attendance is an activity spouses share. For some people church may serve a social function in addition to the religious aspect. Women who live farther from the church tend to attend church less frequently than women who live closer.

Table 6.7 Realized Travel Demand for Church Trips

Variables	**B**	**p-value**
Individual		
Physical limitation	-0.472	0.000
CI	0.096	0.151
Social		
Clubs	0.524	0.000
Spouse provide ride	0.067	0.100
Physical		
Distance to church	-0.059	0.015
Demographics		
Income	0.076	0.011
Threshold parameter 1	-0.792	0.007
Threshold parameter 2	-0.454	0.118
Threshold parameter 3	-0.156	0.590
Threshold parameter 4	-0.062	0.830
Threshold parameter 5	1.864	0.000
Number of observations	931	
Log-Likelihood at constants	-1060.230	
Log-Likelihood at convergence	-999.679	
R^2_{VZ}	0.170	

6.1.8 RTD for Exercise Trips

The model for RTD of exercise trips had six variables statistically significant at the 0.10 level (Table 6.8). Considering the individual level, we found that women with higher self-efficacy tend to make more frequent exercise trips than women with lower self-efficacy. Within the social environment, results reveal that women who belong to clubs tend to make more trips to exercise than those who do not belong to clubs. Some women may view exercise as a social activity. We found that women living in rural areas make fewer exercise trips than those living in urban areas. Three demographic variables were found significant: women with higher incomes make more trips to exercise than those with lower incomes; women with higher educations make more exercise trips, but older women make fewer exercise trips.

Table 6. 8 Realized Travel Demand for Exercise Trips

Variables	**B**	**p-value**
Individual		
SEI	0.140	0.103
Social		
Clubs	0.422	0.000
Physical		
Rural	-0.528	0.000
Demographics		
Income	0.067	0.065
Education	0.091	0.034
Age	-0.023	0.001
Threshold parameter 1	-0.004	0.995
Threshold parameter 2	0.050	0.938
Threshold parameter 3	0.084	0.897
Threshold parameter 4	0.095	0.883
Threshold parameter 5	0.170	0.793
Number of observations	1014	
Log-Likelihood at constants	-718.494	
Log-Likelihood at convergence	-669.651	
R^2_{VZ}	0.150	

6.1.9 RTD for No Particular Place to Go Trips

Making trips with no particular place in mind may seem wasteful to some, but to others these trips carry positive utilities (Handy, et al. 2005). The model for RTD trips for no particular place to go had statistically significant variables at the 0.10 level within the individual level, social environment, and physical environment (Table 6.9). At the individual level, women with higher levels of self-efficacy make more trips with no particular place in mind. Likewise, women who belong to clubs make a higher frequency of these types of trips. Further, women who live in rural areas also make more trips with no particular place in particular to go. The women who make these trips may enjoy getting out of the house. Interestingly, we found that the closer a woman lives to grocery stores, the more often she conducts trips with no particular destination in mind. Therefore, although destination is secondary for this type of trip, a potential destination does attract such trips, which is consistent with Cao, et al. (2007).

Table 6.9 Realized Travel Demand for No Particular Place to Go

Variables	B	p-value
Individual		
SEI	0.373	0.000
Social		
Clubs	0.156	0.039
Physical		
Rural	0.178	0.018
Distance to grocery	-0.055	0.013
Demographics		
Volunteer	0.362	0.078
Threshold parameter 1	1.063	0.000
Threshold parameter 2	1.393	0.000
Threshold parameter 3	1.644	0.000
Threshold parameter 4	1.728	0.000
Threshold parameter 5	1.955	0.000
Number of observations	1017	
Log-Likelihood at constants	-535.610	
Log-Likelihood at convergence	-512.296	
R^2_{VZ}	0.090	

6.1.10 RTD for All Trips

We developed a linear regression model for the RTD for all trips. This variable was computed by summing scales of all nine trip types (here, the ordinal scale is treated as a continuous scale ranging from 1 to 6). Table 6.10 illustrates the model results. Within the individual-level factors, we found that women drivers take more trips (and hence higher RTD) than non-drivers; women with higher self-efficacy take more trips than women with lower self-efficacy; women with physical limitations and those dependent on others are more likely to have a low mobility. The social environment factors in the model showed that women belonging to clubs take more trips than women not belonging to clubs. The physical environment factors indicated that elderly women who live in the small urban locations tend to have a high mobility. Further, elderly women with higher incomes take more trips than women with lower incomes.

Table 6.10 Realized Travel Demand for All Trips

Variables	B	p-value
Individual		
Driver	1.983	.004
SEI	1.362	.000
Physical Limitations	-2.199	.000
Dependence	-1.397	.065
Social		
Clubs	3.120	.000
Physical		
Rural	-1.479	.000
Demographics		
Income	.662	.000
Constant	22.086	.000
Number of observations	1003	
R^2	.246	

6.2 Relative Desired Mobility Models

This section presents nine models for RDM. The R^2_{VZ} ranged from 0.036 for pharmacy trips to 0.171 for hair salon trips. Because the RDM scale centers around 3, with 1 and 2 on the scale representing a desire for less frequent travel, and 4 and 5 on the scale representing a desire for more frequent travel, the interpretation of the coefficients is more complicated than for RTD. A positive coefficient means a greater propensity to be in a higher category - a smaller desire for less frequent travel or a greater desire for more travel. A negative coefficient means a greater propensity to be in a lower category - a smaller desire for more frequent travel or a greater desire for less travel. Table 6.23 in Section 6.3 summarizes the explanatory variables found across all nine models.

6.2.1 RDM for Doctor Trips

The model for RDM of doctor trips had five variables statistically significant at the 0.05 level (Table 6.11). Variables from the individual level, social environment, and demographics appeared in the final model. In addition, two variables related to current RTD were in the model. Within the individual level, self-efficacy is positively associated with RDM for trips to the doctor, which seems to be counterintuitive. As for the social environment, women who receive rides from their neighbor have a smaller desire for more frequent travel or a greater desire for less travel to the doctor. These women may feel that their current numbers of doctor trips are satisfactory or they may feel they burden their neighbor for these rides. The model shows that RTD for doctor trips has a negative association with RDM for doctor trips. Further, women who receive a ride to the doctor from their neighbor or other people are less likely to desire more trips to the doctor, either because their medical travel needs are being met, or perhaps because they are reluctant to depend on another person for the ride. Demographically, age is positively associated with RDM for doctor trips.

Table 6.11 Relative Desired Mobility for Doctor

Variables	B	p-value
Current Travel		
Ride to Doctor in auto	-0.191	0.058
Doctor RTD	-0.168	0.000
Individual		
SEI	0.344	0.000
Social		
Neighbor provide ride	-0.133	0.022
Demographics		
Age	0.023	0.000
Threshold parameter 1	0.330	0.556
Threshold parameter 2	1.350	0.016
Threshold parameter 3	4.439	0.000
Number of observations	995	
Log-Likelihood at constant	-683.163	
Log-Likelihood at convergence	-654.954	
R^2_{VZ}	0.093	

6.2.2 RDM for Store Trips

The RDM model for trips to the store had five variables statistically significant at the 0.10 level (Table 6.12). These variables were categorized within social environment, demographics, and those related to RTD for store. We found that women who have relatives to provide a ride to the store tend to have a smaller desire for more frequent travel or a greater desire for less travel to the store. Similar to the "neighbor ride" variable in the trips-to-the-doctor model, they may actually feel that they go to the store enough or they may not want to ask their relative for more rides. Further, auto ownership has a negative association with RDM for store trips. These women may be able to go to the store when they want to go. We also found that household size is negatively related to RDM for trips to the store. These women may have someone else who does the shopping for them or they go with other household members to shop. Further, we found that senior women who traveled a lot to stores are less likely to desire more store trips. However, women who traveled to the store by bus are more likely to desire more frequent trips.

Table 6.12 Relative Desired Mobility for Store

Variables	B	p-value
Social		
Relative ride	-0.117	0.085
Demographics		
Own auto	-0.387	0.011
Household size	-0.248	0.001
Current travel		
Store trips by bus	0.631	0.039
Store RTD	-0.072	0.097
Threshold parameter 1	-3.762	0.000
Threshold parameter 2	-2.891	0.000
Threshold parameter 3	0.390	0.130
Threshold parameter 4	1.299	0.000
Number of observations	1016	
Log-Likelihood at constant	-190.539	
Log-Likelihood at convergence	-167.485	
R^2_{VZ}	0.159	

6.2.3 RDM for Pharmacy Trips

The individual level and physical environment along with demographic variables provided insight into RDM for trips to the pharmacy (Table 6.13). Two individual-level variables were significant with opposing signs. First, we found drivers are less likely to desire more trips to pharmacy; whereas self-efficacy has a positive association with RDM for pharmacy trips. This could indicate that women may want to get out of the house and going to the pharmacy allows them to browse for additional pharmaceutical or over-the-counter products. The physical environment also plays a role in this model given the variable rural has a positive association with RDM for pharmacy trips. Also, older senior women tend to have a smaller desire for less frequent travel or a greater desire for more travel to the pharmacy. It is uncertain if these aging women need more prescriptions filled or if they simply want to browse pharmaceutical supplies where a pharmacist can answer their questions. Either way, the indication of an unmet need for this vital trip type is troubling.

Table 6.13 Relative Desired Mobility for Pharmacy

Variables	B	p-value
Individual		
Driver	-0.328	0.029
SEI	0.204	0.017
Physical		
Rural	0.153	0.091
Demographics		
Age	0.016	0.018
Threshold parameter 1	-0.205	0.740
Threshold parameter 2	0.542	0.381
Threshold parameter 3	4.013	0.000
Number of observations	1016	
Log-Likelihood at constant	-482.082	
Log-Likelihood at convergence	-482.049	
R^2_{VZ}	0.036	

6.2.4 RDM for Hair Salon Trips

Three variables are significant in the model for RDM for hair salon trips (Table 6.14). Women with high levels of RTD for hair are less likely to desire more trips to the hair salon. The social environment plays a key role in identifying women who tend to want more hair salon trips. Women who have a spouse at home are more likely to want to go to the salon more often. We also find that going to the hair salon by ride is positively associated with RDM for trips to the hair salon. These women may be hesitant to ask for rides and thus have greater desire than can be fulfilled. Women who work full-time are also more likely to desire more trips to the hair salon which may be limited due to their work schedule. Working women may find hair salon more important because they want to enhance their looks for their job.

Table 6.14 Relative Desired Mobility for Hair Salon

Variables	B	p-value
Social		
Spouse at home	0.246	0.040
Demographics		
Work Full-time	0.488	0.080
Current travel		
Ride to hair salon	0.436	0.016
Hair RTD	-0.089	0.095
Threshold parameter 1	-3.149	0.000
Threshold parameter 2	-2.227	0.000
Threshold parameter 3	1.579	0.000
Number of observations	886	
Log-Likelihood at constant	-49.090	
Log-Likelihood at convergence	-41.414	
R^2_{VZ}	0.171	

6.2.5 RDM for Eating Trips

Going out to eat may be a novelty for some people, but it may feel like a necessity for those who may have a difficult time cooking as they age. Four variables were statistically significant at the 0.05 level for eating out trips (Table 6.15). With respect to individual factors, women with physical limitations are more likely to want to eat out more frequently. Women who receive a ride from their relative(s) tend to have a smaller desire for more frequent travel or a greater desire for less travel to eat out, which may signal a reluctance to ask for more rides to go out and eat, or may, in view of the positive influence of rides variables on RTD, be an indication that their needs in this respect are being more than satisfied. Relating to the physical environment, we find that women who live farther from their preferred coffee shop are more likely to want more trips for coffee. Finally, age is negatively associated with RDM for eating out trips.

Table 6.15 Relative Desired Mobility for Eat

Variables	B	p-value
Individual		
Physical limitation	0.550	0.000
Social		
Relative ride	-0.169	0.009
Physical		
Distance to preferred coffee	0.071	0.016
Demographics		
Age	-0.018	0.012
Threshold parameter 1	-3.850	0.000
Threshold parameter 2	-3.384	0.000
Threshold parameter 3	-0.003	.996
Threshold parameter 4	1.017	0.068
Number of observations	1007	
Log-Likelihood at constant	-440.014	
Log-Likelihood at convergence	-419.737	
R^2_{VZ}	0.083	

6.2.6 RDM for Visiting Friends and or Relatives Trips

The individual-level factors and social environment as well as demographics help describe the RDM of trips for women to visit friends or family (Table 6.16). Women with physical limitations are more likely to want to visit friends or family more frequently. These women may have a difficult time getting around and desire more time to socialize. Self-efficacy is negatively associated with RDM for trips for visiting friends and relatives, which is understandable because these women may be more active and are able to socialize more often than women with low self-efficacy. Women who have relatives that can provide a ride for them are less likely to desire more trips for socializing with friends and family. Women who work full-time are more likely to want more trips for visiting friends and relatives which may be due to their busy work schedule.

Table 6.16 Relative Desired Mobility for Visit Friend

Variables	B	p-value
Individual		
Physical limitation	0.283	0.016
SEI	-0.403	0.000
Social		
Relative provide ride	-0.319	0.000
Demographics		
Age	-0.025	0.001
Work full-time	0.477	0.033
Current travel		
Walk to visit friend	-0.385	0.084
Threshold parameter 2	-6.155	0.000
Threshold parameter 3	-2.468	0.000
Threshold parameter 4	-1.328	0.034
Number of observations	963	
Log-Likelihood at constant	-493.554	
Log-Likelihood at convergence	-462.526	
R^2_{VZ}	0.12	

6.2.7 RDM for Church Trips

The coefficients of variables in the model for RDM of church trips are all negative (Table 6.17). Women with high levels of self-efficacy are less likely to desire more church trips. So are women who own an automobile. Further, the women who receive rides from their neighbor or relative tend to have a smaller desire for more frequent travel or a greater desire for less travel to the church. These women may be satisfied with their church trips or they may not want to ask for a ride. We also found that women who already have a high level of RTD for church are less likely to want more church trips.

Table 6.17 Relative Desired Mobility for Church

Variables	B	p-value
Individual		
SEI	-0.305	0.003
Own auto	-0.193	0.209
Social		
Relative provide ride	-0.229	0.002
Neighbor provide ride	-0.134	0.062
Current travel		
Church RTD	-0.103	0.005
Threshold parameter 1	-4.690	0.000
Threshold parameter 2	-4.480	0.000
Threshold parameter 3	-0.610	0.075
Threshold parameter 4	0.584	0.106
Number of observations	1013	
Log-Likelihood at constant	-292.007	
Log-Likelihood at convergence	-269.744	
R^2_{VZ}	0.120	

6.2.8. RDM for Exercise Trips

The RDM for exercise trips has three statistical significant variables at the 0.10 level (Table 6.18). Rural has a negative association with RDM for exercise trips. This association is plausible because rural women may have a more naturally active lifestyle already, or perhaps traveling to reach an exercise location is not something they would consider doing. The variable RTD also has a negative association for exercise trips. Yet, driving to exercise has a positive association with RDM for exercise trips. These women may be busy with other activities and would like to fit more exercise trips into their schedules. Alternatively, women who go to exercise destinations by other modes may be less likely to want to increase their travel to these destinations due to the inconvenience of these modes.

Table 6.18 Relative Desired Mobility for Exercise

Variables	B	p-value
Physical		
Rural	-0.160	0.090
Demographics		
Income	0.060	0.079
Current travel		
Exercise RTD	-0.159	0.004
Exercise trip by auto	0.935	0.000
Exercise trip by walk	0.653	0.033
Threshold parameter 1	-1.781	0.000
Threshold parameter 2	-1.640	0.000
Threshold parameter 3	1.546	0.000
Threshold parameter 4	2.980	.000
Number of observations	1014	
Log-Likelihood at constant	-271.316	
Log-Likelihood at convergence	-261.506	
R^2_{VZ}	0.054	

6.2.9 RDM for No Particular Place to Go Trips

The individual-level factors and social environment play a role in influencing RDM for no particular place to go (Table 6.19). Self-efficacy is negatively associated with RDM for trips with no particular destination in mind. By contrast, women with fewer cognitive limitations are more likely to want to make more of these types of trips as would women with physical limitations. Women who rely on others (relatives) for a ride tend to have a smaller desire for more frequent travel or a greater desire for less travel for trips with no particular purpose. With respect to demographics, age is negatively associated with RDM for trips with no particular destinations, but women who own their own automobile are less likely to wish to make more trips with no particular destination.

Table 6.19 Relative Desired Mobility for No Particular Place to Go

Variables	B	p-value
Individual		
SEI	-0.251	0.005
CI	0.151	0.070
Physical limitation	0.274	0.031
Social		
Relative provide ride	-0.147	0.025
Demographics		
Age	-0.019	0.006
Own auto	-0.301	0.060
Threshold parameter 1	-3.813	0.000
Threshold parameter 2	-3.536	0.000
Threshold parameter 3	-0.461	0.506
Threshold parameter 4	0.738	0.293
Number of observations	942	
Log-Likelihood at constant	-535.610	
Log-Likelihood at convergence	-512.296	
R^2_{VZ}	0.089	

We did not model RDM for all trips combined because the information gained may not be helpful. For example, if a woman indicates she would like to go to the doctor much more, but to eat out much less, the responses cancel out one another regarding latent travel. If we total responses and have a value of 6 we do not know how the responses are combined, e.g., the scales are 1 = much less, 2 = less, 3 = about the same, 4 = more, and 5 = much more; therefore, a total of 6 could represent 1 plus 5 or 3 plus 3.

6.3 Summary

The RTD and RDM models estimated in this chapter provide insight into the actual travel (RTD) and the latent travel demand (RDM) for women age 65 and older in North Dakota. Similarities and differences were found between RTD and RDM among the variables within the individual level, social environment, and physical environment.

When examining the overall patterns of RTD, we found several similarities between trips within the individual level (Table 6.20). Women with higher self-efficacy experienced a higher RTD, particularly for trips to the following: to eat, visit friend, exercise, and no particular place, doctor, and hair. These women have greater abilities and confidence which result in more trips. Women who were more dependent upon others for their trips experienced lower RTD trips to visit friends. This is expected because these women are reliant upon others for trips and are held captive to other people's schedules. As expected, women who drive had higher RTD for store, pharmacy, and eat.

The social environment is important for women's mobility. Women who belong to clubs have a positive association with RTD for seven trip types (eat, friend, no particular place, exercise, church, store, and hair). These women are able to take more frequent trips, perhaps because they are able to call upon club members for rides or perhaps they may sometimes give rides. Also, women who have a spouse, relatives, or neighbors that can provide rides tend to make more trips.

Overall, the physical environment variables had logical associations with RTD. Women who live in the rural areas had quite low RTD for eat, friend, exercise, store, and hair. Interestingly, women living in rural areas have a high RTD for trips with no particular destination. Rural areas may have fewer

destinations and these women may want to just get out of the house and go for a ride or a walk. Distance to preferred destination also influenced trip frequency. Women who have to travel farther for their preferred destinations showed lower RTD for trips to the store, pharmacy, and church.

Demographics play a key role in RTD for aging women. Women with higher incomes had greater RTD for trips to eat, visit friend, exercise, and church. Women with higher education also had higher RTD for doctor and store as well as exercise trips.

The R^2_{VZ} ranged from 0.06 for doctor trips to 0.29 for store trips. The goodness of fit is respectable for most models.

Overall, we found that women who have greater physical limitations or are more dependent upon others tend to have lower RTD. Also those living in rural areas have low RTD for most trip types. Although the women living in the rural areas may have a lower RTD for travel, it does not mean they are not satisfied with their travel. These women may have a lower need or desire for more trips.

Table 6.20 Relationships of RTD and RDM with Explanatory Variables

Category	Variables	Doctor		Store		Pharmacy		Hair		Eat		Friend		Exercise		Church		No Particular Place	
		1	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Individual	SEI		+	+			+	+		+		+	-	+				+	-
	Dependence			-		-		-				-					-		
	CI									+						+			+
	Phys limitation	+		-						-	+	-	+			-			+
	Driver		-	+			-		+	+			-						
Social	Club			+				+		+		+		+		+			
	Spouse at home	+		+					+									+	
	Relative ride				-						-	+	-				-		-
	Neighbor ride		-							+							-		
	Spouse ride					+										+			
Physical	Rural			-			+	-		-		-		-	-			+	
	Distance to preferred			-	+	-					+					-		-	
Demographics	Age		+	-			+	+			-		-	-					-
	Income							+		+		+		+	+	+			
	Education	+		+										+					
	Work full-time								+				+						
	Work part-time	-																+	
	Volunteer																	+	
	Own auto				-												-		-
	Household size				-														

Note: 1 = RTD and 2 = RDM

(Table 6.20 Continued)

Category	Variables	Doctor		Store		Pharmacy		Hair		Eat		Friend		Exercise		Church		No Particular Place	
		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Realized Travel Demand (current travel)	Doctor		-																
	Store				-														
	Pharmacy																		
	Hair								-										
	Eat																		
	Friend																		
	Exercise														-				
	Church																-		
	No particular place																		+
Mode Choice	Auto		-												+				
	Ride in auto								+						+				
	Bus				+														
	Walk												-		+				

Note: 1 = RTD and 2 = RDM

In summary of the RDM models, with respect to the individual-level variables, women with physical limitations are more likely to want more trips to eat, visit friend, or no particular place, which is consistent with this group of women having low RTD for trips (Table 6.20). Women that have high self-efficacy are more likely to want more trips to the doctor and pharmacy, but less likely to desire more trips to visit friends and no particular place. It is not intuitive that women with high self-efficacy want more doctor and pharmacy visits unless they are so busy with other aspects of their life that they neglect these trips. Interestingly, these (plus church) are the very types for which SEI has no impact on actual trip frequency (RTD) – in support of our speculation. That is, self-efficacious women appear to be relatively engaged with respect to day-to-day activities outside the home (eating, grooming, shopping, socializing, and exercising) perhaps to the detriment of longer-term medical and spiritual needs.

Larger social networks are generally negatively associated with RDM, suggesting that the travel needs of those with such networks are largely being met. However, women with a spouse at home are more likely to want more trips to the hair salon. Wanting to go more frequently to the hair salon may be due to the women wanting to look nice for social engagements. On the other hand, women who receive rides from relatives are less likely to want more trips to eat, visit friend, no particular place, and church, and women who receive rides from their neighbor are less likely to desire more rides to the doctor. These results are consistent with the higher RTD of women who had larger social networks, again indicating that their needs are being met, for the most part. However, the negative impact on RDM may reflect women feeling they are a burden. Therefore, even though needs are being met for the most part, it may be at the expense of the women feeling like a burden to their social network.

With respect to physical environment, women who live farther from the store or from eating establishments are more likely to want more trips to these locations. Yet, women in rural areas are more likely to desire more pharmacy trips, but less likely to want more exercise trips. These results suggest that shopping, eating out, and medical care are extremely important for women living in remote areas.

Owning an automobile has a negative association with RDM. This is plausible since these women may have more flexibility to get in their vehicle and travel to their desired destination. The older senior women are more likely to want more doctor and pharmacy trips but less likely to desire more trips to eat, visit friend, and no particular place. These women may be satisfied overall with their current trips, but want more access to medical services. Women who are employed are more likely to want more trips to visit friends and to go to the hair salon. These women may have constraints on their time due to their work schedule.

Mode choice variables were found statistically significant in some of these models. In particular, women who took the bus to the store are more likely to want more trips to the store. They may need more frequent bus service to take them to these locations. Also, women who receive a ride to the hair salon are more likely to want more trips of this type. Therefore, we find that if the mode choice leaves women less in control (those who receive a ride or ride the bus), they are more likely to want more trips.

We found that women with higher RTD had less RDM for several types of trips, or vice versa. As discussed in Chapter 3, given fixed ideal travel demand, desired travel demand increases as RTD decreases, and vice versa. Therefore, it is plausible that RTD has a negative association with RDM. Further, these findings are consistent with Choo, et al. (2005) that

objective mobility had a negative affect on RDM. The R^2_{VZ} was lowest for pharmacy trips (0.036) and highest for hair salon trips (0.171).

When comparing the significant variables in the RTD and RDM models, there were six matched pairs that existed where a variable influences RTD and RDM in opposite ways. The first two matched pairs include the variable SEI being positively associated with RTDs to visit friends and to travel with no particular destination but negatively associated with RDMs. The third matched pair had the same association as the previous matched pairs, for relatives providing ride and visiting friends. The final three matched pairs were women with greater physical limitations had lower RTDs and higher RDMs for eating out and visiting friend trips, and finally, as did distance to preferred store and visiting store. In addition, two pairs of variables influenced RTD and RDM in the same way. In particular, women who live in rural areas tend to travel less frequently to exercise places and they tend to desire less travel to such places; women with higher incomes tend to travel more often to exercise and they tend to desire more travel for exercising. It is interesting that there are not more matched pairs. When a variable is significant for RTD but not RDM, it means that variable helps explain the amount of travel women do, but has no significant influence on what they wish to do. For example, women who belong to clubs make more trips to the store (a positive influence on RTD), but being a member of clubs does not significantly influence on their desire to make more or fewer trips to the store (RDM). Conversely, when a variable is significant for RDM but not RTD, it means although that variable does not help explain the amount of travel women do, it has a significant influence on what they desire to do. For instance, women who work full-time tend to want to visit friends more often (a positive influence on RDM), but their level of current visits (RTD) is not significantly impacted by this employment status. The ability to classify an explanatory variable in this way is a unique strength of this work (i.e., to distinguish its roles with respect to actual versus desired travel).

We were born to unite with our fellow men, and to join in community with the human race. − Cicero

7. CONCLUSIONS

With community there is unity of people. They gather to meet their own needs as well as the needs of one another from the dawn of life through the twilight of life. Community flourishes when people's needs and desires are met. Then other people are attracted to the community. Whether the community is located within a rural or small urban environment, it is the essence of life.

This dissertation investigates the mobility patterns, needs, and desires of women in the twilight of life. In this final chapter, first we review the findings for Realized Travel Demand and Relative Desired Mobility of women age 65 and older in North Dakota; second, we present coping strategies that aging women may consciously or unconsciously implement or may want to implement to improve their mobility; third, we discuss policy implications for mobility of the aging; and finally, contributions and limitations of this study are summarized.

7.1 Summary

Census data has revealed that the elderly population is growing. Previous studies have examined travel patterns of seniors. The new and incoming seniors are used to higher levels of mobility and will likely desire to continue an active lifestyle. Although several studies have investigated the mobility of the elderly population, no studies since Gillan and Wachs (1976) have explored lifestyles and transportation needs of the elderly as they did for those in Los Angeles. To date, many studies have mentioned unmet mobility needs of the elderly, but few have empirically assessed them. Even fewer studies have examined relationships of the mobility patterns of the elderly with their individual level, social environment, and physical environment, which are primary components of the multi-level conceptual ecological model developed by the behavioral sciences and public health disciplines. We utilized this framework to address the Realized Travel Demand (RTD) and Relative Desired Mobility (RDM) of elderly women in North Dakota.

This dissertation is a cross-sectional study that addresses the relationships between RTD and RDM, and variables categorized within the individual level, social environment, and physical environment. A telephone survey was conducted in August 2006 to collect data from 1,021 women age 65 and older living in North Dakota. The respondents were stratified into 509 women living in rural and 512 women living in small urban locations. We measured the dependent variable RTD as frequency of trips on a six-point ordinal scale (never, less than once per month, once or twice a month, about once every two weeks, about once a week, and two or more times a week) for nine types of trips (the doctor, pharmacy, store, hair salon, eating out, visiting friends, church, exercise, and no particular place). The other dependent variable, RDM, measured the senior women's desire for more or less travel using a five-point ordinal scale which ranged from "much less" (1) to "much more" (5), compared to their current level of travel for the same nine types of trips.

Four explanatory variables are classified as individual level: self-efficacy, cognitive abilities, dependence, and physical limitations. The questions used to develop these variables were based upon previously established surveys. The indexes were preferred forms of measurement to help us better understand mobility. The respondents' social environments were measured by proximity to, closeness of relationship

with, and the ability to provide a ride of nearest relative, friend, and neighbor. We also examined the RTD and RDM of women who belonged to clubs and those who did not belong to clubs. Physical environment was measured in two ways: rural vs. urban, and distance to closest preferred destinations. Socio-demographic variables were also measured in the survey.

Assorted statistical techniques were employed to examine the relationships between the RTD and the individual level, social environment, and physical environment, as well as between RDM and the individual level, social environment, and physical environment. We conducted bivariate analysis, then multivariate analysis using ordered probit.

Table 7.1 presents the hypotheses and results for these relationships. Overall, the results were consistent with our hypotheses.

Table 7.1 Summary of Hypotheses and Outcomes

Hypotheses	RTD Expected	RTD Actual	RDM Expected	RDM Actual
Individual level				
Women age 65 and older with high self-efficacy (SEI) have greater RTD than women with lower self-efficacy; those with high self-efficacy have lower RDM.	+	+	-	-
Women age 65 and older with greater cognitive abilities have greater RTD than those with lower cognitive abilities; those with greater cognitive abilities have less RDM than women with lower cognitive abilities.	+	+	-	-
Women age 65 and older that have physical limitations have lower RTD than those without physical limitations; those with physical limitations have greater RDM than those women without physical limitations.	-	-	+	+
Social Environment				
Women with a spouse, relatives, friends, and neighbors that provide rides have a greater RTD than those without these people; Women who have a spouse, relatives, friends or neighbors that provide rides have a lower RDM than women without these people..	+	+	-	-
Women who belong to clubs have greater RTD than women who do not belong to clubs; Women who belong to clubs have a lower RDM than women who do not belong to clubs. .	+	+	-	-
Physical Environment				
Women living in rural locations have a lower RTD than women living in small urban locations; Women living in rural locations have a higher RDM than women living in small urban locations.	-	-	+	+

7.1.1 Realized Travel Demand

Overall, within the individual level, we found that women with higher self-efficacy and higher cognitive abilities had higher RTD. Further, women who have physical limitations and those who are dependent upon others have lower RTD and they want more trips (higher RDM) as indicated in Table 6.20.

The social environment is important for women's mobility. Women who have a spouse, relative, friend, or neighbor who can provide a ride tend to have a higher RTD. Women who belong to clubs also tend to have a higher RTD. They may be able to rely on club members to provide rides.

The physical environment variables had negative associations with RTD. Women who live in the rural areas had quite low RTD. Distance to preferred destination also affected RTD for women. Women who have to travel farther for their preferred destinations showed lower RTD for trips such as to the store, pharmacy, and church.

Demographics play a key role in RTD for aging women. Women with high incomes and women with higher educations are more likely to have a high RTD. The R^2_{VZ} ranged from 0.06 to 0.290.

7.1.2 Relative Desired Mobility

Considering the variables regarding the individual level, women with greater physical limitations tend to have a higher level of RDM, which is consistent with this group of women having lower RTD for trips. Women who have high self-efficacy have limited unmet demand, but the model revealed unmet demand may possibly exist for doctor and pharmacy trips. However, it is not intuitive that women with high self-efficacy want more doctor and pharmacy visits unless they are so busy with other aspects of their life that they neglect these trips.

Women with larger social networks tend to have lower RDM. For example, women with a spouse, relative, or neighbor who could provide a ride, tend to have a smaller desire for more frequent travel or a greater desire for less travel. Women who live in rural environments tend to have a higher RDM for trips to the pharmacy, and distance to preferred shopping and eating establishments are positively associated with RDM.

Automobile ownership has a negative association with RDM indicating potential desire for fewer trips. Women with constraints on their time due to work, etc. tend to have a higher RDM trips to visit friends or to the hair salon. Mode choice may possibly influence RDM; for example, women who take the bus to the store were found to want more trips to the store. Further, women with higher RTD tend to have lower RDM for most types of trips.

7.2 Coping Strategies

After rural or small urban elderly women have stopped driving, they may knowingly or unknowingly develop strategies that help them to fulfill their travel needs. We did not address these coping strategies in the study but believe they are worth noting. We identified four potential coping strategies. First, women may make a conscious effort to keep an active mind, as well as physical mobility, by exercising to maintain their agility and ability to travel. These coping strategies directly impact the individual level of the ecological model. Second, aging women may intentionally or unintentionally develop new social networks to help fill the travel gaps they may experience as a result of cessation of driving. This strategy

would directly impact the social factors of the ecological model. Third, rural elderly women who no longer drive may feel their best option is to move to a location where their travel needs will be better met, in other words, to change their physical environment. Fourth, the women may begin using alternative methods to meet their travel needs such as the Internet or telephone if they have the self-efficacy or mental ability to use these technologies. For example, rather than traveling to the drug store to pick up a prescription, they may call the pharmacy to order it and have it sent to them via postal mail. Further, these women may begin using the internet to fill their time by surfing the Web or corresponding with friends and relatives via e-mail. Leung and Lee (2005) studied the impact the roles of the Internet, use of new media, social support, and leisure activities have on life quality. Although the study did not focus on seniors, it recognized the importance of social support among individuals. Results found that people who receive advice and who actively engage in Internet communication about aspects of their world with friends and strangers report strong social networks. Wright (2000) found that older adult Internet users did report higher satisfaction with Internet providers of social support and greater involvement with an online community was predictive of lower perceived life stress. More research is needed to identify the level of senior Internet involvement, as well as impact on quality of life seniors experience as a result of Internet use, particularly in rural environments. Interestingly, the Internet could potentially impact several of the factors within the multi-level ecological framework.

7.3 Policy Implications

Table 7.2 presents policies identified to address shortcomings within the individual level, social environment, and physical environment.

Table 7.2 Potential Policy Actions to Improve and Enhance Individual Level, Social Environment, and Physical Environment of the Aging

	Policies
Individual Level	Learning programs, exercise programs (in-home and out-of-home), crossword puzzles, etc. distributed to seniors; more volunteer programs to assist the aging with home-based tasks; reduce taxes for the elderly which would provide more money for travel
Social Environment	Internet service (computers) to encourage communication with others; increased efforts to involve seniors in Senior Centers, encourage clubs to reach out to seniors for membership; volunteer programs, unity in community programs.
Physical Environment	Internet service (and computers) for women in rural and small urban locations; transit or other mobility service once a week to certain locations e.g., store, doctor, etc.; improve store contents/services to include multiple purposes (e.g., grocery, pharmacy, etc.)

The study findings indicated that women with high self-efficacy as well as those with high cognitive abilities have higher RTD. Especially, the elderly women with higher self-efficacy tend to have a higher RTD and a lower RDM for visiting friends and traveling with no particular destination. Therefore, women with high self-efficacy, as well as those who have high cognitive abilities, may be able to maintain (or slow the loss of) these abilities by working on puzzles or other learning programs that keep their minds active. Further, women who may have lower self-efficacy or cognitive abilities could also attend learning programs to maintain what they have and also to improve their self-efficacy and their cognitive skills. Moreover, the women who have greater physical limitations had a lower RTD and a higher RDM for trips for eating out and visiting friends. Providing rides to these women on a more regular basis could greatly improve their satisfaction with mobility. Faith-based organizations are just an example of a group of

people that could provide rides. Special equipment may be needed to provide rides for women with physical limitations and therefore would require funds to be raised for the special vehicles.

Women with larger social networks tend to have higher RTD and lower RDM. Results also indicate the family is an important aspect within the social network. If aging women lose their spouse (to death, etc.) or family members (move away), or if family relationships erode, this will have substantial implications for public policy for the well-being of our aging population. These women, as well as others, will need to expand their social networks to improve their mobility. In particular, we can encourage them to participate in clubs or even encourage club members to reach out to seniors either as a volunteer project or to invite the seniors to join the clubs so they can increase their RTD. If clubs would reach out to the aging, it could help improve the mobility of the aging. Further, communities could focus on developing "unity in community" type of programs which would address needs of individuals living within the community. Ultimately, women having relatives who provided rides were more likely to be satisfied with their level of travel, higher RTD and lower RDM. However, some women may not have relatives nearby that can provide rides. Therefore, it could be beneficial to the elderly if the communities can implement the "adopting a relative" or "adopting a senior" program where either younger people or elderly people who can drive provide rides for the elderly women who need greater mobility

Women living in rural areas tend to have lower RTD, and RDM tends to be higher for those living in rural areas or farther from shopping and eating facilities. They desire to make trips for some purposes, but rural areas have limited facilities. One method to address these shortcomings would be for the rural stores to become more multi-purpose (offering more services), e.g., pharmacy, grocery, restaurant, etc. Also, women who either no longer drive or have limited driving capabilities could benefit from more public transit service and hours of operation to meet their mobility needs. It could be beneficial for seniors to have a bus available (sponsored by the community or otherwise) once a week to take them for needed trips, e.g., medical appointments or shopping, etc. Further, some locations may benefit from offering a subsidized (or pre-paid) ride service for seniors, particularly in low density areas where a bus service tends to be less cost effective. This would allow the seniors to receive rides on days that they are most needed, rather than trying to schedule an appointment on the only day the bus service is available to the community.

Finally, results indicate women with higher incomes had higher RTD, but no significant differences were found for income in the RDM models. Therefore, although low-income women traveled less, all else equal, they did not necessarily have an unmet demand and they may be happy with their current travel. As long as women are within a favorable distance to their destination or are able to receive rides, income is not a constraint on their desired mobility. Income assistance may still be valuable, however, precisely to help some seniors move closer to desired destinations (e.g. move into town from outlying areas), or to subsidize collective transportation services.

7.4 Limitations and Contributions

This study has three limitations. First, we used a cross-sectional approach to examine the dependent variables (RTD and RDM) and explanatory variables (individual, social, and physical environment), whereas a longitudinal study would have allowed us to identify causal relationships more confidently. Second, we did not use travel diaries to obtain precise trip locations and frequencies because they can be a burden for seniors and we were concerned that our respondents may not travel on the specific days a travel diary may be distributed, therefore underreporting their trips. Further, it may pose an unnecessary burden on the women to complete the travel diary on the days they do travel, particularly if they have troubles writing (physical limitations). We used an ordinal scale for our trip measurements which we believe are fairly accurate but not necessarily precise. Third, use of the telephone survey could

underrepresent seniors who have physical or mental problems which may preclude them from answering the telephone, thereby creating bias.

Even though there are limitations, this study makes substantial contributions to the literature. First, previous studies investigated the RTD of seniors. This study explored both RTD and RDM which goes beyond the current contributions in the literature on the subject matter. In particular, RDM addresses the unmet needs of the aging women, and the comparison between RTD and RDM substantially contributes to the body of literature. Second, we applied the multi-level conceptual ecological model to mobility of the aging. This framework is new to mobility of the aging. Third, senior women living in rural and small urban locations have been underrepresented in the study of mobility. Studies using NHTS data that addresses rural areas have necessarily omitted several Midwest states (North Dakota, South Dakota, Montana, and Wyoming) because they are not included in the NHTS. This study sought to rectify this problem by examining rural and small urban aging women in North Dakota.

7.5 Future Research

More work is needed to address the mobility needs of the elderly populations. This study may serve as a foundation for addressing the mobility needs of the rural and small urban elderly women living in North Dakota and be a base for further studies. A longitudinal approach would be advantageous to help us better understand the causal relationships between RTD and the individual level, social environment, and physical environment as well as RDM and the individual level, social environment, and physical environment. Such an approach would allow us to follow the women over a period of time to identify patterns in their travel and how these patterns change given modifications in their individual level, social environment, or physical environment. Additional research on RDM of the elderly would be beneficial. It would be useful to have more understanding of how changes in women's lifestyles, e.g., moving, impact their RTD and RDM. Further, it would be beneficial to have more insight into how the elderly provide rides for one another, e.g., older women providing rides rather than just receiving them.

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APPENDIX A: SURVEY INSTRUMENT

StrataY [1 = Urban, 2 = Rural]
ID
CATIRmkTotal [If >= 1, interviewer recorded comments]
City
ZipCode
PhoneNumber

Introduction
Hello, this is _____ calling for North Dakota State University Transportation Institute.

May I speak with _____?
1 Yes
2 Target not at this number

Ask Female
Are you, or someone in this household, a female, at least 65 years old?
1 Yes, I am
2 Yes, someone is
3 No

Explain
You are invited to participate in a study of travel for aging women in North Dakota. Your answers will be used to help build a stronger basis on which to establish policies and design programs to increase and improve travel for aging women in North Dakota.

You will be asked questions about travel behavior and the interview should take about 20 minutes. Your participation is entirely voluntary, and you may stop at any time. Your answers will be kept confidential, and identified only by a code number; your name will not be used. Your name was randomly selected from a list of women in North Dakota.

As a thank you for answering the questions, we will enter your name into a drawing for a chance to win one of five cash prizes of $100 each. If you don't feel comfortable answering a question, you may skip it and still be eligible for the drawing. The chances of winning are 1 in 200.

If you have any questions about this project, please call 701.231.8082. If you have questions about the rights of research participants you may contact the NDSU IRB at 701.231.8908.

1 Enter 1 to continue.

Driver
Do you drive?
1 YES
3 NO

Own Auto
If they drive:
Do you own or have access to an automobile?
1 YES
3 NO

Age
How old are you?
Answer must be in the range from 18 up to 105: ___

The study is designed to gather information from women who are at least 65 years old. Therefore, you are too young.
1 Enter 1 to continue.

WhoIsRsp 2748 – 2749 [1 = Sampled Name, 9 = all others]
Relationship $ 2780 – 2799 [If WhoIsRsp = 9, explanation of respondent]

Store
First, I would like to ask about trips that you take.

How often do you make trips to the grocery store or shopping?
Would you say ... read list below.
1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Store Method
What method of transportation do you usually use to get to the grocery store or shopping?
1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative Grocery
Would you like to travel more or less than you currently are to the grocery store or shopping?

Please respond with one of these responses: much less, less, about the same, more or much more.

1 Much less
2 Less
3 About the same
4 More
5 Much more

Doctor
How often do you make trips to the doctor's office (or other medical offices)?

If necessary, repeat possible answers from list below.

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Doctor Method
What method of transportation do you usually use to get to the doctor's office?

1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative Doctor
Would you like to travel more or less than you currently are to the doctor's office?

1 Much less
2 Less
3 About the same
4 More
5 Much more

Eat
How often do you make trips to go out to eat for a meal or coffee?

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Eat Method
What method of transportation do you usually use to go out to eat for a meal or coffee?

1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative Eat
Would you like to travel more or less than you currently are to the restaurant or coffee place?

1 Much less
2 Less
3 About the same
4 More
5 Much more

Pharmacy
How often do you make trips to the pharmacy or drug store?

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Pharmacy Method
What method of transportation do you usually use to get to the pharmacy or drug store?

1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative Pharmacy
Would you like to travel more or less than you currently are to the pharmacy or drug store?

1 Much less
2 Less
3 About the same
4 More
5 Much more

No Particular Place
How many trips do you make out of the house with no particular destination in mind?

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

No Particular Place Method
What method of transportation do you usually use to get out of the house with no particular destination in mind?

1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative No Particular Place
Would you like to travel more or less than you currently are out of the house with no particular destination in mind?

1 Much less
2 Less
3 About the same
4 More
5 Much more

Friend
How often do you make trips to socialize or visit with a friend or family member?

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Friend Method
What method of transportation do you usually use to make a social visit with a friend or family member?

1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other

Relative Friend
Would you like to travel more or less than you currently are to a friend or family social visit?

1 Much less
2 Less
3 About the same
4 More
5 Much more

Church
How often do you make trips to a Church or civic building (ex. Library)?

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Church Method
What method of transportation do you usually use to get to a Church or civic building?

1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative Church
Would you like to travel more or less than you currently are to a Church or civic building (ex. Library)?

1 Much less
2 Less
3 About the same
4 More
5 Much more

Exercise
How often do you make trips to exercise?

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Exercise Method
What method of transportation do you usually use to get to exercise?

1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative Exercise
Would you like to travel more or less than you currently are to a facility to exercise?

1 Much less
2 Less
3 About the same
4 More
5 Much more

Hair
How often do you make trips to the hair salon?

1 Never
2 Less than once per month
3 Once or twice a month
4 About once every two weeks
5 About once a week
6 Two or more times a week

Hair Method
What method of transportation do you usually use to get to hair salon?
1 Auto
2 Ride in automobile (friend, family, neighbor)
3 Bus
4 Taxi
5 Other (walking)

Relative Hair
Would you like to travel more or less than you currently are to the hair salon?
1 Much less
2 Less
3 About the same
4 More
5 Much more

Solve

Now I will read a series of statements. I would like you to tell me if the statement is not true at all, somewhat true, mostly true or entirely true.

I can always manage to solve difficult problems if I try hard enough.
1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Oppose
If someone opposes me, I can find the means and ways to get what I want.
1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Goals
It is easy for me to stick to my aims and accomplish my goals.
1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Unplanned
I am confident that I could deal efficiently with unexpected events.
1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Resourceful
Thanks to my resourcefulness, I know how to handle unforeseen situations.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Effort
I can solve most problems if I invest the necessary effort.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Cope
I can remain calm when facing difficulties because I can rely on my coping abilities.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Problem
When I am confronted with a problem, I can usually find several solutions.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Trouble
If I am in trouble, I can usually think of a solution.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Handle
I can usually handle whatever comes my way.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Date [dd/mm/yyyy]
I am going to ask you a set of questions that may seem silly. I don't mean to offend you, but I need to ask these questions for the research.

What is today's date? ..-..-....

Day
What day of the week is it?
1 Sunday
2 Monday
3 Tuesday
4 Wednesday
5 Thursday
6 Friday
7 Saturday

Phone Number
What is your phone number? _____

Birth Date
When were you born? ..-..-....

President
Who is the current President of the United States?
1 George W. Bush
2 Bill Clinton
3 Other Name

Past President
Who was the President before him?
1 George W. Bush
2 Bill Clinton
3 Other Name

Day Driving
Do you have any physical conditions which prevent or limit you from driving during the day?

Please respond no limitations, limits how often or how long, or absolutely prevents.
1 No limitations
2 Limits how often or how long
3 Absolutely prevents

Night Driving
Do you have any physical conditions which prevent or limit you from driving at night?
1 No limitations
2 Limits how often or how long
3 Absolutely prevents

Freeway
Do you have any physical conditions which prevent or limit you from driving on the highway?
1 No limitations
2 Limits how often or how long
3 Absolutely prevents

Gravel
Do you have any physical conditions which prevent or limit you from driving on gravel roads?
1 No limitations
2 Limits how often or how long
3 Absolutely prevents

Public
Do you have any physical conditions which prevent or limit you from taking public transportation?
1 No limitations
2 Limits how often or how long
3 Absolutely prevents

Walking
Do you have any physical conditions which prevent or limit you from walking?
1 No limitations
2 Limits how often or how long
3 Absolutely prevents

Bicycle
Do you have any physical conditions which prevent or limit you from riding a bicycle?
1 No limitations
2 Limits how often or how long
3 Absolutely prevents

Clubs
Do you belong to any groups or social clubs in your community or nearest community?
1 YES
3 NO

Bills
Now I will describe a few tasks. For each task, I need you to tell me if you are able to do the task with no difficulty, do the task with difficulty, require assistance or are dependent on someone else.

The first task is writing checks, paying bills and balancing a checkbook.
1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Taxes
Next, assembling tax records or papers, and handling business affairs.
1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Shopping
Shopping alone for clothes, household necessities or groceries.

1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Hobby
Playing a game of skill or working on a hobby.

1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Coffee
Heating water, making a cup of coffee or turning off stove.

1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Cooking
Preparing a balanced meal.

1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Events
Keeping track of current events.

1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

TV
Paying attention to, understanding, and discussing TV, a book, or magazine.

1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Appointments
Remembering appointments, family occasions, holidays and medications.

1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Travel
Traveling out of neighborhood, driving, or arranging to take bus.
1 Does with no difficulty
2 Does by self, but with difficulty
3 Requires assistance
4 Dependent on someone

Household
How many individuals live in your household including yourself?
Answer must be in the range from 1 up to 10: __

If Own Auto = No then:

Car Access
Does someone in your household own or have access to an automobile?
1 Yes
0 No

IF Household ANSWER IS MORE THAN 1 ASK:
If more than 1:
Spouse Home
Does a spouse live with you?

Spouse Ride
Would your spouse be able to provide a ride for you if you needed one?
2 Yes
1 Limited
0 No

Family
Does a family member live with you?

Family Ride
Would this person be able to provide a ride for you if you needed one?
Yes
Limited
No

Friend Home
Does a friend live with you?

Would this person be able to provide a ride for you if you needed one?
Yes
Limited
No

Friend Provide
Would this person be able to provide a ride for you if you needed one?
Yes
Limited
No

Relative Distance
Think about the family member who lives closest to you. How far away does this family member live from you?
1 Less than 1 mile
2 1-4 miles
3 5-10 miles
4 More than 10 miles

Relative Relationship
How would you rate the strength of the relationship you have with this family member, very close, close, somewhat close, not close?
1 Very close
2 Close
3 Somewhat close
4 Not Close

Relative Ride
Would this family member be able to provide a ride for you if you needed one?
Yes
Limited
No

Neighbor Distance
Now, think about the neighbor that lives closest to you. How far away does this neighbor live from you?
1 Less than 1 mile
2 1-4 miles
3 5-10 miles
4 More than 10 miles

Neighbor Relationship
How would you rate the strength of the relationship you have with this neighbor?
1 Very close
2 Close
3 Somewhat close
4 Not Close

Neighbor Ride
Would this neighbor be able to provide a ride for you if you needed one?
1 Yes
2 Limited
3 No

Friend Distance
Now, think about the friend that lives closest to you. How far away does this friend live from you?

1 Less than 1 mile
2 1-4 miles
3 5-10 miles
4 More than 10 miles

Friend Relationship
How would you rate the strength of the relationship you have with this friend?

1 Very close
2 Close
3 Somewhat close
4 Not Close

Friend Ride
Would this friend be able to provide a ride for you if you needed one?

1 Yes
2 Limited
3 No

Sidewalks

I'd like to know what your current neighborhood is like. Please tell me how true each of the characteristics is for your neighborhood on a scale from not at all true, to entirely true.

There are sidewalks on most of the streets in my neighborhood.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Safe
My neighborhood is safe for walking.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Movement
There are lots of people out and about within the neighborhood.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Taxi
There is taxi service available in my neighborhood.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Public Transit
There is public transportation (such as a bus) available in my neighborhood.

1 Not at all true
2 Somewhat true
3 Mostly true
4 Entirely true

Preferred Bank
The following section uses this scale: the ranges are from 0 to ¼ mile; ¼ to 1 mile; 2 to 3 miles; 4 to 5 miles; 6 to 10 miles; over 10 miles.

How far is it to your preferred bank?

Preferred Medical
How far is it to your preferred doctor's office?

Preferred Grocery
How far is it to your preferred grocery store?

Preferred PO
How far is it to your preferred post office?

Preferred Coffee
How far is it to your preferred coffee place or restaurant?

Preferred Pharmacy
How far is it to your preferred pharmacy or drug store?

Preferred Civic
How far is it to your preferred civic building, e.g., library or church?

Preferred Salon
How far is it to your preferred hair salon?

Income
Now I will read you income categories. Please tell me which category contains your approximate annual personal income before taxes.

Read list below.

1 Less than $5,000
2 $5,000 - 10,000
3 $10,000 - 15,000
4 $15,000 - 25,000
5 $25,000 - 35,000
6 $35,000 - 50,000
7 $50,000 - 75,000
8 $75,000 - 100,000
9 $100,000 or more

Education

What is the highest level of education attained? Some grade school or high school, high school diploma, some college or technical school, 4-year college or technical school degree, some graduate school, or graduate degree(s)?

1 Some grade school or high school
2 High school diploma
3 Some college or technical school
4 4-Year college/technical school degree
5 Some graduate school
6 Graduate degree(s)

Employment
What is your current employment status?

1 Full-time
2 Part-time
3 Homemaker
4 Retired
5 Volunteer

Moving
Are you considering moving in the next year?

1 YES
3 NO

If yes, ask 369

Moving Later
Are you considering moving in the next two to three years?

1 YES
3 NO

Why Moving [Up to 5 responses]
Please indicate any or all of the reasons for moving.

Read list and enter all that apply.
No access to transportation.
Want to move from a house to an apartment.
Want to be closer to services (medical, etc.)
Want to be nearer in proximity to family or friends.
Other (please specify).
You may choose 5 out of the possible answers
1 No access to transportation.
2 Want to move from a house to an apartment.
3 Want to be closer to services (medical, etc.).
4 Want to be nearer in proximity to family or friends.
5 Other reason(s)

If Why Moving includes Other, then:

Specify Reason
For what other reasons do you intend to move? _____

Thank you, _____, for your cooperation. Free Copy. This completes the survey!
Thank you again.