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Cost Benefit Analysis of Providing Non-Emergency Medical Transportation

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Executive Summary

Millions of Americans are considered to be "transportation disadvantaged," because they cannot provide or purchase their own transportation. As a result, this population—which is disproportionately elderly, poor, mobility-impaired, minority, or some combination of these—depends on others to access employment, education, shopping, and healthcare. Because they depend on others for transportation, the persons in this population have reduced access to healthcare services, and this places them at risk for poor health outcomes. Lacking available or affordable transportation, they miss or postpone routine care or preventive services, which can lead to a need for emergency care and preventable hospitalizations. For example, poorly managed asthma, a problem among children in the inner city with unique transportation barriers, can cause a major asthma episode (or attack). Access to non-emergency medical transportation (NEMT) can reduce emergency room and hospital expenditures for members of the transportation-disadvantaged population.

In response to the importance of examining the need for improved access to NEMT nationally, TCRP launched Project B-27, "Cost Benefit Analysis of Providing Non-Emergency Medical Transportation." The goal of this study was to compare the costs and benefits, including potentially large net health benefits, of providing NEMT to those who lack access to it. To achieve this goal, the objectives of this study were to

- Identify the transportation-disadvantaged population that misses non-emergency medical care because of a lack of available transportation (the target population);
- Determine the medical conditions that this target population suffers from and describe other important characteristics of these individuals, such as their distribution across urban and rural areas;
- Estimate the cost of providing the transportation that this population would need to obtain medical transportation according to various transportation service needs and trip modes;
- Estimate the healthcare costs and benefits that would result if these individuals obtained transportation to non-emergency medical care for key healthcare conditions prevalent for this population; and
- Compare the relative costs (from transportation and routine healthcare) and benefits (such as improved quality of life and better managed care, leading to less emergency care) to determine the cost-effectiveness of providing transportation for selected conditions.

This study investigated the hypothesis that improving access to healthcare for the transportation-disadvantaged population will lead to improved quality of life and an overall decrease in healthcare costs. Furthermore, this study examined whether this hypothesized net decrease in healthcare costs exceeds the incremental increase in transportation costs. This report explains the methods used in the Altarum Institute's study of this novel and complex issue and presents the findings, along with supporting documentation.

Summary of Results

An analysis of nationally representative healthcare datasets revealed that about 3.6 million Americans miss or delay non-emergency medical care each year because of transportation issues. This target population of 3.6 million persons was found to have a higher prevalence of chronic diseases and a higher rate of multiple chronic conditions. The reasons for this higher prevalence and rate are described in this report, as are the reasons chronic conditions and preventive care conditions were selected for the economic evaluation of providing transportation.

The researchers determined that the most appropriate method of evaluating the benefits of improved access to medical care is cost-effectiveness analysis (CEA). *For all 12 medical conditions analyzed, the researchers found that providing additional NEMT is cost-effective;* for four of these conditions, the researchers found that providing additional NEMT is actually *cost saving* – additional investment in transportation leads to a net decrease in total costs when both transportation and healthcare are examined. Table ES-1 summarizes the condition-specific results highlighting the most likely estimates.

Table ES-1: Summary of Condition-Specific Cost-Effectiveness

Condition	Type	Result
Influenza Vaccinations	Preventive	Highly Cost-Effective
Prenatal Care	Preventive	**Cost Saving**
Breast Cancer Screening	Preventive	Moderately Cost-Effective
Colorectal Cancer Screening	Preventive	Moderately Cost-Effective
Dental Care	Preventive	Highly Cost-Effective
Asthma	Chronic	**Cost Saving**
Heart Disease (Congestive Heart Failure, CHF)	Chronic	**Cost Saving**
Chronic Obstructive Pulmonary Disease (COPD)	Chronic	Highly Cost-Effective
Hypertension (HTN)	Chronic	Highly Cost-Effective
Diabetes	Chronic	**Cost Saving**
Depression / Mental Health	Chronic	Highly Cost-Effective
End-Stage Renal Disease (ESRD)	Chronic	Highly Cost-Effective

The CEA method measures the effectiveness-per-unit cost, as opposed to a cost-to-cost comparison. As described in this report, healthcare improvements are worth the amount invested when the cost is reasonable in light of improvements in mortality (enhanced life expectancy) and morbidity (health-related quality of life). Thus, while cost savings are the best possible outcome, cost increases may nevertheless be seen as worthwhile—i.e., cost-effective if they provide sufficient improvement in quality of life, life expectancy, or both. This standard is met for the eight conditions that are not estimated to be cost saving.

Based on the convention frequently cited in health economics literature, investments that provide one additional Quality Adjusted Life-Year (QALY) are valued at $50,000 (see Appendix C). Interventions that provide one QALY and cost less than $50,000, therefore, are deemed to be cost-effective – worth the investment. Each of the analyses yielded either a cost saving or a net cost increase of less than $50,000 per QALY. Due to variations in cost per QALY, the researchers labeled NEMT for

specific conditions as either highly or moderately cost-effective, with the former referring to costs far less than $50,000 per QALY and the latter referring to costs closer to $50,000 per QALY.

Using two approaches—one for chronic conditions amenable to disease management and one for conditions amenable to preventive care—the researchers were able to determine reasonable healthcare cost differences between well and poorly managed care. These differences were applied to the target population, which is assumed to have poorly managed care due to its transportation barriers. For chronic conditions, the researchers used the Medical Expenditure Panel Study data to determine these cost differences and, for preventive care, used values derived from the literature.

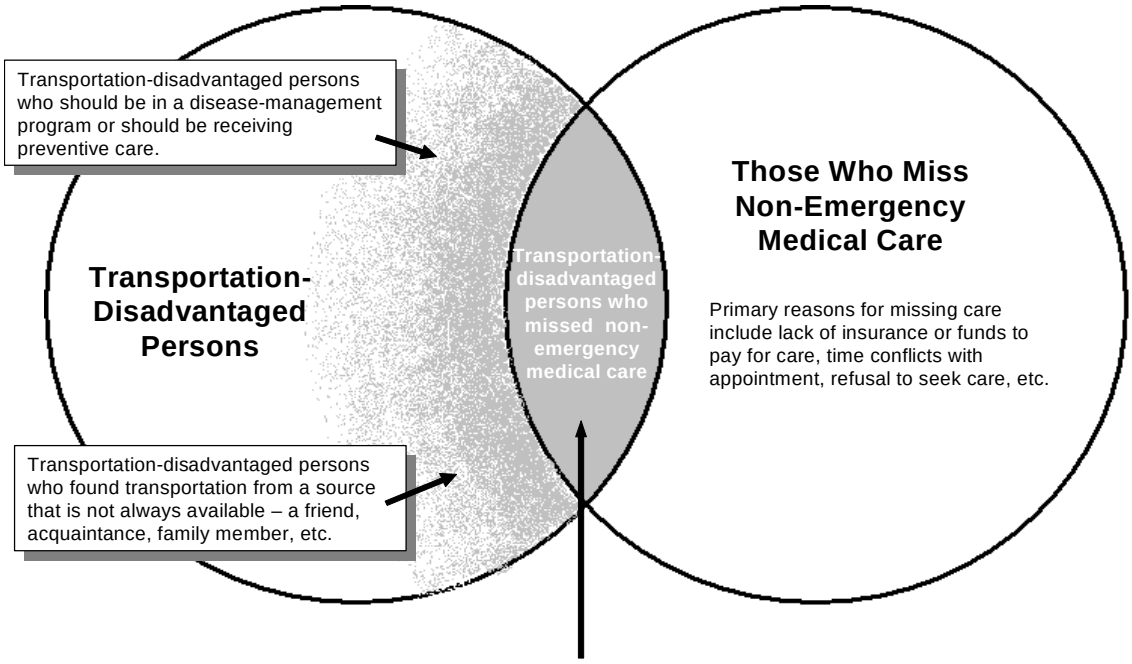
The net healthcare benefits of increased access to medical care for the transportation-disadvantaged exceed the additional costs of transportation for all of these conditions. These benefits include both actual decreases in healthcare costs for some conditions (e.g., emergency care replaced by routine care) and improved quality of life for those who receive access. For three of the chronic conditions (asthma, heart disease, and diabetes), results show net cost savings; for the other four (depression, hypertension, chronic obstructive pulmonary disease, and end-stage renal disease), improvements in life expectancy or quality of life are sufficient to justify the added expense.

These results evince a major finding and theme of this project: adding relatively small transportation costs does not make a disease-specific, otherwise cost-effective environment non-cost-effective. For example, a congestive heart failure monitoring program, already evaluated as highly cost-effective, will not become cost-*ineffective* by only adding incremental transportation costs. In other words, in today's economy, transportation is relatively inexpensive compared with the high and rapidly growing cost of healthcare.

Who Misses Non-Emergency Medical Treatment Because of Lack of Transportation: Defining the Target Population

The estimate of 3.6 million Americans who miss or delay medical care because of a lack of access to NEMT each year, derived from analysis of the National Health Interview Survey (NHIS) and the Medical Expenditures Panel Survey (MEPS), is conservative and should be seen as a lower bound estimate. Response bias inherent in these studies, e.g., their difficulty in surveying the homeless and other truly disadvantaged individuals, lowers the estimate, and some populations may be totally ignored in the data. This bias will tend to make the estimate lower than if the studies truly represented the entire U.S. population. Furthermore, because people can fall into and out of transportation-disadvantaged status over time, as well as change healthcare status (e.g., healthy or not, have insurance or not), results suggest that only some of the Americans who are at risk of missing non-emergency care because of a lack of transportation actually do miss medical treatment in a given year. This phenomenon is shown in Figure ES-1. Finally, several factors and trends—disproportionate population growth of groups in the current target population; the aging of the U.S. population; more expensive, less affordable healthcare; rising disease prevalence—will conspire to dramatically increase the future projection of transportation-disadvantaged individuals at risk of missing health care, i.e., this study's target population.

Figure ES-1: Transportation-Disadvantaged Population at Risk of Missing Non-Emergency Care



Approximately **3.6 million** Americans per

Those who fall into the target population of 3.6 million for this study have characteristics that clearly distinguish them from the rest of the U.S. population. Demographically and socio-economically, the findings show that, compared to the rest of the U.S. population, this target population

- Has relatively low income (54.6 percent have household incomes less than $20,000 per year compared with only 17.7 percent for the remainder of the U.S. population);
- Is disproportionately female (62.8 percent female versus 51.9 percent) and non-white (19.1 percent non-white versus 17.7 percent);
- Has a higher minority representation (13.5 percent African American versus 12.6 percent; 16.7 percent Hispanic versus 13.2 percent);
- Is roughly one-half as likely to possess a four-year college degree;
- Is older (16.3 percent are 70 or older compared with 11.5 percent); and
- Is distributed across urban and rural America much the same as the U.S. population as a whole, although children are slightly more concentrated in urban areas.

In terms of health status, the target population suffers from critical diseases at a higher rate than does the rest of the U.S. population, and it generally accesses more medical care than does the rest of the U.S. population, despite its transportation barriers, almost certainly because it is much more ill on average.

Selection of Health Conditions for the Analysis

The examined diseases were drawn from the prevalence data in NHIS and MEPS. While there is clear value in a condition-by-condition approach for evaluating the costs and benefits of providing transportation to transportation-disadvantaged individuals, there is an obvious trade-off between the number of conditions that are evaluated and the quality of these analyses. For this study, a limited number of health conditions, both chronic and preventive, were analyzed. These conditions were selected primarily because of their prevalence in the target population. The final list was reviewed and approved by the panel convened by TCRP to oversee the project. The conditions are listed in Table ES-2.

Members of the target population are extremely high healthcare users, despite the barriers they face getting to appointments, because they have high disease prevalence, multiple simultaneous diseases, and high disease severity. Based on their demographic, socio-economic, and health characteristics, members of the target population also appear to be more likely than others are to live in less healthy environments, exacerbating their need for healthcare visits. Recent research shows that a significant portion of overall healthcare cost inflation derives from a small set of healthcare conditions – on the order of 30 percent of cost growth is accounted for by five conditions (heart disease, pulmonary disease, mental health, cancer, and hypertension). These findings strongly argue for a condition-specific method, in which a selective set of conditions is intensively studied.

Table ES-2: Critical Medical Conditions Affecting Transportation-Disadvantaged Persons

Type of Care	Medical Condition	Prevalence in the Target Population (%)
Chronic	Depression or Other Mental Health Problem	50
	Hypertension	37
	Heart Disease	26
	Asthma	20
	Chronic Obstructive Pulmonary Disease (COPD)	19
	Diabetes	15
	End-stage Renal Disease (ESRD)	7
Preventive	Dental Problems	28
	Cancer	12
	Prenatal Care	2
	Vaccinations	N/A

Source: National Center for Health Statistics, Centers for Disease Control and Prevention, NHIS (2002).

The Cost of NEMT

To determine the costs associated with providing additional transportation, the researchers analyzed trip cost data for the year 2004 obtained from transportation providers located throughout the United States. The ambulatory, wheelchair, and stretcher costs of various trip types were determined in both urban and rural

locations. Although persons who are ambulatory could, in theory, access fixed-route transportation, the research suggests that those who actually have such access are or could be using it to obtain medical care. Thus, paratransit service was the focus for these three service types in urban and rural areas, resulting in six transportation cost categories. These categories and costs are listed in Table ES-3.

Table ES-3: NEMT Costs for Paratransit Services in Urban and Rural Areas

Service Type	Region	Average Cost per One-way Trip ($)
Ambulatory	Urban	19.95
Ambulatory	Rural	20.95
Wheelchair	Urban	28.52
Wheelchair	Rural	33.02
Stretcher	Urban	89.68
Stretcher	Rural	86.20

Source: Proprietary cost data (from year 2004) based on 800,000 trips provided by services located in 20 locales across the United States.

A small portion of missed trips could be provided by fixed-route public transportation. Using data from the National Transit Database (NTD), the researchers also determined that the average cost of providing a one-way, fixed-route trip is $2.86 (using 2002 data). Using these average costs—paratransit and fixed-route public transportation—for providing the unmet NEMT needs of the target population, the researchers were able to determine whether the net healthcare cost savings exceed the costs, by medical condition.

Missing Links: Shortcomings in Available Data

Addressing the study's objectives was difficult using the available datasets from the healthcare and transportation fields. Simply put, healthcare data lack sufficient information on transportation and access to care, while transportation data contain little on healthcare utilization and nothing on utilization by medical condition. To allow more detailed study of the nationally important questions and hypotheses addressed in this study, both transportation and healthcare professionals and researchers need better data.

Promising Avenues for Future Research

The current study was not able to investigate two important dimensions of the problem associated with the transportation-disadvantaged and access to non-emergency medical care. First, the researchers were not able to examine the target population over time (longitudinally), meaning that the cumulative health benefits derived from improved access to transportation were not captured. Second, the researchers were not able to investigate the effects of disease severity on cost-effectiveness and to identify the individuals most likely to benefit from improved access to NEMT. Both of these limitations are in line with the conservative nature of the research and, when studied in more detail, should contribute to even more significant findings than this study obtained.

Chapter 1: Introduction

Millions of Americans are considered to be "transportation disadvantaged," because they cannot provide or purchase their own transportation. Members of this population, due to low income, physical or mental disability, inability to drive, geographic isolation, or some other reason, cannot transport themselves or are unable to purchase available transportation services, such as those provided by buses or taxis. As a result, this population—which is disproportionately elderly, poor, disabled, or some combination of these—depends on others to access employment, education, shopping, and healthcare. This dependency, in turn, reduces access to essential healthcare services. Although disease progression can be complicated, for some people this reduced access clearly leads to decreases in health status or lost opportunities for detecting diseases early. People who are particularly affected include those with chronic conditions (e.g., heart failure, asthma, diabetes), especially those with multiple conditions (i.e., co-morbidities), and those who stand to benefit from prompt screening and disease prevention.

Because transportation-disadvantaged persons are associated with a critical lack of healthcare access, routine conditions can lead to a need for emergency care. Poor monitoring and preventive activities result in unnecessary hospitalizations. For example, poorly managed asthma—a problem among children in the inner city who are also more likely to be transportation disadvantaged than the general population is—can cause a major attack. This study investigates the hypothesis that improving access to healthcare for the transportation-disadvantaged population will lead to improved quality of life, potential enhancements in life expectancy, and an overall decrease in healthcare costs nationally. Furthermore, this study examines whether or not this decrease in healthcare costs exceeds the incremental increase in transportation costs required to provide additional non-emergency medical transportation (NEMT) to the transportation-disadvantaged population.

Billions of dollars are already being spent on transportation services for transportation-disadvantaged persons nationally. Because these dollars come from so many different sources, identifying and totaling these dollars is not easy. Indeed, according to a report prepared by the General Accounting Office (U.S. GAO, 2003), the multitude of programs makes it difficult to even measure the amount of federal funding spent to serve the transportation disadvantaged, though GAO found that 29 of the 62 federal programs that provide transportation services spent a combined total of nearly $2.4 billion per year, and the states together spend hundreds of millions of dollars per year. (In July 2004, the General Accounting Office was renamed the Government Accountability Office.) These estimates do not include the cost of time off from work and other costs borne by private individuals who transport disadvantaged family members and friends; thus, the real total is much higher than the sum of these federal, state, and local estimates.

For those Americans who are unable to purchase their own transportation or to obtain needed transportation from relatives, friends, and acquaintances, various forms of paratransit (such as demand-responsive buses, taxis, van services, etc.) are a primary mode by which they achieve mobility. This service, including that associated with non-emergency medical transportation, is provided by both public transportation

agencies and other (generally private or not-for-profit) entities. On the public side, paratransit serves a number of trip purposes (medical, shopping, employment) for older adults, people with disabilities, and other members of the transportation-disadvantaged population, much of this through Section 5310 of the transportation bill. In a study of public paratransit in southeastern Michigan, however, Wallace (1997) found that medical-related trips were the dominant trip purpose in the three-county area around Detroit, Michigan.

To access public paratransit, prospective riders generally must schedule their trip two days in advance. Furthermore, the demand may exceed the supply of trips, resulting in denied trip requests. Again for the service in southeastern Michigan, Wallace (1997) found that roughly 15 percent of trip requests could not be accommodated. While those eligible under the Americans with Disabilities Act (ADA) cannot be denied service in many situations, the average older adult without other access to transportation must compete with other users of the system for available service. Thus, denied trip requests can also lead to missed or delayed medical care.

A substantial investment is already being made to provide transportation to help transportation-disadvantaged people obtain medical services. Much of this is part of the Medicaid program and is provided by a patchwork of van services, taxis, ambulance services, and the like. Unlike Medicaid, however, Medicare does not offer a non-emergency transportation benefit, meaning that NEMT needs for this class of medical care must be funded from other sources.

In many regions, brokers have been established to match riders with available services. In other places, state or local agencies manage such services. In all cases, operators face the challenge of making maximum use of available transportation to meet a growing trip demand. Studies from Kentucky (O'Connell et al., 2002), Georgia (Logisticare, 2003a), Connecticut (Logisticare, 2003b), and North Carolina (Olason, 2001) have shown that such factors as computer-aided scheduling and dispatching and tight controls on eligibility can increase the capacity of available service by reducing average trip length, carrying more than one passenger at a time, and reducing the number of ineligible trips. In this way, average trip cost is reduced and more trips can be provided with no change in available resources.

In response to the importance of examining unmet needs for non-emergency medical transportation nationally, the Transportation Research Board (TRB) launched the project, *Cost Benefit Analysis of Providing Non-Emergency Medical Transportation* (TCRP B-27). The primary goal of this study is to determine if the costs of providing NEMT to those transportation-disadvantaged persons who currently lack access to NEMT are outweighed by the benefits of providing this service. To achieve this goal, the objectives of this study are to:

- Identify the transportation-disadvantaged population that misses non-emergency medical care due to a lack of available transportation
- Determine the medical conditions that this target population suffers from and describe other important characteristics of these individuals, such as their distribution across urban and rural areas

- Estimate the cost of providing the transportation that this target population would need to obtain non-emergency medical transportation according to various transportation service needs and trip modes
- Estimate the healthcare costs and benefits that would result if these individuals obtained transportation to non-emergency medical care for a set of key healthcare conditions prevalent for this population
- Compare the relative costs (from transportation and routine healthcare) and benefits (such as improved quality of life and better managed care, leading to less emergency care) to determine the cost-effectiveness of providing NEMT for the target population for the selected conditions

This final report presents the results, conclusions, and supporting documentation from the Altarum Institute's study of this complex issue. The following chapters describe this work, including methods and findings, in detail. In addition, there are three appendices to facilitate use of this report:

A. A brief glossary of technical terms

B. A comprehensive, annotated bibliography for most of the literature reviewed for this study (Articles obtained in the latter stages of completing the cost-effectiveness case studies, mostly found in Chapter 7, are not included in the Annotated Bibliography, but are cited in the References section.)

C. A technical appendix presenting an overview of cost-effectiveness analysis and the use of quality-adjusted life years in healthcare studies (QALYs)

Chapter 2: Literature Review

To develop a better understanding of the status of non-emergency medical transportation in the United States, particularly in regards to unmet trip needs, a thorough literature search of the field was conducted. This was accomplished using local resources (e.g., University of Michigan libraries, including that belonging to the University of Michigan Transportation Research Institute) and national and global search engines (such as TRIS, GOOGLE, Wilson, ProQuest, and Medline/PubMed). This search resulted in more than 200 sources. While not all of these are referenced in this discussion of the main findings and views present, most are summarized in Appendix B: Annotated Bibliography. The results emerging from our literature review focus on the most recent studies and are organized into four major sub-units:

- Identification of the transportation-disadvantaged population
- Evidence of unmet non-emergency medical (NEM) trip needs
- Consequences of this unmet need
- Estimates of the costs and benefits of meeting this unmet need

In addition to these four major thrusts culled from the literature, there is substantial use of published literature that addresses the cost-effectiveness of well- managed care for critical medical conditions affecting the transportation-disadvantaged population in Chapter 7.

2.1 Identification of the Transportation-Disadvantaged Population

Because no single definition of the "transportation disadvantaged" has yet been universally accepted, the literature from the health and transportation sectors can be used to support differing estimates of the size of the transportation-disadvantaged population. Indeed, much of the literature avoids the term altogether and instead simply documents discrepancies in transportation access associated with socio-economic (e.g., household income), demographic (e.g., age), and geographic (e.g., urban vs. rural) factors. Thus, at one extreme, any household that does not own a vehicle might be defined as transportation disadvantaged, and this amounts to 8.3 percent of all households in the U.S. (Pucher and Renne, 2003). Furthermore, 88 percent of Americans aged 15 or higher report that they are drivers, leaving 12 percent who do not operate personal vehicles (U.S. DOT, Bureau of Transportation Statistics, 2003a). When they examined population subgroups, however, Pucher and Renne found that 26.5 percent of households with incomes less than $20,000 do not own a vehicle. They also found that members of this income group were far more likely to use public transit (4.6 percent of all trips compared with an average of 1.7 percent for all Americans) and non-motorized (walk or bicycle) modes (17.0 percent of all trips compared with 10.4 percent for all Americans). Further illuminating who the transportation disadvantaged are, the BTS reported that households with no vehicles also are disproportionately renters, located in urban areas, and made up of a single person (U.S. DOT, Bureau of Transportation Statistics, 2003a).

Race and ethnicity also are associated with being transportation disadvantaged. Using data from the 2001 National Household Travel Study (NHTS), Pucher and Renne (2003) found that African Americans and Hispanics have much lower mobility and use public transit at much higher rates than the general population. Furthermore, Schweitzer and Valenzuela (2004) found that both low-income and minority communities suffer from a lack of access to transportation and from a litany of other ill effects associated with transportation (such as air pollution, noise, and fewer jobs in the transportation sector) at higher rates than do other population groups.

Beyond income and ownership barriers to transportation, studies also show that age and location are important factors in defining the transportation disadvantaged. Although studies have shown that older adults and residents of rural areas continue to rely on personal vehicles for the vast majority of their transportation needs (Rosenbloom, 2003; Pucher and Renne, 2004)—for example, Americans over 65 years of age make about 90 percent of their trips by car and 97 percent of rural households own at least one car—they often have few, if any, options when the car is not available. Indeed, Rosenbloom (2003), citing work done by the Community Transportation Association of America (CTAA), reports that about 40 percent of rural counties have no public transportation and only 14 percent of the rural elderly have transportation service available within one half-mile of their residence.

2.2 Evidence of Unmet Need for NEMT

Published literature both convincingly documents the existence of unmet transportation needs and provides insights into the demographic and other factors associated with these unmet needs. These factors include age, poverty, disability, geographic location, and race. A study commissioned by the Children's Health Fund (Zogby International, 2001) found that nine percent of children in families with incomes less than $50,000 per year miss essential medical appointments due to a lack of transportation, regardless of their insurance status. In fact, at least two other studies have also shown that lack of transportation is a problem even after accounting for insurance status (Aved et al., 1993; Braverman et al., 2000).

Focusing on the population below age 65 in Dayton, Ohio, Ahmed et al. (2001) found that 16 percent of respondents reported that finding transportation for medical care was "hard" and another 15 percent reported that it was "very hard." In a study that focused on the higher end of the age spectrum (defined as those over age 50), O'Malley and Mandelblatt (2003) found that patients who were over age 50 and whose household income was less than 200 percent of the poverty line were nearly twice as likely to delay care due to transportation and/or time issues compared to all patients above age 50. Furthermore, they also found that transportation and time issues were nearly as important a barrier as cost (14.3 percent vs. 18.8 percent) for the same group (>50 years and <200 percent of poverty level). Another study (Sipe et al., 2004), based on interviews with visitors to a pediatric clinic at a large, urban hospital, found that 60 percent of respondents had previously missed or arrived late for an appointment due to transportation difficulties. Finally, another study revealed that not showing up for appointments in the past due to transportation problems was predictive of not showing up in the future (Paul and Hanna, 1997), indicating a recurring problem for the same individuals.

In rural areas, access to healthcare can be even more difficult to obtain than it is elsewhere, and numerous studies (Flores et al., 1998; Ide et al., 1993; Larson et al., 2004; McClure et al., 1996; Mulder et al., 2000) have documented these difficulties. In a study of one rural county, for example, Walker (2002) found that 40 percent of patients missed medical appointments and 28 percent could not get to a pharmacy because of transportation barriers. Contributing to the problem, rural areas are less likely to have public transportation available; indeed, the American Public Transportation Association (APTA) reported that 41 percent of rural Americans have no access to public transit (APTA, 2003). Another contributor to access problems in rural areas is distance; medical facilities tend to be farther away from patients, on average, and distance is associated with missed care. In one study, patients who lived more than 20 miles from the site of care were twice as likely to miss scheduled appointments (Ide et al., 1993) as those who lived closer.

While large-scale, nationally representative studies performed by, or on behalf of, the U.S. Department of Transportation have not specifically examined the nexus of non-emergency medical transportation (NEMT) and unmet trip needs for healthcare, two studies shed some light on the potential scale of the problem. One of these studies, the 2001 *National Household Travel Survey* (NHTS), found that 8.6 percent of respondents reported having a medical condition that limits their travel, regardless of trip purpose (U.S. DOT, Bureau of Transportation Statistics, 2003a). Perhaps more tellingly, a second study (U.S. DOT, Bureau of Transportation Statistics, 2003b) revealed that 3.5 million Americans never leave their homes. Of these, 1.9 million have disabilities, and roughly 528,000 of these have transportation difficulties.

Race and ethnicity, too, are associated with transportation access problems. Research on the effects of race on access to care has shown that 10 to 20 percent more racial minorities than whites are transportation disadvantaged (Friedman et al., 2003; Moran et al., 2003). Looking specifically at access to healthcare, the Institute of Medicine (2002) cited access issues as a reason that minorities receive lower-quality healthcare than do non-minorities, even when the minorities have equal levels of insurance coverage.

2.3 Consequences of Unmet NEMT Needs

The health of individuals who fail to obtain medical care due to transportation barriers depends to some extent on whether the missed care was preventive or treatment for an existing (or chronic) condition. In the preventive arena, lack of transportation can lead to under-immunization (Yawn et al., 2000), difficulties in administering screening programs (Lavizzo-Mourey et al., 1994), failure to attend pediatric check- ups (Specht and Bourguet, 1994), and lack of prenatal care (Aved et al., 1993; Braverman et al., 2000; McCray, 2000).

In the realm of chronic problems, numerous studies have documented inadequate care due to lack of transportation. Conover and Whetten-Goldstein (2002), for example, found that 16.7 percent of AIDS and HIV patients reported difficulties in obtaining transportation and as a result were much less likely to have a primary-care physician or to get regular care. Patients suffering from diabetes who missed more than 30 percent of scheduled appointments suffered significantly worse health outcomes than those who kept their appointments (Karter et al., 2004). Furthermore,

an earlier study, concerned with adherence to standards of care for diabetes, found that transportation problems were among the most frequently cited reasons for missed care (Jorgensen et al., 2002). Additionally, asthmatic patients entering the emergency room have been shown to be much less likely to obtain follow-up care if they do not have access to transportation (Baren et al., 2001; Ebbinghaus and Bahrainwala, 2003; Smith et al., 2002).

A detailed analysis sponsored by the U.S. Agency for Healthcare Research and Quality highlights healthcare access problems faced by rural residents (Gresenz et al., 2004). It finds that the distance between the rural uninsured and a variety of safety net providers (hospital emergency rooms, public hospitals, migrant health centers, etc.) is a significant variable explaining lower healthcare service utilization. The authors of this study present strong evidence that facilitating transport will improve access to care by the rural uninsured. Importantly, this study relies on a preferred dataset derived from the Medical Expenditure Panel Survey—a data source that is also heavily used in the current study.

Not having a car is one factor that hinders access. Urban and rural areas that have some form of public transportation may not have routes to medical care, especially for the most economically disadvantaged neighborhoods (Hobson and Quiroz-Martinez, 2002). Of patients riding public transportation to get medical care, 86 percent reported missing an appointment due to transportation barriers, and 95 percent reported arriving late, as compared with 27 percent and 43 percent, respectively, among patients with cars (Sipe et al., 2004). Another study showed that patients diagnosed with asthma were much less likely to return for a follow-up appointment with a primary-care physician if they relied on public transportation, friends, or walking to access appointments than were patients with their own transportation (Baren et al., 2001).

Older adults are distinctly affected by problems accessing NEMT. Of Americans over age 65, 21 percent do not drive any longer, and these reported taking 15 percent fewer trips to the doctor than did older adults who still drive (Bailey, 2004). In addition to documenting age-related access problems, studies have also shown that the prevalence of more than one health problem (co-morbidity) is also age dependent, suggesting that many older Americans who experience transportation barriers also suffer from multiple chronic health conditions (Bayliss et al., 2003). Indeed, a new body of literature addresses the issues confronted by the roughly 125 million Americans with a chronic illness and 60 million with multiple chronic conditions (Anderson, 2002; Anderson and Knickman, 2001; Burton et al., 2004; Partnership for Solutions, 2004; Partnership for Solutions, 2002). This literature demonstrates that these individuals are more likely to be hospitalized, see a variety of physicians, take several prescription drugs, and be visited at home by health workers. Due to uncoordinated care, they experience unnecessary hospitalization, duplicate tests, conflicting clinical advice, and adverse drug reactions. Furthermore, this group with multiple chronic conditions is estimated to account for 57 percent of total healthcare spending nationwide (Burton et al., 2004).

2.4 Estimates of Costs and Benefits of Meeting Unmet NEMT Needs

Meeting the needs of the transportation-disadvantaged population requires enhanced transportation resources plus additional healthcare—both of which increase costs. These services, however, are hypothesized to result in improved health outcomes, such as reduced need for high-priced emergency care, and better quality of life for affected individuals. As evidence of the former claim, Moran (2003) found that 61 percent of caretakers who experienced transportation problems associated with bringing children to the emergency room reported missing care that the caretaker believed was necessary. Other studies have shown that a high percentage of emergency room visits are actually for non-emergency conditions (Beland et al., 1998; U.S. GAO, 2000a; Burkhardt and McGavock, 2002). An international comparison shows weak primary care coordination, lower access to a usual source of care, and a lack of long-standing patient-physician relationships in the U.S. compared with other countries (Schoen et al., 2004). As discussed above, these shortcomings can lead to emergency care for non-emergency conditions.

Nationally, the General Accounting Office (U.S. GAO, 2003) identified 62 federal programs that "fund transportation services for the transportation disadvantaged," accounting for about $2.4 billion in federal expenditures alone in fiscal year 2001, plus whatever is spent by states and localities, an amount that GAO estimates to be in the hundreds of millions of dollars. Of course, not all of this transportation is for non-emergency medical trips.

Looking only at Medicaid transportation assistance, a comprehensive study of state programs (Stefl and Newsom, 2003) showed that California, the most populous state, alone spent about $95 million of federal and state money (50-50 match) in FY 2002. Florida, another populous state, spent about $69 million in FY 2002, about 56 percent of which were federal dollars; with these funds, Florida provided roughly 3.4 million one-way trips, at an average cost of about $19.65 per trip. Delaware, a much smaller and less populous state than either California or Florida, spent $8.5 million of federal and state funds (again, 50-50 match), and provided 544,000 one-way trips for this money (about $15.65 per one-way trip).

Measuring the benefits of providing transportation is *far more difficult* than measuring its costs. Nonetheless, some studies have succeeded in developing estimates. These studies have shown that interventions that include transportation to increase attendance at appointments often reported positive results, including fewer missed appointments, reduced length of stay, and fewer emergency room visits (Block and Branham, 1998; Baren et al., 2001; Ebbinghaus and Bahrainwala, 2003; Friedhoff, 1999; Friedmann, Lemon, and Stein, 2001; Messeri et al., 2002; Rimmer et al., 2002; Sherer et al., 2002). Examining dollar benefits of improved access, Burkhardt and colleagues (1998) focused on transportation for dialysis patients in Charlottesville, Virginia. They found significant benefits, even though they considered only the cost differential between trip provision by public transit and costs for the same trips provided by private, wheelchair van services. Thus, they did not consider the quality-of-life benefits from these trips, assuming that patients would have made these trips one way or the other due to the life-and-death nature of dialysis. This study inherently failed to investigate the effects of providing otherwise

missed trips—its authors assumed all trips would be made no matter what—so the costs of transportation provision did not need to be balanced against the net benefits of treatment. For near-emergency services such as dialysis, however, one would expect even greater benefits for providing otherwise missed trips.

The literature points to a clear, policy-relevant problem of inadequate transportation serving as a key, contributing factor to a lack of access to medical care. Nevertheless, despite a burgeoning literature on the healthcare access problems in America—typically labeled as a "crisis" of un- or under-insured—only a fraction of the literature specifically relates transportation barriers to the larger problem of healthcare access. Indeed, two articles appearing in a prestigious health journal (*Inquiry*) that attempt to comprehensively link community factors with the health access problems faced by lower-income adults do not even mention the word "transportation" (Davidson et al., 2004; Brown et al., 2004). This gap in the professional literature strongly attests to the value and novelty of the present study.

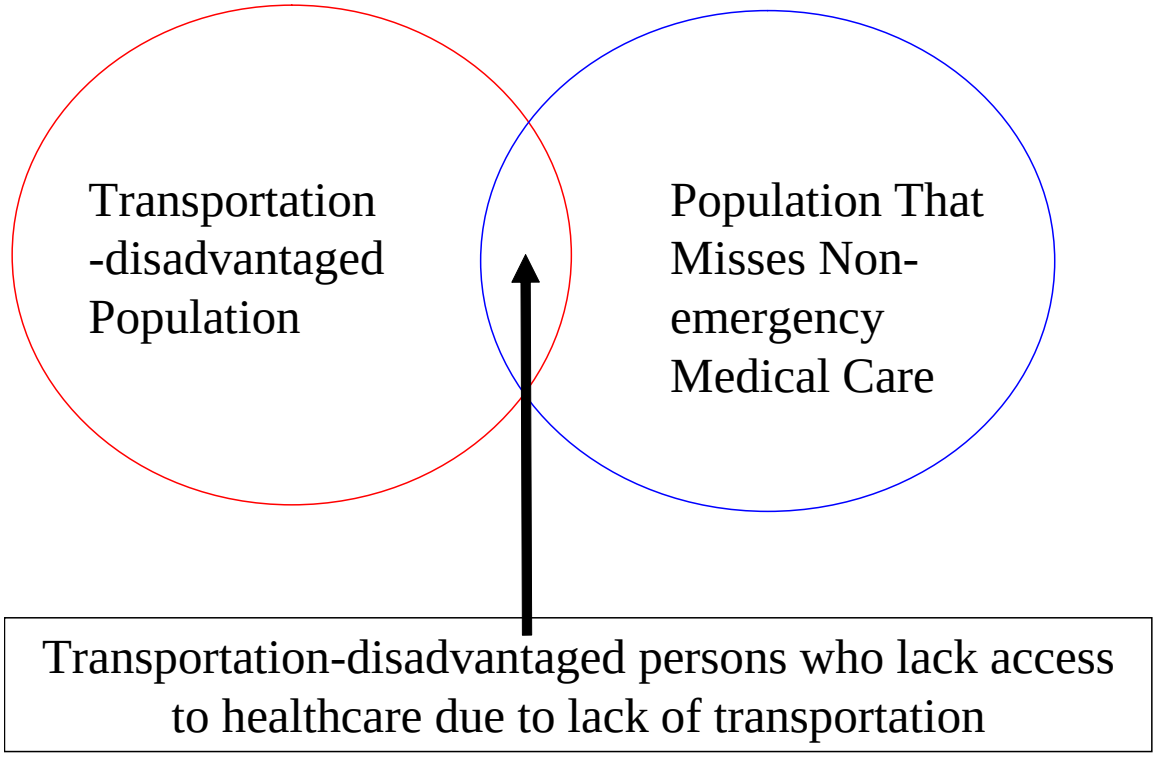
2.5 Additional Use of Literature in This Report

The literature review is intended to be representative of the existing literature and the views and findings presented therein. It is not, therefore, meant to be comprehensive of all literature in the healthcare and transportation fields bearing on non-emergency medical transportation (NEMT). In particular, a large swath of the literature addressing the cost-effectiveness of care for specific disease conditions is referenced in Chapter 7. Furthermore, literature specific to other aspects of this study is referenced in other chapters, where these citations are most relevant and useful. Finally, there is an extensive annotated bibliography of literature included as Appendix B.

Chapter 3: The Transportation-Disadvantaged Population and Access to Healthcare

As stated in the Introduction, the overall goal of this study is to determine if the net benefits of providing NEMT to transportation-disadvantaged persons who currently lack access to NEMT exceed the costs of providing this service, including both transportation and healthcare costs. This determination, however, is complicated by one very important consideration: transportation-disadvantaged status alone is not sufficient to indicate that someone misses medical care due to a lack of NEMT. To miss care, one must first need care, recognize the need for care, attempt to schedule it, etc.; thus, at one extreme, a healthy person may never miss care for any reason, despite being transportation disadvantaged. Furthermore, even a clearly transportation-disadvantaged person may, perhaps through tremendous effort, succeed in obtaining needed NEMT on the one day that he or she needs it. In this instance, such a person, despite being transportation disadvantaged, is not someone who missed care due to a lack of access to NEMT. Thus, our target population for this study—transportation-disadvantaged persons who miss non-emergency medical care due to a lack of access to NEMT—lies at the intersection of two populations: (1) those who are transportation disadvantaged and (2) those who miss non-emergency medical care. This intersection is shown graphically in Figure 3-1.

Figure 3-1: Identification of Target Population for This Study



Estimates of the size of the two major components in the Venn Diagram in the figure suggest that they are of the same order of magnitude, but that the population that

misses medical care is larger. According to the 2001 MEPS, 31.63 million Americans missed non-emergency medical care for some reason or the other in a year. While estimating the total size of the transportation-disadvantaged population is more problematic and highly dependent on the definition of transportation disadvantaged used, the 2001 *National Household Travel Survey* (NHTS) shows that 14.5 million Americans live in households with zero vehicles, one possible definition of being transportation disadvantaged. Similarly, a study completed the Bureau of Transportation Statistics in 2002 revealed that 15.5 million Americans report having "difficulty getting the transportation needed" (U.S. DOT, Bureau of Transportation Statistics, 2003b). Of course, not all persons who miss medical care do so for transportation-related reasons, and not all transportation-disadvantaged persons miss medical care.

While the intersection of these two populations is the primary focus of this study, some attention to the broader populations from which this intersection derives is warranted. These larger populations are at risk of falling into the intersection at any given point in time—that is, a transportation-disadvantaged person who was healthy may become unhealthy and then lack access to NEMT, or a person who misses care due to a non-transportation reason (e.g., lack of health insurance) may overcome his or her primary barrier but then become transportation disadvantaged and miss care for that reason. The issue of *persistence* arises in that different transportation-disadvantaged persons actually miss healthcare due to a lack of access to NEMT in a given year, but a larger population is at risk of missing care (and does miss care) for transportation-related reasons over time. This is shown graphically in Figure 3-2. Note that this phenomenon is well documented in other policy arenas, such as welfare and welfare reform (see, for example, Danziger and Gottschalk, 2004). In the health domain, it is widely understood that spending is concentrated on a small subset of individuals over a given period of time. For example, the sickest 10 percent of enrollees in health plans account for 70 percent of spending in any one year (Robinson and Yegian, 2004). Even with the prevalence of chronic conditions, while high-cost individuals incur a disproportionate share of spending in subsequent years, the correlation is far from perfect. One plan found that its sickest 5 percent of enrollees accounted for 45 percent of costs in one year but only 18 percent in the next. Finally, because of this persistence, or lack thereof, the benefits of disease management can be overstated. That is, if study participants for a disease management intervention are selected on the basis of high costs in a previous period, their costs would be expected to fall in subsequent periods, regardless of the effectiveness of a specific disease management protocol simply as a result of regression to the mean (CBO, 2004).

Given that the primary reasons that people miss care are related to lack of insurance and healthcare cost, identifying those who miss care due to transportation barriers (lack of access to NEMT) is a challenging task, complicated by the multiple possible definitions of transportation disadvantaged. Fortunately, several sources for information regarding non-emergency medical services for both preventive services and treatment of chronic health conditions are maintained at the federal level that allow direct estimation of the number of people who miss medical care precisely due to problems accessing transportation. Two resources that have been used extensively in the health economics and health services research fields and that are largely representative of the non-institutionalized population of the U.S. are the National Health Interview Survey (NHIS, produced by the U.S. Department of Health and

Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics), and the Medical Expenditure Panel Survey (MEPS, produced by the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality).

To identify the medical conditions that are most critical to the population that has difficulty meeting its transportation needs—that is, the most common conditions for those who have recently experienced problems with access to non-emergency care – we analyzed data from both the 2001 and 2002 National Health Interview Surveys. These data are used because they are the most recent available and because the NHIS is the most comprehensive and nationally representative attempt to understand the state of the nation's health. Indeed, for each year, this survey has a sample size of more than 90,000 persons and covers a wide array of health-related issues. The 2002 NHIS data were released in December 2003, but further enhancements are forthcoming. In particular, the variable indicating urban/rural status has not yet been released (see Section 3.0), and some indications are that it might not ever be.

Additionally, we analyzed the 2001 Medical Expenditure Panel Survey. The MEPS contains healthcare utilization and expenditure information at the individual level for more than 30,000 individuals, is nationally representative, and can be linked with the NHIS data (discussed below). Full-year data for 2001 were released on April 2004; while this project had access to 2002 MEPS data, the key variable to indicate transportation difficulties vis à vis ambulatory health utilization was altered and made less relevant to the research at hand.

3.1 Estimating the Size of the Transportation-Disadvantaged Population That Lacks Access to NEMT

As made clear in the Introduction and Literature Review (Chapters 1 and 2, respectively), definitions of the transportation-disadvantaged population vary at the conceptual level, complicating estimates of the size of this population. Research on this issue demonstrates a range of factors affecting the transportation disadvantaged, and a corresponding range of estimates of the size of this population. At the empirical level, however, these complications can and must be reduced to specific variables to operationalize the concept for data queries and subsequent analyses. Because the NHIS and MEPS data sets are used to establish the medical conditions that are most critical to transportation-disadvantaged persons, we first discuss how the NHIS and MEPS can be used to identify this target population.

3.1.1 NHIS Perspective on the Transportation-Disadvantaged Population

With its focus on healthcare and healthcare outcomes, the NHIS can be used to measure the size of the transportation-disadvantaged population in terms of lack of access to care. Thus, the NHIS takes an approach that meshes well with the goals and objectives of this TCRP project. Specifically, the NHIS contains the following question.

> **There are many reasons people delay getting medical care. Have you delayed getting care for any of the following reasons in the PAST 12 MONTHS … because you didn't have transportation?**

For the 2002 NHIS, the weighted results to this question for the adult sample show that 1.33 percent of adults responded affirmatively as shown in Table 3-1. A separate analysis (not shown) demonstrates remarkable consistency in this ratio over the five-year period of 1998 – 2002. The four other reasons given in the survey for delaying care are: 1) Couldn't get through on the telephone; 2) Couldn't get an appointment soon enough; 3) Once there, had to wait too long to see the doctor; and 4) The clinic/doctor's office wasn't open when you could get there. Clearly, the last one of these four could include transportation-related elements, but the data are not detailed enough to parse these out from other reasons (such as could not get off work in time or the like).

Table 3-1: Adults Reporting Lack of Transportation to Medical Care from 2002 NHIS

Response	Weighted Frequency	Percentage
Yes (lack of access)	2,745,947	1.33
No	201,250,000	97.78
Refused/NA/Don't know	1,827,604	0.89
Total	205,830,000	100.00

The same question was asked about children, and the weighted results from the 2002 NHIS for the child sample show that 1.31 percent of children received delayed medical care due to lack of transportation. This result is shown in Table 3-2.

Table 3-2: Children Reported to Lack Transportation to Medical Care from 2002 NHIS

Response	Weighted Frequency	Percentage
Yes (lack of access)	956,584	1.31
No	71,615,707	97.78
Refused/NA/Don't know	397,651	0.55
Total	72,969,942	100.00

Combining the results for adults and children, the 2002 NHIS indicates that 3,702,531 individuals received delayed medical care in the past year due to transportation difficulties (2,745,947 adults plus 956,584 children), or **approximately 3.7 million people**. Importantly, these numbers derive from respondents directly linking a transportation rationale to delayed care over a specific one-year period. Thus, however the notion of transportation disadvantage is conceptualized, this highly rigorous, nationally representative sample reflects exactly the question of interest for this study—medical care missed due to lack of transportation.

3.1.2 MEPS Perspective on the Transportation-Disadvantaged Population

The MEPS also investigates barriers to care, including transportation. For the 2001 study, 11.1 percent of respondents answered "yes" to the following baseline question.

Anyone have difficulty obtaining care?

After responding "yes" to this question, respondents are given a list of 14 items from which they are asked to select the *main* reason for experiencing difficulty. Of these reasons, three are germane to transportation access: (1) medical care too far away; (2) cannot drive/no car/no public transportation; and (3) too expensive to get there. (Other reasons are: 1) Could not afford care; 2) Insurance company would not approve/cover/pay; 3) Pre-existing condition; 4) Insurance company required referral – could not get; 5) Doctor refused family insurance plan; 6) Different language; 7) Could not get time off work; 8) Don't know where to go to get care; 9) Was refused services; 10) Did not have time or took too long; and 11) Other.) It is not surprising that access is compromised by lack of health insurance or low income. In addition to this main reason, the MEPS also gives respondents an opportunity to cite a *secondary* reason.

Summing these responses (but only counting respondents once if they selected a transportation-related reason for both their main and secondary reason) produces a weighted estimate of 1.21 percent, **approximately 3.5 million people**, who cite a transportation-related reason (main or secondary response or both) to explain why they had difficulty obtaining care. While some of these reasons clearly overlap, and one could argue that this number is biased either upwardly (secondary reasons matter less than the main reason and should be discounted) or downwardly (reasons past first or second are not asked about and if asked would boost the estimate), this estimate closely matches the estimate derived from the NHIS and thus appears to be a reasonable baseline for identifying the population that misses medical care due to a lack of access to NEMT.

3.1.3 Conclusions Regarding NHIS, MEPS, and This Study

Together, these two nationally representative perspectives on the *intersection* of delaying care and having difficulty obtaining care produces a consistent result – that is, approximately 3.6 million people in a given year most likely miss non-emergency medical trips due to transportation problems. Needless to say, the number of people missing trips does not equate to the number of missed trips, but it does provide a lower bound – by definition, all of these roughly 3.6 million people had to miss at least one round trip for non-emergency care. On average, Americans have more than three visits per year either to primary care offices, surgical specialty offices, medical specialty offices, or outpatient departments (Burt and Schappert, 2004). Additional visit information is provided in Chapter 4 to help bound an estimate of the number of missed trips associated with the study's target population.

As will be discussed further in Chapter 7, the cost-effectiveness approach used in this study conservatively assumes that all NEM trips for the target population are missed and must be accounted for in determining the cost-effectiveness of improved access. Thus, a positive result is highly encouraging, because it means that the medical care is cost-effective even if all the transportation needed to obtain it has to be funded.

In the remainder of this chapter, we review this estimate of 3.6 million persons who lack adequate access to NEMT and compare it to other possible estimates to validate the reasonableness of this estimate. In Chapter 4, this target population is described in more detail, including its demographic, socio-economic, and medical characteristics.

3.2 Additional Estimates of the Size of the Transportation-Disadvantaged Population That Lacks Access to NEMT

As discussed earlier in this report, an unambiguous estimate of the size of the transportation-disadvantaged population does not exist, and even the definition of transportation disadvantaged varies. The variation in estimates grows further if one attempts to incorporate missed trips that derive from the transportation-disadvantaged designation. Our literature review indicates that a direct, nationally representative estimate of the number of trips missed because of a lack of transportation is not currently available. In short, health-related data lack sufficient detail on transportation to directly measure the number of missed trips, and transportation data lack sufficient detail on health conditions to address utilization. Furthermore, these studies are done using entirely independent samples, making linking of data sets precarious at best. Hence, we focused on establishing and validating the estimate of the population that misses non-emergency medical care due to transportation-related reasons using a variety of available data sources. Checking it against other approaches, including use of two more data sources, the following estimates were analyzed and/or calculated:

- In 2002, the Bureau of Transportation Statistics (BTS) conducted a survey to investigate the transportation status of Americans with disabilities and to compare their status with Americans without disabilities. In this study (the *2002 National Transportation Availability and Use Survey*), the BTS achieved an overall sample size of 5,000 persons, roughly half of whom had disabilities (persons with disabilities were over-sampled to allow for more powerful statistical comparison of this population with the non-disabled population). This study indicated that **3.5 million Americans** never leave their homes. Of these, 1.9 million have disabilities. Of these 1.9 million, 528,000 "experience transportation difficulties." In other words, nearly 1.4 million people with disabilities who never leave the home do *not* report experiencing transportation difficulties. Presumably, then, they could obtain needed transportation if their other problems could be overcome. Thus, these 528,000 persons can be seen as constituting the lowest estimate of the transportation-disadvantaged population that misses medical care due to a lack of access to NEMT, because with available transportation, these individuals likely would have made at least one medical trip during the year related to their disability or otherwise; this leads to a low extreme estimate of **528,000** persons in the target population. Not surprisingly, the homebound population with disabilities of 1.9 million tends to be older (average age is 66) and is more severely disabled (58 percent report their disability as severe) than the population at large. As a result, many of the 528,000 who experience transportation difficulties likely are missing more than one medical trip per year.
- The same BTS study also revealed that 57 percent of persons with disabilities who never leave the home need specialized assistance or equipment to travel outside the home, compared with only 22 percent of people with disabilities who travel outside the home at least once a week. Also, those with disabilities who never leave home have more trouble getting transportation (29 percent) than those with disabilities who leave at least once a week (11 percent). Similarly, 22.9 percent of those with disabilities need specialized

equipment or assistance to travel outside the home, compared with just 0.66% of those without disabilities.

- As discussed earlier in this chapter, the 2001 MEPS indicates approximately **3.5 million people** who cite a transportation-related reason to explain why they had difficulty obtaining medical care.
- As also discussed above, the 2002 NHIS indicates approximately **3.7 million people** (adults and children) who delayed getting medical care in the past year due to transportation difficulties. With a sufficiently short reference period, "delay" and "missed" are equivalent.
- Again, based on the *2002 National Transportation Availability and Use Survey*, the data show that approximately 12.19 percent of those with disabilities either have difficulty obtaining transportation or cannot get transportation they need for any purpose. For those who are not disabled, this value is 3.3 percent. Because approximately 23 percent of the nation's 290 million people experience disabilities according to criteria used in this BTS study, there are a total of **15.5 million persons** who cannot obtain the transportation that they need (regardless of trip purpose): 0.23 * 290 million * 0.1219 = 8.13 million people with disabilities and 0.77 * 290 million * 0.033 = 7.37 million non-disabled persons, for a total of 15.5 million. Clearly, an unknown subset of this 15.5 million people is unable to undertake medical trips because of a lack of transportation, and the data are not sufficiently refined to permit this further estimation.
- The *2002 National Household Travel Survey* (NHTS), also conducted by BTS, revealed that 9 percent of Americans over the age of 14 years have a "travel-affecting medical condition." Furthermore, the NHTS clearly demonstrates that this population takes fewer trips per day than the population that does not have such a medical condition (2.8 vs. 4.4 trips per day), documenting a trip gap across trip purposes, but it does not directly point to missed trips for medical care.

To summarize, the estimates of the number of persons, highlighted above, who miss medical care due to a lack of transportation—the target population for this study—are:

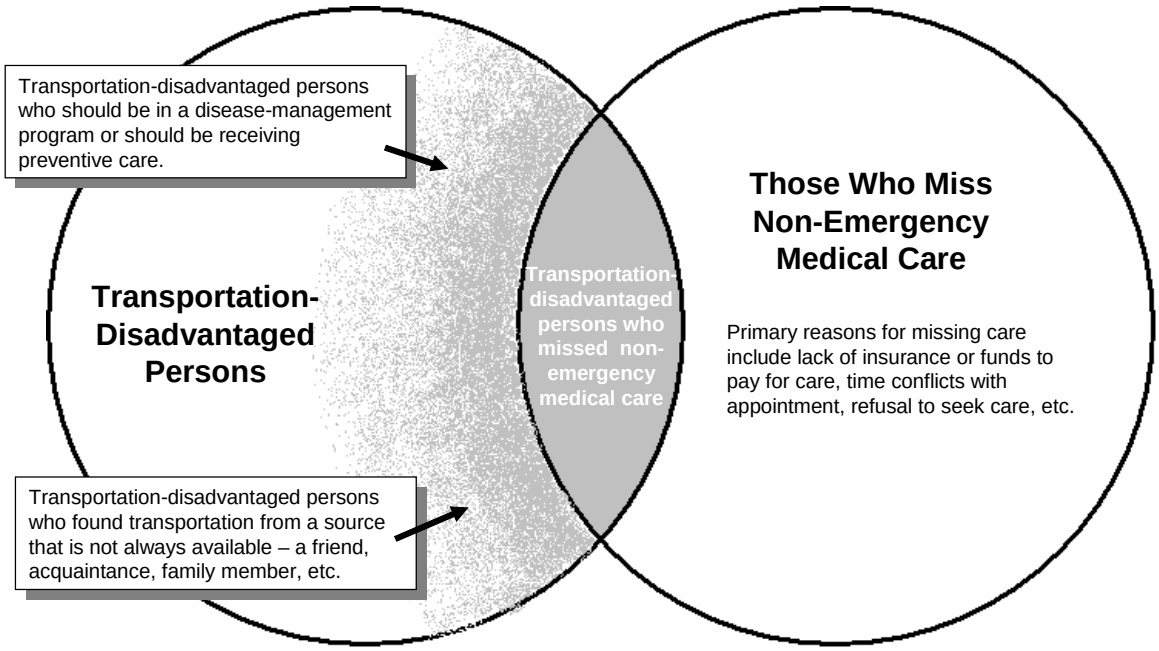
- 528,000 (BTS)
- 3,500,000 (BTS)
- 3,500,000 (MEPS)
- 3,700,000 (NHIS)
- Fewer than 15.5 million (BTS).

Because of the fairly close consistency of the MEPS and NHIS estimates, and their explicit intersection of the health and transportation domains, we have most confidence with an estimate of roughly 3.6 million people who miss at least one trip in a year due to a lack of non-emergency medical transportation. Of course, this is an estimate of the number of people who miss care, not an estimate of the number of missed visits. Importantly, even if a different estimate of the size of the transportation-disadvantaged population that misses non-emergency medical care due

to lack of transportation someday proves correct, only the estimates derived from the NHIS and MEPS are associated with data related to medical conditions and healthcare use; thus, only for the 3.6 million is the data rich enough to permit the cost comparisons required for this study.

Nonetheless, despite confidence in the estimate of the size of the target population, there are important limitations. First, any sampling biases arising from NHIS and MEPS are also present in this estimate. For example, if non-respondents (typically poor, homeless, and in poor health) are more likely to match the target population than otherwise, then our estimate is downwardly biased. Notably, NHIS and MEPS ignore some sectors of the population such as Native Americans living on reservations who are part of the Indian Health Service, and thus these are not represented in our estimate. These individuals are known to have worse health than the general public (Barnes et al., 2005). If these unrepresented population sectors have a higher percentage of transportation-disadvantaged persons who lack access to NEMT than is present in the rest of the population, then again our estimate is low. Second, because people fall into and out of the target population over time, the population *at risk of missing non-emergency medical care due to a lack of transportation* certainly is higher than 3.6 million. As illustrated graphically in Figure 3-2, some transportation-disadvantaged persons will succeed in obtaining transportation to medical care on the day that they need it, and some may simply not recognize a need for medical care, even if it exists.

Figure 3-2: Transportation-Disadvantaged Population at Risk of Missing Non-Emergency Care



Although the available data suggest that this intersection currently contains about 3.6 million Americans in a given year, the at-risk population is larger. Furthermore, as the total population grows and continues to age, the size of this intersection can be expected to grow.

Chapter 4: Description of the Transportation-Disadvantaged Population That Misses Medical Care Due to a Lack of Access to Non-Emergency Medical Transportation

In Chapter 3, the number of non-institutionalized people in the U.S. who are transportation disadvantaged and have missed non-emergency medical treatment at least once in the past 12 months was estimated to be approximately 3.6 million. As discussed, this "target population" differs from the remainder of the U.S. in terms of its socio-economic, demographic, and health characteristics. In this chapter, the characteristics of this target population are described and compared with the rest of the U.S. population to provide a better understanding of who is in the target population and to show what medical conditions are prevalent and important for members of this population. In later chapters these conditions are shown to be critical to further analysis of providing NEMT to the target population.

4.1 Demographic and Socio-economic Characteristics of the Population That Lacks Access to NEMT

Before studying the health characteristics of the target population, it is important to confirm that this population of roughly 3.6 million people demonstrates the demographic and socio-economic conditions that the literature discussed in Chapter 2 suggests that is has. The NHIS and MEPS data are again used to for this analysis.

The NHIS adult sample data were used to compare the demographic and socio-economic characteristics of the target population with the rest of the U.S. population. This analysis showed that, compared to the rest of the U.S. population, the target population:

- Has relatively low income (54.6 percent have household incomes below $20,000 per year compared with only 17.7 percent for the remainder of the U.S. population)
- Is disproportionately female (62.8 percent female versus 51.9 percent) and non-white (19.1 percent non-white versus 17.7 percent)
- Has a higher minority representation (13.5 percent African American versus 12.6 percent; 16.7 percent Hispanic versus 13.2 percent)
- Is roughly one-half as likely to possess a four-year college degree
- Is older (16.3 percent are 70 or older compared with 11.5 percent)
- Is distributed across urban and rural America much the same as the U.S. population as a whole, although children are slightly more concentrated in urban areas

While the demographic and socio-economic characteristics of the target population are decidedly different from the remainder of the U.S. population, these characteristics match well with the descriptions of the transportation-disadvantaged population found in the literature review as described in Chapter 2.

4.2 Urban-Rural Split of the Target Population That Lacks Access to NEMT

To determine the cost of providing the NEMT that this population needs, the target population of transportation-disadvantaged people that missed non-emergency medical care due to a lack of transportation must be disaggregated by location (urban and rural), transportation service needs, and medical condition. Transportation costs in rural locations can be higher due to distance traveled, the reduced ability to consolidate riders into one vehicle, and poorer access to fixed-route public transportation. The type of trip affects the need for specially equipped vehicles, such as ambulances for stretcher transportation service or wheelchair-accessible vehicles. Both characteristics of transportation are crucial for estimating transportation costs for the target population.

Disaggregating the target population by location (rural versus urban) is straightforward using NHIS data. Although the 2002 NHIS currently lacks information pertaining to location, the 2001 NHIS data include this information for both adults and children. NHIS uses a different geographic categorization than is common in transportation data sets, such as NHTS, but the non-MSA (Metropolitan Statistical Area) field in the 2001 NHIS closely matches the rural field in the NHTS. Specifically, the 2001 NHIS indicates that 20.7 percent of adults and 20.0 percent of children reside in non-MSA locations, while the 2001 NHTS indicates that 21.9 percent of all persons represented live in a rural location.

Given this close agreement between the two datasets, we decided to use the non-MSA category in the 2001 NHIS as the operational definition of rural in our analysis. This analysis showed that 22.2 percent (weighted) of the adults who reported missed trips due to transportation problems lived in rural (non-MSA) locations, as did 14.8 percent of target population children. Thus, while the percentage of adults in rural areas who are transportation disadvantaged by NHIS standards is slightly higher than is the percentage of rural adults overall, the percentage of children in rural areas who are transportation disadvantaged by NHIS standards is well below the overall percentage of rural children, indicating that children who lack access to medical care due to a lack of transportation are somewhat more concentrated in urban areas.

Applying these urban and rural percentages to the estimate of roughly 3.6 million in the target population, and recalling that 74.4 percent of the target population are adults (2.76 million adults and 0.95 million children who missed trips from the 2002 NHIS), about 593,721 adults in rural areas are in the target population (meaning that 2,084,319 adults are in urban areas). Likewise, for children, approximately 136,727 of those in the target population live in rural areas (meaning that roughly 785,233 are in urban areas). These results are summarized in Table 4-1.

Table 4-1: Number of Persons Missing NEMT Trips per Year in Urban and Rural Areas

Age Category	Urban	Rural
Adult	2,084,319	593,721
Children	785,233	136,727
Total	*2,869,552*	*730,448*

4.3 Identification of Medical Conditions Faced by Those Lacking NEMT

In our analysis to identify the most important medical conditions for which lack of transportation is a barrier to health-care access, we focused on prevalent conditions for the transportation-disadvantaged population. We used the 2002 NHIS data to examine the prevalence of disease conditions and cross-tabulated this information with the NHIS concept of target population status, as described in Chapter 3. The NHIS has separate data sets for adults, children, and immunizations, and we discuss each in the sections that follow.

4.3.1 Adult Disease Conditions

The results of the adult analysis are shown in Table 4-2. This table presents a comprehensive list of medical conditions for individuals who also reported difficulties accessing care due to transportation problems. It reports the weighted percentage of these adults experiencing the condition in question.

Table 4-2: Medical Conditions Experienced by Adults in the Target Population

Condition	Unweighted Frequency	Percentage of Adults
Pain/Aching Joints	304	55.8
Depressed	280	49.7
Recurring Pain	261	48.2
Insomnia	258	49.4
Arthritis	235	40.0
Hypertension	233	37.7
Vision Problems	219	37.5
Excessive Sleepiness	176	35.2
Heart Disease	167	29.6
Poor Circulation	158	26.8
Dental Problems	157	28.0
High Cholesterol	146	25.7
Medication Allergies	130	23.2
Skin Problems	120	21.4
Urinary Problems	119	20.8
Asthma	113	22.1
Ulcer	110	19.6
COPD	101	17.6

Condition	Unweighted Frequency	Percentage of Adults
Sinusitis	101	16.9
Severe Sprains	99	20.0
Food/Odor Allergies	97	17.8
Diabetes	96	16.0
Irritable Bowel Syndrome	84	12.9
Menstrual Problems	73	13.1
Hay Fever	72	12.5
Thyroid Problems	71	11.7
Cancer	60	11.3
Gynecologic Problems	55	8.8
Stroke	44	8.1
Seizures	42	7.5
Menopausal Problems	40	6.5
Renal Disease	37	7.2
Hearing Aid	35	6.8
Liver Condition	35	6.7
Neuropathy	18	3.1
Multiple Sclerosis	6	1.2
Prostate	3	0.5
Parkinson's Disease	2	1.4
Psychological Problems:		
Hopeless	30	5.8
Nervous	45	8.5
Restless/Fidgety	41	8.8
Sad	28	5.2
Worthless	26	4.8

Before defining a list of conditions for further study, two comparisons between adults in the target population and all other adults, as seen in the NHIS data, are especially instructive:

1. Viewing the phenomenon of multiple diseases suffered by the same person: (1) There is a very large difference in the percentage of adults experiencing *multiple* conditions from this list (92 percent for the target population versus 64 percent for non-target population); and (2) The difference in the percentage who experienced *none* of these conditions is also substantial (3 percent for target population versus 21 percent for non-target population).

2. For each condition (except for “no conditions”), the prevalence of the conditions is higher for target population adults. Examples for some of the highly prevalent conditions are shown in Table 4-3.

Table 4-3: Prevalent Conditions in Adults from 2002 NHIS

Condition	Target population Prevalence (Percentage)	Non-Target population Prevalence (Percentage)	Ratio of Prevalences
Arthritis	40.0	20.5	1.9
Asthma	22.1	10.5	2.1
COPD	17.6	5.3	3.3
Cancer	11.3	6.9	1.6
Depression	49.7	15.2	3.3
Dental Problems	28.0	12.4	2.3
Diabetes	16.0	6.4	2.5
Heart Disease	29.6	15.5	1.9
High Cholesterol	25.7	20.5	1.3
Hypertension	37.7	24.0	1.6
Irritable Bowel	12.9	5.4	2.4
Medication Allergies	23.3	12.9	1.8
Pain/Aching Joints	55.8	29.1	1.9
Poor Circulation	26.8	8.3	3.2
Recurring Pain	48.2	17.7	2.7
Severe Sprains	20.0	8.1	2.5
Skin Problems	21.4	8.5	2.5
Vision Problems	37.5	16.1	2.3

Not only does this disadvantaged group suffer from insufficient transportation to conduct required health-related visits, they exhibit an exorbitant prevalence of a number of serious conditions. The picture that emerges is one of an especially unhealthy population.

In addition to revealing conditions that should be included in the study, our empirical results also indicate one condition that should be dropped – substance abuse. Substance abuse was deleted from the list of conditions for two main reasons: (1) very low acknowledged prevalence in the NHIS; and (2) difficulty connecting it to required visits, and hence, missed visits. The NHIS data also demonstrate that mental health is a key condition for study. Not only do 52 percent of the disadvantaged adults indicate depression, close to one-third mention excessive sleepiness; nearly 50 percent note insomnia; and the psychological problem categories of “hopeless,” “nervous,” “restless/fidgety,” “sad,” and “worthless” each have a prevalence of 5 percent or more. Moreover, these related mental health conditions are highly correlated with other conditions.

4.3.2 Child Disease Conditions

For children in the target population category, our analysis produces similar results as for the adults, as shown in Table 4-4. This table presents a list of the conditions for children in the target population category, including the weighted percentage of children citing this condition. The pattern of co-morbidities and condition prevalence

that we found for adults is also relevant. The results show a large difference both for the percentage experiencing multiple conditions from the list (32 percent for target population children versus 14 percent for non-target population children), and for the percentage experiencing none of the listed conditions (39 percent for target population children versus 57 percent for non-target population children). The prevalence is higher for each condition, when comparing across target population status. For the most prevalent conditions, the percentages are: ADHD/ADD (9.4 percent versus 5.5 percent), asthma (24.4 percent versus 12.4 percent), frequent headaches (12.8 percent versus 5.3 percent), colds (32.2 percent versus 20.5 percent), and learning disability (11.7 percent versus 6.5 percent). Even for low-prevalent conditions, the percentages are: stutters (6.7 percent versus 1.2 percent) and vision problem (7.8 percent versus 2.6 percent), again where the first percentage indicates target population children, and the second non-target population children.

Table 4-4: Medical Conditions Faced by Children Who Lack NEMT

Condition	Unweighted Frequency	Percentage of Children
Head/Chest Cold, past 2 wks	58	32.2
Asthma	44	24.4
Freq Headaches/Migraines	23	12.8
Learning Disability	21	11.7
ADHD/ADD	17	9.4
Vision Problem	14	7.8
Stutters/Stammers	12	6.7
Ear Infections	7	3.9
Freq Diarrhea/Colitis	6	3.3
Eczema/Skin Allergies	5	2.8
Hay Fever	4	2.2
Heart Disease	4	2.2
Mental Retardation	4	2.2
Respiratory Allergies	4	2.2
Food/Digestive Allergies	3	1.7
Seizures	2	1.1
Anemia, Past 12 months	1	0.6
Arthritis	1	0.6
Autism	1	0.6
Cerebral Palsy	1	0.6
Depressed	1	0.6
Muscular Dystrophy	1	0.6
Other Dev Delay	1	0.6
Sickle Cell Anemia	1	0.6

Table 4-4 provides strong evidence that a comprehensive focus on children would include the following conditions:

- ADHD/ADD and learning disabilities in general (as a way to avoid educational delays to the extent possible)
- Asthma
- Frequent headaches/migraines

4.3.3 Discussion and Conclusions from Analysis of Medical Conditions

Our analysis of these nationally representative healthcare datasets reveals that about 3.6 million Americans miss or delay non-emergency medical care per year due to transportation difficulties. Based on the 2002 NHIS data, we selected eleven critical medical conditions that are prevalent in the target population. These conditions include both chronic conditions amenable to disease management and those amenable to preventive care. Table 4-5 lists the conditions and their prevalence in the target population. Using a three-year merged NHIS data set (2001-2003), it has further been determined that approximately two-thirds of the target population is affected by at least one of the seven chronic conditions, thus demonstrating the importance of analyzing these conditions for cost-effectiveness in Chapter 7.

Table 4-5: Critical Medical Conditions Affecting Transportation-Disadvantaged Persons Who Lack Access to NEMT

Type of Care	Medical Condition	Prevalence in the Target Population (%)
Chronic	Depression or Other Mental Health Problem	50
	Hypertension	37
	Heart Disease	26
	Asthma	20
	Chronic Obstructive Pulmonary Disease	19
	Diabetes	15
	End-stage Renal Disease	7
Preventive	Dental Problems	28
	Cancer	12
	Premature Births	2
	Vaccinations	N/A

For both the adult and child samples, the analysis of the NHIS data reveals a much higher prevalence of conditions (and multiple diseases) for target population individuals compared with non-target population individuals. This general finding has important implications for the project. Transportation issues that result in missed trips will potentially exacerbate the diseases afflicting these individuals and may result in costly subsequent medical care (specialist visits, emergency room visits, and possibly hospitalizations). Even when this is not the case—i.e., the potential does not exist to decrease subsequent utilization by more prompt care of an existing condition—there are important quality-of-life concerns. For example, the prevalence of frequent headaches is more than twice as high for children in the target population

as it is for others. To the extent that visits are being delayed for these disadvantaged children, they could be subject to considerable pain and suffering that otherwise could be effectively treated.

4.3.4 The Prevalence of Multiple Medical Conditions Experienced by the Target Population

To support many of the points made above, we conducted a special analysis of condition prevalence by merging the most recent three years of NHIS data, including 2003 results that were released in December 2004. In Table 4-6, we focus on nine conditions for which the specific survey questions aligned over the three-year period. These data clearly show that the target population not only has a higher prevalence of any single health condition, but also are more likely to have multiple medical conditions when compared to the general population. This holds true for all cross sections except for the end-stage renal disease (ESRD) population with hypertension. Accordingly, the proposition that the target population that misses visits is more chronically ill is well supported. The extended cost of care to society at large may be increased by the lack of adequate NEMT.

Table 4-6: Prevalence of Co-Morbidities in the Target Population Compared to Everyone Else

		Key Medical Conditions*										
	Percent with another health condition ➔	**Asthma**	**COPD**	**Diabetes**	**ESRD**	**Heart Disease**	**Hypertension**	**Cancer**	**Currently Pregnant**	Has at least one other target condition	Has at least one other non-targeted condition**	No other targeted condition***
	Transportation-disadvantaged population that missed care											
Health Condition	**Asthma**	100%	45%	20%	10%	36%	42%	14%	2%	95%	91%	5%
	COPD	47%	100%	20%	14%	41%	47%	13%	1%	99%	97%	1%
	Diabetes	26%	25%	100%	16%	50%	69%	15%	1%	97%	95%	3%
	ESRD	26%	35%	33%	100%	45%	54%	20%	0%	98%	95%	2%
	Heart Disease	27%	29%	28%	13%	100%	59%	18%	1%	97%	94%	3%
	Hypertension	22%	24%	27%	11%	41%	100%	15%	1%	96%	92%	4%
	Cancer	23%	20%	19%	12%	40%	47%	100%	1%	97%	93%	3%
	Currently Pregnant	25%	11%	7%	0%	12%	17%	8%	100%	65%	46%	35%
	Everyone else											
Health Condition	**Asthma**	100%	20%	8%	2%	18%	28%	8%	1%	80%	71%	20%
	COPD	37%	100%	13%	5%	30%	41%	14%	1%	94%	86%	6%
	Diabetes	13%	11%	100%	6%	35%	64%	14%	0%	91%	78%	9%
	ESRD	17%	19%	28%	100%	42%	62%	20%	0%	94%	86%	6%
	Heart Disease	15%	13%	18%	5%	100%	54%	16%	0%	91%	81%	9%
	Hypertension	12%	9%	17%	3%	28%	100%	12%	0%	83%	75%	17%
	Cancer	12%	11%	13%	4%	30%	44%	100%	0%	88%	78%	12%
	Currently Pregnant	12%	4%	1%	0%	4%	7%	1%	100%	43%	30%	57%

Notes:

* Mental Health, Dental Problems, and Preventive care are not included in this table as targeted conditions due to data definitions.

** Non-targeted conditions include: Arthritis, Hay Fever, Hearing Aid, Liver Condition, Nervous, Pain/Aching Joints, Poor Circulation, Restless/Fidgety, Sinusitis, Stroke, Ulcer, and Vision Problems.

*** The percent of this population that has only the one targeted condition

4.4 Utilization of Health Resources by the Target Population

The prevalence of multiple health conditions (co-morbidities) has a demonstrable effect on the utilization of health resources. Target population adults use far *more* healthcare services compared to the remainder of the U.S. population. In an analysis of the 2001 NHIS data, the target population required more trips for care than the remainder of the U.S. population. Table 4-7 shows utilization in terms of the mean number of visits for both the target population and non-target populations for emergency room visits, home care visits, routine provider office visits, and number of surgeries—all covering the 12 months prior to the date of the survey. We did not capture hospitalizations for this analysis. The utilization analysis uses 2001 instead of 2002 NHIS data, because the 2002 data do not yet include—and may never include—the data needed to enable one to assign a rural/urban breakdown (see the discussion section below). For 2001, 578 adult cases (1.37 percent or 2,801,152 of the weighted population) are designated as transportation disadvantaged according to our NHIS screen.

Table 4-7: Aggregate Utilization Means for the Target Population and Non-Target Population (Prior 12 Months)

Utilization Category	Mean for Target Population	Mean for Non-target Population
Emergency Room (ER) Visits	1.31	0.35
Home Care Visits	0.54	0.15
Office Visits	6.78	3.97
Number of Surgeries	0.24	0.16

Additional utilization comparisons to consider:

- 54.9 percent of target population had no ER visits compared with 80.1 percent for the remainder of the U.S. population
- 10.9 percent of the target population had no office visits in the past 12 months, and 16.5 percent had 16 or more visits. The corresponding numbers for the non-target population are 19.4 percent who had no visits and 5.7 percent who had 16 or more visits.

The differences across the four types of health services are quite large. The difference for office visits would be larger still but the NHIS utilization data capped the number of visits at 16 and, as noted above, a far greater percentage of disadvantaged individuals experienced at least 16 office visits in the preceding year compared to the other population. These results are substantiated in Section 6 using the more detailed and accurate MEPS data. Table 4-8 shows the average number of visits excluding hospitalizations for individuals with the seven chronic conditions analyzed in Chapter 7. Compared to an average of 3 outpatient visits per person for the total U.S. population, these numbers are extraordinarily high and, while not relating to missed trips, indicate the potential scope of the problem given the nearly 4 million transportation disadvantaged individuals.

Table 4-8: Condition-Based Visits from the 2001 MEPS

Condition	# of Cases	Average Visits
Asthma	1,347	8.8
Heart Disease (CHF)	161	18.9
COPD	1,105	9.9
Hypertension	3,829	11.1
Diabetes	1,555	13.0
Depression	1,427	14.8
ESRD	34	115.0

4.4.1 Disease Prevalence and Co-Morbidities

These results amplify a theme discussed in Chapter 2, that is, the target population (as represented in the NHIS) has a higher prevalence of disease conditions, a much greater propensity for multiple, simultaneous diseases, and most likely has higher severity for individual conditions, as compared with the non-target population. Employing ten important conditions to represent the universe of diseases, 63.4 percent of the target population (versus 34.2 percent for the others) suffers from multiple conditions, while 18.4 percent of the target population (versus 41.1 percent for the others) experiences none of these conditions. Table 4-9 lists the ten selected conditions; they illustrate aspects of the co-morbidity findings and also serve to compare target population and non- target population utilization means at the condition level.

Table 4-9: Condition Prevalence and Utilization Means at the Condition Level – Target Population

	Target Population				Rest of U.S. Population			
Condition	Weighted Percent with Disease	Mean ER Visits	Mean Home Care Visits	Mean Office Visits	Weighted Percent with Disease	Mean ER Visits	Mean Home Care Visits	Mean Office Visits
Arthritis	**41.78**	**1.61**	**1.07**	**8.65**	21.14	0.54	0.39	6.22
Asthma	**16.74**	**2.37**	**0.75**	**7.51**	10.79	0.66	0.18	5.33
COPD	**18.35**	**2.04**	**0.25**	**8.44**	6.34	0.78	0.39	6.62
Diabetes	**15.47**	**1.89**	**1.19**	**8.68**	6.25	0.73	0.62	7.13
Renal Disease	**8.04**	**3.10**	**0.90**	**10.23**	1.53	1.29	0.93	8.41
Heart Disease	**22.03**	**1.77**	**1.69**	**8.64**	11.37	0.74	0.62	6.74
Hypertension	**33.31**	**1.32**	**1.06**	**8.59**	23.39	0.54	0.35	5.83
Mental Health	**15.35**	**2.64**	**0.87**	**9.79**	2.81	1.11	0.48	7.24
Pain/Aching Joints	**54.97**	**1.66**	**0.82**	**8.39**	32.85	0.49	0.28	5.52
Vision Problems	**31.31**	**1.82**	**1.06**	**8.23**	9.70	0.60	0.53	5.81

Source: NHIS 2002

For each of the ten conditions, the disease prevalence is considerably higher for the target population—transportation-disadvantaged persons who miss medical care due to a lack of access to NEMT—compared to the remainder of the U.S. population. For example, 18.35 percent of the target population, but only 6.34 percent of other adults, experience chronic obstructive pulmonary disease (COPD). With two exceptions (mean home care visits for COPD and renal disease), the mean utilization is *higher* for the target population than it is for other adults. The utilization in question is *not* specifically connected to each of the diseases. For example, target population adults who suffer from asthma had a mean of 7.51 office visits in the past 12 months, but we have no direct information that tells us to which conditions these visits pertain. What we know from this analysis is simply the total number of office visits, including those for any unrelated conditions. Even with comprehensive healthcare utilization information, such as the data available in the MEPS, one may know the primary reason for a physician visit, but it would be very difficult to determine what other conditions are treated during an encounter.

Chapter 5: Cost of Providing Non-Emergency Medical Transportation

Because this study focuses on the population of transportation-disadvantaged individuals who miss non-emergency medical care due to a lack of available transportation, we must examine the costs of providing additional transportation to serve the needs of this population to determine if the net healthcare benefits of this transportation are worthwhile. Thus, the primary purpose of this chapter is to develop cost estimates for several categories of non-emergency medical transportation (NEMT) so that these costs can be used in analyses of the cost-effectiveness of providing needed NEMT to the target population identified in Chapter 3 for treating the conditions faced by this population identified in Chapter 4.

As with other transportation costs, NEMT costs vary by location (region of the country and urban or rural) and by the type of transportation service required (i.e., ambulatory, stretcher, wheelchair-equipped, etc.). Other factors can also play a role in transportation costs. For example, trip costs can depend on the technical and managerial skills of the organizations managing the transportation service. In Kentucky, for example, improved operational efficiency and control practices resulted in nearly a 20 percent drop in the cost of an average trip (O'Connell et al., 2002). To keep the current study manageable, however, we focused exclusively on cost variation by location and service type, and sought to develop nationally representative cost estimates. Specifically, we developed estimates of the cost per trip for ambulatory, stretcher, and wheelchair transportation service for both urban and rural areas, along with an estimate of per trip costs for fixed-route transportation in urban areas, though our target population is less likely to use fixed-route transit due to lack of availability, or their physical limitations.

One difficulty in arriving at NEMT cost estimates for our target population stems from distinguishing the costs of non-emergency medical trips from other transit and paratransit trips serving transportation-disadvantaged persons. In many states, and for many public transportation operators, some vehicles serve a variety of trip purposes. While data from both Michigan (Wallace, 1997) and Florida (Florida Commission, 2003) indicate that medical trips dominate, they certainly are not the only trips provided. In our analysis, we minimized this potential problem, however, by focusing on medical trips in forming our cost estimates. According to federal policy, the Medicaid program will pay for transportation to non-emergency medical care for those who cannot otherwise arrange or pay for travel to this care. Medicaid, which generally serves the poor, is joined at the federal level by Medicare, which generally serves older adults. Unlike Medicaid, however, Medicare pays only for emergency transportation (i.e., by ambulance). As discussed in Chapter 2, this policy can result in non-emergency care being accessed by emergency transportation. The cost savings derived from switching service types alone can be substantial, but these are beyond the scope of the current study, which examines only missed care. For the purposes of this study, non-emergency medical transportation (NEMT) refers to trips analogous to those currently provided under the auspices of Medicaid, including a variety of transit and paratransit services provided by public agencies and private entities. One past estimate of the cost of this transportation service, deriving from a survey conducted by the Community Transportation Association of America (CTAA)

completed in 2000 (CTAA, 2001), showed an average cost of about $16 nationally for Medicaid trips, independent of transportation service type.

In the following sections, we develop per trip costs estimates for paratransit and fixed-route transit, with the former focused on costs of Medicaid trips and divided into ambulatory, wheelchair, and stretcher services. In addition, we briefly describe how to associate transportation service types (or modes) with medical conditions. The latter is required to examine cost-effectiveness of additional transportation access for treatment of specific conditions, shown in Chapter 7.

5.1 Paratransit Cost Estimates

We have determined average, per trip costs for non-emergency medical (NEM) paratransit for three service categories (ambulatory, wheelchair, and stretcher) for both urban and rural areas, resulting in six cost categories. Note that ambulatory service refers to transportation for someone who is physically capable of accessing any type of ground transportation. Wheelchair service refers to vehicles capable of safely transporting a wheelchair-bound person, such as a specially equipped van or paratransit vehicle. Stretcher service refers to NEMT for someone who cannot sit on their own; this will often mean transport by ambulance, though not necessarily one that is EMT/EMS-equipped. Thus, we retain focus exclusively on non-emergency care and trip needs; emergency trips by ambulance are not part of the current study.

These costs are listed in Table 5-1 and derive from data from twenty different services in New England, the Mid-Atlantic States, the south, and the west. One Midwestern service is represented in the rural category, but the Pacific Northwest is not represented at all. Some of the services in our data are in the same states. Respecting the proprietary concerns of the organizations providing the data, we have not listed the costs per service area or the exact locales from which the data derive.

As shown in the table, our one-way cost estimates are based on more than 800,000 trips (from year 2004), and they match expected trends, with higher levels of service (wheelchair and stretcher) displaying higher costs and rural areas generally displaying higher costs than urban areas. To make these estimates, we created a weighted average within each service type (or mode) and urban or rural combination (average cost per trip for the service provider based on the number of trips for that service). In fact, in the data we used, “service provider” probably is not an accurate term for most of the reported services. Rather, these data are based on service provision within a given geographic region, but several different providers were used within the region. In that respect, the data accurately reflect the diverse mix of transportation service providers drawn upon within any region, even by public transportation agencies that subcontract out various paratransit trips.

As a check on the veracity and reasonableness of our estimates, we made two additional comparisons of our results to other information. First, we compared them with the costs reported in a Request for Proposals let by the Commonwealth of Pennsylvania for NEMT in Philadelphia County in early 2005. In this RFP (Commonwealth of Pennsylvania, “Request for Proposals for Philadelphia Medical Assistance Transportation Program (MATP)”), paratransit NEMT costs (undistinguished as to ambulatory or wheelchair) are reported as “almost $22 per

one-way trip"—a number that lies in between our urban ambulatory and wheelchair estimates. Furthermore, the American Public Transportation Association (APTA), based on the 2002 National Transit Database, indicates an average operating cost per demand-response trip (independent of trip purpose) of $18.86, and this number closely matches our estimate for urban, ambulatory trips—the category most likely to resemble NTD data. As a result, we have confidence that the estimates are representative, especially for the ambulatory and wheelchair service types.

Table 5-1: Estimated One-Way Trips Costs for NEMT by Paratransit Service Category (2004)

Service Type	Region	Number of Trips in Estimate (Sample Size)	Average Cost Per One-Way Trip ($)
Ambulatory	Urban	420,435	19.95
Ambulatory	Rural	276,705	20.95
Wheelchair	Urban	111,384	28.52
Wheelchair	Rural	87,121	33.02
Stretcher	Urban	4,173	89.68
Stretcher	Rural	7,805	86.20

5.2 Fixed-Route Cost Estimates

Although much of the target population for this study is unlikely to use fixed-route transit—either because of this population's overall poor health and high prevalence of co-morbidities or because fixed-route transit is not available—certainly ambulatory members of this population could use fixed-route transit if it were available to them, and they could afford to pay for the trip (or it were provided for free via some sort of subsidy, as is the case for Medicaid NEMT); furthermore, even those requiring wheelchair service could access fixed-route transit in some circumstances. Thus, we turned to the American Public Transportation Association's Web site for easy access to National Transit Database (NTD) information. According to APTA (based on data from the 2002 NTD), the national average operating cost for fixed-route service (including buses, trolley buses, and rail) is $2.38 per unlinked trip (these calculations are detailed in Table 5-2). Furthermore, APTA estimates that 10-30% of trips require multiple (more than one) links. Using the middle value (20%) and assuming that exactly two links are needed for multiple link trips, we arrived at a national average cost per trip of $2.86 (1.2 times $2.38). Because the NTD best represents urban providers, we believe that limiting use of this estimate to urban fixed-route service is appropriate. Thus, in our later analyses, we will not assign any rural NEMT to fixed-route service.

Table 5-2: Cost Estimates for Fixed-Route Service Based on APTA Web Site (and NTD Data)

Mode	Operating Costs ($1000s)	Number of Unlinked Trips (1000s)	Cost ($) per Unlinked Trip
Bus	14,065,603	5,867,945	2.40
Trolley Bus	186,714	115,968	1.61
Commuter Rail	3,003,211	414,253	7.25
Heavy Rail	4,267,460	2,687,973	1.59
Light Rail	778,274	336,531	2.31
Other Rail	187,768	26,214	7.16
Total	22,489,030	9,448,884	2.38

5.3 Linking Medical Conditions to Transportation Service Type

In addition to developing cost estimates for the transportation-service types that could potentially provide unmet demand for NEMT, to complete the cost-effectiveness analyses we also need to estimate the relevant percentages of trips assigned to each service type (or mode) by location (urban or rural) and medical condition for the eleven conditions that are part of this study. To accomplish this, we made use of questions related to respondents' functional limitations in the 2001 NHIS (2001 was selected because it is the latest dataset that includes an urban-rural designation). Based on responses to these questions for our target population (these questions deal with ability to walk a quarter mile with no difficulties, climb ten steps without need for special equipment, and the like), we estimated the likely split across transportation service type (or mode) within each condition, and then used these splits to determine an average trip cost by condition. Because these estimates are somewhat sensitive to assumptions made about the effects of these functional limitations on transportation service needs, as well as on assumptions about the percentage of trips that are provided by fixed-route public transportation, we have developed low, intermediate, and high estimates for each of the eleven conditions, as shown in Table 5-3. In the cost-effectiveness analyses presented in Chapter 7, we employ all three values to arrive at a range of possible estimates. Chapter 7 also investigates sensitivity based on compliance with prescribed care arising from healthcare visits and on the required number of NEM trips per capita.

The following assumptions were made to arrive at weighted estimates based on the varying costs for paratransit and fixed-route transit by location in Table 5-3:

- *Low Estimate:* All persons in the target population represented as having none of the functional limitations asked about are assumed to need only ambulatory services; for those in urban areas with no limitations, 100 percent are assumed to travel via fixed-route transit (the main assumption that makes this estimate "low"), while similar persons in rural areas are assumed to use ambulatory paratransit. Those represented by some functional limitations but no need for special equipment (such as a wheelchair) are also all assumed to use ambulatory paratransit. Finally, those represented as needing special equipment are assumed to make wheelchair trips via paratransit.

- *Intermediate Estimate:* Again, all persons in the target population represented as having none of the functional limitations asked about are assumed to need only ambulatory services; half of those in urban areas are assumed to use fixed-route transit, and all in rural areas are assumed to use ambulatory paratransit. As with the low estimate, those represented by some functional limitations but no need for special equipment (such as a wheelchair) are also all assumed to use ambulatory paratransit, and those represented as needing special equipment are assumed to make wheelchair trips via paratransit.

- *High Estimate:* For both urban and rural members of the target population, all those represented as having no functional limitations and all those represented as having one or more limitations but no need for special equipment are assumed to travel via ambulatory paratransit service. Those needing special equipment are all assumed to require stretcher transportation service, thereby producing a high estimate that is not likely to be exceeded for any region or locale. Thus, it is a true high estimate.

Table 5-3: Average per NEMT One-Way Trip Cost by Condition

Medical Condition	Low Estimate ($/one-way trip)	Intermediate Estimate ($/one-way trip)	High Estimate ($/one-way trip)
Depression or Other Mental Health Problem	19.58	22.22	41.24
Hypertension	21.40	22.33	43.46
Heart Disease	21.94	22.83	46.05
Asthma	21.07	21.85	37.93
Chronic Obstructive Pulmonary Disease	21.18	21.67	33.92
Diabetes	19.58	22.22	41.24
End-stage Renal Disease	22.39	22.87	42.20
Dental Problems	13.08	16.63	20.18
Cancer	21.93	22.22	37.43
Premature Births	13.08	16.63	20.18
Vaccinations	21.93	22.22	37.43

For three of our conditions (vaccinations, dental problems, and depression), MEPS lacked data on functional limitations. For these, we assigned the costs from those for known conditions using a one-to-one mapping of unknown costs to known costs. Specifically, we assigned cancer transportation costs to vaccination transportation costs (both preventive care), prenatal care transportation costs to dental-problem transportation costs (again, both preventive), and diabetes transportation costs to depression (both chronic conditions). Because the costs do not vary considerably by condition, we believe that this compromise is minor and necessary to allow further examination of these three conditions.

5.4 Discussion of NEMT Cost Estimates

While we have used available data as judiciously as possible to develop our cost estimates, numerous uncertainties still exist in combining these costs with healthcare costs and benefits, as is done in Chapter 7. This section comments on some of these uncertainties. By using the spreadsheet tool that we have developed and that we describe in Chapter 8, state, regional, and local agencies, as well as other interested entities, will be able to tailor analyses specific to their own environment. To the extent that these uncertainties are less pronounced for well-defined transportation service areas, users of the spreadsheet tool will be able to specify more precise transportation cost estimates for their geographic region and thereby minimize the effects of these uncertainties.

One limitation in our transportation cost estimates is that currently unmet trips, by definition, may differ from those that have been taken and are represented in existing datasets. For example, trips not taken may be longer in time or length or occur at peak travel times, thereby increasing their cost relative to the average. Thus, though we focused on Medicaid trips and believe that these are a good analog for our targeted missed trips, the latter may well be more or less expensive to provide in any specific locale. Thus, we have also developed a spreadsheet tool to accompany this report that will allow for local or regional tailoring of these cost estimates to accurately reflect local conditions.

A second limitation relates to the difference between average and marginal costs. Because we use average costs for our healthcare analyses, we chose to use average transportation costs to facilitate like comparisons. In the transportation industry, however, marginal costs can differ significantly depending on the percentage of available capacity that is being used. For example, the incremental cost of providing an additional trip for an under-utilized service will be very low (vehicles, vehicle operators, etc., are already paid for, and labor is often the most expensive component in paratransit, thereby increasing trip cost as trip distance increases). As another example, the marginal cost of providing one more ambulatory or wheelchair trip on fixed-route transit is effectively zero. The incremental cost of an additional trip for a service already at capacity, on the other hand, or one for which trip distances are large (such as in rural areas), may be extremely high.

Further complicating matters, and leading to a third limitation in our estimates, both average and marginal costs can drop through the application of more efficient scheduling routines and procedures, and for many transportation providers it may be possible to provide additional trips through improved service coordination without the addition of any more resources, as described in TCRP Report 91 (Burkhardt et al., 2003). Indeed, improved coordination is a critical component of increasing the supply of available paratransit trips and the topic of much ongoing research.

Finally, we also did not link our target population to specific transit-mode criteria arising from the Americans with Disabilities Act (ADA). This was because the available MEPS data were not sufficient to allow this linkage, especially given that the MEPS provides no geographically specific data.

Chapter 6: Method for Estimating Healthcare Costs and Outcomes

In this chapter, we consider the optimal method to quantify the impacts of missed medical care on healthcare costs and health outcomes in light of the constraints imposed by the data. The work builds on the literature review presented in Chapter 2, and the set of non-emergency medical services needed by the target population identified in Chapter 3 and described in Chapter 4. From both data analysis and an extensive use of the literature, a comprehensive list of conditions that relate to those with transportation difficulties has been investigated.

We discuss economic evaluation in the health domain and describe the optimal methods for attacking the problem at hand. In Chapter 7, these methods are applied to the eleven medical conditions we have selected for specific analyses.

To clearly illustrate the methods, we review health economic evaluation information, present a general methods discussion that argues against a global (macro) cost benefit approach, and conclude by listing the steps required for the favored approach – a series of cost-effectiveness analysis case studies.

6.1 Review of Health Costs and Outcomes Evaluation

Healthcare costs and benefits (outcomes) are often difficult to distinguish from one another due to how some analysts commonly conceive of them, for example, by counting an adverse outcome as a cost or counting reduced utilization due to an intervention as a benefit. In this project we follow the conventions in the cost benefit analysis and cost-effectiveness literature that relegate expenditures to the cost side of the ledger (the *numerator*), and identify and value outcomes–the difference in effectiveness between an intervention and the alternatives to which it is compared–in the benefit column (the *denominator*) (Drummond et al., 1987; Gold et al., 1996; Jefferson et al., 1996).

6.1.1 Healthcare Costs

The healthcare costs associated with missed care include both the cost of the care forgone plus the cost of any care prompted by the care that was forgone, minus any care that is no longer needed because of better primary care. Our presumption is that missed healthcare often results in subsequent, more costly care. The classic healthcare example is a costly emergency room visit (including a potential hospital stay) prompted by missed primary care that could have prevented the emergency condition. The number of hospital emergency department (ED) visits reached a record high of about 114 million in 2003, a 26% increase from a decade earlier (McCaig and Burt, 2005). The U.S. population increased about 12% over this period and the 65-and-over population increased about 10%. Using the 2003 National Hospital Ambulatory Medical Care Survey Emergency Department Summary, the National Center for Health Statistics attributed the increase in ED visits to more adult usage, including those aged 65 and older. The report notes that Medicaid beneficiaries were four times more likely to visit EDs than were those with private

health insurance. Similarly, there is great potential for avoiding costly hospitalizations (Kruzikas et al., 2004).

Healthcare costs derive from five principal utilization categories:

- Hospitalizations (inpatient stays)
- Emergency room visits
- Outpatient visits (including diagnostic tests and labs)
- Physician and other primary care provider visits (office-based visits)
- Pharmacy costs

To perform a health economic analysis, the added transportation costs representing the "intervention," must be added to the new healthcare costs to compute total costs. Cost weights are not separately computed because the cost information comes directly from the MEPS data. However, for newly engendered office visits stemming from enhanced primary care or specialist evaluation and management visits, we will use Medicare cost weights. These are found in the Medicare Physician Fee Schedule for calendar year 2005 and are shown in Table 6-6 (Federal Register, 2004).

6.1.2 Health Outcomes

Quantifying the impact of missed care on healthcare costs requires detailed study, partially completed via our comprehensive literature review. We also have consulted various groups that bring together experts in the field, most notably the Disease Management Association of America, individuals at the relevant disease associations, the National Committee for Quality Assurance, the Agency for Healthcare Research and Quality, and the work by Milliman consulting. We explained that we are attempting to estimate the healthcare visit requirements for various chronic diseases (asthma, diabetes, arthritis, heart disease, etc.) by examining the disease management literature. In this way, we can match the number of trips a person with transportation barriers, suffering from a particular condition, might require to be considered well-managed. We would like to know how many visits (and what type, if possible) a well-managed patient might have, per year, on a disease-specific basis (see Section 6.5).

Similarly, we would like to determine the characteristics of a poorly managed patient on a disease-specific basis. In this way, we can match cost data by condition to derive the direct economic benefit of moving from poorly to well-managed care on the basis of better access to care as a result of improved transportation.

Health outcomes can be divided into quantity (life expectancy or mortality) and quality components (illness or morbidity). Measuring quantity of life is unambiguous; assessing health-related quality of life is both difficult and inherently controversial. To counter these difficulties, health services researchers have adopted the quality adjusted life year (or QALY) as the primary currency in their studies. The QALY method combines duration of life and health-related quality of life into a summary measure. Researchers can then compare interventions across various diseases and affected populations. We discuss our approach to quality of life in further detail, in Appendix C.

6.2 Estimating Missed Trips from a Disease Perspective

In this section, we discuss shortcomings in analytic approaches that rely on an estimate of the number of NEMT trips missed by the target population and explain why other approaches are superior, especially in the realm of preventive care. The resulting discussion sets the stage for use of cost-effectiveness analysis instead of a strict cost benefit analysis.

6.2.1 Identifying and Aggregating Missed Trips

Estimating the number of NEMT trips missed by those persons who need non-emergency medical care and lack transportation – the target population – is a difficult task. The difficulty involves both feasibility and accuracy. Feasibility is low because the data described in Chapters 3 and 4 on the transportation-disadvantaged population in the NHIS and MEPS focus on respondents who report missing at least one medical visit over the past year, but they do not contain enough detail to estimate the number of missed trips per person or to sum across the entire population. Moreover, this survey does not include preventive care, because respondents would not perceive preventive care as missed visits. That is, by definition, *one cannot self-report a missed visit that is not perceived as needed (and hence never scheduled)*. This point also pertains to visits that are not scheduled, because they are a component of an aggressive disease management protocol for chronic conditions that has not been instituted for a segment of the population.

Based on our analysis of available data, we have concluded that there is no sound, accurate, nationally representative way to count and sum missed trips. The converse is not true; counting visits that are actually made is quite easy. On average, each American makes approximately 3.2 healthcare visits per year, excluding hospitalizations and emergency visits (Burt and Schuppert, 2004). These data can be further detailed according to factors such as age, sex, race, payment source, etc. For example, those aged 75 years and above have more than 7 visits per year. Table 4-8 shows extremely high average visits for those identified in the MEPS with the chronic conditions analyzed in Chapter 7. Even with an extensive modeling analysis that matches characteristics of individuals in our target population with data from the National Center for Health Statistics, we would still only be able to estimate the actual number of visits that were made, not those that were missed.

As an alternative, we can straightforwardly compare the healthcare expenditures for individuals suffering from a disease depending on their transportation status. A separate comparison involves a synthetic approach for costing out poorly and well-managed cases by disease according to visit counts obtained from disease experts.

6.2.2 Comparison of Costs for Well and Poorly Managed Individuals

The data limitations make it difficult to match transportation-disadvantaged individuals suffering from certain diseases with missed healthcare in a statistically meaningful way. To overcome this shortcoming, we have developed a method that evaluates missed trips from a disease perspective. Literature on disease management and standards of care guidelines or protocols often include data on number of visits required for a disease to be considered “well-managed.” For example, this literature

recommends that a patient suffering from mild to moderate asthma should see a primary care provider twice a year. Likewise, it recommends that patients with severe asthma see a primary care provider three times a year and a specialist once a year to ensure that their asthma is under control. Thus, for patients in the transportation-disadvantaged population (or others) who have asthma, the ideal number of visits to treat their asthma ranges from two to four per year.

The number of trips missed is needed to estimate the cost of trips for the cost benefit analysis, but these trips also factor into the economic gains associated with more frequent and consistent care that prevents the contraction of a disease or the development of complications. For example, consistent access to transportation for an asthma patient over age one (2 to 4 trips) may prevent one trip to the emergency room or one hospitalization. This change in healthcare utilization provides the direct economic benefit that may offset the cost of providing the asthma care trips (and the cost of additional healthcare visits). Therefore, both the number of trips and the benefits of better health must be calculated on a *disease-specific basis* to provide a meaningful weighing of costs and benefits overall. We return to discussing the promise of this approach after considering issues related to a macro or global cost benefit approach.

6.2.3 Cost Benefit Analysis Issues

Conducting an accurate analysis of costs and benefits by examining diseases and then aggregating trips and benefits across the transportation-disadvantaged population that miss visits, poses a number of challenges. The central problem concerns the indeterminateness and arbitrary nature of translating health benefits into monetary terms required to conduct a strict cost benefit analysis. That is, after accounting for any cost changes – increased costs from the intervention plus any added healthcare expenditures minus reduced healthcare expenditures because of better care – healthcare benefits would have to be evaluated in monetary terms to complete the cost benefit assessment. This is controversial and objectionable to most analysts as it forces one to make monetary valuations for persons suffering from various diseases. These objections have led to an almost exclusive application of on cost-effectiveness analysis in the health domain (Gold et al, 1996).

Beyond the generic problems of conducting a strict cost benefit analysis, the transportation-oriented context of the current study raises additional problems. The crux of the problem with a macro-oriented analysis is that trips and visits do not relate one-to-one. Some visits will address a single, specific health concern. Others will address overlapping conditions for multiple diseases in a single visit. Therefore, estimating the number of trips per year associated with one disease can lead to inaccuracies when aggregating all of the trips and all of the disease-related benefits. In summing trips, we may overestimate the number of trips required by the transportation-disadvantaged population because one trip may provide a visit and therefore a health benefit, for a different disease that has a different benefit associated with better management. Although we can estimate the amount of trip layering in the transportation-disadvantaged population, the final results will have a wide margin of error, especially given the high prevalence of multiple, simultaneous chronic conditions found in the target population.

Instead of focusing on individuals with transportation barriers and aggregating their missed trips, in conjunction with changes in healthcare utilization, to get a macro-level analysis, the benefit of added transportation services is analyzed through a series of *disease specific, cost-effectiveness analyses*. In this way, there is no need to estimate the number of missed trips per transportation-disadvantaged individual, and the problems associated with trip- and visit-layering for persons with multiple chronic conditions are negated. These, in fact, may nevertheless inform and have implications for an aggregate cost benefit analysis. (A preliminary, macro cost benefit appraisal was produced. With plausible ranges for missed trips per disadvantaged persons, cost of added healthcare, and the added expense of transportation services, very little improvement is required in quality of health outcomes, or lowered unnecessary utilization, to derive a net positive cost benefit finding.) In short, cost-effectiveness analyses are more accurate, provide better information for policy makers, and give a better sense of program evaluation options.

6.3 Review of Cost-Effectiveness Analysis in Healthcare

In this section we focus on the use of cost-effectiveness measures to assess the benefit side of the non-emergency medical transportation equation. A more detailed description is contained in Appendix C. To reiterate, we believe the best approach is a series of cost-effectiveness analysis studies corresponding with the most significant diseases from which the target population suffers.

Cost-effectiveness analysis is a well-accepted method in health economics and health services research and is widely used to understand the value of healthcare outcomes associated with increased investment, for example, in transportation services. It serves to incorporate resource consumption into healthcare decisions, but does not directly value, *in monetary terms*, healthcare improvements. Rather, the cost of enhancing health is estimated and this can be compared via quality adjustments to a relative baseline.

There is clear value of a condition-by-condition approach for evaluating the costs and benefits of providing non-emergency medical transportation to transportation-disadvantaged individuals. There is, however, an obvious trade-off between the number of conditions that are evaluated and the quality of these analyses. Even with relatively few conditions studied, those that contribute the most to the analysis of costs and benefits are captured. Three arguments serve to justify this statement:

- An application of the Pareto rule to these conditions – a disproportionately small number of conditions account for a large proportion of costs and benefits
- Recent results from the literature regarding condition costs and chronic condition overlap
- New findings on the effectiveness of disease management procedures (or lack thereof).

The examined diseases were drawn from the prevalence data in NHIS and MEPS, in conjunction with what we know from external evidence about disease conditions that benefit from careful monitoring and comprehensive primary care and account for high healthcare costs. In addition, the final list of conditions was reviewed and

approved by the panel convened for this project by the Transit Cooperative Research Program (TCRP) within TRB.

Addressing the major conditions provides instructive examples and will be of sufficient value. There is limited interest in secondary conditions such as irritable bowel syndrome, especially as compared with the central diseases such as asthma, heart disease, and chronic obstructive pulmonary disease (COPD). Also, because some percentage of the supplied trips result in the treatment of two or more conditions, a correction factor can be integrated into the final analysis. While transportation cost analysis provides triangulated, reliable information, the healthcare cost-effectiveness analyses are necessarily illustrative.

In addition to accounting for limitations in the available data, the approach taken is strongly supported by two recent themes in the literature. The first points to the vast potential of novel disease management strategies (U.S. Congressional Budget Office, 2004). The second aims to compute the number of persons with: (1) chronic illnesses, (2) disabilities, and (3) functional limitations; as well as the various overlaps between people with combinations of these conditions, including those with multiple chronic diseases (Anderson, 2005; Anderson and Knickman, 2001; Partnership for Solutions, 2002). More than 100 million Americans fall into one of the three groups and nearly 10 million are in all three.

Chapter 4 illustrated that there is close alignment with these individuals and those that we characterize as transportation disadvantaged and missing medical care due to a lack of access to NEMT. Nonetheless, these individuals are extremely high users of healthcare despite the barriers they face getting to encounters. We have stressed that inordinately high disease prevalence, multiple simultaneous diseases, and high disease severity explain high healthcare utilization by those with transportation difficulties. Another factor is the likelihood that individuals who lack transportation, particularly those in urban settings, live in less healthy environments and therefore require more visits. Research clearly demonstrates that a significant portion of overall healthcare cost inflation derives from a small set of healthcare conditions – on the order of 30 percent of cost growth is accounted for by five conditions (Thorpe, 2004). These and related findings strongly argue that a condition-specific method, in which a selective set of conditions is intensively studied, is superior to a large set of conditions studied with insufficient detail.

6.4 Using the MEPS for Cost-Effectiveness Analysis

The MEPS is used for cost-effectiveness analysis because it is the richest source of nationally representative, health utilization and expenditure data, and it also contains information suitable to estimating QALYs. These advantages are described below.

6.4.1 QALY Information in the MEPS

The MEPS collects two measures of health status on all respondents, the Short-Form 12 and the EuroQol 5-D (Fleishman, 2005). These are two of the more widely used health status metrics. Each relates to QALY measurements, with the latter enabling direct QALY calculations (Gold et al., 1996). Accordingly, QALY information can be directly integrated into the individual evaluations that depend on MEPS cost and

utilization data. Table 6-1 gives the means of the EuroQol 5-D broken down by whether the individual falls into the transportation-disadvantaged target population, and according to insurance status.

Table 6-1: EuroQol 5 D Results from the MEPS

Transportation Status	UNINSURED ALL OF 2001	N	Population	EuroQoL 5-D Mean
Non-Target Population	Yes	3,045	22,456,521	0.8548
Non-Target Population	No	17,087	164,035,341	0.8195
Target Population	Yes	76	526,597	0.7421
Target Population	No	210	1,769,281	0.5601
N/A	N/A	11,704	95,459,587	N/A
Total		32,122	284,247,327	

6.4.2 Using the Richness of the MEPS for Cost and Benefit Analysis

The initial analytical plan involved linking the NHIS data to the MEPS so that the NHIS's detailed condition information would be supplemented with the MEPS's rich expenditure data. Special linkage disks were obtained via a data user's agreement with the U.S. Agency for Healthcare Research and Quality. Unfortunately, after reviewing the preliminary linked data, it was discovered that the final sample of MEPS respondents would be effectively cut in half (from about 32,000 to 15,000), because only an NHIS sub-sample contains the crucial transportation question that carries through to the linked MEPS data.

Given the other virtues of the MEPS data, including its own transportation-disadvantaged designation and the close agreement between this measure and the one in NHIS, we determined that it could stand on its own for the subsequent cost-effectiveness analyses. The MEPS is the preeminent, nationally representative healthcare cost and utilization dataset in the United States, and it includes extensive encounter and cost data broken down into five categories:

1. Inpatient stays
2. Outpatient visits
3. ER visits
4. Office-based visits
5. Pharmacy costs.

The MEPS data provide significant information on transportation-disadvantaged persons and their use of health services. The study population – those who miss healthcare visits due to a transportation barrier – is described in detail, and contrasted with the rest of the U.S. population, in Table 6-2. The weighted frequencies project the survey sampling onto the entire U.S. population using sophisticated statistical procedures.

6.4.2.1 Demographic Information

Comparing those who we believe to have missed healthcare due to transportation factors, with all others in the survey, Table 6-2 shows that the former group has more older adults, includes more females and minorities, and its members are more likely to have come from households with yearly income under $20,000 (this figure is low due to the focus on individuals, hence children, in the MEPS v. families or households).

Table 6-2: Demographic Review of the Target Population and Rest of the U.S.

	Weighted Frequencies		Weighted Percentages	
Age	Rest of U.S. Population	Target Population	Rest of U.S. Population	Target Population
0-15	63,940,806	848,675	22.8%	24.6%
16-24	34,529,988	419,293	12.3%	12.2%
25-39	59,061,624	683,714	21.0%	19.8%
40-64	86,959,976	985,529	31.0%	28.6%
65+	36,308,457	509,266	12.9%	14.8%
Totals	280,800,851	3,446,477	100.0%	100.0%
Sex				
MALE	137,147,041	1,483,896	48.8%	43.1%
FEMALE	143,653,809	1,962,580	51.2%	56.9%
Totals	280,800,850	3,446,476	100.0%	100.0%
Race				
AMERICAN INDIAN	2,558,716	51,171	0.9%	1.5%
ALEUT, ESKIMO	99,946			
ASIAN OR PACIFIC	11,513,628	142,118	4.1%	4.1%
BLACK	35,483,711	464,591	12.6%	13.5%
WHITE	231,144,849	2,788,595	82.3%	80.9%
Totals	280,800,850	3,446,475	100.0%	100.0%
Personal Income				
$20,000 or more	110,680,755	489,435	39.4%	14.2%
Less than $20,000	170,120,095	2,957,041	60.6%	85.8%
Totals	280,800,850	3,446,476	100.0%	100.0%

Source: 2001 MEPS Data

6.4.2.2 Insurance Status of the Target Population

Transportation-disadvantaged persons who miss healthcare due to a lack of access to NEMT are more likely to be uninsured than those who do not miss healthcare for transportation-related reasons. Of the target population, 22 percent were uninsured for all of 2001, while only 12 percent of the others were uninsured for the entire year. Table 6-3 shows the proportion of people in each of the insured categories.

Table 6-3: Insurance Status of the Target Population

		Rest of U.S. Population	Target Population
Weighted Frequency	**Uninsured**	32,357,569	772,098
	Insured	248,443,282	2,674,378
Weighted Percentage	**Uninsured**	12%	22%
	Insured	88%	78%

6.4.2.3 Utilization of Healthcare Services

The target population is much more likely to have an inpatient stay and emergency room visit as well as have more prescriptions written for them. Table 6-4 shows that for each of these indicators of utilization, the target population was about twice as likely to use these services. This finding confirms earlier analysis that indicates the target population suffers from diseases at a higher rate and also experiences multiple, chronic conditions.

Table 6-4: Utilization of Services

	Inpatient Stays (per 1,000 pop)	Outpatient Visits (per 1,000 pop)	ER Visits (per 1,000 pop)	Office Based Visits	Rx Scripts
Target Population	212	652	464	7.1	17.0
Rest of U.S.	105	524	190	4.7	8. 7
% Difference	103%	24%	144%	49%	96%

6.4.2.4 Per Capita Expenditures by Category

While the median per capita costs of healthcare for the target population is significantly higher than the cost for the rest of the U.S. population, the cost categories that appear to drive the total per capita cost are home health and prescription costs. Table 6-5 shows the weighted per capita cost for each of the cost categories included in the MEPS database.

It is not surprising that the per capita costs for outpatient care are less for the target population. This further demonstrates how difficult it is for transportation-disadvantaged persons who miss medical care due to a lack of access to transportation to obtain care.

Table 6-5: Weighted Median Per Capita Healthcare Costs by Category

	Unweighted Sample	Total Healthcare Expenses	Inpatient	Out patient	ER	Rx	Office-Based Medical Provider	Dental	Home Health	Other
Target Population	454	$1,874	$4,862	$310	$336	$644	$446	$184	$2,156	$141
Rest of U.S.	31,668	$1,095	$5,281	$547	$357	$312	$307	$178	$928	$157
% Difference		71%	-8%	-43%	-6%	107%	45%	3%	132%	-10%

6.5 Establishing the Benefits of Well-Managed Care

There are established standards of care intended to prevent complications for chronic diseases widely prevalent in the United States. When a patient receives well-managed care, his or her disease is under control, complications are minimized, costly care is avoided, and quality of life is enhanced. A disease that is uncontrolled may be a product of patient non-adherence (or noncompliance) with prescribed care or clinical mismanagement or both. Transportation barriers can be attributed both to external barriers for clinical management and to issues of patient access and adherence to treatment (Javors et al., 2003). Because transportation barriers are a factor in poor disease management, it is reasonable to assume that data on poorly managed patients will include transportation-disadvantaged patients. Data from MEPS confirm that transportation-disadvantaged patients experience higher rates of disease complications than the general public. Thus, for the purposes of this economic evaluation, transportation-disadvantaged individuals are considered part of a poorly managed patient population, and the utilization rates and costs will be derived from this perspective.

To efficiently analyze the diseases on our list, we focused our effort on diseases and conditions that have proven financial benefits through better-managed care. Conditions such as diabetes, cardiovascular disease, and asthma, have been widely discussed in the disease management literature and are considered to be the best targets for preventing complications and costly healthcare services using early intervention (Ofman et al., 2004). Other diseases, when the literature on the number of visits and the economic benefits of disease management are relatively unknown, will not be considered.

In Chapter 7, we will analyze the data on well-managed patients compared with poorly managed patients suffering a particular disease and estimate the economic benefits of moving a patient into a well-managed state. This gain, reduced to account for patient and provider compliance, will represent the benefit of providing non-emergency medical transportation for the specific disease being analyzed.

The data on disease management programs and effects provides information on how poorly managed patients can become well managed through more frequent preventive care visits and monitoring (nurse phone calls to home or employing sophisticated remote monitoring equipment), home healthcare, prescription drug adherence, etc.

It is critical that the number and type of visit required to achieve proper management is understood. To obtain insights into this issue, we contacted the research director of the Disease Management Association of America. Through a series of consultations with experts in disease management research, we received suggestions on how to determine the appropriate number of visits per year for each disease, e.g., Karen Fitzner, research director of the Disease Management Association of America, www.dmaa.org, contacted via email on October 15, 2004. From our discussions, we have concluded that the Milliman Care Guidelines also provide useful analyses of disease-specific healthcare utilization. The guidelines include utilization data for ambulatory, inpatient, surgical, and home care health services to provide “best practice” information. They are “drawn from analysis of thousands of abstracts, articles, databases, textbooks, nationally-recognized guidelines and practice

observations, they synthesize the latest medical knowledge and best practices across the United States" (Milliman Consulting, 2004).

To prevent overestimation of the benefits of providing non-emergency medical transportation to a poorly managed, transportation-disadvantaged population, we included a noncompliance factor in the analysis. This factor will account for the providers who do not adhere to standards of well-managed care, patients in the disadvantaged population who do not adhere to treatment, and those patients whose disease is considered uncontrollable, despite the best efforts of the provider and patient. In a study of compliance with clinical management guidelines for cardiovascular disease (CVD), diabetes, and asthma, 90 percent of patients were compliant with their care. Healthcare providers varied in their adherence to national standards from 71.4 percent compliance with CVD to 42.9 percent compliance with diabetes guidelines (Javors et al., 2003).

The compliance factor is equal to the percentage of patients who had improvements in their health as a result of better disease management. The noncompliance factor, therefore, is the percentage of patients enrolled in a disease management program whose healthcare did not change. The hypothesis is that patients with transportation barriers are likely to receive poorly managed care, thus using a compliance factor based on disease management program effects is consistent. This factor is used to reduce the net benefit for the disadvantaged patients who may receive well-managed care through non-emergency medical trips. The equation is:

[Compliance factor * (poorly managed cost – well managed cost)] –

[# of visits * (cost of transportation + cost of medical visit)] = Net Costs

6.6 Benefits and Costs of Providing Transportation for Chronic Medical Conditions: Analytical Steps

The steps to calculate benefits and costs of providing transportation for the chronic medical conditions that are analyzed in Chapter 7 are described below.

1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001).

2. Review the characteristics of well- and poorly managed care, for each condition, through the literature. Well-managed patients use appropriate drugs, have their care monitored via a sufficient number of healthcare provider visits, and take other steps to stay healthy and avoid unnecessary emergency room visits. Poorly managed patients fail to adhere to drug therapy, do not have sufficient provider visits, and otherwise do not take steps to remain as healthy as possible.

3. Isolate the well-managed patients and review their per capita cost of care. These patients represent the expected costs for well-managed patients with transportation deficiencies addressed. Similarly, identify poorly managed patients. These patients represent expected costs for patients who are not

well managed for many reasons, *including* transportation deficiencies. Likewise, review their per capita cost of care.

4. Determine the compliance factor(s) for the disease in question from the literature. This will typically involve a large range so sensitivity must be addressed.

5. Determine from the literature review the number and type of visits (if available) required to manage a patient with the given disease adequately. For example, seeing a primary care provider alone is often insufficient to properly treat a chronic condition.

6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. The fee schedule contains five levels of evaluation and management physician visits for established patients, ranging from basic to extensive. (We use the costs for established patient visits instead of new patients because of the underlying assumption that these patients are being well managed and thus have a usual physician provider.) The middle level visit cost is typically applied. The codes and payment amounts are shown in Table 6-6.

Table 6-6: Medicare Fee Schedule Evaluation & Management Visits for Established Patients

Fee Codes	Description & Typical Visit Length	Payment ($)
99211	Minimal presenting problem(s); may not require physician; 5 minutes	21.60
99212	Self limited or minor presenting problem(s); 10 minutes	38.66
99213	Low to moderate severity presenting problem(s); 15 minutes	52.68
99214	Moderate to high severity presenting problem(s); 25 minutes	82.62
99215	Moderate to high severity presenting problem(s); 40 minutes	120.14

7. Determine the cost of required paratransit trips. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel.

8. Incorporate health-related quality of life adjustments so that the analysis will correspond to the QALY methodology. For each respondent, MEPS collects *EuroQol* data that comprises an accepted quality of life measure. This provides a preference-based index that ranges on a scale from 0 (“worst possible health”) to 100 (“best possible health”). Because we can compute an average score across any subset of the population, we are able to obtain quality of life measures for the poorly- and well-managed subsets.

9. Summarize the results in a table that illustrates ranges for compliance and other factors. Note that while cost savings from healthcare expenditure reductions are anticipated, they are not required for a cost-effective outcome due to the expectation of quality of life improvement.

6.7 Benefits and Costs of Providing Transportation for Preventive Health

The expenditure data contained in the MEPS, while tremendously useful for the chronic conditions, cannot be straightforwardly applied to the analysis of preventive cases. Accordingly, we apply a literature-based approach to these.

6.8 Summary and Discussion of Healthcare Cost Methods

Our preferred method to address the central concern of this study relies on established and peer-reviewed criteria for judging well- and poorly managed care that are applied to separate the population into two groups and to obtain the per capita cost results for the important conditions under review. Only the population that is insured and not transportation-disadvantaged is used for this data analysis. Additional parameters are required to complete the cost-effectiveness studies, especially the integration of QALY information, and variations to key cost factors must be considered.

Alternately, cost differentials could be calculated by directly comparing transportation-disadvantaged individuals to advantaged ones (with or without insurance). These variations are pursued in the next chapter and comprise an essential role in the consideration of sensitivity analysis, that is, a comprehensive comparison of results considering appropriate ranges for key variables.

Numerous studies document the benefit of early interventions and frequent physician contact for chronic conditions like asthma. However, these benefits, or rather, the avoided costs of complications, do not manifest in the patient immediately. In the case of diabetes, hypertension, congestive heart failure, cancer and dental problems, the benefits of prevention are delayed – in fact some of the complications associated with poor management or prevention of these conditions do not develop for decades. Complications, such as heart failure, stroke, disability or early death, are quite costly, and cost-effectiveness literature supports disease management for each of these conditions, as discussed further in Chapter 7.

The cost-effectiveness model developed for the chronic conditions presented in this report relies on the comparison of healthcare costs for well and poorly managed patients at a disease-specific level within MEPS. The current analysis compares the costs for patients within a one-year time frame using MEPS data. This is a suitable structure for asthma, depression, ESRD, and COPD, all of which present an immediate benefit to the well-managed patient, and an immediate cost to the poorly managed patient. MEPS data clearly show higher emergency service or hospital utilization due to complications in the poorly managed populations with conditions like asthma, depression, ESRD, and COPD.

A significant limitation of this method is the lack of longitudinal data required to truly characterize the complications avoided by disease management for diabetes, hypertension and congestive heart failure. It is possible patient with diabetes can be poorly managed yet not exhibit complications (and higher healthcare utilization) until many years have passed. Since the MEPS data only shows the healthcare costs for one year, patients who are poorly managed may have much lower utilization because

they do not regularly see a physician, despite the likelihood of much higher future healthcare costs. While MEPS provides significant detail on healthcare costs and disease burden, there is insufficient data to determine, within diseases, the number of years the patient has had the condition, or the severity of the disease. Therefore, comparing well and poorly managed patients with diabetes, hypertension, or congestive heart failure is likely to discount the true future value of patients in the well-managed group, and will largely underestimate the future costs of those in the poorly-managed population.

Despite these limitations, we are confident this methodology will be useful to decision makers who are considering NEMT based on immediate costs and benefits. For chronic conditions like diabetes, hypertension, and congestive heart failure, the benefits of providing NEMT will not become cost saving for some time. Instead, the one-year snapshot of the benefits of NEMT at the condition level presents the real costs of ensuring patients receive preventive or timely care over a one-year timeframe. The literature on the longitudinal benefits of disease management for diabetes, hypertension, and congestive heart failure are presented in the cost effective analyses in Chapter 7 and indicate the long-term benefits of early intervention for these conditions.

Chapter 7: Condition-Based Cost-Effectiveness Analysis of NEMT and Health

This chapter uses the non-emergency medical transportation cost estimates developed in Chapter 5, and the methods elaborated in Chapter 6, to review and analyze the cost-effectiveness of providing NEMT to those who lack access to it, and who suffer from twelve specific medical conditions. Because the benefits of additional care vary according to medical condition, this analysis essentially produces twelve unique cost-effectiveness results. We analyzed the most important and prevalent conditions faced by the transportation-disadvantaged persons who lack access to NEMT. By analyzing these highly prevalent conditions, we have included the majority of affected individuals, i.e., the project's target population.

Because chronic and preventive conditions require fundamentally different approaches, as discussed in Chapter 6, this chapter is organized into two major sections, one for the conditions using each approach. We begin with the five preventive care conditions. These are followed by the analysis of seven chronic care conditions. A final section discusses how these results may be aggregated into an overall cost-effectiveness analysis for the conditions analyzed, as well as other issues associated with these estimates.

7.1 Cost-Effectiveness of Increased Access to Healthcare for Preventive Care

Presentation of the preventive care examples is straightforward in that they are based on existing cost-effectiveness studies found in the literature. The cost of NEMT is added to the cost side of the ratio to determine the cost-effectiveness of the particular preventive service.

7.1.1 Influenza Vaccinations

Vaccinations can be critical to health and their cost-effectiveness has been extensively studied. Influenza, or flu, occurs annually and can be deadly, especially to infants and the elderly. This cost-effectiveness analysis relies on data from the Centers for Disease Control based on flu vaccination eligibility for all adults, with the exception of pregnant and nursing women. The steps are as follows.

Step 1. Determine the compliance rate. The literature suggests that the compliance rate for preventive care screenings or vaccinations is comparatively low. In the case of the flu vaccine, it is estimated that 18.3% to 40.8% of eligible patients get a flu vaccine (Nichol et al., 2003). This number is closer to 66% for patients over 65 (MMWR, 2003). Among the elderly, immunization programs that increase access have demonstrated vaccination numbers of 84% (Nichol et al., 1998). For the cost-effectiveness of NEMT, compliance with receiving the vaccination is of little interest, since a patient not taking the vaccine is also not likely to incur transportation or medical visit costs. Therefore, no compliance rate is applied in this analysis.

Step 2. Research cost and benefit parameters. Literature on cost-effectiveness of preventive screenings and vaccinations indicates that getting a vaccination is cost-effective. The direct and indirect costs avoided annually for patients with a flu vaccine are estimated to be $49.73 (Nichol et al., 2003).

Step 3. Determine the cost for a vaccination visit. The cost to visit a nurse and be vaccinated for flu, estimated in 1998 dollars, is $10 – $36 depending on whether the patient is a child or adult. This includes the cost of the vaccine (Luce et al., 2001).

Step 4. Determine the cost of a paratransit trip. As determined in Chapter 5, round trip costs range from $43.86 to $74.86.

Step 5. Incorporate the trip cost into the cost-effectiveness calculation. (We are using the term "transit" in this discussion though not all of the transportation services are literally "public transportation".) As stated in Step 1, compliance factors are not applied for patients who do not get vaccinated, as they are assumed to also not use NEMT. The results are presented in Table 7-1, using the low, intermediate, and high transportation costs shown in Table 5-3. Providing NEMT for flu vaccination is not cost saving, however at the highest cost of $61.13, contracting the flu and the quality of life impacts of having the flu can be avoided. Considering the risk of death for elderly flu patients, the cost of NEMT is negligible. *NEMT for flu vaccination is cost-effective*.

Table 7-1: Cost-Effectiveness Results for Flu Vaccine

Transit Cost Scenario	Average Round Trip Cost	Visit and Vaccine Cost (Low Estimate)	Visit and Vaccine Cost (High Estimate)	Total Trip Cost (Low)	Total Trip Cost (High)	Costs Avoided with Flu Vaccine	Net Cost Difference (Low)	Net Cost Difference (High)
Low	$43.86	$10	$36.00	$53.86	$79.86	$49.73	($4.13)	($30.13)
Intermediate	**$44.44**	**$10**	**$36.00**	**$54.44**	**$80.44**	**$49.73**	**($4.71)**	**($30.71)**
High	$74.86	$10	$36.00	$84.86	$110.86	$49.73	($35.13)	($61.13)

7.1.2 Prenatal Care

Prenatal care offers an opportunity to both increase infant survival rates and delay pre-term delivery in high-risk pregnancies, through nutritional counseling and screening for various conditions of the mother or fetus (Bonifield, 1998). Additionally, screening programs for maternal diabetes, neural tube deficiencies, HIV, and Downs's Syndrome have demonstrated effectiveness (USPSTF, 1996; USPSTF, 2005). These screenings often occur during prenatal care visits and the benefits associated suggest that prenatal care is highly cost-effective. This analysis focuses on the cost-effectiveness of prenatal care to prevent premature birth.

Step 1. Determine the compliance rates for prenatal care. Low birth weight can be reduced through prenatal care, but not eliminated. The cost-effectiveness studies above take this fact into account. Despite the availability of prenatal services, 16%

of mothers had inadequate prenatal care (Schramm, 1992). In a study of insured patients, 8% of women received inadequate prenatal care due to transportation barriers (Braveman et al., 2000). The compliance factor ranges from 84% to 92% for prenatal services.

Step 2. Using the literature, determine cost-effectiveness of prenatal care. In a comparison of Missouri women receiving Medicaid, infants born to women who had received adequate prenatal care cost significantly less than infants born to women with inadequate care, defined as no appointments or appointments beginning after month 7 of pregnancy. For each dollar spent on prenatal services, Medicaid saved $1.49 (Schramm, 1992). Infants born to mothers receiving any prenatal care weighed 5.09 ounces more than those born to mothers who received no prenatal care. The cost of care for low birth weight infants is very high, such that the annual cost savings of prenatal care is $230 per patient (Henderson, 1994).

Step 3. Determine the cost for a prenatal care visit and the number of visits required to meet the standards of adequate prenatal care. The average number of prenatal visits in a community setting was 8 with an obstetrician/gynecologist over the 9-month gestation period, while adequate care was defined as at least 9 visits starting within the first 3 months of pregnancy (Bienstock et al., 2001; Schramm, 1992). The cost of providing prenatal care is included in the cost-effectiveness results in Step 2.

Step 4. Determine the cost of a prenatal trip. As determined in Chapter 5, round trip costs range from $26.16 to $40.36. Trip costs are shown in Table 7-2.

Table 7-2: Prenatal Care Trip Costs

Transit Cost Scenario	Average Round Trip Cost	Visit Cost	Trips for Prenatal Care (Low Estimate)	Trips for Prenatal Care (High Estimate)	Total Trip Cost (Low Estimate)	Total Trip Cost (High Estimate)
Low	$26.16	$52.68	8	9	$630.72	$709.56
Intermediate	$33.26	$52.68	8	9	$687.52	$773.46
High	$40.36	$52.68	8	9	$744.32	$837.36

Step 5. Incorporate the medical cost outcomes into the cost-effectiveness calculation. The average cost of care for prenatal patients is $1,045.69 compared to $2,244.11 for those without.

The cost-effectiveness results are shown in Table 7-3. While there are 12 possible combinations of results (3 transit costs * 2 compliance rates * 2 trip amounts), we simplify the presentation by showing 3 outcomes:

- Best outcome – lowest transit cost, highest compliance, lowest visits
- Worst outcome – highest transit cost, lowest compliance, most visits

- Intermediate outcome – intermediate transit cost, mid range for compliance, and a most likely visit count (8).

Prenatal care is cost saving for every scenario, with out most likely outcome of $367 savings per person. Considering that quality of life improvement for patients that have full term pregnancies (both mothers and infants) are *not* included here, *NEMT for prenatal care is clearly cost-effective*.

Table 7-3: Cost-Effectiveness Results for Prenatal Care

Combined Scenario	Compliance Factor	Poorly Minus Well Cost of Prenatal Care	Adjusted Cost Difference	Travel & Medical Cost	Net Change in Costs
Low Transit $, Best Compliance, Fewest Visits	92%	$1,198.42	$1,102.55	$630.72	$472
High Transit $, Worst Compliance, Most Visits	84%	$1,198.42	$1,006.67	$873.36	$169
Intermediate Transit $, Mid Compliance, Likely Visits	88%	$1,198.42	$1,054.61	$687.52	**$367**

7.1.3 Cancer Screening: Breast Cancer

Some cancer screenings are highly effective at catching the early stages of cancer allowing for rapid treatment. Both breast and colorectal cancer benefit greatly from early detection to prevent costly treatments, such as intensive chemotherapy, or undesirable health outcomes including early mortality. This preventive care example presents the cost-effectiveness results for breast cancer screening.

Step 1. Determine the compliance rates for breast cancer screening. Studies have shown that 45-65% of women over age 65 participate in breast cancer screening and follow-up treatment (Mandelblatt et al., 2003). A screening, however, is a trip and so those that are not compliant with screening do not incur any NEMT costs. Compliance does not factor into this analysis.

Step 2. Using the literature, determine cost-effectiveness of breast cancer screening. Biennial breast cancer screening for women age 65 and older has incremental costs of $34,000 to $88,000 per life year gained (Mandelblatt et al., 2003).

Step 3. Determine the cost of breast cancer screening. Mammography screening costs between $66 and $198 for breast cancer (Mandelblatt et al., 2003). A screening is recommended for women over age 65 every two years.

Step 4. Determine the cost of a trip for breast cancer screening. These costs were determined in Chapter 5 and are shown in Table 7-4.

Step 5. Incorporate the trip cost into the cost-effectiveness calculation. Given that breast cancer screening costs $34,000-$88,000 per life year saved, and $50,000 is

commonly accepted as an upper bound cost for an additional life year, the cost for a trip must be less than $16,000. Table 7-4 shows the net costs of NEMT for breast cancer screening. Although these costs are all higher than the healthcare utilization costs avoided, *including our best estimate intermediate cost of $34,176*, they fall under the $50,000 QALY cost estimate threshold, and thus are cost-effective.

Table 7-4: Cost-Effectiveness Results for Breast Cancer Screening

Combined Scenario	Average Round Trip Cost	Visit and Screen Cost (Low Estimate)	Visit and Screen Cost (High Estimate)	Total Trip Cost (Low)	Total Trip Cost (High)	Net Cost of Breast Cancer Screening	Net Cost Difference (Low)	Net Cost Difference (High)
Low Transit $	$43.86	$66	$198	$110	$242	($34,000)	($34,110)	($34,242)
High Transit $	$74.86	$66	$198	$141	$273	($34,000)	($34,141)	($34,273)
Intermediate	**$44.44**		**$132**		**$176**	**($34,000)**		**($34,176)**

7.1.4 Cancer Screening: Colorectal Cancer

This preventive care example presents the cost-effectiveness results for colorectal, or colon, cancer screening.

Step 1. Determine the compliance rates for colon cancer screening. Although studies have shown that 36% of patients getting colorectal screens prefer colonoscopy, participation in this type of screening is low – about 18.2% (Scott et al., 2004). A screening, however, is a trip and so those that are not compliant with screening do not incur any NEMT costs. Compliance does not factor into this analysis.

Step 2. Using the literature, determine cost-effectiveness of colon cancer screening. The cost-effectiveness of a colonoscopy every 10 years to screen for colon cancer is $9,083 to $22,012 (2000 dollars) per life year saved (Pignone et al., 2002a).

Step 3. Determine the cost of colon cancer screening. Colonoscopy screening costs are between $285 and $1,012 for colorectal cancer (Pignone et al., 2002a).

Step 4. Determine the cost of a trip for colon cancer screening. These costs were derived in Chapter 5 and are shown in Table 7-5.

Step 5. Incorporate the trip cost into the cost-effectiveness calculation. Given that 18.2% of men are compliant with colon cancer screening, screening costs $9,083 to $22,012 per life year saved, and $50,000 is commonly accepted as an upper bound cost for an additional life year, the cost for a trip must be less than $27,988. Screenings are recommended every ten years, and as the costs in Table 7-5 show, the trip costs have little impact on colon cancer screening cost-effectiveness. Although these costs are all higher than the healthcare utilization costs avoided, *including our best estimate intermediate cost of $22,735*, they all fall comfortably below the $50,000 QALY cost estimate threshold, and thus are judged cost-effective.

Table 7-5: Cost-Effectiveness Results for Colon Cancer Screening

Combined Scenario	Average Round Trip Cost	Visit and Screen Cost (Low Estimate)	Visit and Screen Cost (High Estimate)	Total Trip Cost (Low)	Total Trip Cost (High)	Net Cost of Colon Cancer Screening	Net Cost Difference (Low)	Net Cost Difference (High)
Low Transit $	$43.86	$285	$1,012	$328.86	$1,055.86	$(22,012)	($22,341)	($23,068)
High Transit $	$74.86	$285	$1,012	$329.44	$1,056.44	$(22,012)	($22,341)	($23,068)
Intermediate	**$44.44**		**$648.50**		**$723.36**	**$(22,012)**		**($22,735)**

7.1.5 Dental Care

Research has demonstrated a link from oral health to general health, thus emphasizing the importance of dental preventive care (U.S. DHHS, 2000; Mertz & O'Neil, 2002; AHRQ, 2002). Dental caries is the leading chronic disease among children and the treatment for caries is the leading unmet need (Bader et al., 2004). 25% of children enter kindergarten with untreated dental decay. This problem affects poor children far more than non-poor (36.8% of poor children age 2-9 years old have untreated dental decay compared to 17.3% of non-poor children). Among adults aged 50-69, 31.2% of African Americans, 28.2% of Mexican Americans and 16.9% have untreated periodontal disease. For adults 70 years and over, the percentages rise to 47.1%, 32.0%, and 24.1% for the three groups (Stanton et al., 2003).

Step 1. Determine the compliance rates for preventive dental care appointments. The authors assumed a 75% participation in preventive dental services in the cohort analyzed for cost-effectiveness (Ramos-Gomez et al., 1999). Participation in preventive dental care among low-income patients on Medicaid is very low – only 20% of children on Medicaid get preventive dental services. 42.9% of children under age 18 in middle or high-income categories received preventive dental services (Stanton et al., 2003).

Step 2. Using the literature, determine cost-effectiveness of preventive dental care. The incremental cost-effectiveness ratio for providing preschool children with preventive dental services resulted in a ratio of $73 for each carious surface avoided (Ramos-Gomez et al., 1999).

Step 3. Determine the cost of a preventive dental appointment. The cost of a specialist appointment according to the Medicare Prospective Payment fee schedule is $120.14; however dental visit costs vary widely by region (U.S. GAO, 2000b). This visit cost is a conservative estimate.

Step 4. Determine the cost of a trip for preventive dental care. These costs were derived in Chapter 5. They range from $26.16 to $40.36, with $33.26 as the intermediate value.

Step 5. Incorporate the trip cost into the cost-effectiveness calculation. Given the population compliance with preventive dental care, and the cost-effectiveness for

dental care is $75 per tooth, the additional cost of providing NEMT does not increase the overall cost of dental care beyond the $50,000 threshold.

The cost-effectiveness results are shown in Table 7-6. While there are 12 possible combinations of results (3 transit costs * 2 compliance rates * 2 trip amounts), we simplify the presentation by showing 3 outcomes:

- Best outcome – lowest transit cost, highest compliance, lowest visits (1)
- Worst outcome – highest transit cost, lowest compliance, most visits (12)
- Intermediate outcome – intermediate transit cost, mid range for compliance, and a most likely visit count (4).

Although these costs are all higher than the healthcare utilization costs avoided, *including our best estimate intermediate cost of $590* they all fall below the $50,000 QALY cost estimate threshold, and thus are judged cost-effective.

Table 7-6: Cost-Effectiveness Results for Preventive Dental Care

Combined Scenario	Compliance Factor	Net Cost of Dental Care per Carious Surface Avoided	Adjusted Cost Difference	Travel & Medical Cost	Net Change in Costs
Low Transit $, Best Compliance	43%	$75	$32.25	$146.30	$(114)
High Transit $, Worst Compliance	20%	$75	$15.00	$1,926	$(1,911)
Intermediate Transit $, Mid Compliance	**31.5%**	**$75**	**$23.63**	**$613.60**	**$(590)**

7.2 Cost-Effectiveness of Increased Access to Healthcare for Chronic Conditions

This section presents the cost-effectiveness case studies that lie at the heart of understanding how enhanced transportation access may improve healthcare for individuals with highly prevalent chronic conditions. These are based on extensive analysis of MEPS data that compares the healthcare expenditure patterns of well and poorly managed patients at the condition level. Beyond the health consequences for affected individuals, these conditions impose large societal costs. Fortunately, there appears to be significant evidence that proper disease management of these conditions has the potential to both reduce healthcare expenditures and improve the health of the patients. Most of this monitoring depends on a high number of routine physician visits, thus transportation plays a critical role in ensuring appropriate care. As discussed in Chapter 6, not all of the conditions can be accurately analyzed through the well and poorly managed delineation. Diabetes, hypertension, and congestive heart failure affect health over a wide time horizon. A one-year MEPS dataset snapshot does not appropriately capture this dynamic context. These conditions will be described using MEPS for the one-year comparison of healthcare costs, and the literature on future cost-effectiveness is also presented.

The following calculations rely on this formula:

[Compliance factor * (poorly managed cost – well managed cost)] –

[# of visits * (cost of transportation + cost of medical visit)] * QALY adj. =

Net change in costs and quality of life for disease management

7.2.1 Asthma

Asthma is highly prevalent in the U.S. population, especially among children. More than seven million children have an asthma diagnosis and 85% use some form of asthma medication. Untreated asthma results in exacerbations that can be deadly without medical interventions. As a result, asthma is an ideal condition for the disease management model – frequent physician contact has been shown to reduce expensive emergency room visits and hospitalizations.

Step 1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001). From this data set, we isolated all patients with the medical condition asthma, as determined using ICD-code 493. This dataset allows us to compare well managed to poorly managed asthma care with the effects of transportation difficulties and lack of insurance removed to avoid confounding the access to care situation. This process located 10,450,078 individuals.

Step 2. Review the characteristics of well- and poorly managed asthma care through the literature. For asthma, poorly managed care is defined as any inpatient stay or emergency room visit. Well-managed care is defined as one year without inpatient or emergency room visits (National Asthma Education and Prevention Program, 1997).

Step 3. Isolate the well-managed patients (those who do not have any hospitalizations or emergency room visits in the past 12 months) and review their per capita cost of care. These patients represent the expected costs for well-managed patients with transportation deficiencies addressed. We identified poorly managed patients as those with at least one hospitalization or emergency room visit. These patients represent expected costs for patients who are not well managed for many reasons, including transportation deficiencies. Likewise, we reviewed their per capita cost of care. Table 7-7 shows the results of this analysis. Median per capita costs were used because they are considered conservative and likely to be a more accurate estimate of true costs. The cost difference is $1,432.

Table 7-7: Cost Comparison of Asthma Patients in MEPS (2001)

		Per Capita						
Population	Unweighted Frequency	Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	Total Costs (Mean)	Total Costs (Median)
Entire Asthma Population	1,347	$329	$47	$14	$403	$127	$920	$279
Transportation-Advantaged / Insured Asthma Population	1,224	$325	$47	$15	$401	$131	$919	$281
Poorly Managed	132	$3,312	$484	$40	$528	$228	$4,593	**$1,675**
Well Managed	1,092	$0.00	$0.00	$13	$387	$120	$520	**$243**
Difference Between Poorly and Well-Managed Care:							$4,073	**$1,432**

Step 4. Determine the compliance factor(s) for asthma care from the literature. Asthma is the most prevalent chronic disease among children. For this reason, an asthma disease management program targeting a pediatric population was used to determine patient compliance with well-managed care for the children in the transportation-disadvantaged population. Following a disease management program, five of the 29 children randomized to the program did not experience changes to their condition significant enough to fit the well-managed asthma criteria. Thus, the noncompliance factor for children with asthma is 5/29 or 17%, and the compliance factor is 83% (Greineder et al., 1999). Adult asthma patients in a disease management program were also studied and non-adherence was estimated at 30 to 70% (Bender et al., 1997). The best-case scenario is compliance at 83%; the worst case is compliance of 30%. Applying this factor to the cost difference between well and poorly managed asthma patients derived in step 3 produces an adjusted cost difference of $1,189 in the best case scenario and $430 in the worst case.

Step 5. Determine from the literature review how many visits or trips per capita, per year are required to manage a patient with chronic asthma adequately. Well-managed asthma requires 2 to 12 visits with providers per year (National Asthma Education and Prevention Program, 1997).

Step 6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. The fee schedule contains five levels of physician visits for established patients, ranging from basic to extensive. As explained in Chapter 6, we use established cost weights as opposed to new cost weights (which are higher) because we assume that care will be well managed and this implies that patients have a usual source of care, i.e., that visits involve an established provider relationship. The five levels, codes, and cost weights are shown in Table 6-6. To capture both maintenance care and occasional specialist care, we use the fourth level cost weight of $82.62.

Step 7. Determine the cost of the NEMT. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel. These estimates were derived in Chapter 5 and, along with medical costs, are summarized in Table 7-8.

Table 7-8: Calculation of NEMT Cost for Asthma

			Trips for Asthma		Total Annual Trip Cost	
Transit Cost Scenario	Average Round Trip Cost	Visit Cost	Fewest Trips	Most Trips	Low Estimate	High Estimate
Low	$ 42.14	$ 82.62	2	12	$ 249.52	$ 1,497.12
Intermediate	$ 43.70	$ 82.62	2	12	$ 252.64	$ 1,515.84
High	$ 75.86	$ 82.62	2	12	$ 316.96	$ 1,901.76

Step 8. Incorporate quality of life adjustments so that the analysis will correspond to the QALY methodology. Patients in the well-managed population have a median QALY score of 0.80 compared to the poorly managed patients who reported a score of 0.73. Thus, patients who move from poor to well managed status can expect a QALY increase of 9.6% ((0.80-0.73)/0.73). Note that the quality of life adjustment inflates the amount of cost saving, but deflates the amount of new costs.

The cost-effectiveness results are shown in Table 7-9. While there are 12 possible combinations of results (3 transit costs * 2 compliance rates * 2 trip amounts), we simplify the presentation by showing 3 outcomes:

- Best outcome – lowest transit cost, highest compliance, lowest visits
- Worst outcome – highest transit cost, lowest compliance, most visits
- Intermediate outcome – intermediate transit cost, mid range for compliance, and a most likely visit count.

The latter outcome – average round trip cost of $43.70, a compliance rate of 56.5%, and 4 visits – produces our *most likely estimate of $333* for adjusted cost savings per person. The results show that *one year of asthma disease management provided through NEMT is cost saving in our intermediate outcome*, and cost-effective overall in that the cost of NEMT does not exceed the $50,000/QALY threshold commonly accepted in healthcare.

Table 7-9: Cost-Effectiveness Results for Asthma NEMT

Combined Scenario	Compliance Factor	Poorly minus Well Median Cost per Capita	Adjusted Cost Difference	Annual Travel & Medical Cost	Net Change in Costs	QALY Adjustment	QALY-Adjusted Cost Savings
	(1)	(2)	(1)*(2) = (3)	(4)	(3)-(4) = (5)	(6)	(5)*(6)
Low Transit $, Best Compliance, Fewest Trips	83%	$1,431.65	$1,188.27	$249.52	$938.75	109.6%	$1,029
High Transit $, Worst Compliance, Most Trips	30%	$1,431.65	$429.50	$1,901.76	$(1,472.27)	109.6%	$(1,325)
Intermediate Transit $, Mid Compliance, Likely Trips	56.5%	$1,431.65	$808.88	$505.28	$303.60	109.6%	**$333**

7.2.2 Heart Disease

Heart disease is the leading cause of death in the United States and accounts for 29 percent of the 2,416,425 total deaths recorded during 2001. There is a steep age-related gradient so that fully 37.5 percent of deaths for those aged 85 years and over are caused by heart disease (Anderson and Smith, 2003). More specifically, congestive heart failure (CHF) is a primary or secondary cause of death for approximately 250,000 people per year in the United States. CHF was the first-listed diagnosis for 962,000 hospitalizations in 1999, and it is the most common diagnosis among hospital patients age 65 and older. There are over three million outpatient office visits each year related to CHF. In 1998, the estimated annual direct cost due to HF was $18.8 billion (Shekelle et al., 2003).

Step 1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001). From this data, we isolate all patients with CHF as determined using ICD-9 code 428. This process located 1,412,685 individuals. In an earlier analysis, we computed cost-effectiveness using an inclusive definition of heart disease (ICD-9 codes 410-414, and 427-429. However, for the cost-effectiveness analysis included in this final report, it was thought that a focus on CHF was more relevant.

Step 2. Review the characteristics of well- and poorly managed CHF care through the literature. Well-managed patients use ACE inhibitors and/or beta-adrenergic blockers. Poorly managed patients are not taking such medications. For CHF, care is defined following an inpatient stay or emergency room visit. Poorly managed heart failure patients will have more than one inpatient stays or emergency room visits within 90 days. Well-managed CHF patients will have one or fewer inpatient or emergency room visits (Hunt et al., 2001).

Step 3. Isolate the well-managed patients (based on the use of the ACE inhibitors and/or beta-blocker medications) and review their per capita cost of care. These patients represent the expected costs for well-managed patients with transportation

deficiencies addressed. We identify poorly managed patients as those who use neither ACE inhibitors nor beta-blocker medications, and have at least one ER/inpatient stay. These patients represent expected costs for patients who are not well managed for many reasons, including transportation deficiencies. Likewise, we reviewed their median per capita cost of care. These costs are summarized in Table 7-10.

Table 7-10: Cost Comparison of CHF Patients in MEPS (2001)

Population	Unweighted Frequency	Per Capita						
		Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	Total Costs (Mean)	Total Costs (Median)
Entire CHF Population	161	$5,501	$154	$476	$486	$510	$7,127	$1,657
Transportation-Advantaged / Insured CHF Population	150	$5,710	$161	$501	$481	$537	$7,390	$1,788
Poorly Managed	39	$15,528	$485	$114	$238	$309	$16,673	**$6,713**
Well Managed	111	$2,085	$42	$643	$571	$622	$3,964	**$1,033**
Difference Between Poorly and Well-Managed Care:							$12,709	**$5,679**

Step 4. Determine the compliance factor(s) for heart disease care from the literature. Heart failure is the single most common DRG in Medicare patients. In a well-managed population one year after an inpatient stay for CHF, 84% of patients were using appropriate ACE medications and 82% were using beta-blockers compared to 38% using ACE and 56% using beta-blockers in the poorly managed population (Akosah et al., 2002). We will use these compliance numbers for heart disease patients.

Step 5. Determine from the literature review how many visits or trips per capita per year are required to manage a patient with heart disease adequately. Well-managed heart disease requires approximately 10 visits with clinicians per year – at least 2 of which are with cardiology specialists (Akosah et al., 2002).

Step 6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. For this analysis we use an estimate equal to $52.68 for a standard physician visit and $120.14 for a cardiology specialist visit.

Step 7. Determine the cost of a trip. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel. These estimates were derived in Chapter 5 and, along with medical costs, whether specialist or primary care, are summarized in Table 7-11.

Table 7-11: Calculation of NEMT Cost for CHF

Transit Cost Scenario	Average Round Trip Cost	Primary Care Visit Cost	Specialist Visit Cost	Trips for CHF (Primary Care)	Trips for CHF (Specialist)	Total Annual Trip Cost
Low	$43.88	$52.68	$120.14	8	2	$1,100.52
Intermediate	$45.66	$52.68	$120.14	8	2	$1,118.32
High	$92.10	$52.68	$120.14	8	2	$1,582.72

Step 8. Incorporate quality of life adjustments so that the analysis will correspond to the QALY methodology. Well-managed patients with CHF have a QALY score of 0.69 compared to poorly managed patients, who report a QALY score of 0.59. Thus, patients who move from poor to well managed status can expect a QALY increase of 16.9% ((0.69-0.59)/0.59).

The cost-effectiveness results are presented in Table 7-12. While there are 6 possible combinations of results (3 transit costs * 2 compliance rates), we simplify the presentation by showing 3 outcomes:

- Best outcome – lowest transit cost and highest compliance
- Worst outcome – highest transit cost and lowest compliance
- Intermediate outcome – intermediate transit cost and mid range for compliance.

The latter outcome – average round trip cost of $45.66 and a compliance rate of 61% – produces our *most likely estimate of $2,743* for adjusted cost savings per person. This analysis shows large potential gains from better management of heart disease for the transportation-disadvantaged population. *Given the $50,000 per QALY threshold, providing NEMT for CHF is highly cost-effective.*

Table 7-12: Cost-Effectiveness Results for CHF NEMT

Combined Scenario	Compliance Factor	Poorly Minus Well Median Cost per Capita	Adjusted Cost Difference	Annual Travel & Medical Cost	Net Change in Costs	QALY Adjustment	QALY-Adjusted Cost Savings
	(1)	(2)	(1)*(2) = (3)	(4)	(3)-(4) = (5)	(6)	(5)*(6)
Low Transit $, Best Compliance	84%	$5,679.37	$4,770.67	$1,100.52	$3,670.15	116.9%	$4,290
High Transit $, Worst Compliance	38%	$5,679.37	$2,158.16	$1,582.72	$575.44	116.9%	$673
Intermediate Transit $, Mid Compliance	61%	$5,679.37	$3,464.42	$1,118.32	$2,346.10	116.9%	**$2,743**

7.2.3 Chronic Obstructive Pulmonary Disease (COPD)

Chronic Obstructive Pulmonary Disease (COPD) is a condition of the lungs where airflow is restricted. Many diseases lead to COPD including emphysema and bronchitis. COPD is often the consequence of smoking and is the fourth leading cause of death worldwide (Van der Valk et al., 2004).

Step 1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001). From this data, we isolate all patients with COPD as determined using ICD-9 codes 490-492 (includes bronchitis, chronic bronchitis and emphysema). This process located 9,565,608 individuals.

Step 2. Review the characteristics of well- and poorly managed COPD care through the literature. Well-managed patients with COPD have a prescription for bronchodilators (long acting beta2-agonists such as salmeterol or formoterol, anticholinergics like tiotropium, and/or theophylline), or patients are maintained on inhaled corticosteroids (National Clinical Guideline on Management of Chronic Obstructive Pulmonary Disease, 2004; Van der Valk et al., 2004). Poorly managed patients have at least one hospitalization for COPD over 1 year (Bourbeau et al., 2003).

Step 3. Isolate the well-managed patients (based on the use of the medications specified in Step 2) and review their per capita cost of care. These patients represent the expected costs for well-managed patients with transportation deficiencies addressed. We identify poorly managed patients as those with at least one inpatient stay for COPD. These patients represent expected costs for patients who are not well managed for many reasons, including transportation deficiencies. Likewise, we reviewed their median per capita cost of care. These costs are summarized in Table 7-13.

Table 7-13: Cost Comparison of COPD Patients in MEPS (2001)

Population	Unweighted Frequency	Per Capita						
		Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	Total Costs (Mean)	Total Costs (Median)
Entire COPD Population	1,105	$548	$32	$31	$194	$146	$952	$150
Transportation-Advantaged / Insured COPD Population	1,009	$578	$31	$34	$191	$149	$984	$150
Poorly Managed	101	$6,358	$339	$55	$413	$238	$7,402	**$1,077**
Well Managed	908	$0.00	$0.00	$32	$169	$140	$342	**$135**
Difference Between Poorly and Well-Managed Care:							$7,060	**$942**

Step 4. Determine the compliance factor(s) from the literature. 40% of patients were compliant with their medications two years after diagnosis with COPD (Make et al., 2003).

Step 5. Determine from the literature review how many visits or trips per capita per year are required to manage a patient with COPD. There are 13 outpatient visits per year for the management of advanced COPD (Strijbos et al., 1996).

Step 6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. For this analysis we are use an estimate equal to $52.68 for a standard physician visit and $120.14 for a nephrology specialist visit. We assume that half the COPD visits will be with a specialist.

Step 7. Determine the cost of a trip. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel. These estimates were derived in Chapter 5 and, along with medical costs, whether specialist or primary care, are summarized in Table 7-14.

Table 7-14: Calculation of NEMT Cost for COPD

Transit Cost Scenario	Average Round Trip Cost	Primary Care Visit Cost	Specialist Visit Cost	Trips for COPD (Primary Care)	Trips for COPD (Specialist)	Total Annual Trip Cost
Low	$42.36	$52.68	$120.14	6	7	$1,707.74
Intermediate	$43.34	$52.68	$120.14	6	7	$1,720.48
High	$67.84	$52.68	$120.14	6	7	$2,038.98

Step 8. Incorporate quality of life adjustments so that the analysis will correspond to the QALY methodology. Well-managed patients with COPD have a QALY score of 0.80 compared to poorly managed patients, who report a QALY score of 0.76. Thus, patients who move from poor to well managed status can expect a QALY increase of 5.3 ((0.80-0.76)/0.76).

The cost-effectiveness results for COPD are presented in Table 7-15. There are 3 possible outcomes depending solely on estimated transit costs. We do not find actual cost savings, but additional transit and healthcare costs pale in comparison to the $50,000 standard. *Thus there are large potential gains from better management of COPD*.

Table 7-15: Cost-Effectiveness Results for COPD NEMT

Combined Scenario	Compliance Factor	Poorly minus Well Median Cost per Capita	Adjusted Cost Difference	Annual Travel & Medical Cost	Net Change in Costs	QALY Adjustment	QALY-Adjusted Cost Savings
	(1)	(2)	(1)*(2) = (3)	(4)	(3)-(4) = (5)	(6)	(5)*(6)
Low Transit $	40%	$942.26	$376.90	$1,707.74	$(1,330.84)	105.3%	$(1,260)
High Transit $	40%	$942.26	$376.90	$2,038.98	$(1,662.08)	105.3%	$(1,574)
Intermediate Transit $	40%	$942.26	$376.90	$1,720.48	$(1,343.58)	105.3%	**$(1,272)**

7.2.4 Hypertension

High blood pressure, or hypertension (HTN), is highly prevalent and often occurs along with diseases such as diabetes, obesity and heart disease. For many, high blood pressure is quite manageable, however when untreated for a long period of time it can lead to serious health complications, including stroke, and early mortality. HTN does not have symptoms that are immediately improved through disease management, and this long-term nature creates difficulty when categorizing the well and poorly managed patients. This is addressed through two separate screens that are described in detail in Step 2.

Step 1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001). From this data, we isolate all patients with HTN as determined using ICD-9 codes 401-405 (includes essential hypertension; hypertensive heart disease; hypertensive renal disease; hypertensive heart and renal disease; and secondary hypertension). This process located 31,944,421 individuals.

Step 2. Review the characteristics of well- and poorly managed HTN care through the literature. Well managed is defined as taking a beta-blocker or angiotensin-converting enzyme inhibitor, as well as 2 physician outpatient visits per year and 3 chemistry panels (CDC Diabetes Cost-effectiveness Group, 2002; National Heart, Blood and Lung Institute, 2004). Poorly managed patients have a diagnosis of hypertension and do not have appointments or take medications to control blood pressure.

Step 3. Isolate the well-managed patients and review their per capita cost of care. We employ two separate screens to classify well and poorly managed HTN patients. The first screen categorizes poorly managed patients as having no visits or blood pressure lowering medications, while well managed patients do have visits and HTN medication. Table 7-16 summarizes the cost comparison under the first screen.

Table 7-16: Drug and Visit Screen Cost Comparison of HTN in MEPS (2001)

Population	Unweighted Frequency	Per Capita						
		Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	Total Costs (Mean)	Total Costs (Median)
Entire HTN Population	3,829	$102	$10	$27	$446	$170	$755	$432
Transportation-Advantaged / Insured HTN Population	3,539	$99	$9	$28	$449	$172	$757	$436
Poorly Managed	2,478	$40	$6	$5	$399	$67	$517	$328
Well Managed	1,061	$240	$18	$82	$568	$422	$1,330	$788
Difference Between Poorly and Well-Managed Care:							$(813)	$(460)

The second screen compares well and poorly managed HTN patients based on medication utilization only. This comparison also looks at the difference in total healthcare costs between the well and poorly managed patients in consideration of the high prevalence of co-morbid conditions present in patients with poorly treated

blood pressure (Table 7-17). We believe that this second screen, using drugs only and counting all costs (inclusive of healthcare costs related to other diseases), best approximates the estimates of the savings associated with HTN disease management from the literature. We will use the average total cost change for the population moving from poor to well managed blood pressure to assess the cost-effectiveness of NEMT. Although median costs have been used in conditions that present the costs of utilization that is disease specific, the mean is a more appropriate measure when total costs are examined. Median costs will eliminate any bias presented by a few patients who are sick enough and therefore utilizing the most healthcare. When looking at the total cost of healthcare for all patients with high blood pressure, the bias of those who are most sick should be taken into account in our cost estimates, as they are the people who could benefit the most from HTN management.

Table 7-17: Drug Screen Only HTN and TOTAL Cost Comparisons in MEPS (2001)

Population	Unweighted Frequency	Per Capita								
		Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	HTN Costs (Mean)	HTN Costs (Median)	Total Costs (Mean)	Total Costs (Median)
Entire HTN Population	3,829	$102	$10	$27	$446	$170	$755	$432	$5,980	$2,595
Transportation-Advantaged / Insured HTN Population	3,539	$99	$9	$28	$449	$172	$757	$436	$6,044	$2,671
Poorly Managed	695	$27	$8	$11	$343	$161	$549	$340	**$6,770**	$2,586
Well Managed	2,844	$117	$10	$32	$474	$174	$807	$463	**$5,869**	$2,690
Difference Between Poorly and Well-Managed Care:							($258)	($123)	**$901**	($104)

Step 4. Determine the compliance factor(s) from the literature. 60% of patients had 3-month appointments; 43% of patients use diuretics, while 29% used calcium channel blockers, and 25% used beta-blockers (Weir et al., 2000).

Step 5. Determine from the literature review how many visits or trips per capita per year are required to manage a patient with HTN. Clinical guidelines recommend 4 outpatient visits per year (National Heart, Blood and Lung Institute, 2004).

Step 6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. For this analysis we are use an estimate equal to $52.68 for a standard physician visit. We assume all of these visits will be with a primary care doctor.

Step 7. Determine the cost of a trip. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel. These estimates were derived in Chapter 5 and, along with medical costs, are summarized in Table 7-18.

Table 7-18: Calculation of NEMT Cost for HTN

Transit Cost Scenario	Average Round Trip Cost	Primary Care Visit Cost	Trips for HTN (Primary Care)	Total Trip Cost
Low	$42.80	$52.68	4	$381.92
Intermediate	$44.66	$52.68	4	$389.36
High	$86.92	$52.68	4	$558.40

Step 8. Incorporate quality of life adjustments so that the analysis will correspond to the QALY methodology. In our first screen of well and poorly managed HTN patients, we saw QALY scores go down for the so-called well managed patients. Our second screen, using drug utilization as an indicator of good disease management, showed QALY scores that were higher for the well-managed patients. We use the second screen to measure both the QALY score change and the cost change for the HTN population. Well-managed patients with HTN have a QALY score of 0.80 compared to poorly managed patients, who report a QALY score of 0.76. Thus, patients who move from poor to well managed status can expect a QALY increase of 5.3% ((0.80-0.76)/0.76).

The cost-effectiveness results are presented in Table 7-19. We simplify the 6 possible combinations of results by showing 3 outcomes:

- Best outcome – lowest transit cost and highest compliance
- Worst outcome – highest transit cost and lowest compliance
- Intermediate outcome – intermediate transit cost and mid range for compliance.

The latter outcome produces our *most likely estimate of $(6)*. Cost savings occur in the best-case scenario; even in the worst-case, hypertension NEMT costs only $315. In light of the $50,000 standard, *we are confident that disease management for HTN patients is highly cost-effective when future cost savings are taken into account*.

Table 7-19: Cost-Effectiveness Results for HTN NEMT

Combined Scenario	Compliance Factor	Poorly Minus Well Mean Cost per Capita	Adjusted Cost Difference	Travel & Medical Cost	Annual Net Change in Costs	QALY Adjustment	QALY-Adjusted Cost Savings
	(1)	(2)	(1)*(2) = (3)	(4)	(3)-(4) = (5)	(6)	(5)*(6)
Low Transit $, Best Compliance	60%	$901.00	$540.60	$381.92	$158.68	105.3%	$167
High Transit $, Worst Compliance	25%	$901.00	$225.25	$558.40	$(331.15)	105.3%	$(315)
Intermediate Transit $, Mid Compliance	42.5%	$901.00	$382.93	$389.36	$(6.44)	105.3%	**$(6)**

7.2.5 Diabetes

Diabetes is a disorder of the pancreas where the body cannot produce or utilize insulin properly. In the United States, the prevalence of Type 2 diabetes is rising dramatically and many Americans with the disease are unaware that they have it. Diabetes follows a disease progression from onset to death that includes five major complications: nephropathy, neuropathy, retinopathy, cardiovascular disease and stroke. This progression can be prevented through appropriate disease management.

Step 1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001). From this data, we isolate all patients with diabetes using ICD-9 code 250 (includes type 1 and 2). This process located 11,580,578individuals.

Step 2. Review the characteristics of well- and poorly managed care through the literature. Well managed, for patients with Type 2 Diabetes, is defined as using insulin, metformin, or sulfonylurea therapy for intensive glycemic control (CDC Diabetes Cost-effectiveness Group, 2002). Patients need to have clinical indicators such as hemoglobin a1C levels within the appropriate ranges. Indicators should be monitored by a physician at least once every three months, or 4 times per year (American Diabetes Association, 2004). MEPS includes a question on whether the diabetic patient received a hemoglobin a1C test in the past year.

Step 3. Isolate the well-managed patients (based on whether they received tests for hemoglobin a1C levels) and review their per capita cost of care. Diabetes is highly co-morbid with other health conditions of increasing severity, including hypertension, congestive heart failure, and renal diseases. Thus, we will follow the process used for hypertension that examines the difference of all-inclusive average total costs, between well and poorly managed diabetic patients, to do the cost-effectiveness analysis of providing NEMT. These patients represent the expected costs for well-managed patients with transportation deficiencies addressed. Poorly managed patients have a diagnosis of diabetes and do not have appointments to monitor glucose levels, or take medications to control diabetes. These costs are summarized in Table 7-20.

Table 7-20: Cost Comparison of Diabetes Patients in MEPS (2001)

Population	Unweighted Frequency	Per Capita								
		Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	Diabetes Costs (Mean)	Diabetes Costs (Median)	Total Costs (Mean)	Total Costs (Median)
Entire Diabetes Population	1,555	$579	$55	$85	$759	$349	$1,827	$808	$8,070	$3,403
Transportation-Advantaged / Insured Diabetes Population	1,393	$449	$48	$90	$768	$352	$1,708	$818	$8,155	$3,539
Poorly Managed	648	$640	$81	$128	$592	$303	$1,745	$687	**$9,034**	$3,484
Well Managed	745	$286	$21	$58	$918	$393	$1,676	$912	**$7,407**	$3,560
Difference Between Poorly and Well-Managed Care:							$68	($224)	**$1,626**	($76)

Step 4. Determine the compliance factor(s) from the literature. 12% of patients missed 30% of their glycemic control appointments (Karter et al., 2004). 14.7% of patients didn't get regular exercise to manage their diabetes because of transportation (Jorgensen et al., 2002). Of patients with diabetes admitted for cardiovascular treatment, 8% did not have a physician who monitored their conditions (Bethel et al., 2004). Compliance, therefore, ranges from 85.3% to 92%.

Step 5. Determine from the literature review how many visits or trips per capita per year are required to manage a patient with diabetes. Well-managed diabetes requires at least 4 appointments a year (American Diabetes Association, 2004).

Step 6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. For this analysis we are use an estimate equal to $52.68 for a standard physician visit and $120.14 for an endocrinology specialist visit. We assume that half the diabetes visits will be with a specialist.

Step 7. Determine the cost of a trip. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel. These estimates were derived in Chapter 5 and, along with medical costs, whether specialist or primary care, are summarized in Table 7-21.

Table 7-21: Calculation of NEMT Cost for Diabetes

Transit Cost Scenario	Average Round Trip Cost	Primary Care Visit Cost	Specialist Visit Cost	Trips for Diabetes (Primary Care)	Trips for Diabetes (Specialist)	Total Trip Cost
Low	$39.16	$52.68	$120.14	2	2	$502.28
Intermediate	$42.37	$52.68	$120.14	2	2	$515.00
High	$82.48	$52.68	$120.14	2	2	$675.56

Step 8. Incorporate quality of life adjustments so that the analysis will correspond to the QALY methodology. Well-managed patients with diabetes have a median QALY score of 0.73 as do the poorly managed patients. Therefore, no QALY adjustment has been made.

The cost-effectiveness results for diabetes are presented in Table 7-22. We simplify the 6 possible combinations of results by showing 3 outcomes:

- Best outcome – lowest transit cost and highest compliance
- Worst outcome – highest transit cost and lowest compliance
- Intermediate outcome – intermediate transit cost and mid range for compliance.

The latter outcome produces our *most likely estimate of $927 cost savings per person*.

This highly cost-effective result is nevertheless based on a one-year analysis of the well and poorly managed as defined by the diabetes literature. This likely underestimates the long-term savings associated with better management of diabetes. Supporting this assumption are several diabetes interventions that have demonstrated cost-effectiveness in the literature. Screening and intervention for diabetic retinopathy for type 1 and 2 diabetic patients was $4,744 per QALY. For every dollar spent on care for diabetic pregnant women, there was a savings of $5.19. Screening to prevent nephropathy, and therefore ESRD, had a cost of $40,214 per QALY. Improved glycemic control for Type 1 diabetes had a cost of $22,933 per QALY and $18,360 per QALY for Type 2 diabetics (all costs in 1998 dollars) (Klonoff et al., 2000). The incremental cost-effectiveness ratio for intensive glycemic control is $41,384 per QALY. The ratio increased with the age at screening – from $9,614 for patients aged 25-34 and $2.1 million for patients age 85-94 (CDC Diabetes Cost-effectiveness Group, 2002).

Table 7-22: Cost-Effectiveness Results for Diabetes NEMT

Combined Scenario	Compliance Factor	Poorly Minus Well Mean Total Cost per Capita	Adjusted Cost Difference	Travel & Medical Cost	Annual Net Change in Costs	QALY Adjustment	QALY-Adjusted Cost Savings
	(1)	(2)	(1)*(2) = (3)	(4)	(3)-(4) = (5)	(6)	(5)*(6)
Low Transit $, Best Compliance	92%	$1,626.41	$1,496.30	$505.28	$994.02	100%	$994
High Transit $, Worst Compliance	85.3%	$1,626.41	$1,387.33	$675.56	$717.77	100%	$712
Intermediate Transit $, Mid Compliance	88.7%	$1,626.41	$1,441.81	$515.00	$926.81	100%	**$927**

7.2.6 Depression/Mental Health

Depression in the community has a lifetime prevalence of 4.9% to 17.1%, and a 12-month prevalence of 5.2 to 7.6% (Pignone et al., 2002b; Kessler et al., 2003b). Conducting this case study is made difficult by the variety of diseases falling under the umbrella mental health condition, the inherent ambiguity of designating the set of relevant individuals (and dividing them into well and poorly managed), and the large range of effective (and ineffective) treatments. Nevertheless, the 2002 NHIS identified as much as 50% of our target population who suffer from depression and there are care guidelines for depression that can resolve symptoms (Harman et al., 2004). We believe there is strong evidence that enhanced NEMT can have a profound effect on patients with this disease.

Step 1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001). From this data, we isolate all patients with depression using ICD-9 codes

296.2-296.8 (affective psychoses) or 311 (depressive disorder). This process located 12,201,518 individuals.

Step 2. Review the characteristics of well- and poorly managed depression care through the literature. Well managed patients with depression have at least 4 outpatient visits with any type of provider (primary care or specialist) for pharmacotherapy (antidepressant or mood stabilizers) that lasted at least 30 days; and/or at least 8 outpatient visits that last at least 30 minutes with a mental health psychotherapy provider (Kessler et al., 2003b). Twenty psychotherapy visits for mental healthcare are covered under typical managed care insurance (Simon et al., 2001). Appropriate medications for the treatment of depression include the following: SSRI, TCA, serotonin norepinephrine reuptake inhibitor [SNRI], norepinephrine reuptake inhibitor [NRI], or dopamine agonist [DA] (Care Management Institute, 2004).

Step 3. Isolate the well-managed patients (based on the use of the medications or visits specified in Step 2) and review their per capita cost of care. These patients represent the expected costs for well-managed patients with transportation deficiencies addressed. Depressed patients incur significant medical costs and have high rates of co-morbidity that decrease with sufficient treatment of depression, so it is important to determine the difference between *total* health care costs, not just those attributable to mental health (Kessler et al., 2003b). Costs attributable to depression for the relevant population are summarized in Table 7-23.

Table 7-23: Depression Only Cost Comparison for Depression Patients in MEPS (2001)

Population	Unweighted Frequency	Per Capita						
		Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	Total Costs (Mean)	Total Costs (Median)
Entire Depression Population	1,427	$408	$7	$38	$590	$354	$1,397	$534
Transportation-Advantaged / Insured Depression Population	1,264	$382	$7	$40	$604	$354	$1,387	$565
Poorly Managed	976	$195	$4	$6	$443	$159	$808	$382
Well Managed	288	$1,006	$17	$154	$1,141	$1,008	$3,326	$1,570
Difference Between Poorly and Well-Managed Care:							($2,519)	($1,187)

Total healthcare costs for these same patients are presented in Table 7-24. The average total healthcare cost for depressed patients will be used to calculate the cost difference between well and poorly managed patients. This follows the same rationale presented in Section 7.2.4 in that we want to retain the costs of the most ill depressed patients in our analysis of total costs.

Though the literature contains evidence that depression management is cost-effective, the one-year, poor and well-managed utilization costs in MEPS do not show this. In fact, well-managed patients are fewer and much more costly, suggesting that the screen determined in Step 2 is flawed, or it is telling us that to manage patients well in a given year requires additional expenditures. A possible explanation is the likelihood that our MEPS sample includes a high proportion of very mild depression

cases that confound the true costs of poorly managed, severely depressed patients. If mildly depressed survey respondents indicate that they have depression, yet do not require and therefore do not receive much medication or many visits to treat their depression, the screen we apply will categorize them as poorly managed, despite the fact that their management is appropriate. MEPS does not include parameters to measure disease severity, which would help to determine whether this hypothesis is correct. Without an accurate measure of the true costs of poorly managed depression cases, this analysis is useful to the extent that we consider the value of higher quality of life.

Table 7-24: Total Healthcare Cost Comparison for Depression Patients in MEPS (2001)

Population	Total Per Capita Costs (Mean)	Total Per Capita Costs (Median)
Entire Depression Population	$6,549	$3,106
Transportation Advantaged / Insured Depression Population	$6,793	$3,263
Poorly Managed Transportation Advantaged / Insured Population	**$6,510**	$2,886
Well Managed Transportation Advantaged / Insured Population	**$7,739**	$4,359
Difference Between Poorly and Well-Managed Care:	**($1,229)**	($1,473)

Step 4. Determine the compliance factor(s) from the literature. Depression is largely undetected in the primary care setting – some 30 to 50% of cases are missed. With usual care, 66% of patients remain depressed, 35% of depressed patients can be expected to resolve without treatment and 50% of patients who are treated will recover fully (Pignone et al., 2002b). 21.7% of individuals with depression in the community are adequately treated over a 12-month interval (Kessler et al., 2003b). For this analysis, we use a compliance range of 22% to 50%.

Step 5. Determine from the literature review how many visits or trips per capita per year are required to manage a patient with depression. Well-managed depression requires at least 4 visits with a primary care physician (low estimate) or 8 visits (high estimate) with a mental health specialist over one year (Kessler et al., 2003b).

Step 6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. For this analysis we use an estimate equal to $52.68 for a standard physician visit and $120.14 for a clinical psychiatrist visit.

Step 7. Determine the cost of a trip. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel. These estimates were derived in Chapter 5 and, along with medical costs, whether specialist or primary care, are summarized in Table 7-25.

Table 7-25: Calculation of NEMT Cost for Depression

Transit Cost Scenario	Average Round Trip Cost	Primary Care Visit Cost	Specialist Visit Cost	Total Trip Cost (Low Estimate= 4 visits to PCP)	Total Trip Cost (High Estimate= 8 visits to Specialist)
Low	$39.16	$52.68	$120.14	$367.36	$1,274.40
Intermediate	$42.34	$52.68	$120.14	$380.08	$1,299.84
High	$82.48	$52.68	$120.14	$540.64	$1,620.96

Step 8. Incorporate quality of life adjustments so that the analysis will correspond to the QALY methodology. Well-managed patients with depression report a QALY score of 0.73 as do poorly managed patients in MEPS. Thus, there is no change in quality of life for better depression management as we have defined it in this analysis. Further analysis into separating patients into well and poorly managed using disease severity will likely alter these results. Nevertheless, a special comparison of patients with depression between transportation-disadvantaged or uninsured, and no transportation difficulties and insured, shows a mean quality differential of 24.0% and a median change of 17.7%. While this approach differs from that used above, it can be justified in that the well v. poor management split is confounding a clear quality discrepancy – individuals with better access to care (regarding transportation and insurance) exhibit much higher quality scores.

The cost-effectiveness results for depression, using total health care costs, are presented in Table 7-26. While there are 24 possible combinations of results (3 transit costs * 2 compliance rates * 2 trip amounts * 2 QALY levels), we simplify the presentation by showing 3 outcomes:

- Best outcome – lowest transit cost, highest compliance, lowest visits, high QALY improvement
- Worst outcome – highest transit cost, lowest compliance, most visits, low QALY improvement
- Intermediate outcome – intermediate transit cost, mid range for compliance, a most likely visit count, low QALY improvement.

The latter outcome produces our *most likely estimate of $675 additional costs per person, which given the $50,000 convention, is highly cost-effective.*

Table 7-26: Cost-Effectiveness Results for Depression NEMT

Combined Scenario	Compliance Factor	Poorly Minus Well Mean Total Cost per Capita	Adjusted Cost Difference	Travel & Medical Cost	Annual Net Change in Costs	QALY Adjustment	QALY-Adjusted Cost Savings
	(1)	(2)	(1)*(2) = (3)	(4)	(3)-(4) = (5)	(6)	(5)*(6)
Low Transit $, Best Compliance, Fewest Trips, High QALY	50%	$(1,228.97)	$(614.49)	$367.36	$(981.852)	124.0%	$(746)
High Transit $, Worst Compliance, Most Trips, Low QALY	22%	$(1,228.97)	$(266.69)	$1,620.96	$(1,887.65)	117.7%	$(1,554)
Intermediate Transit $, Mid Compliance, Likely Trips, Low QALY	36%	$(1,228.97)	$(440.59)	$380.08	$(820.67)	117.7%	**$(675)**

7.2.7 End-Stage Renal Disease

End-stage renal disease (ESRD) is relatively uncommon in the population yet consumes a great deal of healthcare resources. ESRD patients have kidney failure that requires dialysis for maintenance or kidney transplantation for treatment. Many ESRD patients are also hypertensive and/or diabetic.

ESRD presents a unique challenge in applying the cost-effectiveness methodology developed for this project. Patients with ESRD depend on dialysis for survival such that classification of patients into well or poorly managed categories is relatively impossible. ESRD patients that are poorly managed and therefore do not receive the necessary medical treatment for their condition are certain of renal failure and subsequent death. In order to evaluate the impact of NEMT on a population with chronic renal failure, we conducted the cost-effectiveness analysis from the perspective of preventing delays in access to a specialist who can manage pre-dialysis ESRD patients, and improve their overall care.

Step 1. Select all survey respondents in MEPS who did not miss a trip to the doctor due to transportation problems and who had health insurance during the entire year (2001). From this data, we isolate all patients with ESRD as determined using ICD-9 codes 584 and 585 for acute and chronic renal failure and 586 for unspecified renal failure. This process located 221,195 individuals.

Step 2. Review the characteristics of well- and poorly managed care through the literature. For ESRD, poorly managed care is defined as beginning dialysis within 4 months of visiting a nephrologist. Well-managed care is defined as having a period longer than 4 months between seeing a nephrologists and commencing dialysis (Obrador et al., 1998; Kinchen et al., 2002).

Step 3. Isolate the well-managed patients (based on use of the medications specified in Step 2) and review their per capita cost of care. The MEPS data does not include

information on whether dialysis was delayed, so categorizing well and poorly managed ESRD patients within MEPS is not possible. Instead, we apply the estimate of cost savings avoided from the literature to the cost of ESRD. Patients commencing dialysis within 6 months of referral to a nephrologist had an average of 30 inpatient days per year compared to 8 days for those patients being specialist care earlier. Similarly, 70% of late-referred ESRD patients had serious medical complications, compared to 9% of ESRD patients initiating dialysis at an appropriate time. Finally, late-referred ESRD patients were much more likely to die within the first year of dialysis and to be excluded from kidney transplant waiting lists (Jungers, 2002; Obrador et al., 1998; Arora et al., 2000; Kessler et al., 2003a; Manns et al., 2003). The literature further suggests that up to 10% of the burden of dialysis could be avoided through early referral to a nephrologist (Jungers, 2002). The cost of ESRD is presented in Table 7-27.

Table 7-27: Cost of ESRD in MEPS (2001)

Population	Unweighted Frequency	Per Capita						
		Inpatient Costs	ER Costs	Outpatient Costs	Rx Costs	Office Based Cost	Total Costs (Mean)	Total Costs (Median)
Entire ESRD Population	34	$3,134	$176	$7,933	$536	$7,477	$19,255	$17,068

Step 4. Determine the compliance factor(s) from the literature. Late referral for ESRD patients can be due to either asymptomatic renal disease, a noncompliant primary care physician that does not make the referral, or a noncompliant patient that does not attend a specialist visit. In previous studies, 56% of late-referred ESRD patients were either asymptomatic or noncompliant (Obrador et al., 1998). Thus, the compliance factor for pre-dialysis ESRD visits is 44%.

Step 5. Determine from the literature review how many visits or trips per capita per year are required to manage a patient with ESRD. For ESRD, well-managed care involves five or more office visits per year with a nephrologist (Avorn et al., 2002).

Step 6. Use the Medicare Fee Schedule cost weights to determine the average medical cost of the required visits. For this analysis we use an estimate equal to $120.14 for a nephrology specialist visit.

Step 7. Determine the cost of a trip. This cost depends on rural or urban location and whether the patient is mobile or requires a modified vehicle for travel. These estimates were derived in Chapter 5 and, along with medical costs, are summarized in Table 7-28.

Table 7-28: Calculation of NEMT Cost for ESRD

Transit Cost Scenario	Average Round Trip Cost	Visit Cost	Trips for ESRD (Low Estimate)	Trips for ESRD (High Estimate)	Total Trip Cost (Low Estimate)	Total Trip Cost (High Estimate)
Low	$44.78	$120.14	5	10	$824.60	$1,649.20
Intermediate	$45.74	$120.14	5	10	$829.40	$1,658.80
High	$84.40	$120.14	5	10	$1,022.70	$2,045.40

Step 8. Incorporate quality of life adjustments so that the analysis will correspond to the QALY methodology. ESRD QALY scores are low, which is consistent with the literature. Because we do not have a comparison of the QALY scores for patients who were referred late to a nephrologist, we will use the higher risk of early mortality. Late referral to a nephrologist increased the risk of death by a factor of five compared to patients with an early referral (Kessler et al., 2003a).

These results are presented in Table 7-29. We simplify the 6 possible combinations of results by showing 3 outcomes:

- Best outcome – lowest transit cost and fewest visits
- Worst outcome – highest transit cost and most visits
- Intermediate outcome – intermediate transit cost and mid range for visits (7).

The latter outcome produces our *most likely estimate of $410 additional costs per person, which given the $50,000 cost per QALY convention, is highly cost-effective to secure timely access to a nephrologist for ESRD patients*.

Table 7-29: Cost-Effectiveness Results for ESRD NEMT

Combined Scenario	Compliance Factor	ESRD Cost Savings for Early Nephrologist Visit	Adjusted Cost Difference	Travel & Medical Cost	Net Change in Costs
	(1)	(2)	(1)*(2) = (3)	(4)	(3)-(4) = (5)
Low Transit $, Fewest Trips	44%	$1,706.70	$750.95	$824.60	($74)
High Transit $, Most Trips	44%	$1,706.70	$750.95	$2,045.40	($1,294)
Intermediate Transit $, Likely Trips	44%	$1,706.70	$750.95	$1,161.16	**($410)**

7.3 Summary and Discussion

The above sections describe each of 12 cost-effectiveness analyses in detail. In the following sections, we briefly address all 12 at once. While literally aggregating the results is problematic and involves no end of comparing apples to oranges, we instead attempt to provide a qualitative aggregation of the 12 analyses.

7.3.1 Summary of Condition Analyses

Table 7-30 summarizes the condition specific results with the intermediate, most-likely estimate shown as the cost-effectiveness result. All twelve conditions are *cost-effective*, and four of the results are actually *cost saving*. Based on the rule of thumb of one QALY worth about $50,000, *none* of the conditions that we analyzed failed the test of cost-effectiveness. Hypertension, for example, shows a mere increase in net costs of $6 per QALY (well within the noise of being cost saving), and the least cost-effective condition (breast cancer screening) still comes in at significantly less than $50,000 net cost.

Table 7-30: Summary of Condition-Specific Cost-Effectiveness Results

Condition	Type	Cost per QALY	Result
Influenza Vaccinations	Preventive	$31 / QALY	*Highly* Cost-Effective
Prenatal Care	Preventive	**$367 Cost Saving**	**Cost Saving**
Breast Cancer Screening	Preventive	$34,176 / QALY	Moderately Cost-Effective
Colorectal Cancer Screening	Preventive	$22,735 / QALY	Moderately Cost-Effective
Dental Care	Preventive	$590 / QALY	*Highly* Cost-Effective
Asthma	Chronic	**$333 Cost Saving**	**Cost Saving**
Heart Disease (Congestive Heart Failure, CHF)	Chronic	**$2,743 Cost Saving**	**Cost Saving**
Chronic Obstructive Pulmonary Disease (COPD)	Chronic	$1,272 / QALY	*Highly* Cost-Effective
Hypertension (HTN)	Chronic	$6 / QALY	*Highly* Cost-Effective
Diabetes	Chronic	**$927 Cost Saving**	**Cost Saving**
Depression / Mental Health	Chronic	$675 / QALY	*Highly* Cost-Effective
End-Stage Renal Disease (ESRD)	Chronic	$410 / QALY	*Highly* Cost-Effective

7.3.2 Discussion

We have identified cases in MEPS by virtue of expenditures linked to that disease. This process is logical given a focus on actual healthcare costs. However, it does result in omitting individuals with chronic conditions who, for whatever reason, do not incur disease-related healthcare expenditures in that year. This most likely adds another conservative factor to our methods and overall results. That is, the cost differential between well and poorly managed would be even greater, thus enhancing any cost saving results, or lowering any additional costs from enhanced transportation.

We did not update the costs and benefits to inflate the figures to 2005. In light of the illustrative nature of our findings, we do not believe this added detail is necessary. We expect that inflated figures would boost cost-effectiveness.

As described in Chapter 6 and Appendix C, healthcare improvements are worth an investment when the cost is reasonable in light of mortality and morbidity improvements. Thus, while cost savings are clearly the best outcome, the normal expectation is for cost increasing investments that are nevertheless judged to be cost-effective. Such are the results for the eight cases that are not estimated to be cost saving.

These results may be aggregated but caution should prevail. First, an accurate population count is needed. This is best seen as the number of individuals with transportation difficulties suffering from each condition. Given a low sample size for the transportation-disadvantaged population as a whole, deriving reliable condition-specific counts may be problematic. Even with accurate counts, aggregating benefits across diseases runs the risk of duplicating benefits because of multiple conditions suffered by these individuals. Because of such concerns, the Spreadsheet Tool, described in Chapter 8, is that much more valuable to accommodate regional and local issues, including population figures, disease condition prevalence, and regional transportation and healthcare costs.

Chapter 8: A Spreadsheet Tool for Regional and Local Analysis

As shown in Chapter 7, the cost-effectiveness of increased access to NEMT varies by condition and is sensitive to the costs of transportation and healthcare. These latter two, of course, also vary regionally and locally throughout the U.S. *Thus, while our analysis aims to be nationally representative, it may not reflect costs and benefits for a specific locale with significantly different rates of missed NEM trips or significantly different healthcare costs, or both.* To allow local transportation and social service agencies (and other interested parties) to conduct their own analyses tailored to the local demographic and socio-economic environment, we developed a spreadsheet tool (available from the description of TCRP Project B-27 on the TRB website: (http://www4.trb.org/trb/crp.nsf/All+Projects/TCRP+B-27) that calculates condition-based cost-effectiveness that can be varied according to locally determined inputs. In many cases, we would expect these inputs to be more reliable than those used for national analyses, simply because there should be lower local variation in both transportation and healthcare costs, and the rate of missed trips may be better measured and understood at the local level. The intent of this spreadsheet tool is to allow local transportation agencies to tailor variables like the cost per trip (generally highlighted in yellow) to reflect actual data for your community. This report reviews the cost-effectiveness of providing NEMT for a number of conditions prevalent in the transportation-disadvantaged population. The spreadsheet tool accumulates the expected local savings and costs from these conditions to provide an overview of non-emergency medical transportation for a community.

8.1 Regional and Local Analysis

The analysis performed and presented so far in this report examines the cost-effectiveness of receiving transportation to appropriate medical care using data estimated at the U.S. national level. *In reality, local and regional costs for medical and transportation services are affected by the disease mix, the percent of the population living in urban versus rural settings, the local cost of transportation, the availability of reliable mass transit, the mode by which the transportation must be made, and local healthcare costs.* Likewise, regional policies for providing NEMT for the transportation disadvantaged can have a significant effect on the cost and access to services. Depending on local costs, disease prevalence, and the other aforementioned characteristics, use of region-specific data could show that providing NEMT is more or less cost-effective in terms of the projected benefits compared to the total costs.

To allow state, regional, and local agencies to forecast the effects of providing NEMT for the transportation-disadvantaged individuals who currently lack such access in a region, we developed an Excel spreadsheet tool (or model). This model embeds cost-effectiveness analysis (CEA) computations and methods previously discussed in this report, while still allowing users to specify select components of the analysis and to stratify inputs according to various relevant dimensions (e.g., urban v. rural). The model calculates the cost-effectiveness of providing needed NEMT for regions and locales according to local healthcare and transportation costs and disease prevalence estimates, as available. *As an intermediate objective, the model strives to*

produce a conservative estimate of the healthcare savings while trying to be realistic regarding the health treatment options and transportation costs within a region.

With these inputs, model users can analyze the expected number of missed appointments for a region, the number of NEMT trips needed by type of transportation service (ambulatory, wheelchair, and stretcher), the estimated annual costs of transportation services for these trips, and the estimated annual healthcare costs for missed medical care.

8.2 Use of Local Knowledge and Data with Spreadsheet Tool

The total population of the region under study drives calculations within the model. As described in Chapters 3 and 4 of this report, the ratios of the percent of the population lacking access to NEMT, the percent of the population in rural areas, the type of transportation service required for these trips, and the prevalence of chronic and other conditions are used to derive the expected number of missed trips per year. These ratios were developed using national databases, including the National Health Interview Survey and the Medical Expenditure Panel Survey. The transportation costs were estimated using data from the National Transit Database, information and data from the CTAA, and actual data from a panel of 20 transit providers, as described in Chapter 5.

The tool allows local transportation agencies to tailor variables such as the region's population, percent of the population living in areas designated as rural, the type of transportation used, and the cost per trip. These inputs are highlighted in yellow in the spreadsheet and should be changed to reflect actual data for your region. There are other inputs highlighted in green that represent national values that are generally harder to obtain at the regional or local level. Users of the spreadsheet tool are encouraged to collect data and use factors that more closely estimate regional data where they initially see national data in the spreadsheet.

Using only a region's population will provide a projection of the cost-effectiveness of providing NEMT to the transportation-disadvantaged lacking access to it, but local factors can also have a great influence on the model's outcome; therefore, use of local factors is highly recommended. For example, while the city of El Paso, Texas and the entire state of Wyoming have populations that are roughly comparable in size, the health status of the people in these two regions is quite different. In El Paso, the prevalence of diagnosed diabetes is higher (7.4 percent) than it is in Wyoming (5.8 percent) (Sedillos, 2005; Kaiser Family Foundation, 2005). Such disparities clearly affect the outcomes of the model. Similarly, the density of the population and access to public transportation would also affect both the likelihood of missing a trip to the doctor's office and the cost of transportation. Therefore, one would expect that using only the population size to estimate the cost-effectiveness of providing NEMT to the transportation-disadvantaged would lead to less than accurate results at the regional or local level.

Not all of the factors used in the model are easily obtained for a region, and for some measures national averages will need to be used as a proxy for the regional data. National averages are highlighted in green in the spreadsheet and can be changed if accurate data for a region can be found. Upon careful review of this model,

transportation agencies, social service agencies, and other users are encouraged to use validated data for their regions as key inputs to the model. As is true for all models, this model provides results that are only as accurate as the data, ratios, and values that are used in the model. National ratios of prevalence or access to NEMT and average costs may not reflect actual data in a region.

8.3 Sensitivity Analysis with Spreadsheet Tool

As stated above, an intermediate objective in developing this model was to develop a conservative estimate of the savings, and to be realistic regarding the healthcare and transportation costs within a region. Thus, the model includes a number of factors to account for how medical care is provided and the ability of transportation-disadvantaged people to obtain care.

Some people miss appointments because they choose not to seek medical care, even when their physician has recommended it. The likelihood of making a trip takes into account those who will not seek care. This would increase the cost of care as a condition moves from well to poorly managed. While missing treatment would increase the overall cost of care as the CEAs show, providing transportation would not necessarily increase the likelihood of individuals actually receiving care.

Individuals with multiple medical conditions (co-morbidities) also reduce the number of NEM trips required, because physicians can treat a patient for more than one condition during one medical visit. The data clearly show that transportation-disadvantaged persons are more likely to have more than one chronic condition than is the general population. Therefore, to include this issue in the model, the calculated number of missed trips is reduced to account for patients who see their doctor for more than one medical condition.

A third factor that has a direct effect on the cost of providing transportation is mode substitution. Many people who are transportation disadvantaged nevertheless make it to their doctor's office for non-emergency medical care using friends, family, or neighbors. Some of the trips supplied through these means could be converted to other means once additional NEMT is established in a region. If made via the newly supplied services, these trips would add to overall transportation costs but would not reduce healthcare costs, because the patient would have obtained care anyway. This substitution of services could be considered a form of induced demand. Although estimating the amount of mode substitution that would occur if additional transportation services are put into place is difficult to do, induced demand is a well recognized phenomenon in various human services policy domains. For example, in the long-term care arena, it has been known for some time that formal services (paid care) induce demand by substituting for informal services (unpaid care). The estimates of this induced demand, however, can vary anywhere from 8 to 43 percent, especially in the first year of a new program (Dale et al., 2003). If local data suggest that induced demand will not occur, then users of the tool can set this value to zero.

In estimating the benefits of providing NEMT, the model follows the analysis presented in this report by including a compliance factor – the willingness of patients to follow the recommendations of their providers. If patients use transportation to access healthcare then fail to follow the provider's requests, then all the costs of

transportation and healthcare are expended but few if any benefits are realized. The compliance factor for chronic conditions is generally higher than the compliance factor for preventive care. Therefore, the model expects a lower estimated benefit for preventive care when compliance is taken into account.

As explained in Chapter 6 and in Appendix C, it is critically important to include health-related quality of life when evaluating healthcare interventions. Quality of life combines with life expectancy to comprise the quality adjusted life year (QALY) construct. The model enables the user to explicitly vary this parameter. This is very important for a study of individuals suffering from chronic conditions, who by virtue of enhanced transportation, can transition from poorly to well managed care and, in the process, dramatically improver their health-related quality of life.

8.4 Use and Application of Spreadsheet Tool

The Non-Emergency Medical Transportation (NEMT) Cost-Effectiveness Model takes users through the following fours steps:

Step 1: Estimating the Number of NEMT Trips Needed per Year

Step 2: Estimating the Cost of Providing NEMT

Step 3: Estimating the Benefits of Providing NEMT

Step 4: Completing the Cost-Effectiveness Analysis

Numbers and factors highlighted in yellow in the model should be modified to reflect known regional values. Numbers in the model that are highlighted in green come from professionally reviewed research reports and most likely should not be changed unless validated and trusted data for a given region indicates that a different value is more accurate.

The primary driver of the yearly number of NEMT trips begins with the population of the region, the percent of the population that is lacking access to NEMT, and the prevalence of chronic diseases. In Step 1, a projection of the number of trips is made by estimating the number of people without access to transportation for NEM care, the chronic diseases and preventive treatment that this population should seek, and the average number of visits that a patient should have given the specified condition. As described previously, the likelihood of making a scheduled trip and the possibility that the visit covers more than one medical condition are included.

With the number of visits estimated, the next step is to forecast the cost of providing NEMT, both the direct transportation cost and the cost of the resulting medical care. Rural-to-total-population ratios and type of transportation (ambulatory, wheelchair, and stretcher) are used to forecast the number of NEMT trips by type. A higher percentage of the population living in rural areas tends to increase the trip length and percent of trips that have only one rider. This increases the transportation costs. Urban areas generally have more transportation options and public transportation can be used for some trips. Regions where the population is older and sicker will likely require more transportation using wheelchairs and stretchers, also increasing the total cost of providing NEMT. There is a certain percentage of the population that will realize that paratransit for NEMT is available and will use the service instead of

using friends or family that they have traditionally used. This mode substitution for services will increase the cost of transportation but will not affect the healthcare costs, because the patient would have seen his or her doctor anyway.

Step 3 of the model estimates the medical benefits of providing NEMT. This is based on the cost-effectiveness analysis of providing well managed care compared to poorly managed care; the underlining principle is that well managed care occurs when a patient seeks and receives care and complies with their doctor's orders. The costs of well and poorly managed care are derived from both literature and through an analysis of the National Health Interview Survey and the Medical Panel Expenditure Survey. Condition specific cost data can be obtained for regions using these data sets with a good deal of effort. The outcome may not differ significantly from the national norms presented in the model. Compliance factors by condition have also been carefully researched. Patient behavior toward compliance is not expected to significantly differ by region and region specific compliance, especially for those needing NEMT, has not as yet been studied and reported.

The final step, Step 4, is to review the results in their entirety. In Step 4, the model presents the estimated number of missed trips, the transportation and medical costs, and the QALY adjusted benefits of providing NEMT. Comparing the benefits to the costs gives the cost-effectiveness ratio of providing NEMT. Ratios above one indicate that the benefits outweigh the cost of providing care. The net cost-effectiveness forecasts the yearly cost savings or, if negative, the additional cost of providing NEMT over the medical savings generated.

Chapter 9: Conclusions

While there is substantial uncertainty in the precise computations at the condition level, a *strong* case can be made that improved access to NEMT for transportation-disadvantaged persons is cost-effective in terms of better healthcare. In some cases, this cost-effectiveness translates directly into decreases in healthcare costs that exceed the added transportation costs. In other cases, longer life expectancy or improved quality of life for those suffering from the studied conditions justify the added costs of improved access to NEMT cost-effectiveness. The latter is not a "soft finding." To be cost-effective under the well-accepted QALY method, added costs to extend a healthy life must be below a reasonable cost standard, and such is the case for *all* twelve of the analyses detailed in Chapter 7. Conversely, many healthcare interventions, when carefully analyzed, result in added quality-adjusted life years costing hundreds of thousands of dollars, and thus are clearly cost-*ineffective*. In this final chapter, we review our principal findings, discuss limitations of the study, and suggest promising avenues for future research on this novel and important topic.

9.1 Principal Findings

For the twelve conditions that were analyzed, improved access to NEMT is cost-effective for the transportation-disadvantaged population that misses medical care due to transportation barriers. For four conditions – prenatal care, asthma, congestive heart failure, and diabetes – improved transportation produces net cost savings. For six other conditions – influenza vaccinations, dental care, chronic obstructive pulmonary disease, hypertension, depression/mental health, and end-stage renal disease – improvements in life expectancy or quality of life are easily large enough to justify increased net costs. For the two remaining conditions – breast cancer screening and colorectal cancer screening – net transportation costs fall comfortably below the conventionally accepted $50,000 QALY standard (see Table 9-1).

Table 9-1: Summary of Condition-Specific Cost-Effectiveness Results

Condition	Type	Cost per QALY	Result
Influenza Vaccinations	Preventive	$31 / QALY	*Highly* Cost-Effective
Prenatal Care	Preventive	**$367 Cost Saving**	**Cost Saving**
Breast Cancer Screening	Preventive	$34,176 / QALY	Moderately Cost-Effective
Colorectal Cancer Screening	Preventive	$22,735 / QALY	Moderately Cost-Effective
Dental Care	Preventive	$590 / QALY	*Highly* Cost-Effective
Asthma	Chronic	**$333 Cost Saving**	**Cost Saving**
Heart Disease (Congestive Heart Failure, CHF)	Chronic	**$2,743 Cost Saving**	**Cost Saving**
Chronic Obstructive Pulmonary Disease (COPD)	Chronic	$1,272 / QALY	*Highly* Cost-Effective
Hypertension (HTN)	Chronic	$6 / QALY	*Highly* Cost-Effective
Diabetes	Chronic	**$927 Cost Saving**	**Cost Saving**
Depression / Mental Health	Chronic	$675 / QALY	*Highly* Cost-Effective
End-Stage Renal Disease (ESRD)	Chronic	$410 / QALY	*Highly* Cost-Effective

In the sections that follow, we describe other important results as they relate to the objectives of the study and to the spreadsheet tool that was developed to foster local and regional analyses.

9.1.1 The Transportation-Disadvantaged Population and Access to Healthcare

Defining the transportation-disadvantaged population is a complex and contentious problem, made more difficult when trying to identify members of this population who miss non-emergency medical care due to transportation shortcomings – this project's *study population*. Similarly, while it may seem clear who requires healthcare, and thus who misses needed care for one reason or another, such a determination is affected by factors such as "persistence" – not needing care in one period but becoming ill in the next, newly emerging disease management strategies that place a premium on careful disease monitoring, and more effective health promotion and disease prevention activities.

Making use of available, nationally representative healthcare datasets (NHIS and MEPS), we found 3.6 million people in a *given year* who are both transportation disadvantaged and miss non-emergency medical care due to a lack of transportation. Thus, these 3.6 million persons became the *target population* for this study. Although this target population estimate of 3.6 million Americans is an important study finding, our analysis revealed that a larger population is at risk of missing care due to transportation barriers, thus it is conservative and should be seen as a lower bound estimate. There is response bias inherent in these studies that lowers the estimate, and some populations are totally ignored in the data. This bias will tend to lower the estimate than if the studies truly represent the entire U.S. population. Furthermore, because people can fall into and out of transportation-disadvantaged status over time, as well as change healthcare status (e.g., healthy or not, have insurance or not), our results suggest that more Americans are at risk of missing non-emergency care due to a lack of transportation, but that only some of this at-risk population does miss in a given year. This phenomenon is shown in Figure ES-1. Moreover, this number can and should be benchmarked against the number of people suffering from a given condition, and the current resources that are devoted to ameliorating this suffering – or the number of people that stimulates a broad-based public health campaign. For example, the target population is approximately 40% larger than the entire end-stage renal disease group in the U.S. In sum, even with a "small" transportation-disadvantaged population, the healthcare dollars at risk are substantial, and the impact on affected lives is great. Finally, several factors and trends – population growth of groups in the target population, the graying of America, more expensive healthcare, rising prevalence of health conditions – will almost certainly lead to a larger target population in the future as discussed in the following section.

9.1.1.1 Growth of the Target Population

The U.S. Census Bureau projects that the total U.S. population will grow from 282,125,000 in 2000, to 308,936,000 in 2010, and to 335,805,000 in 2020. The population will not grow uniformly, however. The total population that is African American is projected to rise from 12.7 percent to 13.1 percent in 2010, and to 13.5 percent in 2020. The share that is Hispanic is projected to rise in the corresponding years from 12.6 percent to 15.5 percent and then to 17.8 percent. While

transportation status is certainly not driven by race, it is associated with it. In the target population, African Americans and Hispanics are disproportionately represented (see Table 9-2). Furthermore, the share of the U.S. population that is aged 65 and over is projected to rise from 12.4 percent, to 13.0 percent, to 16.3 percent over the same time frame (U.S. Census Bureau, 2004).

While projecting income changes is fraught with uncertainty, recent trends have clearly gone in the direction of higher income (and wealth) disparities. Roughly 125 million Americans had one or more chronic conditions in 2000, and they accounted for approximately 75 percent of health spending, and by 2020, a projected 157 million Americans will have one or more chronic conditions and account for roughly 80 percent of total U.S. healthcare spending (Anderson and Knickman, 2001). Moreover, the obesity epidemic itself will certainly lead to high growth in the risk and occurrence of diseases such as diabetes, high blood pressure, arthritis, and some cancers (Kolata, 2005) – many of the conditions analyzed in this study. These trends conspire to dramatically increase the future projection of transportation-disadvantaged individuals at risk of missing health care.

Table 9-2: Racial Composition of Target Population and All-Others

Population Group	Percent of Target Population	Percent of All-Others
White	80.9	82.3
Black	13.5	12.6
Hispanic	16.7	13.2
Total	1.2	98.8

9.1.2 Characteristics of the Target Population

The target population differs from the larger U.S. population in several important demographic and socio-economic dimensions. It is poorer, older, less well educated, has higher minority representation, and is more female, on average. The target population also suffers from disease at a higher rate than the rest of the U.S. population and accesses more healthcare in total.

A careful review of medical conditions affecting the target population revealed that a focus on 12 conditions would best inform the cost-effectiveness studies. These 12 were prevalent in the target population and amenable to disease management. Of these 12, seven are chronic conditions, while four are preventive care.

9.1.3 Cost of Non-Emergency Medical Transportation

We found that the cost of providing NEMT varies considerably across the U.S., with this variation driven primarily by type of transportation service provided (e.g., ambulatory, wheelchair, or stretcher). We also found variation across modes as a whole, with fixed-route public transportation clearly less expensive than any of the paratransit service types. In addition, we found that NEMT is somewhat more expensive to provide in rural areas than it is in urban areas.

9.1.4 Optimal Method for an Economic Evaluation of Healthcare Costs, Outcomes, and Offsetting Transportation Costs

In completing this study, including review of relevant literature and investigation and analysis of available data sets, we determined that cost-effectiveness analysis is a more appropriate method for meeting the objectives than is cost benefit analysis. As a result, we conducted twelve cost-effectiveness analyses based on identified medical conditions from which members of the target population suffer. The lack of a global cost benefit result is more than counterbalanced by the value of these specific analyses (see Chapter 6 and Appendix C).

9.1.5 Value of a User-Based Spreadsheet Tool

The analyses clearly showed that, for the conditions examined, providing access to NEMT for the target population is cost-effective. Yet, given shortcomings in available datasets and large variations in both transportation and healthcare costs across the U.S., we determined that developing and providing a spreadsheet tool to facilitate local and regional analysis is warranted. Working together, local and regional transportation and healthcare professionals are likely to have access to data that more accurately reflect local and regional conditions. By using the provided tool, these professionals will be able to produce more reliable results for study regions of interest to them.

9.2 Discussion and Suggestions for Further Research

This study has multiple strengths in dealing with a difficult, novel, and important human services problem. Throughout this report, we have stressed that this study was challenging along several important dimensions, presenting both conceptual and analytical difficulties. In this section, we discuss these aspects and present suggestions for future research to further our understanding of the intersection between transportation-disadvantaged status and missed non-emergency healthcare.

At the conceptual level, precisely defining the target population is complex, though in the end direct estimate of this population using NHIS and MEPS data proved successful. Nonetheless, transportation and healthcare officials and researchers would all benefit from a shared, standardized, operational definition of transportation disadvantage. This shared operational definition would facilitate better analysis of this population and increase understanding of its many characteristics, including but not limited to access to non-emergency medical care.

The well versus poorly managed care method points to another issue regarding transportation provision more generally. While transportation is a focus of this study, seen as a significant input to the “production of health,” ultimately it is only one such input. Many elements are required to produce good health, and one should not ascribe undue influence to the role played by improved transportation access. Specifically, one should not assume that solving someone’s transportation access problem will ensure that this person will obtain needed care and adhere to a prescribed course of treatment. Several other barriers, such as lack of insurance, the cost of medications, the difficulty of scheduling visits around work, and whether patients adhere to their medical therapy once received, may remain. Two strengths of

the current study in this regard are (1) the use of MEPS to select the target population based on primary and secondary reasons for missing care only and (2) reduction in prospective benefits by applying compliance factors and other adjustments to avoid over estimating benefits.

As discussed in several places throughout the report and in a forthcoming paper (Wallace et al., in press), shortcomings in available data hinder the ability to investigate the intersection of health and transportation. Simply put, healthcare data lack sufficient information on transportation and transportation access to care, while transportation data contain little on healthcare utilization and nothing on utilization by medical condition. To allow more detailed study of the nationally important questions and hypotheses addressed in this study, both transportation and healthcare professionals and researchers need better data. This could occur through a special supplement connected to one of the major existing studies (such as NHIS or MEPS) or through a dedicated data collection effort. Another possibility is the accumulation of many local case studies (such as promoted by the spreadsheet tool), though these will inherently lack the desirable quality of being nationally representative.

Currently, the prospects for improved data are declining, as evidenced by the status of the 2002 MEPS. Although the 2002 MEPS data became available in December 2004, we were unable to use them for this study due to the loss of a key transportation question. This affects how recent the data available for analysis are, and it also limited our ability to study the selected diseases longitudinally. In addition, NHIS has made the MSA field inaccessible, hindering the ability of researchers to distinguish urban and rural respondents. Sample sizes of both NHIS and MEPS are falling because of budgetary pressure to reduce survey costs.

Selecting the most relevant conditions to analyze in detail presented a challenge. Clearly, important conditions (such as pain management, need for physical therapy, and cancer treatment) were neglected and are good candidates for follow-up study. Also, the high prevalence of multiple conditions (co-morbidities) in the target population introduced noise into the study. There is no quick and easy way to accurately disentangle the effects of these co-morbidities, and we certainly would not want to create a healthcare system that easily disentangled them by, for example, restricting treatment to a single condition at each visit.

Although 12 cost-effectiveness studies were conducted for this study, each of them could easily comprise a full-scale study of its own. We have presented illustrative cases of how healthcare provision could be enhanced by additional transportation resources, but each condition that we studied could be extensively expanded by a stand-alone, detailed economic analysis that includes a longitudinal element to account for time-dependent costs and benefits. To compliment this additional detail, greater analysis of transportation costs would be warranted. This study used selective data to compute transportation costs by mode. A well-constructed survey of transit providers would increase accuracy. In addition, future research should be conducted on a key question: to what extent would the provision of new transportation services involve added costs by luring those who currently use alternative modes? This would allow direct assessment of induced demand.

There is significant ambiguity in using an expenditure-based dataset to make the well versus poorly managed care distinctions that are at the heart of our chronic condition

analyses. In addition, when using the MEPS, one finds people with a condition by finding condition-related expenditures and then working backwards to the individuals. This can create identification problems for those without expenditures in a particular period or for those with expenditures with ambiguous condition identifiers. Again, the issue of persistence arises, because even someone with a chronic condition will not necessarily have expenses, or need care, for that condition in subsequent time periods.

There are selection issues at several junctures of the cost-effectiveness analysis. A compliance factor was used in Chapter 7 to serve as a way to produce more conservative estimates, i.e., reducing benefits by assuming fewer individuals would comply with recommended treatment. A more serious selection problem concerns the comparison between those individuals identified in the target population and those used to make the poor and well-managed designations (and estimate their expenditures). Additional research could analyze these selection issues to determine whether transportation-disadvantaged individuals differ in important ways from those who we use to estimate the benefits of well-managed care.

Further complicating matters, the inability to use MEPS to determine the length of time that an individual has suffered from a given health problem poses difficulties for anyone who would try to add a longitudinal element to this type of study. Hence, we were unable to parse out the cases that would be particularly well suited for early treatment and thus foster early disease management – the very same cases that the literature indicates are extremely cost-effective under a well-managed regime. The same argument pertains to severity demarcation. In both cases, we believe that these limitations are consistent with the conservative stance of our approach. The positive findings that we obtained would be larger still if we had been able to examine cumulative net healthcare benefits over time and if we had been able to focus on the most pertinent set of individuals who lack access to care. To the extent that local providers of transportation and healthcare can identify these people in their region, the resulting net benefits created, using the spreadsheet model, should exceed those outlined in this report.

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Appendix A: Glossary of Technical Terms

Acquired Immune Deficiency Syndrome (AIDS) – A diagnosis of AIDS is made when a person with HIV antibodies has either a CD4 cell count below 200 or one of a list of diseases that are unusual in a person with a healthy immune system.

acute condition – A short term medical condition that resolves usually in less than 3 weeks.

ADA – See Americans with Disabilities Act.

ADHD (ADHD) – See Attention Deficit Hyperactivity Disorder.

adverse drug reaction – A term to describe the unwanted, negative consequences associated with the use of medications.

Agency for Healthcare Research and Quality (AHRQ) – Part of the US DHHS, the AHRQ supports research designed to improve the outcomes and quality of healthcare, reduce its costs, address patient safety and medical errors, and broaden access to effective services.

aggregate – A collection of units; also the whole or sum total.

AHRQ – See Agency for Healthcare Research and Quality.

AIDS – See Acquired Immune Deficiency Syndrome.

Altarum Institute – A family of business groups, each using policy, research, and technology tools to understand a problem and deliver a solution that promotes the sustainable well-being of society and a better way of life.

American Public Transportation Association (APTA) – A Washington, DC based, non-profit organization that serves as an advocate for the advancement of public transportation programs and initiatives.

Americans with Disabilities Act (ADA**)** – Federal legislation enacted in the U.S. 1990 to ensure disabled Americans civil rights, including access to public transit services.

anemia – A lack of red blood cells and/or hemoglobin. This results in a reduced ability of blood to transfer oxygen to the tissues.

APTA – See American Public Transportation Association.

arthritis – A group of conditions that affect the health of the bone joints in the body.

asthma – An immunological disease which causes difficulty in breathing. It is a form of Type I hypersensitivity in which the bronchioles in the lungs are narrowed by inflammation and spasm of the lining of the airway wall. A person with asthma may experience wheezing and shortness of breath, particularly after exercise or when emotional. Sudden attacks of breathlessness may require hospitalization.

Attention Deficit Hyperactivity Disorder (ADHD) – A mental disorder that affects children and adults producing predominantly inattentive, predominantly hyperactive, or a combination of these in the behavior.

autism – A neurodevelopmental disorder that causes marked problems with social relatedness, communication, interest, and behavior.

benefit – In economics, the utility of people considered in aggregate.

bias – In statistics, the word bias means that an estimator for some reason, on average, over- or under-estimates what is being estimated.

binomial distribution – The discrete probability distribution of the number of successes in a sequence of n independent yes/no experiments, each of which yields success with probability p. The binomial distribution is the basis for the popular binomial test of statistical significance.

BTS – See Bureau of Transportation Statistics.

Bureau of Transportation Statistics (BTS) – A part of the U.S. Department of Transportation that compiles, analyzes, and makes accessible information on the nation's transportation systems; collects information on intermodal transportation and other areas as needed; and enhances the quality and effectiveness of DOT's statistical programs through research, development of guidelines, and promotion of improvements in data acquisition and use.

cancer – The group of diseases characterized by uncontrolled cell division and the ability of these cells to invade other tissues and spread to other areas of the body where the cells are not normally located (metastasis).

cardiovascular disease – The class of diseases that involve the heart and/or blood vessels (arteries and veins). These problems are most commonly due to consequences of arterial disease, atherosclerosis, but also can be related to infection, valvular, and clotting problems.

CBA – See cost benefit analysis.

CDC – See Centers of Disease Control and Prevention**.**

CEA – See cost-effectiveness analysis.

Centers of Disease Control and Prevention (CDC) – The federal agency charged with protecting the public health and safety of people by providing credible information to enhance health decisions, and promoting health through strong partnerships with state health departments and other organizations.

cerebral palsy – A group of permanent disorders associated with developmental brain injuries that occur during fetal development, birth, or shortly after birth. Characterized by a disruption of motor skills with symptoms such as spasticity, paralysis, or seizures.

CHF – See congestive heart failure.

chronic condition – A prolonged disease state, e.g. Congestive heart failure, diabetes, asthma.

chronic obstructive pulmonary disease (COPD) – A group of diseases of the respiratory tract that are characterized by airflow obstruction or limitation. Usually caused by smoking.

clinical guideline – A collection of practical information for use by doctors and other medical professionals, often gleaned from systematic review of medical journals and other published material.

clinician – A professional in the healthcare industry that is involved in the direct care of individuals' physical and/or mental health. Also called a healthcare provider.

Community Transportation Association of America (CTAA) – A trade association that strives to build communities through transportation access and enhanced mobility.

co-morbid condition – The presence of one or more disorders (or diseases) in addition to a primary disease or disorder.

co-morbidity - The effect of all other diseases an individual patient might have other than the primary disease of interest.

congestive heart failure (CHF) – The inability of the heart to pump a sufficient amount of blood throughout the body. Also called congestive cardiac failure and heart failure.

COPD – See chronic obstructive pulmonary disease.

coronary heart disease – The end result of the accumulation of atheromatous plaques within the walls of the arteries that supply the myocardium (the muscle of the heart). Also called coronary artery disease (CAD) and atherosclerotic heart disease.

cost – A price paid, or otherwise associated with, a commercial event or economic transaction.

cost benefit analysis (CBA) – The process of weighing the total expected costs vs. the total expected benefits of one or more actions in order to choose the most profitable option.

Cost-effectiveness analysis (CEA) – The comparison of the relative expenditure (costs) and outcomes (effects) associated with two or more courses of action. Cost-effectiveness is typically expressed as an incremental cost-effectiveness ratio (ICER) the ratio of change in costs to the change in effects. In health economics a figure of US$50,000 per quality-adjusted life year (QALY) is often suggested as the upper limit of an acceptable ICER.

cost estimation model – A set of mathematical algorithms used to estimate the costs of a product or project. The results of the models are typically necessary to obtain approval to proceed, and are factored into business plans, budgets, and other financial planning and tracking mechanisms.

cost-minimization analysis – When relevant effects of the given healthcare interventions are observed to be similar, cost-minimization analysis is used to compare net costs. In principle, this analysis requires clinical evidence to support the notion that differences in health effects between alternatives are minimal or not important.

cost-of-illness study – A cost of illness study is used to determine the overall cost to society of a particular disease or condition. These studies are generally conducted at national level, making use of surveys of health professionals in addition to published epidemiological and other data. Cost of illness studies highlight the impact of a particular disease on society, particularly the extra resources that are required to manage the disease or the productivity lost as a result of the disease.

CTAA – See Community Transportation Association of America.

demand – The quantity of a good that consumers are not only willing to buy but also have the capacity to buy at the given price.

demographic factors – Characteristics that segment the population into groups, e.g. age; gender; nationality.

depression – A medical condition with symptoms that last two weeks or more, and are so severe that they interfere with daily living.

diabetes – A medical disorder characterized by varying or persistent hyperglycemia (elevated blood sugar levels), especially after eating. All types of diabetes mellitus share similar symptoms and complications at advanced stages, which can include cardiovascular disease, chronic renal failure, retinal damage with eventual blindness, nerve damage and eventual gangrene with risk of amputation of toes, feet, and even legs.

dialysis – A method for removing waste such as urea from the blood when the kidneys are incapable of this.

direct cost – See variable cost.

disability – Having a condition that impedes the completion of daily tasks using traditional methods including physical impairments affecting movement, such as post-polio syndrome, spina bifida and cerebral palsy; sensory impairments, such as visual or hearing impairments; cognitive impairments such as Autism or Down Syndrome.; or psychiatric conditions such as Depression and Schizophrenia.

disease incidence – A measure of occurrences of a disease in a specified time interval.

disease management – A system of coordinated healthcare interventions and communications for populations with conditions in which patient self-care efforts are significant.

Disease Management Association of America (DMAA) – The non-profit, voluntary membership organization, founded in March of 1999, which represents all aspects of the disease management community.

disease prevalence – The prevalence of a disease in a statistical population is defined as the ratio of the number of cases of a disease present in a statistical population at a specified time and the number of individuals in the population at that specified time.

DMAA – See Disease Management Association of America.

dominance – A method for comparing alternative interventions in a cost-effectiveness analysis. Strong dominance favors a strategy that is both more effective and less costly. Strong dominance occurs only when the innovation is very good (it works better and saves cost) or very bad (its works worse and costs more).

dummy variable – A binary (off-on) variable designed to take account of exogenous shifts or changes of slope in an econometric relationship.

eczema – A skin irritation characterized by red, flaky skin, sometimes with cracks or tiny blisters.

emergency room (ER) – A room, or group of rooms, within a hospital that is designed for the treatment of urgent and medical emergencies.

End Stage Renal Disease (ESRD) – A slowly progressive loss of renal function over a period of months or years that leads to ESRF.

End Stage Renal Failure (ESRF) – The ultimate consequence of renal disease. Dialysis is generally required although renal transplant can be an option.

ER – See emergency room.

ESRD – See End Stage Renal Disease.

ESRF – See End Stage Renal Failure.

EuroQol 5D – A standardized instrument for use as a measure of health outcome. Applicable to a wide range of health conditions and treatments, it provides a simple descriptive profile and a single index value for health status.

Federal Highway Administration (FHWA) – A division of the U.S. Department of Transportation that specializes in highway transportation funding, standards, and research.

Federal Transit Administration (FTA) – A division of the U.S. Department of Transportation that specializes in public transportation funding, standards, and research.

FHWA – See Federal Highway Administration.

fixed cost – Costs that do not vary with output, e.g., rent. In the long run, all costs can be considered variable.

fixed route – A predetermined destination, or set of destinations.

FTA – See Federal Transit Administration.

functional limitation – A condition that limits a function of daily living, often the result of a disability.

GAO – See Government Accountability Office.

gap analysis – A process to map the difference between a desired and existing state.

General Accounting Office – See Government Accountability Office.

geographic factors – The location and spatial characteristics of residence, e.g., urban, rural.

Government Accountability Office (GAO) – An independent and nonpartisan agency that studies the programs and expenditures of the federal government as requested by Congress. Prior to 2004, this agency was called the General Accounting Office.

health economics – A branch of economics concerned with the formal analysis of costs, benefits, management and consequences of healthcare. Health economics often uses mathematical models to synthesize data from biostatistics and epidemiology for support of medical decision-making, both for individuals and for wider health policy.

healthcare provider – A professional that provides service related to: the preservation or improvement of the health of individuals, or the treatment or care of individuals who are injured, sick, disabled or infirm. It includes medical doctor (physician), nurse-practitioner, physician assistant, nurse, or dentist. Also called a clinician. Can also be spelled health-care provider.

heart disease – An umbrella term that includes the following conditions: coronary heart disease; ischaemic heart disease; hemorrhagic heart disease; cardiovascular disease.

health-related quality of life – A construct that refers to the impact of the health aspects of an individual's life on that person's quality of life, or overall well-being. Also used to refer to the value of a health state to an individual, e.g., living with a chronic disease or a particular disability.

HIV – See Human Immunodeficiency Virus.

home health care – The limited part-time or intermittent skilled nursing care and home health aide services, physical therapy, occupational therapy, speech-language therapy, medical social services, durable medical equipment (such as wheelchairs, hospital beds, oxygen, and walkers), medical supplies, and other services provided in the patient's home.

HRQL – See health-related quality of life.

HTN – See hypertension.

Human Immunodeficiency Virus (HIV) – A retrovirus that infects cells of the human immune system. Infection with HIV has been established as the underlying cause of AIDS.

hypertension – Abnormally high blood pressure.

ICD – See International Classification of Diseases.

immunization – The process by which an individual is exposed to a material that is designed to prime his or her immune system against that material. Immunizations differ from vaccines in that no viral agent is used.

incremental cost – The increase in total cost that arises when the quantity produced (or purchased) increases by one unit.

inpatient stay – Hospital care delivered to a patient for a time period longer than 24 hours.

insomnia – A sleep disorder characterized by an inability to sleep and/or to remain asleep for a reasonable period during the night.

International Classification of Diseases (ICD) – An internationally recognized coding system for medical conditions.

Irritable Bowel Syndrome – A group of functional bowel disorders with symptoms of abdominal pain or discomfort associated with changes in bowel habits.

ischaemic heart disease – A disease characterized by reduced blood supply to the heart. It is the most common cause of death in most western countries.

labor – The work done by human employees.

margin of error – The 99 percent confidence interval for a reported percentage of 50 percent. It represents an upper bound to the uncertainty; one is at least 99 percent certain that the "true" percentage is within a margin of error of a reported percentage for any reported percentage.

marginal cost – See incremental cost.

mean – The sum of all the observations divided by the number of observations. Also called average.

median – A number that separates the highest half of a sample, population, or probability distribution from the lowest half. More precisely, 1/2 of the population will have values less than or equal to

the median and 1/2 of the population will have values equal to or greater than the median.

Medicaid – State and federal health insurance program for low-income Americans.

Medical Expenditure Panel Survey (MEPS) – The third (and most recent) in a series of national probability surveys conducted by AHRQ on the financing and utilization of medical care in the United States.

Medicare – Federally funded health insurance program for elderly and disabled persons.

mental health – The absence of a mental illness such as depression that limits the capacity to live a full life.

MEPS – See Medical Expenditure Panel Survey.

Metropolitan Statistical Area (MSA) – Formal definition of a metropolitan area that is organized around county boundaries.

mode – The type of transportation used for travel, e.g., bus, car, bike. Mode choice has been analyzed in transit studies to determine travel behavior and preference for modes, e.g., red bus, blue bus.

monitoring – A planned, systematic, and ongoing process to gather and organize data, and aggregate results in order to evaluate a patient's disease status.

morbidity – Illness.

mortality – Death.

MSA – See Metropolitan Statistical Area.

multiple linear regression – The method of estimating the conditional expected value of one variable y given the values of some other variable or variables x.

Multiple Sclerosis – A non-contagious chronic autoimmune disorder of the central nervous system which can present with a variety of neurological symptoms occurring in attacks or slowly progressing over time. Due to its effects of the nervous system, it can lead to long-term impaired mobility and disability in the more severe cases.

muscular dystrophy – A group of genetic and hereditary muscle diseases; characterized by progressive skeletal muscle weakness, defects in muscle proteins, and the death of muscle cells and tissue.

National Center for Health Statistics (NCHS) – One of the Centers of Disease Control and Prevention, the NCHS is the United States' principal health statistics agency. It designs, develops, and maintains a number of systems that produce data related to demographic and health concerns.

National Health Interview Survey (NHIS) – A nationally representative, longitudinal survey coordinated by the NCHS, on the health of the United States civilian non-institutionalized population.

National Household Travel Survey (NHTS) – A survey conducted by the Bureau of Transportation Statistics and the Federal Highway Administration to collect data on both long-distance and local travel by the American public (formerly known as the National Personal Transportation Survey, or NPTS)

National Transit Database (NTD) – A database collected and maintained by the Federal Transit Authority on the state of public transportation in the U.S.

NCHS – See National Center for Health Statistics.

NEMT – See non-emergency medical transportation.

neuropathy – A disease of the peripheral nervous system.

NHIS – See National Health Interview Survey.

NHTS – See National Household Travel Survey.

noncompliance – Can refer to either patient or provider behavior that does not adhere to recommended standards of care.

non-emergency medical transportation (NEMT) – Transit for healthcare purposes, excluding emergency transit, e.g. Routine medical appointments, dental care, preventive services.

NTD – See National Transit Database.

office-based visit – A visit to a healthcare provider that operates outside of a hospital.

opportunity cost – The value of the best alternative that was not chosen in order to pursue the current endeavor, e.g., what could have been accomplished with the resources expended in the undertaking. It represents opportunities forgone.

outpatient visit – A visit to a hospital-based healthcare provider that does not include an overnight stay.

parameter – A measurement or value on which something else depends. In probability theory, one may describe the distribution of a random variable

as belonging to a family of probability distributions, distinguished from each other by the values of a finite number of parameters. Statistical analysis attempts to estimate the parameters of a distribution based on observed data.

paratransit – A passenger transportation service primarily intended for mobility-impaired, mentally-impaired, and senior citizens (elderly persons). The trips may be provided by public, non-profit, or other organizations and are often subsidized for the rider and require advance scheduling.

Pareto rule – An observation generally borne out in analyses of a wide variety of distributions that states that 20% of cases will account for 80% of the outcomes under study. For example, 20% of patients will account for 80% of healthcare expenditures in a given population. It is also labeled the "80-20" rule.

Parkinson's disease – A neurodegenerative disease affecting the part of the brain that controls and adjusts communication between neurons in the brain and muscles in the body.

per capita – A Latin phrase meaning "for each head" that is usually used to indicate the average per person of any given statistic.

poorly managed patients – Patients whose disease or diseases are not managed according to current clinical guidelines.

prenatal care – Medical care recommended for women before and during pregnancy. The aim of good prenatal care is to detect any potential problems early, to prevent them if possible (through recommendations on adequate nutrition, exercise, vitamin intake etc), and to direct the woman to appropriate specialists, hospitals, etc. if necessary.

prescription – An order by a medical doctor to a pharmacist for a drug to be provided to the doctor's patient.

prescriptive analysis – A measurement of whether actual data meets an ideal standard.

present value – The present value of a future cash flow is the nominal amount of money to change hands at some future date, discounted to account for the time value of money. A given amount of money is always more valuable sooner than later since this enables one to take advantage of investment opportunities.

preventive medicine – Health services aimed at preventing the contraction or progression of disease, e.g. screening or vaccinations.

primary care – A term used for a healthcare provider who acts as a first point of consultation for all patients. Generally, primary care physicians are based in the community, as opposed to the hospital.

probability – A number expressing the likelihood that a specific event will occur, expressed as the ratio of the number of actual occurrences to the number of possible occurrences.

Prospective Payment System – A method of reimbursement in which Medicare payment is made based on a predetermined, fixed amount.

public transit – Comprises all transport systems in which the passengers do not travel in their own vehicles. While it is generally taken to mean rail and bus services, wider definitions would include scheduled airline services, ferries, and taxicab services. Also called public transport or mass transit.

QALY – See quality-adjusted life year.

quality health outcomes – Health outcomes that affect quality of life issues, e.g. illness or disability.

quality-adjusted life year (QALY) – A measure of the benefit of a medical intervention based on the number of years of life that would be added by the intervention. If the extra years would not be lived in full health, for example if the patient would be blind, then the extra life-years are adjusted by a factor to account for this.

quantity health outcomes – Health outcomes that can be quantified in a benefit cost analysis or cost-effectiveness analysis, e.g., life expectancy or mortality.

race and ethnicity– A social construct that distinguishes populations who are identified by themselves or others as biologically or culturally similar.

randomized controlled trial – A form of clinical trial, or scientific procedure, used in the testing of the efficacy of medicine because of its record of reliability. A randomized controlled study is one in which there are two groups- one treatment group and one control group. The treatment group receives the treatment under investigation, and the control group receives either no treatment or some standard default treatment; and patients are randomly assigned to all groups.

renal disease – Any acute or chronic condition of the kidneys that lead to failure or improper functioning.

Resource Based Relative Value System – The system designed to compensate Medicare providers that assigns every action a doctor makes (e.g. procedures, referrals, etc.) a relative value. This is multiplied by a conversion factor (in dollars) to find what the doctor should be paid.

rural – Sparsely settled places away from the influence of large cities and towns.

Rx – See prescription.

safety net providers – Healthcare providers or facilities that ensure Americans without adequate health insurance can access medical care, e.g. hospital emergency rooms, and migrant health centers.

sampling – The analysis of a group by determining the characteristics of a significant percentage of its members chosen at random.

screening – Preventive health service to detect the early onset of disease, e.g. certain types of cancer; or depression.

SF-12 – See Short Form 12.

Short Form 12 (SF-12) – A survey designed to assess health profiles as well as summary measures of health-related quality of life.

sickle cell anemia – A genetic disease in which red blood cells may change shape under certain circumstances causing the cells to become stuck in capillaries. This deprives the downstream tissues of oxygen and causes periodic painful attacks, eventually leading to damage of internal organs.

sinusitis – An inflammation, either bacterial, viral, allergic or autoimmune, of the paranasal sinuses that can be acute or chronic.

socioeconomic factors – The social and economic characteristics that affect a population, e.g., education levels; or annual income.

specialty care – Medical care delivered by providers who specialize in a type of medicine, e.g. obstetrics, or gerontology.

statistical significance – In statistics, a result is significant if it is unlikely to have occurred by chance, given that a presumed null hypothesis is true.

stroke – A stroke occurs when the blood supply to a part of the brain is suddenly interrupted by occlusion or by hemorrhage. It is a medical emergency and a significant cause of disability and death.

substance abuse – A pattern of continued harmful use of a mood altering substance, which results in adverse social consequences. Substance abuse may lead to addiction or substance dependence.

survey – A gathering of a sample of data or opinions considered to be representative of a whole.

Target Population – In survey research, the target population is the ideal population to be surveyed to meet the objectives of the survey. Similarly, in this report, we use "target population" to refer to the precise population that this research attempts to describe and study: individuals who miss non-emergency medical care and who are transportation disadvantaged (see the Venn diagram shown in Chapter 3 of the report). There is an intrinsic ambiguity in counting this target population for a given time period. First, on the transportation side, one can be distinctly transportation disadvantaged (do not own a vehicle, unable to drive, have barriers to use of public transportation, etc.), and yet find transportation in a given instance for a specific purpose (rely on a relative or neighbor, pay for a taxi, etc.). Second, on the health side, by definition, one cannot miss a health care visit that one believes is unnecessary or does not even attempt to schedule for some non-transportation-related reason (e.g., lack of health insurance, inability to pay). In addition, a transportation-disadvantaged individual may, by good fortune, be healthy over the measurement period. If this person becomes ill, then he or she would transition into the target population. This study labels this phenomenon *persistence*. Alternately, a visit may be perceived as unnecessary because of its preventive nature, or it may be a monitoring or follow-up visit that has a high value after the fact if it is productive (could have prevented serious disease), but that appears superfluous prior to the visit. For these reasons and others, the target population at risk of missing non-emergency care due to transportation barriers is larger than the one that we can measure using nationally representative data sources.

transit – Local area common carrier passenger transportation configured to provide scheduled service on fixed routes on a non-reservation basis.

transportation barriers – An impediment to accessing transportation, e.g., no car, bus route is unavailable; or cannot find a ride.

transportation disadvantaged – Those who, due to low income, physical or mental disability, inability to drive, geographic isolation, or some

other transportation barrier, cannot transport themselves or are unable to purchase available transportation services.

Transportation Research Board (TRB) – A division of the National Research Council that serves as an independent adviser to the federal government and others on scientific and technical questions of national importance.

Transportation Research Information Services (TRIS) – A bibliographic database funded by sponsors of the Transportation Research Board primarily the state departments of transportation and selected federal transportation agencies.

travel behavior – The study of what people do over space and how people use transport. The questions studied in travel behavior are broad and very much related to activity analysis and time use studies.

travel-affecting medical condition – A medical condition that impacts mobility and access to transportation.

TRB – See Transportation Research Board.

triangulation – A method in social science, also called "cross examination", that relies on multiple methods to confirm a conclusion.

TRIS – See Transportation Research Information Service.

United States Congressional Budget Office (US CBO) – A federal agency within the legislative branch of the United States government. The main goal of this office is to provide Congress with objective, timely, nonpartisan analyses needed for economic and budget decisions and with the information and estimates required for the Congressional budget process.

United States Department of Health and Human Services (US DHHS) – A Cabinet department of the United States government with the goal of protecting the health of all Americans and providing essential human services.

United States Department of Transportation (US DOT) – Federal agency responsible for public transportation, road and highway safety, and more, including funding for highways and public transportation.

urban – Cities or towns with increased population density, size, and, often, incorporated legal status.

US CBO – See United States Congressional Budget Office.

US DHHS – See United States Department of Health and Human Services.

US DOT – See United States Department of Transportation.

vaccine – An antigenic preparation used to produce active immunity to a disease, in order to prevent or ameliorate the effects of infection by any natural or 'wild' strain of the organism.

variable cost – Costs that vary directly with the rate of output, e.g., labor, fuel, power, or cost of raw material. Also known as operating costs, prime costs, or direct costs.

vehicle – A non-living means of transport, most often made by humans, e.g., cars, motorcycles, trains, ships, aircraft, buses.

weight – In statistics, a coefficient assigned to elements of a frequency distribution in order to represent their relative importance.

weighted function – A mathematical device used when performing a sum, integral, or average in order to give some elements more of a "weight" than others. Weighted means are commonly used in statistics to compensate for the presence of bias.

well-managed patients - Patients whose disease or diseases are managed according to current clinical guidelines.

Appendix B: Annotated Bibliography

Ahmed, S.M., Lemkau, J.P., Nealeigh, N., Mann, B., Barriers to Healthcare Access in a Non-Elderly Urban Poor American Population, *Health and Social Care in the Community*, 9:445-53, 2001.

This study focuses on urban poor under age 65 in Dayton, Ohio, considering barriers between working and non-working poor to healthcare access. Interviews were conducted door-to-door, enabling patients without telephones to participate. 16% of respondents reported finding transportation for medical care was "hard"; an additional 15% reported "very hard". People reporting transportation barriers were more likely to have no phone in the home, live below the poverty level and be nonworking. The number one reason patients did not access care was because they were unaware of programs available to them for free or at reduced rates. Table 3 shows that in regression analysis the odds a person will have difficulty finding transportation increases with poverty status, female gender, no health insurance. The strongest predictor of transportation difficulty is having no phone in the home (OR 4.40).

Table 3 Regression or logistic regression coefficients of demographic variables on barriers

	Number of concurrent barriers	Lack of knowledge of free or discounted programmes	$$ worry prevented care previous 12 months	Difficulty paying for care in general	Difficulty finding child-care†	Difficulty taking time off work‡	Difficulty finding transportation	Poor previous experience with healthcare system
Independent variables	Standardized coefficient (*P*-value)	Odds ratio (*P*-value)	Odds ratio (*P*-value)	Odds ratio (*P*-value)	Odds ratio (*P*-value)	Odds ratio (*P*-value)	Odds ratio (*P*-value)	Odds ratio (*P*-value)
Poverty status (1 = Yes)	0.09 (0.147)	0.41 (0.033)*	1.29 (0.443)	1.54 (0.210)	1.06 (0.892)	1.83 (0.302)	2.13 (0.043)*	2.30 (0.051)
Respondent's age	0.01 (0.885)	1.03 (0.064)	1.02 (0.151)	1.00 (0.876)	0.944 (0.004)**	0.98 (0.539)	0.99 (0.478)	1.03 (0.061)
Number of children	0.09 (0.141)	1.25 (0.097)	0.95 (0.566)	1.05 (0.647)	1.29 (0.066)	1.85 (0.012)*	0.98 (0.868)	0.87 (0.255)
Respondent's gender (1 = female)	0.06 (0.285)	1.14 (0.766)	1.54 (0.240)	1.71 (0.151)	1.44 (0.473)	0.51 (0.256)	0.74 (0.425)	1.40 (0.449)
Neighbourhood Type§	−0.07 (0.223)	1.28 (0.337)	1.26 (0.219)	0.91 (0.626)	0.56 (0.014)*	0.46 (0.081)	0.59 (0.012)*	1.22 (0.407)
Appalachian descent (1 = yes)	−0.03 (0.637)	0.43 (0.015)*	1.18 (0.541)	1.48 (0.172)	0.83 (0.562)	0.19 (0.007)**	1.13 (0.680)	1.16 (0.663)
Race (1 = nonwhite)	−0.02 (0.780)	0.60 (0.151)	0.89 (0.673)	1.06 (0.854)	0.99 (0.971)	0.67 (0.480)	0.88 (0.684)	1.72 (0.129)
No telephone in the home (1 = yes)	0.21 (0.001)**	3.39 (0.0401)*	1.20 (0.611)	0.85 (0.657)	2.49 (0.017)*	4.09 (0.195)	4.40 (0.000)**	1.78 (0.169)
Worker (1 = yes)	0.00 (0.943)	0.63 (0.252)	0.96 (0.912)	0.86 (0.660)	0.76 (0.544)	not applicable	0.43 (0.029)*	1.25 (0.587)
Health insurance (1 = no)	0.27 (0.000)**	0.78 (0.549)	8.70 (0.000)**	8.53 (0.000)**	0.95 (0.917)	3.54 (0.051)	0.76 (0.477)	0.97 (0.936)
n	282	282	282	282	218	93	282	282

† Analysis restricted to respondents with children in the household.
‡ Analysis restricted to respondents who work full time or part time outside the home.
§ Neighbourhood type coding: 1, 15–29% poverty dense; 2, 30–49% poverty dense; 3, 50–100% poverty dense.
* Statistically significant, $P < 0.05$; ** Statistically significant, $P < 0.0$.

Altarum, Healthcare Management Model, V. 2.0.4, January 24, 2002.

The Healthcare Management Model, created by Altarum, simulates various health experiences and predicts service and material requirements.

American Public Transportation Association, *Americans in Transit,* 1992.
http://www.apta.com/research/stats/ridershp/income.cfm

Americans in Transit study is an older survey of public transit officials to determine rider statistics. Results on income and trip purpose are shown in Tables 13 and 15.

Annual Family Income of Passengers by Population Group

TABLE 13

POPULATION OF URBANIZED AREA/ URBAN PLACE	UNDER $15,000	$15,000-$50,000	ABOVE $50,000
Under 50,000	61%	36%	3%
50,000-199,999	55%	39%	6%
200,000-500,000	54%	38%	8%
500,000-999,999	52%	42%	6%
1 million and more	25%	57%	18%
NATIONAL AVERAGE	28%	55%	17%

Source: APTA, *Americans in Transit*, 1992.

Purpose of Trips by Population Group

TABLE 15

POPULATION OF URBANIZED AREA/ URBAN PLACE	WORK	SCHOOL	SHOPPING	MEDICAL	SOCIAL	OTHER
Under 50,000	26%	9%	8%	34%	27%	2%
50,000-199,999	39%	26%	12%	6%	9%	12%
200,000-500,000	46%	19%	13%	5%	8%	9%
500,000-999,999	51%	15%	11%	5%	6%	12%
1 million and more	55%	15%	9%	5%	9%	7%
NATIONAL AVERAGE	54%	15%	9%	5%	9%	8%

Source: APTA, *Americans in Transit*, 1992.

American Public Transportation Association, *Mobility for America's Small Urban and Rural Communities*, 2003. http://www.apta.com/research/info/online/

This is a brochure publication created by APTA and the Public Transportation Partnership for Tomorrow as part of the Benefits of Public Transportation series. The brochure uses research by Cambridge Systematics, Inc to educate consumers and decision-makers about the supply and demand of public transportation in small urban and rural areas. The following are highlights:

- 41% have no access to transit;
- Another 25% live in areas with below-average transit services;
- Americans in the lowest 20% income bracket, many of whom live in rural settings, spend about 42% of their total annual incomes on transportation compared to middle income Americans who spend under 22%;
- Small urban and rural America is now home to 56 million residents in 2,303 non-metropolitan counties, as well as 35 million more residents living in rural settings on the fringes of metropolitan areas.

The report also profiles two communities that increased access to healthcare through public transportation: Mitchell, South Dakota area (pop. 14,558) created public transportation alternatives that expanded access for medical treatment and reduced healthcare costs by reducing in-patient medical treatment and the costs of 911 responses and the use of Emergency Medical Services; North Carolina's 100 counties coordinate human service and general public transportation services by requiring joint plans for state funding.

American Public Transportation Association, *The Route to Better Health*, 2003. http://www.apta.com/research/info/online/

This is a brochure publication created by APTA and the Public Transportation Partnership for Tomorrow as part of the Benefits of Public Transportation series. This report mainly addresses the environmental and public health benefits of a public transportation system. The medical access issue is addressed as a problem mainly among low income and minority populations. Key highlights:

- As many as four million children in families with incomes under $50,000 a year miss essential doctor appointments because of inadequate transportation;
- In Cincinnati, 60 percent of the patients using Good Samaritan Hospital's clinics use public transportation to access the clinics;
- Tri-Met in Portland, OR, carries 65 percent of non-emergency Medicaid trips;
- The Metropolitan Tulsa Transit Authority (MTTA) coordinates Medicaid transportation statewide, handling 400 calls a day;
- The Rhode Island Public Transit Authority (RIPTA) also coordinates Medicaid transportation statewide, using existing bus routes for 98 percent of the trips.

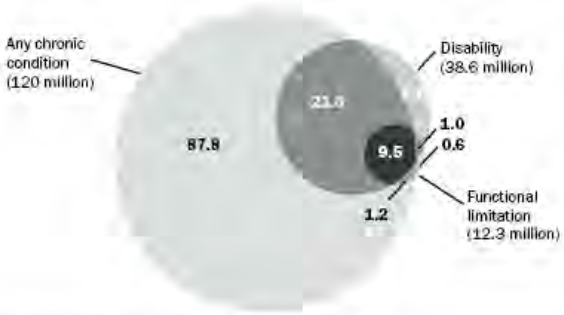
American Public Transportation Association, *Transit Resource Guide*, No. 3, Revised April 2004. http://www.apta.com/research/info/briefings/documents/brief3.pdf

A handout intended to educate seniors who may be encountering transportation barriers. Resources include a Census Bureau brief on the 65 years and older demographic, a study by the Brookings Institute on services for older Americans, and several reports on travel trends among older Americans, along with public transportation services that target older travelers. The document ends with profiles of communities that have strong public transit programs for seniors.

Anderson, G., Knickman, J.R., Changing the Chronic Care System to Meet People's Needs, *Health Affairs*, 20(6): 146-160, November/December 2001.

A profile of the healthcare system from the perspective of the 128 million patients with a disability, chronic disease and/or functional limitation. Chronic illness accounted for 75% of healthcare costs in 2000. The current system limits coordination between the various providers managing chronic conditions, which presents problems with insurance and increases the likelihood of medical errors. Additional challenges exist when patients require professional long-term care that is cost-prohibitive.

EXHIBIT 1
Overlap Of Chronic Conditions, Disability, And Functional Limitation Among Noninstitutionalized Americans, 1996



SOURCE: Medical Expenditure Panel Survey, 1996.
NOTE: Amounts in millions.

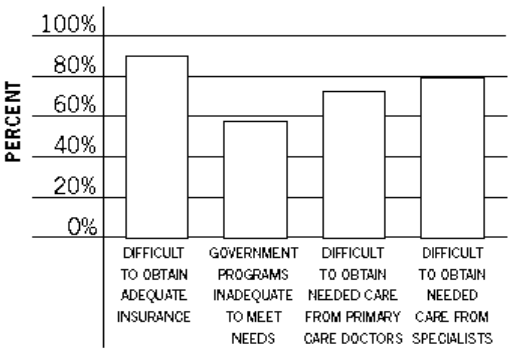
Anderson, G., The Cost and Prevalence of Chronic Conditions are Increasing. A Response is Overdue, *Expert Voices*, Issue 4, January 2002.

This is a summary article on the prevalence and cost of chronic diseases in America and the trends over time and age groups. Citations include MEPS data and a Harris Poll. Public perceptions are presented as concerned.

FIGURE 2

The American Public is Concerned

about the Ability of People with Chronic Conditions to Obtain Necessary Medical Care and Adequate Insurance



SOURCE: Harris Interactive Inc. Survey on Chronic Illness and Caregiving, January 2001

Ashman, J.J., Conviser R., Pounds, M.B., Associations Between HIV-positive Individuals' Receipt of Ancillary Services and Medical Care Receipt and Retention, *AIDS Care*, 14: S109-S118, 2002.

This article uses data on AIDS and HIV patients who obtained safety-net services cities or states participating in the Health Resources and Services Administration's Client Demonstration Project from January 1997 to the end of 1998. The focus of the research is on the relationship between providing support services (including transportation) and patient attendance in primary care. 28%

of the AIDS patients surveyed used the transportation service offered. Table 5 shows the relationship between receiving ancillary services and retention in primary care.

Table 5. *Odds ratios* of receipt of ancillary services for any medical care, retention in medical care, and greater than the mean number of medical visits*

	Any medical care		Retention in care		# medical visits > mean	
Receipt of ancillary services	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Mental health	1.58	1.48/1.68	1.46	1.36/1.57	2.01	1.89/2.13
Substance abuse	2.55	2.18/2.98	1.49	1.30/1.72	1.95	1.72/2.21
Case management	0.70	0.65/0.76	NS		0.92	0.86/0.99
Housing assistance	1.33	1.24/1.44	0.63	0.57/0.69	NS	
Food bank	1.27	1.20/1.35	NS		1.06	1.01/1.13
Emergency financial assistance	1.14	1.04/1.26	NS		0.89	0.80/0.98
Transportation	1.18	1.11/1.26	1.18	1.09/1.26	NS	
Buddy/companion	0.83	0.76/0.90	0.31	0.27/0.36	0.79	0.72/0.86
Advocacy	1.50	1.41/1.60	1.20	1.12/1.28	1.32	1.24/1.40
Respite	3.05	2.56/3.64	0.83	0.70/0.98	2.67	2.31/3.09

* All odds ratios are significant at $p < 0.05$ unless noted by NS (non-significant).

Aved, B. M., Irwin, M. M., Cummings, L.S., Barriers to Prenatal Care for Low-Income Women, *Western Journal of Medicine*, 158:493-8, 1993.

This research article studies women enrolled in Medi-Cal (California's Medicaid program) admitted into one of eight Sacramento-area emergency rooms to give birth from April to May 1991, without a physician on record. Of the 69 women who listed "no doctor" upon giving birth, 29% never tried to obtain doctor's services because of transportation issues. Women who did seek services but failed to secure care cited transportation issues as the second most important factor preventing them from having a doctor. Distance to doctor's office and the cost of transportation were also factors cited as barriers to care. The article also surveyed reasons that physicians rejected Medi-Cal patients. The perception of low patient compliance both to appointments and instructions were cited as the second highest reason to reject Medi-Cal patients. Table 2 shows the experiences of the women studied and their use of prenatal care.

TABLE 2—*Major Barriers to Prenatal Care Reported by Women, According to Use of Prenatal Care*

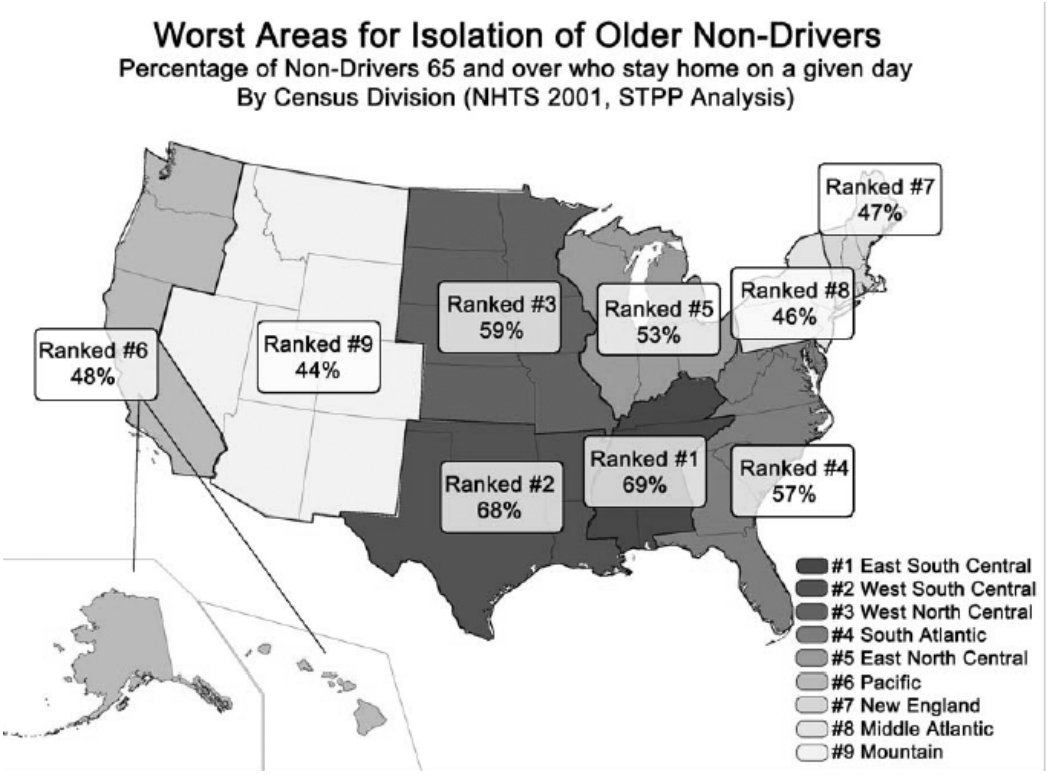
Major Barrier	All Women, (n=69)		Some Care, (n=26)		No Care, Tried, (n=23)		No Care, Did Not Try, (n=20)	
	Rank	%	Rank	%	Rank	%	Rank	%
No one taking new patients	1	64	1	59	1	96	8	35
Transportation	2	53	2	33	2	65	1	65
Fare for transportation	3	37	9	19	5	43	2	55
Distance to care	4	34	6	22	7	35	3	50
Difficulty getting appointment	5	33	4	30	4	48	17	20
Didn't know where to go	6	31	12	15	3	52	10	30
Problems with Medi-Cal	7	29	2	33	6	39	--	--
Child care problems	7	29	5	26	12	22	14	25
Family problems	9	26	6	22	--	--	5	40
Felt fine, no need to go	9	26	12	15	9	26	5	40
Pregnant before, knew all	11	23	22	7	9	26	5	40
Couldn't afford care	11	23	16	11	--	--	4	45
No telephone	11	23	9	19	9	26	14	25
Felt depressed	14	20	16	11	12	22	10	30
Denial of pregnancy	14	20	6	22	--	--	10	30
Attitude of physicians, nurses	--	--	9	19	--	--	--	--
Unaware of pregnancy	--	--	16	11	8	30	--	--
Afraid of examinations	--	--	24	4	--	--	8	35
Hassled about smoking	--	--	24	4	--	--	10	30
Afraid of child custody	--	--	16	11	--	--	--	--
Clinic hours inconvenient	--	--	16	11	--	--	--	--
Couldn't see same physician	--	--	16	11	--	--	--	--
Parents knowing	--	--	22	7	--	--	--	--
Afraid to confirm pregnancy	--	--	24	4	--	--	20	15
Hiding pregnancy from others	--	--	24	4	--	--	20	15
Hassled about drinking	--	--	24	4	--	--	20	15
Provider not responsive	--	--	24	4	--	--	--	--
Don't like doctors	--	--	--	--	--	--	17	20
Long wait during visit	--	--	12	15	--	--	--	--
Ambivalence about pregnancy	--	--	12	15	--	--	14	25
Drug use	--	--	24	4	--	--	17	20

Bailey, L., Aging Americans: Stranded Without Options, Surface Transportation Policy Project, April 2004. http://www.transact.org/report.asp?id=232

This is a policy brief on transportation options for older Americans. Much of the data is derived from the 2001 National Household Travel Survey. Highlights from the Executive Summary include:

- More than one in five (21%) Americans ages 65 and older do not drive. Some reasons include:
- Declining health, eyesight, physical or mental abilities;
- Concern over safety (self-regulation);
- No car or no access to a car;
- Personal preference.
- More than 50% of non-drivers age 65 and older - or 3.6 million Americans stay home on any given day partially because they lack transportation options. The following populations are more heavily affected:

- Rural communities and sprawling suburbs;
- Households with no car;
- Older African-Americans, Latinos and Asian-Americans.
- Older non-drivers have a decreased ability to participate in the community and the economy. Compared with older drivers, older non-drivers in the United States make:
- 15% fewer trips to the doctor;
- 59% fewer shopping trips and visits to restaurants;
- 65% fewer trips for social, family and religious activities.
- Public transportation trips by older non-drivers totaled an estimated 310 million in 2001;
- Older minority populations account for a significant share of these trips, with older African-Americans and Latinos more than twice as likely to use public transportation as their white counterparts.
- More livable communities have lower rates of staying home, and higher rates of public transportation use and walking among non-drivers aged 65 and over.
- 61% of older non-drivers stay home on a given day in more spread-out areas, as compared to 43% in denser areas;
- More than half of older non-drivers use public transportation occasionally in denser areas, as compared to 1 in 20 in more spread-out areas;
- One in three older non-drivers walks on a given day in denser areas, as compared to 1 in 14 in more spread-out areas.



Baren, J., Shofer, F.S., Ivey, B., Reinhard, S., DeGeus, J., Stahmer, S.A., Panettieri R, Hollander, J.E., A Randomized, Controlled Trial of a Simple Emergency Department Intervention to Improve the Rate of Primary Care Follow-up for Patients With Acute Asthma Exacerbations, *Annals of Emergency Medicine*, 38: 115-122, 2001.

Study of whether an intervention in the emergency department impacts the rate of follow-up over a 4-week window with primary care physicians (PCP) for patients aged 16-45 who enters the emergency department for asthma. The study is a randomized, controlled trial in a university emergency department comparing usual care to an intervention that includes a sample of medicine, a transportation voucher and a phone call reminder to schedule an appointment with the PCP. Sample size was 192 over 8 months, with 93% patients completing follow-up. In both control and intervention groups only 53% of patients had their own car, as shown in Table 2 (abbreviated from original document). Those receiving the intervention were significantly more likely to see the PCP, as shown in Table 4; however transportation itself was not a significant predictor of follow-up attendance.

Table 2.
Comparison of intervention and control groups: patient characteristics.

Variable	Control Frequency (%)	Intervention Frequency (%)
Have physician	66 (79.5)	66 (69.5)
Car access	44 (53.0)	51 (53.7)
Transportation to physician		
Taxicab	0 (0)	7 (7.4)
Own car	28 (33.7)	20 (21.1)
Public transportation	27 (32.5)	40 (42.1)
Walked	14 (16.9)	16 (16.8)
Friend/family car	12 (14.5)	8 (8.4)
Transportation to ED		
Taxicab	10 (12.1)	5 (5.3)
Own car	12 (14.5)	17 (17.9)
Public transportation	11 (13.3)	20 (21.1)
Walked	10 (12.1)	5 (5.3)
Friend/family car	28 (33.7)	30 (31.6)
Ambulance	11 (13.3)	18 (19)

Table 4.
Comparison of patients who followed up with PCP visit versus those who did not.

Variable	PCP Follow-up No. (%)	No PCP Follow-up No. (%)	RR	95% CI
Asthma checkups			0.6	0.40, 0.83*
Don't go	24 (35.3)	60 (58.8)		
Once/y	11 (16.2)	8 (7.8)		
Twice/y	6 (8.8)	12 (11.8)		
3–4 times/y	11 (16.2)	11 (10.8)		
>4 times/y	16 (23.5)	11 (10.8)		
Called physician before coming to ED	26 (39.4)	24 (26.7)	1.4	0.96, 2.0
Can get appointment with physician if emergency	49 (83.1)	59 (73.7)	1.4	0.81, 2.4
Intervention	44 (64.7)	51 (46.4)	1.6	1.1, 2.4
Intubations	4 (6.2)	8 (7.6)	0.87	0.38, 2.0
Inhaled steroids	37 (55.0)	38 (34.9)	1.7	1.1, 2.4
Oral steroids	9 (13.6)	14 (12.8)	1.04	0.60, 1.8
Sex: female	52 (76.5)	76 (59.4)	1.3	0.81, 2.0
Ethnicity			0.54	0.37, 0.79
Asian	3 (4.6)	4 (3.7)		
Black	48 (73.9)	98 (89.9)		
Hispanic	1 (1.5)	2 (1.8)		
White	13 (20.0)	5 (4.6)		
Type of insurance			0.33	0.11, 0.96
Government-HMO	25 (37.3)	46 (42.2)		
Government/military	4 (6.0)	3 (2.7)		
HMO	20 (29.8)	18 (16.5)		
None	3 (4.5)	19 (17.4)		
Private	15 (22.4)	23 (21.1)		
Car access	37 (54.4)	58 (52.7)	1.04	0.72, 1.5
Have physician	63 (92.7)	69 (62.7)	4.4	1.9, 10.2
Transportation to physician			1.4	0.94, 1.9
Taxicab	5 (7.4)	2 (1.8)		
Own car	23 (33.8)	25 (22.7)		
Public transportation	22 (32.4)	45 (40.9)		
Walked	9 (13.2)	21 (19.1)		
Friend/family car	9 (13.2)	11 (10.0)		

*$P<.05$.

Bayliss, E.A., Steiner, J.F., Fernald, D.H., Crane, L.A., Main, D.S., Descriptions of Barriers to Self-Care by Persons with Comorbid Chronic Diseases, *Annals of Family Medicine*, 1:15-21, 2003.

This article presents the results of interviews with 16 patients with at least 2 comorbid chronic diseases in urban areas to determine the barriers to self-care. Although this study has good background information on the prevalence of comorbidities, nothing transportation specific is discussed. Of the 125 million Americans suffering chronic conditions, 60 million have more than one chronic condition. Comorbidity is age dependent, such that 69% of Americans 65 and older have 2 or more chronic conditions. On average, Americans over age 60 have 2.2 chronic conditions.

Beland, F., Lemay A., Boucher, M., Patterns of Visits to Hospital-Based Emergency Rooms, *Social Science Medicine*, 47: 165-179, 1998.

This article attempts to understand the patterns of emergency room (ER) visits by assessing the utilization patterns in the one hospital emergency room (311 beds) in Laval, Quebec, an urban area near the metropolis of Montreal. The 14,045 visits sampled from 1981, 1988, 1986, and 1990 were divided into 4 categories: urgent care only available at a hospital, urgent care available at a hospital and other settings, non-urgent care available only at a hospital, and non-urgent care available at a hospital and other settings. These visits are utilized differently by different generations of patients and by patients grouped in other ways- i.e., low income, young and male, etc. These patterns of utilization may be useful in assessing how many emergency visits could be avoided through more regular care.

Bender, B., Milgrom, H., Rand, C., Nonadherence in asthmatic patients: is there a solution to the problem? *Annals of Allergy, Asthma and Immunology*, 79:177-186, 1997.

This meta-analysis on patient compliance with asthma treatment reveals that patients only take 50% of medications they are prescribed. This range is 40-70% nonadherence.

Benway, C.B., Hamrin, V., McMahon, T.J., Initial Appointment Nonattendance in Child and Family Mental Health Clinics, *American Journal of Orthopsychiatry*, 73:419-428, 2003.

This article is something of a literature review on the reasons that patients miss mental health appointments and the efficacy of various interventions intended to increase attendance. The authors found no consistency and some contradictions for reasons that appointments are missed and although there were reports of effective interventions, they were not related to the reasons patients miss appointments. Transportation is discussed, briefly. Table 2 shows the results of the literature review.

Table 2
Reasons Stated for Initial Appointment Nonattendance

Stated reason	*N* (%), Lowman et al. (1984)	*N* (%), Carpenter et al. (1981)	Mean rating, Kourany et al. (1990)	*N* (%), Lai et al. (1997)
The problem got better (no longer in need of help)	21 (29)	29 (28.2)	0.64	15 (39.5)
Found help elsewhere	35 (47)	42 (40.7)	0.52	
Dissatisfaction with application procedure	15 (20)			6 (21.4)
Could not afford services	7 (10)	2 (1.9)	0.54	2 (5.3)
Clinic too far away	4 (6)	2 (1.9)	0.39	8 (21.1)
Fears and expectations about psychiatric treatment		3 (2.9)		
Not able to come at time of appointment		6 (5.8)	0.72	35 (92.1)
Child refused to come			0.20	24 (63.2)
Spouse didn't want them to come			0.20	
Had to wait too long for initial appointment	9 (12)	12 (11.7)	0.40	7 (18.4)

Bishaw, A., Iceland, J., Poverty: 1999, Census 2000 Brief, 2003. www.census.gov

This is a Census 2000 Brief produced by the U.S. Census Bureau in the Department of Commerce on poverty according to the 2000 Census survey of families and their incomes in 1999. The report characterizes the current level and burden of poverty based on age, geography, race/ethnicity, and family type.

Block, B., Branham, R.A., Efforts to Improve the Follow-Up of Patients with Abnormal Papanicolaou Test Results, *Journal of the American Board of Family Practitioners*, 11: 1-11, 1998.

This is a study of the impact on follow-up of patients from 1994-1996 diagnosed with abnormal Pap tests in a family practice clinic in Pittsburgh, Pennsylvania. An intervention to increase follow-up wherein patients were supplied reminder and support services, including round trip coverage of taxi fare if a transportation barrier was expressed, increased attendance compared to pre-intervention attendance rates in 1990 and 1993. Transportation assistance was the most successful intervention reported.

Bostock, L., Pathways of Disadvantage: Walking as a Mode of Transport Among Low-Income Mothers, *Health and Social Care in the Community*, 9:11–18, 2001.

This is qualitative research of low-income mothers and their experiences without cars. The author interviewed 30 mothers on social security benefits in 1996, regarding their experiences without transportation. Many relayed stories of delaying healthcare because of limited access to transportation and the desire to "save up" rides from friends for emergencies only.

Braveman, P. Marchi, K., Egerter, S., Pearl, M., Neuhaus J., Barriers to Timely Prenatal Care Among Women With Insurance: The Importance of Prepregnancy Factors, *Obstetrics and Gynecology*, 95:874-870, 2000.

This is a subsample study of 100,000 postpartum women interviewed at one of 19 California hospitals between August 1994 and July 1995. The subsample of 3071 had public (MediCal) or private insurance throughout their pregnancy, was 18 or older, had family incomes at or below 200% poverty, and lived in California in their first trimester. Despite insurance coverage, 8% of pregnant women did not access available prenatal care in a timely manner due to transportation barriers as shown in Table 2.

Table 2. Factors Associated With Untimely Initiation of Prenatal Care Among Low-Income Women With Continuous Prenatal Coverage in California 1994–1995

	Prevalence of each potential risk factor* % (SE)	Adjusted† OR (95% CI) for untimely initiation among women who knew they were pregnant in the first trimester‡	Adjusted† OR (95% CI) for being unaware of pregnancy during the first trimester§
Sociodemographic Factors¶			
Income 0–100% of poverty level	65.3 (2.6)	1.24 (0.91, 1.68)	1.21 (0.78, 1.86)
Medi-Cal coverage	52.1 (4.2)	1.12 (0.77, 1.63)	1.38 (0.82, 2.31)
Age 18–19 y	12.0 (1.1)	1.34 (0.95, 1.89)	1.94 (1.28, 2.92)
Less than high school education	36.1 (4.0)	1.71 (1.22, 2.40)	0.97 (0.61, 1.54)
High school only	39.8 (3.1)	1.41 (1.02, 1.94)	1.14 (0.74, 1.76)
2nd–4th birth	70.2 (1.5)	1.33 (0.96, 1.85)	1.40 (0.90, 2.16)‖
≥5th birth	8.8 (1.5)	2.04 (1.30, 3.18)	
Unmarried	49.0 (2.9)	1.20 (0.91, 1.57)	1.47 (1.00, 2.15)
Black	12.3 (2.0)	1.33 (0.83, 2.12)	0.92 (0.49, 1.72)
Hispanic (Spanish speaking)	36.6 (1.9)	1.23 (0.79, 1.91)	1.35 (0.74, 2.45)
Hispanic (English speaking)	16.9 (0.8)	1.27 (0.80, 2.02)	1.69 (0.94, 3.04)
Other ethnicity and other language	3.5 (0.6)	0.83 (0.35, 1.98)	1.05 (0.33, 3.29)
Other ethnicity but English speaking	5.6 (1.9)	1.80 (0.89, 3.65)	0.65 (0.18, 2.28)
Knowledge, attitudes, beliefs or behaviors¶			
Lacked knowledge of importance of early care	3.3 (0.6)	2.01 (1.24, 3.27)	
Doubted importance of prenatal care for baby's health	3.6 (0.4)	1.64 (0.94, 2.84)	
Her care was not "very important" to others	9.1 (0.9)	1.36 (0.98, 1.90)	
No regular source of care before pregnancy	21.8 (3.0)	1.37 (1.04, 1.80)	1.27 (0.87, 1.84)
Feared procedures	19.2 (4.4)	1.11 (0.84, 1.47)	
Smoked	15.2 (5.5)	0.98 (0.69, 1.40)	1.52 (1.00, 2.32)
Concerned about confidentiality	5.9 (2.6)	1.00 (0.58, 1.74)	
Preferred another site	12.0 (3.6)	1.22 (0.87, 1.71)	
Unplanned pregnancy	65.8 (4.8)	1.35 (1.03, 1.77)	2.66 (1.68, 4.21)
Unwanted pregnancy	43.1 (1.0)	1.41 (1.11, 1.80)	1.28 (0.93, 1.77)
Feared disclosure of pregnancy	12.7 (2.8)	1.47 (1.06, 2.05)	1.07 (0.69, 1.64)
Stressful circumstances during pregnancy¶			
No social support	4.1 (0.4)	0.95 (0.57, 1.58)	
Separated/divorced	18.8 (2.3)	1.08 (0.82, 1.44)	
Homeless	4.9 (3.3)	1.37 (0.80, 2.36)	
Not enough food	13.2 (1.1)	0.92 (0.62, 1.36)	
Prepregnancy health fair/poor	15.8 (3.0)	0.90 (0.67, 1.21)	
Logistic barriers¶			
Transportation problems	7.9 (0.9)	1.68 (1.16, 2.43)	
Child care problems	10.4 (1.0)	0.86 (0.60, 1.23)	
Problems getting time off	1.4 (0.3)	1.13 (0.51, 2.53)	
Had to try >1 site	4.5 (0.7)	1.58 (0.99, 2.50)	

SE = standard error; OR = odds ratio; CI = confidence interval.

* Among 3071 women aged 18 years or older who lived in California during the first trimester, had family incomes ≥200% of poverty, and had continuous Medi-Cal (n = 1449) or private (n = 1622) coverage before and throughout pregnancy. Estimates weighted to reflect statewide maternity population.

† Adjusted for all variables listed in table with exclusions noted; also adjusted for hospital-based sampling design by including indicator variables representing the study hospitals. Unweighted data.

‡ n = 2676 women in the sample who knew they were pregnant during the first trimester, for whom we had information on all variables in the model (this excluded 4.9% of the total), and had at least one prenatal visit (this excluded 1.4% of the total). Prevalences of the risk factors among this subset are not shown (available on request), but there were negligible differences when compared with prevalences among the entire group (column one of this table).

§ n = 2951 women (all women in sample except those [3.1%] with missing data on any variable in the model).

¶ For each variable, the reference category for the multivariate analyses is omitted from the table.

‖ Comparing second or subsequent birth with first birth.

** Not included in model predicting untimely awareness of pregnancy.

Brown, D.M., *Public Transportation on the Move in Rural America*, Economic Research Services, Department of Agriculture, 2004.
http://www.nal.usda.gov/ric/ricpubs/publictrans.htm

This is a policy brief in response to 2004 Congressional reauthorization opportunities on the benefits of public transportation services in rural areas. Currently, public transit exists in 60% of all rural counties, with a total of 1200 systems. Rural public transit services benefit economic efficiency and reduce the impact of social inequality.

Brown, E.R., Davidson, P.L., Yu, H., Wyn, R., Andersen, R.M., Becerra, L., Razack, N., Effects of Community Factors on Access to Ambulatory Care for Lower-Income Adults in Large Urban Communities, *Inquiry*, 41: 39-56, 2004.

This study examines community factors and their effect on access to ambulatory care using data from low-income, non-elderly, urban residents in the 1995 and 1996 National Health Interview Surveys. The analysis determines the likelihood of visiting a physician over the last year based on individual and community variables.

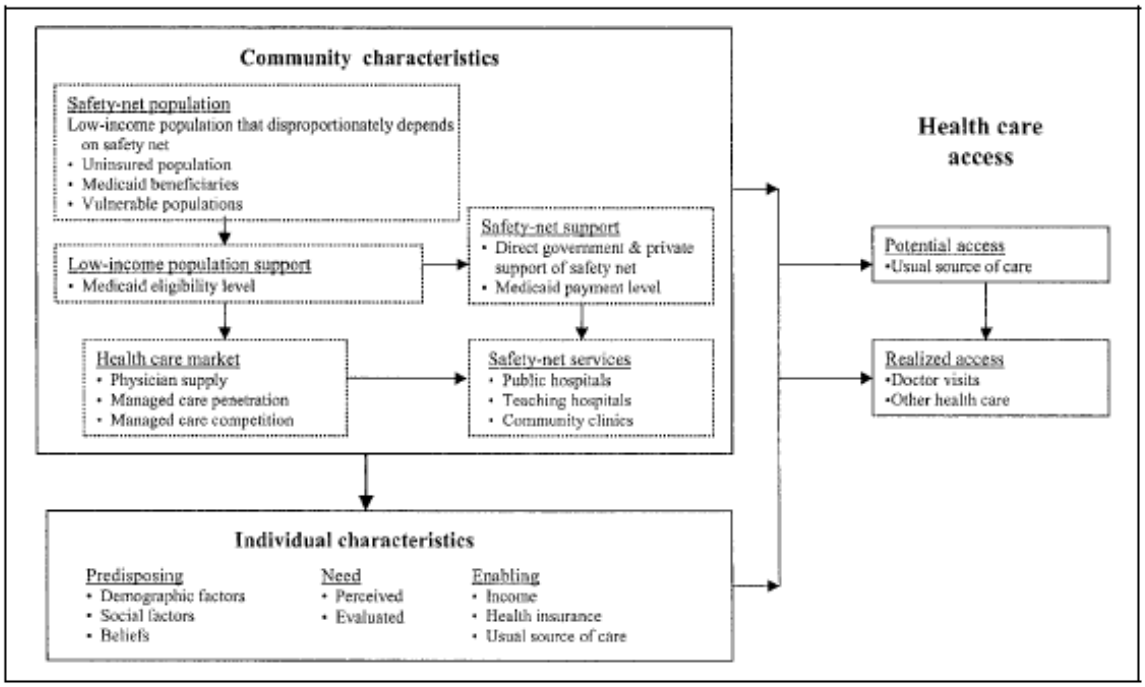


Figure 1. Effects of community characteristics on access to ambulatory care for lower-income adults

Table 6. Multivariate models for probability of physician visit in 12-month period, by insurance status, lower-income adults, ages 19–64, 1995–1996

	Probability of physician visit in last 12 months	
	Odds ratios	
	Uninsured	Insured
Individual-level variables		
Predisposing variables		
Age 19–39 (40–64)	1.041	.914
Female (male)	2.316***	2.138***
Ethnicity (non-Latino white)		
Latino	.869	.951
African American	1.197	1.083
Asian or Pacific Islander	.891	.677**
American Indian/Alaska Native	.942	1.336
Education (beyond high school)		
Not high school graduate	.756**	.698**
High school graduate	.878	.811*
Marital status (not married)		
Married	1.000	1.051
Recent immigrant: <5 years in U.S.? (no)		
Yes	.980	.677*
Enabling variables		
Poverty level (151%–250% of FPL)		
≤50%	1.323*	1.197
51%–100%	.961	1.271
101%–150%	.861	.970
Health insurance (private, Medicare, and other public)		
Uninsured	N/A	N/A
Medicaid	N/A	1.284*
Usual source of care (no source)		
Has usual source of care	2.586***	3.127***
Need variables		
Low health status (not low health status)	2.664***	3.190***
Community variables		
Safety-net population		
% Noncitizen	.990*	N/S
Safety-net support		
Medicaid payments	N/S	1.051*
Safety-net services		
Outpatient visits in teaching hospitals	1.000	N/S
Number of FQHCs in MSA	1.336*	1.246*
Health care market	N/S	N/S

Notes: Odds ratios adjusted for covariates shown in model; ( ) = excluded category.
N/A = not applicable in this model; N/S = not significant in development of the model for this outcome.
* $p \leq .05$.
** $p \leq .01$.
*** $p \leq .001$.

Burkhardt, J.E., Hedrick, J.L., McGavock, A.T., *Assessment of the Economic Impacts of Rural Public Transportation*, TCRP Report 34, Transportation Research Board, 1998.

This document provides guidance to decision makers and transit authorities on the economic impacts of rural public transportation, both in the costs of running a system and in the financial benefits created for a community. Each chapter focuses on a different aspect of the economic impacts associated with public transportation and rural areas, including a section on successful programs that have already been established. The 50% of all rural counties with transit systems

experienced an 11% average net economic growth compared to those counties without public transportation. This document provides a useful guide in assessing transportation costs and benefits.

Burkhardt, J., Hamby, B., McGavock, A.T., *Users' Manual for Assessing Service-Delivery Systems for Rural Passenger Transportation*, TCRP Report 6, Transportation Research Board, 1995.

According to the project description on the TRB website, this document serves to educate transit agencies interested in providing services to rural communities with a step-by-step process for implementing and evaluating the system. There are several case studies of cost efficient rural transit systems. Much of this work appears to be updated in the 1998 rural transportation report by the same author.

Burkhardt, J., Koffman, D., Murray, G., *Economic Benefits of Coordinating Human Service Transportation and Transit Services*, TCRP Report 91, Transportation Research Board, 2003.

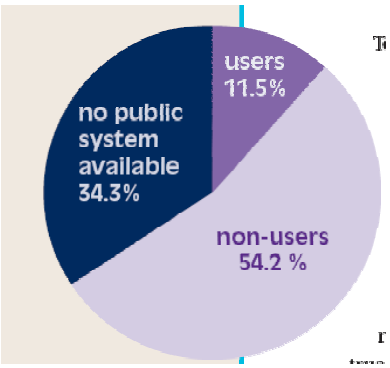
The focus of this paper is on coordination of public transportation to lower overall costs and increase utilization. In discussing access, the executive summary cites examples of moving more Paratransit users onto fixed route lines and the cost savings associated with this transition. There is a set of examples of areas that used school buses during school hours to provide Paratransit services. Another savings in coordination comes from using human services agencies to coordinate Paratransit services and utilize volunteers/donations, or to open bids to Paratransit providers. The article is full of case studies and includes medical access specific information. The following figure appears in the executive summary.

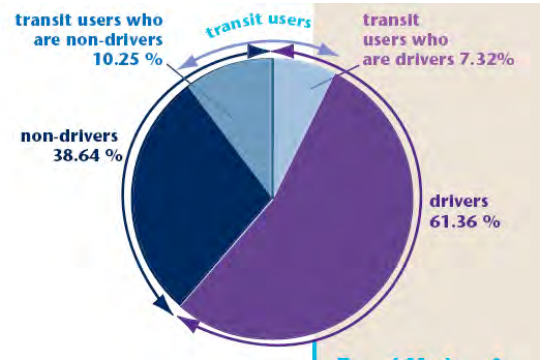
AGGREGATE POTENTIAL INDUSTRY BENEFITS ASSOCIATED WITH VARIOUS TRANSPORTATION COORDINATION STRATEGIES

Strategy	Potential Aggregate Benefits
Additional revenues generated when transit authorities provide trips for Medicaid agency clients	$15,000,000 to $50,000,000
Cost savings realized when nontransit agencies provide ADA and other paratransit services	$30,000,000 to $148,000,000
Cost savings realized when paratransit riders are shifted to fixed route services	$90,000,000 to $300,000,000
Cost savings realized when local human service agencies coordinate their transportation services	$35,000,000 to $60,000,000
Economic benefits realized when transportation services are expanded to areas or populations not now served	$40,000,000 to $132,000,000

Burkhardt, J., McGavock, A.T., Nelson, C.A., *Improving Public Transit Options for Older Persons*, TCRP Report 82, Transportation Research Board, 2002.

This book focuses on public transportation and how the services rendered fit the demand from the senior population. The short run recommendations on meeting this demand include maintaining punctuality, coordination with older representatives and the addition of vehicles that support wheelchairs or stretchers to accommodate a range of abilities among older riders. The authors emphasize coordination and a consumer oriented approach that coordinates rides with a variety of ride and vehicle options to suit the older passenger. The two graphs printed below appear in the executive summary and reflect the current trends in utilization and demand for public transit users. The data is from the National Health Interview Survey of 1994.





Burkhardt, J., McGavock, A., *Researching the Health Care Benefit of Medicare Transportation*, Community Transportation Association of America, Research, 2002.
http://www.ctaa.org/ct/medical2002/research

This report focuses on emergency transportation funded by Medicare. Medicare imposes severe restrictions on transportation that can be reimbursed, however many trips taken in an ambulance could be provided with less cost through Paratransit or public transportation, and would relieve the burden on emergency rooms to provide care. The report cites a GAO study that claimed 50% of ambulance trips were for non-emergency care, although more recent estimates claim only 10%, but the costs are still in the order of $250 million to $1.25 billion transportation dollars.

Burt, C.W., and Schappert, S.M., Ambulatory Care Visits to Physician Offices, Hospital Outpatient Departments, and Emergency Departments: United States, 1999-2000, *National Center for Health Statistics: Vital Health Statistics*, 13:1-70, 2004.

This report presents data from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey from 1999-2000 on all patient visits to physician offices, hospital outpatient departments, and hospital emergency departments based on patient characteristics and presenting condition. Visits to medical specialists were compared to 1993-1994 data. In 1999-2000 there were 979 million visits, at a rate of 3.6 visits per person.

Burton L. C., Anderson G. F., Kues, I. W., Using Electronic Health Records to Help Coordinate Care, *The Milbank Quarterly*, 82: 457-481, 2004.

A paper on multiple chronic health conditions and the higher utilization and medical error associated with these 60 million Americans. Electronic Health Records offer great potential in coordinating care and enhancing communication to reduce errors and lower utilization.

The greatest burden stemming from this lack of easy and effective care coordination is for the 60 million Americans with multiple chronic conditions. Studies have found that people with multiple chronic conditions are more likely to be hospitalized, see a variety of physicians, take several prescription drugs, and be visited at home by health workers. For example, Medicare beneficiaries with five or more chronic conditions fill an average of 48 prescriptions, see 15 different doctors, and receive almost 16 home health visits during one year. Furthermore, the poor coordination of care has been associated with poor clinical outcomes such as unnecessary hospitalization, duplicate tests, conflicting clinical advice, and adverse drug reactions. One study showed that Medicare beneficiaries with four or more chronic conditions were 99 times more likely to have an unnecessary hospitalization during the year than was a beneficiary without a chronic condition… Because people with multiple chronic conditions represent 57 percent of healthcare spending, the potential for cost savings from better coordination of their care is obvious. Equally obvious are the problems associated with poor care coordination: unnecessary hospitalizations, unnecessary nursing home visits, duplicate tests, and adverse drug events.

Canupp, K.C., Waites, K.B., DeVivo, M.J., Richards, J.S., Predicting Compliance With Annual Follow-up Evaluations in Persons With Spinal Cord Injury, *Spinal Cord*, 35: 314-319, 1997.

This is a comparison study of 102 compliant and 61 noncompliant patients who suffered a spinal cord injury between 1977-1986. Noncompliance with follow-up evaluations was associated with access to transportation, as shown in Table 2.

Table 2 Reasons for not returning for scheduled urologic evaluations following spinal cord injury

Variable	*Subjects* (n=*61*) (%)	*Controls* (n=*102*) (%)	P *value*
Cost of examination	44	18	0.0002
Distance to travel	30	12	0.0047
Availability of transportation	25	12	0.0330
Belief that follow-up not necessary	25	0	0.0001
Time involved	10	25	0.0209
Discomfort	7	18	0.0449
Availability of good local doctor	16	0	0.0001
Inconvenience	13	16	0.6539

Card, D., Dobkin, C., Maestas, N., The Impact of Nearly Universal Coverage on Health Care Utilization and Health Evidence from Medicare, NBER Working Papers 10365, March 2004.

This report shows that health care utilization goes up when Americans enroll in Medicare, often for elective procedures, but the rate of growth of mortality does not similarly change. The issues of access to transportation are not addressed (the word 'transportation' does not even appear), but this paper aids in the assessment of moral hazard that might accompany provision of a transportation benefit.

Clancy, C.M., Andresen, E.M., Meeting the Health Care Needs of Persons with Disabilities, *Milbank Quarterly*, 80: 381-391, 2002.

This is a qualitative article on the challenges of patients with disabilities in accessing health care. Transportation is not addressed, but other access issues are. The various barriers to access discussed stem from offices and equipment designed for "able" patients as opposed to the disabled.

Clayton, A.B., Ed., *Older Road Users, The Role of Government and the Processions*, Proceedings of a one-day conference held at the Royal Society of Arts, London, November 1993.

An older compilation of research conducted in Britain and Europe regarding older drivers, public safety related to automobile accidents, and the demand for transportation.

Cleemput, I., Katrien, K., DeGeest, S., A Review of the Literature on the Economics of Noncompliance. Room for Methodological Improvement, *Health Policy*, 59:65-94, 2002.

This is a qualitative review of issues of noncompliance and the methodologies used to study it. Several articles on noncompliance in patient appointment attendance are referenced, providing a good source of additional material to assess the impact of transportation on missed appointments.

Committee on Injury and Poison Prevention, School Bus Transportation of Children With Special Health Care Needs, *Pediatrics*, 108: 516-518, 2001.

This is a review of the safety laws surrounding transportation for children with special needs in school buses. It addresses wheelchair access and issues for children with oxygen or tracheostomies, along with the obligations to provide staff with training and nurses onboard depending on the health needs of the child.

Committee on Injury and Poison Prevention, Transporting Children With Special Health Care Needs, *Pediatrics*, 104: 988-992, 1999.

This review of safety laws for providing transportation for children with special needs discusses wheelchair and seatbelt harnesses and how transportation needs must be included in planning medical care from a healthcare facility. Seat belt restraints and car seats for toddlers through teenagers are described in detail, as are the needs of children with tracheostomies.

Community Transportation Association of America, Medicaid Transportation: Assuring Access to Health Care, A Primer for States, Health Plans, Providers and Advocates, Washington, DC, January 2001.

This primer has federal and state information on Medicaid transportation services with specific state examples.

Community Transportation Association of America, Medical Transportation Tool Kit and Best Practices, Washington, DC, January 2001.

This document contains step-by-step guidance on community transportation services designed to provide non-emergency medical transportation, either provided by state or community funding or through special local programs. The tool kit promises to:

- Understand how community transportation can assist the need many patients have for transportation assistance to medical appointments, pharmacies, dialysis, chemotherapy and other treatments.
- Understand how and when Medicaid pays for transportation for enrollees.
- Discover new funding sources for NEMT.
- Learn how to use transit or other existing transportation providers for patients.
- Learn how to contract for transportation services.
- Understand the issues behind transportation for medical employees.
- Learn how other medical organizations and transportation providers are addressing their medical transportation needs.

Conover, C.J., Whetten-Goldstein, K., The Impact of Ancillary Services on Primary Care Use and Outcomes for HIV/AIDS Patients with Public Insurance Coverage, *AIDS Care*, 14:S59-S71, 2002.

This is a study of 377 adults, over age 18, eligible for public insurance, suffering AIDS or HIV, and seeing physicians in one of three academic hospitals in North Carolina, to determine the impact of support services on primary care utilization, and health outcomes. Transportation fell into the "other" catch-all ancillary service. Transportation problems are self-reported in 16.7% of all patients, as seen in Table 1. From the discussion: *Difficulties in obtaining transportation (a) increased the total number of annual primary care visits; (b) consistently reduced the likelihood of receiving adequate primary care during the year, as noted above; and (c) had no significant effect on whether patients received any primary care.* This effect is shown in Table 4.

Table 1. *Ancillary services needed and received (survey patients)*

	Total patients		Percentage of patients		Percentage of needed who receive
	Service needed	Service received	Service needed	Service received	
Case management	NA	243	NA	64.5%	NA
Basic necessities					
Emergency food	102	83	27.1%	22.0%	81.4%
Nutritional assistance	90	59	23.9%	15.6%	65.6%
Housing assistance	143	96	37.9%	25.5%	67.1%
Illness-related services					
Pharmaceutical assistance	137	111	36.3%	29.4%	81.0%
Mental health	108	85	28.6%	22.5%	78.7%
Substance abuse	43	40	11.4%	10.6%	93.0%
Other support services					
Difficulty in obtaining transporation	63	NA	16.7%	NA	NA
Legal assistance	87	65	23.1%	17.2%	74.7%
Child care	27	15	7.2%	4.0%	55.6%

Table 4. *Ancillary services and receipt of adequate primary care, merged survey/Medicaid Data, all patients*

	Services variables		Plus demographic variables		Plus health status variables		Full specification	
	Coefficient	SE Sig.	Coefficient	SE Sig.	Coefficient	SE Sig.	Coefficient	SE Sig.
Intercept	2.06	0.35***	1.86	1.13*	−0.62	2.36	−0.20	2.58
Support services								
Difficulty in obtaining transportation	−0.97	0.43**	−1.14	0.47**	−1.21	0.59**	−1.18	0.62*
Case management	0.01	0.41	−0.22	0.45	0.11	0.54	−0.03	0.59
Emergency food	−0.18	0.49	0.01	0.53	−0.40	0.61	−0.30	0.64
Nutritional assistance	−0.45	0.47	−0.65	0.50	−0.61	0.64	−0.47	0.69
Housing assistance	0.77	0.51	0.94	0.54*	2.02	0.75***	2.02	0.79***
Mental health	−0.05	0.44	−0.06	0.45	0.35	0.64	0.28	0.68
Pharmaceutical assistance	−0.45	0.39	−0.50	0.43	−0.95	0.57*	−1.04	0.59*
Substance abuse	−1.34	0.55***	−1.78	0.60***	−1.99	0.70***	−2.37	0.78***
Legal assistance	−0.12	0.48	−0.14	0.52	−0.09	0.58	0.01	0.62

Coughlin, J., Transportation And Older Persons: Perceptions and Preferences, A Report on Focus Groups, AARP Public Policy Institute, 2001.

This report details the results of focus groups and interviews with non-institionalized adults over age 75 regarding their perceptions and preferences for transportation. The groups included subsets of suburban and urban nondrivers and suburban drivers. Respondents placed overwhelming preference for the private car as the ideal means of transportation. Urban drivers were most likely to use public transportation. Suburban residents did not know what services were available. Health features only in whether it caused respondents to delay or cancel trips. Public transport was considered unsafe and taxicabs too expensive.

Crane, L.A., Kaplan, C.P., Bastani, R., Scrimshaw, S.C.M., Determinants of Adherence Among Health Department Patients Referred for a Mammogram, *Women and Health*, 24:43-64, 1996.

This is a study of variables impacting adherence among women referred to get a mammogram. In the sample of 576 women over 50 from a federal community health department interviewed one year after a mammogram referral, 39% of non-adherent women experienced transportation barriers, compared to 27% of adherent women. Table 4 shows that transportation barriers predict non-adherence.

TABLE 4: Predictors of Adherence: Stepwise Logistic Regression[a]

Predictors	Beta	Odds Ratio	P value
Transportation barrier	-0.5650	0.57	.02
Fear of immigration authorities	-1.3320	0.26	.008
Control over breast cancer	0.1144	1.12	.01
Self-rated health status	0.3064	1.36	.01
Age 60-64	0.6950	2.00	.008
Provider-patient communication	-0.1027	0.90	.005

[a] All variables significantly related to adherence at the bivariate level were entered into a stepwise logistic regression procedure.

Daly, J., Sindone, A.P., Thompson, D.R., Hancock, K., Chang, E., Davidson, P., Barriers to Participation in and Adherence to Cardiac Rehabilitation Program: A Critical Literature Review, *Progress in Cardiovascular Nursing*, 17:8-17, 2002.

This is a review of the literature on patients who do not attend cardiac rehabilitation programs. Distance and transportation are factors in missing appointments. Patients that miss appointments are older, female, have low education levels, have pessimistic perceptions about the benefits of cardiovascular rehabilitation, suffer angina, and get little physical activity during leisure time. The author review cautions that there are methodological weaknesses behind many of the conclusions.

Damiano, P.C., Momany, E.T., Foster, N.S.J., McLeran H.T., *Transportation of Rural Elders and Access to Health Care,* University of Iowa Public Policy Center and US Dept of Transportation, June 1994.

This is a profile of the demographics, demand for transportation, and current utilization patterns Iowans 75 and older residing in rural areas assessed through a telephone survey of 800 residents and 13 Area Agency on Aging directors and 16 transit managers. Figure 3-4 shows the trip purpose and mode utilized. Table 5-2 shows the funding potential as assessed by AAA and transit personnel for expansion of medical transit programs. Tables 6-4 and –5 focus on the medical care and transportation issues described by the elderly Iowan resident surveyed.

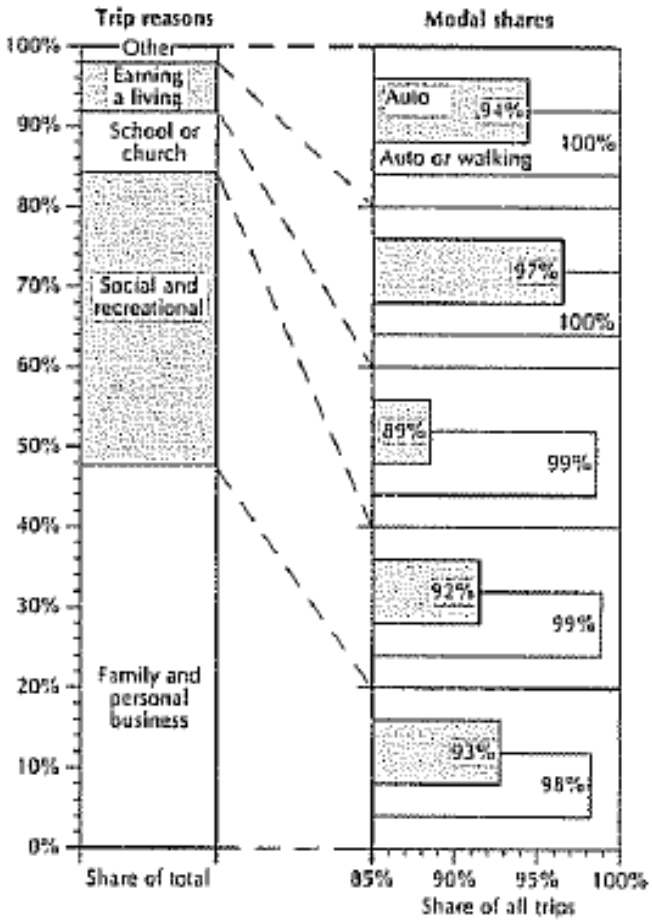


Figure 3–4. Trip purposes and modal shares for automobiles and walking

Table 5–2 Funding sources and their perceived potential for expanding rural elderly transportation services in the future

	High potential	Medium potential	Low potential
AAA contract	1	2	12
Medicaid revenue (Title 19)	2	2	11
Other contracts	2	4	8
Local operating subsidies	2	5	8
Farebox revenue	2	7	6
Public-private partnerships such as grocery shuttles	2	7	6

Table 6–4 Characteristics of vehicles and drivers for trips taken, all trips versus last medical trip taken

Trips taken where elder:	All trips taken yesterday (n=941) Number (percent)	Last medical trip taken (n=345) Number (percent)
Used private automobile	862 (92% of all trips)	311 (90% of all trips)
of which, vehicle used was from elder's household	751 (87% of auto trips)	260 (84% of auto trips)
of which, driver was		
self	626 (73% of auto trips)	189 (61% of auto trips)
spouse or partner	96 (11% of auto trips)	48 (16% of auto trips)
other person	140 (16% of auto trips)	73 (24% of auto trips)
of which,		
brother or sister	13 (9% of other drivers)	2 (3% of other drivers)
son or daughter	60 (43% of other drivers)	40 (55% of other drivers)
grandchild	5 (4% of other drivers)	2 (3% of other drivers)
friend	43 (31% of other drivers)	15 (21% of other drivers)
neighbor	7 (5% of other drivers)	6 (8% of other drivers)
other	12 (9% of other drivers)	8 (11% of other drivers)

Table 6–5 Travel to see a primary care or specialist physician

Proportion of elders who:	Type of physician traveled to: Primary care (n=344)		Specialist (n=129)	
Travel 10 miles or less	69%	(237)	40%	(52)
Travel over 50 miles	5%	(17)	20%	(26)
Travel to a different county	16%	(55)	42%	(54)
Travel to a different state	3%	(10)	9%	(12)
Travel by:				
Private auto	90%	(310)	98%	(126)
Bus	1%	(2)	0%	(0)
Taxi	2%	(5)	0%	(0)
Transit	2%	(7)	1%	(1)
Walking	5%	(18)	0%	(0)
other	1%	(2)	1%	(2)
Drove using a household vehicle	84%	(289)	80%	(103)
Elder was driven by:				
Self	61%	(189)	45%	(57)
Spouse	16%	(48)	18%	(23)
Brother/Sister	1%	(2)	1%	(1)
Son/Daughter	13%	(40)	22%	(28)
Grandchild	1%	(2)	2%	(2)
Friend	5%	(15)	5%	(6)
Neighbor	2%	(6)	2%	(3)
Other	3%	(8)	5%	(6)
Proportion of other drivers who live outside household*	89%	(108)	91%	(63)
Proportion who made compensation				
in money	21%	(15)	20%	(9)
in another form	15%	(11)	15%	(7)

*That is, drivers other than the elder or a spouse.

Davidson, P.L., Andersen, R.M., Wyn, R., Brown, E.R., A Framework for Evaluating Safety-Net and Other Community-Level Factors on Access for Low-Income Populations, *Inquiry*, 41: 21-38, 2004.

This paper presents a policy-oriented framework for assessing individual and community level factors that impact access to safety net healthcare services. Community level factors and data sources are outlined below.

Table 1. Constructing community determinants of access and access outcomes

Domain and indicator	Variable definitions	Geographic unit of observation	Data sources (examples)
Safety-net population			
Percent low-income, nonelderly uninsured	The numerator for the variable includes those with no reported coverage of any kind during the year, who are also nonelderly (<65 years) and low-income (<250% federal poverty level [FPL]) in a defined geographic population. The denominator includes the total area population.	State, Metropolitan Statistical Area (MSA), county	Bureau of the Census, March Current Population Survey, National Health Interview Survey, California Health Interview Survey
Percent low-income, employed, and uninsured	The numerator for the variable includes low-income (<250% FPL), employed persons who are also uninsured. The denominator is the total population in the defined geographic area.	State, MSA, county	March Current Population Survey, National Health Interview Survey, California Health Interview Survey
Percent Medicaid[a]	The number of individuals ages 0–64, who are both low-income and respond that they had Medicaid any time in the past 12 months, is calculated for each geo-area. The denominator is the total population in the defined geographic area.	State, MSA, county	Bureau of the Census, March Current Population Survey, National Health Interview Survey, California Health Interview Survey
Percent female single-headed households	The numerator for the variable includes the number of unmarried females (age 18+) with children in the household. The denominator includes the total population of households with children residing in a defined geographic area.	State, MSA, county	Bureau of the Census, March Current Population Survey
AIDS incidence rates	The numerator for the variable includes the number of individuals testing positive with HIV/AIDS in the state, MSA, or county population. The denominator includes the total population for the defined geographic area.	State, MSA, county	Centers for Disease Control and Prevention (CDC)
Percent immigrant noncitizens <5 years in U.S. 5 to 10 years in U.S. >10 years in U.S.	The numerator for the variable includes the number of immigrant noncitizens present in the state or MSA population. The denominator includes the total population for the defined geographic area.	State, MSA, county	March Current Population Survey, National Health Interview Survey, California Health Interview Survey
Percent homeless	The numerator for the variable includes the percent of homeless individuals in a defined geographic area. The denominator includes the total population for the defined geographic area.	City, county, MSA	Data source not available
Low-income population support			
Medicaid generosity index[a]	Medicaid generosity index is calculated based on each state's individual decisions regarding where to set eligibility levels in a given year for its own population given congressionally mandated minimums. The index is an aggregate of income eligibility levels for the state, weighted for each particular age group's proportion within an applied standardized population.[b]	State	National Governors Association; variable constructed by the UCLA Center for Health Policy Research
Medicaid payments per enrollee	Constructed indicator showing 1997 Medicaid per capita payments for all Medicaid recipients and separately for American Indians/ Alaskan Natives	State	Centers for Medicare & Medicaid Services (CMS) – CMS 2082 and CMS 64 forms Calculations were provided by the Indian Health Service http://www.ihs.gov/nonmedicalprograms/Inf/medicaidpc.htm Refer also to: Finance Working Group Report: The Lewin Report on Medicaid Payments to Hospitals and Related Issues

Table 1. (continued)

Domain and indicator	Variable definitions	Geographic unit of observation	Data sources (examples)
Managed care payments per enrollee	Table 9C in the Uniform Data System, "Managed Care Revenue and Expenses," provides a breakdown of revenues and expenses by payer category Medicaid, Medicare, other public, private, and total. The numerator can be constructed from this table. The denominator is the number of patients served at the federally qualified health centers (FQHCs) located in a defined geographic area. Another option would be state indicators of average monthly Medicaid managed care rates (Holahan, Rangarajan, and Schirmer 1999).	State, MSA, county	Bureau of Primary Health Care Uniform Data System
Safety-net support			
Per capita expenditures awarded by HRSA to FQHCs	The numerator is annual dollars provided to a community health center to subsidize care for low-income uninsured populations served. The denominator is the number of low-income uninsured persons residing in the defined geographic location.	Federally qualified health centers in a state, MSA, county	Bureau of Primary Health Care Uniform Data System
Disproportionate share hospital (DSH) payment rates	The numerator includes expenditures available to directly subsidize safety-net hospitals in a geographic area. The denominator is the total population of uninsured persons, 0–64, residing in the geographic area.	State	CMS-64 Annual Report
DSH payment rates	Data not available	MSA, county	Data source is not available; would require telephone interviews with state and local health officials and hospital associations.
State and local grants, and grants from local charities and foundations	The numerator would be the extent of government and philanthropic funding to provide charity care in a defined geographic area. The denominator would be the number of low-income uninsured persons residing in the geographic area.	State, MSA, county	Comparable data are not collected systematically.
Health care market			
Physician supply	The variable measures the number of non-federally employed MDs who provide total patient care per 1,000 population in a geographic area.	MSA, county	American Medical Association (AM/ Physician Master Files contained i the Area Resource File (ARF)
Number of hospital beds per capita	The numerator is the total number of hospital beds in a geographic area. The denominator is the total population size in the area.	MSA, county	American Hospital Association data (numerator); Census Bureau (denominator)
HMO penetration	HMO total enrollment is divided by the total population in a defined geographic area.	MSA, county	Interstudy
Medicaid penetration	2002 indicators are provided for Medicaid enrollment, managed care enrollment, and percent in managed care.	State	CMS http://www.cms.hhs.gov/ medicaid/managedcare/mmcss02.as
Medicaid managed care penetration	The numerator is the number of individuals enrolled in Medicaid managed care in federally qualified community health centers in a geographic area. The denominator is the total number enrolled in Medicaid in the same area.	MSA, county	Bureau of Primary Health Care Unif Data System
HMO competition	Competition index is calculated by subtracting from 1 the sum of the squared percent of total HMO market share for each HMO operating in a geographic area. A value of 1 indicates several nearly equal competitors; a value close to 0 indicates a monopoly.	MSA, county	Interstudy

Table 1. (continued)

Domain and indicator	Variable definitions	Geographic unit of observation	Data sources (examples)
Safety-net services			
Number of FQHCs per capita for low-income population	The numerator includes the number of FQHCs in a geographic area. The denominator is the number of low-income (≤200% FPL) in the area.	MSA, county	Bureau of Primary Health Care Uniform Data System
Percent outpatient department visits in public hospitals	The numerator is the number of outpatient department visits in the public hospital in the geographic area. The denominator is the size of the low-income population (≤200% FPL) in the geographic area.	MSA, county	American Hospital Association data (numerator); Census Bureau (denominator)
Percent outpatient department visits in a teaching hospital	The numerator is the number of outpatient department visits in the teaching hospital in the geographic area. The denominator is the size of the low-income population (≤200% FPL) in the geographic area.	MSA, county	American Hospital Association data (numerator); Census Bureau (denominator)
Volume of services provided by local health departments	The numerator is the volume and type of services provided by the local health department in a geographic area. The denominator is the size of the low-income population in the area.	State, MSA, county	State and county health departments

[a] Similar variables can be constructed for percentages of Healthy Families enrollees and/or children enrolled in the State Children's Health Insurance Program.
[b] Since each state sets different eligibility levels for different ages, the standardizing ensures the differences in the index are not based on differences due to age structure of the population, but rather due to variations in the eligibility index within an age group. The index measures how likely a person of a certain age is to be eligible for Medicaid in a particular state relative to other states.

Davidson, R.A., Giancola, A., Gast, A., Ho, Janice, Waddell, R., Evaluation of Access, A Primary Care Program for Indigent Patients: Inpatient and Emergency Room Utilization, *Journal of Community Health*, 28: 59-64, 2003.

This study assesses the impact on utilization given a free primary care program is made available to 91 low-income, chronically ill, Florida patients. In before and after implementation comparisons emergency room utilization and costs went down but inpatient admissions did not change. These results aid in determining moral hazard and the effects of providing care.

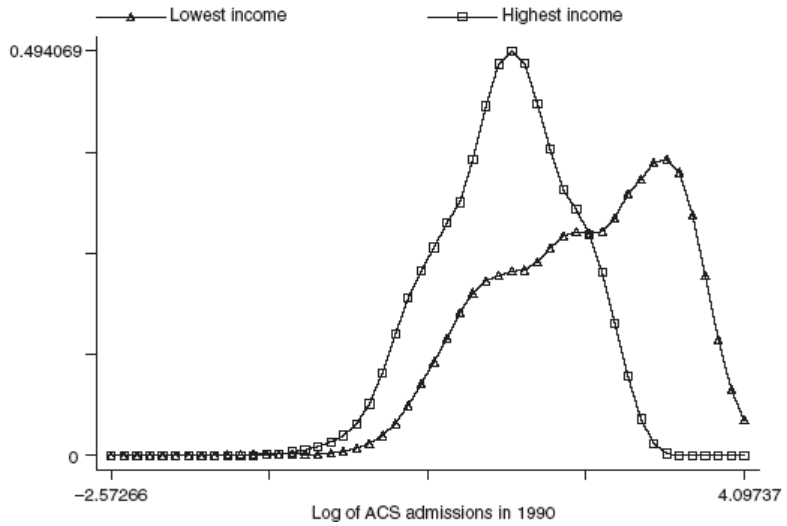
DeJong, G., Palsbo, S.E., Beatty, P.W., National Rehabilitation Hospital Center for Health and Disability Research, The Organization and Financing of Health Services for Persons with Disabilities, *Milbank Quarterly*, 80:261-301, 2002.

This is a qualitative review of the healthcare needs of the disabled. Transportation issues are described in some detail in regard to the limitations of public transit and the poor scheduling options using Paratransit. Legal information pertaining to the Olmstead case and the American Disability Act is also addressed.

DeLia, D., Distributional Issues in the Analysis of Preventable Hospitalizations, *Health Services Research*, 38: 1761-1780.

This study examines the impact of location on preventable hospitalizations, called ambulatory care sensitive admissions, based on zip codes and socioeconomic variables from the US Census and New York state hospital discharge data from 1990-1998. Figure 1 shows preventable hospitalizations by income, demonstrating that lower income patients experience higher ACS. This study addresses the burden of poverty and location on health.

Figure 1: Distribution of the Log of ACS Admissions by Area Income, 1990



Dewees, S., Transportation in Rural Communities: Strategies for Serving Welfare Participants and Low-Income Individuals, Rural Welfare Issue Brief, April 2000.

This issue brief describes transportation challenges for low-income rural dwellers. Highlights of the problem: lack of private vehicle ownership; lack of access to public transportation; and long distances between jobs, childcare sites, and home. The brief includes examples of how strategies that address these needs have succeeded.

Disease Management Association of America, www.dmaa.org

This is a special interest group for healthcare professionals and the healthcare community to explore issues related to disease management. Research documents, conferences and other disease management resources are available.

Drummond, M., Stoddart, G. and Torrance, G. *Methods for the Economic Evaluation of Health Care Programmes*, 1987. New York: Oxford University Press.

This book details the various methods economists can evaluate healthcare programs. Cost effectiveness analysis is explained in detail.

Ebbinghaus, S., Bahrainwala, A.H., Asthma Management by an Inpatient Asthma Care Team, *Pediatric Nursing*, 29: 177-182, 2003.

This is a study of the efficacy of pediatric asthma case management intervention that includes arranging transportation for future appointments, and emphasizes moving patients off the emergency medical system for transit needs. Comparing costs and outcomes pre 1996, before the case management program (IAS) was implemented, and post 1996 showed that the patients in the program had better coordination of care between inpatient and outpatient programs, and reduced length of stay, as shown in Figure 1. Figure 3 shows the reduced readmission rates for patients in the intervention program.

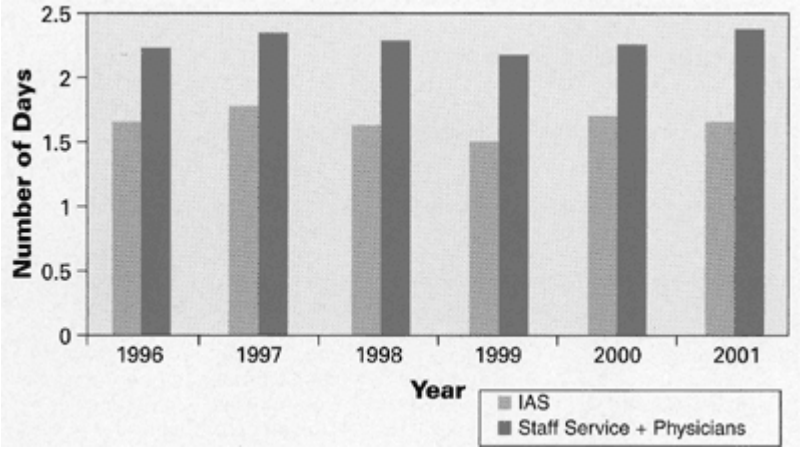


Figure 1. *Average Length of Stay for Asthma Inpatients by Service*

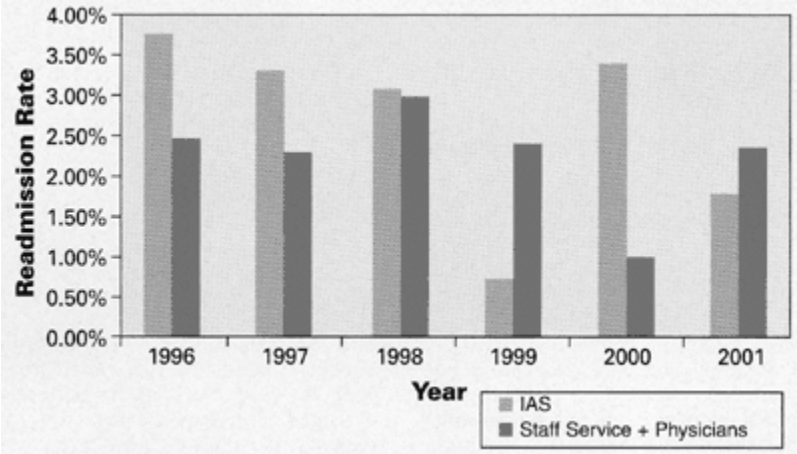


Figure 3. *Readmission Rate for Asthma Inpatients by Service/Year*

ECONorthwest, Parsons Brinckerhoff Quade and Douglas, Inc, *Estimating the Benefits and Costs of Public Transit Projects: A Guidebook for Practitioners CD ROM*, TCRP Report 78, Transportation Research Board, 2002.

This is a CD-ROM that includes both a guidebook and a tool to model the benefits and costs of public transit projects. Although medical transportation is not the focus, the information on costs associated with transportation programs is relevant.

Evans, C., Tavakoli, M., Crawford, B., Use of Quality Adjusted Life Years and Life Years Gained as Benchmarks in Economic Evaluations: A Critical Appraisal, *Health Care Management Science*, 7:43-49, 2004.

This research touches on the methodology of quality adjusted life years as a measure of cost effectiveness, and discusses ways to benchmark results.

Flores, G., Abreu, M., Olivar, M.A., Kastner, B., Access Barriers to Health Care for Latino Children, *Archives of Pediatric Adolescent Medicine*, 152: 1119-1125, 1998.

This is a survey of 203 urban Latino parents bringing children into the Pediatric Latino Clinic at the Boston Medical Center from February 1996 to February 1997 regarding their children's healthcare experiences prior to attending the Pediatric Latino Clinic. The single greatest barrier to access to care for Latino children is a language barrier; however transportation was cited as the greatest barrier by 6% of parents surveyed. 21% of respondents said transportation has been a barrier to accessing care in the past. Of the 42 parents citing transportation problems, 62% said they had no car.

Flores, G., Abreu, M., Chaisson, C.E., Sun, D., Keeping Children Out of Hospitals: Parents' and Physicians' Perspectives on How Pediatric Hospitalizations for Ambulatory Care-Sensitive Conditions Can Be Avoided, *Pediatrics*, 112:1021–1030, 2003.

This article researches the reasons children are hospitalized in cases that could be avoided and the leading causes of these avoidable hospitalization conditions (AHC). The study includes the opinions of parents, PCPs and inpatient attending physicians. Participants were under 18 and were admitted to the inpatient ward of Boston Medical Center from May 1997 through December 1998 with AHC for a total of 676 episodes. Parents responded to a questionnaire, while admitting (IAP) and primary care (PCP) physician interviews were face-to-face or over the telephone. Table 5 shows the results of a regression analysis on the factors related to AHC. According to PCPs, 0.7% of AHC is caused by parent or guardian transportation problems.

TABLE 5. Reasons for Avoidability of Hospitalizations, According to the Parents, PCPs, and IAPs of Hospitalized Children ($N = 554$)

Reason Hospitalization Was Avoidable	Proportion Considered Avoidable by Source		
	Parent	PCP	IAP
Parent/patient-related	35.3%§	71.1%¶	48.1%††
Medication related (adherence problems, ran out, didn't call in refill)	15.8%‡	27.4%	22.7%
Inadequate prevention, including not avoiding known disease trigger	13.5%†	5.9%	7.0%#
Delayed or did not bring child in for follow-up care	2.3%§	33.3%¶	16.8%‡‡
Needed to call earlier	1.5%	1.5%	—
Child not immunized	—	0.7%	—
Did not monitor child's peak flow	—	0.7%	—
No transportation	—	0.7%	—
Appropriate care not provided at home	—	0.7%	—
Parent did not correctly diagnose child's condition	0.8%	—	—
Parents did not adequately educate themselves	—	—	1.1%
Parents don't have enough time to care for child	—	—	0.5%
Physician-related	48.1%§	17.8%¶	36.8%**
Inadequate or no intervention administered to child (including medications and intravenous fluids)	12.8%**	—	22.1%**
Physician did not adequately educate parent/child	10.5%	10.5%	11.4%
Poor quality of care	8.3%	—	—
Physician failed to make diagnosis	7.5%	—	—
No follow-up arranged	3.0%	1.5%	2.1%
Child discharged from hospital too early	2.3%	—	—
Physician failed to act on abnormal laboratory findings	0.8%	—	—
Child not referred to specialist	0.8%	—	0.5%
Long wait to see specialist	0.8%	—	—
Inadequate continuity of care	0.8%	—	—
Physician bias	0.8%	—	—
Inappropriate admission	—	5.2%‖	0.5%†
Primary care physician not contacted after last admission	—	0.7%	—
Primary care physician not involved	—	—	2.1%
Equipment/medication failure	4.5%*	0.7%	1.1%#
Housing conditions	3.0%	2.2%	2.2%
Financial issues	1.5%	—	—
Health care system issues	—	3.7%	3.8%
Social issues	—	1.5%	3.2%
Employment exposure	0.8%	—	—
No reason/don't know	5.3%	3.0%	4.9%
Other	1.5%	—	—

P values for comparison between parents and primary care physicians: * = .03; † = .02; ‡ = .01; § < .001.
P values for comparison between primary care and inpatient attending physicians: ‖ = .004; ¶ < .001.
P values for comparison between parents and inpatient attending physicians: # = .03; ** = .02; †† = .01; ‡‡ < .001.

Friedhoff, S.G., Intensive Case Management of High-Risk Patients in a Family Medicine Residency Setting, *Journal of the American Board of Family Practitioners*, 12:264-269, 1999.

From January to April, 1998, 19 high risk patients in a family medicine residency practice in Mount Holly, New Jersey, were moved into the case management intervention group. Case management included transportation coordination. The residency experienced considerable cost savings ($166,083) as a result of 51% fewer patient days and 46% hospital charges. The case management charges were only 16% of all charges incurred by the case managed patients.

Friedman, J., Dinan, M.A., Masselink, L, Allsbrook, J., Bosworth, H., Bright, C., Oddone, E., McIntosh, M., Schulman, K., Weinfurt, K., *Perceptions of Access and Barriers to Healthcare: A Survey of Durham County, NC*, Duke Clinical Research Institute, November 2003.

Based on a national Kaiser Family Foundation survey of access, this research focuses a very similar set of questions for Durham County, North Carolina. Using a telephone survey of residents and a targeted survey to PrimaHealth IPA Provider Network participants (1131 respondents), the authors studied access issues with a focus on the minority populations in Durham and perceptions of racism as a barrier to care. More detailed questions on transportation barriers are below.

Question	White	Black	Latino	p-value
In the last year, how often had you had trouble getting to doctors' appointments because of lack of transportation?				.0012
Most of the time	0	3	3	
Very often	1	1	7	
Fairly often	0	3	2	
Not too often	6	11	15	
Never	93	83	73	

All results are presented as percentages unless otherwise noted.

Question	White	Black	Latino	p-value
What other problems have you encountered when getting healthcare in the Durham community?				.0000
No Problems	68	66	52	
Difficult to get transportation	0	1	3	
Difficult to find child care	0	1	1	
Inconvenient service times	0	2	1	
Too long of a wait to be seen at a healthcare provider	4	2	7	
Can't get off work	0	0	0	
No insurance	2	5	6	
Do not understand medical directions	0	0	1	
Lack of sensitivity among healthcare providers	1	2	0	
Difficulties in making appointments	1	1	1	
Language barrier with physician	0	0	10	
No translator	0	0	5	
Don't know where to get healthcare	0	0	1	
Lack of trust in healthcare community	0	2	0	
Can't afford medications	1	0	0	
Can't afford visit to clinic/doctor	0	1	0	
Other	16	15	3	
Don't know	8	5	9	

All results are presented as percentages unless otherwise noted.

Friedmann, P.D., Lemon, S.C., Stein, M.D., Transportation and Retention in Outpatient Drug Abuse Treatment Programs, *Journal of Substance Abuse Treatment*, 21:97-103, 2001.

This is a study using data from the Drug Abuse Treatment Outcomes Study (sample size of 1144 patients in an outpatient methadone clinic and 2031 in an outpatient drug-free clinic) on the effects of transportation assistance to improve outpatient treatment retention for patients in drug abuse treatment programs. The provision of a car, van or contracted transportation service improved treatment retention, but vouchers or payment for public transportation did not.

Gibson, M.J., Freiman, M., Gregory, S., Kassner, E., Kochera, A., Mullen, F., Pandya, S., Redfoot, D., Straight, A., Wright, B., *Beyond 50.03: A Report to the Nation on Independent Living and Disability*, AARP Public Policy Institute, 2003.

This is a summary report of a survey administered to 1102 Americans over 50 with a disability. Demographic trends and disability rates are summarized as well as health care coverage and access. The majority of older Americans rely on a private car for transportation. The next most common form of transportation is through rides from friends and family- 8.5% of those 50 and older (over 6 million Americans). Older age, low income, and worse disability increases the rate of dependence on others for rides. 50% of those over 50 complain that depending on others for rides creates problems. 32% of Americans 65 and older with a disability report transportation barriers compared to 4% without disabilities. Despite Americans with Disabilities Act provisions that public transit support travelers with disabilities, very few of the elderly surveyed take advantage of these options.

Gimotty, P.A., Burack, R.C., George, J.A., Delivering Preventive Health Services of Breast Cancer Control: A Longitudinal View of a Randomized Controlled Trial, *Health Services Research*, 37:63-83, 2002.

This is a randomized controlled trial to evaluate physician reminders as a strategy to increase mammography. Data was collected from women over 40 who had not had breast cancer and had made a visit to the health department primary care clinic in Detroit, Michigan from May 1989 to April 1990. Transportation is not mentioned but other factors that account for missed preventive care are described, shown in Table 2.

Table 2: Characteristics of Women with Delayed and Timely Referral by the End of the Intervention Year and the Adjusted Odds Ratios with 95% Confidence Intervals from the Logistic Regression Analysis of Delayed Referral for the Retrospective Case-Control Study

	Delayed Referral Percent n = 195	*Timely Referral Percent n = 337*	*Multivariate Logistic Regression*	
			Odds Ratio	*95% CI*
Age				
40 to 49	13	20	1.0	(0.6, 1.8)
50 To 64	41	51	1.0	–
65 or older	46	29	1.9	(1.1, 3.3)
Health Insurance				
Insured	54	41	1.0	–
Uninsured	46	59	1.0	(0.6, 1.7)
Chronic Illnesses				
None	4	12	1.0	–
One or two	55	61	2.1	(0.9, 4.9)
Three or more	41	27	2.8	(1.1, 6.8)
Previous-Year Visits				
One to three	13	19	1.0	–
Four to six	29	32	1.2	(0.7, 2.2)
Seven or more	58	49	1.4	(0.8, 2.5)
Previous-Year Mammogram				
Yes	9	11	0.8	(0.4, 1.5)
No	91	89	1.0	–
Intervention Assignment				
Intervention	38	60	0.4	(0.3, 0.6)
Usual care	62	40	1.0	–

Glick, H., Cook, J., Kinosian, B., Pitt, B., Bourassa, M.G., Pouleur, H. and Gerth W. 1995. "Costs and Effects of Enalapril Therapy in Patients with Symptomatic Heart Failure: An Economic Analysis of the SOLVD Treatment Trial," *Journal of Cardiac Failure* 1: 371-81.

This article presents the cost-effectiveness evaluation results stemming from primary data of the Studies of Left Ventricular Dysfunction (SOLVD) Treatment Trial. *Therapy with enalapril during the approximate 48-month follow-up period in SOLVD resulted in a gain of 0.16 year of life and savings of dollars 718. During the patient's lifetime, a survival benefit of 0.40 year, a cost per year of life saved of dollars 80, and a cost per quality-adjusted life year of dollars 115 with the use of enalapril were projected.*

Gold, M., Siegel, J., Russell, L., and Weinstein, M. eds., *Cost-Effectiveness in Health and Medicine*, 1996, New York: Oxford University Press.

This book outlines cost-effectiveness analytical methods with a focus on healthcare and medical treatments.

Greineder, D.K., Loane, K.C., Parks, P., A Randomized Controlled Trial of a Pediatric Asthma Outreach Program, *Journal of Allergy and Clinical Immunology*, 103: 436-430, 1999.

This randomized controlled trial of a team case management approach to pediatric asthma care demonstrated that better management can reduce hospitalization rates by 75% compared to controls, emergency room visits by 57% and out-of-health-plan use by 71%. Asthma is the most prevalent chronic condition among children, with nearly 5 million children diagnosed.

Gresenz, C.R., Rogowski, J.A., Escarce, J.J., *Health Care Markets, the Safety Net and Access to Care Among the Uninsured*, 2004, Cambridge, MA: NBER Working Papers 10799.

This article analyzes data on healthcare markets, utilization, and the uninsured using the Medical Expenditure Panel Survey.

Guse, C.E., Richardson, L., Carle,M., Schmidt, K., The Effect of Exit-Interview Patient Education on No-Show Rates at a Family Practice Residency Clinic, *Journal of the American Board of Family Practice*, 16: 399-404, 2003.

This is a study designed to assess the value of exit interviews as a means of reducing missed appointments in a family practice residency clinic in Milwaukee, Wisconsin. There were 146 patients in the intervention group who received an exit interview including clinic policies and patient education following first appointments. Patients who missed appointments or were in 4 clinic sessions not assigned to the intervention made up the 297 patients in the control group. Data from billing records and the 1999 Census were used to analyze socioeconomic variables. Part of the exit interview intervention included conversation/education about transportation. Missed appointments were associated with low income and noncommercial insurance. Table 3 shows the risk of non-attendance given various factors.

Table 3. Relationship of Factors with No-Show Outcome

	Odd Ratios (95% Confidence Interval)	
Factor	Unadjusted	Adjusted*
Exit Interview Intervention	0.71 (0.51, 0.99)	0.71 (0.51, 0.97)
Age <18 years	0.70 (0.53, 0.94)	0.60 (0.44, 0.82)
Commercial insurance	0.57 (0.42, 0.78)	0.49 (0.35, 0.68)
Residential ZIP code median income below $20,000	1.48 (1.10, 1.98)	1.46 (1.09, 1.95)

* Adjusted for 3 other factors in the model and intrasubject variability.

Hasselblad, V., McCrory, D., Meta-Analytic Tools for Medical Decision Making: A Practical Guide, Medical Decision Making, 15:81-96, 1995.

This paper provides a methodology for meta-analysis of medical research using actual examples. The methods include those for combining p-values, for analyzing general fixed-effects models, for analyzing contingency tables, and for analyzing count and continuous outcomes.

Haynes, R., *Geographical Access to Health Care*, Access to Health Care, p.13-35, edited by M. Gulliford and M. Morgan, New York, 2003.

This is a chapter in a book on access issues, published in Britain. The author describes geographic location and transportation issues in health care in general. Figure 2.1 provides a useful diagram of the complexity of this problem.

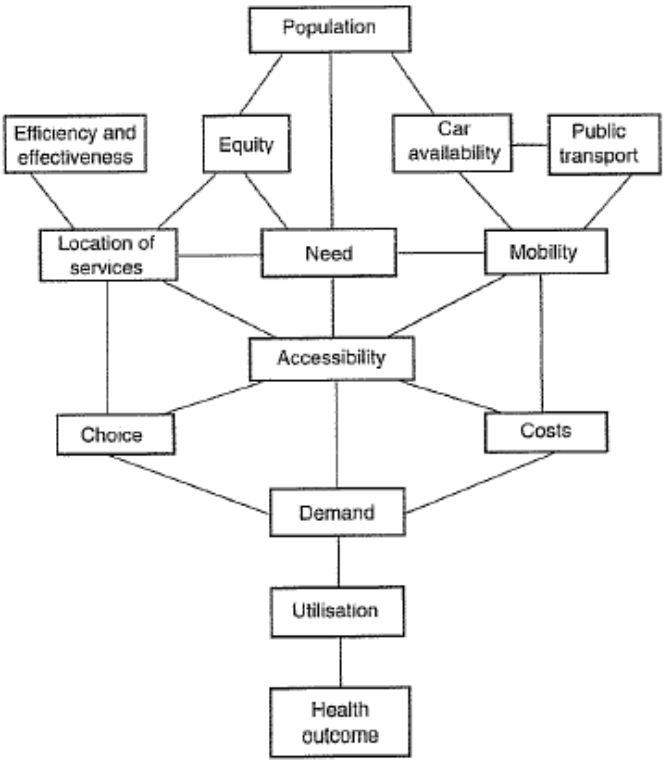


Figure 2.1 Determinants and consequences of geographical access to health care

Health and Retirement Study, University of Michigan Institute for Social Research, http:/hrsonline.isr.umich.edu

According to the website: The University of Michigan Health and Retirement Study (HRS) surveys more than 22,000 Americans over the age of 50 every two years. Supported by the National Institute on Aging (NIA U01AG09740), the study paints an emerging portrait of an aging America's physical and mental health, insurance coverage, financial status, family support systems, labor market status, and retirement planning.

Hetzel L, Smith, A., *The 65 Years and Over Population, 2000,* Census 2000 Brief, 2001.

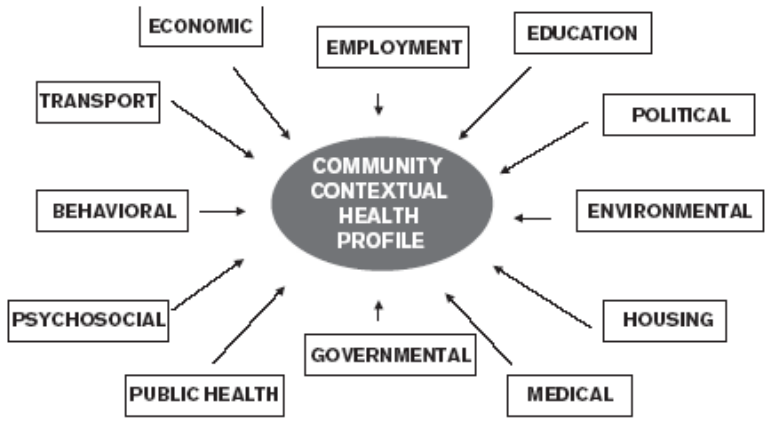
This is a Census 2000 Brief produced by the U.S. Census Bureau in the Department of Commerce on the population in American aged 65 and older. The report characterizes the current rates and projections of age, life expectancy, income, disability status, geography, race/ethnicity, and family type.

Hillemeier, M.M., Lynch, J., Harper, S., Casper, M., Measuring Contextual Characteristics for Community Health, *Health Services Research*, 38:1645-1718, 2003.

Transportation is considered one of 12 dimensions in the study of how to measure community health, as seen in Figure 1, but the issues studied are public health related: injuries and death from motor vehicle accidents, safety in walking, and environmental factors like car pollution and congestion. Access to jobs is also addressed under the transportation dimension. Information on

access to public transportation by neighborhood was through the American Housing Survey. Information on spending and fare revenue for public transit systems was through the National Transit Database.

Figure 1: Twelve Dimensions of the Proposed Community Contextual Health Profile



Hixon, A.L., Chapman, R.W., Nuovo, J., Failure to Keep Clinic Appointments: Implications for Residency Education and Productivity, *Family Medicine*, 31: 627-630, 1999.

This research examines the impact of missed appointments on health providers through a survey administered to all 486 family practice residencies in the U.S. on missed appointments. Of the 60% of clinics that respondent the average, estimated no-show rate was 21%. There was no statistically significant difference in no-show rates between clinics that used reminder systems or not.

Hobson, J., Quiroz-Martinez, J., *Roadblocks to Health: Transportation Barriers to Healthy Communities*, Transportation for Healthy Communities Collaborative, 2002.
www.transcoalition.org

The research focuses on the health of fifteen low-income communities of color in Oakland, California, using geographic information systems (GIS) to study access and transportation barriers and a multi lingual survey of 699 residents. Highlights:

Alameda County

- Only 28% of the residents of Alameda County's disadvantaged neighborhoods have transit access to a hospital, leaving over 160,000 residents without transit access.
- African-American pedestrians in Alameda County are 2.5 times more likely than white pedestrians to be hit by a car and killed or hospitalized.

Contra Costa County

- Contra Costa County's disadvantaged neighborhoods have the worst access of the three counties in this study: 20% of residents have transit access to a hospital, 33% have transit access to a community clinic, and 39% have walking access to a supermarket.

- In four of the county's six neighborhoods, no residents have transit access to a hospital.
- In Monument Corridor neighborhood in Concord, residents suffer from 0% transit access to hospitals and only 1% access to clinics, despite the presence of facilities nearby.
- North Richmond residents have 0% access to hospitals and supermarkets.

Santa Clara County

- Of the three counties studied, Santa Clara County's disadvantaged neighborhoods residents have the best transit access to hospitals and supermarkets.
- Access to hospitals is threatened by the planned closure of the San Jose Medical Center, which would reduce transit access to a hospital from 42% to 0% for residents of downtown San Jose, and from 74% to 48% for residents of East San Jose.
- Residents of suburban Gilroy suffer from poor transit access under all the measures in this report, including 0% access to clinics, 7% transit access to hospitals and 33% to supermarkets.

Ide, B.A., Curry, M.A., Drobnies, B., Factors Related to the Keeping of Appointments by Indigent Clients, *Journal of Health Care for the Poor and Underserved*, 4:21-39, 1993.

A comprehensive study of the clinic and client records from 1986-1987 at the University Medical Hospital in Lafayette, Louisiana, and a sub sample telephone survey of the factors predicting no-shows in an indigent population. Of the 213 in the sample, 155 had missed their last appointment, within the sub sample of 41, all had missed appointments. Results showed that patients living more than 20 miles from the source of care were twice as likely to miss an appointment. Lack of transportation was a leading cause for non-attendance as shown in Table 3.

TABLE 3
CLINIC DIFFERENCES IN CLIENT CHARACTERISTICS FOR INTERVIEW SAMPLE (n=41); NUMBER (PERCENTAGE)

CHARACTERISTIC	CLINIC			
	INTERNAL MEDICINE (n=9)	SURGICAL (n=16)	GYNECOLOGY (n=8)	ORTHOPEDIC (n=8)
Health status				
Very poor	1 (11.1)	0 (0.0)	0 (0.0)	2 (25.0)
Poor	2 (22.2)	6 (37.5)	0 (0.0)	0 (0.0)
Fair	6 (66.7)	5 (31.3)	6 (75.0)	4 (50.0)
Good	0 (0.0)	5 (31.3)	2 (25.0)	2 (25.0)
Living arrangements				
Alone	2 (25.0)	3 (25.0)	2 (28.6)	3 (42.9)
Spouse present	6 (75.0)	8 (66.7)	4 (57.1)	3 (42.9)
Others	0 (0.0)	1 (8.3)	1 (14.3)	1 (14.3)
Help received				
Spouse	1 (22.2)	1 (6.3)	1 (12.5)	1 (12.5)
Friends	6 (66.7)	10 (62.5)	6 (75.0)	5 (62.5)
Agency	1 (11.1)	5 (31.3)	1 (12.5)	2 (25.0)
Why appointment was not kept				
Clinic problem	0 (0.0)	3 (20.0)	1 (12.5)	1 (12.5)
Personal problem	5 (55.6)	5 (33.3)	5 (62.5)	3 (32.5)
Too sick	1 (11.1)	2 (13.3)	0 (0.0)	0 (0.0)
No transportation	3 (33.3)	5 (33.3)	2 (25.0)	4 (50.0)

Institute of Medicine, *Unequal Treatment: What Healthcare Providers Need to Know about Racial and Ethnic Disparities in Health Care.* Washington, D.C.: National Academy Press, 2002.

This report addresses racial and ethnic disparities in healthcare with emphasis on how this impacts healthcare provider's practices. A lack of awareness of disparities, subjective medicine, as opposed to "evidence-based medicine" and too few minority providers contribute to the problem.

Irwin, C.E., Millstein, S.G., Ellen, J.M. Appointment-keeping Behavior in Adolescents: Factors Associated with Follow-Up Appointment Keeping, *Pediatrics*, 92:20-3, 1993.

Interviews/questionnaires with 166 adolescent patients in a California general adolescent medical clinic found that 12.8% of patients failed to keep appointments because of transportation issues. Through the Health Belief Model, the number of perceived negative health outcomes if appointments were missed predicted patient appointment compliance. Parental involvement impacted initial appointment keeping but not follow-up appointment compliance.

Javors, J. R., Bramble, J. E., Uncontrolled Chronic Disease: Patient Non-Compliance or Clinical Mismanagement? *Disease Management*, 6: 169-178, 2003.

This evaluation of patient compliance in a population of chronically ill beneficiaries in a Midwestern company revealed that nearly all the patients were following doctor's orders, but 50% did not have their conditions under control due to clinician behavior. Clinicians that followed national guidelines were highly correlated with patients who had their conditions under control. Patients who did not have their conditions under control had clinicians that were aware of the guidelines but did not agree or misunderstood them. Communication and administrative barriers were also cited as a reason for failure on the clinician's part to adequately follow guidelines.

Jefferson, T., Demicheli, V., Mugford, M., *Elementary Economic Evaluation in Health Care*, BMJ Publishing Group, London, 1996.

This book presents various methods for evaluating the economics of healthcare, including cost of illness studies, healthcare financing and resource allocation, with case studies and real-life examples.

Jorgensen, W.A., Pollvka, B.J., Lennie, T.A., Perceived Adherence to Prescribed or Recommended Standards of Care Among Adults with Diabetes, *The Diabetes Educator*, 28:989-998, 2002.

This is a survey administered to 264 diabetic adults receiving care at a health department clinic, and 111 patients in a non-profit healthcare agency to evaluate how diabetes patients perceived and adhered to the four standards of care: diet, exercise, weight and diabetes self-management education and whether barriers affected either perception or adherence. The most frequent reasons cited for missing appointments and not receiving appropriate care included transportation, as shown in Tables 4 and 5.

Table 4.

Factors in Nonadherence to Diet and Exercise Guidelines

Factors	Clinic	Agency	Total
	n/n (%)	n/n (%)	n/n (%)
If you are not always able to get needed foods, what is the reason?			
Can't always afford it	107/136 (78.7)	20/30 (66.7)	127/166 (76.5)
No transportation to store	22/136 (16.2)	4/30 (13.3)	26/166 (15.7)
Other reasons*†	7/136 (5.1)	6/30 (20.0)	13/166 (7.8)
Prescribed/recommended an exercise regimen	98	46	144
Reasons for no exercise			
Another health problem prevents exercising	20/41 (48.8)	6/15 (40.0)	26/56 (46.4)
Too busy	5/41 (12.2)	2/15 (13.3)	7/56 (12.5)
Don't like to exercise	5/41 (12.2)	2/15 (13.3)	7/56 (12.5)
No one to go with me	2/41 (4.9)	2/15 (13.3)	4/56 (7.1)
No good place to exercise	5/41 (12.2)	2/15 (13.3)	7/56 (12.5)
Exercise makes diabetes difficult to control	2/41 (4.9)	1/15 (6.7)	3/56 (5.4)
No transportation	2/41 (4 9)	0 (0)	2/56 (3 6)

These percentages do not equal 100% because some respondents checked more than one answer.
**Clinic vs agency, P< 01*
†Unspecified reasons for being unable to obtain needed foods.

Table 5.

Frequency of Visits With a Dietitian and Reasons for Not Consulting With a Dietitian

	Clinic		Agency		Total	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
About how many times have you seen a dietitian for diabetes?*	241	1.9 (1.5)	109	1.7 (1.4)	350	1.9 (1.5)
	n/n (%)		n/n (%)		n/n (%)	
Reasons for not seeing dietitian						
Can't afford	8/50 (16.0)		2/25 (8.0)		10/75 (13.3)	
No time	2/50 (4.0)		1/25 (4.0)		3/75 (4.0)	
No transportation	10/50 (20.0)		1/25 (4.0)		11/75 (14.7)	
Not important	5/50 (10.0)		2/25 (8.0)		7/75 (9.3)	
Can't get appointment	0 (0)		3/25 (12.0)		3/75 (4.0)	
Doctor teaches	15/50 (30.0)		8/25 (32.0)		23/75 (30.7)	
Other†	10/50 (20 0)		8/25 (32 0)		18/75 (24 0)	

These percentages do not add up to 100% because some respondents checked more than one answer.
**Responses ranged from 0 to 5 times respondent visited a dietitian*
†Unspecified reasons for not seeing a dietitian

Karter, A.J., Parker, M.M., Moffet, H.H., Ahmed, A.T., Ferrara, A., Liu, J.Y., Selby, J.V., Missed Appointments and Poor Glycemic Control, An Opportunity to Identify High-Risk Diabetic Patients, *Medical Care*, 42:110-115, 2004.

A study of missed appointments and glycemic control/diabetes self management in the 84,040 members of the Kaiser Permanente Northern California Diabetes Registry during 2000. Appointment keeping was measured as no missed, 1- 30% missed and more than 30% missed appointments in the calendar year. Transportation was not specifically measured but mentioned in the discussion. Highlights: The adjusted mean glycosylated hemoglobin (HbA1c) among members who missed more than 30% of scheduled appointments was 0.70 to 0.79 points higher (P <0.0001) relative to those attending all appointments. Patients who missed more than 30% of their appointments were less likely to practice daily self-monitoring of blood glucose and to have poor oral medication refill adherence.

Kaye, H.S., *Mobility Device Use in the United States*, Report #14, National Institute on Disability and Rehabilitation Research, 2000.

This report contains national information on current trends in disability and device use based on the results of the National Health Interview Survey. Table 9 shows the health conditions associated with mobility use, Table 14 shows the rates and types of mobility device use by age and insurance status.

Table 9. Health conditions and impairments reported as the main cause of disability among mobility device users, by type of device: United States civilian noninstitutionalized population, ages 18–64.

	Any mobility device	Wheelchair /Scooter	Cane	Crutches	Walker
	(Number of persons in thousands)				
All conditions	2,169	635	1,465	325	356
Absence or loss of lower extremity	71	29	25	38	10 *
Absence or loss of rib, bone, joint, or muscle of trunk	24	4 *	19	2 *	4 *
Quadraplegia (paralysis of entire body or four limbs)	32	32	0	0	0
Hemiplegia (paralysis of one side of body, including limbs)	18	7 *	15 *	1 *	4 *
Paraplegia (paralysis of both legs)	50	45	3 *	3 *	1 *
Cerebral palsy	48	29	11 *	13 *	3 *
Hemiparesis (partial paralysis of one side of body, including limbs)	11 *	4 *	7 *	2 *	0
Other paralysis	32	15 *	17	7 *	4 *
Curvature of spine or back	11 *	1 *	9 *	0	2 *
Spina bifida	14 *	10 *	2 *	4 *	0
Deformity of lower extremity	18	0	14 *	4 *	1 *
Orthopedic impairment of back or neck	162	20	131	21	21
Orthopedic impairment of shoulder and/or upper extremity	16	4 *	11 *	4 *	3 *
Orthopedic impairment of hip and/or pelvis	29	4 *	20	7 *	4 *
Orthopedic impairment of lower extremity	140	20 *	105	38	18
Orthopedic impairment of other and ill–defined sites	23 *	6 *	16 *	0	3 *
Cancer	30	14 *	19	4 *	8 *
Diabetes	54	21 *	37	5 *	17 *
Mental disorders (excluding mental retardation)	26	9 *	18	4 *	2 *
Alzheimer's and other cerebral degenerations	2 *	2 *	0	0	1 *
Senility without mention of psychosis	2 *	1 *	2 *	0	0
Parkinson's disease	8 *	6 *	6 *	0	7 *
Amyotrophic lateral sclerosis	32	14	18	7 *	2 *
Multiple sclerosis	98	58	52	2 *	31
Other disorders of the central nervous system	39	20	22	3 *	16 *
Mononeuritis, carpal tunnel, and other disorders of the peripheral nervous system	45	20 *	32	2 *	7 *
Hypertensive disease	17	6 *	14	0	5 *
Ischemic heart disease	25	7 *	19	0	7 *
Other forms of heart disease	47	10 *	36	3 *	7 *
Cerebrovascular disease	100	44	74	3 *	18
Other circulatory system disorders	30	10 *	20	4 *	2 *
Emphysema	25	14 *	10 *	0	3 *
Asthma	6 *	1 *	5 *	2 *	3 *
Other diseases of the respiratory system	15	7 *	9 *	2 *	4 *
Rheumatoid arthritis and other inflammatory polyarthropathies	92	21	63	16 *	15 *
Osteoarthrosis and allied disorders	228	31	204	24	34
Spondylosis and allied disorders	33	5 *	26	2 *	9 *
Intervertebral disc disorders	176	20	160	17	27
Osteoporosis	9 *	0	9 *	0	0
Other and unspecified disorders of bone and cartilage	23	2 *	18 *	5 *	0
Chronic injuries or late effects of injuries	69	13 *	27	37	10 *
Other conditions	239	53	161	39	47

Source: National Health Interview Survey on Disability, 1994–95

*Estimate has low statistical reliability (standard error exceeds 30 percent of estimate).

Table 14: Number and proportion of mobility device users and non-users with and without health insurance, by age and type of device: United States civilian noninstitutionalized population.

	Total		No mobility device		Any mobility device		Wheelchair		Scooter		Cane		Crutches		Walker	
	Number (1000s)	%	Number (1000s)	%	Number (1000s)	%	Number (1000s)	%	Number (1000s)	%	Number (1000s)	%	Number (1000s)	%	Number (1000s)	%
All persons †	255,671	100.0	248,963	100.0	6,708	100.0	1,570	100.0	141	100.0	4,678	100.0	559	100.0	1,789	100.0
Insured	214,629	83.9	208,253	83.7	6,376	95.1	1,493	95.1	131	92.8	4,467	95.5	507	90.6	1,734	96.9
Medicare	32,429	12.7	27,571	11.1	4,858	72.4	1,091	69.5	100	71.1	3,532	75.5	236	42.3	1,464	81.8
Medicaid	24,054	9.4	22,768	9.2	1,286	19.2	395	25.2	15 *	10.4 *	798	17.1	119	21.3	394	22.0
Private insurance	180,143	70.5	176,211	70.8	3,932	58.6	843	53.7	88	62.6	2,817	60.2	287	51.3	1,078	60.2
Other	10,147	4.0	9,605	3.9	542	8.1	129	8.2	12 *	8.5 *	407	8.7	69	12.2	103	5.8
Uninsured	41,042	16.1	40,710	16.4	332	4.9	77	4.9	10 *	7.2 *	211	4.5	52	9.4	55	3.1
All persons aged <18 †	68,727	100.0	68,584	100.0	143	100.0	86	100.0	0	0.0	19 *	100.0	36	100.0	27	100.0
Insured	58,170	84.6	58,041	84.6	129	90.4	77	89.4	0	0.0	19 *	100.0	32	88.0	22	83.6
Medicaid	13,018	18.9	12,952	18.9	66	46.2	51	58.9	0	0.0	4 *	21.9 *	9 *	24.3 *	14 *	52.9
Private insurance	43,999	64.0	43,930	64.1	69	48.1	32	36.9	0	0.0	13 *	69.7	24	64.9	9 *	32.7 *
Other	2,806	4.1	2,799	4.1	7 *	5.1 *	5 *	5.9 *	0	0.0	2 *	8.5 *	0	0.0	1 *	2.4 *
Uninsured	10,557	15.4	10,543	15.4	14 *	9.6 *	9 *	10.6 *	0	0.0	0	0.0	4 *	12.0 *	4 *	16.4 *
All persons aged 18-64 †	156,087	100.0	153,822	100.0	2,265	100.0	598	100.0	77	100.0	1,509	100.0	369	100.0	364	100.0
Insured	125,902	80.7	123,920	80.6	1,982	87.5	542	90.5	68	88.7	1,322	87.6	322	87.3	322	88.6
Medicare	3,236	2.1	2,476	1.6	760	33.6	250	41.9	43	55.7	517	34.3	93	25.2	140	38.4
Medicaid	8,847	5.7	8,269	5.4	578	25.5	190	31.8	8 *	10.8 *	346	22.9	85	23.0	123	33.7
Private insurance	113,009	72.4	111,971	72.8	1,038	45.8	270	45.1	41	53.5	693	46.0	177	47.9	146	40.0
Other	5,741	3.7	5,482	3.6	259	11.4	54	9.0	7 *	9.0 *	191	12.7	51	14.0	35	9.6
Uninsured	30,185	19.3	29,902	19.4	283	12.5	57	9.5	9 *	11.3 *	187	12.4	47	12.8	41	11.4
All persons aged 65+ †	30,856	100.0	26,557	100.0	4,299	100.0	886	100.0	64	100.0	3,150	100.0	155	100.0	1,398	100.0
Insured	30,556	99.0	26,292	99.0	4,264	99.2	875	98.8	63	97.8	3,127	99.3	154	99.3	1,389	99.4
Medicare	29,112	94.3	25,017	94.2	4,095	95.3	838	94.7	57	89.5	3,015	95.7	142	91.5	1,323	94.6
Medicaid	2,190	7.1	1,548	5.8	642	14.9	154	17.4	6 *	9.9 *	448	14.2	26	16.7	257	18.4
Private insurance	23,133	75.0	20,309	76.5	2,824	65.7	542	61.2	47	73.5	2,110	67.0	87	56.1	923	66.0
Other	1,599	5.2	1,323	5.0	276	6.4	70	7.9	5 *	7.9 *	214	6.8	17	11.0	68	4.8
Uninsured	301	1.0	266	1.0	35	0.8	11 *	1.2 *	1 *	2.2 *	23	0.7	1 *	0.7 *	9 *	0.6 *

Source: National Health Interview Survey, Disability and Family Resources Supplements, 1994–95

† Population estimates in this table exclude a small fraction of persons whose health insurance status is unknown.

*Estimate has low statistical reliability (standard error exceeds 30 percent of estimate).

Kenagy, G.P., Linsk, N.L., Bruce, D., Warnecke, R., Gordon, A., Wagaw, F., Densham, A., Service Utilization, Service Barriers, and Gender Among HIV-Positive Consumers in Primary Care, *AIDS Patient Care and STDs*, 17: 235-244, 2003.

Study of AIDS/HIV primary care beneficiaries of the Ryan White CARE Act in Chicago to determine the utilization and barriers for primary care services. Of the 161 patients surveyed, 43% reported at least one unmet demand. The most common included transportation (16.8% total, 20.4% of men and 11.5% of women) as shown in Table 2.

Table 2. Percentage of Sample Unable to Obtain Services Because of Cost

Services	*Total sample*[a] N = *161*	*Male* N = *98*	*Female* N = *61*
Adoption/foster care	0.6	1.0	0.0
Alternative therapies*	5.6	9.2	0.0
Day and respite care	2.5	2.0	3.3
Dental care	28.0	29.6	26.2
Direct emergency assistance	9.9	12.2	6.6
Food services	15.5	16.3	14.8
Home health services	1.2	0.0	3.3
Hospice care	0.0	0.0	0.0
Housing service	25.5	29.6	19.7
Legal services/client advocacy	8.1	10.2	4.9
Mental health services	10.6	13.3	6.6
Rehabilitation	3.1	3.1	3.3
Substance abuse treatment	5.6	5.1	6.6
Transportation	16.8	20.4	11.5

*$p < 0.05$.
[a]Includes two transgender people that are not reflected in the male/female categories.

Kindig, D. et al., What New Knowledge Would Help Policymakers Better Balance Investments for Optimal Health Outcomes? *Health Services Research*, 38(6), Part II:1923-1937, December 2003 (A special supplement to HSR on the social determinants of health).

A synthesis of factors which play a role in "producing" good health and a discussion of which factors deserve greater research activity.

Twenty-five years after Grossman's seminal work on the health production function, there is a growing scholarly and policy appreciation that producing health comes from much more than medical care, and that optimizing health outcomes requires a balanced investment strategy across all determinants… This article's purpose is to stimulate research to produce knowledge about cross-sectoral relationships that might be useful to inform policymakers as they develop and implement policies for population health improvement. We do not here establish such relationships but reiterate and emphasize this residual gap between knowing that there are relationships and knowing exactly the order and weight these relationships take. We consider such sectors and factors to be medical care, public health, income and income maintenance, education, land use, air and water quality, agriculture and food processing, housing, social cohesion, political stability, and economic development. We define cross-sectoral to be explicit coordination or reallocation of resources in order to achieve a benefit in maintaining or improving health status for a population.

Kolata, G., Annual Physical Checkup May Be an Empty Ritual, *New York Times*, August 12, 2003.

Newspaper article on the value of physical check-ups every year. The concepts presented here bear on the benefits calculated for providing transit services for missed appointments.

Kulkarni, M., ***Fact Sheet: Medicaid Transportation Services*****, National Health Law Program, June 2000. http://www.healthlaw.org/pubs/200006FactSheet_trans.html**

This is a fact sheet on what the Medicaid program is required by law to provide Americans. Each state plan must ensure that Medicaid patients have necessary transportation to and from health services. Necessary can be defined according to the following:

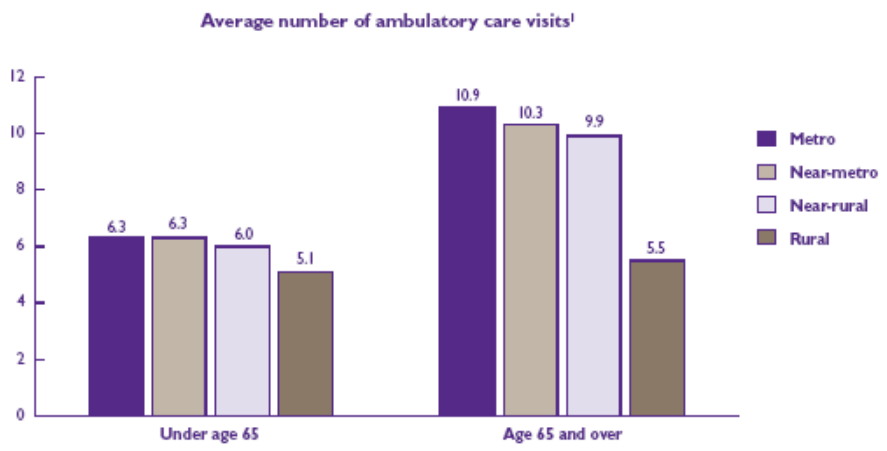
- Transportation to and from Medicaid-covered services;
- The least expensive form available and appropriate for the client;
- To the nearest qualified provider; and
- No other transportation resource is available free of charge.
- Transportation can be funded either as an administrative expense or as a medical service.

Lamberth, E.R., Rothstein, E.P, Hipp, T.J., Souder, R.L., Kennedy, T. I., Faccenda, D.F., Casher, D., Kratz, R.T., Homeier, B.P., Rates of Missed Appointments Among Patients in a Private Practice: Medicaid Compared with Private Insurance, ***Archives of Pediatric and Adolescent Medicine*****, 156:86-7, 2002.**

Over 11-weeks appointments in a suburban/rural pediatric practice in Pennsylvania were evaluated for missed appointments and insurance status. Medicaid patients missed nearly twice as many appointments as privately insured patients.

Larson, S.L., Machlin, S.R., Nixon, A., Zodet, M., *Health Care in Urban and Rural Areas, Combined Years 1998-2000*. Agency for Healthcare Research and Quality, Rockville, MD. MEPS Chartbook, No.13, 2004. AHRQ Pub. No. 04-0050.

This report compares healthcare access, use and costs between urban and rural areas using the metropolitan statistical areas (MSA) designations in the Medical Expenditure Panel Survey data from 1998-2000. More rural residents were elderly, female, and in poor health compared to urban residents. Rural residents had fewer visits than their urban counterparts- a difference that was especially true among elderly rural residents.



Lavizzo-Mourey, R., Smith, V., Sims, R., Taylor, L., Hearing Loss: An Educational and Screening Program for African-American and Latino Elderly, *Journal of the National Medical Association*, 86:53-9, 1994.

This is a study on African-American and Latino elderly to determine the effectiveness of culturally sensitive educational pamphlets and screenings. Of the 296 seniors screened, 174 had abnormal hearing but only 26% obtained further testing. The barriers to follow-up care included problems with finances, transportation and illness.

LeSon, S., Gerswhin, M.E., Risk Factors for Asthmatic Patients Requiring Intubation. I. Observations in Children, *Journal of Asthma*, 32: 285-294, 1995.

This is a study of risk factors for asthma intubation in young adults as potential predictors of death. The sample included all asthmatics 5-12 admitted over a 10-year period to UC Davis Medical Center. Despite comprehensive patient characteristics recorded, transportation was not directly mentioned.

LeSon, S., Gerswhin, M.E., Risk Factors for Asthmatic Patients Requiring Intubation.III. Observations in Young Adults, *Journal of Asthma*, 33: 27-35, 1996.

This is a study of risk factors for intubation in young adults as potential predictors of death. The sample included all asthmatics 20-34 admitted over a 10-year period to UC Davis Medical Center. Transportation is not a variable considered, however other risk factors that correlate with the transportation disadvantaged population are considered.

Lo, W., MacGovern, T., Bradford, J., Association of Ancillary Services With Primary Care Utilization and Retention for Patients With HIV/AIDS, *AIDS Care*, 14: S45-S57, 2002.

A study of 999 patients of Boston's Fenway Community Health Center from 1997 to 1998 to assess HIV and AIDS patients use of support services and subsequent utilization and primary care retention rates. 5.1% of patients needed transportation and 78.4% received it. Table 4 shows the association of transportation with primary care visits.

Table 4. *Comparison of patients in meeting primary care 'standard'*

	% of Patients with at least 1 primary care visit every 6 months			% of Patients with 4 or more primary care visits per year		
Ancillary service	Received (%)	Not received (%)	Significantly different	Received (%)	Not received received (%)	Significantly different
Mental health	70.5	57.1	**	85.3	69.0	**
Case management	63.8	57.8	*	80.1	65.9	**
HDAP	69.1	58.8	*	82.6	71.3	**
Food/nutrition	79.6	57.0	**	89.9	70.3	**
Complementary	73.3	58.8	**	86.0	71.5	**
Housing	72.9	60.0	*	89.9	71.8	**
Transportation	70.0	60.5	NS	92.5	72.6	**
Legal	73.3	60.4	NS	93.3	73.0	*
Translation	40.0	61.1	NS	80.0	73.6	NS
Substance abuse treatment	65.9	60.7	NS	86.4	72.6	*

*$p \leq 0.05$; **$p \leq 0.005$

Logisticare 2003b. *Case Study: The Connecticut Medicaid NET*. www.logisticare.com. Accessed 7/31/03.

This is a commercial white paper on the experience of LogistiCare in providing coordination assistance to the various non-emergency medical transportation service providers in the state of Connecticut.

Logisticare. 2003a. *Case Study: State of Georgia Medicaid NET*. www.logisticare.com. Accessed 7/31/03.

This is a commercial white paper on the benefits of the coordination between LogistiCare and the Georgia Medicaid program to provide cost effective non-emergency medical transportation to Medicaid patients. Georgia reduced costs by 50% and increased services threefold.

Longino, C.F. Jr., Taplin, I.M., How Does the Mobility of the Elderly Affect Health Care Delivery in the USA? *Aging Clinical Experience and Research*, 6: 399-409, 1994.

This research is a qualitative study on how the demands mobile older Americans impact health care delivery, with a focus on migrant workers, veterans, and those transitioning into nursing homes or concentrating into rural areas for retirement.

Long, S.K., Coughlin, T.A., Kendall, S.J., Access to Care Among Disabled Adults on Medicaid, *Health Care Financing Review*; 23: 159-174, 2002.

This article explores in more detail the access issues for disabled Medicaid beneficiaries based on disability subgroups among adult Social Security beneficiaries in New York City from 1999-2000. Those with mental retardation/developmental disabilities and those with increased activities of daily living (ADL) limitations faced the greatest barrier to accessing care. Transportation is not directly addressed however vehicle needs can be extrapolated.

Table 1

Health and Disability Status of Adult SSI Recipients in New York City, by Disabling Condition: 1999-2000

Characteristic	Total Sample	Primary Disabling Condition: Mental Illness	MR/DD	Physical Disability
Sample Size	816	236	285	295
Health Status		Percent		
Very Good/Excellent	14.5	11.6	*31.7	11.0
Good	23.5	23.1	*31.7	21.1
Fair/Poor	61.9	65.3	*36.6	67.8
Needs Assistance				
Neither ADLs or IADLs	25.3	28.8	*14.8	26.2
IADLs Only	31.4	**33.8	*43.6	25.6
1 to 2 ADLs	23.2	22.2	22.6	24.2
3 or More ADLs	20.0	**15.1	19.0	24.0
Needs Assistance with ADLs				
Bathing	30.1	*23.2	33.5	34.1
Dressing	20.0	16.2	**28.4	19.9
Eating	6.4	6.8	7.9	5.6
Transfering	17.3	16.3	*11.6	19.9
Toileting	14.1	*8.7	17.3	17.1
Getting Around Home	27.4	*19.7	*17.5	36.4
Needs Assistance with or Does Not Do IADLs				
Meal Preparation	42.0	37.1	*57.2	40.6
Shopping	57.1	51.0	**66.7	58.3
Finances	37.2	35.3	*68.1	28.4
Telephone	16.5	14.3	*34.1	12.2
Housework	39.3	35.1	42.6	41.4
Medications	29.4	**29.0	*59.3	19.7

* Significantly different from individuals with a physical disability at the 0.01 level.

**Significantly different from individuals with a physical disability at the 0.05 level.

NOTES: SSI is Supplementary Security Income. MR/DD is mental retardation/development disabilities. ADLs are activities of daily living. IADLs are instrumental activities of daily living.

SOURCE: New York Survey of Working-Age Disabled Medicaid Recipients, 1999-2000.

Lovett, A., Haynes, R., Unnenberg, G.S., Gale, S., Car Travel Time and Accessibility by Bus to General Practitioner Services: a study using patient registers and GIS, *Social Science & Medicine*, 55: 97-111, 2002.

Research in the Britain using geographic information systems (GIS) to evaluate accessibility of surgery clinics through public and private transit routes. Highlights: The results indicated that only 10% of residents faced a car journey of more than 10 min to a GP. Some 13% of the population could not reach general medical services by daily bus. For 5% of the population, the car journey to the nearest surgery was longer than 10 min and there was no suitable bus service each weekday. GIS may be a useful way to evaluate accessibility, especially for rural and low-income populations.

Luce, B. R., Zangwill, K. M., Palmer, C. S., Mendelman, P. M., Yan, L., Wolff, M. C., Cho, I., Marcy, S. M., Iacuzio, D., Belshe, R. B., Cost-Effectiveness Analysis of Intranasal Influenza Vaccine for the Prevention of Influenza in Healthy Children, *Pediatrics*, 108: 24-33, 2001

This cost effectiveness analysis focuses on children and shows that administration of the influenza vaccine on an individual basis was $30 for each day of illness avoided. The analysis was sensitive to the cost of the vaccine and its administration. If the study was done on a group basis, the vaccine was cost saving as long as the vaccine cost less than $28.

Majeroni, B.A., Cowan, T., Osborne, J., Graham, R.P., Missed Appointments and Medicaid Managed Care, *Archives of Family Medicine*, 5:507-11, 1996.

This retrospective cohort study of missed appointments in an 18-month period in an urban primary care practice studied the correlation between insurer, age, sex, race, ZIP code and diagnoses. Of all established patients, 48% missed one or more appointment. Medicaid managed care insured patients scheduled and missed more appointments than other insurances.

Mark, D., Hlatky, M., Medical Economics and the Assessment of Value in Cardiovascular Medicine: Part I, *Circulation* 106: 516-20, 2002.

This article presents a framework for analyzing advances in cardiovascular care through medical economics. A glossary on economic terms that apply to medical evaluations is included. The following methods are discussed as they pertain to comparisons of new technology to standard care.

Outcomes of Comparing a New Therapy and a Standard Therapy

	Clinical Effectiveness		
Net Cost	New>Std	New=Std	New<Std
New>Std	CEA	Standard Rx cost-saving	Standard Rx dominant
New=Std	New Rx more effective	Toss-up	Standard Rx more effective
New<Std	New Rx dominant	New cost-saving	CEA

Std indicates standard therapy; CEA, cost-effectiveness analysis; and Rx, therapy.

McClure, R.J., Newell, S.J., Edwards, S., Patient Characteristics Affecting Attendance At General Outpatient Clinics, *Archives of Disease in Childhood*, 74: 121-125, 1996.

Results from a survey administered to parents of 359 children over 6-months at a general clinic in Leeds, England showed two distinct categories of attenders and non-attenders. 36% of non-attenders used a car, compared to 63% of attenders. Non-attenders also spent 8 minutes more than attenders getting to appointments. The parent's perception of the severity of illness was not a factor in attendance, indicating that logistical and social factors are behind non-attendance.

McCray, T., Delivering Healthy Babies: Transportation and Health Care Access, *Planning Practice and Research* 15: 17-29, 2000.

This is a study of how transportation patterns and access impact prenatal care using data from Detroit, MI and South Africa. Infant mortality is greatly reduced by prenatal care, however

pregnant women are unlikely to access healthcare if transportation services are unavailable or unreliable.

McCray, T., *Promoting the Journey to Health: Healthcare Access and Transportation in Rural South Africa*, University of Michigan, Ph.D. Dissertation, 2001.

A precursor to McCray's other article, this study analyzes data from South Africa that shows pregnant women's access to healthcare is impacted by transportation resources, including safety at public transit stops and reliability of transit systems.

McNeil, J., *Americans with Disabilities: Current Population Reports – 1997*, February 2001.

This profile of Americans with disabilities from the 1997 Survey of Income and Program Participation documents the type and magnitude of disability in the United States in 1997. 27.9% of severely disabled adults live below the poverty line, compared to 8.3% of non-disabled adults. Additional statistics are shown below.

Table A.
Selected Disability Measures: 1997

[Numbers in thousands]

Categories	Number with specified characteristic (in thousands)		Percent with specified characteristic	
	Number	90-percent confidence interval (±)	Percent	90-percent confidence interval (±)
All ages	267,665	(X)	100.0	(X)
With a disability	52,596	814	19.7	0.3
Severe disability	32,970	673	12.3	0.3
Needed personal assistance with an ADL or IADL	10,076	390	3.8	0.1
Age 15 years and over	208,059	(X)	100.0	(X)
Used a wheelchair	2,155	183	1.0	0.1
Used a cane, crutches, or walker (not a wheelchair)	6,372	313	3.1	0.2
Had difficulty seeing	7,673	342	3.7	0.2
Unable to see	1,768	166	0.8	0.1
Had difficulty hearing	7,966	348	3.8	0.2
Unable to hear	832	114	0.4	0.1
Age 25 to 64 years				
With any disability	26,493	612	100.0	(X)
In poverty	5,669	295	21.4	1.0
With a nonsevere disability	9,794	385	100.0	(X)
In poverty	1,018	126	10.4	1.2
With a severe disability	16,700	496	100.0	(X)
In poverty	4,651	268	27.9	1.4
No disability	112,604	1,007	100.0	(X)
In poverty	9,376	377	8.3	0.3

(X) Not applicable.
Note: See box on page 2 for a description of ADLs and IADLs.
Source: U.S. Census Bureau, 1996 Survey of Income and Program Participation: August - November 1997.

Messeri, P.A., Abramson, D.M., Aidala, A.A., Lee, F., Lee, G., The Impact of Ancillary HIV Services on Engagement in Medical Care in New York City, *AIDS Care*, 14: S15-S29, 2002.

Longitudinal data on 577 HIV positive adults in New York City was used to examine the effect of ancillary support services on the number of HIV patients entering and retaining medical care. Transportation was identified as a logistical need that could be addressed with advice/education on how to access rides or more practical help. Ancillary service provision was associated with increased entry and continuity, especially when the service provided met a documented need.

Table 5. *Relationship of HIV ancillary services and selected medical care outcomes (odds ratios): New York City CHAIN cohort, 1995–1998*

	Entry into care to any medical provider ($n = 203$)		Entry into appropriate medical care ($n = 483$)		Continuity with any medical provider ($n = 1{,}650$)		Continuity in appropriate medical care ($n = 1{,}360$)	
Service	Without need	With need	Without need	With need	Without need	With need	Without need	With need
Transportation								
Alone	NA	0.9	NA	0.9	NA	0.8	NA	1.4
With other services	NA	0.2	NA	0.4	NA	0.8	NA	1.0
Lagged service	NA	NA[4]	NA	4.8**	NA	1.3	NA	1.3
Medical case management								
Alone	3.5*	3.1	1.6	0.9	0.9	1.0	1.1	2.3***
With other services	2.0	1.4	1.1	0.4	0.9	0.9	1.2	1.2
Lagged service	0.2	0.2	1.1	2.7	0.9	1.0	1.3	2.4
Case management counselling								
Alone	3.7**	3.5	2.1	2.0	1.1	1.1	0.9	2.6***
With other services	NA[3]	NA[3]	1.1	0.7	1.3	0.8	0.8	1.3
Lagged service	5.9	0.8	0.6	0.3	1.2	1.4	1.0	1.1
Case management social service								
Alone	3.1**	9.4**	2.2	3.3**	1.1	1.3	0.9	2.9***
With other services	1.9	5.9	1.7	5.7**	1.0	1.7	0.9	2.0*
Lagged service	2.8	13.3	3.2*	4.3	0.9	1.0	0.7	2.2
Therapeutic drug treatment								
Alone	2.2	8.1**	2.4	2.2	1.0	1.0	1.3	1.5
With other services	1.9	3.8	2.0	1.6	1.0	1.0	1.2	1.3
Lagged service	1.8	2.1	1.3	1.2	0.7	0.9	1.1	1.2
Self-help drug treatment								
Alone	1.9	6.4**	2.3	2.5*	0.9	0.8	1.2	2.3***
With other services	1.4	1.5	1.7	1.5*	0.9	0.8	1.1	1.8*
Lagged service	0.3	0.8	1.9	3.3*	1.0	1.0	1.2	1.0
Mental health								
Alone	5.5***	7.3**	2.4	2.1*	0.9	1.2	1.5	1.5
With other services	4.2**	7.0*	1.9*	1.7	0.9	1.2	1.4*	1.2
Lagged service	7.1**	15.5**	0.8	1.6	1.0	1.2	1.2	1.2
Housing								
Alone	NA	3.8*	NA	1.4	NA	1.0	NA	2.5***
With other services	NA	2.1	NA	1.0	NA	0.9	NA	2.3***
Lagged service	NA	2.1	NA	3.2**	NA	1.0	NA	1.4

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Notes. [1]Odds ratios are adjusted for gender, race/ethnicity, t-cell counts, educational attainment and secular trend; [2]the impact of ancillary services among individuals in need of those services is derived as the sum of the odds ratios of the main service effects and by the odds ratios of the associated interaction terms (not pictured). Impact odds ratios are not available for all ancillary services, since some services (transportation, housing, drug treatment) are measured only for those who express a need. For these services there is no calculated interaction term of service x need; [3]this variable is dropped due to high colinearity between case management counselling and case management social service; [4]transportation service is dropped due to small cases. In the entry into care for any medical provider, 11 people received the service among 39 people who expressed transportation need. Among this 11 who received the service, only one stayed without a medical provider in the next wave, compared to ten who entered into medical care.

Milliman Care Guidelines, www.careguidelines.com

This is a commercial product designed to support clinical healthcare providers by providing evidence-based practices at the point of care. The Care Guidelines cover inpatient and outpatient services, as well as home care, long-term care, and other specialty services.

Mishan, E., *Cost-Benefit Analysis*, 4th Edition, Unwin Hyman, London, 1988.

This textbook explains the methodology of cost-benefit analysis with case studies.

MMWR, Facilitating Influenza and Pneumococcal Vaccination Through Standing Orders Programs, *Morbidity and Mortality Weekly Report*, 52: 68-69, 2003.

This is an update of the Advisory Committee on Immunization Practices (ACIP) recommendations on the use of the influenza and pneumococcal vaccines. Influenza can be relatively harmless but can cause hospitalizations and sometimes death in young children and the elderly, who are considered most at risk. *The primary target groups recommended for annual vaccination are 1) persons at increased risk for influenza-related complications (e.g., those aged ≥65 years, children aged 6--23 months, pregnant women, and persons of any age with certain chronic medical conditions); 2) persons aged 50--64 years because this group has an elevated prevalence of certain chronic medical conditions; and 3) persons who live with or care for persons at high risk (e.g., health-care workers and household contacts who have frequent contact with persons at high risk and who can transmit influenza to those persons at high risk).* The vaccine prevents influenza in 70-90% of adults under age 65. Efficacy results in children vary, with the lowest estimate at 30% of children protected against the virus. Among the elderly who are not in nursing homes, the vaccine protects against hospitalization for 30-70% of users.

Cost effectiveness studies of the influenza vaccine estimated a cost of approximately $60--$4,000/illness averted among healthy persons aged 18--64 years, depending on the cost of vaccination, the influenza attack rate, and vaccine effectiveness against influenza-like illness. Another cost-benefit economic model estimated an average annual savings of $13.66/person vaccinated. Among persons aged ≥65 years, vaccination resulted in a net savings per quality-adjusted life year (QALY) gained and resulted in costs of $23--$256/QALY among younger age groups. Additional studies of the relative cost-effectiveness and cost utility of influenza vaccination among children and among adults aged <65 years are needed and should be designed to account for year-to-year variations in influenza attack rates, illness severity, and vaccine efficacy when evaluating the long-term costs and benefits of annual vaccination.

Table 2 shows vaccine coverage rates by age group according to 2002 NHIS data.

TABLE 2. Influenza vaccination coverage rates among adult target* population groups — United States, National Health Interview Survey, 2002 (n =31,044 [crude] and 205,825,095 [weighted])

Population group	Crude sample size	Weighted sample size	Influenza vaccination rate (%)	(95% CI)†
All aged 50–64 years	6,424	42,946,096	34.0	(32.7–35.3)
Aged 50–64 years and not at high risk§	4,373	29,521,511	29.7	(28.2– 31.2)
All aged ≥65 years	5,757	32,524,974	65.6	(64.1–67.0)
Persons with high-risk conditions§				
Aged 18–49 years	2,428	16,983,876	23.1	(21.1–25.2)
Aged 50–64 years	1,969	12,925,647	43.6	(41.2–46.0)
Pregnant women¶	319	2,119,391	12.4	(8.5–16.3)
Health-care workers**	2,066	13,850,828	38.4	(35.9–40.9)
Household contacts of persons at high risk††				
Aged 18–64 years	3,127	24,298,165	18.1	(16.5–19.7)
Aged 18–49 years	2,654	20,450,993	14.6	(12.9–16.3)
Aged 50–64 years	473	3,847,172	36.3	(31.7–40.9)

* As recommended by the Advisory Committee on Immunization Practices.
† CI = Confidence interval.
§ Persons categorized as being at high risk for influenza-related complications self-reported one or more of the following: 1) ever being told by a physician they had diabetes, emphysema, coronary heart disease, angina, heart attack, or other heart condition; 2) having a diagnosis of cancer in the past 12 months (excluding nonmelanoma skin cancer) or ever being told by a physician they have lymphoma, leukemia, or blood cancer in the past 12 months; 3) being told by a physician they have chronic bronchitis or weak or failing kidneys; or 4) reporting an asthma episode or attack in the past 12 months.
¶ Aged 18–44 years, pregnant at the time of the survey and without high-risk conditions.
** Adults were classified as health-care workers if they were currently employed in a health-care occupation or in a health-care industry setting, on the basis of standard occupation and industry categories recoded in groups by CDC's National Center for Health Statistics.
†† Interviewed adult in each household containing at least one of the following: a child aged <2 years, an adult aged ≥65 years, or any person aged 2–64 years at high risk (see previous footnote §).

Moran, C.M., Hletko, P., Darden, P.M., Reigart, J.R., Transportation: A Barrier to Health Care for Rural Children? *The eJournal of the South Carolina Medical Association*, 99:261-268, 2003.

This is a study of access to care in rural Georgetown County, South Carolina through the administration of a 42 question, multiple-choice questionnaire to 341 caretakers whose patients received care at two health care systems emergency rooms serving the county in 2000. Tables 2, 3 and 4 profile the transportation barriers existing within the various subpopulations of the sample and the associated health care utilization. Table 5 shows the association of belief in the health care system with emergency room visits.

FACTOR	PERCENT OF GROUP WITH RIDE PROBLEMS N=42	PERCENT OF GROUP WITHOUT RIDE PROBLEMS N=293	PROBABILITY (chi square)
Black/African American race	82.5	65.3	0.0294
High school diploma or less	71.4	56.8	0.0718
Single parent	33.3	57.9	0.0041
More than two children less than 6yo home	90.5	96.9	0.0429
Believe in need for well child care	92.7	79.8	0.0473
Believe in need for child to have own doctor	94.9	97.8	0.281
Believe there are enough doctors for children in Georgetown County	57.5	57.6	0.9873
Believe ED can take better care of children then a doctor's office	89.2	80.7	0.2108
Believe that ED can do everything for children that a doctor's office can do	64.1	63.7	0.9582

Table 2

FACTOR	PERCENT OF GROUP WITH RIDE PROBLEMS N=42	PERCENT OF GROUP WITHOUT RIDE PROBLEMS N=293	PROBABILITY (chi square)
Household does not own a car	69.1	20.1	<0.0001
Child has own doctor	95.1	94.7	0.9021
Ride problems to other medical places (medicaid, WIC offices)	66.7	6.2	<0.0001
Has to pay cash for ride to child's doctor	85.4	21.5	<0.0001
Payor source=medicaid or self pay	90.00	71.4	0.0124
Ever NOT SEEN when caretaker thought child needed to be seen because of lack of ride	61.9	9	<0.0001
Child's home has mail delivered	69.1	74.8	0.4236
Child's home has a telephone	78.6	82.3	0.5563
Child's home is in rural area	38.1	52.7	0.0761
30 minute or less travel time to child's regular source of care	61	71	0.1951

Table 3

FACTOR	PERCENT OF GROUP WITH RIDE PROBLEMS N=42	PERCENT OF GROUP WITHOUT RIDE PROBLEMS N=293	PROBABILITY (chi square)
Perceived health of child as good or excellent	73.8	83.3	0.1317
Child perceived as vulnerable	11.9	6.5	0.2002
Child has had a well check in previous 12 months (for those children less than 7yo; N=32 and 191)	84.4	85.9	0.8241
Child has been to ED in previous 12 months	40.5	54.5	0.0898

Table 4

Factor	Has been to ED in last 12 months N=153	Has not been to ED in last 12 months N=170	p-value
Child has not had a well check in the previous 12 months	14.7%	22.8%	0.0655
Child has his/her own physician	96%	93%	0.30
Caretaker does not believe in need for well care	15.8%	21.3%	0.19
Caretaker does not believe in need for child to have own physician	3.3%	1.9%	0.41

Table 5

Mulder, P.L., Shellenberger, S., Streiegel, R., Jumper-Thurman, P., Danda, C.E., Kenkel, M.B., Constantine, M.G., Sears, S.F.Jr., Kalodner, M., Hager, A., *The Behavioral Health Care Needs of Rural Women*, Report Of The Rural Women's Work Group and the Committee on Rural Health Of the American Psychological Association, September 2000. www.apa.org/rural/ruralwomen.pdf.

According to the executive summary, commonly cited barriers to treatment include low population density; geographical distance from large metropolitan areas; isolation; inclement weather; geographic barriers; dense social networks; patriarchal or traditionalist social structures; a culture of self-sufficiency; and fewer economic resources. Many families do not have telephones; many families do not have automobiles, and public transportation is almost never available in rural areas. Cost is consistently listed as the main deterrent to health care, including mental health services. Rural women are less likely to have health insurance than males because of the lack of employment opportunities and poverty. Rural residents are frequently unaware of the various entitlement programs available to them and the rural population struggles with a limited tax base to fund needed services, resulting in underfunding and understaffing of health care centers, further exacerbating the problem.

National Asthma Education and Prevention Program, Expert Panel Report 2: *Guidelines for the Diagnosis and Management of Asthma*, National Institutes of Health, 1997. Publication No. 97-4051.

Overview of asthma in children and adults including symptoms to track, goals for disease management and drugs that are approved and recommended for different stages of the disease.

Nemet, G.F., Bailey, A.J., Distance and Health Care Utilization Among the Rural Elderly, *Social Science and Medicine*, 50:1197-1208, 2000.

This research focuses on the distance from health care services and the impact on utilization among rural elderly in Vermont assessed through a mailed survey to 20 random elderly residents of Orleans County. Although there is some evidence that distance impacts utilization, the sample size is too small to draw a significant conclusion.

Newacheck, P.W., Hung, Y.Y., Park, J., Brindis, C.D., Irwin, C.E.Jr, Disparities in Adolescent Health and Health Care: Does Socioeconomic Status Matter? *Health Services Research*, 38:1235-1252, 2003.

A study using 1999-2000 NHIS data to analyze access for children aged 10-18. Transportation barriers are only mentioned in the conclusion, but this article characterizes access for a low-income population well. Results for medical information are shown in Figure 1, access issues are in Figure 3.

Figure 1: Health Status of Adolescents by Income: U.S. 1999 and 2000

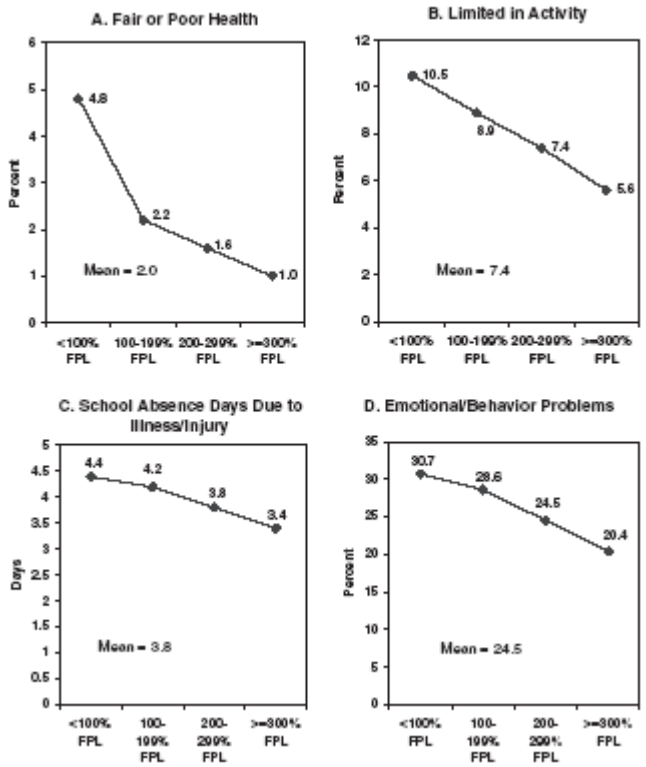
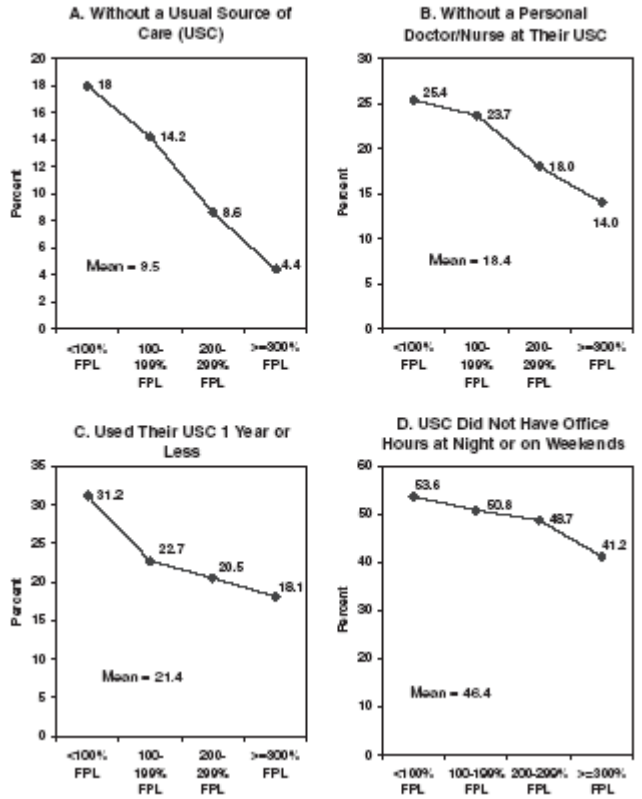


Figure 3: Access to and Satisfaction with Primary Care for Adolescents by Income: U.S. 1999



Nichol, K.L., Mallon, K. P., Mendelman, P. M., Cost Benefit of Influenza Vaccination in Healthy, Working Adults: an Economic Analysis Based on the Results of a Clinical Trial of Trivalent Live Attenuated Influenza Virus Vaccine, *Vaccine*, 21: 2207-2217, 2003.

This cost benefit analysis of providing an influenza vaccine to healthy adults showed that the breakeven cost of the vaccine and its administration was $43 per person. Work missed as well as ineffective work time and visits to healthcare providers were calculated as part of the cost of contracting influenza.

Nichol, K.L., Ten Year Durability and Success of an Organized Program to Increase Influenza and Pneumococcal Vaccination Rates Among High-Risk Adults, *American Journal of Medicine*, 105: 385-392, 1998.

This is a ten-year study on the effectiveness of a vaccination program in the Veterans Affairs Medical Center of Minneapolis. Compliance rates with vaccines for influenza went from 58% to 84% over the study period. Rates were lowest among high risk patients under age 65.

Northwest Research Group, Oregon's Mobility Needs: General Population Survey and Transportation Provider Survey Final Report, SPR 395, Oregon Department of Transportation, January 1999.

This is a study of the mobility needs of Oregon residents, evaluated through telephone surveys with 578 mobility impaired residents and 129 mailed surveys to transit providers. Highlights for the mobility impaired in Oregon:

- Mobility impairment has an 8% incidence rate;
- 61% of trips were for medical appointments;
- 16% reported no access to public transportation.
- Transportation barriers were assessed for the mobility impaired and health population, as shown in Figure ES.1. Figure ES.2 shows the type of mobility impairment.

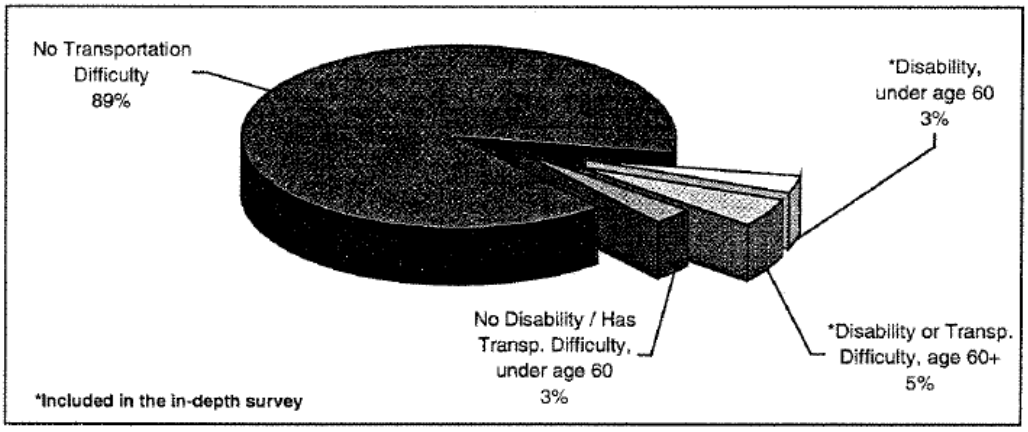


Figure ES.1: Incidence of Transportation Difficulty (Base = All Respondents)

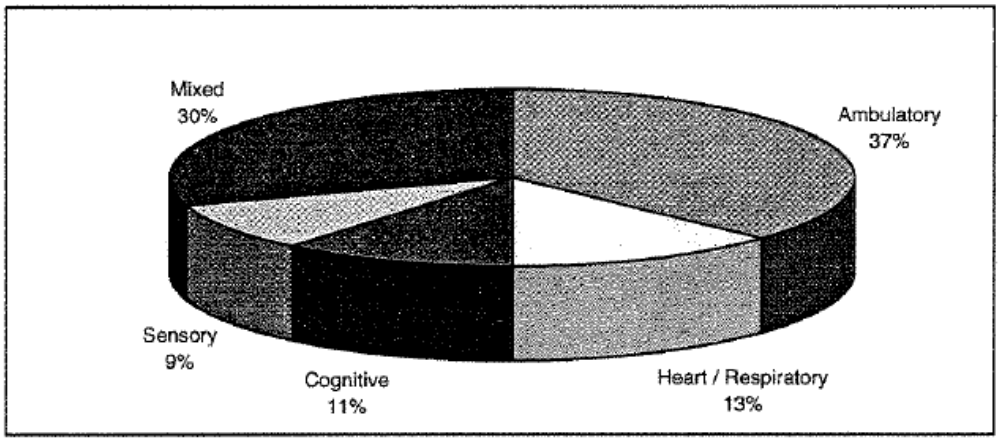


Figure ES.2: Type of Disability (Base = All Mobility Impaired Respondents)

O'Connell, L., Grossardt, T., Siria, B., Marchand, S., McDorman, M., Efficiency Through Accountability: Some Lessons from Kentucky's Improved Medicaid Transit Service, *Journal of Transportation and Statistics*, 5: 73-81, 2002.

This is an evaluation of Kentucky's 1998 reform of its Medicaid non-emergency medical transit program through interviews with transit providers and Medicaid beneficiaries. Through better accountability and efforts to increase efficiency, quality, customer satisfaction and cost control all improved. The number of trips increased by 58% while unit cost decreased by 18%. Figure 1 displays the accountability changes. Table 3 shows the changes before and after reform in the mode of transportation.

FIGURE 1 The Structure of Accountability Under the Capitated Broker System

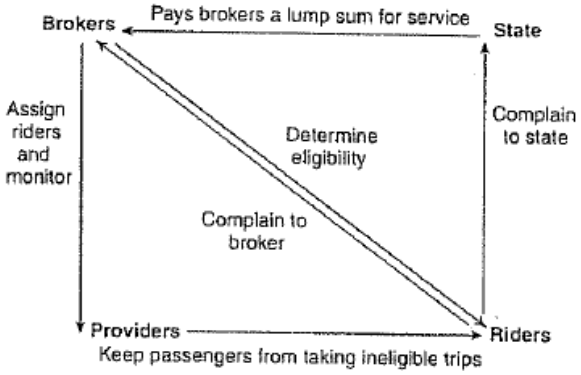


TABLE 3 Type of Vehicle Used for Medicaid Transportation

Vehicle type	Before HSTDP	After HSTDP
Car	18.3%	10.6%
Taxi	35.1%	37.3%
Van	35.7%	40.7%
Bus	10.2%	10.9%
Did not recall	0.7%	0.4%

n = 1,036
Note: Columns do not necessarily sum to 100% due to rounding

O'Day, B., Dautel, P., Scheer, J., Barriers to Healthcare for People with Mobility Impairments, *Managed Care Quarterly* 10:41-57, 2002.

Fifty-seven working age disabled people discuss barriers to quality, access, and payment in focus groups and interviews. Specific disabilities discussed include spinal cord injury (SCI), multiple sclerosis (MS), cerebral palsy (CP) and arthritis. Transportation barriers include wheelchair users who need lift-equipped, regular route bus service or door-to-door Paratransit services, or medical transportation. Patients complained of the advance notice required to schedule Paratransit services and the unreliability of the Paratransit system.

O'Day, B., Palsbo, S. E., Dhont, K., Scheer, J., Health Plan Selection Criteria by People with Impaired Mobility, *Medical Care*, 40:732-42, 2002.

Observational study and qualitative analysis of structured focus groups discussing disability as a barrier to accessing care. Focus group disliked Paratransit.

Ofman, J. J., Badamgarav, E., Henning, J. M., Knight, K., Gano, A. D. Jr., Levan, R. K, Gur-Arie, S., Richards, M. S., Hasselbad, V., Weingarten, S. R., Does Disease Management Improve Clinical and Economic Outcomes in Patients with Chronic Disease? A Systematic Review, *American Journal of Medicine*, 117: 182-92, 2004.

This review of the literature on disease management and chronic disease conditions demonstrates the benefits possible through improved coordination of care and patient management. The most successful disease management programs focus on depression, hyperlipidemia, coronary artery disease, hypertension, and diabetes. Chronic obstructive pulmonary disease and chronic pain were the least effective. Information on cost savings was limited. Patient education was the most common disease management strategy.

Olason, R.A., Accessible Raleigh Transportation: A Paratransit System Using Trip-by-Trip Eligibility Determination and Two-Tiered, User-Side Subsidy. *Transportation Research Record*, 1760: 121-134, 2001.

This is a profile of the community funded, Paratransit service in Raleigh, North Carolina that provides non-emergency medical transportation to disabled patients unable to ride buses. Taxicab ordinances allowed the community to create a complementary service with wheelchair accessible vans and cars that meets the demands of disabled residents. Tiered subsidies ensure effective cost sharing that does not inhibit utilization.

O'Malley, A.S., Mandelblatt, J., Delivery of Preventive Services for Low-Income Persons Over Age 50: A Comparison of Community Health Clinics to Private Doctor's Offices, *Journal of Community Health*, 28:185-97, 2003.

This study used 1998 National Health Interview Survey results to compare preventive care between patients in privately insured offices versus community health care clinics. Of patients over age 50 and <200% the poverty level, 14.3% reported transportation and/or time issues that delayed care in the past year, as opposed to 8.7% of all patients over 50 in the U.S. A higher number of patients over 50 and <200% of the poverty level did not get needed treatment in the past year because of cost barriers-18.8% as opposed to 7.5% of all patients over 50 in the U.S.

Pagano, A.M., How Effective is Computer-Assisted Scheduling and Dispatching in Paratransit? 1760, Paper No. 01-2290, Transportation Research Record 2001.

A survey and follow-up telephone interview administered to 14 nation-wide transportation managers with computer-assisted scheduling and dispatching (CASD) systems implemented. Table 1 shows the descriptive data from the survey. Figure 2 shows how the functions of the CASD system are being used, revealing that half of managers do no use all the functions of the CASD. Table 3 shows how the CASD has improved Paratransit services, demonstrating efficiency gains in the majority of Paratransit areas.

TABLE 1 Sample Description

Trips per Day	Vehicles	Average Vehicle Load Ratio[1]	Trip to Employee Ratio[2]	Total Organization Employees	Number of Paratransit Employees	Level of Automation[3]
1500 (high)	63	24	9	2000 (high)	167 (high)	S, D, MDT
1400	50	28	40 (high)	45	35	S,D
1300	65 (high)	20	15	9 (low)	85[4]	Roster Only
850	31	28	26	120	33	S, D
700	58	12	17	60	42	S
700	36	20	13	170	55	S, D
600	32	19	19	31	31	S, D
500	11	45 (high)	20	100	25	S, D, Billing
325	30	11	8	50	43	S, D
250	10	25	16	16	16 (low)	S
250	13	20	14	18	18	Billing Only
250	23	11	7	150	38	S, D
180	6 (low)	30	4 (low)	76	43	S, D
150 (low)	28	5 (low)	5	30	30	S, D
Mean 639	*33*	*21*	*15*	*205*	*47*	
Median 550	*30.5*	*20*	*14.5*	*55*	*37*	

[1] Average Vehicle Load Factor ÷ Trips per day ÷ Vehicles
[2] Trip to Employee Ratio = Trips per day ÷ Number of Paratransit Employees
[3] "S" = Scheduling, "D" = Dispatching, "MDT" = Mobile Data Terminals
[4] Contracts out all vehicle operations. Count includes contracted drivers. This operator consolidates rides requests and forwards passenger lists to contracted vehicle operators.

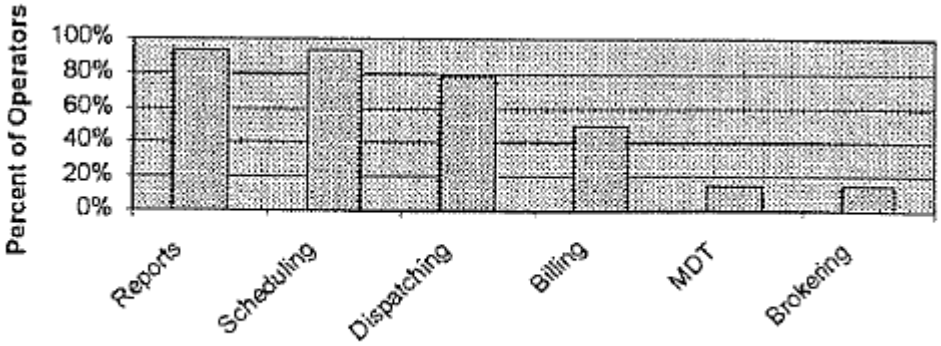


FIGURE 2 Distribution of features used in CASD (MDT = mobile data terminals)

TABLE 3 Reported CASD Impacts on Productivity and Quality of Service

Results	Percent of Respondents
Easier Reporting	79
Better Vehicle Optimization and Scheduling	79
Better Use of Vehicle Assets	79
Reduced Call Intake/Scheduling Time	71
Increased Operational Capacity	71
Reduced Administrative Time	64
More Efficient Dispatching and More Relaxed Atmosphere	64
Increased Passengers per Hour	64
Fewer Turn-downs	64
On-time Performance	50
Reduced Cost per Trip	36
Increased Driver Productivity	36
Increased Customer Satisfaction	21
Real-time Information to Customers	14
Increased Monthly Ridership	14
Track Driver Productivity	7

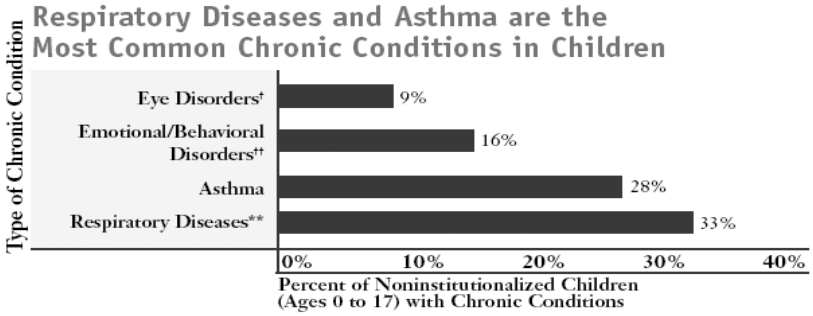
Partnership for Solutions, *Asthma: The Impact of Multiple Chronic Conditions*, August 2004. www.partnershipforsolutions.org.

This is a summary of the prevalence, cost and health burden of asthma by age group. Comorbid conditions are also included, shown in Table 1.

Age Group	Most Common Comorbidity (%)	Second-Most Common Comorbidity (%)
0-17	Allergies (23%)	Pre adult Disorders (5%)
18-34	Allergies (19%)	Chronic Respiratory Infections (11%)
35-64	Hypertension (27%)	Allergies (26%)
65-74	Hypertension (51%)	Heart Disease (31%)
75+	Hypertension (54%)	Heart Disease (34%)

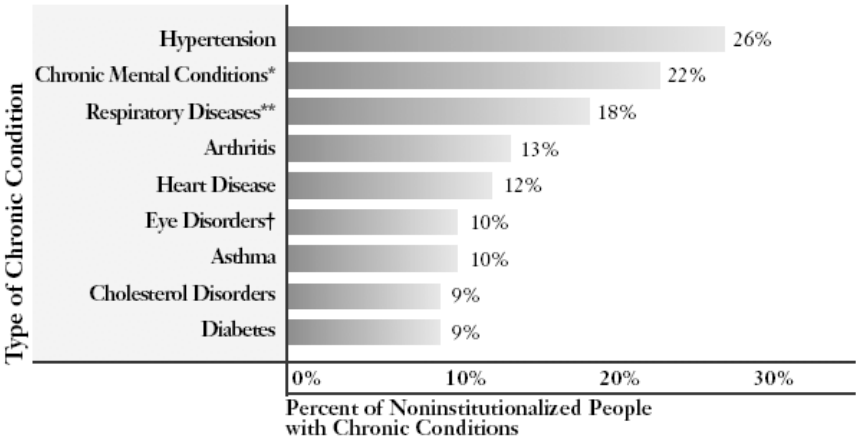
Partnership for Solutions, *Chronic Conditions: Making the Case for Ongoing Care*, December 2002. www.partnershipforsolutions.org.

This chartbook on chronic conditions highlights prevalence, trends, cost and utilization data from several different sources. The patient and clinician perspectives are considered in regard to barriers to coordination of care and the unique role of caregivers is also explored. Women have more chronic conditions than men; older adults have more chronic conditions than younger people.



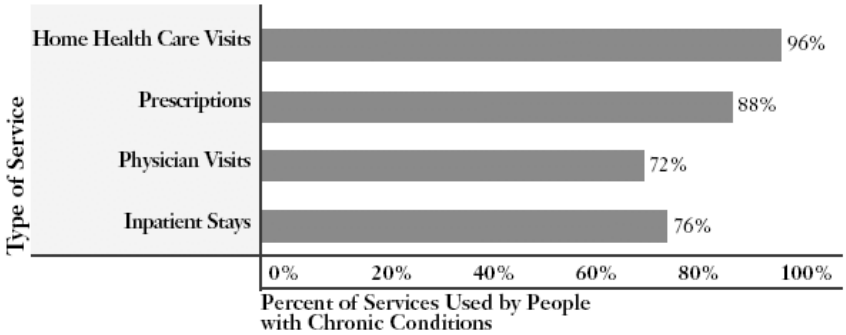
Source: Medical Expenditure Panel Survey, 1998.

Hypertension is the Most Common Chronic Condition



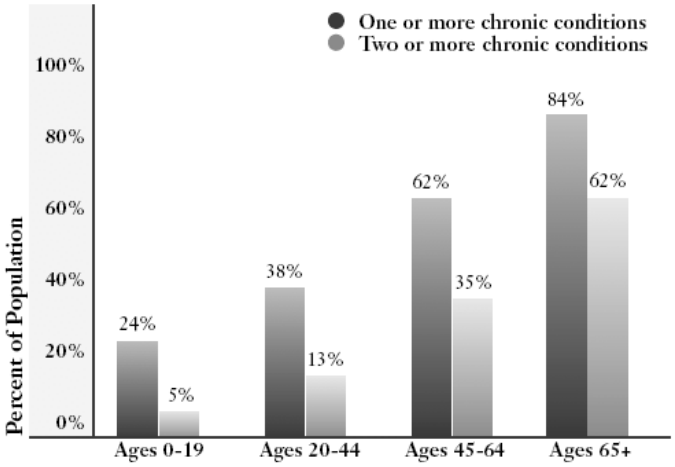
Source: Medical Expenditure Panel Survey, 1998.

People with Chronic Conditions Are the Heaviest Users of Health Care Services



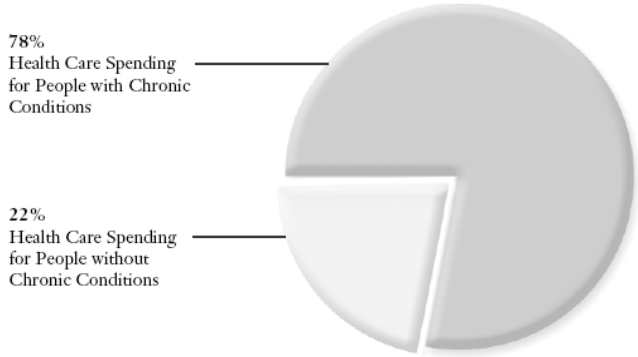
Source: Medical Expenditure Panel Survey, 1998.

Older Adults Are More Likely to Have Multiple Chronic Conditions



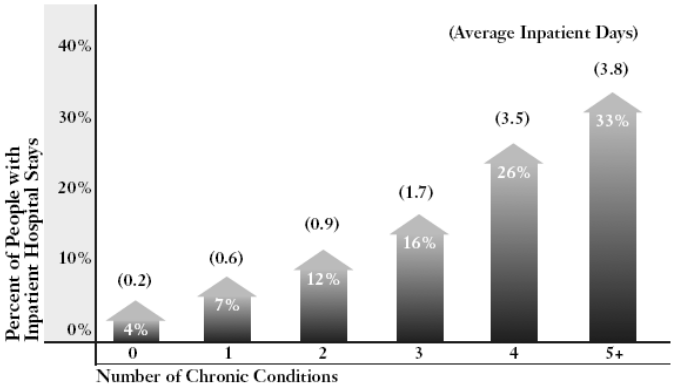
Source: Wu, Shin-Yi, and Green, Anthony. *Projection of Chronic Illness Prevalence and Cost Inflation.* RAND Corporation, October 2000.

People with Chronic Conditions Account for 78 Percent of All Health Care Spending



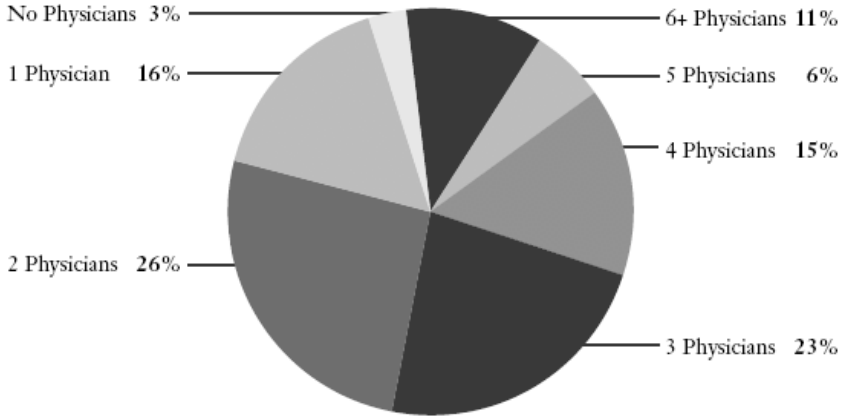
Source: Medical Expenditure Panel Survey, 1998.

People with Multiple Chronic Conditions Are Much More Likely to be Hospitalized



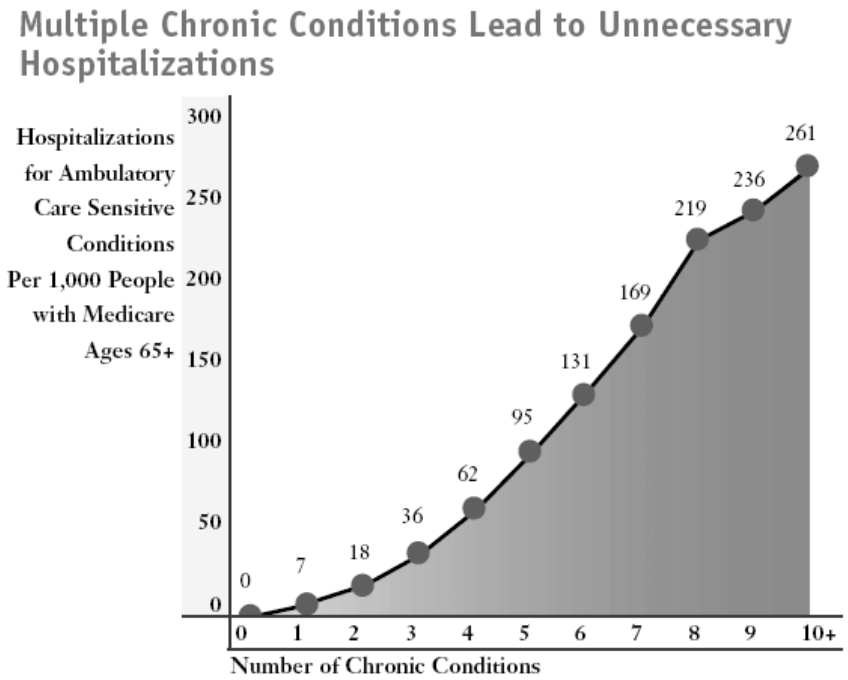
Source: Medical Expenditure Panel Survey, 1998.

More than Half of People with Serious Chronic Conditions* Have Three or More Different Physicians

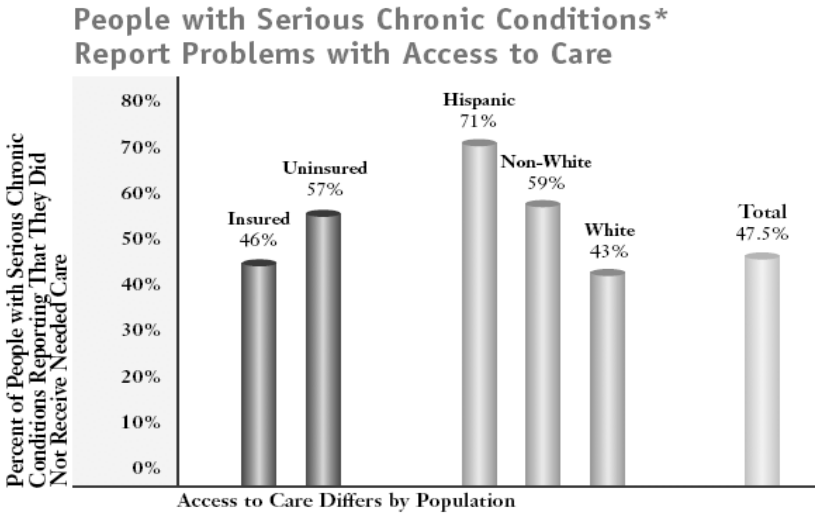


Source: *Serious Chronic Illness Survey*, conducted by the Gallup Organization, 2002.

*People with serious chronic conditions have a condition that is expected to last a year or more, requires ongoing medical attention, and limits what one can do. Serious chronic conditions are a subset of chronic conditions, which are also expected to last a year or more but limit what one can do, *and/or* may require ongoing medical care.



Source: Medicare Standard Analytic File, 1999.



Source: *Serious Chronic Illness Survey*, conducted by the Gallup Organization, 2002.

Paul, J., Hanna, J.B., Applying the Marketing Concept in Health Care: The No-Show Problem, *Health Marketing Quarterly*, 14:3-18, 1997.

An economic analysis of missed appointments and how the marketing concept can effectively be applied. A survey was administered to 114 randomly selected patients over a two-week period in an urban, hospital-based internal medicine clinic, and then telephone interviews were conducted with 44 of the 66 patients who had missed appointments in the week following the written survey administration. 22.7% of patients interviewed via telephone missed appointments because of transportation. Past no-shows predicted future no-shows.

Phelps, K., Taylor, C., Kimmel, S., Nagel, R., Klein, W., Puczynski, S., Factors Associated with Emergency Department Utilization for Nonurgent Pediatric Problems, *Archives of Family Medicine*, 9: 1086-1092, 2000.

This is a survey administered to caretakers who brought children into the emergency room (ER) for non-acute conditions. The sample size was 200, 82% of who were mothers, and 70% of who were single parents, surveyed in one of two urban hospitals. Caretakers who were taken to the ER as children and caretakers on Medicaid viewed the ER as the usual site of care. Being a single caretakers predicted non-urgent visits. 19% of subjects surveyed reported not having a car and using public transportation or walking. 20% of caretakers surveyed answered the question "Why did you bring your child to the ER today?" with "the emergency room is closer to my home than the doctor's office". Although transportation was assessed in the patient characteristics, it was not listed as a predictor of non-urgent ER use.

Porter, V., Angels on the Web: Free Flight for Patients in Need, *Medscape Infectious Diseases*, 4, 2002.

A description of an airline program that helps underserved populations, particularly children and those in remote settings, access health care.

Pucher, J., Renne J.L, Socioeconomics of Urban Travel: Evidence from the 2001 NHTS, *Transportation Quarterly*, 57: 49-77, 2003.

This is a report on the results of the 2001 National Household Travel Survey. Comparisons are made to previous NHTS survey results. Private car is the primary means of travel, consistent with past survey results. 2% of trips are made via public transit, 5% of trips for those in the lowest income categories. Low income and minority Americans account for 63% of those riding public transit.

Pucher, J., Renne J.L., Urban-Rural Differences in Mobility and Mode Choice: Evidence from the 2001 NHTS, Rutgers University, April 2004.

This paper compares urban and rural trip behavior using the National Household Travel Survey data from 2001. Mobility in rural areas is higher than in urban areas. Urban poor and minorities experience the greatest deficits in access and personal car ownership. Highlights:

- Over 97% of rural households own at least one car vs. 92% of urban households;
- 91% of trips are made by car in rural areas vs. 86% in urban areas.

Table 3 shows vehicle ownership rates, Table 5 shows trip mode.

Table 3. Vehicle Ownership by Income Class

Vehicles per Household	Households Earning Less than $20,000		Households Earning More than $20,000		All	
	Rural	Urban	Rural	Urban	Rural	Urban
0	11.3	26.5	0.7	3.0	3.3	8.3
1	44.9	48.3	14.9	28.8	22.0	33.2
2	27.2	17.5	41.6	43.2	38.2	37.4
3 or more	16.5	7.7	42.7	25.0	36.5	21.1
All	100	100	100	100	100	100

Source: Calculated by the authors from the 2001 NHTS.

Note: Vehicles include passenger cars, as well as station wagons, pallenger vans, sport-utility vehicles, pickup trucks, light trucks, motorcycles, mopeds, and recational vehicles.

Table 5. Modal Split by Income Group

Means of Transportation	Households Earning Less than $20,000		Households Earning More than $20,000		All	
	Rural	Urban	Rural	Urban	Rural	Urban
Auto	89.4	75.9	90.7	87.5	90.5	85.9
SOV[1]	35.8	30.0	40.0	38.5	39.3	37.3
HOV[2]	53.6	45.9	50.7	49.0	51.2	48.6
Transit	0.3	4.6	0.1	1.2	0.1	1.7
Total Nonmotorized	7.2	17.0	5.9	9.4	6.1	10.4
Walk	6.0	16.2	5.2	8.5	5.3	9.5
Bicycle	1.2	0.9	0.7	0.9	0.8	0.9
School Bus	2.9	1.9	2.7	1.4	2.7	1.5
Other	0.3	0.5	0.6	0.5	0.6	0.5
All	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate daily travel, the sample was limited to trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no plssengers.

2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.

Rimmer, J.H., Silverman, K., Braunschweig, C., Quinn, L., Liu, Y., Feasibility of a Health Promotion Intervention for a Group of Predominantly African American Women With Type 2 Diabetes, *The Diabetes Educator*, 28:571-581, 2002.

This is a study of the impact of a health promotion intervention on 30 African American urban women with type 2 diabetes and co morbidities. The patients attended a 12-week university based intervention to promote healthy behavior that included diet, nutrition, and behavior. Transportation to and from the site was provided free to each patient. Compliance was 72% and health outcomes were very good, as shown in Table 2.

Table 2.

Paired t-test of Preprogram/Postprogram Differences on Selected Health Outcome Measures (N=30)

Health Outcome Measures	Preprogram Mean (SD)	Postprogram Mean (SD)	*P* Value
Blood			
Total cholesterol, mg/dL	186.5 (30.5)	176.5 (24.6)	.03
HDL cholesterol, mg/dL	47.8 (9.7)	48.7 (11.0)	NS
LDL cholesterol, mg/dL	111.9 (25.9)	98.7 (21.4)	.005
Triglycerides, mg/dL	132.4 (60.4)	140.7 (75.9)	NS
Fasting glucose, mg/dL	178.9 (64.4)	162.3 (46.7)	NS
A1C, %	10.8 (2.6)	10.3 (2.3)	NS
Exercise			
Peak VO_2, ml/min*	1328.8 (420.7)	1420 (493)	.01
Bench press, lb	34.3 (19.4)	45.7 (22.4)	.0001
Leg press, lb	185.7 (59.5)	247.3 (65.3)	.0001
Body composition			
Body weight, kg	114.6 (26.4)	114.7 (27.4)	NS
Skinfold triceps	40.2 (9.5)	39.2 (10.0)	.01
Skinfold thigh	39.7 (11.4)	37.9 (12.9)	NS
Nutrition			
RYP†	43 (1.2)	48 (0.8)	.01
Self-efficacy‡	46.7 (1.00)	52.4 (1.3)	.001
Energy intake, kcal	2654 (133)	1768 (153)	.002
CHO, %	54 (6.00)	56 (2.5)	NS
Protein, %	18 (3)	18 (2.4)	NS
Fat, %	30 (1.1)	26 (1.6)	.05
Health behavior			
CES-D§	29.1 (8.6)	17.4 (13.4)	.001
Life satisfaction	37 8 (9 1)	36 (7 8)	NS

*Higher value reflects greater cardiovascular fitness.
†Rate your Plate: higher score reflects improved eating habits
‡Higher value reflects greater self-efficacy
§Measure of depression based on Center for Epidemiological Studies Depression scale (CES-D); score of 16 or higher is classified as depression. Data presented on 14 subjects who were classified as depressed on the CES-D prior to the intervention.

Ritter, A.S., Straight, A., Evans, E., Understanding Senior Transportation: Report and Analysis of a Survey of Consumers 50+, AARP Public Policy Institute, April 2002.

This is a report produced by the AARP Public Policy Institute that describes the transportation utilization and demand among Americans over 50. The results of a national telephone survey administered to 2422 adults 50 and over from October 1998 to January 1999 regarding their travel behavior, show that health and disability status greatly reduces mobility and that less than 5% of those surveyed relied on either walking, public transit, taxis, or community vans for mobility. Only 2% of those surveyed reported dissatisfaction with their mobility, and those with worse health or disabilities are more likely to fall into this category.

Rittner, B., Kirk, A.B., Health Care and Public Transportation Use by Poor and Frail Elderly People, *Social Work*, 40:365-73, 1995.

Study on survey data of 1083 low-income, non-institutionalized elderly attending a daytime meal program in three south Florida metropolitan areas. Most of the elderly relied on public transportation to gain access to health services, which was a barrier to healthcare. Researchers rode the bus service used by the elderly studied and found the average trip was two hours each way. Each route had missing or late buses, lack of shelters, buses that were difficult to get on or off, dirty windows and occasional confrontations with other passengers. A primary reason public transportation posed a barrier is fear of victimization. Tables 4 and 5 show the impact of transportation access on health care utilization.

Table 4

Refitted Hierarchical Regression Model of Factors Associated with Obtaining Emergency Medical Care

Independent Variable	Beta	R^2 Change	Total R^2
Gender	–.4029	–.29	.15
Availability of transportation	.2270	.04	.19
Fear of victimization	–.2430	.0551	.245
Contact with relatives	.2466	.044	.289
Friendship support system	.2263	.051	.34

Table 5

Refitted Hierarchical Regression Model of Factors Associated with Obtaining Ongoing Medical Care

Independent Variable	Beta	R^2 Change	Total R^2
Gender	–.1794	.032	.032
Availability of transportation	.2936	.117	.190
Fear of victimization	–.0949	.010	.127
Contact with relatives	.2863	.067	.192

Rosenbloom, S., *The Mobility Needs of Older Americans: Implications for Transportation Reauthorization*, The Brookings Institution Series on Transportation Reform, 2003.

This policy brief encourages decision makers to consider the needs of the elderly population in regard to transportation and mobility over the next twenty years.

Figure 1. Projected Growth in Elderly Population

Source: U.S. Census

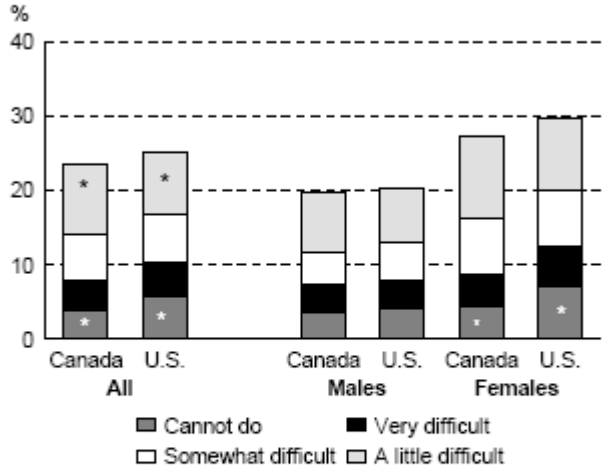
Rosenbloom, S., Transportation Needs of the Elderly Population, *Clinics in Geriatric Medicine*, 9:297-310, 1993.

This article is a qualitative discussion of elderly dependence on the car as the primary means of transportation. As seniors become more disabled, driving decreases. The mileage driven also decreases with age. Public transit is not an adequate alternative in that there is environmental and land use barriers. There is a gap in service for elderly non-drivers and those eligible for Paratransit, and many elderly who are eligible do not register. Paratransit has so many restrictions that it is not a viable solution for many seniors without access to a car. The APTA in 1989 reported one-way Paratransit costs at $9.70.

Sanmartin, C., Ng, E., Blackwell, D., Gentleman, J., Martinez, M., Simile, C., *Joint Canada/ United States Survey of Health, 2002-03*, Statistics Canada, Catalogue 82M0022-XIE, 2004.

This is a comparison of national health data for the United States and Canada. The data is collected through a one-time telephone survey, with a sample of 3505 in Canada and 5183 in the United States. 13% of Americans and 11% of Canadians reported unmet health needs. Chart 3 shows mobility limitations by type of limitation, gender and residency.

Chart 3
Mobility limitation[a] by gender, Canada and United States, 2002/03‡



Data source: Joint Canada/United States Survey of Health, 2002/03.
Notes: Household population aged 18 and over.
Missing data ("I don't know", "not stated", "refusal") have been excluded from the analysis.
‡ Age-adjusted percents calculated using the projected 2000 U.S. standard population.
** Statistically significant difference between Canada and U.S. (p <0.05).*
a See definitions for list of activities.

Scheer, J. Kroll, T., Neri, M.T., Beatty P, Access Barriers for Persons with Disabilities, *Journal of Disability Policy Studies*, 13:221-231, 2003.

Qualitative interviews with 30 disabled people (multiple sclerosis, cerebral palsy and spinal cord injuries) to understand access barriers. Transportation is discussed along with other barriers to utilization of necessary care. Two main factors in the utilization of public transportation are that

conditions preclude use and that provider office and medical equipment vendors are not on transit routes. Paratransit services eliminate these problems but require advance scheduling, which is not practical if a patient requires immediate care. Interview respondents experienced Paratransit services that were late, failed to arrive at all, or arrived with the wrong equipment. Respondents who relied on private car transportation felt that office hours for providers did not always match the free time available in a driver's work schedule. One man missed a PCP appointment for this reason and was later seen in the emergency room and required extensive follow up care.

Schilling, L.M., Scatena, L., Steiner, J.F., Albertson, G.A., Cyran, L., Ware, L., Anderson, R.J., The Third Person in the Room: Frequency, Role, and Influence of Companions During Primary Care Medical Encounters, *Journal of Family Practice*, 51: 685-690, 2002.

This is a study of 1294 patients in 1998 arriving at primary care appointment in the general internal medicine practice of the University of Colorado Health Sciences Center with a third party, to provide transportation or emotional support. Sometimes these patients are in the room during appointments. Results showed that patients that reported that if a companion was with them because they needed help with transportation then they were unlikely to sit in with the doctor, as shown in Table 2.

	Patient's report			Companion's report		
	Companion in waiting room	Companion in examination room	$P^{\dagger}$	Companion in waiting room	Companion in examination room	$P^{\dagger}$
Companion's reasons for accompaniment						
Help with transportation	58 (69)	81 (55)	.05	64 (79)	66 (58)	.003
Provide company	39 (46)	58 (53)	.39	43 (53)	55 (49)	.59
Help communicate concerns to the doctor	6 (7)	56 (51)	<.001	5 (6)	60 (53)	<.001
Help remember physician's advice and instructions	4 (5)	51 (46)	<.001	5 (6)	54 (48)	<.001
Provide emotional support	20 (24)	48 (44)	.004	27 (33)	60 (53)	.006
Express concerns regarding the patient to the physician	6 (7)	41 (37)	<.001	9 (11)	51 (45)	<.001
Help make decisions	5 (6)	39 (35)	<.001	2 (2)	32 (28)	<.001
Help with language barriers	1 (1)	14 (13)	.003	0 (0)	12 (11)	<.002
Help with insurance or payment forms	7 (8)	11 (10)	.69	7 (9)	5 (4)	.23
Companion's influence on medical encounter						
No influence or don't know	57 (70)	28 (25)	<.001	58 (72)	24 (21)	<.001
Companion influenced						
Physician understanding	5 (6)	63 (57)	<.001	5 (6)	69 (61)	<.001
Patient understanding	3 (4)	59 (54)	<.001	10 (12)	68 (60)	<.001
Tests ordered	3 (4)	13 (12)	.039	1 (1)	12 (11)	.01
Prescribed treatment	1 (1)	26 (24)	<.001	4 (5)	26 (23)	<.001
Number of referrals	0 (0)	10 (9)	.005	1 (1)	6 (5)	.13
Length of visit	7 (8)	19 (17)	.07	6 (7)	20 (18)	.04

*Values are number (percentage) unless otherwise indicated.
†Difference between waiting room and examination room companion.

TABLE 2 Patients' and companions' reports of companion's reasons for accompaniment and influence on the medical encounter*

Schoen, C., Osborn, R., Huynh, P.T., Doty, M., Davis, K, Zapert, K., Peugh, J., Primary Care and Health System Performance: Adults' Experiences in Five Countries, *Health Affairs Web Exclusive,* W487-503, 2004.

This article compares the results of the 2004 Commonwealth Fund International Health Policy Survey on primary care experience of patients in the United States, United Kingdom, New Zealand, Australia, and Canada. The United States ranks worst in public opinion of the healthcare system; also for out of pocket patient costs. Access to care was also more difficult and infrequent in the United States compared to other countries.

EXHIBIT 1
Health System Views And Cost Experiences Among Adults In Five Countries, 2004

	AUS	CAN	NZ	UK	US
Unweighted N	1,400	1,410	1,400	3,061	1,401
Overall system views, trend 1998–2004					
Only minor changes needed, system works well					
2004	21%[d,e]	21%[d,e]	19%[d,e]	26%[e]	16%
2001	25[a]	21	18	21[a]	18
1998	19	20	9[a]	25	17
Fundamental changes needed					
2004	55[b,c,d,e]	63[d,e]	60[e]	59[e]	47
2001	53	59	60	60	51
1998	49	56	57	58	46
Rebuild completely					
2004	23[b,c,d,e]	14[c,e]	19[d,e]	13[e]	33
2001	19[a]	18[a]	20	18[a]	28[a]
1998	30[a]	23[a]	32[a]	14	33
Confidence and costs in 2004					
Confident will get quality and safe medical care when needed					
Very confident	28	25[d,e]	27	30	30
Somewhat confident	46[b]	54[c,d,e]	47	47	44
Not very or not at all confident	25[b]	20[c,e]	25	23	24
Out-of-pocket medical expenses in the past year, in U.S. dollar equivalent[f]					
None	10[b,c,d]	22[c,d,e]	7[d,e]	57[e]	11
$1–$100	14[b,c,e]	19[d,e]	21[d,e]	15[e]	7
$101–$1,000	44[b,c,d]	39[c,d]	50[d,e]	21[e]	42
More than $1,000	14[c,d,e]	12[c,d,e]	5[d,e]	4[e]	26

SOURCES: Commonwealth Fund International Health Policy Surveys, 1998, 2001, and 2004.
NOTE: Reading from left to right, the letter indicates $p < .05$ for differences with countries to the right, as below.
[a]Within country, $p < .05$ for difference from 2004.
[b]For difference with CAN.
[c]For difference with NZ.
[d]For difference with UK.
[e]For difference with US.
[f]Out-of-pocket expenses do not add to 100 percent because of "don't know"/missing.

EXHIBIT 2
Access To Care And To Physicians In Five Countries, 2004

	AUS	CAN	NZ	UK	US
Unweighted N	1,400	1,410	1,400	3,061	1,401
Do you have a doctor or GP you regularly see?					
Yes	88%[c,d,e]	86%[c,d]	91%[e]	91%[e]	83%
No, but usual place of care	6[b]	9[c]	6[d,e]	8	8
No usual doctor or place	5[c,d,e]	5[c,d,e]	3[d,e]	1[e]	9
Length of time with doctor or usual place					
No regular doctor/place of care	5[c,d,e]	5[c,d,e]	3[d,e]	1[e]	9
2 years or less	22[d,e]	20[e]	21[e]	18[e]	29
3-5 years	22[d]	21[d,e]	20[d,e]	17[e]	25
More than 5 years	50[c,d,e]	53[d,e]	56[d,e]	63[e]	37
Last time you were sick or needed medical attention, how quickly can you get an appointment to see a doctor?					
Same day	54[b,c,d,e]	27[c,d,e]	60[d,e]	41[e]	33
Next day	21[b,d,e]	15[c,d]	24[d,e]	18	18
2 to 5 days	17[b,c,d,e]	27[c]	11[d,e]	26	24
6 or more days	7[b,c,d,e]	25[c,d,e]	2[d,e]	13[e]	19
How difficult is it to get care on nights, weekends, or holidays without going to the ER?					
Very or somewhat easy	25[c,d]	29[c,e]	46[d,e]	30[e]	23
Very or somewhat difficult	54[b,c,d,e]	59[c,d,e]	33[d,e]	43[e]	63
Never needed care in evenings, weekends, holidays	15[b,d,e]	8[c,d,e]	18[d,e]	21[e]	11
Have you called a help line for medical or health advice in past 2 years? (percent answering yes)	8[b,d,e]	24[c,d,e]	8[d,e]	28[e]	17
Access problems because of costs during past 12 months					
Did not get medical care because of cost of doctor's visit	17[b,c,d,e]	6[c,e]	28[d]	4[e]	29
Skipped medical test, treatment, or follow-up because of cost	18[b,d,e]	8[c,d,e]	20[d,e]	2[e]	27
Did not fill Rx or skipped doses because of cost	12[d,e]	9[d,e]	11[d,e]	4[e]	21
Yes to at least one of the above	29[b,c,d,e]	17[c,d,e]	34[d,e]	9[e]	40

SOURCE: Commonwealth Fund International Health Policy Survey, 2004.

NOTES: Reading from left to right, the letter indicates $p < .05$ for differences with countries to the right, as below. GP is general practitioner. ER is emergency room.

[b] For difference with CAN.

[c] For difference with NZ.

[d] For difference with UK.

[e] For difference with US.

Schweitzer, L., Valenzuela Jr., A., Environmental Injustice and Transportation: The Claims and the Evidence, *Journal of Planning Literature*, 18: 383, 2004.

This article creates a framework for evaluating whether transportation policy has put poor and minority communities at a disadvantage through unjust environmental damage.

Sherer, R., Stieglitz, K., Narra, J., Jasek, J., Green, L., Moore, B., Shott, S., Cohen, M., HIV Multidisciplinary Teams Work: Support Services Improve Access to and Retention in HIV Primary Care, *AIDS Care*, 14: S31-44, 2002.

This is a study of support services and the impact on access to care using longitudinal data from the HIV Primary Care Center 1997-1998. Transportation was one of the four support services, along with mental health care, chemical dependency support, and case management. Each service improved access for any care, regular care, and patients with any service had more visits than patients with no services. Retention increased 15-18%. The best outcomes were for patients with access to all services.

Sipe, W.E.,Wei, M.C., Roth, E.J., Chi, G.W., Naidu, S.K., Samuels, R.C., *Barriers to Access: A Transportation Survey in an Urban Pediatric Practice*, General Pediatrics and Preventive Pediatrics: Miscellaneous - Poster Session I, 2004 Pediatric Academic Society's Annual Meeting, May 2004.

This poster discusses the results of a survey administered to patients of a hospital based urban pediatric clinic regarding their transportation options. Results: A total of 82 surveys were completed. A private car was used by 66% of patients, whereas 27% used some combination of bus and other public transportation. Average one-way trip time was 55 minutes (45 minutes by car, 81 minutes by bus), and 60% of respondents said that they had previously missed or been late to an appointment due to problems with transportation. Of patients arriving by private car (n=51), 27% reported missing an appointment at some time due to transportation difficulties, while 43% had arrived late. Of those patients using a bus for some point of their trip (n=22), 86% reported missing an appointment due to transportation difficulties and 95% had arrived late. Compared to those arriving by private car, patients arriving by bus or other mode of transportation were significantly more likely to have missed or been late for appointments, and had longer trip times ($p<0.007$ for all). The average cost for those arriving by car was $7.71.

Smith, C.M., Yawn, P.B., Factors Associated with Appointment Keeping in a Family Practice Residency Clinic, *Journal of Family Practice*, 38:25-9, 1994.

Study on Midwestern urban family practice residency clinic patient records between April and June of 1991 revealed that appointment keeping rates were higher among older, white or Asian patients, private or managed care insured patients, and those who had appointments scheduled the day they called the clinic.

Smith, S.R., Highstein, G.R., Jaffe, D.M., Fisher, E.B. Jr., Strunk, R.C., Parental Impressions of the Benefits (Pros) and Barriers (Cons) of Follow-up Care After an Acute Emergency Department Visit for Children With Asthma, *Pediatrics*, 110:323–330, 2002.

Parents of low-income, urban asthma patients rated 41 items as pros or cons to bringing their children into a primary care physician after an emergency room episode. 147 parents interviewed in the ER filled out the form and 24 items were considered highly associated with whether a parent would bring a patient in for follow up. One of the cons was "I have to find transportation". The list of pros and cons are in Table 2.

TABLE 2. Initial Loading Values for Original 41 Items

	Component			
	1.000	2.000	3.000	4.000
Pros (Informational)				
P1 Going to a follow-up visit allows me to ask the doctor questions.	0.505	−0.148		
P2 Going to a follow-up visit allows me to find out if my child is better.	0.559		0.130	0.191
P3 Going to a follow-up visit allows me to ask about triggers or things that worsen asthma.	0.529			0.140
P4 Going to a follow-up visit makes me feel that I have done my best.	0.553		0.185	
P5 Going to a follow-up visit allows me to get my child's medications checked.	0.553			0.265
P6 Going to a follow-up visit allows my child's brothers, sisters, and other family to learn about asthma.	0.562		−0.112	0.226
P7 Going to a follow-up visit allows me to get asthma medication for my child at school.	0.531			
P8 Going to a follow-up visit allows me to get asthma information for my child's school.	0.650		0.108	
P9 Going to a follow-up visit allows my child to be sent to a specialist.	0.511		0.203	0.164
Pros (Attitudes and Beliefs)				
P10 Children with asthma are healthier if they see their doctor regularly.	0.298			0.634
P11 Going to a follow-up visit helps me feel that next time I might be able to prevent the ED or ER visit.	0.327		0.156	0.569
P12 Children with asthma have fewer ED or ER visits if they see their doctor regularly.	0.127		0.106	0.759
P13 Children with asthma miss less school if they see their doctor regularly.		0.103	−0.125	0.467
P14 Children with asthma have fewer symptoms if they see their doctor regularly.	0.160		0.274	0.681
Cons (Practical)				
C1 Going to a follow-up visit means I have to find transportation to get there.		0.701		
C2 Going to a follow-up visit forces me to take time off from work		0.544	0.177	
C3 Going to a follow-up visit means I have to get a family member or friend to sit with the other kids.	0.200	0.736	−0.159	
C4 Going to a follow-up visit means I have to find a baby-sitter for the other children.	0.100	0.749	−0.172	0.133
C7 Going to a follow-up visit means I have to pay for transportation.	−0.116	0.703	0.205	
C6 Going to a follow-up visit is hard because my family doesn't want to spend the time.	−0.202	0.464	0.141	0.116
Cons (Attitudes and Beliefs)				
C7 I don't need to see the doctor unless my child is sick.			0.654	
C8 Going to a follow-up visit is hard because my family doesn't think the child has asthma			0.566	
C9 Going to a follow-up visit is hard because my family doesn't want to spend the money.		0.121	0.466	
C10 My family and friends can give me good advice about asthma so I don't need to go to a follow up visit.	−0.166	0.127	0.484	
Items not chosen				
My child is better and does not need a follow up visit.			0.613	0.139
The doctor doesn't tell me anything helpful.	0.129		0.496	0.120
My child doesn't need to see another doctor so soon.	0.222	0.146	0.470	−0.106
Going to a follow-up visit allows my child's brothers, sisters, and other family to learn what to do when the child with asthma has symptoms.	0.553			0.199
Going to a follow-up visit allows me to find out if my child has allergies.	0.539			0.460
Going to a follow-up visit allows me to ask about sports and activities.	0.437			−0.139
Going to a follow-up visit allows me to get a peak flow meter.	0.427	0.354		
Going to a follow-up visit allows me to get an Asthma Action Plan.	0.424		−0.161	0.340
Going to a follow-up visit allows me to ask why my child got sicker.	0.365			0.290
Going to a follow-up visit means I have to get a family member or friend to drive us to the appointment.	−0.161	0.539	0.325	−0.121
Going to a follow-up visit is hard because it is difficult to get an appointment at a good time.		0.464	0.261	
It is embarrassing because I don't have the money to pay for the visit.	−0.335	0.399	0.212	0.123
Going to a follow-up visit I get praise from the doctor.	0.171	0.320		0.139
I feel embarrassed because my child was in the ED.		0.281		
When I take our child to a follow up visit I get approval from my family.		0.260		0.199
My child must miss school to go to a follow up visit.	0.176	0.213	0.431	−0.197
I am angry at myself because my child had to go to the ED.	−0.323	0.107	0.341	

ER indicates emergency room.

Specht, E.M., Bourguet, C.C., Predictors of Nonattendance at the First Newborn Health Supervision Visit, *Clinical Pediatrics*, 33: 273-279, 1994.

319 infant notes from the Continuity Care Clinic in Ohio showed relative risk of nonattendance at the first newborn visit was highest for multiparous mothers, women with no telephone, and unmarried teen mothers. 27.9% of newborns in this low-income population did not attend their first health visit.

State of Illinois, Office of Inspector General, *Non-Emergency Medical Transportation Reviews*, 99-0269, December 1999.

This document reviews the non-emergency medical transportation services in the state of Illinois. From 1997-1999 expenditures for NEMT increased by 24.9% and 60 out of 64 providers had discrepancies in claims. The report recommends increased monitoring and accountability to prevent fraudulent claims or poorly rendered services.

Stefl, G., Newsom, M., *Medicaid Non-Emergency Transportation: National Survey 2002-2003*, National Consortium of the Coordination of Human Services Transportation, December 2003. http://www.ctaa.org/ntrc/hrt.asp#rep

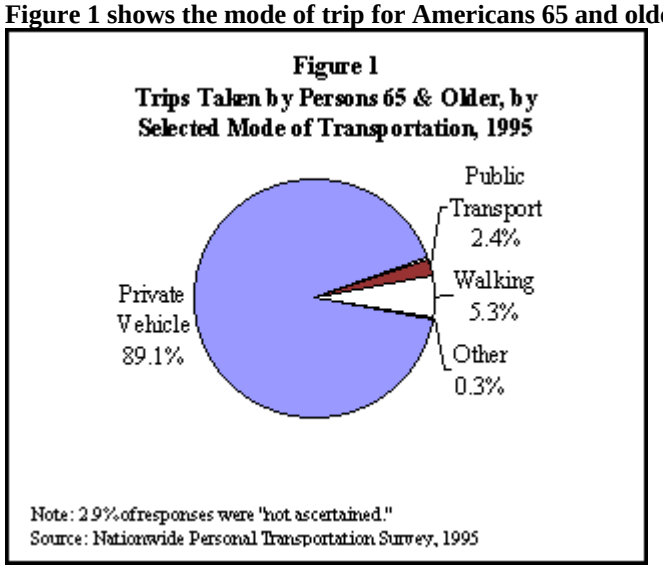
This report analyzes the results of a survey of non-emergency medical transportation providers administered to each state in 2002. Half of all states report NEMT expenditures are less than 1% of all Medicaid expenses. A majority of states are implementing cost containment measures on NEMT programs due to budget shortages. The federal government finances about 57% of all Medicaid costs. More than half of states reported coordination between state transit and Medicaid programs to save money and increase mobility. The report breaks down which states use what Medicaid categorization to fund NEMT.

Straight, A., Gregory, S. R., *Transportation: The Older Person's Interest, AARP* Public Policy Institute, March 2002. http://research.aarp.org/il/fs44r_transport.html

This report echoes similar research by the AARP on travel behavior and service demand among seniors aged 65 and over. Highlights:

- In 2000, 56 percent of elderly persons lived in suburban areas and 23 percent in rural areas, with the remaining 21 percent in central cities;
- Whereas the number of people age 65 and older grew approximately 12 percent from 1990 to 2000, the number of licensed drivers age 65 and older grew 35 percent during the same period.

Figure 1 shows the mode of trip for Americans 65 and older.



Thorpe, K. E., Florence, C. S., Joski, P., Which Medical Conditions Account for the Rise in Health Care Spending? *Health Affairs-Web Exclusive*, August 2004. W4-437.

Growth in healthcare costs from 1987 to 2000 was examined to determine which conditions acted as cost drivers. Five medical conditions account for 31% of the growth in spending: heart disease, mental disorders, pulmonary disorders, cancer, and trauma. Some of this was due to increased prevalence (cerebrovascular diseases, pulmonary conditions and diabetes), other cost increases stemmed from rising costs of treatments (heart disease, hypertension).

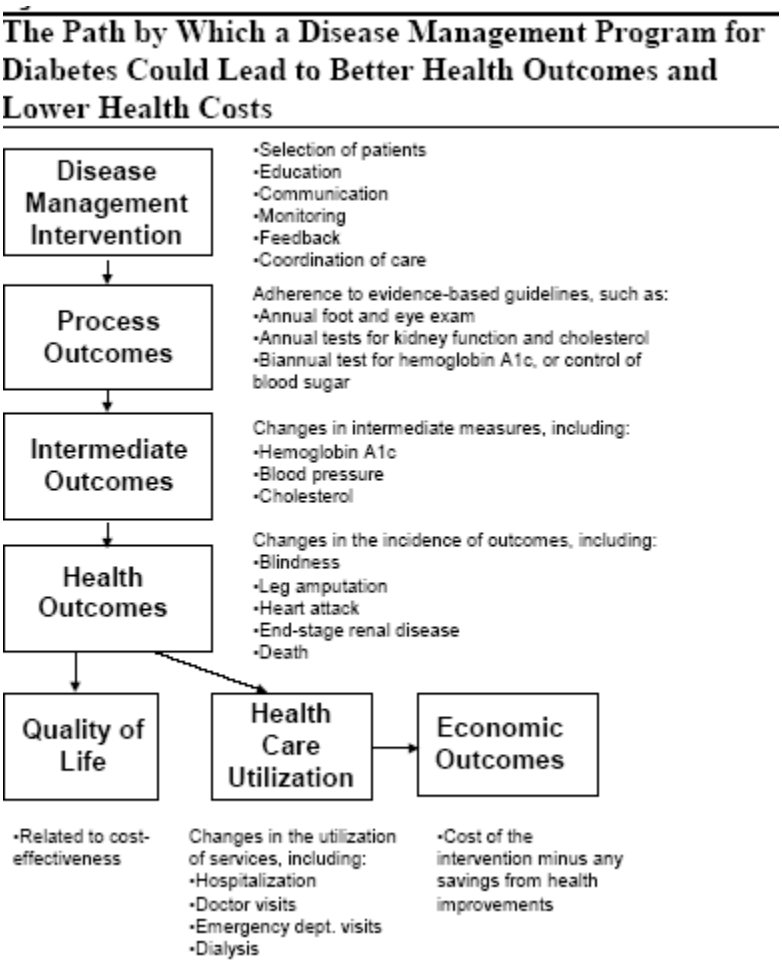
United States Census Bureau, Transit and Ground Transportation, Transportation and Warehousing Industry Series, 2002 Economic Census, April 2004.

This is a report on economic data on transit and ground passenger transportation from the 2002 Census. Highlights:

- The nation had 1,234 urban transit systems in 2002, up from 618 in 1997;
- Revenues grew from $1.5 billion to $3.6 billion;
- Urban transportation systems employed nearly 66,000 people in 2002, compared with 33,000 in 1997
- Between 1997 and 2002, revenues of the privately operated school and employee bus transportation industry grew from $4.4 billion to $5.9 billion;
- This industry showed an increase of more than 24,000 jobs, for a total of nearly 176,000.

United States Congressional Budget Office, *An Analysis of the Literature on Disease Management Programs*, October 13th, 2004. www.cbo.gov

This is a meta-analysis by the Congressional Budget Office on the benefits of disease management programs and how they might apply to Medicare. Congestive heart failure, coronary artery disease and diabetes are examined specifically while other disease management programs are also considered. The conclusion of the literature review is that there is not significant proof that healthcare costs are reduced through disease management programs, especially in a Medicare population.



United States Department of Commerce, Office of Technology Assessment, *Health Care in Rural America,* Report Number OTA-H- 434, September 1990.

This is an older report on both the access and barriers that exist for rural Americans in utilization of health care. The section on patient mobility uses 1988 Medicare data to show that only a few hospitals incur the majority of charges for rural Americans, suggesting that although the distance between the patient and health care provider can be very wide, the options closer to home are scarce. Less than 6% of hospitals provided 75% of Medicare services. In addition to few health care options, distance and transportation access are significant barriers, but mode of travel was not specifically considered.

United States Department of Health and Human Services, *Centers for Disease Control Fact Book* 2000/2001, Washington DC, September 2000.

The factbook presents the preventive activities the CDC engaged in from 2000 through 2001.

United States Department of Health and Human Services, *Healthy People, 2010,* Washington DC, 2000.

The majority of health care providers use the Healthy People guidelines to set goals to bring the public health of the nation up. These goals are described in this publication and provide guidance on standards that healthy people should achieve in terms of utilization of care and health outcomes.

United States Department of Health and Human Services, Office of the Inspector General, *Controlling Medicaid Non-Emergency Transportation Costs,* OEI-04-95-00140, 1997.

This is a report on how to address the 10% average rise in state non-emergency medical transportation costs that occurred between 1990-1995. Case studies in six states revealed a variety of strategies to control costs by eliminating trips for unnecessary care, people who have alternative transportation, and fraudulent claims for trips not made. Brokers reduced costs, as did reducing the number of high cost vehicles.

United States Department of Health and Human Services, *Prevention Makes Common "Cents",* Washington DC, September 2003.

This is a report on the rising costs of health care and the burden of preventable diseases. The following are high cost, chronic conditions that could be prevented, thereby reducing the high cost of health care.

- Approximately 129 million U.S. adults are overweight or obese which costs this Nation anywhere from $69 billion to $117 billion per year.
- In 2000, an estimated 17 million people (6.2 percent of the population) had diabetes, costing the U.S. approximately $132 billion. People with diabetes lost more than 8 days per year from work, accounting for 14 million disability days.
- Heart disease and stroke are the first and third leading causes of death in the United States. In 2003 alone, 1.1 million Americans will have a heart attack. Cardiovascular diseases cost the Nation more than $300 billion each year.
- Approximately 23 million adults and 9 million children have been diagnosed with asthma at some point within their lifetime, with costs near $14 billion per year.

United States Department of Transportation and Health and Human Services, Coordinating Council on Access and Mobility, established 1986. *United We Ride* http://www.unitedweride.gov/

This website provides resources to those with mobility needs. Information on public transit and paratransit services are organized by location. Policy development and research associated with transportation and access to healthcare are presented.

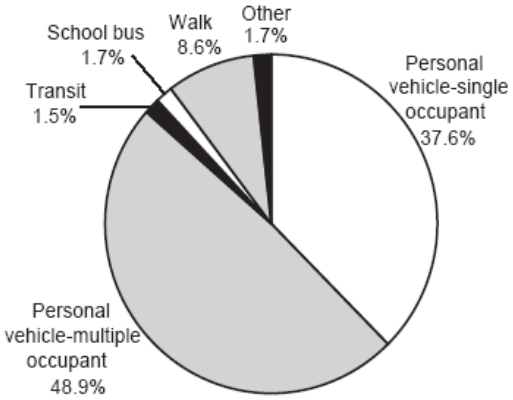
United States Department of Transportation, Bureau of Transportation Statistics, *Freedom to Travel*, BTS03-08, Washington DC, 2003.

This is a survey of 5,000 disabled and non-disabled public transportation riders. Results showed that just over 1% of the US population is homebound, 1.9 million of whom are also disabled. 528,000 of disabled, homebound Americans experience transportation barriers.

United States Department of Transportation, Bureau of Transportation Statistics, *Highlights of the 2001 National Household Travel Survey*, BTS03-05, Washington DC, 2003.

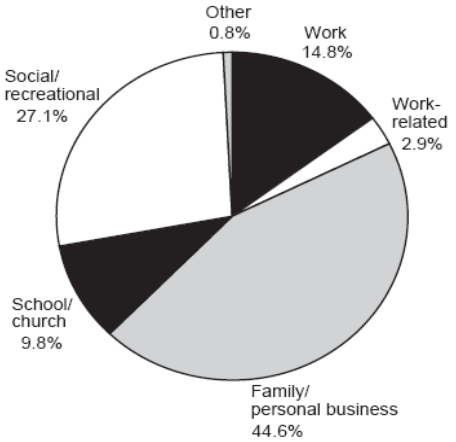
The National Household Travel Survey of is administered to 26,000 households regarding their travel behavior. 8% of US households report not having a car for daily use, while 88% of Americans over age 15 report driving. The majority of trips were made in a personal vehicle, but 9% of all trips were made walking, and 2% were in public transit, as shown in Figure 6. Figure 7 shows the purpose of trips. 8.6% of respondents reported a medical condition that limits travel. Because medical visits were included as personal business with several other variables, the number of trips for medical care could not be determined.

Figure 6
Proportion of Trips by Mode



SOURCE: The 2001 National Household Travel Survey, daily trip file, U.S. Department of Transportation.

Figure 7
Proportion of Trips by Purpose



SOURCE: The 2001 National Household Travel Survey, daily trip file, U.S. Department of Transportation.

United States Department of Transportation, *Safe Mobility for a Maturing Society: Challenges and Opportunities*, Washington DC, November 2003.

This report addresses the needs of the population aged 65 and over and safety on highways, local roads, and in automobiles and in public transportation. After the aged 16-24 cohort, Americans 75 and over have the highest fatality rates on the road. The report is a consensus of focus groups, industry stakeholders, and community forum participants from around the country in creating a 10 year vision of the changes to roadway and public transportation safety that should come about to increase the mobility of the elderly population.

United States General Accounting Office, *CMS Did Not Control Rising Power Wheelchair Spending*, GAO 04-716T, April 2004.

This report shows that spending on power wheelchairs, the most expensive product in the durable medical equipment category that Medicare covers, rose by 450% from 1999-2003, despite a change of only 11% in all other Medicare spending. Although there is concern that vendors supplying power wheelchairs are cheating the system with unfairly high prices, the relevant information is on the number of Americans using wheelchairs that may require special modes of transportation.

United States General Accounting Office, *Mass Transit: FTA Needs to Better Define and Assess Impact of Certain Policies on New Starts Program*, GAO-04-748, June 2004.

Report on how the FTA makes funding decisions. There is a good description of cost effectiveness as a criterion.

United States General Accounting Office, *Rural Ambulances: Medicare Fee Schedule Payments Could Be Better Targeted*, GAO HEHS 00-115, July 2000.

This report on rural ambulance providers shows that ambulance trips are often necessary to ensure equal access for Medicare beneficiaries. The report discusses revised pay scales to ensure equity in payments and to allow rural providers to maintain service.

Table 1: Characteristics of Medicare Ambulance Transport by Urban and Rural Freestanding Providers, 1998

	Number of transports		Transports of 20-49 miles (percentage)		Transports of 50+ miles (percentage)	
Transport type	Urban	Rural[a]	Urban	Rural[a]	Urban	Rural[a]
Ground nonemergency	2,405,524	580,130	3.2	11.3	0.5	5.3
Ground emergency	2,404,369	802,412	2.1	10.7	0.2	3.6
Air (emergency and nonemergency)	427	459	3.8	5.2	4.2	36.8

[a]Defined as rural if the address of the beneficiary who was transported was not in a metropolitan statistical area (MSA).

Note: Figures from this table represent all claims in which mileage was billed separately.

Source: HCFA, *National Claims History 100% Nearline File, 1998* (June 1999).

United States General Accounting Office, *Supports for Low Income Families, States Serve a Broad Range of Families through a Complex and Changing System*, GAO-04-256, January 2004.

This report shows the types of government programs that provide support to low-income families. Most states subsidize public transportation for low-income families, described in Table 8. Almost all families take advantage of state subsidized public transit but in states that also offer discounted car repairs, less than half of low-income families take advantage of this service.

Table 8: Proportion of Eligible Applicants Who Receive Transportation Assistance, by State and Type of Assistance

State	Public transit subsidies	Van/shuttle service	Car repairs	Car insurance	Fuel vouchers	Establishment of public transit route	Used cars	Carpool matching
Alabama	Don't know	Don't know	.	.	.	Don't know	.	.
Alaska	All or almost all	All or almost all	All or almost all	All or almost all	All or almost all	.	.	.
Arizona	Almost none	Almost none	Almost none	Almost none	Almost none	.	.	Almost none
Arkansas	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	.
California	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
Colorado	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	.
Connecticut	All or almost all	All or almost all	All or almost all	More than half	All or almost all	All or almost all	More than half	.
Delaware	Don't know	All or almost all	All or almost all	All or almost all	.	Don't know	More than half	Don't know
District of Columbia	.	.	.	.	.	.	.	.
Florida	About half	Don't know	Don't know	Don't know	About half	Don't know	Don't know	.
Georgia	About half	About half	Less than half	Less than half	.	.	.	.
Hawaii	All or almost all	.	.	All or almost all	.	.	.	.
Idaho	Don't know	.	Don't know	Don't know	Don't know	.	.	.
Illinois	All or almost all	Don't know	Less than half	Don't know	Don't know	Don't know	Almost none	.
Indiana	More than half	Less than half	About half	.	About half	.	Less than half	.
Iowa	Don't know	Don't know	Less than half	Less than half	Less than half	Don't know	Less than half	.
Kansas	Don't know	.	Don't know	Don't know	.	.	Don't know	.
Kentucky	.	.	All or almost all	All or almost all	.	.	.	.
Louisiana	Don't know	Don't know	Don't know	Don't know	.	.	Almost none	.
Maine	.	All or almost all	.	.	.	All or almost all	.	.
Maryland	All or almost all	All or almost all	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
Massachusetts	All or almost all	Less than half	Almost none	.	Almost none	Almost none	Almost none	Almost none
Minnesota	More than half	.	.	.	.	More than half	.	.
Mississippi	All or almost all	All or almost all	Almost none	Don't know	.	.	.	.

State	Public transit subsidies	Van/shuttle service	Car repairs	Car insurance	Fuel vouchers	Establishment of public transit route	Used cars	Carpool matching
Missouri	.	Almost none	About half	.	.	.	.	.
Montana	All or almost all	.	All or almost all	All or almost all	All or almost all	.	All or almost all	.
Nebraska	Don't know	Don't know	Don't know	Don't know	Don't know	.	Don't know	.
Nevada	.	.	Almost none	Almost none	Almost none	Almost none	.	.
New Hampshire	All or almost all	Don't know	All or almost all	All or almost all	.	Don't know	About half	.
New Jersey	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
New Mexico	All or almost all	All or almost all	More than half	More than half	All or almost all	.	Almost none	.
New York	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
North Carolina	All or almost all	All or almost all	All or almost all	All or almost all	All or almost all	All or almost all	About half	Less than half
North Dakota	More than half	About half	All or almost all	All or almost all	More than half	Less than half	.	Less than half
Ohio	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
Oklahoma	Don't know	Don't know	Don't know	Don't know	.	Don't know	Don't know	.
Oregon	About half	Almost none	Less than half	Almost none	About half	Almost none	.	Almost none
Pennsylvania	All or almost all	All or almost all	All or almost all	All or almost all	All or almost all	All or almost all	All or almost all	All or almost all
Rhode Island	Don't know	All or almost all	.	.	.	Don't know	.	.
South Carolina	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
South Dakota	.	.	.	.	.	.	.	.
Tennessee	.	.	.	.	.	.	.	.
Texas	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
Utah	.	More than half	More than half	Less than half	More than half	.	Almost none	.
Vermont	All or almost all	All or almost all	Don't know	.	.	More than half	Don't know	All or almost all
Virginia	.	.	.	.	.	.	.	.
Washington	Don't know	Don't know	All or almost all	All or almost all	All or almost all	Don't know	Don't know	Don't know
West Virginia	.	.	About half	.	About half	.	Almost none	.
Wisconsin	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know
Wyoming	Almost none	.	Almost none	Almost none	Almost none	.	.	.

Source: GAO survey, spring 2003.

United States General Accounting Office, *Transportation-Disadvantaged Populations: Some Coordination Efforts Among Programs Providing Transportation Services but Obstacles Persist*, GAO-03-697, June 2003.

This report discusses the federal programs that exist to provide transportation services. Transportation disadvantaged people are predominantly low-income, disabled, and/or elderly. Four national agencies, Transportation, Health and Human Services, Labor and Education provide transit programs, and coordination could reduce redundant services saving money, and could increase mobility for riders. In fiscal year 2001, 29 of the 62 federally funded transportation programs spent $2.4 billion dollars. The Coordinating Council on Access and Mobility is working toward coordination efforts in each state. Some obstacles to coordination include rules or limits specific to certain agencies, and a lack of financial incentives to increase coordination and communication about program availability to riders.

United States General Accounting Office, *Transportation-Disadvantaged Populations: Federal Agencies Are Taking Steps to Assist States and Local Agencies in Coordinating Transportation Services*, GAO 04-420. February 2004.

This report follows-up on the 2003 Transportation Disadvantaged report by the GAO. Results showed positive coordination efforts, but obstacles still remained. The Department of Education lagged in strategic planning for coordination and, along with the Department of Labor, has not joined the Coordinated Council on Access and Mobility. All four agencies have launched independent initiatives, like the "United We Ride" program to increase coordination and dissemination of information to riders, but long-term funding remains unclear.

***United States Preventive Health Services Task Force, 1996*. Williams and Wilkins, 2nd ed., 1996.**

This document provides guidance on preventive services to set up the missed care aspect of the benefit cost analysis. The majority of preventive services are recommended for people over age 50.

Walker, R.B., *Transportation-related Barriers to Medical Care: A Grant Supported Study of a Rural West Virginia County*, TRB Economic Development Conference, May 2002.
http://www.marshall.edu/ati/tech/PortlandConference/updatedPDFs/Portland_Walker.pdf

This report is an assessment of rural healthcare access and the effect of public transportation in Lincoln County, West Virginia, a rural area with a population of 23,675. Highlights of transportation-related barriers to care:

- 28.3% (75/266) walked or relied on someone to drive them to care;
- 36.8% (98/266) needed someone else to take them outside the county;
- Half had to pay for transportation to care;
- More than half said they could afford $5.00 (typical cost was $6.00 to $10.00);
- More than 10% could not pay for transportation to care.

Lack of transportation resulted in:

- Missed appointments (40.2%);
- Inability to get to a pharmacy (27.8%).
- Almost half (44.7%) reported that road conditions kept them from medical care
- Only 4 of 266 patients rode the bus despite 8 stops a day at the health center.

Wallace, R.R. 1997. "Paratransit Customer: Modeling Elements of Satisfaction with Service," *Transportation Research Record* 1571: 59-66.

Using demographic and other characteristics of paratransit customers in southeastern Michigan, along with paratransit service characteristics in the region, this paper develops a causal model of factors affecting customer satisfaction with paratransit service. Such models, which analyze the covariance structures of variables and factors hypothesized to exhibit causal relationships, aid in the gauging the potential impact of improving customer satisfaction through changes in paratransit operations and management. Furthermore, these models can suggest which elements of customer satisfaction are most affected by system changes. A key finding from the study is that characteristics specific to the customers themselves—such as personal mobility—contribute

substantially to overall customer satisfaction. In addition, the study also showed that transit system characteristics also contribute to overall customer satisfaction, especially to satisfaction with the trips-scheduling process, meaning that technological and other system enhancements have ample potential to improve customer satisfaction, but that this potential is limited in part by characteristics of the customers. The study also revealed that, for the system in question, the agency accommodated about 85 percent of trip requests and that riders were overwhelmingly female and older adults, traveling for a wide variety of trip purposes. Of these purposes, however, medical trips and shopping trips were the most common.

Warner, K.E., Luce, B.R., *Cost Benefit and Cost-Effectiveness Analysis in Health Care: Principles, Practice, and Potential*, Health Administration Press, Ann Arbor, MI, 1982.

This textbook covers cost benefit and cost effectiveness analyses with a focus of healthcare.

Weingarten, N., Meyer, D.L., Schneid, J.A., Failed Appointments in Residency Practices: Who Misses Them and What Providers are Most Affected? *Journal of the American Board of Family Practice*, 10:407-11, 1997.

This study focuses on patient billing information and appointment records over 36 sampled days during 1995 for a community-hospital-based family practice in New England. The missed appointment rate was 6.7%. Missing appointments was correlated with being between 17-30 years of age, Medicaid coverage, lack of health insurance, and appointments scheduled with first year residents or medical students. Transportation was not one of the variables studied.

Weinick, R.M., Krauss, N.A., Racial/Ethnic Differences in Children's Access to Care, *American Journal of Public Health*, 90: 1771-1774, 2000.

This analysis of 1999 Medical Expenditure Panel Survey data explores racial and ethnic differences in access to care among children. 17.2% of Hispanic children had no usual source of care, as compared to 12.5% of black, 8.6% of Asian, and 6.0% of white/other children.

Weinick, R.M., Zuvekas, S.H., Drilea, S.K., *Access to Health Care-Sources and Barriers, 1996*, MEPS Research Findings No. 3, AHCPR Pub. No. 98-0001, Agency for Health Care Policy and Research, 1997.

This analysis of 1996 Medical Expenditure Panel Survey data focuses on access to health care. Transportation barriers are included in "other problems" and account for 20.7% of all respondents experiencing access barriers.

Welch, G.H., *Dangers in Early Detection*, Washington Post, p. A23, July 1, 2004.

This newspaper article suggests that more costs are incurred through early detection and preventive screening measures than are warranted for the benefits perceived. Early warning signs for diseases could mask conditions that resolve without medical care or initiate treatment for diseases that may worsen health conditions rather than improving them.

Wittenburg, D., Favreault, M., ***Safety Net or Tangled Web? An Overview of Programs and Services for Adults with Disabilities,*** **Occasional Paper No. 68, The Urban Institute, 2004.**

This report addresses the needs of the adult disabled population and the government safety net programs that exist to meet these needs. Data from the 1999 National Survey of America's Families is used to profile the health of low income adults aged 25-55 and the subsequent challenges they face. Highlights of findings: Of the 28.9 million low-income adults in the U.S., 23% report a work limitation, 25% report fair/poor health status, and 15% report poor mental health. The prevalence of these problems is even higher among those with income below the poverty level; over 30% of adults report work limitations and/or fair or poor health, and 23% report poor mental health. Each condition is about twice as prevalent in the low-income population as in the total adult population. The report than discusses the government programs that provide services to this population. Transportation is not directly covered.

Yang, S., Tipnis, S., Saenz, C., Kelly, N., ***The Impact of an Intervention Utilizing Mass Transit on Access to a Medical Home for Low-Income, Minority Urban Children,*** **General Pediatrics and Preventive Pediatrics: Parental Role Education - Poster Session I, 2004 Pediatric Academic Society's Annual Meeting, May 2004.**

This poster demonstrates the effectiveness of a mass transit program that targets pediatric patients with transportation problems at risk for missing appointments among low-income families in the urban Texas Hospital Residents Primary Care Group Clinic. This randomized controlled trial offered caregivers an intervention of bus tokens and route information in addition to routine discharge instructions. In the 6-month follow-up, the 60 caregivers receiving the intervention did not have different missed appointment rates from the control group. Missed appointments within the intervention group were associated with the receipt of multiple intervention boosters ($p<0.001$) and a higher income level ($p=0.003$). Results: At baseline, 55% reported they used their own car to reach clinic, 72% had never used public transit to clinic, and 25% reported missing an appointment due to transportation.

Yawn, B.P., Xia, Z., Edmonson, L., Jacobson, R.M., Jacobsen, S.J., Barriers to Immunization in a Relatively Affluent Community, ***Journal of the American Board of Family Practice,*** **13: 325-332, 2000.**

A self reported transportation barrier was associated with under immunization in 20-month-old children in this survey of 596 parents in a family practice clinic in affluent Olmstead County, Minnesota. Table 3 shows the results of the perceived barriers and under immunization of children.

Table 3. Association Between Perceived Barriers and Underimmunization

Problem	Univariate Analysis Overall		Adjusted* Analysis	
	Odds Ratio (95% CI)	Attributable Risk (95% CI)	Odds Ratio (95% CI)	Attributable Risk (95% CI)
I had problems getting transportation	7.8 (1.9, 31.8)	4.9 (-0.7, 10.4)	4.7 (1.1, 20.8)	5.2 (0.1, 13.7)
My child had been sick and I didn't take my child for shots	5.2 (2.3, 11.5)	12.5 (3.4, 21.4)	4.0 (1.7, 9.3)	12.1 (2.4, 21.8)
I didn't know when the next shot was needed	2.8 (1.5, 5.3)	13.6 (2.9, 21.2)	2.8 (1.4, 5.4)	14.1 (2.4, 25.8)
It was hard to remember the appointment	2.6 (1.0, 6.8)	5.2 (-1.6, 12.0)	2.7 (1.0, 7.4)	5.5 (-1.9, 13.0)
I was afraid my child would have a reaction to the shot	2.3 (1.3, 4.2)	14.4 (2.5, 26.4)	2.5 (1.3, 4.6)	16.4 (3.6, 29.2)
I didn't like the doctors or nurses at the clinic	3.1 (0.9, 10.1)	3. (-1.7, 9.3)	2.4 (0.7, 8.1)	3.5 (-3.0, 10.0)
My doctor advised that my child not have shots at this time	3.1 (0.9, 10.1)	3.8 (-1.7, 9.3)	2.5 (0.7, 8.5)	3.6 (-2.1, 9.3)
I found the clinic location was not convenient	2.6 (0.9, 7.3)	4.3 (-1.9, 10.5)	2.7 (0.9, 8.0)	4.6 (-2.0, 11.3)
I had to pay too much for the shots	2.0 (0.9, 4.4)	6.4 (-2.0, 18.0)	1.1 (0.5, 2.7)	0.5 (-10.6, 11.6)
I didn't want to put my child through the pain of shots	1.4 (0.7, 2.9)	4.0 (-5.1, 13.3)	1.1 (0.5, 2.5)	1.6 (-9.2, 12.3)
I didn't want my child to get more than one shot at a time	1.6 (0.7, 4.1)	3.3 (-3.4, 10.0)	1.7 (0.7, 4.5)	4.1 (-3.9, 12.1)
Any barriers listed above	2.5 (9.0, 49.4)	33.0 (15.2, 50.7)	2.1 (1.2, 3.6)	29.2 (9.0, 49.4)

Note: Barriers are combined reported major and minor barriers.

* Associations after adjusting for income and self-payment.

Zogby International, *Survey Reveals Millions of U.S. Children Unable to Access Health Care Due to Lack of Transportation*, New York, 2001.
http://www.childrenshealthfund.org/release071201.html

The survey commissioned by the Children's Health Fund and conducted by the polling firm Zogby International finds transportation is a major barrier to healthcare access for children. Poor and low-income families who live up to 50 miles away from medical facilities are hardest hit, but urban areas face problems also. 9% of children in families with incomes up to $50,000 miss essential medical appointments dues to lack of transportation, regardless of insurance. 59% of children enrolled in the states Children's Health Insurance Program (SCHIP) do not know that Medicaid provides transportation; only one out of ten Medicaid families has used it.

Zorc, J.J., Scarfone, R.J., Yuelin, L., Hong, T., Harmelin, M., Grunstein, L., Andre, J.B., Scheduled Follow-up After a Pediatric Emergency Department Visit for Asthma: A Randomized Trial, *Pediatrics*, 111:495–502, 2003.

This is an evaluation of an intervention to schedule follow-up appointments immediately following an emergency room (ER) visit for asthma and the subsequent health effects and utilization patterns among 144 randomly assigned urban children (2-18 years of age) compared with a control group of 142 receiving no intervention. In the intervention group more children returned for follow up appointments (64% compared with 46%) there was no change in return ER visits, missed school, and asthma medication use at home. Only 24% of patients in the

intervention group had appointments scheduled during the ER visit. Transportation barriers were mentioned in the discussion. This is a good characterization of asthma in urban children.

Appendix C: Cost-Effectiveness Analysis and QALYs

This study makes heavy use of a number of economic concepts, particularly as they pertain to healthcare. This appendix presents a brief overview of two concepts that may not be well known by all readers of this report. They are cost-effectiveness analysis (CEA) and quality-adjust life years (QALYs).

C.1 Economic Evaluations in Healthcare

Economic evaluation methods used in healthcare include cost-of-illness studies, cost-minimization analysis, CEA, and cost benefit analysis (Jefferson, et al., 1996). For this project, we believe that the most appropriate method of evaluating the benefits of increased transportation is through CEA. This method employs measures of the effectiveness-per-unit-cost, as opposed to a typical cost-to-cost comparison (Warner and Luce, 1982). Gold writes, "A primary objective of cost-effectiveness analysis is to incorporate a consideration of resource consumption into decisions about healthcare. An explicit examination of resources allows an assessment of costs relative to the health benefits of an intervention" (1996, p.176).

Interventions devoted to extending life or increasing its quality may be so successful that *net* costs (the cost of the intervention minus savings that accrue due to decreased healthcare expenditures) fall – the intervention pays for itself! Most often, however, interventions will have a *positive net cost*, but the benefit may still be judged worthwhile. This is the proper domain of CEA, as illustrated in Figure C-1.

Figure C-1: The Basic Cost-Effectiveness Analysis Matrix

Costs ↓ Outcomes ↓	Costs ↓ Outcomes ↑
Costs ↑ Outcomes ↓	Costs ↑ Outcomes ↑

Black: "Dominance"; Grey: Reject Out of Hand; Textured: CEA Relevant

The upper, right quadrant of the figure shows the "dominant" situation, which is characterized by lower net costs after an intervention coupled with better outcomes. The lower left "rejection quadrant" indicates the worst of both worlds: higher costs and worse outcomes. The two textured, diagonal quadrants exemplify the situations relevant to CEA: lower costs/worse outcomes or higher costs/improved outcomes. Because we usually expect better health to warrant an investment, the key question becomes:

Is a particular health improvement worth its additional cost?

C.2 Cost-Effectiveness Analysis Ratios and QALYs

The quality-adjusted life year (QALY) concept acts to combine mortality and morbidity into a single measurement for gauging the value of a health-related intervention. Augmenting the conventional CEA framework with the QALY measure elevates the CEA method's true power: providing a summary measure that specifically integrates quality improvements and facilitates comparisons *across* therapies – not only can one asthma intervention be compared with another, but each can now be compared with, e.g., a congestive heart failure intervention. The QALY concept depends on a health-related quality of life (HRQL) measurement than can be represented as a continuum bounded by two extremes: 0 representing death and 1 representing perfect, or optimal, health. Thus:

$$0 < HRQL \leq 1$$

The concept begins with a single individual and is then expanded to a population by summing HRQLs across individuals. With estimated HRQLs, the QALY concept can be illustrated as follows. Suppose a randomized control trial of 1,000 heart failure patients is initiated to test an integrated disease management strategy. Assume this intervention leads to an average, per person gain of 0.1 years of life expectancy that is adjusted downward by one-half to reflect its severely impaired HRQL. That is, the representative individual would live 1.2 extra months, but do so at a level that is rated at approximately one-half that of perfect health. The total QALYs obtained from this hypothetical intervention would be:

$$0.1 * 0.5 * 1{,}000 = 50$$

The cost of the intervention results in increased life expectancy or a higher quality of life (or both) for the affected population, as measured by surveys and health-related standards. Comparing the intervention as a discrete alternative to a baseline case yields a cost-effectiveness *ratio*: All costs are placed in the numerator and the benefit (the sum of QALYs) is shown in the denominator. Continuing from the above illustration, the total cost of the heart failure trial (which would include all incremental costs for treating the experimental group *minus* any cost savings from reduced healthcare expenditures experienced by this group) might equal $1,000,000. Accordingly, the CEA ratio would be:

$$\$1{,}000{,}000/50 \text{ QALYs} = \$20{,}000 / \text{QALY}$$

While not based on actual data, this example is germane to this study precisely because an integrated disease management protocol would rely heavily on multiple healthcare encounters for a severely impaired population. This population may also be medically underserved either because of low income or very high utilization, the costs of which are not fully covered by insurance. The potential for missed visits due to transportation is great; the potential for decreases in health status (net health benefits) because of these missed visits likewise is great, especially to the extent that the missed visits are instrumental to the success of the disease-management strategy.

An example of a highly cost-effective therapy concerns use of ACE inhibitors by symptomatic patients with heart failure. This treatment has demonstrated a CEA ratio of only $115 per added QALY (Glick et al., 1995). Similar, highly cost-

effective results have been found for strategies to prevent neural tube defects (Gold et al., 1996).

C.3 Relative and Absolute Appraisals in Healthcare Analysis

Researchers often anticipate robust results that will show an intervention to be cost-effective, if not actually cost saving – the case of "dominance." As discussed above, while several examples of highly positive results exist – especially studies that analyze prevention for at-risk populations – most interventions show increases in *net* cost. Are the benefits worth the cost? While no absolute standard is without controversy, a general convention in the field is that a CEA ratio of less than $50,000 per QALY is regarded as economically attractive. This is based on the cost of providing dialysis to renal failure patients (Evans et al., 2004; Mark and Hlatky, 2002). CEAs that result in a cost per QALY greater than $100,000 are seen as clearly unattractive; the $50,000-to-$100,000 range represents a gray area that requires more subjective judgment by the analyst.

Finally, the QALY construct should be seen as producing a relative-absolute measure. The absolute component is a QALY cost estimate for a particular healthcare intervention, and the relative component is the comparison of this estimate to either a different healthcare intervention or to healthcare interventions in general. As above, denoting an intervention as cost-effective can never be assessed in a perfect, non-contentious manner. Both the HRQL assessment and the cost-effectiveness demarcation (e.g., $50,000) will remain controversial. In the health arena, however, this approach is far superior to a strict cost benefit analysis, because the latter forces the researcher to evaluate all the health benefits (as well as the costs) in purely monetary terms. Thus, instead of asserting that different health states can be ranked according to a 0 – 1 scale, and that this scale can be used to adjust life expectancy from a particular intervention, the cost benefit approach requires an estimate of the absolute monetary value of a quality-adjusted life expectancy. Such an estimate is controversial at its core and objectionable to most analysts on ethical and other grounds.