IMPROVING TRANSPORTATION ACCESS TO HEALTH CARE: ADDRESSING THE NEEDS OF THE ELDERLY

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ABSTRACT

This research investigates whether the elderly have adequate transportation access to health care services. It also explores whether transportation access issues may be influencing elders' health care choices, such as how frequently they use medical services and whether and where they receive preventative care.

The main impetus for this study is the elderly population increases projected for the coming decades. For older adults, adequate access to medical care is crucial for maintaining good health and avoiding many common chronic health problems. A second impetus is the expected growth in health care costs among the elderly and the potential for better access to care to help keep these costs in check. This research seeks to identify significant transportation access to care issues now so that they can be addressed before the problems become magnified.

The study conducts a spatial analysis of transportation and health care services and assesses potential disparities between where the elderly population lives and where these services are located. The Boston metro region is the geographic area of focus for that analysis. The study also examines the elderly's health care use and cost trends nationally to explore the possible health and cost impacts of access to care issues.

The study finds that most older adults have adequate transportation access to care. However, it is shown that transportation issues influence other elders into making sub-optimal health care choices, including relying on emergency services for non-urgent problems or preventative care, or deciding to forego treatments such as chemotherapy that require multiple doctors' visits.

The research also suggests that in the future, more elders may have problems accessing health care. Not only will the future elderly population be larger, but it will also be more based in suburbs, many of which have few transportation alternatives to the automobile. In addition, as the elderly population spreads out, health care providers are expected to be consolidating into fewer physical locations, and most elders may need to make longer trips to reach medical services. Combined with the anticipated weakening of the informal friends and family networks that so many seniors rely upon to help them with their transportation needs, these factors are likely to lead to decreased access to care.

One option for improving the elderly's access to health care that is particularly promising is telehealth home care. Telehealth decreases the elders' need to travel to receive care and increases their interactions with their doctors. In addition, preliminary studies have shown that telehealth care can improve elderly patients' health while also reducing their overall costs of care.

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As older adults age, their independent mobility often decreases and they become more reliant on others for transportation. Younger elderly take the majority of their trips as drivers, whereas older elders are more likely to be passengers. As older adults become non-drivers or limit their driving, it is important that they are still able to make the trips (social, recreational, and medical) that are essential to maintain a high quality of life. Elderly non-drivers frequently have trouble sustaining their mobility; among elders, drivers make three times as many trips per week as non-drivers (Straight, 1997). They also have trouble maintaining their links to their communities; as a result, they are at increased risk for depression and a sense of helplessness and low self-esteem (Carp, 1988). The non-driving transportation options that are available to seniors are often limited, and elders who stop driving frequently either rely on family or friends or cut back their trips substantially.

As adults age, it is essential that they are still able to access medical care and the other services that help them remain healthy as they grow older. The elderly have high incidence rates of chronic diseases and conditions, such as heart disease, for which regular medical care is essential. With regular care and monitoring, many of the potential complications of these diseases can be reduced and eliminated. Good access to care helps the elderly remain healthy and active and reduces disability. It also helps decrease medical expenditures due to chronic disease complications and the resulting hospitalizations and intensive treatments. These types of expenditures currently contribute disproportionately to overall health care spending, especially among the elderly. Better transportation access to care has the potential to reduce these costs.

This research focuses on the elderly’s transportation access to health care. The research starts by evaluating the elderly’s current access to care. A main hypothesis of this study is that there are spatial and transportation barriers that may be leading older adults to neglect the need for regular, preventative care, and causing them to make other sub-optimal health care choices. The research also examines potential access issues for current and future elders. It
then explores ways in which these potential barriers to access could be removed and older adults’ access to care improved.

This research is taking place at a time when issues concerning the elderly, and particularly elder mobility and health care expenditures, are moving increasingly to the forefront of public policy concerns. The elderly population is already growing significantly and the first wave of baby boomers will begin turning 65 in 2011, roughly ten years from now. As the number of elderly increases, there is a growing sense of urgency regarding their health care and transportation needs. Officials are already working to develop programs and policies that can effectively address the elderly’s current transportation and health care problems while minimizing the societal costs associated with an aging population. This research is also prompted by demographic and economic changes that make the issues of transportation access to health care even more pressing and more challenging to address. This research seeks to explore the potential impact of these changes now, in advance of future problems, so that possible issues can be addressed ahead of time in an efficient way.

1.1 Research Context

1.1.1 Challenges

Each of the following anticipated changes and current issues may adversely affect society’s ability to provide older adults with quality access to health care.

Projected growth in the elderly population. Over the next two decades, the number of people 75 years old and above in the U.S. is expected to increase by over 30 percent, growing from 16.5 million today (year 2000 estimate) to almost 22 million in 2020 (U.S. Census Bureau, 1996a). As the elderly population increases, it is also projected to become more racially diverse. Between now and 2020, the Asian population age 75 and over is expected to almost double, to 875,000, and the number of Hispanics in this age group is projected to grow by more than 150 percent, to 1.9 million (U.S. Census Bureau, 1996a). As the elderly population becomes more racially diverse, more elders may need health care services that are culturally sensitive and available in different languages in order to have quality access to care.
Continuing suburbanization among older adults. Growth in the number of older adults is expected to be accompanied by increased spatial dispersion of the elderly population. Elders today live predominantly in cities and near-in suburbs. Younger generations, including future elders such as the baby boomers, live less in cities and more in suburbs, particularly suburbs along the urban fringe. Most people in these younger age groups intend to stay in these suburban communities as they grow older (Burkhardt, 1998; Roper Starch and AARP, 1999). The increases in the suburban elderly population will create a number of issues related to access and mobility. Suburbs, particularly the suburbs farther away from cities, tend to have lower population densities and more separation of land uses than urban areas. Walking for transportation is usually not an option in suburban communities. In addition, suburbs frequently provide few alternatives to the automobile. Suburban residents who limit their driving or stop driving altogether as they age usually find their mobility restricted. Compared to urban elders, suburban seniors often also feel more isolated and have less access to activities and services. As the numbers of suburban elders grows, it will be increasingly important to provide these individuals with ways to access essential services, including health care, and stay involved in their communities.

Physical consolidation of health care resources. At the same time that the elderly population is become more spatially dispersed, health care providers such as doctors and hospitals are consolidating and becoming more spatially concentrated. In recent years, the number of hospitals and physicians’ practices has decreased significantly. In the Boston metro area, for example, between 1987 and 1997 the number of hospitals declined by almost 20 percent and the number of physicians’ offices and clinics by more than 10 percent. With the consolidation of health care providers, the neighborhood doctor is quickly becoming an antiquated concept. Fewer physicians are working in local communities, and a result, patients, including the elderly, frequently have to travel farther to receive medical care. For patients with inadequate transportation resources, the greater trip distances to health care services can present a significant access barrier to care.

Health care cost increases and public spending constraints. Over the past few decades, health care costs have risen considerably. From 1990 to 1997, total U.S. health care expenditures grew by more than 50 percent and now total an estimated $1.1 trillion annually.\(^2\) The elderly contribute disproportionately to the current health costs. In 1995, people ages 75 and over comprised only 6 percent of the nation’s population, but accounted for one-fifth of total personal health care dollars spent.\(^3\) Moreover, as the elderly population grows, health care costs are expected to increase tremendously as well. One estimate (Fuchs, 1998) has health care expenditures for the 65 and over population quadrupling to $1.3 trillion yearly by 2020.

The rising costs of health care, particular for older adults, will make it difficult and expensive to provide all elders with access to quality care. In addition, there is increasing pressure to limit the growth in medical costs and reduce future health care spending. As part of the Balanced Budget Act in 1997, Congress severely restricted Medicare reimbursements for health care services, especially for nursing home and home health care. As a result, Medicare spending for home health care fell almost 45 percent between 1997 and 1999; many home care providers and nursing home have subsequently declared bankruptcy or gone out of business. Also, health insurers have been dropping many elderly clients because of concerns about Medicare reimbursement. Although Congress may restore some of the cut funding, the emphasis on managing health care costs and decreasing future growth in expenditures is likely to continue. These fiscal constraints will make it more difficult to provide the elderly with quality access to health care services.

1.1.2 Opportunities

Although, as discussed above, current demographic trends and budgetary concerns present potential barriers to the elderly’s future access to health care services, there are also a number of anticipated changes that may help improve older adults’ access to care. One, future elders are expected to be wealthier than the elderly of today. The poverty rate of among seniors has been dropping over the past few decades and is likely to continue to do so. Future generations of elders are expected to keep working longer and therefore have greater incomes. In

\(^2\) Health Care Finance Administration (HCFA) data, as cited in National Center for Health Statistics (NCHS), Health Chartbook, 1999.
addition, it is anticipated that the baby boomers will inherit between $10 and $14 trillion from their parents, the biggest generational transfer of wealth that has ever occurred (Coughlin, 1999). As seniors have more money, they will be more able to buy their way into mobility if they cease or discontinue their driving. They will also be more able to buy access to important services such as health care.

Another significant anticipated change is an increase in the availability and use of home medical technologies and telehealth services. Although telehealth for home care is a relatively new field, it already looks particularly promising as a way to improve the elderly’s access to health care. Home health technologies and monitoring systems can allow patients to monitor chronic health problems on a daily basis without having to visit the doctor. They can also transmit patients’ vital data to their doctors to help keep them up to date on the patients’ condition and to enable the doctors to make any necessary adjustments to treatment between visits. Preliminary studies have shown that telehealth programs can improve elderly patients’ health while reducing their cost of care. These results suggest that telehealth home care for the elderly may offer an effective, accessible alternative to more traditional types of care.

1.2 Research’s goals and objectives

This study is interdisciplinary in nature, exploring the relationship between the availability of transportation options and the elderly’s use of health care services. The research on the elderly’s use of health care area primarily comes from the medical and public health professions; as a result, it typically focuses on the medical side of care and treatments and not on how the elderly reach health care providers. Research on transportation services primarily comes from the transit and planning professions, for which medical trips are just one among many types of travel undertaken by the elderly. This study strives to reduce this current gap in research.

The primary goal of this research is to explore how older adults’ transportation access to care may be influencing their health care choices and how lack of access to medical services may be potentially leading them to make sub-optimal health care decisions such as foregoing

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1HCFA data, as cited in Hodgson and Cohen (1999b).
preventative care. This exploration is conducted in the context of anticipated demographic changes such as an aging population and growth in the number of elderly living in suburban communities. A second goal is to examine health care cost patterns for the elderly and to investigate how improved transportation access to care could potentially reduce the future growth in health care expenditures.

The research’s specific objectives are the following:

- to develop a method for evaluating elderly demographic trends and current transportation and health care service coverage using spatial analysis and Geographic Information Systems (GIS) technology; and to test this analytic approach using the Boston metropolitan area as a case study;
- to utilize the above analytic method to explore how the availability of transportation alternatives may affect the elderly’s access to health care providers in the Boston region;
- to identify potential spatial and transportation barriers to care for the elderly and to test the research’s hypothesis that these barriers could be leading some elders to make sub-optimal decisions regarding health care;
- to examine the usage and degree of reliance on emergency medical services among older adults, and evaluate how the elderly’s use of these services may be related to limited transportation access to other health care services;
- to review health care costs for the elderly, including expenditures related to chronic diseases, such as diabetes and heart disease, where regular health monitoring and access to care is essential for preventing costly complications and disabilities; and
- to explore ways in which the elderly’s transportation access to health care could be improved, and the potential for better access to care to reduce the complications and costs associated with common chronic health conditions, such as heart disease and diabetes, in the older adult population.

1.3 Overview of this report

Chapter 2 contains a review of the background literature used for this study. It opens with an overview of the research that has been done regarding the aging of the U.S. population, the population’s migration to the suburbs, the elderly’s desire to age in place, and the issues involved with elder drivers and with older suburbanites’ dependence on the automobile. Chapter 2 then focuses on research regarding the elderly’s use of health care services,
particularly emergency medical care, and the elderly’s transportation access to health care providers.

Chapter 3 discusses the research’s primary analytical methods and assumptions. It also summarizes the principal data sources that were used for the analysis.

Chapter 4 considers how the increasing suburbanization and growth of the elderly population may affect older adults’ access to transportation and medical services. The chapter focuses on the spatial relationship between these services and the elderly, using data for the Boston metropolitan region as the basis for its discussion. Chapter 4 starts by inventorying the region’s transportation services and health care providers and their spatial coverages. It then discusses the potential for disparities to arise between where older adults reside and where these services are located and the implications of these disparities on the elderly’s access to services.

Chapter 5 starts by examining national health care expenditures and spending projections, particularly for the elderly population. It then concentrates on the incidence and costs associated with two common chronic conditions among the elderly: diabetes and coronary heart disease (CHD). These diseases account for a large proportion of elderly health care costs. However, with good access to care and regular disease monitoring, the costs and complications of these diseases could potentially be cut significantly. Chapter 5 examines the national figures for these diseases first and then explores their cost and hospitalization impacts for Boston area elders.

Chapter 6 explores the primary options for improving the elderly’s access to health care. It presents them in the context of the role these options could have in helping older adults manage chronic diseases such as diabetes and CHD and in reducing complications from these conditions. It discusses two main alternatives for increasing elders’ access to care: (1) improvements to transportation services, and (2) home-based health care and technologies that could reduce the older adults’ need to travel to receive medical care.

Chapter 7 summarizes the results of the research’s analysis and explorations. It also highlights questions raised by the research and recommends areas for additional research.
The appendices contain technical notes on the U.S. Census Bureau’s Economic Census and the results of a brief analysis comparing the spatial population distributions by age group for the Boston metropolitan area to the comparable distributions for five other metropolitan regions.
CHAPTER 2: LITERATURE REVIEW

By 2020, the number of elderly aged 65 years old and above in the U.S. is expected to grow to more than 50 million, up from 35 million today. Within this time frame, the elderly’s share of the total U.S. population is also anticipated to increase, expanding from one-eighth of the total to one-sixth. (U.S. Census Bureau, 1996a)

It is projected that the increase in the number of elderly will be accompanied by another significant change: a shift in the geographic distribution of the older adult population. Today, less than 50 percent of older adults live in suburbs and about 30 percent live in central cities (American Association of Retired Persons (AARP) and the Administration on Aging (AoA), 1997). However, among younger generations, such as the baby boomers, a large majority resides in suburbs, particularly suburbs located farther away from cities on the urban fringe. Research has shown that as they get older, many of these younger suburban residents intend to age in place in the communities where they currently live (National Council on the Aging, 1990). As a result, the suburbs are expected to experience large increases in their elderly populations in the coming years.

The growth in the number of suburban elderly will create issues related to the few transportation alternatives to the automobile available in most suburbs. Suburban elders’ dependence on the automobile may keep some older people driving after it is no longer safe for them to do so. In addition, elders who end or limit their driving may find it more difficult to access services and stay involved in their communities. One specific service that the elderly may have trouble accessing as they age is medical care. Access issues and the lack of transportation options in the suburbs could discourage the elderly from seeking preventative care or treatments and could potentially increase their reliance and use of emergency medical services. These types of health care choices could reduce the elderly’s overall health status. They could also contribute to greater health care costs for society as a whole. Without good

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1 The literature (from the U.S. Census Bureau, National Center for Health Statistics, etc.) typically defines elderly as 65 years of age or older. That definition is used for Chapter 2, except where otherwise noted. However, the focus of this research is on people 75 years old and above, and in the other chapters, except where age is specifically mentioned, the term “elderly” refers to this older age group.
access to preventative care, adults may have more medical problems as they age, and may ultimately require more intensive and expensive health care services.

Chapter 2 contains a review of the background literature used for this study. It opens with an overview of the research that has been done regarding the aging of the U.S. population, the population’s migration to the suburbs, the elderly’s desire to age in place, and the issues involved with older drivers and with suburban elders’ dependence on the automobile (Section 2.1). Chapter 2 then focuses on research regarding older adults’ use of health care services, particularly emergency medical care, and their transportation access to health care providers (Section 2.2). The chapter closes (Section 2.3) by discussing the need for additional research regarding the elderly’s demand for medically-related transportation services.

2.1 Overview of elderly population forecasts and the issues of older drivers

2.1.1 Population projections for the elderly

Since the beginning of the 20th century, the number of elderly aged 65 and over in the U.S. has grown more than ten-fold, from 3 million in 1900 to 33.6 million in 1995 and almost 35 million today. This age group’s population is projected to increase to over 50 million by 2020 and almost 80 million by 2050 (Figure 2-1). As the elderly population expands, the growth in the number of “oldest old” elders – people 85 years old and over – is expected to be particularly substantial. It is projected that between 1990 and 2050, the oldest old population will expand from 3 million to 18 million. This increase represents an average growth rate of 3.0 percent annually, almost four times the average annual increase for the population overall (0.8 percent) and close to double the annual growth rate for all elderly 65 and over (1.6 percent). By 2050, it is anticipated that one-fifth of the population will be at least 65 years old and one-twentieth will be 85 years or older. (U.S. Census Bureau, 1996b)

The elderly population of the future is expected to be significantly different from the elderly population today. As discussed above, it will likely be older. It is also projected to be more racially diverse. African Americans, Hispanics, and Asians currently comprise only 8

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2 Hispanic persons can be of any race, including Black, White, or Asian.
percent, 16 percent, and 2 percent respectively of people aged 65 and over in this country. By 2050, these groups’ share of the elderly population are expected to rise to 17 percent for African Americans, 20 percent for Hispanics, and 10 percent for Asians (U.S. Census Bureau, 1996b). As the older adult population becomes more diverse, it will be important that services for the elderly become more diverse as well and reflect the cultures and languages of the people they are aimed at.

The elderly of tomorrow are also likely to have greater incomes and less poverty than current and past elders. Over three-quarters of baby boomers plan to keep working after their retirement. In addition, the boomers are expected to inherit between $10 and $14 trillion from their parents, in the biggest generational transfer of wealth that has ever occurred (Coughlin, 1999). As the incomes and wealth of most older adults increase, their ability to buy mobility and transportation services and to buy access to health care as they age will probably grow as well.

Figure 2-1: U.S. Elderly Population Projections to 2050

As mentioned early, it is also projected that future elderly will live predominantly in suburbs. Although approximately 30 percent of elders today live in central cities (AARP and AoA,
younger generations are less likely to. The U.S. population as a whole is migrating to suburban areas. From 1990 to 1998, the population living in suburbs grew 13 percent; during the same time period, the population in central cities increased only 4 percent (U.S. Census Bureau, 1999b). The disparity in population growth between these areas is expected to continue. Recent U.S. Census Bureau data (1998) show that among people who relocated in a given year, over 30 percent moved to suburbs within the same metropolitan area, either from other suburbs or from the central city. In addition, there is a strong migration trend among the baby boomers towards metropolitan de-concentration and suburban living (Longino, 1990). They and other younger generations are primarily settling in suburbs and most intend to stay there as they age (Burkhardt, 1998; Roper Starch and AARP, 1999).

2.1.2 Elderly’s interest in aging-in-place

Research shows that most elders want to age in place, growing older in the same communities and same homes where they currently reside instead of relocating to a retirement community or somewhere else. A 1992 AARP survey of older homeowners indicated that over 80 percent would like to remain in their present homes as they age (AARP, 1992). Older renters feel the same way. Among both groups, those few people who decide to move usually stay in the same region. In the past four national censuses, roughly only 4 to 5 percent of persons aged 60 years or older had interstate moves within the past five years (e.g. moved between 1985 and 1990 for the 1990 Census) (Longino, 1998). On an annual basis, only 5 percent of persons aged 65 and over switch residences; over half of these movers stay within the same county, and four-fifths within the same state (U.S. Census Bureau, 1998). It is anticipated that these general migration patterns among the elderly will continue in the coming decades (Longino, 1998).

There are many reasons that older adults desire to age in place in their current homes and communities. Staying in their homes can provide several benefits for the elderly. These benefits include the sustainment of independence, the sense of purpose associated with doing activities around the home, the familiarity of the home environment, physical links to the home and memories of events that have occurred there, and connections to neighbors and the local neighborhood (Fogel, 1992). Staying in the same community helps the elderly maintain
ties to friends and activities and to the social networks they have built over the years. “Older adults [who relocate] often find it difficult to participate at the same level of degree and community affairs in their new locations” (Burkhardt et al., 1998, 139). For example, in their study of frail elders who had moved to Florida, Rittner and Kirk (1995) found that many felt socially isolated. Over 60 percent of participants in their study felt lonely or very lonely and less than half said they had regular or frequent social contact with others. The elderly of the future, including the baby boomers, would face these same sorts of issues if they moved and will consequently have many of the same reasons for wanting to age in place.

As the elderly suburban population increases and as more people choose to age in place in suburban communities, society will face some challenging issues. A primary one will be how to accommodate the transportation needs of suburban elderly. Suburbs, especially low-density suburbs on the urban fringe where more of tomorrow’s elderly will live, usually provide few alternatives to the automobile. In most suburbs, the ability to drive and the ability to live a fulfilling independent life are inseparable. However, as people enter their senior years, their driving skills and their comfort with driving often decline (i.e. Burkhardt et al., 1998; U.S. Department of Transportation (USDOT), 1997; Rosenbloom; 1988). (Details on the characteristics of automobile use among the elderly are provided in Section 2.1.3). Consequently, many suburban elders face a difficult choice: continue to drive even when it becomes more difficult or unsafe to do so, or begin to rely more on friends and family for rides and lose some mobility and independence.

2.1.3 Automobile use by the elderly

The elderly today use automobiles for over 95 percent of their daily travel (Burkhardt et al., 1998). For younger elderly, most trips are taken as drivers; older elderly are more likely to be passengers. Almost 90 percent of people aged 60 to 64 use their own cars for their usual transportation compared to less than half (48 percent) of those ages 80 to 84 and only 22 percent of those 90 years of age or older. Among people 75 years of age and above, over 40 percent are non-drivers. Not driving is more common for women than for men in this age
group; almost 80 percent of men still drive, but less than half of women do. In addition, as people age, those who still drive do so less frequently. Male drivers 65 years old and over drive only 60 percent as many miles as younger male drivers (9,680 v. 16,324 miles per year, on average). Elder female drivers drive less than 40 percent as much as younger females (3,956 v. 9,957 miles per year average). Also, for drivers age 85 and over, two-thirds of men and almost 90 percent of women drive less than 5,000 miles per year. (Burkhardt et al., 1998)

Although the elderly drive fewer miles annually than younger age groups, they are at higher risk than younger adults for being injured or killed in a car accident. Sensory, motor and cognitive skills related to driving tend to diminish with age. Elders often have worse vision (especially at night), more trouble hearing, and a harder time blocking out irrelevant stimuli that can interfere with concentration while driving. They frequently also experience longer reaction times, lower attention spans, and reduced strength and range of motion. These factors all contribute to the higher risks for older drivers. On a per mile basis, drivers over age 75 have more driving fatalities than all other age groups except teenagers, and drivers over age 85 have the highest fatality rate of any age group. (U.S. Department of Transportation (USDOT, 1997)

As they age, some seniors become more wary of driving and of their driving skills. As a result, some elders decide to self-regulate their trips and limit their driving to certain times of day, specific destinations, or particular roadways. For example, over 60 percent of the drivers in Straight’s study (1997) of people aged 75 and over avoided driving at night, 51 percent avoided driving during rush hour, and 33 percent avoided driving on certain routes, especially those with heavy traffic volumes or high speeds. Older adults often also avoid driving in rain or bad weather. As a result of their declining skills, some older drivers have their licenses taken away. Others voluntarily stop driving. A small percentage, however, continue to drive even when they no longer feel safe doing so; they do so because they feel as if they have few

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3 National Personal Transportation Survey (NPTS) data, 1995, as cited in Burkhardt et al. (1998).
4 Most of the numbers in this paragraph are based on data from the National Personal Transportation Survey (NPTS), 1995, as cited in Burkhardt et al. (1998).
5 It is important to note, though, that age-related declines in functional and cognitive abilities vary considerably between individuals according to their fitness levels, health status, and other factors (USDOT, 1997).
or no other transportation options and because driving is so linked to their sense of independence (Burkhardt et al., 1998).

It is projected that the number of older drivers will increase significantly over the next few decades. Not only is the elderly population growing, but greater levels of future elderly, especially for women, are currently licensed drivers who plan on continuing to drive as they age. Because of the combined impact of these changes, the number of drivers 70 years of age and older is projected to more than double by the year 2020 and the number of drivers 85 years of age and older to more than quadruple by 2030 (Burkhardt et al., 1998).

Over the next few decades, it is also projected that the older adults who drive will be driving more frequently and for longer distances. Between 1995 and 2020, vehicle miles traveled (VMT) per capita among elderly drivers is expected to increase 40 percent for men (to 13,400 per year) and 106 percent for women (to 8,200 per year) (Burkhardt et al., 1998). As the number of older drivers expands and the annual miles per driver increase, the total miles driven by the elderly is expected to grow substantially. Burkhardt et al. (1998) estimate that from 1995 to 2020, total elderly VMT will double to over 450 billion per year.

Much of the driving future elders do will be in suburbs. Suburban driving may be challenging for many older adults, especially those who have experienced significant declines in their driving skills. Suburban driving often involves segments on arterial roadways with high traffic volumes and high speeds. It consequently requires particularly good eyesight, hearing, and response times (Hale, 1992). Having to do this type of driving will be hard for many elders and may lead to increases in elderly driving accidents and injuries. Research also shows that suburban elders drive more frequently than elders living in urban settings. Zhou and Lyles (1997), for example, estimated that older drivers in suburbs travel 25 percent more miles than urban elderly drivers. This increased mileage will also contribute to accidents among older drivers.

For older non-drivers living in suburbs, there will also be problems with mobility. The majority of non-drivers today relies on friends and families for rides, and uses other transportation services rarely, if at all. In the future, fewer friends and family may be
available to help these elders with trips (Morrison, 1990). As the overall population ages, more of the elderly’s friends and family will be elderly themselves and may be facing the same travel and mobility issues. Additionally, as the population becomes older, the overall ratio of potential caregivers to elder persons will fall. In 1990, there were 8 non-elders (aged 20-64) for each person aged 65 or above. In 2050, there is expected to be only 6 non-elders per elder (U.S. Bureau of Census, 1996b). Another issue is that in the future, more family and family are likely to be working or to live farther away from elders seeking help and may be less able to assist with transportation and other needs. Transportation alternatives to driving will have to be developed to address the needs of suburban elderly and non-drivers. Without good transportation options and access to services, there will be large social and health care costs, both for individual elderly and for society as a whole.

2.1.4 Social and health costs of inadequate transportation options for older adults

Because of the lack of good transportation options, elders who cease or limit their driving face many costs associated with the change in their mobility status. They often become more dependent on family and friends for rides. Some use transit or paratransit more though it may not really meet their needs (i.e. Rosenbloom, 1999; Carp, 1988; Burkhardt et al., 1998), and in the case of paratransit, it may be too expensive (Hare, 1992). It becomes more difficult for them to travel when they want, how they want, or to decide to go somewhere at the last moment. They have to plan ahead for most trips they make, and as a result, they often find themselves staying at home more and getting out less. Marottoli et al. (1995) found that individuals who stop driving generally experience lower activity levels. Older adults who do not drive often have significantly less mobility than those who do. Similarly, Straight (1997) found that elderly drivers took three times as many trips per week as elderly non-drivers. Older adults who do not drive often experience more helplessness, lower self-esteem, and increased depression (Carp, 1988). Depression may then contribute to declining physical health, which may in turn lead to a move to an assisted living facility (Burkhardt et al., 1998).

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6 In areas with good, high quality, transportation alternatives for the elderly, there are less costs associated with not driving and seniors with access to these alternatives are at decreased risk for the problems mentioned here.
Society as a whole also faces costs when people’s mobility is reduced as they age. If, as people get older, they have less ability to make trips, they may withdraw from their communities and community activities. Society then faces the costs of their discontinued participation – as volunteers, as employees (if they still worked) and as citizens – in the life of these places.

Older adults’ limited mobility is also likely to lead to higher health care costs for society. As discussed above, the lack of mobility can contribute to depression and physical decline. In addition, elders with reduced mobility are likely have less transportation access to health care (Marottoli, 1999). As a result, they may see their regular doctors less frequently and neglect the need for preventative care. These choices can put them at increased risk for health problems and complications from chronic conditions, such as diabetes and heart disease, which are common among the elderly, and quite manageable with regular monitoring and treatment. Such decisions can translate to higher medical expenditures. For example, it is estimated that over 60 percent of the costs of caring for elderly diabetes patients comes from complications and comorbidities associated with the disease and not the primary treatment for the diabetes itself (Hodgson and Cohen, 1999a). In addition, elders with limited access to regular care look to emergency medical services, both ambulances and emergency rooms, to fulfill more of their health care needs, even for non-urgent care (The elderly’s use of emergency medical services is discussed more under Section 2.2.) For example, the elderly are twice as likely as younger populations to use emergency ambulances for non-emergencies (Ettinger et al., 1987). Such use of emergency medical services is both inefficient and expensive (Dickinson et al., 1996), and also contributes to higher health care costs overall.

In 1997, U.S. health expenditures totaled almost $1.1 trillion dollars. Close to one-third of personal health care spending is on health care for people 65 years of age and above, and one-fifth is for people 75 and older. As people age, health care resources are increasingly spent on intensive services such as nursing homes. Among people under age 65, nursing home care accounts for 2 percent of expenditures. For persons aged 75 to 84, it represents 23 percent of costs, and for people 85 years of age and over, it makes up 46 percent (Hodgson and Cohen, 1999).

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7 HCFA data, as cited in NCHS (1999).
People relocate to nursing homes and other assisted living facilities because of failing health and their inability to live independently. The lack of transportation alternatives and transportation access can contribute to both these problems. In addition, society as a whole bears the costs when these issues lead the elderly to seek nursing home care that they could potentially otherwise avoid (Burkhardt et al., 1998).

2.2 Access to health care

Access to quality medical care is essential for the elderly to maintain good health. Older adults, especially the oldest old, experience more health problems than younger adults. The latest research from NCHS (1999)\(^8\) indicates that 27 percent of people aged 65 and over and 36 percent of people 85 and over consider themselves to be in only fair or poor health.\(^9\) In contrast, only 7 percent of those ages 18 to 44 and 16 percent of those 45 to 64 feel the same way. Many older people suffer from chronic medical problems. Among people 70 years and older, 33 percent have hypertension, over one-fourth heart disease, and 11 percent diabetes (NCHS, 1999). Over 70 percent of the people who suffer a stroke in a given year are at least 65 years old (American Heart Association, 1999). Improving access to health care has the potential to decrease the incidence of these conditions in the elderly and to reduce the number of elders who develop costly and disabling complications as a result of these diseases.

Accessibility to health care has a number of components. One involves the absolute availability of health care, for example, the quantity of health care providers, the number per capita, and the hours that health care services can be obtained. A second entails the costs of health care and the ability to pay, or to have insurance that pays, for doctors' visits and medical treatments. A third component of accessibility examines the spatial relationship between health provider locations and the populations they serve and the population's ease of travel for medical care. The literature on health care access focuses on the first two aspects of accessibility. It also evaluates the patterns of health care usage among different populations.

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\(^8\) Data from the 1999 NCHS report are generally from 1996 or 1997. Data, except where noted, are for community-living elderly only and exclude those persons residing in a nursing home or other institutional setting.

\(^9\) Data from the National Health Interview Survey, 1996, as cited in NCHS (1999). Ratings on a scale of excellent, very good, good, fair or poor.
such as the elderly and minorities. The costs of care can have significant influence on where and how often people receive medical care and treatment. Another major factor is the quality and availability of transportation to different medical providers.

Section 2.2 examines the literature regarding this third aspect of accessibility and the role it plays in affecting the elderly’s use of medical services. The section opens with an overview of the general patterns of health care service use among older adults. It then focuses on the elderly’s usage of emergency medical services, including emergency transport. According to a study of 88 emergency departments (ED) in 21 states (Strange and Chen, 1998), people age 65 and over comprise 16 percent of ED patients. This is only slightly greater than their share of the total population, 13 percent. The same study reports, however, that elderly ED patients are almost 5 times as likely as younger patients to use ambulance transport. Even for non-urgent problems, the elderly take emergency ambulances twice as frequently as younger age groups (Ettinger et al., 1987). This section examines the role of transportation and accessibility in influencing the elderly’s decisions on where to obtain health care, and on the tendency of the elderly to use emergency medicine and emergency transport services. It also discusses how transportation access issues may affect the elderly’s decisions regarding preventative care and treatments for ongoing illnesses.

2.2.1 Use of health care services by the elderly

Older adults typically visit doctors more frequently than younger age groups and have more total interactions with health care providers. Over 90 percent of people aged 65 and over have had contact with a physician within the past year compared to 80 percent of adults overall. The elderly average more than 11 physician contacts annually. In comparison people aged 45 to 64 have an average of 7 doctor contacts per year, and people aged 15 to 44 have an average of 4. Older people who have the worst health generally have the most contact with doctors. On average, older elders have more contact with doctors than younger elders do, and older adults in poor or fair health have over twice as many physician contacts as those in good or excellent health. For example, oldest-old elderly who rate their health as fair or poor average

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10 Contacts include visits to doctors’ offices, outpatient clinics, and emergency rooms, home care, and phone consultations.
25 doctor contacts per year. Similarly, Black elders, who have more health problems such as hypertension, diabetes, and for women, strokes, than White elders also have more doctor contacts. Among people aged 75 and over, there is a difference of almost 50 percent: Blacks average 20 contacts per year and Whites average 13. (NCHS, 1999)\(^\text{11}\)

As people age, more of their contact with medical professionals occurs at home. For people under age 65, an estimated 85 percent of physician contacts take place at doctor's offices, hospitals, and other outpatient settings and 2 percent occur via home health care services. Over age 65, close to 20 percent of physician contacts are through home health care, and contacts through visits to doctors and other outpatient care drops to 71 percent of the total. For the elderly, the proportion of contacts occurring at home grows from 10 percent of contacts for those ages 65 to 74, to 22 percent for people aged 75 to 84, to almost forty percent of contacts for those age 85 and above. (NCHS, 1999).\(^\text{12}\)

Another trend as people become older is that their number of visits to emergency rooms (ERs) increases. The number of ER visits is 30 per 100 population for persons ages 55 to 64. The rate rises slightly to 34 per 100 for those ages 65 to 74 and then increases almost 80 percent to 61 per 100 for persons ages 75 and above. With each of these age groups, the number of ER visits is higher than for Blacks than for Whites, though the differences decrease with each successive age group. For example, in the 65 to 74 age group, Blacks average 54 visits per 100 population and Whites average 32 per 100, or 40 percent less. Among those aged 75 and above, Blacks have 76 visits per 100 and Whites have 61 per 100, 20 percent less. (NCHS, 1999).\(^\text{13}\) More details on ER use among the elderly are given in Section 2.2.2.

The higher ER visit rates for Black elders reflect cohort characteristics not captured by the overall statistics on physician contacts. The total contact numbers presented initially can be useful for describing where the elderly receive medical care in broad general terms; however, they do little to characterize the type and quality of care for different populations of elderly. For example, although the total number of doctor visits is similar for older Blacks and Whites (approximately 6 visits per year (600 visits per 100 persons) for those aged 65 and over

\(^{11}\) National Health Interview Survey data, 1996, as cited in NCHS (1999).

\(^{12}\) Ibid.

\(^{13}\) Ibid.
regardless of race), Black elders have close to 60 percent more visits to outpatient programs and clinics than White elders (7.7 and 3.2 visits respectively per year).¹⁴ They also have approximately 30 percent more visits to emergency rooms (4.5 v. 6.3 annually).¹⁵ A recent study of poor elderly African Americans (Bazargan et al., 1998)¹⁶ found that in the past six months, 63 percent had not visited a doctor’s office and that over one-fifth had been to an ER.

Factors contributing to the patterns of medical services use among Black elderly

One important factor influencing Black elders’ patterns of health care services use is the population’s lower level of health insurance compared to the White elderly population. Over 95 percent of African Americans aged 65-84 have Medicare coverage, as do 99 percent of those ages 85 and above. However, only a relatively small portion of older Blacks supplement their Medicare coverage with additional insurance. Black elderly have Medicare and private insurance together half as frequently as White elderly do.¹⁷ Private insurance can be used to pay expenses not covered under Medicare. Older adults with Medicare coverage only are less likely to have a primary medical provider than persons with Medicare and supplemental insurance. “In addition, elderly persons with Medicare only [are] more likely to delay care or to go without medical care” completely (NHCS, 1999, 72).

Another factor contributing to the patterns of service usage among minority elderly is their inadequate transportation access to certain health providers. Studies have demonstrated that lower accessibility (Bazaragan et al., 1998) and difficulties in obtaining transportation to a doctor’s office (Baker et al., 1996) among elderly Blacks leads them to make fewer visits to doctors’ offices and to use emergency departments more. Some studies have suggested that there are definite distinctions by race in the patterns of health care use, and that Black elders are generally more likely to visit emergency rooms than are White elders (White-Means, 1995). However, other research has found that certain other patient characteristics are more important than race for predicting ER use. For example, O’Brien et al. (1997) showed that a

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¹³ National Hospital Ambulatory Care Survey data, 1997, as cited in NCHS (1999).
¹⁴ National Ambulatory Medical Care Survey data, 1997, as cited in NCHS (1999).
¹⁵ National Hospital Ambulatory Care Survey data, 1997, as cited in NCHS (1999).
¹⁶ The elderly was defined for the Bazargan et al. study as people 62 years of age and above.
¹⁷ National Health Interview Survey data, 1996, as cited in NCHS (1999).
having a low income increases the likelihood that an individual will rely on ERs for regular care and did not find that race alone was important. Similarly, Baker et al.’s work (1996) found that after controlling for health insurance coverage, difficulty obtaining transportation to a doctor’s office, and older age, “race/ethnicity was not significantly associated with ED use” (677).

2.2.2 Use of emergency departments by the elderly

A few dozen published medical studies over the past 25 years have explored emergency department (ED) use by the elderly. Most of the literature, especially the older studies, focuses on ED use at individual hospitals (i.e. Baum and Rubenstein, 1987; Ettinger et al., 1987). In recent years, more of the research has looked at the general trends of ED use among the elderly using multi-hospital databases (Strange and Chen, 1998; Strange et al., 1992; Singal et al., 1992; Hedges et al., 1992) and the results of the National Hospital Ambulatory Medical Care Survey (Wofford et al., 1996). Both types of studies, especially those using the larger data sets, have provided insights into the reasons the elderly seek emergency room treatment and how older people’s use of ED facilities differs from that of younger adults. The research makes it clear that there are significant differences between the patterns of ED use for the two groups.

The latest data (1995) shows that visits to emergency departments in the U.S. total just over 100 million per year (Strange and Chen, 1998). This number represents an increase of over 8 percent since 1990 (The total population grew only 5 percent during the same period). The elderly age 65 and over make approximately one-sixth of all ER visits, 15.7 million visits annually. As Table 2-1 shows, an estimated 45 percent of elderly ER patients are aged 65 to 74, 37 percent are 75 to 84, and 17 percent are 85 and over. The proportion of ER patients who are 85 years of age and older (3 percent) is twice that age group’s proportion in the total population. However, on the whole, the elderly attend ERs at levels (16 percent of all ER patients) only slightly higher than their overall population share.
Table 2-1: Percent of Elderly Emergency Room Patients by Age Group
Results from various studies

<table>
<thead>
<tr>
<th>Study</th>
<th>% Aged 65-74</th>
<th>% Aged 75 &amp; Over</th>
<th>% Aged 75-84</th>
<th>% Aged 85 &amp; Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strange and Chen, 1998</td>
<td>45</td>
<td>55</td>
<td>38</td>
<td>17</td>
</tr>
<tr>
<td>Wofford et al., 1996</td>
<td>46</td>
<td>54</td>
<td>37</td>
<td>17</td>
</tr>
<tr>
<td>Strange et al., 1992</td>
<td>46</td>
<td>54</td>
<td>37</td>
<td>17</td>
</tr>
<tr>
<td>Ettinger et al., 1987</td>
<td>47</td>
<td>53</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Baum and Rubenstein, 1987</td>
<td>42</td>
<td>58</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Adapted from table in Strange and Chen, 1998, 1161.

There are a few significant demographic differences between elderly and non-elderly ED patients. Elderly patients are more likely to be female; in the over 75 age group, more than 60 percent of patients are women (Baum and Rubenstein, 1987; Ettinger et al., 1987). Elderly patients also more often live alone (Hedges et al., 1992; Ettinger et al., 1987). Additionally, as with the elderly in general, elderly ED patients are more likely to have health insurance, a primary care provider, and to have been to a non-ED doctor within the past year.

Medical problems and treatment of elderly ER patients

Most elderly people who visit ERs do so because they are suffering from chronic medical problems that are common in older adults. Singal et al. (1992) found that 94 percent of elderly ER patients present with chronic diseases. The most common chronic illnesses among elderly in the ER are cardiac (28 percent of all patients) and pulmonary diseases (5 to 11 percent) and hypertension (34 percent) (Singal et al., 1992; Ettinger et al., 1987). The top two specific problems diagnosed for elders in the ER are chest pain and congestive heart failure (Wofford et al., 1996). In comparison, younger ER patients are more likely to have had traumas (37 percent of younger adults in the ER have acute injuries and fractures) or infections (14 percent). However, they are also more likely to be in better general health and be facing less serious overall health problems.

More older ER patients than younger patients have serious medical problems requiring prompt attention. Four-fifths of patients age 65 and over have urgent or emergent conditions compared to 60-70 percent of patients under 65 (Singal et al., 1992; Ettinger et al., 1987).

Emergent conditions are life-threatening or have a high probability of leading to permanent disability. Urgent conditions are serious, but not life-threatening, and should be treated within 24 hours.
Additionally, almost one-tenth of elderly patients need immediate emergency care (Singal et al., 1992).

Because the elderly frequently present to the ED with more serious conditions than do younger patients, older patients tend to use more of a hospital's resources. ED staff spend more time per patient with the elderly and elder patients also stay at the ED longer (Strange and Chen, 1998; Singal et al., 1992; Baum and Rubenstein, 1987; Ettinger et al., 1987). Additionally, elderly patients tend to be given more diagnostic tests (Baum and Rubenstein, 1987; Ettinger et al., 1987), even in cases where their medical problems are not urgent (Ettinger et al., 1987). Since older patients have longer ED visits and receive more tests, their total ED charges are often higher than those for younger patients. For example, Singal et al. (1992) estimated that ED charges per visit were over 25 percent higher for the elderly.

Because elderly ER patients often have more serious medical problems, they are admitted more frequently than younger patients following their ER visits. ER patient studies have shown elderly admission rates ranging from 32 to 51 percent of all older ER patients, whereas admissions rates for patients under age 65 have been estimated at 8 to 14 percent. For ER patients aged 75 and over, the proportion of admissions is even higher, ranging from 45 percent to 55 percent in different studies (Wofford et al., 1996; Baum and Rubenstein, 1987). One recent large-scale study (Strange and Chen, 1998) found that overall, elderly ER patients are almost 7 times more likely than younger patients to be admitted from the ER and 5 times more likely to be admitted to an intensive care unit.

Once elder patients leave the ED, they face a higher risk than do younger patients of returning to the ED at a future date. Denman et al. (1989) surveyed elderly and non-elderly ED patients three weeks after they had been discharged from the ED. Among the non-elderly patients, over four-fifths reporting feeling better than they had three weeks earlier when they came to the ED and only 4 percent felt worse. However with the elderly patients, only two-thirds felt better after three weeks and 20 percent felt worse. Among this latter 20 percent were patients who had required additional hospitalization or who had died. In contrast, none of the non-elderly patients had hospital re-admissions or fatalities. Denman et al. (1989) also found that older patients who were left with reduced mobility or impaired functional status in terms of
basic activities of daily living\textsuperscript{19} after their ED visits were most at risk for continued health problems and re-hospitalization.

The elderly make approximately 15 percent of all ER visits. However, they use much more than this share of ED resources, especially when they make repeat ED visits because of declining health. For the reasons discussed above -- longer visits, more tests, more use of staff time -- elderly patients “place great demands on ... ED staff.” (Strange and Chen, 1998, 1160). Since most elderly people have a regular physician, they do not generally rely on emergency department for their primary care (Singal et al., 1992; Strange et al., 1992; Denman et al., 1989). Moreover, given the greater urgency of their medical problems and their higher hospital admission rates, the elderly’s use of ED resources is not inappropriate (Strange et al., 1992; Ettinger et al., 1987, Baum and Rubenstein, 1987). Nevertheless, as the number of elderly grow and emergency departments face even more service demand from this segment of the population, many ED’s may be struggling to adequately accommodate these additional patients.

In addressing this problem, health care resources and funding would be well spent improving ER elderly services by incorporating more social workers and health care aides into the ER to assist the elderly (Baraff et al., 1992; Craig, 1991) and by increasing the amount of geriatric medical training for doctors (Sanders, 1992). Another important approach is to increase preventative care services for elders. “Preventative gerontology is probably one of the most cost-effective” ways to promote better health for the elderly (AMA Council for Scientific Affairs, 1990). More preventative care could reduce the occurrence of the main health problems -- cardiac and pulmonary diseases, and hypertension -- that lead most elderly patients to come to the ER in the first place. Another needed change is an improvement in the elderly’s access to non-emergency health care services. Improved access would encourage those elderly who don’t visit primary care physicians regularly to do so. Poor elderly in particular are apt to cite access and transportation problems as reasons for not seeing their doctor more frequently (Rittner and Kirk, 1995). Improved access could also divert non-emergent health care visits that now go to the ER to other health services. The

\textsuperscript{19} The basic activities of daily living (ADLs) include bathing or showering; using the toilet; dressing; eating;
degree to which access to non-ER services is currently a problem is discussed in later sections of this chapter, including below.

Reasons for using the ED as opposed to a primary care doctor

Over 90 percent of older adults have a primary care physician. Yet many elderly choose to visit emergency departments instead of their primary doctors for non-urgent medical problems. Understanding the reasons behind this decision is crucial to changing this pattern and limiting health care expenditures for elderly care.

Elderly patients visit emergency rooms primarily during workday hours (Ettinger et al., 1987; Parboosingh and Larsen, 1987). In contrast, younger patients visit more frequently at night. Since primary care providers have office hours during the weekday, this trend raises the question of why these elderly go to the ER instead of their regular doctors. The research shows that close to half of elders who go to the ER actually do try to contact their doctors beforehand (Ettinger et al., 1987; Parboosingh and Larsen, 1987). However, they often have difficulty reaching them. A study in Philadelphia found that “Nearly two-thirds of the seniors surveyed found their doctors to be inaccessible during a crisis because of irregular office hours or the lack of a 24-hour answering service.”\(^{(20)}\) In addition, Hedges et al. (1992) found that 55 percent of elderly ER patients considered themselves too sick to even try to contact their physicians. Further, in cases when the elderly call and actually do reach their physicians, many times the doctors recommend that they go to the ER anyway. (Singal et al., 1992; Denman et al., 1989) Other reasons given in Hedges et al.’s study for visiting the ED as opposed to a primary care doctor included believing the care in the ER is better (43 percent) and having insurance that didn’t cover office visits (27 percent).

The 10 percent of elderly without a primary care physician, including those few without any health insurance (1 percent of elders), do not have the option of going to a primary doctor when they have a medical problem. As a result, they have a higher reliance on emergency rooms and emergency health care services for non-urgent problems and preventative care (Craig, 1991).

A factor that may also play a role in elders' decision to go to the ER instead of other health care services is the lack of convenient transportation access to other providers. Numerous studies allude to the issue of transportation access and assume that it is a factor.\(^{21}\) It is well known that the elderly use emergency ambulances more frequently than younger persons to travel to EDs. In addition, research shows that the elderly are up to twice as likely as younger age groups to use emergency transport for non-urgent medical problems (Dickinson et al., 1996; Ettinger et al., 1987). This suggests that in some cases, the elderly use ambulances more as a transportation resource than as a medical one. More research and studies are needed to further investigate this idea and to explore how much of an impact transportation issues have on the elderly’s use of emergency medical services.

2.2.3 Use of emergency transport by the elderly

In 1995, 13 percent of all ER patients, 13.3 million people, arrived at emergency rooms via ambulances (Strange and Chen, 1998). The use of ambulances in ER patients increases with patient age. Most studies have found that less than one-eighth of ER patients under age 65 use emergency transport compared to one-third (30-35 percent) of patients 65 and over\(^{22}\) (Table 2-2). Similarly, Beland et al. (1987) estimated that the average age of ER patients using ambulance transport is 59 years and that the average age of ER patients who did not use ambulances is 44 years, almost 15 years less.

Overall, 39 percent of emergency transports (5.1 million) are for elderly patients (Strange and Chen, 1998). The proportion of older patients taking emergency ambulances increases for each successive age group. In their study, Singal et al. (1992), found the percentage of ER patients who used ambulances to reach the ER grew from 32 percent for patients ages 65 to 74, to 36 percent for those 75 to 84, to 55 percent for those 85 and above.

\(^{21}\) However, few to no studies have focused on the impact that transportation access to care has on ER usage.

\(^{22}\) The higher percentages in the Ettinger et al. study (1987) may reflect its use of data from only one hospital and the smaller size of its dataset.
Table 2-2: Percent of ER patients Using Emergency Transport, by Age Group
Results from Various Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Percent of Patients In Each Age Group Using Emergency Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Under Age</td>
</tr>
<tr>
<td>Strange and Chen, 1998</td>
<td>10</td>
</tr>
<tr>
<td>Strange et al., 1992</td>
<td>9</td>
</tr>
<tr>
<td>Singal et al., 1992</td>
<td>11</td>
</tr>
<tr>
<td>Ettinger et al., 1987</td>
<td>24</td>
</tr>
<tr>
<td>Baum and Rubenstein, 1987</td>
<td>12</td>
</tr>
</tbody>
</table>

Not only do the elderly account for a greater proportion of ambulance transports than other age groups, Dickinson et al. (1996) suggest that elder patients also use more emergency care resources per ambulance trip. Their research found that a greater percentage of ambulance calls for older adults needed advanced life support (ALS)\(^ {23} \) services as opposed to basic life support (BLS). Adults 65 years of age and over required ALS for over half (54 percent) of all transports while adults ages 25 to 44 needed ALS only one-third of the time. The Dickinson et al. study also showed that transports for elder patients take longer.

The Dickinson et al. work is one of the few exploring how ambulance service needs differ between older and younger adults. The study considered only one EMS system, in the suburban community of Colonie, New York (1990 population: 77,000), and its findings therefore may not reflect ambulance usage in other areas. Additional studies on this topic are required before accurate generalizations of geriatric emergency transport needs and use characteristics can be made.

Are the levels of ambulance usage by the elderly justified?

Studies that have explored this issue generally agree that the elderly tend to be more justified in their use of ambulance services than other adults (Richards and Ferrall, 1998; Denman et al., 1989; Ettinger et al., 1987). Ambulance use is considered justified when a patient has an urgent or emergent medical problem that requires EMS transport. Dickinson et al. (1996) reported that elderly ambulance patients require ALS care more often than younger patients, which suggests that ambulance transport for these elders is justified. Similarly, Ettinger et al.

\(^ {23} \text{ALS care includes the use of oxygen and IV treatments.} \)
(1987) concluded that three-fifths of elderly ambulance transports were justified compared to 36 percent of other adult transports. Denman et al. (1987) and Richards and Ferrall (1998) also found higher levels of justified use among elderly ambulance patients (74 percent and 67 percent, respectively) than among non-elderly (56 and 48 percent).24

Although ambulance use among the elderly is generally more justified than for younger age groups, there are significant numbers of elderly using EMS transport inappropriately. Dickinson et al. (1996) estimated that geriatric patients are almost twice as likely as younger patients to use ambulance transport for minor medical problems such as a fever or common cold. Similarly, Ettinger et al. (1987) discovered that almost one-third (31 percent) of elderly ambulance users had non-urgent medical problems for which emergency transport was both inappropriate and inefficient. In that research, Ettinger et al. also found little relationship for the elderly between the urgency of a medical problem and the use of ambulance transport. They surmised that the availability or lack of transportation could be a more contributing factor in whether an ambulance is used.25

As with other transportation-related topics in the emergency medical literature, the role of transportation options in the elderly’s decision to use emergency transport is ambiguous and requires more research. It seems that current transportation deficiencies may be increasing the use of ambulance and EMS services. However, these deficiencies have yet to be clearly defined so that they can better be addressed. In addition to the question of general transportation access to care, there is also the issue of how well different transportation options meet the needs of certain elders. For example, Denman et al. (1989) found that 8 percent of elder patients who used emergency ambulances did so because they felt that their limited physical mobility made other transportation infeasible. Further investigation on the impact of the availability of accessible transportation on the decision to use emergency ambulances is needed to see if better transport options, such as paratransit, could reduce these elders’ likelihood of relying on EMS services in non-emergency situations.

24 For Richards and Ferrall’s study (1998), the elderly percentages are for patients ages 61 and over. This group comprised only 6 percent of all the patients in their study. As a result, their results regarding the elderly may be somewhat skewed.

25 Ettinger et al. (1987) also suggested that primary care takers calling for ambulances may also contribute to the higher rates of emergency transport for the elderly population.
Increases in elderly ambulance transports

Strange and Chen (1998) compared national emergency ambulance use in 1990 and 1995. They found that over the five-year period, the total number of ambulance transports to ERs grew 18 percent from 11.3 million to 13.3 million. Transports for the elderly over the time period grew at an even faster rate, increasing 26 percent, from 4.1 million to 5.2 million. (Ambulance transports for the non-elderly grew only 14 percent). In 1990, 30 percent of elderly ER patients used emergency transport. By 1995, one-third did. If these trends continue, the growth in total demand for emergency transport will be significant. ER usage is presently increasing faster than the size of the population, and the population is becoming older. With these current trends, EMS workers can expect to face more and more elderly patients, who use more EMS resources per patient than younger patients. At the growth rates above (18 percent overall and 26 percent for elders), the number of annual emergency ambulance calls would increase to more than 30 million by 2020 with over half of the trips serving the elderly. Since the population is aging and the number of elderly and older elderly increasing, these projections are most likely low estimates of future ambulance demand.

2.2.4 Estimating the demand for emergency transport

A population's age is a major factor in its demand for emergency ambulance services; elderly adults tend to use emergency ambulances more often than non-elderly do. The national ambulance usage figures developed by Strange and Chen (1998) work out to EMS transport rates (1995) of 50 per 1,000 for the population overall and 154 per 1,000 (three times greater) for the elderly. Using 1990 data, the rates were slightly lower: 40 per 1,000 and 131 per 1,000 respectively.

Research in Dallas, Texas (McConnel and Wilson, 1998) and Forsyth County, North Carolina (Wofford et al., 1995) estimated emergency ambulance utilization rates for different age groups in those regions. Among the elderly, both studies found that rates increase with each successive age group (Table 2-3). Compared with the ambulance utilization rates for people

\[26\] Future growth rates may be higher because of changing demographic trends and the aging of the population.
aged 65 to 74, the rates for people aged 85 and over were estimated to be 2.5 times larger in McConnel and Wilson’s study and 3.7 times higher as high in Wofford et al.’s work.

### Table 2-3: Emergency Ambulance Usage Among the Elderly
Results from Two Population-Based Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Emergency Ambulance Utilization Rates per 1,000 Residential Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ages 65 &amp; Over</td>
</tr>
<tr>
<td>McConnel and Wilson, 1998</td>
<td>96</td>
</tr>
<tr>
<td>Wofford et al., 1995</td>
<td>125</td>
</tr>
</tbody>
</table>

Cadigan and Bugarin (1989) took a different approach in developing their estimates of the demand for emergency ambulance transport, employing regression models instead of population-based utilization rates. Their analysis looked at Massachusetts municipalities with populations between 2,500 and 65,000 and used municipal-level data on the number of EMS calls and transports annually (1986). In their regression models, Cadigan and Bugarin found that the following independent variables were all significantly related to the demand for EMS services: population, percentage of the population aged 65 years or over, median income, percentage of households below the poverty level, and a dummy variable for whether a community was located on Cape Cod (where there are high levels of tourism and vacationers). Because of the strong correlation between some of these variables, Cadigan and Bugarin’s single best equation for EMS ambulance included only population, median income and the “Cape Cod” variable. For non-Cape Cod communities, this equation was the following:

\[
\text{# of EMS transports/yr} = 345.8 + 0.0327(\text{population}) - 13.0(\text{median income in }$1,000's)
\]

The population variable coefficient (0.0327) agrees with the general rule-of-thumb estimate that the number of annual emergency transports equals 3.5 percent of the population (roughly the equivalent of one transport per 10,000 population per day) (Cadigan and Bugarin, 1989). The household income factor is also logical. Household income is related to many other characteristics, including the ability to purchase health insurance, age of the householder, and the number of cars per household member. These types of factors are likely at work in the

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Footnote: Communities in Cape Cod were found to average 250 more ambulance transports per year than other communities of comparable population.
equation above. The inclusion of income, and not the percentage of elderly, in the final equation, suggests that as they age, elders with a certain level of wealth may be able to buy good transportation access to health care and not have heightened demand for EMS services.

2.2.5 Issues of transportation access to health care outside of emergency rooms

The discussions earlier in this chapter have touched on the impact of transportation availability on the elderly’s decisions regarding their use of health care services outside of emergency rooms. Although transportation is not only the factor in these decisions, it is often an important one. In their study of poor elders, Rittner and Kirk (1995) found that less than half (47 percent) had seen a doctor during the previous six months and that only a third visited a doctor regularly. Among their survey group, the transportation availability was significantly related to whether elders received regular care. Rittner and Kirk also found that being dependent on public transit “posed ... barriers to health care use, among them fear” (p. 365). Similarly, difficulty in obtaining transportation was identified in Hedges et al.’s work (1992) as the major reason that elderly ER patients often failed to get the follow-up care recommended after their discharges from emergency rooms. In both these studies, a common participant characteristic that contributed to transportation access to care problems was living alone. Both studies had a significant number of people who lived by themselves: 33 percent of participants in Hedges et al.’s study and over 70 percent of participants in Rittner and Kirk’s work. The people who lived alone often had few friends or family members or friends they could turn to for rides to the doctor. As a result, they ended up receiving less health care, especially preventative care, than they should have.

Another area of health care where transportation assistance can be especially important is in the treatment of cancer, kidney failure, and other serious and debilitating illnesses. These conditions, and sometimes the treatments to cure them, often leave patients weak and unable to take public transit or drive themselves to treatments and doctors’ visits. In addition, these conditions frequently involve multiple visits over a period of weeks or months. Patients are often dependent on others - family members, volunteers, or other informal caregivers - to drive them to treatment centers on a regular basis. A survey of family caregivers of chemotherapy patients (Carey et al., 1991) showed that among other assistance, most helped
the patient with transportation. Elderly patients, particularly women, are more likely than younger patients to need illness-related help with transportation (Mor et al., 1992). This is in part because as discussed above, more elderly women live by themselves and may have few transportation options.

Some patients have trouble finding good transportation and their lack of transportation access to care can influence their treatment decisions. For example, for cancer patients, difficulty finding an affordable, convenient way to get to chemotherapy and radiation treatments may even lead some patients to forego these treatments completely (Guidry et al., 1997).29 In a related example, doctors treating elderly women with breast cancer in rural Indiana30 find that the women sometimes opt for mastectomies over less invasive, smaller, lumpectomies largely for transportation reasons. Each winter, the proportion of women choosing mastectomies increases. Although the two procedures can be equally effective in treating breast cancer, lumpectomies require 6 weeks of radiation treatments (mastectomies require none) and more follow-up care, and the elderly women are concerned about having to drive back and forth to treatments on icy roads.

2.3 Need for additional research for health-related transportation demand among elders

The literature on the elderly's use of medical services and access to health care emanates primarily from the medical and public health professions. As a result, it typically focuses on the medical side of care and treatments and the benefits and costs associated with care. It pays less attention to how the elderly access health care services and the influence that access issues can have on the elderly's health care. Transportation access to care issues have occasionally been raised in the literature and alluded to and are generally thought to have some impact on the elderly’s decisions regarding care. However, few, if any, studies have fully investigated how transportation affects where and how frequently the elderly seek medical care. Research on this topic is sorely needed.

29 Guidry et al.'s study (1997) included both elderly and non-elderly cancer patients.
The quality of the elderly's transportation access to health care is both a transportation issue and a health care one, and more research is needed to determine how big a role transportation plays in health care decisions. Although many older adults report few problems getting to the doctor (Janes et al., 1999), the research discussed earlier shows that transportation difficulties can have a substantial effect on the elderly's use of health care. The studies mentioned in this chapter suggest that transportation issues can lead some elders to receive care less frequently, to rely on emergency medical services more – even for non-urgent medical problems, and to potentially forego beneficial treatments, such as chemotherapy for cancer patients. Researchers should explore these topics further. In addition, studies should be expanded to larger populations. Many of the studies conducted thus far are small-scale, limited to a small number of participants and confined to one geographic area, and their results may not reflect more general trends and attitudes.

One area of research which deserves further examination as well is the elderly's attitudes towards their health care and health care access, and what they see as the major ways in which care and access could be improved. Other important topics for exploration include the distance that older adults travel to receive health care and the typical transportation mode for those trips. Research has shown that rural elderly are less likely to drive themselves to medical care than they are to drive themselves for other trip purposes and more likely to rely on friends and family (Damino et al., 1994). Further research should examine whether this trend applies to other elders as well. The elderly today, especially non-drivers, typically depend on the informal transportation networks of friends and family to help them with most of their trips and use formal transit and paratransit services rarely, if at all. However, demographic trends such as the aging of the population, increased numbers of people working after retirement, and migration shifts away from cities to suburbs all suggest that these networks may be less available to help the elderly in the future. Because of these changes, it is likely that more future elders will have difficulties with their transportation access to health care.

It is important that the impact of transportation on the elderly's health care decisions is investigated now so that current and potential transportation issues can be addressed before
the problems become magnified. In addition to the demographic trends listed above, the expected consolidation of health care facilities into fewer physical locations may also reduce access to care. If the elderly’s access to care is limited, a number of negative consequences could result. These include more health problems and lower quality of life for older adults. They also include greater health care expenditures as the lack of access to care, particularly preventative care, leads to more chronic disease complications and increased surgeries and disabilities, and more need for nursing home care. Already projections estimate that national health care expenditures for the elderly could quadruple by 2020 (over 1995 levels) (Fuchs, 1998). Costs due to access to care problems could increase them even further if these issues are not adequately addressed.
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CHAPTER 3: RESEARCH METHODOLOGY

Chapter 3 overviews the primary methods, assumptions, and data sources behind the research and analysis discussed in this document.

3.1 Focus on the age 75 and over population

The research and analysis focuses on people who are 75 years of age and older. The definition of elderly used by the U.S. Census Bureau, National Center for Health Statistics, and numerous other agencies and researchers generally refers to people age 65 and over. This definition of elderly has been used for a number of years. Age 65 is the age by which most people traditionally retire and the age where people have historically become eligible for elderly benefits and programs such as Social Security and Medicare. It is also the age where traditionally people begin being thought of as “old,” having more medical problems, and needing more assistance. However, times are changing. People are living longer and are staying active and healthy as they age. Today, in health, lifestyle, and activities, people 65 years of age are not much different from people who are 60 or 55. By age 75, however, more significant differences in health status, physical abilities, and overall mobility begin to occur. These differences are briefly discussed below. As people reach age 75 and above, their health often begins to decline and their activities typically become more restricted. This research concentrates on people age 75 and over so that it can best explore these changes and how they affect this older population’s need for better transportation access to health care services.

People 75 years of age and over generally have more health problems and functional difficulties than people younger than 75.\(^1\) When people are asked to rate their health status, only a quarter of people aged 65 to 74 consider themselves to be in fair or poor health. In comparison, one-third of people 75 and over feel the same way.\(^2\) Similarly, among people 65 to 74, only 23 per 1,000 have health problems that require them to receive health care services.

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1 The descriptions in this and other sections discuss the general trends of aging currently experienced by elderly populations. However, as Chapter 2 mentions, aging is a heterogeneous process, affecting people differently depending on their health status, activity levels, and other characteristics (USDOT, 1997). These descriptions, therefore, do not apply equally to all elderly.

2 Data from National Health Interview Survey, 1996, as cited in NCHS (1999).
at home; for people 75 and over, more than 3.5 times as many (85 per 1,000) need home health care.\(^3\) Table 3-1 summarizes the percentage of people in each older age group with certain functional limitations. As Table 3-1 shows, the prevalence of limitations expands dramatically between ages 65 to 74 and ages 75 and over. For example, the number needing assistance with daily activities increases from 10 percent to 30 percent between the two age groups. There are comparable increases in the number having difficulty walking or difficulty getting outside.

**Table 3-1: Prevalence of Certain Functional Limitations Among Elderly Age Groups**

<table>
<thead>
<tr>
<th>Functional Limitation</th>
<th>Percent in Each Age Group with Functional Limitation</th>
<th>Ratio of % for 65-74 &amp; % for 75+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Ages 65-74 &amp; Over</td>
<td>% Ages 75 &amp; Over</td>
</tr>
<tr>
<td>Difficulty walking</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>Difficulty getting outside</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td>Needs help with daily activities</td>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>


Largely because of their greater health problems and functional limitations, people age 75 and above are less able to drive themselves than younger age groups and have more dependence on others for transportation. Over 40 percent of people 75 and above are non-drivers, compared to only 21 percent of people aged 65 to 74. Additionally, those people in the older age group who do drive are likely to curtail their driving and drive less frequently (Table 3-2). Two-thirds of drivers aged 75 and over drive less than 5,000 miles annually and only 18 percent drive more than 10,000 miles per year. In comparison, among the 65-74 age group, 44 percent drive under 5,000 miles per year and 35 percent drive over 10,000. The differences in driving behaviors between age groups are especially noticeable for women. Over half of women aged 75 and over do not drive at all, and over 80 percent of the female drivers in this age group drive less than 5,000 miles per year. In addition to limiting the amount they drive, drivers age 75 and over also restrict their driving in other ways. More than 60 percent avoid driving at night, over half avoid driving during rush hour, and one-third avoid certain routes or roads, such as those with higher speeds or traffic volumes. (Straight, 1997).

\(^3\) National Home and Hospice Care Survey data, 1996, as cited in NCHS (1999).
Table 3-2: Decreases in Driving Between Ages 65-74 and Ages 75 & Over

<table>
<thead>
<tr>
<th>Amount of Driving</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ages 65-74 &amp; Above</td>
<td>Ages 75 &amp; Above</td>
<td>Ages 65-74 &amp; Above</td>
</tr>
<tr>
<td>Do not drive, %</td>
<td>21</td>
<td>42</td>
<td>10</td>
</tr>
<tr>
<td>Among drivers, %</td>
<td>44</td>
<td>66</td>
<td>24</td>
</tr>
<tr>
<td>who drive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>under 5,000 miles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Among drivers, %</td>
<td>35</td>
<td>18</td>
<td>52</td>
</tr>
<tr>
<td>who drive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>over 10,000 miles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per year</td>
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</tr>
</tbody>
</table>


In addition to driving themselves less, people 75 years of age and over often have more trouble finding rides from others. Over half of women and 20 percent of men in this age group live alone; if they do not drive, they therefore have no other source of transportation available through their households.

This research concentrates on people age 75 and above because this age group drives less than younger cohorts (including those aged 65 to 74), has more non-drivers, and greater problems with mobility in general. In considering transportation access to health care, the research emphasized those options that are available to people who no longer drive and who may have trouble getting around on their own. Because people 75 and over are more likely to fall into this category, and because they also generally use health care services more frequently, they are the population on which the most focus has been placed for this study.

One vocabulary note: the terms “elderly”, “older adults”, “elders”, and “seniors” used in this document are generally intended to refer to people who are 75 years of age and over. Where exceptions to this are noted, such as in Chapter 2, these terms refer instead to the broader, more common definition of elderly and include all people 65 years of age and older.

3.2 Focus on the Boston metropolitan region

The Boston metropolitan region, as defined in this section, is the geographic area of focus for much of this research’s analysis. The spatial analysis in Chapter 4 concentrates entirely on the Boston metropolitan area, examining population trends and transportation and health care resources in that region. In Chapter 5, hospitalizations and medical costs due to diabetes and coronary heart disease are estimated for the Boston metro area. Other chapters also reference
the region and make recommendations based on the results of the Boston-oriented section of the analysis.

3.2.1 Definition of the Boston metropolitan region

For this research, the Boston metropolitan region includes parts of the seven Massachusetts counties in the federally designated Boston, MA-NH Primary Metropolitan Statistical Area (PMSA). The research's region contains all of Suffolk, Norfolk, Middlesex, Essex, and Plymouth Counties. It also includes five towns in Bristol County – Easton, Mansfield, Norton, Raynham, and Taunton – and seven towns in Worcester County – Berlin, Bolton, Harvard, Milford, Southborough, Northborough, and Westborough. The region extends from the City of Boston out to towns that border Interstate 495.

There are a total of 159 towns and cities in the Boston metropolitan region (Figure 3-1). For the spatial analysis, these municipalities are divided into those inside of Interstate 95 and those outside of I-95. Municipalities that border I-95 are generally considered to be outside of I-95, even if much their area is inside the Interstate 95 loop. This is the case for Lexington and a few other communities. In total, 19 of the 159 municipalities in the region are viewed as being inside Interstate 95. They are Arlington, Belmont, Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Melrose, Milton, Quincy, Revere, Saugus, Somerville, Stoneham, Watertown, Winchester, and Winthrop. The remaining 140 towns and cities are considered to lie outside Interstate 95. The discussions regarding suburban communities in the Boston metropolitan area generally concentrate on these 140 municipalities.

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4 PMSAs and MSAs are designated by the federal Office of Management and Budget (OMB). Although the counties in both the PMSA and this research's metropolitan area are the same, some of the towns in each area are different. See Appendix B for more details on these differences.
Figure 3-1: Towns in the Boston Metropolitan Region

3.2.2 Reasons for focusing on the Boston metropolitan area

The Boston metropolitan region was selected as the geographic area of this analysis for a number of reasons. Boston is a well-established city with classic patterns of growth and sprawl. The metropolitan area is not experiencing much growth anymore; the population grew at an average of only 0.5 percent between 1990 and the present (2000). However, like many cities, it is facing increasing sprawl and development on the urban periphery. Already (1995) two-thirds of the population reside in the suburbs outside of Interstate 95 and only one-third live in the city of Boston and the inner suburbs. By the year 2010, the population in the outer suburbs is expected to grow almost another 10 percent. The number of elderly people living in the suburbs is projected to increase even more dramatically during this time period as the younger generations who currently reside in the suburbs remain there as they age. Between 1990 and 2010, the number of elderly 75 and over living in the suburbs beyond I-95 is projected to grow by 20 percent, and the number living inside I-95 is expected to decline by almost the same amount (18 percent).6

The Boston region was also chosen because of its fairly large population size, 4.2 million people (2000) and the quantity of transportation and health care providers that have been established to serve this population. The region is large enough to have sufficient transportation and health care services for an interesting spatial analysis, but not so many that the analysis would need to include a extensive data collection effort and major data crunching and aggregation once the data was obtained.

A third primary reason for focusing on the Boston metropolitan area was the ease and timeliness with which detailed information on population projections and transportation and health care services for the region could be obtained. Agencies in the region and in the state of Massachusetts have done a considerable amount of analysis on the Boston metro area and its resources already, and their work is invaluable as references for this new research. The town-level population projections developed by MISER, in particular, are used extensively for the spatial analysis. The spatial analysis also relies heavily on the GIS shape files provided by

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5 Population numbers and growth estimates are based on data and projections by MISER (1999).

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MassGIS, Central Transportation Planning staff, Bridgewater State College's Moakley Center, and other organizations. These files provide important data layers and details for the maps in this document. Had all of these resources not been available, the scope of the research would have probably been scaled back considerably.

3.2.3 Considering the population patterns for other metropolitan regions

This research includes an examination of the population patterns of five other metropolitan areas and a comparison with the patterns for the Boston region. Basic statistics for these five metropolitan areas\(^7\) are listed in Table 3-3. All five have a fairly large number of residents, with total populations ranging from 2.5 to 4.9 million.

<table>
<thead>
<tr>
<th>Metropolitan Region</th>
<th>1990 Population (millions)</th>
<th>1999 Population (millions)</th>
<th>Annual Avg Population Growth (%)</th>
<th>% of Pop Age 75 &amp; Over, 1990</th>
<th>% of Pop Age 45-54</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston, MA</td>
<td>2.800</td>
<td>4.0</td>
<td>4.2(^a)</td>
<td>0.5</td>
<td>5.6</td>
</tr>
<tr>
<td>Atlanta, GA</td>
<td>3.000</td>
<td>2.5</td>
<td>3.2(^b)</td>
<td>2.7</td>
<td>3.0</td>
</tr>
<tr>
<td>Twin Cities, MN</td>
<td>3.000</td>
<td>2.3</td>
<td>2.5</td>
<td>1.2</td>
<td>4.3</td>
</tr>
<tr>
<td>Dallas, TX</td>
<td>9.600</td>
<td>4.0</td>
<td>4.9</td>
<td>2.2</td>
<td>3.3</td>
</tr>
<tr>
<td>Denver, CO</td>
<td>7.300</td>
<td>1.9</td>
<td>2.3</td>
<td>2.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>6.600</td>
<td>2.8</td>
<td>3.3</td>
<td>1.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Total for Nation</td>
<td>249.4</td>
<td>272.7</td>
<td>1.0</td>
<td>5.3</td>
<td>10.1</td>
</tr>
</tbody>
</table>

"For 2000 (estimate)." For 1997.

Some of these metro regions area more physically spread out than Boston, and all are experiencing higher rates of growth. However, despite these differences, Boston and the other five areas appear to have similar spatial patterns of population distribution and sprawl.

To explore these similarities, a brief comparative analysis has been conducted. As part of this analysis, maps have been created to show the spatial concentration of different adult age groups for each metro region. The maps include the following four cohorts: ages 75 and over, ages 65 to 74, ages 55 to 64, and ages 45 to 54. The percentage of the total population in each

\(^6\) Ibid. Figure 4-1(b) on page 72 displays the anticipated percentage growth in the 75 and over population for each town and city in the region.

\(^7\) These metropolitan areas were defined using a combination of the OMB's PMSA definitions and the areas included under the jurisdictions of regional governments and planning councils. In a few cases, such as for Denver, areas outside of these defined regions were included in the metropolitan area to reduce the variations in the radial distances between the central city and the regional boundaries. In Denver, without this adjustment, the radial distances would have varied from between 20 and 60 miles.
of these age groups has been calculated by U.S. Census tract using 1990 Census data. Maps showing the population distribution and the spatial concentrations of the four age groups are displayed in Appendix A. Appendix A includes one map for the Boston metropolitan region and comparable maps for each of the other five areas. The maps all reveal, though to different extents, the same basic trend of each successive age group living farther from the central city and more in the suburbs. Each map also shows higher concentrations of the younger age groups in the suburbs, especially the outer suburbs. The maps suggest that Atlanta, Minneapolis-St. Paul and the other metro regions may experience future suburban sprawl similar to that anticipated for Boston. If most people aged 45 to 54 and younger in these regions decide to age in place where they currently live, as researchers have projected the majority will, more and more of the future population growth in these areas will occur in the suburbs. In addition, the populations in the suburban communities will become increasingly elderly. The age group that was 45 to 54 in 1990 (the year for this data) will be at least 75 by the year 2020, just two decades away.

The analysis of metro areas besides Boston discussed here is not extensive. However, the similarities in the spatial population patterns of these regions with Boston’s suggest that the Boston-based evaluations of transportation access to health care conducted for this research may potentially be a useful tool for helping other communities think about their own aging in suburbs and access to medical care issues.

3.3 Population estimates and projections

The population estimates and projections used in this research come from two main sources: the U.S. Census Bureau, and the Massachusetts Institute of Social and Economic Research (MISER). The U.S. Census Bureau has developed race and age-specific population projections out to 2050 for the nation as a whole (U.S. Census Bureau, 1996a). MISER has similar projections to 2010 for the counties, towns, and cities within Massachusetts (MISER, 1999). MISER’s population forecasts are based upon both Massachusetts-specific data and on the assumptions used by the U.S. Census Bureau for its own forecasts. Both organizations have created high, middle, and low level projections. This thesis research uses the middle level forecasts exclusively in its analysis. In addition, because the Massachusetts projections
available though Misher go out only to 2010, the research focuses on the 1990 to 2010 time period.

The methodology and assumptions behind the U.S. Census Bureau and Misher forecasts are briefly discussed below. The discussion of the population projections is limited to the 1990 to 2010 time period, the same time frame as the analysis. Additionally, the discussion focuses on the elderly age groups that are the emphasis of this research.

The population models used by the U.S. Census Bureau and Misher are demographic models that rely on the current population and three main demographic variables: births, deaths, and net migration. No economic variables are explicitly included. The basic formula for these models is the following:

\[ P_t = P_{t-1} + B_{t-1, t} - D_{t-1, t} + NM_{t-1, t} \]

where:
- \( P_t \) = Population in year \( t \)
- \( P_{t-1} \) = Population in year \( t-1 \)
- \( B_{t-1, t} \) = Births during the period \( t-1 \) to \( t \)
- \( D_{t-1, t} \) = Deaths during the period \( t-1 \) to \( t \)
- \( NM_{t-1, t} \) = Net migration during the period \( t-1 \) to \( t \)

This formula can be used for the population overall or for sub-populations based on race, Hispanic origin, or sex. A slightly modified version of the formula can be applied to estimate the population of a certain age:

\[ P_{a, t} = P_{a-1, t-1} - D_{a-1, t-1, t} + NM_{a-1, t-1, t} \]

where:
- \( P_{a, t} \) = Population of age \( a \) in year \( t \)
- \( P_{a-1, t-1} \) = Population of age \( a-1 \) in year \( t-1 \)

and so on.

3.3.1 U.S. Census Bureau population forecasts

The U.S. Census Bureau uses different assumptions about the changes in births (fertility), deaths (life expectancy), and migration over the next few decades to generate its low, middle,
and high series projections. Separate fertility, death, and migration rates are calculated for different race, Hispanic origin, age, and sex cohorts.

For births, the U.S. Census Bureau's middle series projections expect that fertility rates for each cohort will stay at their 1994 levels through 2010. Under the low series forecasts, fertility rates for each cohort drop 15 percent from their 1994 levels by 2010. Under the high series forecasts, fertility rates increase 15 percent by 2010.

For life expectancy and deaths, the middle series forecasts assume a slight increase in life expectancy. The high series projections assume a greater increase in life expectancy and the low series projections assume a slight decrease in life expectancy. Under the middle series projections, by 2010, people who are 65 years of age are expected to live until almost age 82 if they are male and until 85 if they are female (Table 3-4).

### Table 3-4: Projected Total Life Expectancy for People 65 Years of Age, U.S., 1995-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Low Series Projections</th>
<th>Middle Series Projections</th>
<th>High Series Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>1995</td>
<td>80.5</td>
<td>84.2</td>
<td>80.5</td>
</tr>
<tr>
<td>2000</td>
<td>80.4</td>
<td>84.1</td>
<td>80.9</td>
</tr>
<tr>
<td>2010</td>
<td>80.3</td>
<td>84.1</td>
<td>81.8</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau, 1996a, Table B-3. Includes 65 years plus the expected years of life left beyond age 65.

For migration, the middle series projections assume that net migration remains constant through 2010 at 820,000 people per year (1,042,000 immigrants and 322,000 emigrants). Under the high series forecasts, net migration increases to almost 1.4 million people annually. Under the low series forecasts, net migration drops to 300,000 people per year. Table 3-5 shows the anticipated net migration for elderly age groups under each projection. Among elderly age groups, there is generally expected to be a net out-migration to other countries. Only the high series estimate for ages 75 and over forecast a net increase due to migration: approximately 4,000 people per year. The middle series projections estimate over 12,000 people aged 75 and above and almost 9,000 people 85 and over will leave the country each year beginning in the year 2000 and continuing through 2050.

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Based on documentation provided with the MISER projections (1999).
The low, middle, and high series for births, deaths, and migration area combined to produce overall low, middle, and high series population projections. Table 3-6 displays the projections for the elderly populations 75 years old and over and 85 and over through 2010. By 2010, the 75 and over population is expected to grow to between 17 million (low series) and 20 million (high series), and the age 85 and over population is anticipated to increase to between 5 and 6.5 million.

### Table 3-6: U.S. Elderly Population Projections to 2010

<table>
<thead>
<tr>
<th>Years</th>
<th>Ages 75 &amp; Over</th>
<th>Ages 85 &amp; Over</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Series</td>
<td>Middle Series</td>
</tr>
<tr>
<td>1995 Pop</td>
<td>14.8</td>
<td>14.8</td>
</tr>
<tr>
<td>2000 Pop</td>
<td>16.3</td>
<td>16.6</td>
</tr>
<tr>
<td>2010 Pop</td>
<td>16.9</td>
<td>18.4</td>
</tr>
<tr>
<td>% of Total Pop 2010</td>
<td>6.0</td>
<td>6.2</td>
</tr>
<tr>
<td>% Growth 1995-2010</td>
<td>14.5</td>
<td>24.1</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau, 1996a, Tables 1 and 2.

3.3.2 MISER population projections for Massachusetts

MISER population projections for cities and towns within Massachusetts use both Massachusetts data and the national projections developed by the U.S. Census Bureau. MISER calculates separate fertility, death, and migration rates for different race, Hispanic origin, age, and sex cohorts. It then uses these rates to project the populations of Massachusetts' 351 towns and cities for 1995 to 2010. Low, middle, and high series population projections are developed for each place.

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9 Persons of Hispanic origin can be of any race. The U.S. Census Bureau develops separate rates for non-Hispanic Whites, non-Hispanic Blacks, non-Hispanic American Indians (including Eskimo and Aleut), non-Hispanic Asian and Pacific Islanders, and Hispanic-origin populations.

10 MISER develops separate rates for each 5-year age group. It also develops different rates for non-Hispanic Whites, non-Hispanic Blacks, non-Hispanic American Indians and Asians (combined), and Hispanic populations.
Fertility and birth rates are based upon vital statistic birth data provided by the Massachusetts Department of Health (MDH). Average annual fertility rates are calculated for the period 1991 to 1995, and 1986 to 1995. For all non-Hispanic Whites, and minorities in cities with a population of at least 100,000, fertility rates are estimated by town. For minorities in smaller communities, fertility rates are approximated by county. Birth projections through the year 2000 use the 1991-1995 fertility rates and projections from then to 2010 use the 1986-1995 rates. In addition, adjustments to the 2000 to 2010 projections were made based on the expected national changes in fertility by race reported by the U.S. Census Bureau in its low, middle, and high series forecasts.

Average annual death rates are estimated using MDH mortality data for 1991 through 1995. As with fertility rates, the death rates are either calculated by town (for non-Hispanic Whites) or by county (for minorities). Mortality projections through 2010 are based on these rates. For the period 2000 to 2010, these local projections are adjusted according to the anticipated nation-level changes in death rates reported by the U.S. Census Bureau.

In calculating and projecting migration, MISER looks both at international migration and domestic migration. Based on U.S. Census Bureau middle series migration estimates, MISER holds the net international migration constant through 2010. For domestic migration, MISER has three alternative models (low, middle, high) based on historic migration trends at the town (and county) level for the time period 1981 to 1995 and for three sub-periods (1981-1985, 1986-1990, and 1991-1995). The middle series model assumes that annual domestic migration rate by town through 2010 will stay at the average for 1986 to 1995. The high and low series models assume that rates will be at the highest and lowest levels that they were respectively for any of the three shorter time periods.

3.4 Inventory and evaluation of transportation services

The transportation inventory and evaluation focuses on the transportation services and alternatives to driving that are available to elders in the Boston metropolitan area. The primary transportation data used for the analysis are summarized in Table 3-7.
Table 3-7: Principal Transportation Data for the Analysis

<table>
<thead>
<tr>
<th>Data</th>
<th>Data Source(s) with Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit authority districts and boundaries</td>
<td>Bridgewater State College, FTA service area maps, 1999; regional transit authorities, 2000.</td>
</tr>
<tr>
<td>Subway and commuter rail lines</td>
<td>Massachusetts Bay Transportation Authority, 2000.</td>
</tr>
<tr>
<td>Fixed bus routes and hours of operation</td>
<td>Bridgewater State College, FTA bus route files, 1999; regional transit authorities, 2000.</td>
</tr>
<tr>
<td>Transit authority paratransit services and</td>
<td>Regional transit authorities, 2000; MA Department of Housing and Community Development, 1998.</td>
</tr>
<tr>
<td>hours of operation</td>
<td></td>
</tr>
<tr>
<td>Area Agencies on Aging and Councils of</td>
<td></td>
</tr>
<tr>
<td>Aging</td>
<td></td>
</tr>
<tr>
<td>Transportation services offered through</td>
<td>Multisystems, 2000 (same source).</td>
</tr>
<tr>
<td>other state agencies</td>
<td></td>
</tr>
<tr>
<td>Taxi company locations</td>
<td>Netscape Yellow Pages (<a href="http://www.netscape.com">www.netscape.com</a>), 2000.</td>
</tr>
</tbody>
</table>

3.4.1 Area coverage of transportation services and potential spatial disparities

The evaluation examines the spatial coverage and locations of transportation providers. It looks at the level of services inside I-95 compared to the level of services outside of I-95. The analysis also evaluates the relationship between where services are currently located and where the 75 years old and over population resides, and considers the potential for spatial disparities between the two to arise. The potential for disparities is assessed assuming a status quo level of services coupled with MISER’s projected population changes through the year 2010 and the expected increases in the number of people aged 75 and over living in the suburbs beyond I-95.

The first aspect of the evaluation involves the mapping of transportation service areas and locations using the ArcView (v3.2a) GIS software developed by the Environmental Systems Research Institute (ESRI). Maps are created using the GIS shape file coverages (i.e. bus routes, etc.) and the transportation service data listed in Table 3-7. The taxi company locations available through the Netscape Yellow Pages (2000) as street addresses are converted to a geographic shape file using ArcView’s StreetMap (v1.1) address-matching extension so that they can be mapped. Maps are also developed that display both transportation services and population densities for the 75 and over age group, typically for the years 1990 and 2010. These combined maps are employed to help evaluate the potential for spatial disparities between the elderly and services. Using these maps and ArcView’s capabilities, quantitative analysis is performed to address the following sorts of questions:
how many elderly live in areas currently not served by fixed route bus or transit authority paratransit services; how much elderly population growth is expected for these areas between 1990 and 2010; in what areas do the regional Area Agencies on Aging make transportation service a priority; and how is the elderly population of these areas and of those areas where transportation services are not a priority expected to change in the next few decades. The transportation service maps are shown in Chapter 4.

3.4.2 Qualitative assessment of access to transportation services

The second aspect of the evaluation involves a qualitative assessment of the elderly’s access to transportation services, particularly services that provide transportation to health care. This section looks at the general issues of accessibility, such as availability and service hours of operation, and considers how accessibility will be affected by a more spatially dispersed elderly population. For some types of transportation services where little detailed or spatial information can be readily obtained, such as for taxis, the analysis is limited to basic maps and a qualitative discussion and assessment of services and access. For taxis, little information is available on either service areas for different taxi companies or the total number of vehicles in taxi fleets.

3.5 Inventory and evaluation of health care services

The inventory and evaluation of health care services uses the same basic approach as that taken for transportation services and discussed above in the previous section. The analysis focuses on the health care resources available to the elderly in the Boston metropolitan region. The primary health care data that are examined as part of the analysis are listed in Table 3-8.
Table 3-8: Principal Health Care Data for the Analysis

<table>
<thead>
<tr>
<th>Data</th>
<th>Data Source(s) with Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals with acute care (i.e. emergency room) facilities</td>
<td>QuadraMed, On-line directory, 2000; Metro Boston EMS Service Council, 1999.</td>
</tr>
<tr>
<td>Ambulance services</td>
<td>MA Office of Emergency Medical Services, 2000.</td>
</tr>
</tbody>
</table>

3.5.1 Location of health care services and potential spatial disparities

The evaluation looks at the locations and spatial coverage of the health care services listed in Table 3-8: doctors' offices and clinics, hospitals, ambulance services, and pharmacies. It examines the level of services inside I-95 and outside I-95 and compared the two. It also investigates the potential for spatial disparities between where these services are located and where elderly people live. The potential for spatial disparities is considered in the context of the continuing consolidation of hospitals and doctors' offices and clinics into fewer geographic locations while the elderly population becomes more spatially dispersed. Most of Boston's elderly population growth through 2010 is expected to occur in the suburbs beyond I-95. These suburbs are the same locations where some of the biggest decreases in physician’s offices and clinics have taken place over the last ten years.

The Economic Census publishes town-level data on doctors' offices and clinics for only a small fraction of the towns in the region.11 As a result, it is difficult to map the number and locations of doctors' offices and clinics across the entire region, and doing so would require additional data collection. As a result, the analysis of doctors' offices and clinics primarily involves examining the change in the number of these providers by town (where the data is already available) and comparing those changes to anticipated increases or declines in the each town’s elderly population.

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11 Town-level data on hospitals and doctors’ offices and clinics is only collected for towns with at least a certain number of service establishments. The exact number needed varies from year to year. In addition, town-level data includes only doctors and clinics who are subject to federal income taxes (almost all are).
For the other categories of health care services, service locations are mapped spatially using ArcView. Address-based data – ambulance service providers, pharmacies, and hospitals – are all geo-coded and turned into spatial files. The maps also include elderly population data for 1990 and 2010 (usually population densities) to facilitate the exploration of the relationship between service locations and elderly population centers. The health care services maps are displayed in Chapter 4.

3.5.2 Elderly’s proximity to hospitals

One aspect of the spatial analysis of health care services assesses the elderly’s proximity to hospital services. A 5-mile radial distance is extended from each hospital and the percentage of the elderly living within these areas was estimated. The 5-mile distances are calculated as straight distance, not as miles using the street network, with the implicit assumption that that local roads will support direct travel to each hospital from all parts of its surrounding 5-mile area. The percentage of elderly living within 5 miles of a hospital is then estimated for 1990 and 2010. These estimates use MISER population data and assume that each town’s elderly population is uniformly distributed across each town’s area. Separate estimates are calculated for the percentage of elderly living within 5 miles of any hospital and the percentage living within 5 miles of an acute care facility (acute care facilities provide emergency care services). Access to both types of hospitals is considered to be important for the elderly, and examining only one would present an incomplete picture of the elderly’s overall proximity to hospital care.

3.5.3 Qualitative assessment of access to health care services

As with the transportation services analysis, the evaluation of access to health care services includes a qualitative component and discussion. That section examines the general issues affecting access to health care, including proximity to care and availability of transportation

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12 The validity of this assumption was checked by doing the same analysis using Census tract level data from the 1990 Census. That version of the analysis assumed that elderly populations were distributed uniformly only across each Census tract, not across entire towns. Despite the greater analytic precision of the tract-based approach, the results of that method were almost identical to those of the town-based approach. The town-based version of the analysis was selected over the tract-based one because MISER town-level population forecasts allowed for comparisons of proximity to hospitals in two different years, 1990 and 2010, whereas no tract-level data was available for years beyond 1990.
services that provide transport to medical appointments. It also considers potential access issues that may arise as the elderly population becomes larger and more spatially spread out, and it becomes more difficult and more costly to provide a high quality level of access to health care for all seniors. Because of the limitations of some of the health care data provided, such as for ambulances, the analysis of some services is primarily qualitative in nature. For ambulance providers, especially private providers, little information on geographic service territories is available; as a result, it is difficult to fully evaluate and quantify the elderly's degree of access to ambulance care.

3.6 Estimates and projections of incidence and costs of chronic diseases

The research explores the incidence and costs of two common chronic diseases, diabetes and coronary heart disease, and estimates and projects the costs of these diseases in the Boston metropolitan area.

3.6.1 Reasons for focusing on diabetes and coronary heart disease

Coronary heart disease (CHD) and diabetes were chosen as the diseases to focus on for a number of reasons. Both are common diseases among the elderly; more than one-third of people 75 and over have heart disease, and more than one-eighth have diabetes. Both are also among the top ten primary causes of death nationally; heart disease is the number one cause and diabetes is number seven. Additionally, the medical expenditures for treating these conditions are immense. National personal health care expenditures for diabetes total close to $48 billion annually and spending for CHD is approximately $39 billion per year. Much of the health care costs for treating these diseases come from the need for hospitalization and nursing home care, particularly among the elderly.

Although the health care costs associated with these diseases are high, there is considerable potential to reduce these costs through improved health monitoring of people with diabetes or health disease and more preventative care. This potential is another reason these diseases are studied here. In their early stages, before any disabling and expensive complications develop, both diseases are primarily managed through a combination of exercise, diet, and medications.
For diabetics, simple monitoring and regulation of blood glucose levels is also important. With both diseases, disease symptoms can sometimes be eliminated through weight loss or diet alone. The responsiveness of early stage diabetes and CHD to simple treatments make them ideal conditions to study, as is done for this research, in the context of how improving the elderly's access to health care services can potentially help their overall health and also reduce their medical expenditures.

3.6.2 National costs of diabetes and CHD among the elderly

Current costs

The current (1995) national personal health care expenditures for CHD and diabetes were estimated by Hodgson and Cohen (1999a; 1999b) using data from the Health Care Financing Administration (HCFA). Hodgson and Cohen's work estimated the cost of these diseases for the elderly by sex and by age group. Their analysis of the costs of diabetes explicitly evaluated the medical costs associated with diabetes complications and comorbidities in addition to the direct costs of treating diabetes itself. However, their analysis of CHD costs looked only at the medical costs of the primary disease. Hodgson and Cohen calculated the per capita costs of CHD and diabetes for each elderly age and sex cohort using total cost and national population figures. The per capita figures served as the basis from which 1995 cost estimates for the Boston metropolitan area are generated. They are also the foundation for the national and regional 2010 cost projections.

Future costs

The future per capita costs for diabetes and CHD are estimated using the current per capita costs for 1995 and assuming constant rates of growth in per capita medical costs for the 1995 to 2010 time period. The growth rates used for the cost calculations are based on HCFA data on the annual spending changes in five major health care expenditure categories from 1990 to 1997 and the five year annual averages for 1990-1995 and 1992-1997 (Table 3-9). Table 3-10 indicates the growth rates that are used for the 2010 calculations. These rates are kept low to

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13 In neither of Hodgson and Cohen’s studies were the indirect, non-“medical” costs of diabetes or CHD (i.e. lost wages, cost of transportation to care, etc.) incorporated into the cost estimates. Moreover, it is unfortunately
avoid overstating future costs. These growth rates reflect the overall cost increases for each expenditure type, and not increases in the costs for specific diseases such as CHD and diabetes alone. Nonetheless, these rates are assumed to be reasonable proxies for the growth in costs for these two diseases. The future cost calculations also implicitly assume that current spending patterns for health care (i.e. the distribution of costs among hospital care, professional services, etc.) will remain constant through 2010.

**Table 3-9: Annual Average Percentage Increase in Medical Expenditures, 1990-1997**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Care</td>
<td>10.1</td>
<td>8.1</td>
<td>6.2</td>
<td>4.4</td>
<td>3.4</td>
<td>3.9</td>
<td>2.9</td>
<td>6.4 4.2</td>
</tr>
<tr>
<td>Professional Services</td>
<td>8.8</td>
<td>10.1</td>
<td>4.9</td>
<td>6.7</td>
<td>5.3</td>
<td>4.1</td>
<td>5.1</td>
<td>7.1 5.2</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>12.2</td>
<td>9.0</td>
<td>7.6</td>
<td>7.8</td>
<td>6.2</td>
<td>5.2</td>
<td>4.3</td>
<td>8.5 6.2</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>22.4</td>
<td>22.3</td>
<td>17.1</td>
<td>13.8</td>
<td>11.0</td>
<td>7.1</td>
<td>3.7</td>
<td>17.2 10.4</td>
</tr>
<tr>
<td>Drugs and Medical</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.6</td>
<td>8.4</td>
<td>9.5</td>
<td>9.9</td>
<td>7.7 8.6</td>
</tr>
<tr>
<td>Durables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: HCFA, as cited in NCHS, 1999 and 1995, Table 119.

**Table 3-10: Projected Annual Percentage Increase in Medical Costs through 2010**

<table>
<thead>
<tr>
<th>Expenditure Type</th>
<th>Projected Annual % Increase in Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Care</td>
<td>5</td>
</tr>
<tr>
<td>Professional Services</td>
<td>5</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>6</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>10</td>
</tr>
<tr>
<td>Drugs and Medical Durables</td>
<td>8</td>
</tr>
</tbody>
</table>

As with the original 1995 per capita costs, per capita expenditures for 2010 are calculated separately for each older age (75 to 84 and 85 and over) and sex cohort. This is done because the total level of expenditures varies significantly between these two age groups and because the distribution of costs between expenditure types is different for women and men. The projected per capita figures presented in Chapter 5 are computed by using each cohort’s individual per capita cost forecasts and the U.S. Census Bureau’s (1996a) projections of population distribution in 2010 and then combining them into the summary categories.

beyond the scope of this research to generate estimates of those costs independently. Such estimates would be very useful in estimating the full monetary costs of these diseases to society and the diseases’ total impacts.
3.6.3 Elderly hospitalizations and deaths from these diseases in the Boston metro region

The number of elderly hospitalizations and deaths due to CHD and diabetes in the Boston metropolitan region are estimated with data provided by the Massachusetts Department of Public Health (DPH). The DPH has developed a powerful software tool, the Massachusetts Community Health Information Profile (MassCHIP), for generating various health statistics for different segments of the population and parts of the state. MassCHIP users can define the specific population (age, sex, etc.) they would like data on, and the towns and years the data should cover. For this research, a region is defined in MassCHIP that includes all 159 towns and cities in the Boston metropolitan area. The hospitalization and death summary statistics are then calculated for that geographic area. The number of hospitalizations due to diabetes complications is available through MassCHIP and those data are incorporated into the tables in Chapter 5; comparable information is unfortunately unavailable through MassCHIP for CHD.

3.6.4 Costs of diabetes and CHD among the elderly for the Boston metro region

Medical costs in the Boston metro region for diabetes and CHD among the elderly are computed using the national per capita figures, and population estimates and projections provided by MINDER. Although Boston elders are thought to have slightly lower incidence of CHD and diabetes than the national rate, Boston area costs for health care services are higher than costs in other parts of the country. Because these two factors counterbalance each other, it is assumed that the national level per capita cost figures provide a reasonably accurate estimate of the costs of these diseases for Boston seniors.

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14 As estimated using national and regional hospitalization and mortality data for these diseases.
Today, a greater number of elderly live in cities than do younger generations. Residing in cities has a number of benefits for older adults. Cities typically have higher population densities and more mixed-use development than suburbs. As a result, more stores and services are likely to be located near residences and within walking distance. Additionally, cities offer more providers of the services seniors use and need most, such as health care, and community and social service programs aimed at the elderly population. In cities, not only are these programs more often located near to where the elderly live, but there are more transportation options to help the elderly reach them. Cities also typically have better public transit service than suburbs, with larger areas of coverage, longer operating hours, and more paratransit availability. They also have larger networks of alternative transportation providers that can make up gaps in transit authority services. The variety and quality of transportation options and proximity to service providers limit urban elder’s reliance on automobile transportation and help them maintain their mobility even after they no longer drive.

Despite these benefits of city living, the proportion of elderly residing in cities is expected to decline over the next few decades. Beginning in the 1950s, the elderly population already began shifting from cities to suburbs (Longino, 1990), and today, close to half of older adults reside in suburban communities (AARP and AOA, 1997). Demographers anticipate that the current elderly migration to suburbs will continue (Longino, 1990; National Council on the Aging, 1990). The population overall is moving to suburban areas. In addition, in the year 2021, the baby boom generation begins reaching age 75. Many baby boomers already live in suburbs and research shows that most intend to stay there as they age.

As the older adult population becomes increasingly decentralized and suburban, it may become more difficult for the elderly to access important services such as medical care. Limited health care resources may be available in many suburban communities. In addition, elder non-drivers may have trouble finding transportation for travel to health care providers. The reduced access to health care and other services could encourage some elders to continue...
driving after it is no longer safe for them to do so. It could also lead elders to make sub-optimal health care choices such as neglecting the need for preventative care or relying on emergency medical services in non-emergency situations. Some older adults have already reported than transportation issues can pose a significant barrier to regular health care and lead them to see their doctors less frequently than they should (Ritter and Kirk, 1995). Such problems will likely worsen as the number of elderly living in suburbs increases.

Chapter 4 explores these issues and evaluates the potential for spatial disparities to arise between where elderly people live and where medical and transportation services are located. The chapter opens by providing population data and projections for the Boston metropolitan region and exploring the trends of increasing decentralization and an aging suburban population (Section 4.1). In Section 4.2, a brief inventory of the transportation services in the region is conducted, and the spatial relationship between the elderly population and these services is examined. Section 4.3 conducts a similar inventory and evaluation of health care providers. Section 4.4 inventories services that focus on medical-related transport and explores the elderly’s reliance on these options. As all the sections discuss, the potential for inadequate access to services will probably increase with the spatial dispersal of elderly population. The chapter closes with Section 4.5, which summarizes the results of the inventory and spatial analysis and makes a few concluding remarks.

4.1 Population projections for the Boston metropolitan region

Section 4.1 overviews population data and projections for the Boston metropolitan area. Its discussion is based largely on population estimates and forecasts developed by MISER for the 1990 to 2010 time period.1 The section considers population changes for each town and city as well as for the areas inside and outside of the Interstate 95 corridor.2 The first part of the section examines the trends and projected growth through 2010 for the total population. The second part focuses on changes in the number of elderly.

1 The analysis here uses MISER’s mid-level projections released in 1999.
2 Towns and cities are designated as being outside I-95 if they lie beyond I-95 or touch a section of it. This designation is discussed more in Chapter 3. For this analysis, 140 of the 159 municipalities in the region are considered to be outside of I-95.
4.1.1 Projections for the region’s total population

MISER projects that the region’s total population will grow to 4.3 million by the year 2010. This represents an increase of 10 percent since the year 1990 and of 4 percent since 2000. Most of the region’s growth through 2010 is expected to occur in the communities outside of Interstate 95. MISER forecasts that between 1990 and 2010, the population inside I-95 will grow only 1 percent compared to 14 percent growth outside of I-95 (Table 4-1). In 1990, two-thirds of the region’s residents lived in communities outside of I-95. By 2010, it is expected that almost 70 percent will.

Table 4-1: Projected Population Changes in the Boston Metro Region, 1990-2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside I-95</td>
<td>2,622,816</td>
<td>204,796</td>
<td>161,149</td>
<td>365,945</td>
<td>14</td>
</tr>
<tr>
<td>Inside I-95</td>
<td>1,347,141</td>
<td>-4,641</td>
<td>21,668</td>
<td>17,027</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>3,969,957</td>
<td>200,155</td>
<td>182,817</td>
<td>382,972</td>
<td>10</td>
</tr>
</tbody>
</table>


The left panel of Figure 4-1 shows the projected population changes by town. Eleven of the 19 municipalities inside I-95 are expected to see their populations decrease and only four – Brookline, Cambridge, Chelsea, and Milton – are projected to have increases of more than 10 percent. Watertown, with a population decrease of 36 percent, is forecasted to experience the greatest decline and Chelsea, with a population increase of 33 percent, the greatest growth within the I-95 corridor.

The biggest population increases by town are expected to occur outside of I-95. Many of the fastest growing communities lie on the region’s periphery, with some beyond even I-495. Of the 13 towns expecting population growth of more than 50 percent between 1990 and 2010, 9 border or are located beyond I-495. Only three communities beyond I-495 are projected to have net losses in population: Ashby (2 percent decrease), Milford (6 percent), and Ayer (31 percent).
Figure 4-1: Percentage Increase in the Total and Elderly Populations, 1990-2010

(a) Total Population
(b) People 75 & Over

4.1.2 Projections for the region's elderly population

For the population 75 years old and above, the shift to the suburbs is expected to be even more dramatic than that for the population as a whole. Even before the baby boomers, many of whom live in suburbs, begin turning 75 in the year 2021, significant graying of suburbia is forecasted to take place. Between 1990 and 2010, it is projected that there will be only a small increase in the elderly population (6 percent) for the region as a whole. However, during the same time period, there is expected to be considerable migration by the elderly to the communities outside of I-95, with the number of elders residing outside of I-95 growing by 20 percent (As Table 4-2). At the same time, the number living inside I-95 is projected to decrease by almost the same amount (18 percent). When the region’s elderly population reaches 222,000 in 2010, 71 percent of Boston area seniors are expected to be living outside of I-95, compared to only 62 percent two decades earlier.

Table 4-2: Projected Elderly Population Changes in the Boston Metro Region, 1990-2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside I-95</td>
<td>137,591</td>
<td>14,961</td>
<td>12,958</td>
<td>27,919</td>
<td>20</td>
</tr>
<tr>
<td>Inside I-95</td>
<td>84,443</td>
<td>-5,228</td>
<td>-10,124</td>
<td>-15,352</td>
<td>-18</td>
</tr>
<tr>
<td>Total</td>
<td>222,034</td>
<td>9,733</td>
<td>2,834</td>
<td>12,567</td>
<td>6</td>
</tr>
</tbody>
</table>


Figure 4-1(b) displays the expected percentage change in each town’s elderly population. All but three of the municipalities inside I-95 – Saugus, Winchester, and Stoneham –are projected to see decreases in their number of elders. Outside of I-95, declines in the elderly population are expected for only 20 of the 140 towns, and most of decreases are minor. (The median decrease is 110). All the towns where the number of elders is projected to decrease by 500 or more are listed in Table 4-3. There are 13 such towns, 8 of which are within I-95.

Between 1990 and 2010, the City of Boston is expected to lose the greatest number of seniors, over 6,700, of any of the municipalities, and Watertown is projected to have the biggest percentage decline, 36 percent.
Table 4-3: Towns with Expected Elderly Population Decreases of at Least 500 People, 1990-2010

<table>
<thead>
<tr>
<th>Towns</th>
<th>Inside I-95</th>
<th>Outside I-95</th>
<th>Overall for these 13 towns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75 Years &amp; Over Population 1990</td>
<td>75 Years &amp; Over Population 2010</td>
<td>Change 1990-2010</td>
</tr>
<tr>
<td>Boston</td>
<td>29,643</td>
<td>22,901</td>
<td>-6,742</td>
</tr>
<tr>
<td>Quincy</td>
<td>6,463</td>
<td>4,860</td>
<td>-1,603</td>
</tr>
<tr>
<td>Brookline</td>
<td>4,655</td>
<td>3,391</td>
<td>-1,264</td>
</tr>
<tr>
<td>Watertown</td>
<td>2,585</td>
<td>1,655</td>
<td>-930</td>
</tr>
<tr>
<td>Malden</td>
<td>3,807</td>
<td>2,909</td>
<td>-898</td>
</tr>
<tr>
<td>Somerville</td>
<td>4,149</td>
<td>3,499</td>
<td>-650</td>
</tr>
<tr>
<td>Chelsea</td>
<td>1,773</td>
<td>1,180</td>
<td>-593</td>
</tr>
<tr>
<td>Everett</td>
<td>2,576</td>
<td>2,058</td>
<td>-518</td>
</tr>
</tbody>
</table>

| Lynn      | 5,503       | 4,446        | -1,057                    | -19               |
| Lawrence  | 4,035       | 3,189        | -846                      | -21               |
| Haverhill | 3,458       | 2,742        | -716                      | -21               |
| Lowell    | 5,479       | 4,809        | -670                      | -12               |
| Salem     | 2,603       | 2,073        | -530                      | -20               |

| Overall for these 13 towns | 76,729 | 59,712 | -17,017 | -22 |


As shown in Figure 4-1, all 17 of the communities whose elderly populations are expected to double between 1990 and 2010 are located beyond I-95. Four of them are situated even farther out near I-495. Table 4-4 lists those towns that are projected to add at least 500 older adults during the two decades. There are 18 municipalities where this is expected and as before, all are in the suburbs outside of I-95. Among these towns, Peabody is projected to gain the greatest number of people aged 75 and over, with a net increase of close to 1,400. The greatest percentage growth in elders is forecasted for Topsfield and Burlington, both of which are expecting roughly a tripling of their elderly populations.

The aging of suburbia is explored graphically in Figure 4-2. The figure shows the percentage of each town's population that is 75 years old or over for the years 1990 and 2010. The changes between the two panels indicate the spatial shift of elderly towards the suburbs, especially towards those towns beyond the I-95 corridor. Over the next two decades, many suburban communities are expected to experience an aging of their populations. In 1990, most towns whose populations were more than 7 percent elderly were located within I-95. However, by 2010, many of the towns that are projected to be over 7 percent elderly will be outside of I-95. Similarly, in 1990, there were 26 communities (including 25 beyond I-95) that had less than 3 percent elders. By 2010, the number of such communities is expected to decrease by more than half, to only 12 total.
Table 4-4: Towns with Expected Elderly Population Increases of at Least 500 People, 1990-2010

<table>
<thead>
<tr>
<th>Towns</th>
<th>75 Years &amp; Over Population 1990</th>
<th>75 Years &amp; Over Population 2010</th>
<th>Change 1990-2010</th>
<th>Percentage Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peabody</td>
<td>2,535</td>
<td>3,904</td>
<td>1,369</td>
<td>54</td>
</tr>
<tr>
<td>Lexington</td>
<td>2,148</td>
<td>3,335</td>
<td>1,187</td>
<td>55</td>
</tr>
<tr>
<td>Burlington</td>
<td>575</td>
<td>1,715</td>
<td>1,140</td>
<td>198</td>
</tr>
<tr>
<td>Chelmsford</td>
<td>1,210</td>
<td>2,213</td>
<td>1,003</td>
<td>83</td>
</tr>
<tr>
<td>Framingham</td>
<td>3,634</td>
<td>4,354</td>
<td>720</td>
<td>20</td>
</tr>
<tr>
<td>Topsfield</td>
<td>349</td>
<td>1,051</td>
<td>702</td>
<td>201</td>
</tr>
<tr>
<td>Concord</td>
<td>1,028</td>
<td>1,695</td>
<td>667</td>
<td>65</td>
</tr>
<tr>
<td>Walpole</td>
<td>841</td>
<td>1,483</td>
<td>642</td>
<td>76</td>
</tr>
<tr>
<td>Bedford</td>
<td>787</td>
<td>1,417</td>
<td>630</td>
<td>80</td>
</tr>
<tr>
<td>Carver</td>
<td>458</td>
<td>1,083</td>
<td>625</td>
<td>136</td>
</tr>
<tr>
<td>Acton</td>
<td>510</td>
<td>1,122</td>
<td>612</td>
<td>120</td>
</tr>
<tr>
<td>Andover</td>
<td>1,233</td>
<td>1,832</td>
<td>599</td>
<td>49</td>
</tr>
<tr>
<td>Ashland</td>
<td>378</td>
<td>948</td>
<td>570</td>
<td>151</td>
</tr>
<tr>
<td>Woburn</td>
<td>1,763</td>
<td>2,328</td>
<td>565</td>
<td>32</td>
</tr>
<tr>
<td>Lynnfield</td>
<td>552</td>
<td>1,104</td>
<td>552</td>
<td>100</td>
</tr>
<tr>
<td>Wayland</td>
<td>491</td>
<td>1,034</td>
<td>543</td>
<td>111</td>
</tr>
<tr>
<td>Sudbury</td>
<td>409</td>
<td>949</td>
<td>540</td>
<td>132</td>
</tr>
<tr>
<td>Sharon</td>
<td>592</td>
<td>1,106</td>
<td>514</td>
<td>87</td>
</tr>
<tr>
<td>Overall for these 18 towns</td>
<td>19,493</td>
<td>32,673</td>
<td>13,180</td>
<td>68</td>
</tr>
</tbody>
</table>


4.1.3 Population changes beyond 2010

MISER’s town-level population projections serve as the basis for much of Section 4.1’s analysis. MISER’s forecasts currently extend only to the year 2010. They will no doubt be extended further after the data from the year 2000 national U.S. Census become available.

The research here consciously chose not to develop its population projections beyond 2010 on its own, preferring instead to defer to the MISER professionals. As a result, there are no quantitative predictions of what changes the region’s total and elderly population will undergo after 2010. Qualitatively, though, it seems reasonable to assume that the current trends of suburbanization and graying of the suburbs will continue beyond 2010. Through 2010, the youngest old (people ages 65 to 74) are expected to settle even more in the suburbs outside of I-95 than the 75 and over population is. Additionally, most research suggests that the youngest old, as well as the baby boomers to follow them in the aging process, intend to retire and grow old in these suburban areas.

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3 Section 3.3.2 contains details on how MISER develops its population forecasts.
Figure 4-2: Percentage of the Total Population that is 75 Years Old or Over, 1990 & 2010

(a) 1990

(b) 2010

4.2 Location of transportation service providers

As the elderly reach their older years, it becomes less likely that they will drive themselves when they want to go somewhere. For younger elders, most daily trips are taken as drivers. However, less than half of people aged 80-84 and only one-fifth of people 90 years old or over use their own cars for their usual transportation (Burkhardt et al., 1998). Older elderly rely more on friends and family and transportation services, such as transit and taxis, for their daily travel, instead of driving on their own. However, even with these resources, they often find that their mobility is significantly reduced from their younger years. Adequate alternatives to the automobile are essential for preserving mobility and quality of life as people age. They are also important for reducing the probability that older adults will continue to drive when it becomes no longer safe for them to do so, because they feel they have no other choice.

Section 4.2 explores and inventories the transportation services and alternatives to driving that are available to seniors in the Boston metropolitan area. These transportation options include public transit, paratransit, taxi services, and senior citizen shuttles. Each option is evaluated in terms of geographic coverage and level of service. The relationship between where these services are located and where the elderly live is also discussed.

4.2.1 Transit authority services

This section summarizes the transportation services provided by the Massachusetts Bay Transportation Authority (MBTA) and the eight Regional Transit Authorities (RTAs) operating in the Boston metro area. Figure 4-3(a) displays the region’s service area for each transit authority and Table 4-5 lists the number of communities within the region in each’s district. The largest transit provider in the region is the MBTA. The MBTA runs light rail, commuter rail, buses, and ferries within its service district and to 52 other communities in

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4 The MBTA is not considered one of the regional transit authorities (RTAs) because it was created under separate state legislation from the RTAs and is administered differently.

5 A number of the transit authorities operating in the metro area have transit service outside of the region. The discussion in this chapter, however, only considers transit operations within the region and the number of metro area municipalities receiving transit services.
eastern Massachusetts. The MBTA has almost 700,000 one-way passenger trips and 1 million total boardings each day.

Table 4-5: Transit Authorities in the Boston Metro Region

<table>
<thead>
<tr>
<th>Transit Authority</th>
<th>Number of Communities*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massachusetts Bay Transportation Authority (MBTA)</td>
<td>78</td>
</tr>
<tr>
<td>Merrimack Valley Regional Transit Authority (MVRTA)</td>
<td>14</td>
</tr>
<tr>
<td>Lowell Regional Transit Authority (LRTA)</td>
<td>12</td>
</tr>
<tr>
<td>Greater Attleboro Taunton Regional Transit Authority (GATRA)</td>
<td>11</td>
</tr>
<tr>
<td>Brockton Area Transit (BAT)</td>
<td>8</td>
</tr>
<tr>
<td>Cape Ann Transportation Authority (CATA)</td>
<td>4</td>
</tr>
<tr>
<td>Southeastern Regional Transit Authority (SRTA)</td>
<td>1</td>
</tr>
<tr>
<td>Worcester Regional Transit Authority (WRTA)</td>
<td>5</td>
</tr>
<tr>
<td>Montachusett Regional Transit Authority (MRTA)</td>
<td>4</td>
</tr>
<tr>
<td>*Counts include only those communities that are part of the Boston metropolitan region. Sources: Bridgewater State College, 1999; regional transit authorities, 2000.</td>
<td></td>
</tr>
</tbody>
</table>

The Worcester Regional Transit Authority (WRTA) and Montachusett Regional Transit Authority (MRTA) are listed last in Table 4-5 because although there are a few Boston area communities within their districts, none of them receive transit authority bus or paratransit services.

There are 22 towns in the metro region that are not in any transit district (Figure 4-3(b)). Many of these towns lie on the periphery of the metropolitan area. Together these towns are estimated to comprise 6 percent of the region’s total population and 4 percent of its elderly (2000 estimate).6

Rail service

The region’s rail service includes subways and commuter rail, both of which are operated and coordinated solely by the MBTA. The MBTA runs four subway lines in the City of Boston and 10 nearby communities: Braintree, Brookline, Cambridge, Malden, Medford, Milton, Newton, Quincy, Revere, and Somerville. Except for service to Braintree, the subways operate completely within the Interstate 95 corridor. The subways run daily between the hours of 5:00 AM and 1:00 AM, though some sections of the lines have slightly shorter hours.

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Figure 4-3: Transit Authority Districts in the Region

(a) Transit Authority Districts

(b) Towns not in a Transit Authority District

A greater number of metro area communities have commuter rail than have subway service. However, commuter rail is of limited use for most of the region’s elderly and for many non-commuting trips. Commuter rail primarily connects the area’s suburbs with the City of Boston and its neighboring towns and cities and has limited coverage elsewhere in the region. In addition, commuter trains have infrequent service during the middle of the day, at night, and on weekends, three “off-peak” times when the majority of non-work related trips are made. During some off-peak times, such as weekends, there may be no service at all depending on the area. Because of these characteristics, commuter rail is generally less practical for non-commuting trips than other transit services, such as buses. As a result, it is less utilized by seniors for their travel than are other modes.

**Bus routes**

The MBTA and six RTAs operate fixed-route bus service in the Boston metro area. Table 4-5 indicates the number of communities served by each transit system, their number of routes in the metro region, and the level of bus service provided on weeknights and weekends. Figure 4-4(a) maps each agency’s bus routes. The MBTA has the most comprehensive bus service in the area with 170 routes and 7 day per week operations. The other transit agencies provide more limited service, with fewer bus routes and operating hours. Only Brockton Area Transit (BAT) and Greater Attleboro Taunton Transit (GATRA) have any weeknight bus service, and GATRA’s is limited to the bus routes it sponsors in the Plymouth-Kingston area. BAT and GATRA are also the only transit agencies besides the MBTA with any Sunday service, though for both agencies it is limited. GATRA’s Sunday service is restricted to the Plymouth-Kingston area and BAT operates less than half of its routes on Sundays. Off-peak service for the MBTA is also restricted. Only approximately four-fifths of the MBTA’s routes run on Saturdays and three-fifths on Sundays and weeknights. In addition, during off-peak times, MBTA routes run less frequently and times between buses may be an hour or more.

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7 GATRA’s Plymouth and Kingston area service is operated by the Plymouth and Brockton Street Railway Company.
Table 4-6: Bus Service in the Boston Metro Region

<table>
<thead>
<tr>
<th>Transit Authority</th>
<th>Number of Communities Served in Region</th>
<th>Number of Routes in Region</th>
<th>General Weeknight Service* (after 7pm)</th>
<th>General Saturday Service*</th>
<th>General Sunday Service*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBTA</td>
<td>43</td>
<td>170</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>MVRTA</td>
<td>8</td>
<td>32</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>LRTA</td>
<td>6</td>
<td>20</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>GATRA</td>
<td>6</td>
<td>19</td>
<td>Limited</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>BAT</td>
<td>4</td>
<td>17</td>
<td>Yes</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>CATA</td>
<td>3</td>
<td>8</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SRTA</td>
<td>1</td>
<td>1</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

*Service offered during these off-peak periods may be restricted to certain routes and/or communities.


Most of the transit agencies have some bus routes that are primarily or exclusively oriented towards commuters. For example, Cape Ann Transportation (CATA) runs two express buses to business and industrial parks in its district. Similarly, BAT provides commuter service to business parks in Avon and West Bridgewater, and Merrimack Valley Regional Transit (MVRTA) operates five special routes to employers in its area. There are other examples as well. Though these routes are beneficial for particular groups of commuters, they are of limited usefulness to the general population and the elderly. They often run infrequently during the day and their operations are usually restricted to commuter-oriented hours. In addition, their stops and destinations do not reflect the primary places that the general public and the elderly are interested in traveling to. Commuter and employment-oriented routes are among those mapped in Figure 4-4(a). However, their inclusion may lead to an overstating of the practical spatial coverage of transit authority routes for many transit riders.

Figure 4-4(a) also does not reflect the fact that bus service in and to outlying communities in the region is frequently more limited than in the primary service areas. Bus routes for outlying towns often have longer headways and more restricted hours. BAT’s service to Stoughton, for example, has only 4 trips per day, and SRTA’s service to Mattapoisett includes only three. When service is offered so infrequently, it may not be a viable or practical option for many potential riders. In addition to the communities with infrequent buses, there are also a large number of towns without any fixed-route bus service. There are 88 such towns in the region, all of them located outside of I-95.
Figure 4-4: Bus Service Offered by the Regional Transit Authorities

(a) Fixed Bus Service

(b) Paratransit

There are 56 towns without paratransit.

Paratransit

The MBTA and RTAs that run fixed-route bus service in the region also provide paratransit service for the elderly and the disabled (Table 4-7). Paratransit service is for individuals who are unable to use fixed-route service because of physical or mental impairments. Paratransit is on-demand, curb-to-curb service that operates without a fixed route. The 1990 Americans with Disabilities Act (ADA) mandates transit agencies to offer paratransit transportation to all areas within 3/4 of a mile of their fixed bus routes. All of the Boston area transit authorities provide this mandated level of service. However, many also offer paratransit service in a larger area than required under the ADA, covering entire towns within their districts even if their fixed routes do not extend that far. All the municipalities in the region with paratransit coverage are shaded in Figure 4-4(b). In total, the MBTA and RTAs combined provide paratransit service to 103 of the 159 towns and cities in the metro area.

Table 4-7: Paratransit Service in the Boston Metro Region

<table>
<thead>
<tr>
<th>Transit Authority</th>
<th>Number of Communities Served in Region</th>
<th>How Far in Advance of Trip Should Be Made</th>
<th>General Weeknight Service*</th>
<th>Saturday Service*</th>
<th>Sunday Service*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBTA</td>
<td>62</td>
<td>1-14 days</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>MVRTA</td>
<td>8</td>
<td>1-2 days</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>LRTA</td>
<td>10</td>
<td>1 day</td>
<td>No</td>
<td>Limited</td>
<td>No</td>
</tr>
<tr>
<td>GATRA</td>
<td>10</td>
<td>1 day</td>
<td>No</td>
<td>Limited</td>
<td>No</td>
</tr>
<tr>
<td>BAT</td>
<td>8</td>
<td>1 day</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>CATA</td>
<td>4</td>
<td>1 day</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SRTA</td>
<td>1</td>
<td>up to 7 days</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Service offered during these off-peak periods may be restricted to certain routes and/or communities. Source: regional transit authorities, 2000.

The largest paratransit operations in the region are run by the MBTA. The MBTA’s service, the RIDE, operates 365 days per year in 62 communities, and provides close to 1.2 million one-way trips annually (4,000 rides per day). Over 46,000 individuals use the RIDE each year. The MBTA is the only transit agency with weeknight paratransit service and one of the two with Sunday service. SRTA offers paratransit transport on Sundays, serving Mattapoisett. Most of the RTAs have paratransit service on Saturdays, though GATRA and LRTA only serve a limited area. In total, statewide, the RTAs (which exclude the MBTA),

8 RIDE statistics for fiscal year 1998, MBTA.
provide over 2.5 million paratransit rides per year statewide, most of them in the Boston metropolitan region (Multisystems, 2000).

In conversations with employees at the region’s transit authorities' most indicated that paratransit rides could generally be scheduled just one day before a trip and that availability was usually not a problem. For RIDE service, the MBTA specifically requires that contractors limit the number of requested rides that cannot be filled due to lack of availability to “no more than 1 percent (average monthly) of [all] trips requested.” Most also schedule trips up to a week or two in advance, though with the RIDE, patrons who reserve a trip in advance are not told until the day before whether it could be scheduled as requested (Multisystems, 2000). Among the other transit agencies, an employee at only one, SRTA, suggested that next-availability would be limited and recommended than patrons reserve rides up to a week in advance.

Much of the transit agencies’ paratransit service is provided by contractors or in conjunction with agencies serving the elderly. For example, the RIDE service is operated by 7 private transportation companies who contract with the MBTA for different parts of the MBTA service district. Other agencies use contractors as well, and sometimes the paratransit service contracts within the same district can be for different hours depending on location. For example, in the Lowell RTA district, only Billerica and Tewksbury have paratransit service on Sundays.

The transit authorities also work with agencies for the elderly, such as the regional Area Agencies on Aging (AAAs) and their local partner Councils on Aging (COAs). Sometimes these agencies provide the paratransit service in local areas. For instance, the AAA for Lynn and surrounding communities, the Greater Lynn Senior Services, is the MBTA’s RIDE contractor on the north shore. Also, a number of the COAs lease vans from the transit agencies and then offer local paratransit service. (A fuller discussion on the transportation options offered by the AAAs, COAs, and other organizations takes place in Section 4.2.2.)

9 Phone interviews with transit authority staff, conducted in March and April, 2000.
10 MBTA, Contract by and between the Massachusetts Bay Transit Authority and the Joint Venture of Thompson Transit, Inc. and Tommy’s Taxi, Inc., 1996.
Transit agencies’ use of contractors for paratransit operations means that the level of service can vary considerably by area and by contractor. As mentioned above, the hours of service can differ by location within the same district. Contractors’ attitudes towards customer service can also vary. The Boston Globe recently reported that most of the complaints made by RIDE passengers to the Massachusetts Office on Disability are directed at one company, Veterans Transportation Services, which serves Brookline, Newton, Brighton, Allston, and part of the MBTA’s northwest service area.11 The Globe article suggested that a primary contributor to poor service is the low wages paid to RIDE drivers; starting drivers at the RIDE typically earn about $9 per hour, less than is earned driving school buses or delivery vehicles. Another contributor could also be the lack of centralized control over paratransit operations (in part because of contractors) within each transit district. More uniformity and centralization could help provide a higher level of service and satisfaction for all riders.

Potential spatial disparity and access issues

At present, there is a fairly strong relationship in the region between where the elderly and other people live and where transit services are located. Transit authorities provide fixed-route or paratransit bus service, or both, to over 100 communities in the region, and their service areas cover almost every community with a sizeable population. Together, the 54 towns with neither bus routes nor paratransit account for only 11 percent of the region’s elderly (aged 75 and above) and only 14 percent of the region’s total residents (2000 estimate).

The existence of paratransit or fixed-route bus service within a community indicates merely the presence of service and does not necessarily mean that it is comprehensive or frequent. In many communities, the provided service may be inadequate for meeting the basic transportation needs of the people, such as the elderly and non-drivers, who can benefit most from a good transit system and suffer the most in the absence of one. The region’s outlying low-density communities are the most likely to have inadequate transit service.

---

These same outlying communities are also the most likely to be without any transit service. Figure 4-5 indicates the 54 towns where the regional transit agencies provide neither fixed-route bus service nor paratransit. The Figure also displays the population densities, by town, for people 75 years old and above in 1990 and 2010. Most of the towns without transit are in the outer parts of the region, and none are within the I-95 corridor. Also, in both years, almost all the communities with an elderly population density of at least 40 people per square mile have some type of transit service available.

Although the communities without transit service currently comprise only a small portion of the region’s population, they are experiencing some of the area’s greatest growth, especially for the elderly. Between 1990 and 2010, the elderly population living in towns without bus or paratransit service is expected to increase almost 50 percent. Moreover, over four-fifths of the region’s net growth in the number of elderly during this time period is expected to occur in these same towns.

From 1990 to 2010, 29 communities in the region are expected to see their elderly populations increase by at least 75 percent. Figure 4-6 shows where these communities are located. Figure 4-6 also displays the 54 towns without bus or paratransit service to see where overlaps occur. There are 17 towns that currently have no bus or paratransit service where large increases in the number of elderly are forecasted. These towns are indicated in Figure 4-6 by the intersection of the red and orange hatching, and are listed in Table 4-8. Between 1990 and 2010, the elderly population of these towns is expected to increase by 116 percent. It will be important for these towns to develop sufficient alternatives to driving as their numbers of seniors grow and their populations age. Without these alternatives, aging residents in these communities may find their mobility increasingly restricted.
Figure 4-5: Towns without Paratransit or Fixed-Route Bus Service
Shown with Population Density of Persons 75 Years Old & Over, 1990 & 2010

From 1990 to 2010, the elderly population of the 54 towns without transit service is expected to increase 48 percent.


Service designation is based on services provided by regional transit authorities. Population density shown by municipality.
Figure 4-6: Towns without Transit Service &
Towns with Large Projected Growth in Their Elderly Populations, 1990-2010

There are 17 towns without paratransit or fixed route service and with an increase of at least 75 percent in the number of elderly. From 1990 to 2010, the 75 yrs & over population of these 17 towns combined is expected to increase 116 percent.


Service designation is based on services provided by regional transit authorities. Population increase is for 1990-2010.
Table 4-8: Towns with No Bus or Paratransit Service and Large Expected Increases in their Elderly Populations 1990-2010

<table>
<thead>
<tr>
<th>Towns</th>
<th>75 Years &amp; Over Pop 1990</th>
<th>75 Years &amp; Over Pop 2010</th>
<th>Change 1990-2010</th>
<th>Percentage Change (%)</th>
<th>Median Household Income (1989)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside I-95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashland</td>
<td>378</td>
<td>948</td>
<td>570</td>
<td>151</td>
<td>51,173</td>
</tr>
<tr>
<td>Bellingham</td>
<td>378</td>
<td>669</td>
<td>291</td>
<td>77</td>
<td>45,397</td>
</tr>
<tr>
<td>Bolton</td>
<td>77</td>
<td>165</td>
<td>88</td>
<td>114</td>
<td>63,757</td>
</tr>
<tr>
<td>Boxborough</td>
<td>41</td>
<td>320</td>
<td>279</td>
<td>680</td>
<td>51,330</td>
</tr>
<tr>
<td>Boxford</td>
<td>159</td>
<td>513</td>
<td>354</td>
<td>223</td>
<td>78,562</td>
</tr>
<tr>
<td>Carlisle</td>
<td>116</td>
<td>294</td>
<td>178</td>
<td>153</td>
<td>83,985</td>
</tr>
<tr>
<td>Hamilton</td>
<td>266</td>
<td>516</td>
<td>250</td>
<td>94</td>
<td>49,167</td>
</tr>
<tr>
<td>Hanover</td>
<td>408</td>
<td>817</td>
<td>409</td>
<td>100</td>
<td>54,759</td>
</tr>
<tr>
<td>Harvard</td>
<td>122</td>
<td>255</td>
<td>133</td>
<td>109</td>
<td>47,299</td>
</tr>
<tr>
<td>Holliston</td>
<td>343</td>
<td>633</td>
<td>290</td>
<td>85</td>
<td>58,018</td>
</tr>
<tr>
<td>Marion</td>
<td>236</td>
<td>445</td>
<td>209</td>
<td>89</td>
<td>46,189</td>
</tr>
<tr>
<td>Northborough</td>
<td>414</td>
<td>736</td>
<td>322</td>
<td>78</td>
<td>57,963</td>
</tr>
<tr>
<td>Plympton</td>
<td>49</td>
<td>88</td>
<td>39</td>
<td>80</td>
<td>46,151</td>
</tr>
<tr>
<td>Sherborn</td>
<td>126</td>
<td>353</td>
<td>227</td>
<td>180</td>
<td>93,925</td>
</tr>
<tr>
<td>Stow</td>
<td>163</td>
<td>308</td>
<td>143</td>
<td>87</td>
<td>66,292</td>
</tr>
<tr>
<td>Sudbury</td>
<td>409</td>
<td>949</td>
<td>540</td>
<td>132</td>
<td>79,092</td>
</tr>
<tr>
<td>Wayland</td>
<td>491</td>
<td>1,034</td>
<td>543</td>
<td>111</td>
<td>72,057</td>
</tr>
<tr>
<td>Overall for these 17 towns</td>
<td>4,178</td>
<td>9,043</td>
<td>4,865</td>
<td>116</td>
<td>60,309</td>
</tr>
</tbody>
</table>


One obvious way to try to improve elderly mobility in the communities currently without bus or paratransit service is to begin to offer such service. In many of these communities, however, it is not clear how important it will be for transit authorities or other agencies to provide transit, or even whether residents and the elderly would use new bus or paratransit services. The median household incomes in the 54 towns without transit are generally higher than the regional average. Only 6 percent of the 54 towns have median household incomes (1989) below $40,000 and 12 have median incomes above $60,000. Among the 17 fastest growing communities without transit listed in Table 4-8, median household income (1989) ranges from $46,000 to $94,000, with an average of $60,000. These income levels suggest many older adults in these towns may be able to buy their way into continued mobility once they no longer drive using taxis and other private sector transportation options. Of course, it is unknown how incomes in these communities will change as people retire; however research by Lewin-VHI (1997) indicates that baby boomers are likely to have more income after they retire than do current elderly. These findings suggest that although some transportation services are likely to be needed to help the less wealthy elders in these communities who will
depend on public transit options, the lack of transit in these areas will not as big a problem as it first appears.

4.2.2 Other public and non-profit transportation alternatives

Transit authority services are supplemented by other public and non-profit transportation providers. Among these providers are state agencies, the regional Area Agencies on Aging, local Councils on Aging, and non-profit and volunteer organizations. The services they offer are generally aimed at the elderly, handicapped, or other populations whose mobility may be limited. This section briefly reviews these transportation alternatives, focusing its discussion on services for older adults.

Executive Office of Elder Affairs

The Massachusetts Executive Office of Elder Affairs plans and coordinates services for seniors throughout the state. Services, including transportation, are provided through three sets of related organizations: the Area Agencies on Aging, the Area Services Access Points, and the Councils on Aging.

The AAAs are the regional planning and administrative agencies that were established to meet the requirements of the national Older Americans Act (OAA). There are 23 AAAs in the state, 17 in the Boston metropolitan area. The Boston area AAAs are shown in Figure 4-7 and listed in Table 4-9. Table 4-9 also indicates the number of communities and older adults in the metro area served by each AAA. The AAAs provide services to all people ages 60 and over. Table 4-9, however, uses the more common definition of elderly as all people 65 and over, and shows that population for each AAA. Elder Services of Merrimack Valley serves the area with the greatest number of elderly: close to 61,000 people aged 65 and over, and 28,000 aged 75 and over (2000 estimate). The Commission on Affairs of the Elderly, for the City of Boston, serves the second largest elderly population: almost 55,000 people 65 and above, and 27,000 people 75 and older.
Figure 4-7: Area Agencies on Aging in the Region

Elder Services of Merrimack Valley, Inc.
West Suburban Elder Services, Inc.
Minuteman Home Care Corp.
Central Mass Agency on Aging, Inc.
Baypath Home and Community Services, Inc.
Somerville/Cambridge Elder Services, Inc.
Health and Social Services Consortium, Inc.
Bristol Elder Services, Inc.
Old Colony Planning Council
Coastline Elderly Services, Inc.
North Shore Elder Services, Inc.
SeniorCare, Inc.
Greater Lynn Senior Services, Inc.
Mystic Valley Elder Services, Inc.
Chelsea/Revere/Winthrop Home Care Center Inc.
Commission on Affairs of the Elderly
South Shore Elder Services, Inc.

Table 4-9: Area Agencies on Aging in the Boston Metro Region

<table>
<thead>
<tr>
<th>Area Agency on Aging (AAA)</th>
<th>Number of Communities Served in Region</th>
<th>65 Years &amp; Over Population (yr 2000) of these Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elder Services of Merrimack Valley, Inc.</td>
<td>23</td>
<td>60,949</td>
</tr>
<tr>
<td>Commission on Affairs of the Elderly</td>
<td>1</td>
<td>54,960</td>
</tr>
<tr>
<td>Old Colony Planning Council</td>
<td>23</td>
<td>49,321</td>
</tr>
<tr>
<td>West Suburban Elder Services, Inc.</td>
<td>8</td>
<td>44,619</td>
</tr>
<tr>
<td>South Shore Elder Services, Inc.</td>
<td>11</td>
<td>43,621</td>
</tr>
<tr>
<td>Minuteman Home Care Corporation</td>
<td>16</td>
<td>37,768</td>
</tr>
<tr>
<td>Mystic Valley Elder Services, Inc.</td>
<td>8</td>
<td>36,866</td>
</tr>
<tr>
<td>Baystate Home and Community Services, Inc.</td>
<td>14</td>
<td>30,631</td>
</tr>
<tr>
<td>Health and Social Services Consortium, Inc.</td>
<td>12</td>
<td>23,873</td>
</tr>
<tr>
<td>North Shore Elder Services, Inc.</td>
<td>5</td>
<td>20,219</td>
</tr>
<tr>
<td>Greater Lynn Senior Services, Inc.</td>
<td>5</td>
<td>19,566</td>
</tr>
<tr>
<td>Somerville/Cambridge Elder Services, Inc.</td>
<td>2</td>
<td>17,799</td>
</tr>
<tr>
<td>SeniorCare, Inc.</td>
<td>9</td>
<td>17,371</td>
</tr>
<tr>
<td>Chelsea/Revere/Winthrop Home Care Center, Inc.</td>
<td>3</td>
<td>12,145</td>
</tr>
<tr>
<td>Central Mass Agency on Aging, Inc.</td>
<td>12</td>
<td>11,772</td>
</tr>
<tr>
<td>Bristol Elder Services, Inc.</td>
<td>4</td>
<td>10,684</td>
</tr>
<tr>
<td>Coastline Elderly Services, Inc.</td>
<td>3</td>
<td>2,242</td>
</tr>
<tr>
<td></td>
<td>159</td>
<td>494,406</td>
</tr>
</tbody>
</table>


Each of the AAAs evaluates the needs of the elderly in their service area and develops planning priorities and programs based on their assessment. Seven of the 17 AAAs operating in the Boston metro region consider transportation to be their number one service priority, and 14 of the 17 rank it in their top five priorities. One of the few AAAs who ranked it lower is the AAA for the City of Boston, the Commission of Affairs of the Elderly, where a high level of transportation and paratransit service is already available. As shown in Table 4-10, 10 of the 17 Boston area AAAs have in-house transportation coordinators and 13 maintain resource guides or databases of transportation services in their areas. Five of the AAAs have also developed a taxi voucher programs which can offer the elderly reduced-fare taxi rides when no other transportation options are available. (MA Executive Office of Elder Affairs, 1998)

Although transportation is not a top priority for some of the region’s AAAs, all have some transport programs and provide some level of trip assistance. For example, all the AAAs offer rides to seniors either directly themselves or through the COAs or other local providers. The degree of services varies considerably among the AAAs. Some operate only a few vans and provide only a small number of rides. At the other end of the spectrum are North Shore Elder Services, where 25 to 30 service vehicles provide 150,000 rides per year, and Greater
Lynn Senior Services (GLSS), with over 100 service vehicles and over 500,000 rides annually. GLSS offers rides both through its program to transport seniors to medical appointments and through its contract with the MBTA to provide RIDE service in the north shore area.

Table 4-10: Area Agencies on Aging Transportation Support Activities

<table>
<thead>
<tr>
<th>Area Agency on Aging (AAA)</th>
<th>Transportation Programs funded through OAA* Title III</th>
<th>Has Transportation Coordinator</th>
<th>Maintains Transportation Resource Guide or Database</th>
<th>Taxi Discount Coupon Program in Service Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baystate Home and Community Services, Inc.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bristol Elder Services, Inc.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Central Mass Agency on Aging, Inc.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Chelsea/Revere/Winthrop Home Care Center, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Coastline Elderly Services, Inc.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Commission on Affairs of the Elderly</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Elder Services of Merrimack Valley, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Greater Lynn Senior Services, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Health and Social Services Consortium, Inc.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Minuteman Home Care Corporation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Mystic Valley Elder Services, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>North Shore Elder Services, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Old Colony Planning Council</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>SeniorCare, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Somerville/Cambridge Elder Services, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>South Shore Elder Services, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>West Suburban Elder Services, Inc.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Older Americans Act


In general, AAA ride services focus on providing transportation for necessary, priority trips such as medical appointments, nutrition programs, grocery shopping, and day care. Their transportation services for social and recreational purposes are typically more limited; such services may not even exist at all for some of the smaller AAAs.

The Aging Service Access Points (ASAPs) provide assistance, including transportation, to low-income frail seniors. Close to 40,000 older adults participate in ASAP programs statewide, and more than three-quarters of them are at least 75 years old. ASAP services are
aimed at helping elders maintain their ability to live independently in the community. Services offered include grocery shopping, delivered meals, home health care, and transportation. ASAP offices arrange rides for elders through other public and private transportation providers. Rides are arranged through DMA, if the client and ride are DMA-eligible, and through transit authority and COA paratransit services if they are not. If neither of these options are not available, ASAPs will arrange for rides through private transportation vendors. There are 27 ASAPs statewide. ASAP service territories generally coincide with AAA boundaries; however, in the Boston and Greater Brockton areas, there are multiple ASAPs within the AAA regions. (Multisystems, 2000)

The COAs are run by local city and town governments. Each of the Boston metro region’s 159 municipalities (and all but 4 statewide) operate a COA. COAs provide a variety of services to the elders in their communities, including transportation. The state Executive Office of Elder Affairs estimates that COA-affiliated transportation programs provide more than 2.1 million one-way rides for seniors annually.

A number of the COAs offer their own transportation services. Many COAs own one or two vans, and others, typically in larger communities, own a whole fleet of vehicles. The Peabody COA, for example, operates 18 ride vans and Boston’s COA runs 34 (Multisystems, 2000). Instead of running their own ride service, or in addition to it, some COAs coordinate rides through local transportation vendors or transit authority paratransit programs. COAs sometimes offer rides volunteer driver or escort programs.

COA transportation programs generally focus on rides within their own and neighboring communities. Only a limited number provide service outside of the immediate area, such as to Boston or other cities. As with AAA programs, COAs transportation offerings vary considerably between areas. Some COAs provide only a minimal amount of transportation for medical appointments, with service only during limited weekday hours. Other COAs offer a full range of services, including rides for social, recreation, and shopping trips, both throughout the week and on weekends. Predictably, COAs in communities with large elderly populations tend to have more transportation programs and a larger range of services than those in towns with fewer numbers of seniors.
Executive Office of Health and Human Services

The Massachusetts Executive Office of Health and Human Services provides transportation services through a number of its affiliated agencies. Among others these agencies include the Division of Medical Assistance (DMA), the Department of Mental Retardation (DMR), the Department of Mental Health (DMH), the Massachusetts Commission for the Blind (MCB), among others. DMR runs bus routes for the mentally impaired to improve their access to jobs and day programs. MCB provides the legally blind with rides to medical appointments and other activities. (Multisystems, 2000)

DMA offers transportation to any MassHealth (State Medicaid) funded program or service, including medical appointments, day care, rehabilitation services, and other programs. Many services and programs offered through other agencies (DMR, MCB, DMH, etc.) are funded in part by MassHealth and therefore, clients of these programs are eligible for DMA transportation. DMA transportation is provided to any eligible MassHealth members, though “DMA encourages [them] to arrange for transportation with family, friends, or to use public transit as a first option” (Multisystems, 2000, 30). For eligible MassHealth members who cannot secure a ride through other means, DMA offers three types of transportation assistance. First, it provides demand-response shared-ride van or taxi transport to all MassHealth programs. In fiscal 1997-1998, close to 1.1 million one-way rides were given through this service. Second, DMA offers chair-car and ambulance transportation to those living in nursing homes. Third, it reimburses the cost of public transit or trips provided by family and friends when these options are used instead of direct DMA transportation. (Multisystems, 2000)

For most of the state agency transportation programs, service is coordinated at the regional level and provided by local contractors. Usually the regional transit authorities help manage and oversee the local providers in their districts. However, not all the RTAs participate in the state programs. As a result, some RTAs end up managing state transportation services outside of their regular service territories. Multisystems’ analysis (2000) suggests that this can sometimes lead to inefficient trip allocation and use of resources.
Local transit agencies

Some communities provide their own local transit services for residents. For example, the Town of Bedford operates local weekday buses, providing door-to-door bus service during commuter off-peak hours and fixed-route service throughout the day. The Town of Lexington also has local fixed-route bus service and weekday chair-car service. Newton and other communities offer local bus services as well. Although such services are usually aimed at particular groups of citizens – for example, the elderly or commuters, other people often have access to them as well. Two limitations of these services are that they typically have short operating hours and provide transportation only within a small, localized area.

Volunteer organizations

A number of volunteer organizations in the Boston metro area provide rides for certain kinds of trips. Many of them primarily offer transportation for medical appointments, and a number provide trip assistance only for older adults. One volunteer program that assists seniors with medical trips is Drive People Happy. Drive People Happy is coordinated by six AAAs, and is a partnership between them, local COAs, and other community sponsors. Drive People Happy also runs a transportation resource and referral service to inform seniors about other transportation options available in their communities. Another volunteer program is Friends in Service Helping (FISH). FISH gives elders rides to a variety of destinations, including medical appointments in downtown Boston. FISH services are coordinated through COAs. Other organizations offering medical appointment rides include the American Red Cross and the American Cancer Society; though they generally provide this service only when people have no other transportation available. For all of these programs, rides are given by volunteers who are usually using their own cars. Therefore, these ride services may not be an option for seniors who have difficulties getting in and out of private automobiles.

Potential spatial disparity and access issues

The discussion above in this section (4.2.2) briefly reviews the variety of non-profit transportation options that are available in the Boston region outside of transit authority bus and paratransit services. The discussion shows that there are a fairly large number of non-profit transportation choices for the region as a whole, especially for the elderly. However, on
a local basis, services vary tremendously between communities and in some areas are quite limited. Some AAAs and COAs, for example, are considerably more active than others in providing transport services and developing transportation options for seniors. Transportation programs are generally the most comprehensive within the largest communities and those with the highest number of elderly.

One potential access issue arises with current population projections which suggest that the places with the most seniors today, the cities and inner suburbs, may have fewer elders in the future. Most of the future elderly population growth for the Boston area is expected to occur on the periphery of the region, where fewer transportation alternatives to driving are usually available.

Table 4-11: Region Elderly Population Changes by AAA, 1990-2010

<table>
<thead>
<tr>
<th>Area Agency on Aging (AAA)</th>
<th>75 Years &amp; Over Pop 1990*</th>
<th>75 Years &amp; Over Pop 2010*</th>
<th>Change 1990-2010</th>
<th>Percentage Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baystate Home and Community Services, Inc.</td>
<td>11,439</td>
<td>16,113</td>
<td>4,674</td>
<td>41</td>
</tr>
<tr>
<td>Bristol Elder Services, Inc.</td>
<td>4,390</td>
<td>5,106</td>
<td>716</td>
<td>16</td>
</tr>
<tr>
<td>Central Mass Agency on Aging, Inc.</td>
<td>4,454</td>
<td>5,741</td>
<td>1,287</td>
<td>29</td>
</tr>
<tr>
<td>Chelsea/Revere/Winthrop Home Care Center, Inc.</td>
<td>-6,472</td>
<td>5,072</td>
<td>(1,400)</td>
<td>-22</td>
</tr>
<tr>
<td>Coastline Elderly Services, Inc.</td>
<td>744</td>
<td>1,168</td>
<td>424</td>
<td>57</td>
</tr>
<tr>
<td>Commission on Affairs of the Elderly</td>
<td>29,643</td>
<td>22,901</td>
<td>(6,742)</td>
<td>-23</td>
</tr>
<tr>
<td>Elder Services of Merrimack Valley, Inc.</td>
<td>26,663</td>
<td>28,628</td>
<td>1,965</td>
<td>7</td>
</tr>
<tr>
<td>Greater Lynn Senior Services, Inc.</td>
<td>9,150</td>
<td>8,980</td>
<td>(170)</td>
<td>-2</td>
</tr>
<tr>
<td>Health and Social Services Consortium, Inc.</td>
<td>9,149</td>
<td>11,831</td>
<td>2,682</td>
<td>29</td>
</tr>
<tr>
<td>Minuteman Home Care Corporation</td>
<td>14,195</td>
<td>20,216</td>
<td>6,021</td>
<td>42</td>
</tr>
<tr>
<td>Mystic Valley Elder Services, Inc.</td>
<td>17,950</td>
<td>16,622</td>
<td>(1,328)</td>
<td>-7</td>
</tr>
<tr>
<td>North Shore Elder Services, Inc.</td>
<td>8,261</td>
<td>9,783</td>
<td>1,522</td>
<td>18</td>
</tr>
<tr>
<td>Old Colony Planning Council</td>
<td>20,184</td>
<td>24,335</td>
<td>4,151</td>
<td>21</td>
</tr>
<tr>
<td>SeniorCare, Inc.</td>
<td>7,361</td>
<td>8,949</td>
<td>1,588</td>
<td>22</td>
</tr>
<tr>
<td>Somerville/Cambridge Elder Services, Inc.</td>
<td>8,796</td>
<td>7,806</td>
<td>(990)</td>
<td>-11</td>
</tr>
<tr>
<td>South Shore Elder Services, Inc.</td>
<td>19,816</td>
<td>19,911</td>
<td>95</td>
<td>0</td>
</tr>
<tr>
<td>West Suburban Elder Services, Inc.</td>
<td>23,367</td>
<td>21,439</td>
<td>(1,928)</td>
<td>-8</td>
</tr>
<tr>
<td><strong>Total for Region</strong></td>
<td><strong>222,034</strong></td>
<td><strong>234,601</strong></td>
<td><strong>12,567</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

*Population includes only those towns in the Boston area, not necessarily the AAAs’ entire service region.

Table 4-11 displays the regional elderly population changes by AAA for the 1990 to 2010 period. The largest decrease in people age 75 and over is projected for the Commission on Affairs of the Elderly service territory, the City of Boston (decrease of 6,700 elders (23 percent)). The next largest declines are expected in the western suburbs (decrease of 1,900), the Chelsea/Revere/Winthrop area (1,400), in Somerville and Cambridge (1,000). The four
AAAs operating in these areas provide some of the greatest level of transportation options and services of any AAAs state-wide. Other AAAs in the region have fewer services. In the future, some of these other AAAs, particularly those in the outlying suburban communities expecting large influxes of elderly, and the local COAs in these areas may need to expand their transportation programs to be able to adequately provide for their growing, aging populations.

Even in areas with relatively good transportation programs, access to services and activities can be an issue. Some ride programs have a limited capacity and cannot accommodate all ride requests, especially those made with short notice. In addition, some programs operate only during weekday hours and are not available on weeknight or weekends. Further, many of the non-profit transportation programs focus on providing rides for necessary and critical purposes such as medical appointments and nutrition services. As a result, other types of trips that are equally important for seniors for maintaining a high quality of life, such as to social and recreational destinations, are often neglected and under-served.

In its review of transportation programs in Massachusetts (2000), Multisystems discusses a few specific accessibility issues that may restrict certain seniors’ use of COA transportation. Some ride vans operated directly by COAs are not handicap accessible. Additionally, not all COA drivers and ride-assistance volunteers have training on helping and transporting people with mobility impairments or disabilities. These issues can limit transportation options and access for handicapped elders in some COA areas. It can also adversely affect their ability to participate fully in other COA programs and other activities in their communities.

Another issue with COA service is that most COAs provide rides exclusively in their local communities and elders wanting to travel to a farther destination may have trouble finding transportation. This problem is particularly acute for out-of-town transport for medical treatments. It also especially affects seniors living in rural areas, where transportation options are usually at a minimum to begin with, and COA and AAA vehicle supplies may be too small to tie up vehicles providing out-of-town transport. As noted earlier, the state

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12 The Executive Office of Elder Affairs (1998) cites the need for better medical transportation, especially long-distance transport, as one of its major unmet needs throughout the state.
Department of Medical Assistance (DMA) offers rides for medical appointments, even over long distances, to MassHealth eligible persons, including the elderly. Non-eligible elderly, however, do not have this option. Coordination of transport services between DMA and AAAs and COAs may provide a way to offer significantly more long-distance rides for medical treatments for not much additional cost.

Over the past few years, the Commonwealth of Massachusetts has been exploring how to better coordinate its human service transportation programs, including those under Elder Affairs and Health and Human Services, and a multi-agency state working group has been meeting to address this issue. Many state human service agencies offer transportation services to their clients. Often, these agencies each work independently with regional transportation providers to arrange for rides, resulting in overlapping services and system inefficiencies. In the working group’s final report released earlier this year, it recommends that each region of the state have a mobility manager who coordinates all the transportation services for participating agencies within the region. Coordinating transportation programs regionally could increase passenger transportation efficiency state-wide. It could help reduce current gaps in services by better allocating vehicles and by eliminating unnecessary overlaps between programs. It could also allow for better monitoring and management of transport services and enable the collection of system-wide and state-wide trip and rider statistics. More coordination among the human service agencies is likely to improve the state’s ability to provide cost-effective, comprehensive transport services. This in turn will likely then help improve the elderly’s access to high-quality transportation options to the automobile, and allow them to better maintain their mobility as they age.

4.2.3 Taxi service

Taxis offer an important and convenient transportation service. Taxis provide private, unshared transport, and offer transport at hours when other services are usually unavailable. Taxis supply on-demand, curb-to-curb service and require only limited advanced notice.
Most taxi services will also assist customers who have difficulty getting in and out of vehicles, or who are carrying heavy packages or luggage.\textsuperscript{13}

However, all this convenience, does not come without a price. Taxis are among the most expensive modes of transportation for local and regional trips. As a result, they are used most when time and convenience are valued at a premium over monetary cost. People also take taxis when they have no other easy way to get where they’d like to go. Although taxis are expensive, taxi riders’ costs can occasionally be reduced. Taxi companies sometimes allow frequent customers to buy a certain number of trips in advance and pay less than the regular fare for each ride. In addition, taxi costs for low-income or elderly riders can sometimes be decreased with subsidies from public agencies or non-profit organizations. As mentioned earlier, for example, five of the Boston area AAAs have developed taxi voucher programs that offer the elderly reduced-fare taxi rides when no other transportation is available. Similarly, hospitals and medical centers occasionally provide taxi subsidies for trips to and from medical treatments when patients have no other way to get there. In general, though, these types of fare-reduction programs are not the norm and taxi service remains relatively expensive for most potential riders.

More than 250 taxi companies operate in the Boston metropolitan area. The location of these companies is displayed in Figure 4-8. Figure 4-8 also shows the 1990 and 2010 town-level population densities for people ages 75 and over. Taxi company addresses were determined using the yellow pages (Netscape, 2000). However, these addresses likely reflect more about where vehicles are garaged or where taxi company offices are located than where service is available. Unfortunately, little useful additional information on taxi services could be obtained. The Massachusetts Registry of Motor Vehicles (RMV) provided data on the number of livery vehicles registered in each town, for this research. As before, though, where vehicles are registered does not necessarily coincide with where they provide service. In addition, the livery designation applies a range of vehicles including taxis, limousines, shuttles for social service agencies, nursing home vans, and school buses. The RMV could

\textsuperscript{13} Most taxis, however, are not wheelchair accessible, and few taxi drivers have training on assisting the disabled. These characteristics may make taxis unsuitable for certain potential riders.
supply no disaggregated counts based on organization or vehicle type. Because of these limitations in the RMV data, it was not used for the research's final analysis.

Potential spatial disparity and access issues

Because of the limited data available, it was difficult to evaluate where potential spatial disparity and access issues in taxi service may occur. Figure 4-8 suggests that the Boston metro region has fairly good taxi coverage, since the region's taxi companies are concentrated in areas with large general and elderly populations and high population densities. However, without more detailed information, it is more difficult to fully assess services and access. Important characteristics to consider when evaluating access include the number of taxis owned by each company and the geographic areas these taxis serve. Taxi companies are often restricted in where they can pick up rides, even when they can drop customers off in a larger area. For example, a city of Boston-based taxi taking a passenger from Boston to Cambridge is generally not allowed to pick up a new rider in Cambridge once they drop the first one off, and is required to return to Boston empty.

Despite the costs of taxi service, the elderly take approximately one-fifth of all taxi trips (Coughlin and Lacombe, 1997). Because seniors are such large consumers of taxi services, it is likely that taxi transportation will always be offered in communities with large elderly populations. As seniors migrate from the urban centers towards the suburbs, taxi services are likely to follow them. The taxi vendor locations presented in Figure 4-8 show only their current placement. In the future, they are likely to be even more spread out across the region.
Figure 4-8: Location of Taxicab Companies and Similar Transportation Providers
Shown with Population Density of Persons 75 Years Old & Over, 1990 & 2010


Limousine companies are excluded. Population density shown by municipality.
As with other types of transportation services, seniors living in low-density communities with small numbers of elderly are likely to have less access to taxis than elders in other areas. Although seniors in such communities will be able to call and arrange for taxi transportation, taxi services may not be immediately available and may also take longer to reach them than taxis would in more densely settled areas. The greater dispersion of people and services in low-density areas may also translate to longer trip distances, and since taxi fares are often a direct function of trip length, into higher trip costs as well. For some elders, especially those on fixed incomes, these higher costs could make taxis prohibitively expensive for all but the most essential trips.

4.2.4 Section summary

Section 4.2 reviews and inventories various transportation services that are available to seniors and to the general population in the Boston metro region. It also evaluates the potential for spatial disparities to arise between where the elderly live and where these services are located, and whether there are other factors that could also adversely affect the elderly’s access to transportation. Overall, the region has a variety of transportation services, both public and private, many of them aimed specifically at older adults. However, the elderly’s access to such services changes considerably between different communities. Urban areas typically have the most transportation alternatives. Transportation options are usually fewest in the low-density, single-use zoned communities where pedestrian access is the least viable, and where they are needed the most. In the future, more of the region’s elderly will be living in some of these same low-density communities. Without better transportation services in the areas, these elders’ mobility and access to important activities and services may be seriously limited. More coordination between agencies that provide senior transportation is a step in the right direction towards improving access and mobility. However, new and more comprehensive transportation programs and service for the elderly may also have to be developed to meet the needs of an aging population.
4.3 Location of health care services

Foremost among services that the elderly should have good access to as they age is health care. The elderly frequently have more health problems than younger adults and a greater need for health monitoring. Good access to health care includes a number of components. A primary element, and the one focused on in this section, is close physical proximity to medical services. Section 4.3 evaluates the relationship between where the elderly live and where health care services are located. It starts by inventorying health care providers in key categories, including doctors, hospitals, and pharmacies. For each, it then assesses whether the elderly have close proximity to services and, if not, whether their access to care may be adversely affected. Part of the evaluation also considers the impact that the projected spatial dispersion of the region’s elderly population over the next few decades may have on its health care access.

4.3.1 Physicians’ offices and clinics

In 1997, there were approximately 2,900 physicians’ offices and clinics in the Boston metro region. This number represents a decline of more than 10 percent from the 3,300 area physicians’ offices and clinics operating in 1987. These counts include individual and group practices of physicians working either in their own offices or in facilities such as hospitals and HMO medical centers.

From 1987 to 1997, the number of physicians’ offices and clinics declined more in some towns than in others. Table 4-12 gives the 1987 and 1997 counts for 23 towns in the Boston metro region. Over half the region’s doctors’ practices are located in these 23 towns. Between 1987 and 1997, the number of physicians’ offices and clinics decreased in 17 of the towns, increased in only 7, and remained constant in one (Lexington). Most of the increases occurred in towns outside of the Interstate 95 corridor, as did some of the greatest decreases.

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14 Data from the 1987, 1992, and 1997 Economic Census, U.S. Census Bureau, Economic and Statistics Administration. Comparing the Boston region data for these two years is difficult because changes to the definition of “physicians’ offices and clinics” and changes to the boundaries of the Boston metro region. These changes and how they are addressed by the analysis are discussed in some detail in Appendix B.

15 Only these 23 towns in the region had data on physicians’ offices and clinics reported in the 1987 or 1992, and 1997 Economic Censuses. Counts include only those establishments that are subject to federal income tax; however, very few are tax-exempt.
The largest percentage drops in practices occurred in Lawrence and Wellesley (both with a 44 percent decline), Natick (40 percent decline), and Braintree (39 percent), all of which lie outside I-95. During this time period, the number of doctor’s offices and clinics for the 23 towns as a whole declined 15 percent.

### Table 4-12: Change in the Number of Doctors' Offices & Clinics 1987-1997, Selected Towns

<table>
<thead>
<tr>
<th>Town</th>
<th>Number of Doctors' Practices 1987</th>
<th>Number of Doctors' Practices 1997</th>
<th>Change 1987-1997</th>
<th>Percentage Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inside I-95</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>447</td>
<td>367</td>
<td>-80</td>
<td>-18</td>
</tr>
<tr>
<td>Brookline</td>
<td>204</td>
<td>181</td>
<td>-23</td>
<td>-11</td>
</tr>
<tr>
<td>Cambridge</td>
<td>116</td>
<td>82</td>
<td>-34</td>
<td>-29</td>
</tr>
<tr>
<td>Quincy</td>
<td>67</td>
<td>74</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Somerville</td>
<td>23</td>
<td>18</td>
<td>-5</td>
<td>-23</td>
</tr>
<tr>
<td><strong>Outside I-95</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braintree</td>
<td>18</td>
<td>11</td>
<td>-7</td>
<td>-39</td>
</tr>
<tr>
<td>Brockton</td>
<td>96</td>
<td>82</td>
<td>-14</td>
<td>-15</td>
</tr>
<tr>
<td>Burlington</td>
<td>12b</td>
<td>14</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>Framingham</td>
<td>66</td>
<td>68</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Lawrence</td>
<td>36</td>
<td>20</td>
<td>-16</td>
<td>-44</td>
</tr>
<tr>
<td>Lexington</td>
<td>32</td>
<td>32</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lowell</td>
<td>71</td>
<td>69</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Lynn</td>
<td>61</td>
<td>47</td>
<td>-14</td>
<td>-23</td>
</tr>
<tr>
<td>Natick</td>
<td>47</td>
<td>28</td>
<td>-19</td>
<td>-40</td>
</tr>
<tr>
<td>Needham</td>
<td>40b</td>
<td>31</td>
<td>-9</td>
<td>-23</td>
</tr>
<tr>
<td>Newton</td>
<td>199</td>
<td>158</td>
<td>-41</td>
<td>-21</td>
</tr>
<tr>
<td>Norwood</td>
<td>60b</td>
<td>66</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Peabody</td>
<td>36b</td>
<td>23</td>
<td>-7</td>
<td>-23</td>
</tr>
<tr>
<td>Salem</td>
<td>53</td>
<td>62</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>Waltham</td>
<td>57</td>
<td>43</td>
<td>-14</td>
<td>-25</td>
</tr>
<tr>
<td>Wellesley</td>
<td>95</td>
<td>53</td>
<td>-42</td>
<td>-44</td>
</tr>
<tr>
<td>Weymouth</td>
<td>50</td>
<td>55</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Woburn</td>
<td>16</td>
<td>19</td>
<td>3</td>
<td>19</td>
</tr>
</tbody>
</table>

*Doctors' practices include individual and group offices, and clinics. b1992 data; 1987 counts were unavailable. Source: Economic Census, U.S. Census Bureau, 1987, 1992, and 1997.

### Potential spatial disparity and access issues

The decrease in the number of physicians’ offices and clinics suggests a potential decline as well in the population’s access to doctors. The decrease in offices primarily reflects the consolidation of physicians’ practices and their concentration into fewer locations due to rising costs and economic pressures. As offices consolidate, some practices close completely, instead of being combined into other larger practices. The consolidation and concentration of practices means that the traditional neighborhood doctor is becoming an antiquated concept, and that patients often have to travel farther to receive medical care. In addition, the
remaining offices now serve a greater number of patients; this can also decrease individuals' access to health care professionals and services.

Doctors' practices are consolidating at the same time that the population is becoming more spatially dispersed. As discussed earlier in Section 4.1, most of Boston's population growth through 2010, is expected to occur in the suburbs beyond Interstate 95, and this is particularly true for the elderly. These same suburbs are where some of biggest decreases in physicians' offices and clinics have taken place (Table 4-12 & Table 4-13), and the elderly's future access to health care services may be adversely affected as a result.

Table 4-13: Comparison of Changes in the Number of Doctors' Practices & in Population Size, Selected Towns

<table>
<thead>
<tr>
<th>Towns</th>
<th>% Change % of Doctors' Practices</th>
<th>% Change 75 Yrs &amp; Over Population</th>
<th>% Change Total Population</th>
<th>% Change # Doctors &lt; 75+ Pop</th>
<th>% Change # Total Pop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside I-95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cambridge</td>
<td>-29</td>
<td>-3</td>
<td>7</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Somerville</td>
<td>-22</td>
<td>-2</td>
<td>0</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Boston</td>
<td>-18</td>
<td>-9</td>
<td>-1</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Brookline</td>
<td>-11</td>
<td>-18</td>
<td>11</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Quincy</td>
<td>10</td>
<td>-9</td>
<td>-1</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Outside I-95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wellesley</td>
<td>-44</td>
<td>5</td>
<td>9</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Natick</td>
<td>-40</td>
<td>16</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Braintree</td>
<td>-39</td>
<td>-2</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cambridge</td>
<td>-29</td>
<td>-3</td>
<td>7</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Waltham</td>
<td>-25</td>
<td>1</td>
<td>4</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Peabody</td>
<td>-23</td>
<td>33</td>
<td>9</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Needham</td>
<td>-23</td>
<td>8</td>
<td>1</td>
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<td>Yes</td>
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<tr>
<td>Newton</td>
<td>-21</td>
<td>3</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Brockton</td>
<td>-15</td>
<td>4</td>
<td>-4</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Lowell</td>
<td>-3</td>
<td>-6</td>
<td>4</td>
<td>Yes</td>
<td>Yes</td>
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<td>0</td>
<td>24</td>
<td>11</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Framingham</td>
<td>3</td>
<td>9</td>
<td>1</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Norwood</td>
<td>10</td>
<td>0</td>
<td>-1</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Weymouth</td>
<td>10</td>
<td>7</td>
<td>-1</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Burlington</td>
<td>17</td>
<td>59</td>
<td>3</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Randolph</td>
<td>17</td>
<td>3</td>
<td>7</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Woburn</td>
<td>19</td>
<td>17</td>
<td>-1</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Overall for These 23 Towns</td>
<td>-15</td>
<td>-1</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 4-13 examines changes in the number of doctors’ offices and clinics and in the overall and elderly population for the same 23 towns as in Table 4-13. The last two columns in the table indicate towns which have bigger increases in the population (through the year 2000) than in the number of doctors’ practices (1987-1997). Increases in the number of elderly outpaced increases in offices and clinics in 17 of the 23 towns. Sixteen of the towns experienced more growth in their population overall than in their number of doctors’ practices. The two towns with the biggest discrepancies between changes in population and in physicians’ offices and clinics were Wellesley and Peabody. Wellesley experienced a 44 percent drop in the number of physicians’ offices concurrent with a 9 percent increase in its population (1990-2000). During the same period, Peabody witnessed a 23 percent decrease in doctors' offices and 9 percent growth in its total population, including a 33 percent increase in the number of elderly.

Given the current emphasis on health care cost containment through consolidation of services, the number of physicians’ practices and offices in the Boston metropolitan region is likely to continue to decrease in the future. Continued reductions in the number of physician office locations may make it difficult for certain populations, such as the elderly, to access medical care. Most people drive to the doctor, and for them, having to drive a little further or to the next town over may not be a big inconvenience. However, for the elderly, especially frail elders, not having doctors located nearby may be more burdensome. Frail elders and older elderly in particular have the most health problems and should see their doctor the most frequently. However, with the spatial concentration of doctors’ services, it is likely that most of these elders may not live near a doctor. Since many of them do not drive, they will then have to find a ride or take transit for their appointments. This may be difficult since the rides they need will be longer, and possibly more expensive, and since many of the suburbs where the future elderly will live have only limited transit and paratransit service. They may also have troubles with transportation because of restricted physical mobility. As a result of these difficulties, these elders may not end seeing their doctor or monitoring their health problems as regularly as they should. These trends and their reduced access to care could adversely affect not only these elders health, but their overall quality of life as well.
4.3.2 Hospitals

Ninety-three hospitals currently serve the Boston metropolitan region. Five of them are children's hospitals that are excluded from the analysis here since its focus is on services for the elderly. Sixty percent of the 88 remaining hospitals are general medical and surgical facilities, including 43 acute care hospitals with emergency care facilities. The rest of the hospitals are specialty facilities that provide services such as psychiatric care, substance abuse treatment, and rehabilitation. Figure 4-9 displays the location of all the non-children's hospitals in the region. Slightly more than one-fifth of all these hospitals and over one-quarter of the acute care facilities are situated within the city of Boston.

As with doctors' offices and clinics, the number of hospitals in the region declined from 1987 to 1997, dropping almost 20 percent (from 115) during the decade. Also, as with doctors' practices, a primary reason for the decrease was the consolidation of hospitals and the closing of secondary facilities.

**Potential spatial disparity and access issues**

With the consolidation of hospital resources and a decrease in the total number of facilities, the public, especially the elderly, may have more trouble accessing hospital services. In some cases, consolidation may increase an individual facility's capabilities and therefore possibly improve access to some specialized tests or treatments. However, overall, consolidation is likely to lead to a decline in access and proximity to care for many patients. Fewer hospitals will mean longer travel distances and travel times to reach hospital facilities. This is true particularly since the population is spreading out spatially across the region at the same time that hospital consolidation and closures are taking place. The resulting longer distances to hospitals may especially be an issue for frail and older elders who have the greater individual mobility problems and who are also the least likely to drive. These elders often also have the greatest health problems and the need to visit doctors and hospitals on a regular basis.

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16 By definition, acute care hospitals operate emergency rooms and provide emergency care, among other services.
17 Acute care hospitals are identified in the American Hospital Directory (Quadramed, 1999) and in a list by the Boston EMS Service Council (1999). These sources and the MA Hospital Association Directory of Hospitals (1999) were used to determine the number of hospitals in the region and their locations.
18 Data from the 1987 and 1997 Economic Census, U.S. Census Bureau.
114
Figure 4-9: Location of Hospitals

(a) All Hospitals

(b) Emergency Care Hospitals

Figure 4-10 displays the location of hospitals and acute care hospitals and current (year 2000) town-level population densities for people 75 years of age and older. As the figure shows, there is a fairly strong correlation between elderly population centers and hospital locations. All of the towns with the highest population densities of seniors (top quartile) outside of the I-95 corridor have at least one hospital, and all except Wellesley also have a facility with acute care services. For Wellesley residents, the Newton-Wellesley Hospital in Newton and the Deaconess-Glover Hospital in Needham, both of which offer acute care, are only a town away.

Figure 4-11 shows the 5-mile area around each hospital and the elderly population for each town. Figure 4-12 does the same for acute care hospitals. The figures are used to estimate the number of elderly living farther than 5 miles from a hospital in 1990 and 2010 and to see how the expected dispersion of the elderly population could affect its proximity to hospital care. The five miles are calculated as a straight distance, with the assumption that local road networks support this general direction of travel, and was thought to be a reasonable trip distance for hospital care.

Based on expected increases in the suburban older adult population (MISER, 1999), it was estimated that between 1990 and 2010, the number of elderly living more than 5 miles from a hospital will grow by approximately 7,200 (45 percent) (Table 4-14). During the same time frame, the number residing over 5 miles from an acute care facility is projected to increase an estimated 11,500 (33 percent). As shown in Table 4-14, the changes will primarily result from population growth in the communities outside of I-95. By 2010, approximately 46,000 elders and 917,000 people overall are expected to live more than 5 miles from a hospital with an emergency room. The numbers represent 20 percent of the elderly and 21 percent of the total population in the region.

Proximity to hospitals is an important component of access to care. However, other factors are also significant. Among them is the availability of transportation to hospitals. As has been discussed, some seniors, particularly in low-density suburbs, have few transportation options even for necessary trips such as medical care. A lack of transportation services can hinder the elderly's access to regular hospital care. It can also potentially make them more
dependent on emergency services and emergency transport (Baker et al., 1996; Ettinger et al., 1987;) even for non-urgent medical problems.

Table 4-14: Elderly Population Living More than 5 Miles from a Hospital, 1990 & 2010

<table>
<thead>
<tr>
<th>Hospital counts shown in ()</th>
<th>Elderly living more than 5 mi from hospital</th>
<th>Change 1990-2010</th>
<th>Percentage Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1990</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td><strong>All hospitals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside 1-95 (58)</td>
<td>16,100</td>
<td>23,300</td>
<td>7,200</td>
</tr>
<tr>
<td>Inside 1-95 (32)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total (90)</td>
<td>16,100</td>
<td>23,300</td>
<td>7,200</td>
</tr>
<tr>
<td><strong>Acute care hospitals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside 1-95 (26)</td>
<td>31,800</td>
<td>43,300</td>
<td>11,500</td>
</tr>
<tr>
<td>Inside 1-95 (18)</td>
<td>3,000</td>
<td>3,000</td>
<td>0</td>
</tr>
<tr>
<td>Total (44)</td>
<td>34,800</td>
<td>46,300</td>
<td>11,500</td>
</tr>
</tbody>
</table>

*Estimates developed using MISER projections (1999) and straight distance GIS spatial analysis.*

Another important component of hospital access is the capacity of hospital facilities and the ratio of patients to medical staff. As this ratio grows, doctors have less time to spend with individual patients, and patients can have more trouble getting appointments. As the elderly population in the Boston metro area grows, it will necessary to ensure that the patients per doctor ratio does not become too high and that older adults are still able to get doctors appointments when they need them.

The results presented here assume that the current supply of hospitals represents the supply for 2010. If this is indeed the case, then suburban hospitals may find themselves increasingly overburdened by patient load and demand. By 2010, 69 percent of the metro area’s population and 71 percent of its elderly are expected to live outside of I-95. However, only 59 percent of the region’s acute care facilities and 64 percent of its hospitals overall are also outside of I-95. As a result, if suburban patients intend to visit suburban hospitals for most of their hospital-based care, there will probably be deficiency in hospital and care access unless new hospitals are added or existing facilities expanded. There may also issues with the availability of emergency care since in most cases, acute care is provided at the nearest local facility.
Figure 4-10: Hospital Locations with Elderly Population Density


Density categories represent quartiles. Population density (yr 2000 estimate) shown by municipality.
Figure 4-11: Number of Elderly Living within 5 Miles of a Hospital, 1990 & 2010

Between 1990 and 2010, the number of people 75 and over living more than 5 miles from a hospital is expected to increase 45 percent.

Figure 4-12: Number of Elderly Living within 5 Miles of an Acute Care Hospital, 1990 & 2010

Between 1990 and 2010, the number of people 75 and over living more than 5 miles from an acute care hospital is expected to increase 33 percent.

In considering the future quantity of hospitals, there is the possibility that additional hospital consolidations and closings will occur. Most at risk for closure are non-acute care facilities, since communities need to maintain a basic level of access to emergency care. The closing of any hospitals, however, could adversely affect some people’s access to hospital services. The elderly, especially those in the suburbs, are particularly at risk for access problems.

One uncertainty in thinking about access to hospital care is how services differ between emergency (acute care) and non-emergency hospitals, and which hospital services are generally the most important to patients, including the elderly. Among non-emergency hospitals are facilities that offer general medical care and surgeries. For many patients, these hospitals may be sufficient for most of their care, and rarely, if ever, will they need to visit acute care facilities or receive emergency services. In addition, patients receiving on-going medical treatment (i.e. chemotherapy, radiation, dialysis) at a non-emergency care hospital may be able to obtain some care for acute, urgent problems at that facility, especially when they are related to the condition(s) for which they are getting treatment.

Further, for some patients, the services provided by specialty hospitals, such as rehabilitation, may be just as significant as those offered by the general medical and surgical hospitals. Unfortunately, the hospital data available for this analysis did not fully characterize the services available at the region’s specialty hospitals and other non-acute care facilities. Access to both emergency and non-emergency hospitals has been discussed in this section because it is clear that both types of facilities are important health care providers. However, the discussion would have been more complete if distinctions among the non-acute care hospitals had been made in the data, and spatial analysis regarding access and proximity to different hospital types could have been conducted.

4.3.3 Pharmacies

For many older adults, their pharmacy is an important part of their health care network. The elderly often have more frequent contact with their pharmacist than with their doctors. The average 70 year old takes 16 prescriptions per year,19 and people aged 65 and over spend more

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19 Cited from Walgreens, 1999 Annual Report.
than $400 out-of-pocket annually on prescription medications (AARP, 1999). In addition to filling prescriptions, pharmacists can help the elderly become more informed about their medications, as well as provide general counseling regarding their health and chronic medical problems.

The Boston metro region has approximately 650 pharmacies. This is roughly equivalent to one pharmacy for every 350 people 75 years old and above, and one for every 6,400 people in the general population. The primary drug store chain in the area is CVS, which has over 200 stores. Other chains with a large regional presence include Walgreens (approximately 60 stores), Osco Drug (50 stores), and Brooks Pharmacy (40 stores). The locations of pharmacies in the Boston area were determined using the yellow pages (Netscape, 2000), and are shown in Figure 4-13, along with elderly population densities. As the Figure demonstrates, although the pharmacies are most concentrated in the region's elderly population centers, they are also scattered across the region, and most towns have at least one.

Potential spatial disparity and access issues

It is doubtful that any large spatial disparities will arise between where pharmacies are situated and where the elderly reside. Pharmacies are market-driven companies that want to locate in places with strong potential customer bases and opportunities for profits. As Walgreens indicated in its 1999 annual report, prescription sales in 1998-1999 grew by almost one-quarter over the previous year, and accounted for more than half its total revenues. Many pharmacy companies, including Walgreens, feel that the aging of the population combined with the increased use of pharmaceuticals for managed care will lead to expanding demand for pharmacy products and services. Since older adults are such large consumers of prescriptions and pharmacy products, pharmacy companies will be interested in establishing a presence, or expanding their presence, in communities with growing numbers of elderly residents. As a result, the spatial coverage and number of pharmacies in the region are likely to continue to expand, and there are unlikely to be major issues regarding the elderly's proximity and access to pharmacy services.
Figure 4-13: Location of Pharmacies with Elderly Population Density for 1990 & 2010

(a) 1990

(b) 2010

Additionally, for seniors who do not live near a pharmacy or have easy transportation access to one, pharmacy services can also be reached without having to leave the home. Pharmacists are often available to answer questions over the phone, and many pharmacies offer prescription delivery via either courier services or the mail. Further, the number of mail-order and internet drugstore and prescription sites is growing, providing the elderly with yet another way for getting prescriptions and drugstore supplies.

Five major Internet pharmacy sites were reviewed as part of this research. Each of the sites allow prescriptions to be ordered and refilled, and all also offer additional features. The sites’ features are summarized in Table 4-15. Each of the sites will ship orders to any address in the U.S., charging little or nothing in shipping costs, even for non-prescription orders. Of the five sites, CVS’s is the most comprehensive and provides the most options. The CVS site allows customers to put together two orders simultaneously. Customers also have the option of picking up their orders at the CVS store of their choice; none of the other sites have this feature. In addition, the CVS site and three others allow customers to e-mail pharmacists with questions. The Walgreens, Sav-On Drug, and Drugstore.com sites all indicate that a pharmacist will personally respond to an e-mail question typically within one business day. However, CVS’s site makes the unfriendly disclaimer that “our expert receives hundreds of questions every day, so your question may or may not be answered.”

A fair number of elderly already use the Internet and more will likely do so in the future. Internet pharmacies can provide a valuable alternative to traveling to a brick-and-mortar drugstore, and it likely that the number of Internet drug store sites, and physical stores with an Internet presence, will increase in the future. It is important that the companies running the sites are responsive to needs and concerns of existing and potential customers, including the elderly. Ease of use is especially important. To assist with use, all of the reviewed sites offer phone support and three of them also allow a customer to place an order entirely over the telephone. Other important features include the option to order non-drug items and to talk with or e-mail a pharmacist, and guarantees of data privacy and security.
Table 4-15: Features of Selected Internet Pharmacy Sites

<table>
<thead>
<tr>
<th>Company and Web Site</th>
<th>Stores &amp; Patient Profile</th>
<th>Has Health Library</th>
<th>Includes Non-drug Items</th>
<th>Access to Pharmacist</th>
<th>Can Also Order Through (800) #</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVS <a href="http://www.cvs.com">www.cvs.com</a></td>
<td>Yes</td>
<td>Yes, with WebMD</td>
<td>Yes</td>
<td>E-mail</td>
<td>Yes</td>
<td>Can pick up order at store; can fill 2 orders at the same time</td>
</tr>
<tr>
<td>Walgreens <a href="http://www.walgreens.com">www.walgreens.com</a></td>
<td>Yes</td>
<td>Yes, with Mayo Clinic</td>
<td>No</td>
<td>E-mail</td>
<td>Yes</td>
<td>Can e-mail reminders to refill prescription</td>
</tr>
<tr>
<td>Sav-on Drugs (includes Osco Drug, Lucky, Acme) <a href="http://www.sav-ondrugs.com">www.sav-ondrugs.com</a></td>
<td>No</td>
<td>Yes, with HealthNotes</td>
<td>Yes</td>
<td>E-mail</td>
<td>No</td>
<td>Includes health discussion groups</td>
</tr>
<tr>
<td>Drugstore.com <a href="http://www.drugstore.com">www.drugstore.com</a> (links to RiteAid, <a href="http://www.riteaid.com">www.riteaid.com</a>)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>E-mail</td>
<td>No</td>
<td>Can e-mail reminders to refill prescription; has health magazine</td>
</tr>
<tr>
<td>AARP Pharmacy <a href="http://www.rpspharmacy.com">www.rpspharmacy.com</a></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Phone</td>
<td>Yes</td>
<td>Pharmacists on-call for urgent medical questions 24 hrs/day</td>
</tr>
</tbody>
</table>

For the elderly to be able to benefit from Internet and mail-order services, they need to be aware of these options, and the services need to publicize their existence. During an informal survey of Boston area pharmacies, none of the chain-affiliated pharmacies whose companies had (800) number mail-order services or internet sites mentioned these options when asked whether the pharmacy could ship or deliver prescriptions, even when the individual stores did not provide these services directly themselves. Better information about these alternatives needs to be made available so that they can be more fully utilized.

4.4 Services providing medically-related transportation

Section 4.2 reviewed the Boston metro region’s public and private transportation resources. Section 4.3 inventoried the area’s principal health care resources. Section 4.4 looks at the relationship between the two and investigates the services that focus on providing transportation to medical care, especially for the elderly. Two types of services are examined: regular transportation to medical appointments and transport to health care via ambulance.
4.4.1 Regular transportation to medical appointments

A number of services in the Boston metro area offer rides to medical appointments. Many of them were discussed in Section 4.2 and are only briefly mentioned here. One type of service is the demand-response paratransit offered by the MBTA and the regional transit authorities for people with disabilities and mobility impairments. The paratransit programs generally provide rides for a variety of purposes, though priority is often given to necessary trips, such as those for medical care. The transit agencies also work with hospitals and medical centers to make sure they are served with regular bus service. Hospitals also sometimes run their own transport shuttles, from in-town locations or transit stops, to help patients access care. Ten of the 17 AAAs in the Boston region, for example, report that some hospitals in their areas provide at least limited transportation for medical appointments and treatments. In other cases, hospitals have programs to subsidize taxi rides for patients with no other means of transportation.

In addition to these programs, some states agencies, including the Department of Medical Assistance, the Massachusetts Commission for the Blind, provide assistance with medical appointment transportation for qualifying individuals. Other providers of medical trips include volunteer organizations such as the American Red Cross and the American Cancer Society. These organizations can sometimes give rides to medical appointments if people have absolutely no other options available. As mentioned earlier though, these rides are generally provided in volunteers’ own cars, and as such handicapped or wheelchair-bound individuals cannot always be accommodated.

The options mentioned in this section so far help a variety of people, including the elderly, with transportation to medical care; moreover, often the elderly constitute one of the largest user groups for these services. However, older adults also have access to transportation programs aimed directly at the elderly population. Among these programs are those coordinated by Area Agencies on Aging and Councils on Aging in the Boston region. Many of the AAAs and COAs have ride programs, run on their own or in conjunction with transit authorities, for seniors in their areas. Although the scope and size of these transportation
services ranges significantly from area to area, at a minimum, they generally provide rides for medical appointments and other necessary purposes.

This chapter has already discussed how transportation programs and options for seniors vary considerably between communities. This variation applies to medical transportation as well. Ride programs, including for medical appointment rides, are usually the largest in the region’s population centers and in communities with large numbers of older adults. In smaller communities, programs are more likely to be insufficient in scope or unable to meet demand, and they are more likely to have limited hours. In addition, both small and large programs typically have difficulty accommodating two types of ride requests. First, few services have the capacity to provide same-day transport, even when requested for urgently needed care. Second, only a limited number of services can provide transportation for medical appointments outside of the local areas, including to Boston where many medical centers and hospitals are located. The Massachusetts Executive Office of Elder Affairs considers the lack of transport availability for these two types of trips to be a major shortcoming of current services and an unmet need for many seniors across the state.

**SCM Community Transportation**

SCM Community Transportation Corporation (SCM) is one of the larger private providers of elderly transit services in the Boston metro region. SCM offers rides to medical appointments, including those at Boston medical facilities, as well as to adult day care and other services. A non-profit company, SCM contracts with municipalities, elder service agencies (i.e. COAs and AAAs), and hospitals to provide door-to-door transit service for the elderly and people with mobility impairments. As with many paratransit contractors, SCM primarily operates during the week and has only limited service on weekends. Started in 1983, SCM now provides between 600 and 700 one-way rides each day and more than 150,000 rides per year. SCM’s focus has always been on offering transportation for essential life activities and SCM President John Long considers medical trips to be the “heart and soul of the organization.”

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SCM supplied copies of its client and trip database for this research. Since the emphasis of this research is on transportation to health care, this research’s review of the SCM database focused on trips for medical appointments. Although the SCM database contains information only about its own services and clients, the SCM data is useful for starting to characterize the people who use medical transport services in the Boston region and their medical trips.

Analysis of the SCM database focused on medical trips provided during fiscal 1999. During fiscal 1999, over 2,600 people scheduled almost 28,500 one-way trips with SCM for medical appointments; this averages to approximately 100 one-way medical trips per day.

Most of SCM medical ride clients are elderly. Among those who indicated their age, almost half were 75 to 84 years old and over a quarter were aged 85 and above (Table 4-16). Only 6 percent were under age 65. In addition, SCM served considerably more women than men in every age group, and female clients outnumbered male clients by almost 3 to 1.

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Number of Clients</th>
<th>% of Clients in Each Age Group</th>
<th>For each Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>% Female</td>
</tr>
<tr>
<td>Under Age 65</td>
<td>77</td>
<td>6</td>
<td>71</td>
</tr>
<tr>
<td>Ages 65-74</td>
<td>236</td>
<td>19</td>
<td>78</td>
</tr>
<tr>
<td>Ages 75-84</td>
<td>631</td>
<td>49</td>
<td>79</td>
</tr>
<tr>
<td>Ages 85-Over</td>
<td>339</td>
<td>26</td>
<td>85</td>
</tr>
<tr>
<td>Total (includes persons with no age given)</td>
<td>2,620</td>
<td>100</td>
<td>72</td>
</tr>
</tbody>
</table>

Most of the people who use SCM for rides to medical appointments do so because it is inexpensive (SCM does not charge for rides though a $1-2 donation is suggested) and because it is convenient and offers door-to-door service. Many SCM passengers have trouble walking or getting around and feel unable to use other transit services such as the MBTA. Over one-fifth of them specifically reported having difficulty using MBTA buses and subways. One-sixth said they had trouble going up stairs and the same number reported difficulty walking 200 feet on flat ground. Over 35 percent of SCM riders rely on a cane, walker, or crutches,

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22 Eleven percent of scheduled trips were canceled in advance or had no shows. Summary statistics on SCM medical trips were calculated using all of the medical ride client records for 1999 (2,620 clients in all) and all the medical rides they scheduled (16,239 rides, equivalent to 28,416 one-way trips) even when some rides did not actually take place.
and five percent use a wheelchair. Even among clients not reporting specific disabilities, there were a number who mentioned arthritis, leg and ankle problems, or difficulty breathing, all conditions that can make getting around or using transit more challenging. SCM’s ride services accommodate these problems and help preserve health care access for these individuals.

Most of the people who schedule SCM rides to medical appointments rely on SCM only a few times a year. In 1999, these clients scheduled an average of 11 one-way trips. The median number of one-way rides was 4, the equivalent of only 2 round trips. Over one-fifth of medical trip clients scheduled only the equivalent of one round trip a year (Table 4-17). Among infrequent riders are those who used SCM because of a temporary disability or following surgery when they still had difficulty getting around. Other infrequent users relied on SCM only as a last resort and usually had other transportation available.

<table>
<thead>
<tr>
<th>Number of Medical Appointment Trips* Scheduled in 1999</th>
<th>Number of Clients</th>
<th>Percent of All Medical Trip Clients for 1999 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>391</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>557</td>
<td>21</td>
</tr>
<tr>
<td>3-6</td>
<td>595</td>
<td>23</td>
</tr>
<tr>
<td>7-10</td>
<td>314</td>
<td>12</td>
</tr>
<tr>
<td>11-14</td>
<td>217</td>
<td>8</td>
</tr>
<tr>
<td>15-20</td>
<td>172</td>
<td>7</td>
</tr>
<tr>
<td>21-30</td>
<td>157</td>
<td>6</td>
</tr>
<tr>
<td>31-50</td>
<td>125</td>
<td>5</td>
</tr>
<tr>
<td>51-100</td>
<td>80</td>
<td>3</td>
</tr>
<tr>
<td>Over 100</td>
<td>12</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Total</td>
<td>2,620</td>
<td>100</td>
</tr>
</tbody>
</table>

*One-way trips.

A few riders use SCM for medical trips on a much more regular basis. One of out of every 8 clients scheduled at least 2 trips per month, and over 3 percent averaged at least one trip per week. There were also 2 clients who scheduled over 200 trips for the year.

Access to SCM transportation is through the agencies and organizations SCM contracts with to provide rides. These agencies and organizations include the local governments in Medford, Somerville, Cambridge, and Everett, West Suburbs Elder Services, Somerville-Cambridge

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23 About half of the clients gave SCM their birth dates. Age was calculated as age as of January 1, 1999.

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Elder Services, Minuteman Home Care, and the Councils of Aging in Somerville and Lexington, among others. Demand for SCM service is high. People requesting rides typically have to schedule them at least a week or two in advance. Not having more vans and rides available limits elders’ access to this service and possibly to medical appointments as well. It is not clear how many potential riders end up not scheduling because of this lack of availability (though the limited access to rides presents one possible explanation for why most riders do not use SCM services more frequently). It is also unknown how many people who cannot schedule with a trip with SCM find another way to get to their medical appointment or how many could be foregoing their medical trip altogether. These questions are worth further investigation.

The Massachusetts Executive Office of Elder Affairs has identified the lack of access to short-notice transport and out-of-town trips for medical appointments as major issues for seniors in the state. Large private transport providers such as SCM could potentially play an important role in addressing these service gaps. They have bigger ride vehicle fleets than many paratransit and elder agencies transportation programs, and they have greater flexibility to accommodate short-notice requests for transport and longer distance medical appointment trips. As part of the state government initiative to improve human service transportation through better agency coordination, increased coordination with the large private providers should also be explored.

4.4.2 Ambulance transportation

Ambulance transportation provides an important way for some people to access medical care and treatment, in both emergency and non-emergency situations. Two types of ambulance services are generally offered, regular convalescent transport and emergency transport, with many ambulance providers, especially in the public sector, focusing on emergency services. When medical emergencies arise, good access to emergency medical care and EMS transport is crucial for resolving life-threatening health problems and restoring patient health.
There are three main groups of ambulance providers: municipalities and town-level organizations, private ambulance transport companies, and hospitals and medical centers. All three types of providers offer services in the Boston metro region.

Municipal-level ambulance services are frequently run by fire departments or local emergency service units. In other cases, a volunteer or non-profit group will supply the ambulance and EMS services for a community. Town-level ambulance services generally focus on emergency care and transport, though they will sometimes also provide non-urgent, convalescent transport if they have the resources to do so. Locally-based ambulance services, especially in low-population areas, are usually small in size and scope, running only a few ambulances and often providing only basic life support care. In order to be registered by the state to provide more advanced (paramedic) care and advanced life support (ALS) services, an ambulance provider is required to have a minimal annual call volume and to be able to offer ALS-level care 24 hours a day, 7 days a week. Most municipalities have neither the call volume needed nor the capacity to provide round-the-clock ALS service. Sometimes, a number of local, town-based ambulance providers will group together and jointly sponsor paramedic service for their area. Another option is for towns to contract with a private ambulance company to supplement their local ambulances and to provide ALS service as necessary.

In the Boston metro region, many towns and cities operate their own ambulance services or coordinate a volunteer or non-profit provider. This is especially common for smaller communities, such as those beyond Interstate 95. Outside of I-95, 103 of the 140 communities have their own ambulance services. In contrast, only slightly more than a third of towns and cities inside I-95 run their own ambulances. For both groups, the community ambulance services usually provide basic life support only, and less than a third offer paramedic care. Table 4-18 indicates the number of communities with each level of service, and Figure 4-14(a) shows where these providers are located. Provider locations were determined using data supplied by the Massachusetts Office of Emergency Medical Services.
Figure 4-14: Location of Ambulance Services

(a) Locally-Based Public And Volunteer Services

(b) Other Ambulance Services

Private ambulance companies can supply additional EMS care and transport capabilities to communities that have their own ambulance services. They can also contract to provide EMS services to municipalities without their own ambulances. A review of state data on ambulance service providers indicates that there are quite a few towns and cities in the Boston metro region who do not have their own ambulance services, and therefore contract for services with private providers. This is particularly common among larger municipalities, for whom it can be difficult to supply cost-effective ambulance services that are sufficient to meet demand. A third function of private ambulance providers is to transport patients between hospitals or for scheduled care. Sometimes patients use ambulances for rides to care when they need the additional medical support that ambulances provide over other modes. For example, ambulances are used for regular transport for nursing homes, dialysis and radiation treatments, and some hospital discharges. Ambulances can also provide wheelchair accessible transportation to care when no other options are available.

There are 17 private ambulance companies in the Boston region. Together, they have a combined fleet to 750 ambulances. The largest of private providers by far is American Medical Response of Massachusetts (AMR) which has over 400 ambulances. As shown in Table 4-19, private companies account for close to 75 percent of the ambulances in the region. The locations where these companies are based are shown in Figure 4-14(b). One thing to note is that, particularly for larger providers, these locations may not correspond to where
their ambulances are stored, or to their service areas. Unfortunately, little information on service territories for these companies was available. It was also difficult to get data on whether more of their transports are for emergency or non-emergency trips.

Table 4-19: Ambulance Service Providers in the Boston Metro Region

<table>
<thead>
<tr>
<th>Type of Service Provider</th>
<th>Number of Providers</th>
<th>Number of Ambulances</th>
<th>% of All Ambulances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal and Volunteer Services</td>
<td>112</td>
<td>222</td>
<td>22</td>
</tr>
<tr>
<td>Private Ambulance Companies</td>
<td>17</td>
<td>740</td>
<td>75</td>
</tr>
<tr>
<td>Hospitals</td>
<td>11</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>4</td>
<td>&lt;&lt;1</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>990</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: MA Office of Emergency Medical Services, 2000; designation of provider type is author's own.

In addition to the ambulance transport available through locally-based organizations and private medical transport companies, ambulance services are also provided by a number of hospitals and medical centers. Some hospitals provide EMS services and paramedic ambulance assistance to the communities in which they are located, or they run joint services with their local governments. Other hospitals, especially those that do not have acute (emergency) care facilities, use their ambulances primarily for non-urgent patient transport. In the Boston metro region, 11 hospitals and medical centers have their own ambulance services; all but a few of these hospitals and centers are acute care facilities.

Potential spatial disparity and access issues

Figure 4-15 shows the location of ambulance providers and the population density of elderly people in the years 1990 and 2010. As the population, especially the elderly population, expands spatially across the region, as is anticipated over the next few decades, more ambulances and emergency staff may be necessary to maintain the same quality of access to emergency care.
Figure 4-15: Location of Ambulance Services with Elderly Population Density for 1990 & 2010


Population density shown by municipality.
A population that is spatially dispersed requires a greater supply of ambulances and EMS workers than one with higher population densities. The principal reason for this is that low-density development and population dispersal leads to longer ambulance response times and transport times than in higher density communities. With emergency care, response times are critical for preserving patient health and need to be kept to a minimum. In addition, longer transport times means that it takes more time for each ambulance to be ready for a new call, and that less transports per hour are possible. Therefore, to maintain ambulance transport capacity as population density decreases, local communities, and the region as whole, will need additional ambulances and emergency medical staff.

Another access issue arises from the growing elderly population. The elderly are major users of ambulance services; close to 40 percent of all emergency ambulance calls are for people aged 65 and over (Strange and Chen, 1998). This is much greater than this group’s 13 percent share of the overall population. As the number of older adults increases, their total ambulance call volumes is likely to grow as well. Ambulance services will need to develop strategies to address this potential future growth; without such strategies, the elderly’s access to ambulances may become increasingly limited.

One option is to reduce the future population’s demand and need for ambulances and emergency transport. Emergency ambulances are intended to be used only for transport in medical emergencies. However, many people with limited transportation access to health care, such as some elderly, use EMS services and emergency transport for non-urgent medical problems as well. For example, studies show that the elderly are up to twice as likely as younger adults to call for emergency transport in non-urgent situations and for minor medical illnesses (Dickinson et al., 1996; Ettinger et al., 1987). Improving transportation access to regular health care could decrease the demand for emergency transport for non-emergencies, and also help contain the growth of emergency ambulance call volumes.

Improving access to regular care could also lead to better health overall and decreased incidence of medical emergencies for the elderly. Many older adults visit emergency room or call for EMS services because of complications related to chronic health problems such as
heart disease. Improving their access to regular health care could decrease their likelihood of complications and their need for emergency medical services, including ambulance transport.

Better access to regular health services could also decrease society’s overall costs of transportation to medical care. For one, improving the elderly’s access to their regular care providers, and helping them stay healthy, could actually reduce the total number of trips the elderly need to make to their doctors. If they maintain their health, they will have less need for intensive treatments and health monitoring that may require frequent visits. In addition, even more expensive regular transportation options for medical appointment trips, such as paratransit, with a cost of $20 or more per ride, pale in comparison to ambulance transport expenses, often at least $150 to $200 per trip (7 to 10 times greater). Therefore, expanding regular transportation services such as paratransit and other options, could be significantly cheaper than having to provide additional ambulance transport as the population ages.

4.5 Summary and comments

The analysis in this chapter focuses on examining the elderly’s access and proximity to transportation and medical services and on exploring how this access could change in the future in light of the elderly population growth and continuing suburbanization expected for the region. The first aspect of the analysis is spatial in nature, using the latest GIS technologies to graphically explore the relationship between where the elderly reside and where transportation and health services are located. This is a valuable approach as the spatial displays of population and service provider information facilitate insights into the relationship between people and services that might be missed when examining the data in a more traditional fashion. The spatial connections between the elderly and health care providers are explored in the context not only of physical proximity between the two, but in terms of the transportation services that allow older adults to travel from home to care.

This spatial analysis finds that most elders in the Boston metro area have fairly close proximity to health care services such as doctors’ offices, hospitals, and pharmacies. Almost 95 percent of people age 75 and above live within 5 miles of a hospital and almost 85 percent live with 5 miles of a hospital with acute care capabilities. In addition, more than 90 percent
of the towns and cities in the Boston region have pharmacies and those that do not are low-density communities with few seniors; further, places without pharmacies have access to those in neighboring towns. The analysis also finds that even as the elderly population becomes more spread out, for most seniors, the distances to health services will not increase dramatically, as services are still likely to be offered in communities with the highest numbers of older adults. However, elders living in areas with smaller elderly populations may experience increasing distances to care.

In addition to proximity to health care, another crucial component of the elderly’s access to care is the ability to travel from home to care services. For many older adults, especially those who do not drive, transportation to care issues can present a more significant barrier to health services than distance alone. In the Boston metro area, there are a variety of transportation options available to seniors. They include transit and paratransit services provided by the MBTA and regional transit authorities, elder agency and state agency transportation programs, non-profit and volunteer ride programs, and taxi service, as well as the option to rely on family and friends for important trips. Further, rides to medical care and other necessary services are often emphasized by the public and non-profit transportation providers (while other trip types are sometimes neglected), to ensure that the elderly can reach health care services when they need to. The spatial analysis indicates that most Boston area elders have access to these transportation options, and to medical care. However, the analysis also suggests that the elderly’s transportation access to care may decline in the future as the older population becomes more dispersed. Fifty-four towns in the region have no transit or paratransit services provided by the regional transit authorities. Between 1990 and 2010, the combined elder populations of these communities is expected to increase by almost 50 percent. Even as their numbers of elderly grow, it is unlikely that many of the towns will begin to offer expanded transit or elderly transportation services.

The second aspect of the evaluation concentrates on the characteristics of the elderly’s transportation access to health care that are less spatial in nature, such as transportation quality and availability. Here, too, the research finds that some Boston region elders have problems finding rides to medical care. Most paratransit and elderly transport programs
require participants to sign up for rides in advance and cannot accommodate short-notice requests. Also, these services typically only operate during limited weekday hours and are not available to help seniors with rides to care outside of these times. In addition, it can be difficult for seniors to find rides to care outside of their immediate communities. More elders are likely to have problems with their transportation access to care as the number of older adults grows. The elderly are large consumers of medical and health care resources, and as the elderly population grows, their total demand for health care and for rides to health care will increase as well. Unless current services are expanded, which is not so likely, access to care will become a more substantial issue for the elderly in the future.

Particularly for the elderly, who generally have the most health problems, quality access to health care is essential for maintaining good health. Preserving the elderly’s access to care has benefits for society as a whole. It helps older adults remain in their communities as they age, continuing to contribute to and participate in the activities and life of those places, and decreases the likelihood that they will end up moving to nursing homes or assisted living facilities. In helping them retain their health, it also reduces the elderly’s need for intensive and costly medical care and treatments. Older adults contribute disproportionately to health care costs in this country. Many elderly health care expenditures result from disabilities and complications of common chronic disabilities, whose incidence could potentially be decreased with better access to health care and more regular health management before problems develop. Improving the elderly’s access to health care can help reduce their levels of disabilities and chronic health problems, and enhance their quality of life. It can benefit society overall as well, by helping prevent future health care costs from spiraling out of control as the population ages and the number of seniors grows significantly.
CHAPTER 5: INCIDENCE AND COSTS OF CHRONIC DISEASES AMONG THE ELDERLY POPULATION

Improving the elderly’s transportation access to health care, especially preventative care, has the potential to reduce health care expenditures for older adults, and to limit the future growth in costs. The elderly contribute disproportionately to national health care spending. Seniors aged 65 and over account for 35 percent of all personal health care expenditures nationwide (1995), more than $310 billion annually, even though they comprise only 13 percent of the population. In addition, some projections have elderly medical costs quadrupling to $1.3 per year by 2020 (Fuchs, 1998).

Many of the health care expenditures for the elderly result from chronic diseases and their complications. Heart disease among those age 65 and over, alone costs $58 billion per year, accounting for almost one-fifth of medical spending for this age group (NCHS, 1999). Diabetes costs an additional $26 billion annually (NCHS, 1999). Inadequate access to regular checkups and preventative care contributes to the incidence of these conditions as well as their health care costs. If, because of regular health monitoring, people are aware that they are at risk of developing these diseases, they can change behavior (diet, lack of exercise, etc.) that can be adding to this risk, and can often avoid experiencing these diseases full-scale. Furthermore, the lack of good access to health care once these diseases are diagnosed increases the possibility that complications will develop. With the right monitoring, many chronic conditions, including heart disease and diabetes, are relatively easy and inexpensive to treat and control. However, without good monitoring and regular care, conditions and complications often become exacerbated and the health care costs associated with these conditions increase tremendously. For example, Hodgson and Cohen (1999a) estimated that only 39 percent of diabetes health care expenditures are for primary treatment of the diabetes.\(^1\) The remaining 61 percent of costs are for secondary complications and comorbidities resulting from the diabetic condition.

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\(^1\) Primary treatment of diabetes refers to all health care where diabetes is the first listed diagnosis according to HCFA records. Hodgson and Cohen’s analysis used 1995 HCFA data.
More regular care and better health management, and improved access to these services could help limit health care costs for chronic diseases such as diabetes and heart disease, as well as medical care expenditures for the elderly overall. Currently 42 percent of health care spending for people age 75 and above is for hospital care and almost one-third for nursing home care. Both nursing home and hospital services are more intensive and expensive than other forms of care, and the need for these types of care increases when people develop complications and disabilities due to ongoing, worsening health problems. Better access to preventative, regular health care has the potential to help the elderly stay healthy and to reduce their demand for these services. This, in turn, could help limit future medical care spending and lead to a more efficient and effective health care system.

Chapter 5 discusses current national health care spending, both overall and for the elderly, as well as medical cost projections for older adults. Section 5.1 summarizes national health care costs for the population as whole, and hospitalization and chronic disease rates for the elderly. Sections 5.2 and 5.3 then explore the disease incidence and costs associated with two chronic conditions common among older adults: coronary heart disease and diabetes. The costs and complications associated with these diseases could potentially be significantly reduced through better access to preventative care and more disease management and monitoring. These sections examine national cost and incidence figures first and then focus on the Boston metropolitan area, developing elderly health care cost estimates for these diseases out to the year 2010 for the region. These estimates are based upon regional population projections and growth trends in health care costs. The chapter closes (Section 5.2) by briefly summarizing the findings of the cost analysis and making a few concluding comments.

5.1 National health care spending, overall and for the elderly

The most recent figures indicate total national health care expenditures are approaching 1.1 trillion dollars per year. Close to 90 percent of this spending ($969 billion) is for personal

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3 HCFA data, reported in NCHS (1999).
health care. Hospital care ($371 billion) and physician and other professional services ($280 billion) are the two largest expenditure categories, accounting for 38 percent and 29 percent of spending respectively. If dental and "other" health care service costs are excluded from the spending (as is done for the age-specific analysis later in the section), the percentage of expenditures for hospital care and physician and other professional services rise to 42 and 31 percent respectively.

Between 1980 and 1997, personal health care costs expanded to almost 4.5 times their 1980 level ($217 billion). From 1990 to 1997 alone, expenditures grew by almost 60 percent ($354 billion) (Table 5-1). During the 1990-1997 period, the largest absolute spending increase was for home health care ($147 billion) and the other personal health care category ($167 billion). The largest percentage growth was for these categories as well, with spending for home health care increasing an average of 14 percent per year, more than double the growth rate for personal health care spending overall.

Table 5-1: National Personal Health Care Expenditures, 1990, 1995, and 1997

<table>
<thead>
<tr>
<th>Expenditure Type</th>
<th>Personal Health Care Expenditures (in billions of $)</th>
<th>Change (billion $)</th>
<th>% Change 1990-1997</th>
<th>Average Annual % Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Care</td>
<td>256.4 347.2 371.1</td>
<td>114.7</td>
<td>44.7</td>
<td>5.4</td>
</tr>
<tr>
<td>Physician and Other</td>
<td>181.0 255.5 279.5</td>
<td>98.5</td>
<td>54.4</td>
<td>6.4</td>
</tr>
<tr>
<td>Professional Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>50.9 75.5 82.8</td>
<td>31.9</td>
<td>62.7</td>
<td>7.2</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>13.1 29.1 32.3</td>
<td>19.2</td>
<td>146.6</td>
<td>13.8</td>
</tr>
<tr>
<td>Dental Services</td>
<td>31.6 45.0 50.6</td>
<td>19.0</td>
<td>60.1</td>
<td>7.0</td>
</tr>
<tr>
<td>Drugs and Medical Durables</td>
<td>70.4 102.0 122.8</td>
<td>52.4</td>
<td>74.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Other Personal Health Care</td>
<td>11.2 25.1 29.9</td>
<td>18.7</td>
<td>167.0</td>
<td>15.1</td>
</tr>
<tr>
<td>All Personal Health Care</td>
<td>614.7 879.3 969.0</td>
<td>354.3</td>
<td>57.6</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Note: Because of rounding, the sum of expenditures for each year may not equal the totals.
Source: HCFA, 1997, as reported by the National Center for Health Statistics, 1999.

5.1.1 Variations in health care expenditures among different age groups

The distribution of personal health care spending among expenditure types (doctors' visits, hospitalization, nursing home care, etc.) varies considerably among different age groups.

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4 Personal health care includes physician and other professional services, dental services, hospital and home health care, and prescription drugs and medical durables. Other health care spending included administration (5 percent), government public health activities (3 percent), and research and construction (3 percent).
Under age 65, only 3 percent of health care spending goes for nursing or home health care. Over age 65, that percentage increases from 14 percent for people 65-74, to 54 percent for those aged 85 and over. For the under 65 age group, hospital care, doctors visits and other professional services together comprise 86 percent of health care spending. For older age groups, the percentages of total expenditures for these services decline as more resources go to nursing home care. Ninety percent of all nursing home costs ($68 billion) are for people over age 65 ($68 billion), and 42 percent ($31 billion) are for those 85 and older.

Table 5-2: Distribution of Personal Health Care Expenditures for Different Age Groups, 1995

<table>
<thead>
<tr>
<th>Expenditure Type</th>
<th>Under Age 65</th>
<th>Ages 65-74</th>
<th>Ages 75 &amp; Over</th>
<th>Ages 75-84</th>
<th>Ages 85 &amp; Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Care</td>
<td>44.9</td>
<td>51.9</td>
<td>41.7</td>
<td>45.9</td>
<td>34.6</td>
</tr>
<tr>
<td>Physician and Other Professional Services</td>
<td>41.3</td>
<td>23.0</td>
<td>14.2</td>
<td>17.4</td>
<td>8.8</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>1.6</td>
<td>8.8</td>
<td>31.4</td>
<td>22.8</td>
<td>45.9</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>1.8</td>
<td>5.2</td>
<td>7.8</td>
<td>7.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Drugs and Medical Durables</td>
<td>10.4</td>
<td>11.0</td>
<td>4.9</td>
<td>6.1</td>
<td>2.9</td>
</tr>
<tr>
<td>All Personal Health Care</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*See footnote 4 for expenditures that were excluded from the analysis.

Source: Hodgson and Cohen, 1999b, analysis of HCFA data.

Older populations expend considerably more health care dollars than their younger counterparts. People ages 75 and over comprise only 6 percent of the population but accounted for 20 percent of total personal health care dollars spent ($175 billion) (1995). On a per capita basis, annual personal health care spending rises with each successive age group, from an estimated $1,900 for people under age 65, to $6,200 for those 65-74, to $10,400 among 75-84 year olds, to almost $19,000 for people 85 and above.

5.1.2 Incidence of chronic medical conditions in the elderly

Chronic conditions and their complications contribute to older adults’ disabilities and declining health as well as their high health care costs. “The incidence of chronic illness increases with age and becomes a major cause of disability requiring medical care” (Rice, 1999, 14). Table 5-3 summarizes the prevalence of major chronic conditions in older age

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5 HCFA data, analyzed by Hodgson and Cohen (1999b). Hodgson and Cohen's analysis excluded dental expenditures and spending that could not be allocated to a particular diagnosis. Approximately 94 percent of all personal health care spending, including 99 percent of hospital expenditures and 100 percent of nursing home costs, is accounted for in their numbers.
groups. The most common chronic condition among the elderly is arthritis, which appears in 55 percent of people 75 years of age or older. Other common conditions are hypertension (42 percent), heart disease (36 percent), chronic respiratory diseases⁷ (12 percent), and diabetes (12 percent). Almost all of the conditions in Table 5-3 are more prevalent in adults 75 and over than in those who are 65 to 74. Diabetes is the one exception, with a slight decline from a rate of 12.6/100 adults ages 65-74 to 11.7/100 adults 75 and over.

### Table 5-3: Prevalence of Selected Major Chronic Conditions Among the Elderly, 1995

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Conditions per 100 Persons, by Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ages 65 &amp; Over</td>
</tr>
<tr>
<td>Arthritis</td>
<td>48.9</td>
</tr>
<tr>
<td>Hypertension</td>
<td>40.3</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>30.8</td>
</tr>
<tr>
<td>Chronic Respiratory Diseases</td>
<td>13.8</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>12.6</td>
</tr>
<tr>
<td>Selected Cancers*</td>
<td>7.4</td>
</tr>
<tr>
<td>Cerebrovascular Diseases</td>
<td>7.1</td>
</tr>
<tr>
<td>Atherosclerosis</td>
<td>4.1</td>
</tr>
</tbody>
</table>

*Include cancers of skin, intestines, breasts (women), genital organs (women), prostate (men), lungs and other respiratory sites.

Source: 1995 National Health Interview Survey (unpublished data), as reported in Desai et al., 1999.

A number of elders report that chronic conditions limit their ability to complete the basic activities of daily living (ADLs). In the 1994 National Health Interview Survey,⁸ more than one of out ten adults aged 70 years old and above (11 percent) indicated that arthritis limited their ADL abilities. Four percent had ADL constraints because of heart disease, and 3 percent and 2 percent experienced ADL limitations due to respiratory diseases and diabetes respectively.

5.1.3 Hospitalization rates among the elderly

Chronic conditions and their complications also increase the elderly’s need for hospitalization. In total, adults 75 and over account for an estimated 48 million days of in-patient care and 7 million hospital discharges per year. These figures represent almost 30 percent of in-patient days of care and 22 percent of hospital discharges for the population as a

⁶ Ibid.
⁷ Chronic respiratory diseases include asthma, chronic bronchitis, and emphysema.
⁸ Results as reported in NCHS (1999).
whole.\(^9\) Table 5-4 lists the primary causes of hospitalizations among the elderly. Heart disease is the leading cause of hospitalization among older adults of all age groups, and accounts for an estimated one-quarter of elderly hospital discharges. For people age 75 and over, heart disease has a discharge rate of 102.5 per 1,000 population. The next two main causes of hospitalization in this age group are pneumonia (31.8/1,000) and cerebrovascular diseases (31.2/1,000). The hospitalization rates for most chronic conditions grow with age, with pneumonia having an especially dramatic increase with successive age groups. Hospital discharge rates for pneumonia more than double between ages 75-84 and 85 and above, increasing from 24.6/1,000 to 53.8/1,000.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Ages 65-74</th>
<th>Ages 75 &amp; Over</th>
<th>Ages 75-84</th>
<th>Ages 85 &amp; Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Disease</td>
<td>62.4</td>
<td>102.5</td>
<td>97.4</td>
<td>117.9</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>11.8</td>
<td>31.8</td>
<td>24.6</td>
<td>53.8</td>
</tr>
<tr>
<td>Cerebrovascular Diseases</td>
<td>13.5</td>
<td>31.2</td>
<td>28.5</td>
<td>39.6</td>
</tr>
<tr>
<td>Fractures</td>
<td>7.0</td>
<td>25.9</td>
<td>18.4</td>
<td>48.7</td>
</tr>
<tr>
<td>Cancer</td>
<td>21.4</td>
<td>22.2</td>
<td>22.7</td>
<td>20.6</td>
</tr>
<tr>
<td>Bronchitis</td>
<td>7.8</td>
<td>11.4</td>
<td>10.9</td>
<td>12.9</td>
</tr>
<tr>
<td>Arthritis</td>
<td>8.3</td>
<td>9.1</td>
<td>10.6</td>
<td>4.6</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>5.4</td>
<td>6.4</td>
<td>6.3</td>
<td>6.8</td>
</tr>
<tr>
<td>Diseases of Nervous System &amp; Sense Organs</td>
<td>4.1</td>
<td>7.3</td>
<td>6.9</td>
<td>8.5</td>
</tr>
</tbody>
</table>

As discussed early, hospital care costs are the largest component of total personal national health care expenditures, accounting for an estimated 40 percent of all costs. In addition, for the elderly age 65 and over, hospital care spending tops $135 billion per year. Older adults' rates of hospitalization and hospital costs for many of the conditions listed in Table 5-4 could likely be decreased with more regular and preventative health care. For example, pneumonia, is a major cause of hospitalization among elders, especially the oldest old. Pneumonia is an inflammation of the lungs caused by influenza or other viruses or bacteria. It typically affects people with weakened immune systems such as frail elders and people already suffering from other health problems (American Medical Association, 1994). Increasing the level of

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\(^9\) Data from the National Hospital Discharge Survey for non-federal short-stay hospitals, 1996, as cited in NCHS (1999).
influenza vaccinations among these populations\textsuperscript{10} and providing them with other treatments that help boost their ability to fight infections could help reduce the incidence and hospitalization rates, and therefore costs, for this illness.

Improving the elderly’s access to regular care would encourage older adults to see their doctors more frequently and would help them achieve better monitoring of health overall, as well as specific health problems. Not all the conditions presented in Table 5-4 (i.e. arthritis) would necessarily respond to better care access and more preventative care but the majority of them likely would. In addition to possibly reducing the elderly’s incidence and hospitalization due to pneumonia, better access to care and more doctors’ visits could also potentially reduce the complications and hospitalizations for coronary heart disease and diabetes, two of the most common and also most expensive chronic conditions among the elderly population. These two diseases and their costs are discussed further in Sections 5.2 and 5.3, and options for improving access to treatment for these conditions are explored in Chapter 6.

5.1.4 Projected increases in health care expenditures for older adults

If the current patterns of disease incidence and complications among the elderly continue in the 21\textsuperscript{st} Century, the total health care expenditures for older adults will increase substantially as the number of elders grows. Projections for future health care spending for older adults generally all predict tremendous cost increases. The exact predicted level of increase, however, varies among researchers since they use different assumptions and methods to generate their estimates. For example, Rice (1996) assumes a constant level of age-specific spending from the present, and predicts that personal health care spending for the elderly (65 and over) will grow to close to $500 billion (in constant 1994 dollars) by the year 2020. This represents an increase of 60 percent over expenditures in 1994 (Table 5-5). Another projection (Fuchs, 1998) assumes that health care spending will grow at a rate of 5.8 percent annually, which was the average yearly increase observed between 1985 and 1995). Fuch’s

\textsuperscript{10} In 1997 surveys by the Behavioral Risk Factor Surveillance System, only 71 percent of people aged 75 years and over reported receiving an influenza vaccination during the previous 12 months. Data cited in Janes et al. (1999).
A number of public health initiatives, for example Healthy People 2010 (U.S. Department of Health and Human Services), and other programs have been undertaken to encourage more preventative care and monitoring of current and potential health problems, and to increase overall access to medical services. These programs are often aimed at the populations most at-risk for health problems, such as the elderly and the poor. These initiatives have promise for reducing the incidence and complications of many chronic medical conditions among current and future elderly and the population overall. If these programs can be successful, they have the potential to cost-effectively improve overall health levels in this country and to decrease the expected future growth in national health care spending.

### 5.2 Incidence and costs of coronary heart disease in the elderly

Over 58 million people in this country, almost one-quarter of the nation’s population, have heart disease (Centers for Disease Control (CDC), 2000). Heart disease is even more prevalent among the elderly, affecting more than one-third (36 percent) of those aged 75 and above. In addition, one-third of older adults’ visits to the ER result from heart disease and its complications.

Heart disease is also the leading cause of death nationwide, accounting for close to 960,000 deaths per year overall, equal to 40 percent of all deaths, (CDC, 2000) and 470,000 deaths annually among adults 75 and older.12

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11 National Health Interview Survey data, 1995, as reported in Desai et al. (1999).
12 CDC/NCHS Mortality file data, 1996, as reported in Desai et al. (1999).
Heart disease is any disease affecting the heart or blood vessels. Coronary heart disease (CHD) is a specific type of heart disease where arteriosclerotic narrowing of the coronary arteries results in insufficient blood and oxygen reaching the heart. CHD accounts for roughly half the incidence of heart disease in this country. An estimated 2.5 million people age 75 and over (17 percent of that population) have CHD, and approximately 650,000 elderly hospitalizations per year are due to CHD problems.

CHD often produces angina, severe chest pain. Furthermore, if CHD leads to complete blockage of a coronary artery, it will result in a heart attack. Heart attacks then themselves can lead to a number of additional health complications including congestive heart failure, heart rhythm abnormalities, heart muscle aneurysms, heart valve damage, and other problems (McGoon and Gilliland, 1993).

5.2.1 National health care expenditures for coronary heart disease

National personal health care expenditures for CHD total close to $39 billion per year (Table 5-6). Forty-one percent total CHD spending ($16 billion) is for people age 75 and over, and an estimated 16 percent overall ($6 billion) is for elders 85 and over. With successive elderly age groups, spending for hospital care declines and expenditures for nursing home care increase. From the 75-84 age cohort to the age 85 and over group, hospital spending declines over $3.6 billion, while nursing home costs almost double to $3.8 billion. (Hodgson and Cohen, 1999b)

Per person health care expenditures for those with CHD were estimated by Hodgson and Cohen (1999b). They found that per person costs grew significantly with age. Annual health care expenditures for people with CHD under age 65 averaged close to $3,500. Among CHD patients 85 and older, average costs were almost 80 percent higher, and more than $6,200 per year.

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14 Data from the National Hospital Discharge Survey for non-federal short-stay hospitals, 1996, as cited in NCHS (1999).
Table 5-6: National Personal Health Care Expenditures for Coronary Heart Disease, 1995

<table>
<thead>
<tr>
<th>Expenditure Type</th>
<th>All Ages</th>
<th>Health Care Spending ($ million) &amp; Pct (%) of Costs for Each</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Costs ($mil)</td>
<td>% of All Costs</td>
</tr>
<tr>
<td>Hospital Care</td>
<td>23,396</td>
<td>61</td>
</tr>
<tr>
<td>Physician and Other</td>
<td>5,416</td>
<td>14</td>
</tr>
<tr>
<td>Professional Services</td>
<td>6,470</td>
<td>17</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>956</td>
<td>2</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>2,421</td>
<td>6</td>
</tr>
<tr>
<td>Drugs and Medical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Personal Health Care</td>
<td>38,659</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: Because of rounding, sums for each age group may not equal the totals.

Source: Hodgson and Cohen, 1999b, analysis based on HCFA data.

Hodgson and Cohen (1999b) also calculated per capita CHD expenditures (1995) for different elderly age groups. The per capita estimates are based on the total population figures, not only the number of people with CHD. The top half of Table 5-7 displays their results. Estimated annual CHD costs are $852 for adults 75-84, and over twice as much, $1,739, for those age 85 and above. Hospital care and nursing home care make up the two largest spending categories for each age group. Among people 75-84 years old, per capita CHD costs are higher for men than women ($931 v. $802); however, for people who are at least 85 years old, per capita CHD spending is more for women than men ($1,765 v. $1,591). Among women age 85 and above, nursing home care accounts for two-thirds of per capita CHD costs.

Projections of elderly per capita CHD costs for the year 2010 have been developed as part of this research (Table 5-7). These projections are based on U.S. Census Bureau population estimates for 2010 and on historic HCFA data regarding the annual average percentage spending changes for major health care expenditure categories. An average of recent rates for each category have been applied to the 1995 per capita spending figures to forecast the corresponding values for 2010.\(^\text{15}\)

\(^{\text{15}}\) The research looked at HCFA cost growth rates for 1990 to 1997. Growth rates during that time varied from 5 to 10 percent annually depending on type of expenditure. Section 3.6 provides details on the methods used to generate the cost projections.
The research's calculations and future cost estimates assume that current CHD incidence rates and cost patterns among elder age groups (proportion of costs for hospital care and other expenditures) will remain constant through 2010. The projections predict that with these elements remaining constant, per capita CHD spending for people age 75 and over will increase almost 150 percent to $2,625 by 2010 (Table 5-7). For elders 85 and older, per capita CHD costs are expected to grow to over $4,000 during the same period, and by 2010, expenditures for nursing home care (almost $2,500) among this age group are projected to be greater than their total per capita costs for CHD today.

5.2.2 Coronary heart disease incidence and cost estimates for Boston region elderly

Because the primary geographic focus of this research is the Boston metropolitan area, the research uses the available national and state data to estimate the incidence and costs of CHD for Boston area elderly. Coronary heart disease is estimated to occur at a slightly reduced rate among Boston area elders than it does nationally, affecting approximately 35,000 people (16 percent) 75 years of age and above. Coronary heart disease is thought to have reduced
incidence in the Boston region based on the fact that both elderly death rates and hospitalization rates for CHD are lower for the region (and for Massachusetts) than for the nation as a whole. For instance, National Hospital Discharge Survey data (1995) indicates a rate of 42.8 hospital discharges per 1,000 people age 75 and above. Regional numbers for the same year and age group (MA Department of Public Health, 2000) show a slightly lower rate of 41.2 hospital discharges per 1,000 (Table 5-8).

| Table 5-8: Elderly Hospitalizations for Coronary Heart Disease, Boston Region, 1995 |
|---------------------------------|----------------|----------------|----------------|
| Ages 65-74                       | Ages 75 & Over | Ages 75-84     | Ages 85 & Over  |
| Total Hospital Discharges        | 8,728          | 9,550          | 7,032          | 2,518          |
| Rate Per 1,000 Persons           | 31.9           | 41.2           | 42.6           | 37.7           |

Source: MA Department of Public Health, MA Community Health Information Profile database, downloaded June 20, 2000.

Estimates of CHD health care spending for Boston area elders have been developed using the national per capita CHD costs and regional population figures.

| Table 5-9: Total Medical Costs of Coronary Heart Disease Among the Elderly, Boston Metro Region, 1995 & 2010 |
|---------------------------------|----------------|----------------|----------------|
| Year and Expenditure Type       | Total Medical Expenditures ($ million), by Age Group |
|                                | Age 75 & Over | Ages 75-84     | Ages 85 & Over  |
| 1995 Hospital Care             | 109           | 78             | 31             |
| 1995 Physician and Other       | 20            | 16             | 4              |
| 1995 Professional Services     | 98            | 30             | 69             |
| 1995 Nursing Home Care         | 11            | 8              | 3              |
| 1995 Home Health Care          | 12            | 8              | 3              |
| 1995 Drugs and Medical Durables| 251           | 140            | 111            |
| 2010 Hospital Care             | 227           | 163            | 64             |
| 2010 Physician and Other       | 42            | 33             | 9              |
| 2010 Professional Services     | 236           | 71             | 165            |
| 2010 Nursing Home Care         | 47            | 33             | 14             |
| 2010 Home Health Care          | 37            | 27             | 10             |
| 2010 All Personal Health Care  | 589           | 326            | 263            |
| Change in Costs, 1995-2010     | 338           | 186            | 152            |
| Percentage Change              | 135           | 133            | 137            |

Note: Because of rounding, sums for each age group may not equal the totals.

16 As reported in NCHS (1999).
Although Boston elders have a slightly lower incidence of CHD than the national rate, health care costs in the Boston region are higher than elsewhere. These two factors have been assumed to cancel each other out. Regional CHD medical expenditures for the elderly are estimated at $251 million per year (1995) (Table 5-9), with elders age 85 and over accounting for 44 percent ($111 million) of this spending. By 2010, elderly CHD health care spending is projected to total close to $600 million. This expenditure level represents an increase of $338 million (135 percent) between 1995 and 2010.

5.3 Incidence and costs of diabetes in the elderly

Close to 16 million people (6 percent of the population) nationwide have diabetes (American Diabetes Association (ADA), 2000). Approximately one-third of diabetics (5.4 million) have never been diagnosed with diabetes and are unaware that they have the disease. Diabetes afflicts 12 percent of older adults (age 75 and above), 1.8 million people. Diabetes is the seventh leading cause of death overall, accounting for close to 200,000 deaths annually (ADA, 2000). Among the elderly, diabetes is the primary cause of approximately 35,000 deaths per year.18

Diabetes is a disease in which the body does not produce insulin (Type 1 diabetes) or properly use it (Type 2 diabetes) to absorb glucose out of the blood stream and provide the body with energy. Over 90 percent of diabetics have Type 2 diabetes, which primarily affects people over age 40. With Type 2 diabetes, greater than normal amounts of insulin are needed to maintain normal blood glucose levels.

Monitoring and regulating blood glucose levels is essential for controlling diabetes and limiting complications from the disease. Primary complications of diabetes include:

- **Blindness.** Diabetes is the leading cause of new blindness in people ages 20-74.
- **Kidney disease.** Diabetes is the leading cause of kidney disease and renal failure, and is responsible for 40 percent of new cases each year.
- **Nerve disease and amputations.** Diabetes can contribute to permanent nerve damage. Diabetes is the main cause of non-trauma related lower limb amputations in the U.S.,

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17 National Health Interview Survey data, 1995, as reported in Desai et al. (1999).
18 Data from CDC/NCHS Mortality file, 1996, as reported in Desai et al. (1999).
accounting for 50 percent of amputations not due to trauma. The elderly are especially at risk for diabetes-related amputations.

- **Heart disease and stroke.** Adults with diabetes are 3 times more likely to die of heart disease than the general population. Heart disease is present in three-quarters of diabetes-related deaths. Diabetics also have increased risk (2-4 times the risk for the general population) of experiencing a stroke.

(Levin and Pfeiffer, 1998; ADA, 2000). Poor glucose control increases the likelihood of these and other diabetic complications.

### 5.3.1 National health care expenditures for diabetes

National personal health care spending for diabetes and its complications totals close to $48 billion annually (1995) (Table 5-10). Hodgson and Cohen (1999a) found that approximately only 40 percent of health care spending attributable to diabetes is for the primary treatment of the condition itself. The majority of spending is for complications of primary diabetes, treatment of secondary diabetes, and the impacts of diabetes on other health care for unrelated conditions, such as a longer recovery time for an unrelated operation for diabetics than non-diabetics.

<table>
<thead>
<tr>
<th>Table 5-10: National Personal Health Care Expenditures for Diabetes, 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health Care Spending ($ million) &amp; Pct (%) of Costs for Each</strong></td>
</tr>
<tr>
<td><strong>Expenditure Type, by Age Group</strong></td>
</tr>
<tr>
<td><strong>All Ages</strong></td>
</tr>
<tr>
<td><strong>% of Costs</strong></td>
</tr>
<tr>
<td>Costs ($mil)</td>
</tr>
<tr>
<td>Costs ($mil)</td>
</tr>
<tr>
<td>Hospital Care</td>
</tr>
<tr>
<td>Physician and Other Professional Services</td>
</tr>
<tr>
<td>Nursing Home Care</td>
</tr>
<tr>
<td>Home Health Care</td>
</tr>
<tr>
<td>Drugs and Medical Durables</td>
</tr>
</tbody>
</table>

| All Personal Health Care | 47,871 | 100 | 14,157 | 101 | 9,636 | 100 | 4,521 | 100 |

*Note: Because of rounding, sums for each age group may not equal the totals.*

*Source: 1995 costs by type and age: Hodgson and Cohen, 1999a, middle level estimates.*

Adults age 75 and over account for 30 percent of all health care spending for diabetes ($14 billion per year). Approximately $4.5 billion (9 percent) of all diabetes health care dollars is expended for adults 85 years old and above. The main components of elderly medical expenditures for diabetes are hospital care and nursing home care, 39 and 30 percent of spending respectively. (Hodgson and Cohen, 1999a)
Total elderly per capita costs for diabetes-related medical expenditures (1995) are approximately $950 per year. Elderly per capita costs increase with age, from $864 for people 75-84 to $1,244 (44 percent higher) for those 85 and older (Table 5-11). As before, hospital care and nursing home care account for bulk of diabetes-related expenses. There is little gender difference in expenditures until age 85. Among the age 85 and over population, however, per capita diabetes costs for men ($1,435) are significantly higher (18 percent) than those for women ($1,170). Men at that age have twice the home health care costs as women and 40 percent more hospital care expenses as well.

Table 5-11: Elderly Per Capita Medical Costs for Diabetes, 1995 & 2010

<table>
<thead>
<tr>
<th>Year and Expenditure Type</th>
<th>Per Capita Costs ($)</th>
<th>By Age Group</th>
<th>Age 75 &amp; Over</th>
<th>Ages 75-84</th>
<th>Ages 85 &amp; Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Care</td>
<td>372</td>
<td>343</td>
<td>461</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physician and Other</td>
<td>114</td>
<td>113</td>
<td>116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>284</td>
<td>223</td>
<td>473</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Health Care</td>
<td>149</td>
<td>146</td>
<td>158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs and Medical Durables</td>
<td>39</td>
<td>40</td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Personal Health Care</td>
<td>958</td>
<td>864</td>
<td>1,244</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Care</td>
<td>796</td>
<td>717</td>
<td>971</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Professional Services</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>710</td>
<td>523</td>
<td>1,127</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Health Care</td>
<td>628</td>
<td>607</td>
<td>676</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs and Medical Durables</td>
<td>123</td>
<td>126</td>
<td>116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Personal Health Care</td>
<td>2,495</td>
<td>2,209</td>
<td>3,134</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Change in Total Per Capita Costs, 1995-2010

| Percentage Change | 161   | 156   | 152   |

Note: Because of rounding, sums for each age group may not equal the totals.

The research has developed projections of elderly per capita diabetes-related costs for the year 2010. These forecasts use the same method and assumptions as the coronary heart disease cost estimates discussed earlier. As shown in Table 5-11, diabetes expenditures for the elderly age 75 and over are expected to increase approximately 160 percent to close to $2,500 per year. Diabetes-related spending for adults 85 and over is projected to be 26 percent higher, $3,134 annually. The biggest growth in expenditures, especially for the oldest old, is expected to come from the increase in nursing home care costs.
5.3.2 Diabetes incidence and costs estimates for Boston region elderly

Within the Boston metro area, diabetes is estimated to occur among the elderly at a slightly reduced rate than it does nationally, affecting approximately 11 percent of seniors (25,000) age 75 and over. Both elderly death rates and elderly hospitalization rates for diabetes are lower for the Boston region than for the nation as a whole. Nationally, the death rate from diabetes for elders 75 and above is 196 per 100,000 population; in the Boston metro area, it is lower, 182 per 100,000. Similarly, the annual hospital discharge rate for diabetes for this age group is 6.4 per 1,000 nationally and only 4.8 per 1,000 for the Boston region (Table 5-12).

| Table 5-12: Elderly Hospitalizations for Diabetes, Boston Region, 1995 |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                | Ages 65-74      | Ages 75 & Over  | Ages 75-84      | Ages 85 & Over  |
| Diabetes                       |                 |                 |                 |                 |
| Total Hospital Discharges      | 1,041           | 1,107           | 840             | 267             |
| Rate Per 1,000 Persons         | 3.8             | 4.8             | 5.1             | 4.0             |
| Diabetes Complications         |                 |                 |                 |                 |
| Total Hospital Discharges      | 1,959           | 2,349           | 1,719           | 630             |
| Rate Per 1,000 Persons         | 7.2             | 10.1            | 10.4            | 9.4             |
| Total                          |                 |                 |                 |                 |
| Total Hospital Discharges      | 3,000           | 3,456           | 2,559           | 897             |
| Rate Per 1,000 Persons         | 11.0            | 14.9            | 15.5            | 13.4            |
| % of Hospitalization Due to    | 65              | 68              | 67              | 70              |
| Complications                  |                 |                 |                 |                 |


Data on elderly hospitalizations for complications from diabetes were available through the Massachusetts Department of Public Health for towns within Massachusetts. Diabetic complications are a significant component of the costs associated with diabetes care and treatment. Table 5-12 presents Boston region elderly hospital discharge data for diabetes alone and diabetic complications. In all of the elderly age groups, close to two-thirds or more of hospital discharges for diabetes are related to diabetes complications and not directly a result of the disease itself.

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19 Ibid.
20 Calculated with data from MA Department of Public Health, MassCHIP database, downloaded June 20, 2000.
21 Comparable data was not found at the national level.
The research has estimated current and 2010 medical expenditures for diabetes among older adults in the Boston metro area. As with the cost estimates for CHD, these figures are based upon national per capita diabetes costs (Table 5-11) and MISPER population estimates. Total current (1995) diabetes-related medical spending for elders in the Boston metro area is estimated at approximately $222 million per year (Table 5-13). Adults age 85 and over account for 36 percent of the expenditures ($80 million); this is a lower rate than that for CHD (44 percent). By 2010, elderly diabetes expenditures for the region are predicted to grow to over $550 million. This spending level represents an increase of $343 million (154 percent) between 1995 and 2010.

Table 5-13: Total Medical Costs for Diabetes Among the Elderly, Boston Area, 1995 & 2010

<table>
<thead>
<tr>
<th>Year and Expenditure Type</th>
<th>1995</th>
<th>2010</th>
<th>Change in Costs, 1995-2010</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Medical Expenditures ($ Million), by Age Group</td>
<td>Age 75 &amp; Over</td>
<td>Ages 75-84</td>
<td>Ages 85 &amp; Over</td>
</tr>
<tr>
<td></td>
<td>Age 75 &amp; Over</td>
<td>1995</td>
<td>2010</td>
<td>343</td>
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<tr>
<td></td>
<td>Ages 75-84</td>
<td>56</td>
<td>39</td>
<td>224</td>
</tr>
<tr>
<td></td>
<td>Ages 85 &amp; Over</td>
<td>29</td>
<td>15</td>
<td>118</td>
</tr>
<tr>
<td>Hospital Care</td>
<td>86</td>
<td>178</td>
<td>343</td>
<td>154</td>
</tr>
<tr>
<td>Physician and Other</td>
<td>26</td>
<td>54</td>
<td>224</td>
<td>157</td>
</tr>
<tr>
<td>Professional Services</td>
<td>29</td>
<td>178</td>
<td>343</td>
<td>154</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>68</td>
<td>163</td>
<td>31</td>
<td>14</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>34</td>
<td>142</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Drugs and Medical Durables</td>
<td>9</td>
<td>28</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>All Personal Health Care</td>
<td>222</td>
<td>367</td>
<td>198</td>
<td>198</td>
</tr>
</tbody>
</table>

Note: Because of rounding, sums for each age group may not equal the totals.
5.4 Summary and comments

Table 5-14 summarizes the estimated 1995 and 2010 health care expenditures for coronary heart disease and diabetes among the elderly in the Boston metro region. By 2010, regional medical expenditures for coronary heart disease and diabetes among people age 75 and over are predicted to grow to $589 million and $565 million respectively. Since the number of older adults in the Boston metro area is expected to increase only minimally (6 percent) between 1995 and 2010, the main driver of these higher costs is the projected inflation in health care prices. Regional home health care costs for CHD and for diabetes are projected to grow by over 300 percent each by 2010. Nursing home care and hospital care expenditures for these diseases are both similarly projected to more than double. Reducing the elderly’s need for these expensive types of care is essential for keeping regional health care costs in check and limiting the future growth in health care spending as the population ages.

<table>
<thead>
<tr>
<th>Total Medical Expenditures ($ Million)</th>
<th>Change 1995-2010</th>
<th>Percentage Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coronary Heart Disease Total</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Care</td>
<td>109</td>
<td>227</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>98</td>
<td>236</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>11</td>
<td>47</td>
</tr>
<tr>
<td><strong>Diabetes Total</strong></td>
<td>222</td>
<td>565</td>
</tr>
<tr>
<td>Hospital Care</td>
<td>86</td>
<td>178</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>68</td>
<td>163</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>34</td>
<td>142</td>
</tr>
</tbody>
</table>

Good access to regular and preventative health care is important for helping the elderly maintain their health as they get older and for reducing the incidence of chronic conditions that are common among older adults such as diabetes and heart disease. More health screenings could make elders aware when they are at risk for developing these diseases, and could also help prevent existing conditions from worsening. These conditions are easy and inexpensive to manage in their earlier stages, and complications from diabetes and coronary heart disease account for much of the health care expenditures for treating these diseases. Good access to care could help reduce chronic disease complications among older adults, as well as the costs that can result from these complications and the treatments they require.
Chapter 6 explores options for improving the elderly’s transportation access to health care. Better connections to health services encourage the elderly to receive care and checkups more frequently, in advance of serious health problems. Better access to care can also help the elderly stay healthy as they age and, therefore, enhance their ability to remain involved in the activities they love and their overall quality of life.
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CHAPTER 6: IMPROVING THE ELDERLY'S TRANSPORTATION ACCESS TO PRIMARY HEALTH CARE: EXAMINING OPTIONS IN THE CONTEXT OF TWO COMMON CHRONIC DISEASES

Improving older adults’ access to regular health care is essential for helping manage many common chronic illnesses, including diabetes and coronary heart disease (CHD). It is also important for preventing the complications and disabilities that are often associated with these illnesses from arising. Better access to preventative care among the elderly can also help slow the anticipated growth in health care expenditures as the elder population increases significantly over the coming decades. Chronic diseases and their complications account for most of the health care resources expended by the elderly. Health care costs for people age 65 and over total an estimated $310 billion (1995). More than one-sixth of this sum goes towards health care spending for diabetes ($26 billion) and for CHD ($27 billion).

For adults 65 and over, almost 70 percent of medical expenditures go towards hospital care (46 percent) and nursing home care (23 percent). For elders 85 and over, these categories account for more than four-fifths of all health care spending (35 percent and 46 percent respectively) (Hodgson and Cohen, 1999b). These types of care contribute disproportionately to total health care expenditures and this spending could be potentially reduced with improvements in the elderly’s access to care. Good access to care can help manage many chronic conditions and decrease the likelihood of complications and the need for hospitalization. Research looking at factors that contribute to potentially preventable hospitalizations among the elderly (age 65 and above) (Culler et al., 1998) found that elders with potentially preventable hospitalizations often had problems obtaining health care. They were also more likely to be age 75 or over, to be in poor health, and to have had coronary heart disease, a heart attack, or diabetes. It is estimated that older adults age 65 and over account for almost half (49 percent) of all potentially preventable hospitalizations (Pappas et al., 1997). Further, it have also been estimated that 30 percent of older adults with diabetes

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1 HCFA data, as reported in NCHS (1999).
2 Potentially preventable hospitalizations involve medical conditions that potentially could be treated in an outpatient setting, if patients “access ... care at the appropriate time, if the appropriate care is prescribed, and if the patient responds to the treatment as expected.” (Culler et al., 1998, 807).
and 32 percent of those with coronary heart disease have had at least one preventable hospitalization (Culler et al., 1998).

In addition to helping reduce hospitalizations among the elderly, better access to care and more patient education can also decrease the likelihood of re-hospitalization following an acute medical event such as a heart attack. Studies have shown that follow-up care and education after hospitalization and discharge for an acute event significantly reduce the number of new unplanned hospital admissions and days spent in the hospital (Stewart et al., 1999a; Stewart et al., 1999b; Naylor et al., 1999). This was found to be the case even for elders particularly at risk for declines in health after their hospital discharges (Naylor et al., 1999).

More preventative care and patient education also increases the monitoring of patients' health conditions and patients' own understanding of their illnesses and their risk factors, and how they can be controlled and further health problems prevented. Research shows that a leading, underlying cause of hospitalizations and re-hospitalizations is patients' failure to take medications as prescribed; better patient education increases medication compliance.

Greater preventative care can result in better patient health without higher health costs (Burton et al., 1995). For certain at-risk populations, such as the elderly and those who have been hospitalized for chronic conditions, better treatment and management can even lead to significant cost savings (Naylor et al., 1999).

There are two primary ways to improve the elderly's transportation access to regular medical care and to help reduce the complications and costs of many chronic diseases. The first involves establishing better transportation services to help seniors travel to health care providers. These services should have characteristics that meet the needs and wants of the elderly population, including good availability and handicapped accessibility. The second option for improving access to care is to offer more home-based health services, through more home contact with nurses and through telehealth technologies. Home-based health care can improve the management of many chronic and potentially disabling diseases, allowing
patients to be checked and monitored on a regular basis from their own homes without having to travel to doctors’ offices and hospitals for checkups.  

Chapter 6 discusses these options for improving the elderly’s access to health care. It presents them in the context of the role these options could have in helping older adults manage chronic diseases such as diabetes and CHD and reducing complications from these conditions. The chapter opens (Section 6.1) by reviewing the recommended care and treatment for diabetes and CHD (the number of doctors’ visits per year, regular tests, etc.). Section 6.2 considers the transportation services that could help improve access to care for these and other conditions. Section 6.3 examines the potential of home-based services and technologies to improve access to health care, especially for the treatment of diabetes and CHD. The chapter closes (Section 6.4) by summarizing the information presented in the earlier sections and by discussing current limits on the potential of home-based technologies.

6.1 Medical care and treatment for diabetes and coronary heart disease

For people suffering from chronic diseases such as diabetes and coronary heart disease (CHD), regular medical care and monitoring is essential for controlling these conditions and preventing complications. It is important that regular checkups include tests to help detect the presence of these diseases even in their early stages so that treatment can be begin as soon as possible. It is estimated that one-third of the people with diabetes (5.4 million) are unaware that they have the disease (ADA, 2000). Similarly, for those with CHD, sometimes the first sign that anything is wrong occurs when they develop serious chest pain or have a heart attack. Regular checkups and tests are especially important for older adults who are at risk for developing these diseases and who are more likely to experience complications and disabilities if they do. Heart disease is the number one cause of hospitalizations and deaths among adults 75 years of age and older. Diabetes ranks eighth for hospitalizations and is the sixth leading cause of death among the same population.

Not all common chronic diseases benefit from increased monitoring and access to treatment. For example, arthritis, the most prevalent common disease among the elderly, is not particularly responsive to increased care or monitoring (though care can help manage arthritis pain). The same is true for chronic respiratory diseases such as emphysema and bronchitis and certain cancers where curative treatments are limited or non-existent and
Section 6.1 overviews the primary tests to detect diabetes and CHD and the recommended treatment and care for people with either of these diseases. The section then focuses on those aspects of care that may require travel to a doctor’s office or health provider, and on patients’ overall access to these health care services.

6.1.1 Medical care for diabetes

Diabetes results from the body’s inability to absorb enough glucose out of the blood stream to provide the body with a sufficient amount of energy. Symptoms of diabetes include excessive thirst, frequent urination, a feeling of tiredness and weakness, and reduced resistance to infections. In Type 2 diabetes, which is common among the elderly, the symptoms often appear years after the initial onset of the disease. Diabetes can be diagnosed using a test that checks for glucose and ketones in the urine. If both are present, it indicates that the patient has diabetes. Sometimes an additional test is conducted to measure glucose content in the blood stream. Blood glucose levels are considered to be a more accurate measure of the body’s total glucose than the amount of glucose found in the urine.

Once diabetes is diagnosed, a plan to manage the disease should be developed together by the doctor and patient. The day-to-day management of diabetes is primarily the responsibility of the diabetic, in consultation with a primary care doctor. Daily diabetes management relies on a combination of healthy eating and meal planning, weight control, exercise, medication (insulin and oral medications), regular glucose monitoring, and foot care. Type 2 diabetes can often be managed with diet and weight control alone. Over 90 percent of Type 2 diabetes cases are related to being overweight, and sometimes a return to normal weight can bring blood glucose levels back to normal.

For people with diabetes, keeping glucose levels as close to normal as possible is essential for preventing diabetic complications. Elevated glucose levels contribute to retinal problems, kidney failure, nerve damage, and heart disease (ADA, 2000); type 2 diabetes is thought to be an underlying factor in up to 75 percent of all heart disease (Tucker, 2000). In addition,
elevated glycohemoglobin levels (which indicate blood glucose levels over a 2-3 period) have been shown to contribute to hospitalization in diabetics (Moss et al., 1999). Despite the importance of maintaining close-to-normal glucose levels, many diabetics, especially those not taking insulin, rarely, if ever, check their glucose levels to see how they doing. Harris et al. (1993) found that among Type 2 diabetics aged 65 and above, 50 percent of those who were taking insulin, and 80 percent of those who were not taking insulin had never checked their glucose levels. Self-monitoring of blood glucose is key to avoiding complications and the “infrequent blood glucose measurements made in the [doctor’s office] during patient visits are insufficient to achieve adequate blood glucose control for the prevention of diabetes complications” (Harris et al., 1993, 1121).

In addition to the basic diabetes management performed at home, periodic tests and screenings should be conducted at doctors’ offices to check for and prevent diabetes complications. These screenings and their recommended frequencies are summarized in Table 6-1. Most of these tests are normally performed as part of a regular visit with one’s doctor. Based on these screening recommendations, it is estimated that diabetes patients should be visiting their regular doctors on a quarterly basis and also going to the ophthalmologist once a year for an eye exam. Current visit frequencies, however, are lower than this. Diabetics aged 65 years and over average only 2 to 3 visits to their doctor per year (Verbrugge and Patrick, 1995) and only 30 percent of diabetics have annual eye screenings. Improving diabetics’ access to care could help increase their health screening and visit rates. This could then in turn help decrease the incidence and costs of diabetic complications.

Table 6-1: Recommended Screenings to Prevent Diabetic Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Screening and Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retinal damage</td>
<td>Eye exam annually</td>
</tr>
<tr>
<td>Kidney function</td>
<td>Check annually</td>
</tr>
<tr>
<td>Foot deformities and nerve damage</td>
<td>Foot exam at least twice a year</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>Check at least annually (more often if blood pressure is elevated above 140/85)</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>Check at least every 5 years, more often (every 1-2 years) if cholesterol level is above 240 mg/dl</td>
</tr>
<tr>
<td>Elevated glycohemoglobin</td>
<td>Check 4 times a year</td>
</tr>
</tbody>
</table>

Adapted from table in Levin and Pfeiffer, 1998, Appendix.
6.1.2 Medical care for coronary heart disease

Coronary heart disease (CHD) occurs when arteriosclerosis in the coronary arteries obstructs blood and oxygen flow to the heart. The major risk factors for developing CHD include high blood pressure, high cholesterol, lack of exercise, obesity, smoking, stress, and diabetes. Having a number of these factors can indicate the presence of CHD. CHD symptoms also include severe chest pain.

CHD is diagnosed and evaluated using a variety of tests including an exercise stress test with electrocardiography (ECG), radioisotope scanning, echocardiography, and magnetic resonance imaging (MRI). These tests supply information about blood flow in the coronary arteries and the extent of damage, if any, to the heart. Sometimes an additional procedure, coronary angiography, is performed to detect blockage or narrowing in the arteries. This test provides the most detailed information about the condition of the arteries. However, because of the complications and risks associated with this procedure, it is usually only performed if surgery is already being considered. (AMA, 1994)

If CHD is diagnosed, a plan to treat it should be developed together by doctor and patient. No matter what the extent of the CHD, this plan should include ways to reduce the patient’s CHD risk factors. All CHD patients, no matter how advanced their disease, can benefit from controlling the disease’s risk factors and preventing further disease progression. The risks of CHD can be reduced by stopping smoking, exercising regularly, eating a healthy diet, and controlling one’s weight. Taking these actions can also help lower high cholesterol and blood pressure levels, which are two other risk factors. For some patients, however, medication may be the only way to lower cholesterol and blood pressure to acceptable levels. For patients with serious CHD, treatment may include heart medications or surgery. The two primary surgeries for CHD are balloon angioplasty and coronary bypasses.

With the doctor’s support and advice, the patient oversees most of the day-to-day management and treatment of CHD. CHD patients without any serious problems or

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4A recent large-scale study of 84,000 women tracked over 14 years (Stampfer et al., 2000) found that a health lifestyle which included a nutritious diet, regular exercise, no smoking, and alcohol consumption only in moderation, reduced the risk of developing coronary heart disease by over 80 percent.
complications visit their doctors only periodically for blood pressure, cholesterol, and weight
checks, and to report on how well they are managing the disease’s risk factors. CHD patients
aged 65 and over average between 1 and 2 visits to their doctors annually for CHD care
(Verbrugge and Patrick, 1995). This seems a reasonable number of doctors’ visits for these
patients.

For patients with more advanced CHD and complications, more frequent care and monitoring
by doctors is called for. Patients who experience a heart attack or who undergo surgery for
CHD are often hospitalized for a week or more afterwards, with much of the time spent in
intensive care. After they are released from the hospital, they often need months of close
monitoring by medical professionals, and rehabilitation. Depending on the individual
patient’s heart problems and general health, rehabilitation may last 6 months or more.
Patients who are frail and unable to care for themselves independently following the heart
attack or surgery, and any consequent complications may be sent to an extended care facility
such as a nursing home and undergo rehabilitation there, instead of being based at home. This
is most likely to happen to patients who have other serious health problems or functional
limitations. Other patients in poor health may use home health care services and rely on home
care nurses to provide their basic care and treatment. The elderly are large users of both of
home care and nursing home services. Patients healthy enough not to need either of these
services should still have regular doctors’ visits during the rehabilitation period. Initially,
doctors’ visits may occur on a weekly basis, or even more often; eventually, they generally
taper off to monthly, quarterly, or less.

There is little specific data about the level of access that CHD patients have to post-hospital
discharge care, though there are some indications of inadequacies and problems. After
hospital discharges for CHD, elderly patients often experience declines in their condition and
end up being re-hospitalized within a month or less. In addition, among patients age 65 years
and over, angina (severe chest pain) accounts for 16 percent of potentially preventable
hospitalizations (Culler et al., 1998). Better access to care could reduce further
hospitalizations in CHD patient. Another indication of problems in accessing care is the lack
of participation in cardiac rehabilitation exercise programs. Cardiac rehabilitation programs
have many benefits – among them, improving aerobic capacity and decreasing chest pain, shortness of breath, and cardiovascular death. Despite these positive outcomes, typically only 15 percent of patients who are eligible for these programs participate in them. Work by Ades et al. (1992) found that access issues, including the lack of transportation, geographic distance, and work and time constraints, all contribute to low participation.

A third access issue is the tremendous recent decrease (45 percent between 1997 and 1999) in national Medicare home health care funding. Additional reductions of 15 percent are slated for next year. These declines in funding mean that fewer CHD patients will have access to home health care, or that those with access will have less than they used to, and possibly less frequent home health care visits. As a result, they will have to travel for care more frequently, enter a nursing home to receive care, or go without care altogether. Addressing these issues and providing better access to care for post-discharge patients is essential for helping them recover from surgery and heart disease, and helping them achieve fuller, healthier lives.

6.2 Transportation service options for improving the elderly’s access to care

As earlier chapters have discussed, elderly people, even those who do not drive, often have a range of transportation options, public as well as private, for accessing medical care. Fixed-route bus service often includes stops at local or regional medical centers. In addition, although paratransit and elderly transit services vary significantly between communities, at a bare minimum, they usually provide transportation for doctor appointments. In some communities, hospitals and medical centers run their own patient shuttles or have voucher programs to subsidize taxi trips for patients with no other transportation alternatives. In other cases, volunteer programs run through the American Heart Association and local service groups offer medical trips on an as-needed basis. Moreover, beyond these options, there are always the informal transportation networks provided by friends and family, and the convenient but often expensive regular-fare rides offered by taxi services. Most elderly feel that the transportation alternatives available to help them access medical services are
sufficient for their needs. A survey of Medicare beneficiaries showed only 6 percent of those ages 75 and over were “not satisfied with the ease of getting to [the] doctor.”

Although most older adults have decent access to medical care, there is still considerable room for improvement. The 6 percent of elderly reporting dissatisfaction with their ability to get to the doctor represents over 1 million people aged 75 and over nationwide. Additionally, especially in outlying suburbs and rural communities, services that transport elders to medical appointments can be insufficient to meet demand. In many areas, paratransit and senior transit programs are small in scale, with only a few vehicles in total. As a result, people who wish to use these services may have to reserve a ride far in advance, and if a person becomes ill or has an injury and wants to visit their doctor on short notice, these services may be unable to accommodate them. Another potential issue involves public programs with strict limits on who qualifies for transportation services (i.e. only persons below a certain income level, certain degree of disability, etc.) Depending on where they live and what other services are available in their area, elders who just miss qualifying for these transportation programs may have almost as much need for transportation help as those who do qualify. For example, older adults with incomes slightly above the maximum income limit for some transportation assistance programs would likely still find taxis and other private transportation services to be too cost-prohibitive. Unless other, less-expensive options are available to them, they may have difficulties making their medical trips.

A further problem concerns the lack of programs that provide transportation to medical facilities beyond local service areas. Most elderly transportation services are locally-based and serve only a limited number of communities. This is generally not a problem for older adults residing in cities with good availability of comprehensive medical care. However, elders living in low-density rural or suburban areas with few medical providers occasionally need to make trips to large medical facilities or specialists beyond their local area. There are few services to help them with these trips. In fact, in Massachusetts, the Executive Office of Elder Affairs views the need for long-distance medical transportation to as a major unmet need for seniors across the state (MA Executive Office of Elder Affairs, 1998).

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6.3 Health care services that reduce the need to travel for medical care

Home-based health care offers an important service for the elderly. Home-based health care can be used by those older adults who live a long distance from medical services. It is also an key option for older adults with frailty or disabilities who have difficulty traveling to receive routine medical care. If not for home visits, some frail elders would probably receive no routine care at all (Fried et al., 1998). As people age and become frailer, more of their contact with health care professionals generally does occur at home. For persons under age 65, only 2 percent of physician contacts⁶ occur at home. Over age 65, home contacts account for almost 20 percent of the total, and the home contact percentage grows for each successive age group, from 10 percent of contacts for people aged 65-74 to 38 percent of contacts for people ages 85 and over (NCHS, 1999).

As was already briefly mentioned, the elderly’s current level of access to home health care has been recently been threatened because of Congressional actions to limit Medicare spending and spending increases. Between 1997 and 1999, Medicare funding for home health care services fell 45 percent, dropping from $17.7 billion to $9.7 billion. Ad additional 15 percent in funding cuts in slated for this year. Since the cuts began in 1997, nationwide, more than 2,500 agencies that deliver home health care services have been forced to close,⁷ and the number of people receiving home health care services has declined by approximately 20 percent. The people most at risk for losing home health care in this environment are frail and disabled elders. As the NY Times reported in a recent editorial (April 24, 2000), “reports from across the country indicate that the most disabled are being rejected or forced from [home health care] rolls. Home health care agencies are spurning old people whose care may cost them more, they fear, than they can be reimbursed.”

With the growing emphasis on controlling health care costs, it will be increasingly important for home health care programs to demonstrate their cost-effectiveness and their ability to help lower overall costs. Two home heath care options with high potential to deliver quality health

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⁶ Contacts include visits to doctors’ offices, outpatient clinics, and emergency rooms, home care, and phone consultations.
care to the elderly at lower costs are short-term home-based intervention (HBI) programs following hospital discharges, and telehealth home care technologies which supplement or substitute for traditional home health care. Although these options have only been tried on a limited and small-scale basis, their preliminary results are promising. Studies have shown that both of these options can have significant, positive impacts, including increasing patient self-care and monitoring, decreasing complications, and lowering the need for hospitalization and emergency medical care, two of the most expensive medical services. The rest of this chapter discusses HBI programs and telehealth care systems in more detail.

6.3.1 Home-based interventions following hospital discharges

Home-based medical care can be a valuable tool for helping the elderly avoid acute medical incidences that require emergency care or hospitalization. Home-based care, even on a short-term basis, has been shown to be effective in helping manage patient illnesses, and in educating and enabling patients to better manage themselves. A small number of studies have examined the impacts of home-based interventions (HBIs) by health professionals following hospital discharges by the elderly for chronic conditions. These studies have generally found that HBIs lead to positive effects on patient outcomes and health, and are even more effective than office visits alone. Naylor et al. (1999) evaluated the effectiveness of HBIs and nurse discharge planning for elders especially at risk for re-hospitalization following discharge. The control patients in their study received routine follow-up care after leaving the hospital: follow-up outpatient appointments with their doctors and basic home care if they were referred for it. The intervention group received more intensive care including at least two home visits by advanced practice nurses (APNs) specializing in geriatrics, at least weekly telephone contacts with these nurses, and APN availability via telephone 7 days a week. In the home visits, the APNs conducted complete physical and environmental assessments. Based on individual patient needs, the APNs then focused the intervention and counseling on areas such as medications, diet, exercise, symptom management, sleep, and medical follow-up. Adjustments to medication and treatment were also made when necessary. HBIs led to

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8 Patient characteristics related to a higher risk of re-hospitalization include being age 80 or over, having an inadequate social support system, having had multiple hospitalizations within the last six months, being in poor
better patient outcomes over the study period; patients were followed for 24 weeks after initial discharge. Compared to control patients, intervention patients had statistically significant fewer hospital re-admissions (20 percent intervention patients readmitted within 24 weeks v. 37 percent for controls), fewer multiple re-admissions (6 percent v. 14 percent), a longer time to re-hospitalization (17 percent v. 47 percent re-hospitalized within 6 weeks of initial discharge), and fewer total new days spent in the hospital (1.5 days v. 4.1 days).

Other research has produced similar results. Work by Stewart et al. (1998) looked at the impact of HBIs on elderly patients with various chronic diseases and found that HBIs decreased the number of hospital re-admissions. Follow-up studies by Stewart and his colleagues then examined the impacts of HBIs on elderly patients with chronic heart failure.

In two studies of older adults with CHF, Stewart et al. (1999a, 1999b) assessed the effectiveness of HBIs following hospital discharge. In both studies, control patients had post-discharge outpatient appointments with their doctors or with a cardiology clinic and follow-up through the study period (6 months (Stewart et al., 1999a) or 18 months (Stewart et al., 1999b) following initial discharge). The intervention patients also had appointments with their doctors and in addition, received a home visit by a cardiac nurse within 1 to 2 weeks after discharge. During these visits, the nurses assessed each patients' progress since discharge, their compliance with their medication and treatment regimen, and their understanding of their condition and treatment. Based on the nurse’s assessment, patients then received follow-up counseling, as appropriate, regarding diet, exercise, and ways to monitor their illnesses. In addition, adjustments were made to patients' medication and treatment when changes were called for. After the initial visit, nurses contacted patients at regular intervals (usually every 3 months) via telephone to assess their progress and arrange to additional follow-up care or treatment adjustments if necessary. No other home visits were conducted, except for in the second study (Stewart et al., 1999b) where home visits were repeated for patients with two or more unplanned hospital re-admissions during the study period. Both of the studies showed statistically significant reductions in hospital re-
admissions and total days of hospitalization. These results are particularly noteworthy for the longer of the two studies (Stewart et al., 1999b) which demonstrated that the health benefits of even a single intensive home nursing visit can extend for well over a year.

All the HBI studies discussed here found that the intervention patients had lower hospital care costs over the study period than the control patients did. These lower costs resulted primarily from the smaller amount of re-hospitalization among the intervention group. In addition, Naylor et al. (1999) found that the HBI, despite its intensive nature, resulted in lower health costs overall for the intervention patients.

The success of the HBI programs comes from a combination of factors. The nurses in these programs all have advanced training (advanced degrees or specialization) beyond that of the typical visiting nurse. This training can help them assess patients more accurately than they could otherwise. In addition, the intensive nature of the home-based interaction (even with only one visit) facilitates a more thorough patient assessment than can be achieved in a short doctor’s office visit. The HBI nurses are able to evaluate how patients are doing in a home setting and how they are responding to their current treatment regimens. The nurses can then alert a patient’s doctor if the patient’s health has deteriorated since discharge or if changes in treatment may be appropriate. Through the HBIs, the nurses are also better able to identify patient characteristics and behaviors that may contribute to long-term decline. For example, as mentioned earlier, a leading cause of hospitalization is patient non-compliance with their medications. In an office setting, doctors may overestimate patient adherence to medication and other treatment because they rely on the information provided by patients and patients may overstate their compliance. With the HBI, the nurses can see for themselves what patients are doing. Stewart et al. (1999a, 1999b) found that before the home-based visit, between 25 and 50 percent patients were not taking their medications as prescribed. They also saw that shortly after the HBI, patients had a better understanding of their medications. The home-based counseling provided with the HBI allows patients and their caretakers to become more informed about the chronic conditions and how to monitor and manage them effectively. Educating HBI patients helps empower them and gives them more control over their illnesses. The HBI studies suggest that this education and the resulting greater patient
self-management contributed to their positive health outcomes over the studies’ duration. It is also reasonable to think that at least some of the skills and knowledge learned through the HBI counseling would stay with patients beyond a 6 to 18 month time frame. If so, positive health benefits and reduced hospitalization costs could result even over a longer time horizon.9

The HBI studies to date have been limited in scale, with only a small number of participants. It is unclear whether HBIs would have the same positive results for a larger population. Intuitively, it would seem that most patients with severe chronic illnesses (i.e. those who have been hospitalized) would benefit from counseling and at-home interventions and assessments. However, no clinical studies have yet shown that definitively. Additionally, even if HBIs are found to be effective at producing good patient outcomes and reducing health care costs, it is uncertain whether HBIs would ever be implemented on a large scale. In recent years, the demand for home health care has grown exponentially and the home nursing supply has not kept pace. Over 1.5 million home health visits take place daily in this country (Wheeler, 1998); this number would be even higher if everyone interested in home health care could receive it. There is especially high demand for nurses with specialty training, such as the APNs and cardiac nurses who participated in the HBI studies. There are also questions about the costs of home-based care ($100 or more per visit for a registered nurse) and medical insurers’ willingness to pay for it. In this era of growing emphasis on managing health care and controlling costs, insurers may be unlikely to support an increase in home nursing services or HBIs, even though they could result in lower health care costs overall.

6.3.2 Overview of telehealth home care

Telehealth is an emerging medical field with great potential to improve chronic disease patients’ access to health care, even from their own homes. It also offers an important alternative and supplement to traditional home care services, which, as discussed above, can be expensive and limited in availability. Telehealth and the related field of telemedicine have been defined in a variety of ways. Telehealth generally refers to the use of the telecommunication systems for remote health monitoring, education, and promotion; whereas

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9 No studies have yet to this author’s knowledge looked at the longer-term outcomes of short-term HBIs.
telemedicine is usually defined more narrowly and emphasizes the clinical, medical aspects of care (Darkins and Cary, 2000).

Telehealth home care includes a large spectrum of activities and varying degrees of complexity. At its most basic, telehealth care involves automated phone messages that remind patients when medications should be taken or refilled or when there are upcoming doctors’ appointments (Balas et al., 1997). At the next level, it includes patients checking their basic vital signs (i.e. blood pressure, pulse, and temperature) and other relevant data (i.e. blood glucose levels for patients on insulin) with a monitoring system in their homes. This data can then be sent electronically to keep the medical provider informed of the patients’ condition. If data values are out of normal range, the system may automatically send a message or telephone to alert the provider. Also, based on the transmitted data, a nurse or other medical professional may decide make remote adjustments to medication levels for IV or insulin patients.

At its most sophisticated, telehealth care involves teleconference visits between patients and nurses. The visits are conducted using video devices and phone lines and home monitoring equipment that transmits patient data. At a minimum, the home monitoring systems check basic vital signs; however, they can be more complex and include telephonic stethoscopes and other measuring tools and electrocardiogram machines. During a telehealth visit, the patient and nurse talk with each other, and the nurse checks on the patient status and may recommend dietary or activity changes if necessary. After the visit, the nurse will let the patients’ doctor(s) know if any medical problems presented during the visit and discuss whether treatment adjustments may be indicated. The nurse will then follow-up with the patient afterwards. A telehealth home-care visit is very similar to a regular home-care visit with the major exception being that patients and nurses are not in the same room, but are communicating over a distance. Some patients in telehealth home-care studies report missing the in-person interactions provided by home nurses, though most seem satisfied with the telehealth visits.

Telehealth home care can have a number of benefits. It can give patients a more active role monitoring and managing their health and chronic illnesses. It can also help patients have
more frequent contact with the health care system than they would have otherwise; some
telehealth systems even include 24-hour access. Additionally, when monitoring systems are
installed, better data is obtained on a patient’s condition and the changes that occur on a day-
to-day basis. Without a monitoring system, data is only collected when doctors’ or home care
visits take place and provides a less complete picture of a patient’s status. Telehealth home
care visits are also significantly less expensive than regular home care visits ($20-30 v. $100)
(Wheeler, 1998; Kinsella, 1999). These cost savings result primarily from nurses’ reductions
in travel and travel time when they don’t need to physically visit each patient. Because they
don’t need to travel as much, the nurses are able to check in with more patients: 15 to 20 per
day with a telehealth system, compared to 5 to 6 daily with traditional visits. Because more
patients can be cared for on a daily basis, the frequency of contacts with each patient could be
expanded. Also, total patient loads could be increased to meet the anticipated demand as the
population ages. Moreover, in the future there may be even more benefits generated from the
reduced need for nurses to travel to patients’ homes. This country is already experiencing
increasing suburbanization and aging of the population in suburban communities, and these
trends are projected to continue. As more home health care patients (typically, the elderly)
live in suburban communities, it will take more time and resources to provide them with
quality at-home care, and in fact it may become cost-prohibitive to do so. Telehealth care and
home visits can also offer an important way for these elders to improve their access to health
care services while reducing their need to travel for care.

6.3.3 Telehealth services in combination with traditional home care visits

Even when traditional home health care is available, it has been shown to produce better
patient outcomes when combined with telehealth home monitoring. A study in Japan
(Nakamura et al., 1999) examined the impacts of supplementing home care services with
videophone communication systems. Regular home health care patients in the study received
3 to 4 visits per week by health care workers. Videophone patients had regular home care at
the same frequency and also received 3 to 4 visits weekly via videophone. The average time
health care workers spent interacting with patients was almost the same for both groups (only
10 minutes greater per week for the videophone patients). However, when travel times to
home visits were included, slightly more time (13 minutes per week) was spent on the regular patients than the videophone ones. Although the time spent on care for both groups was similar, the videophone patients had much better patient outcomes by the end of the 4-month study period. They experienced improved independence in the activities of daily living (ADLs) and improved communications independence, whereas the regular patients had declines in both these areas.

A recent Kaiser Permanente study (Johnston et al., 2000) also looked at the benefits of telehealth technologies combined with home health visits over home health care alone. Participating patients had been diagnosed with chronic illnesses and were anticipated to need home care at least twice a week over a four-week period. Control patients in the study had access to routine home health care, including in-person home visits and phone visits with nurses during regular business hours. The intervention group had remote home visits via a video system as well as the in-person and phone visits. The video system also gave the intervention group access to a home care nurse 24 hours a day. Over the time of their participation in the study, control patients averaged 11.1 in-home visits. Intervention patients averaged 13.7 visits, 9.8 in-home visits and 3.9 via video. The mean visit length of visits was 45 minutes for in-person care and 18 minutes for remote care. In terms of total time of visits, this translates to an average of 500 minutes of visits for the control group over the study period and 511 minutes of visits for the intervention group, basically the same between the two groups. Over 90 percent of the intervention patients were happy with the remote visits and appreciated having the additional access to care. Overall, the costs of care (excluding home care costs) varied considerably more ($2,675 per control patient v. $1,950 per intervention patient); this cost difference was largely attributable to the greater hospital usage and costs for the control group. For home care costs, expenses were higher for the intervention group if the full cost of the video and telecommunications equipment was included for the group’s costs. However, if only depreciation expenses were included, the home health care costs for the two groups were comparable, and the total savings from the intervention (approximately $900 per patient) therefore considerable. Because of the results of this study and the demonstrated potential for costs savings with telehealth visits, Kaiser Permanente has now begun offering telehealth home care as a standard care option for
selected patients. Patients in the program receive about half of their home care via the remote video system.

6.3.4 Telehealth programs that help monitor and manage chronic diseases

The telehealth home visits and interventions discussed earlier in Chapter 6 offer strategies that could potentially be very useful for monitoring and managing certain patient populations. The studies mentioned above found that these types of programs can help produce better outcomes in patients who are the most at-risk for complications or hospitalization and can do so at little, or no, added cost. These programs can be beneficial to patients with a variety of chronic illnesses, including diabetes, congestive heart failures, chronic pulmonary diseases, and any other chronic conditions where monitoring and care can prevent health problems from worsening.

Many patients with chronic illnesses, however, may not have access to such intensive types of care. Thus far, they have been organized in only a few geographic areas and had only a small number of total participants. Scarce health care resources and questions about reimbursement by insurers may limit their future expansion. Also, if a condition is not serious enough, patients may not qualify to participate in these types of programs.

Telehealth home visits and other intensive telehealth options cover only one area of telehealth care. Telehealth services include a variety of other, less intensive options such as automated messaging systems. These types of options may be also be effective in improving patient health and may be much easier to implement on a large scale. Much of the telehealth research so far has looked at systems that could be used to help treat diabetes or chronic heart problems. This section presents an overview of the some of the less-intensive programs that have been tried or proposed as ways to help monitor and manage these two chronic illnesses. Most of these programs have promise to improve both patients’ access to care and overall long-term outcomes, and to do so without tremendous cost.
Telehealth programs for managing diabetes\textsuperscript{10}

As was discussed earlier in this chapter (Section 6.1.1) managing blood glucose levels and keeping them as close to normal as possible is essential for controlling diabetes and preventing complications. Because it is so important, blood glucose monitoring and management has been the focus of most telehealth initiatives aimed at the diabetic population. Table 6-2 summarizes recent glucose monitoring studies. In all of them, data on patient glucose levels were transferred to the health care provider at regular intervals (i.e. weekly or daily). Some studies (Ahring et al., 1992; Shultz et al., 1992) used glucometers hooked to modems to transmit data directly. Others (Albisser et al., 1996; Billard et al., 1991) had patients call in their glucose readings and enter them through an automated system. In each case, the medical provider reviewed the transferred data and then provided follow-up remote (i.e. telephone or voice-mail) counseling to patients to recommend changes in diet or medication as necessary. Each of the studies found the increase in glucose monitoring to have a positive effect on patient status, with participants in each experiencing a statistically significant decrease in their glycohemoglobin levels. A number of the researchers wondered if this finding was only a temporary effect and due to patients' excitement about using a new technology. However, others pointed to the fact that patients' interest and level of participation (i.e. phone check-ins per month) had remained constant throughout the study period, even in the year-long study by Albisser et al. (1996), to suggest that the results could in fact be sustainable over the longer term.

<table>
<thead>
<tr>
<th>Study</th>
<th>Method of Data Transfer</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahring et al., 1992</td>
<td>Transmission of glucometer data over modem</td>
<td>Glycohemoglobin levels decreased by 13.2% (P&lt;0.05)</td>
</tr>
<tr>
<td>Albisser et al., 1996</td>
<td>Patients telephone provider system to enter glucose levels</td>
<td>Glycohemoglobin levels decreased by 11.2% (P&lt;0.001)</td>
</tr>
<tr>
<td>Billard et al., 1991</td>
<td>Patients telephone provider system to enter glucose levels</td>
<td>Glycohemoglobin levels decreased by 4.3% (P&lt;0.05)</td>
</tr>
<tr>
<td>Shultz et al., 1992</td>
<td>Transmission of glucometer data over modem</td>
<td>Glycohemoglobin levels decreased (P&lt;0.001)</td>
</tr>
</tbody>
</table>

Based on table in Balas et al., 1997, which referenced some of these same studies.

\textsuperscript{10} Most of the programs discussed in this section included both elderly and non-elderly diabetic patients and reported few, if any, results differentiated by age.
Some telehealth diabetes initiatives have also looked at broader patient care. An advanced version of the system used by Albisser et al. (1996) had each patient record information on their recent food intake, appetite, stress and exercise levels, etc. relative to normal (i.e. more appetite, less appetite, same) in addition to the basic glucose measurements. The medical provider then used the sum of all that information to assess the patient and make recommendations.

A program developed by Piette and Mah (1997) checks on diabetic patients using an automated voice messaging (AVM) system. The system calls the participating patients at a time they have said would be convenient and asks them 9 basic questions about their health and their diabetes management. Patients respond to the questions by pressing telephone digits corresponding with possible multiple choice answers. Patients are then given the option to listen to informational messages about specific aspects of managing diabetes, such as eye exams, diet, exercise, etc. If a patient reports any serious problems, they receive a call from a human care provider who follows up and checks to make sure the patient obtains appropriate care. In the pilot study for Piette and Mah's AVM system almost 100 percent of participants said they found it helpful, with close to 90 percent being interested in receiving more AVM calls. Additionally, over three-quarters (77 percent) said that receiving AVM calls would make them more satisfied with their healthcare. Piette and Mah estimated that running a full-scale version of their system would cost less than 5-10 percent of the costs for a comparable system where the calls were made by medical staff, instead of a computer. Though they didn’t measure the impact of the AVM program on patient outcomes, leaving that question to further research, their results demonstrate such AVM systems could be a useful way to improve patient monitoring and overall access to care. One benefit of these types of systems which will become especially significant as the population becomes more racial diverse is the ability to program the AVM systems to interact with patients in their native languages.

11 These questions included – How were you feeling this past week? Have you had any chest pain? Have you had foot problems? Have you had any symptoms of hypoglycemia? (Main symptoms were listed during call) Have you had any symptoms of hyperglycemia? (Symptoms listed) What was your blood sugar count the last time you checked? Did you measure your blood sugar level in the past week? How often do you take your prescribed medications as prescribed? How often do you follow the diet recommended by your doctor?
Bellazzi et al. (1998) have developed a home telemedicine system for managing and adjusting insulin medications. The system includes a basic computer unit and glucometer in the patient’s home (patient unit (PU)) and a more complicated computer unit at the medical facility (medical unit (MU). The PU collects data (from the glucometer and patient inputs) and periodically transmits to the MU, performs basic data analysis, and makes small adjustments to insulin dosages when necessary. The PU also generates advice to patients and alerts the medical provider if a potential problem arises. The MU analyzes data sent by the PU and provides the patient’s physician with recommendations regarding the patient protocol and potential adjustments to treatment. The physician reviews these recommendations and may then make changes to the patient protocol recorded in the MU. Treatment is adjusted accordingly through the PU. This system is interesting because it functions with a fair amount of independence. The patient and the PU can adjust insulin dosages (slightly) without contacting the physician and the MU has a complex decision-making system and library of protocols that allow it to generate recommendations on its own. This quality helps make the system a cost-effective means for managing diabetic patient treatment. Also, through its continuous monitoring, it presents a way for patients to receive more frequent and thorough care from their own homes.

One last telehealth system for diabetics focuses on preventing one of most common diabetes complications, disease of the retina. The system was developed by Professor R. Zeimer at John Hopkins in response to the small percentage of diabetics who have annual eye exams. Although it is recommended that all diabetics have a yearly eye exam, only 30 percent of them do because it requires a separate trip to an ophthalmologist. This new system reduces the need for this extra journey. Zeimer developed a device that regular doctors can use to take pictures of the retina and store the image. During a diabetic’s visit to their primary doctor (they typically have 2-3 visits per year), the doctor can use this device and then send the image of the patient’s retina to an ophthalmologist via e-mail. The ophthalmologist then reviews the image for potential problems and notifies the primary doctor if the patient needs treatment. The system improves patients’ access to preventative eye care by reducing their

need to make extra trips to receive this care. It is possible that eventually, a similar system could be developed for use in the patient’s home; this could further reduce the diabetic’s need to travel to eye care.

**Telehealth programs for managing coronary heart disease**

Telehealth initiatives for managing coronary heart disease (CHD) have focused on providing services to people with serious CHD symptoms or complications, most of whom are elderly. Although there is potential for telehealth programs to assist people with early stage CHD, the treatment required in the disease’s initial phases is relatively minor, involving periodic monitoring of CHD’s risk factors. In the disease’s more advanced stages, considerably more care is needed. For example, congestive heart failure, one of the potential complications of CHD, is the leading cause of hospitalizations in this country. Similarly, people who have had heart attacks or coronary surgery often require months of intensive treatment and rehabilitation. Because advanced CHD patients need a heightened level of care to prevent even more complications, and because of the expenses of managing advanced CHD, and its complications contribute disproportionately to health care costs in the country, the telehealth programs aimed at CHD have concentrated on these patients. Some of these programs are briefly described below.

Many of the general telehealth home care pilot programs have included a large number of patients who had serious heart disease, heart attacks, or congestive failure. For example, more than one-third (36 percent) of the participants in Kaiser Permanente’s initial home care telehealth program (Johnston et al., 2000) had a primary diagnosis of congestive heart failure. Heart patients need frequent monitoring and telehealth home-based services offer a good option for providing this care. Home-based monitoring equipment can check vital signs and blood pressure, and even generate electrocardiograms (ECGs), and automated messages can remind patients to take their medications. These systems can then be supplemented by home nursing visits via video and telephone calls that provide human-based contact and facilitate monitoring of the more qualitative aspects of the patient’s health.

Telehealth home programs aimed at heart patients have been shown to improve patient outcomes and reduce hospitalization. A recent study by Shah et al. (1998) measured the
impact that a moderate-level telehealth program for CHF patients had on their hospital admission rates and found significant improvements. Under the program, patients were given educational materials about CHF. They also patients received a digital blood pressure measuring device, a digit scale, and a pager. The pager was used to send messages reminding participants to take their medications and measure and record their weight, heart rate, and blood pressure. A nurse contacted the patients by phone once a week to discuss their condition and to receive the recorded data. Patients could also contact a nurse by phone 24 hours a day to report any problems or changes in their condition. If serious problems arose, there was immediate follow-up with the patient's cardiologist. In the absence of any such problems, the cardiologist reviewed the patient's data once a month and would contact the patient at that time if necessary. The program was conducted for a year and the average length of participation was 8.5 months. After patients participated in the study, their number of hospitalizations for heart problems per year dropped to half their pre-participation levels (0.3 hospitalizations per patient after the study compared to 0.6 before). Additionally, their total days spent in the hospital for heart problems declined 90 percent, from 7.8 per patient before the study to 0.7 per patient, post-study. These improvements were generated at the same time that the nurses' and patients' need to travel was reduced.

Another telehealth study focused on decreasing patients' need to travel to participate in cardiac rehabilitation programs following an acute coronary event such as a heart attack or surgery (Ades et al., 2000). The benefits of cardiac rehabilitation programs are well-known; they include "increased exercise capacity, decreased symptoms of angina and dyspnea [shortness of breath], improved psychosocial well-being and stress levels, and reduced rates of total and cardiovascular mortality" (Ades et al., 2000, 543). Despite these positive results, only 15 percent of patients who are eligible for these programs partake in them.

Transportation issues and lack of geographic accessibility are two reasons that participation rates are so low, especially for older patients (Ades et al., 1992).

In the trial study by Ades and colleagues (2000), they tested a cardiac rehabilitation program that was based in patients' homes and measured its effectiveness against that of the traditional programs conducted on-site at medical centers. For each rehabilitation session, home
program participants were monitored from a remote site via an electrocardiogram machine hooked to a modem and a telephone connection. The telephone hookup allowed participants to communicate with the staff overseeing the session and other program participants. The home sessions followed the same format as those on-site: warm-up and stretching, aerobic exercise with increasing intensity, and cool-down. Exercise sessions were stopped if patients experienced any chest pain or problems. (This happened only 7 times over 3,100 hours of patient-sessions during the 3-month study). At the end of the study, patient improvements in the home-based program were comparable to those in the traditional version, and both groups had heightened peak aerobic activity, more energy, less pain, and higher overall physical and social functioning. These results suggest that home-based programs can be effective for improving patient health. By reducing the need to travel and offering more scheduling flexibility, since patients can participate when it’s convenient for them, they also remove potential barriers to program participation. Additionally, Ades et al. believe that home-based rehab programs could offer cost savings over traditional programs. This is especially true for low and moderate-risk heart patients who would require less real-time monitoring than was provided in the trial study.

As was discussed earlier, telehealth initiatives for heart patients have primarily been aimed at patients with advanced CHD and cardiac complications. These programs are important, since these patients need regular monitoring and are highly at risk for further problems. Nonetheless, focusing on this population exclusively neglects the potential of basic telehealth technologies to help people with early stage CHD and those at-risk for developing this disease. People with early stage CHD need relatively only a small degree of care and intervention, much of which could be provided with basic telehealth services. For example, automated voice messages could remind people to check their blood pressure and cholesterol regularly, refill medications, and follow exercise and diet guidelines. At a slightly more involved level, a program such as the automated system organized by Piette and Mah (1997) could call patients a few times a year and interactively check on their status. Such simple types of measures can still improve patients’ access to care and their ability to care for themselves.
6.4 Summary and comments

As the number of elderly, particularly older elderly, grows significantly in the coming decades, it will be important to ensure that health expenditures for older adults do not experience the same levels of growth. Improving the elderly’s access to health care, especially preventative and routine care, is essential for keeping increases in health care costs in check. Medical expenditures for older adults stem largely from the occurrence of chronic conditions, such as diabetes and heart disease, and the complications that can result with inadequate care and poor access to medical services. Complications can lead to costly surgeries and an increased need for expensive nursing home and hospital care. Chronic conditions and their complications can also decrease the elderly’s quality of life.

There are two primary alternatives for promoting better access to health care for the elderly. The first is to improve and expand the services that provide transportation to medical appointments. Better transportation options to medical services could make the elderly more likely to receive regular care and could also decrease their use of emergency medical resources. Although most elderly do not feel that transportation is a major issue in their ability to reach care, there are over 1 million older adults for whom transportation access is a problem. Because of their difficulties in accessing care, this population may be less likely to see their doctors on a regular basis. This puts them at increased risk for health problems that could be prevented or controlled with regular visits and care.

The second option for improving the elderly’s access to health care is to increase the use of home health care services. Health care provided at home is automatically accessible – no travel required – and research has shown that home services, even as little as one home health care visit, can lead to a significant reduction in the need for future hospitalization. Home care services are particularly effective when combined with telehealth technologies that allow for more patient self-monitoring and decrease the need for health care workers to make in-person patient visits. With home care visits via phone or video, home care nurses can check-in with more patients each day, and each patient more often. Largely because of saved travel and travel time by nurses, video home care visits are estimated to cost only one-quarter to one-third as much as traditional home care visits ($20-30 v. $100). Telehealth care also provides a
way for patients to avoid having to make a physical trip to the doctor to receive health care services. For patients most at risk for health problems and complications, and who are frequent users of health care services, telehealth home interventions have proven particularly cost-effective. For example, in a pilot program conducted through the U.S. Army medical center in Augusta, Georgia, telehealth home monitoring systems were set up in the homes of patients who had multiple medical problems and who were frequently in the emergency room or hospitals. Although home monitoring systems can be expensive, costing up to $15,000 or $20,000 for the most advanced systems, over a 10 month period, the program achieved a savings of more than $75,000 for its four least healthiest, most expensive patients alone.  

Of the two options for improving the elderly's access to care, and therefore, their use of preventative care services, the most promising is increasing home access to care, particularly through telehealth technologies. There are already a variety of programs and agencies that provide the elderly with transportation to medical appointments. Though there are ways in which these programs can be improved, for example, offering more travel to out-of-town medical facilities and providing better availability, there are costs involved with doing so, and it is unclear how many more medical appointments trips elders would make if current services were improved. Only a limited number of seniors (6 percent), report that transportation access to medical services is an issue. This suggests that most elderly have some way to get to their doctors for regular visits. If they choose not to go to the doctor as often as they should for routine and preventative care, it is therefore largely not because of transportation issues alone, but because of other reasons such as expense, inconvenience, lack of time, scheduling conflicts, or discomfort around doctors.

More access to health care through home telehealth services can address many of these other issues better than increased transportation offerings can. Home-based services make patients more involved in their own care and less reliant on doctors. In addition, home-based services are convenient. Patients can take measurements and participate in home telehealth activities (transferring data, looking up information, engaging in remote exercise sessions) at times

when it best fits their schedule. Additionally, patients do not need to travel for most of their care, therefore saving both travel time and travel expense.

So far, telehealth home programs have only been established on a limited basis and in some areas. Most are still in the pilot study stage. However, after its pilot study, Kaiser Permanente (KP), the country's largest HMO, was so convinced of the benefits of telehealth programs, that it committed itself to making telehealth services an integral part of its home health care offerings. This permanent program recently started, and few other medical care providers or insurers yet share KP's enthusiasm for telehealth home care.

Telehealth home care has great potential to improve access to care, although there are currently a number of issues with implementing telehealth care on a larger-scale. There are a few technical ones in terms of what telecommunication connections are needed to operate a telehealth system, but they are being addressed. Already one telehealth company, American TeleCare, has introduced a home monitoring system that uses only one basic phone line for simultaneous voice connections and data transfers. There are also issues about whether remote health care can substitute for in-person care. Few people, though, propose that it should substitute for face-to-face care entirely, suggesting rather that it could provide elders with supplemental interaction with health care providers between visits which might otherwise not be available. A major continuing concern regarding telehealth care is funding and federal support. Medicare and other insurers currently restrict their reimbursements for telehealth services. Home-based health services receive only limited reimbursements unless a professional health care worker is present in the home, and typically phone consultations with doctors or nurses receive no reimbursement at all. Additionally, in last few years, Congress has cut home health care funding by almost $9 billion. These cuts and potential additional reductions in funding could make it difficult to get telehealth home-based programs up and running. At a time, when home health care clients are being dropped because of the funding crunch, it may be difficult to justify a new type of service, even if in the end, it could result in better health care service delivery and health outcomes at a lower cost. These issues and barriers will need to be addressed to make telehealth home care a viable and attractive way to improve health care services for the elderly and to increase their access to care.
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CHAPTER 7: CONCLUSIONS AND AREAS FOR FUTURE RESEARCH

The main premise of this research is that inadequate transportation can limit the elderly’s access to health care. In contrast to this hypothesis, the study finds that for most elders, transportation barriers to care are actually not that significant and do not prevent them from seeking medical care when necessary. However, the study also concludes that some elders do have serious transportation barriers to care and that, as a result, may be foregoing care altogether or making other sub-optimal health care decisions. In addition, the study suggests that in the future, greater suburbanization of the elderly and other societal changes could lead to overall decreases in the spatial availability of health care as well as in older adults’ transportation access to health care, even among elders with good access today.

Chapter 7 reports on this research’s major findings, summarizing the elderly’s current access to health care (Section 7.1) and discussing future potential access issues (Section 7.2). It then suggests ways in which older adults’ access to care could be improved, focusing particularly on the potential of home-based technologies and telehealth care (Section 7.3). The chapter then closes by reviewing current data limitations and recommending additional areas for research (Section 7.4).

7.1 Findings on the elderly’s current transportation access to health care

Most elderly have fairly good access to medical services. Over 90 percent of people 65 years of age and over have visited a doctor in the past year or have had contact with a doctor through home care or phone consultations. For this age population, physician contacts average more than 11 per year; elders in poor health or with chronic health problems see doctors even more frequently.¹ In the Boston area, most elders live fairly close to a hospital or doctor. For example, over 90 percent live within 5 miles of a hospital and over 80 percent live within 5 miles of a hospital with emergency care facilities.

¹ National Health Interview Survey data, 1996, as cited in NCHS (1999).
Older adults, even those who don't drive or who restrict their driving, often have a range of transportation options, public as well as private, for accessing medical care. Public and non-profit transit and paratransit services for the elderly usually at least offer rides for medical appointments and other necessary trips, even when rides for other purposes are not available. In addition, in many communities, volunteer programs provide stopgap medical transportation for elders with no other options. Besides these alternatives, there are always private transportation services such as taxis and the informal transportation networks provided by friends and family. In fact, the majority of elders who don't drive rely almost exclusively on these private transportation options, especially for health care trips. Most older adults find the current transportation options available for helping them access medical services are sufficient for their needs. In a recent survey only 6 percent of elders aged 75 and over reported having trouble with transportation to visit their doctors.²

Although most seniors are able to access health care services when necessary, it is clear that some improvements in access are still needed. For one, the 6 percent of elderly who are dissatisfied with their ability to travel to their doctor represent more than 1 million people aged 75 and over nationwide. If these individuals feel that making a trip to their doctor is too difficult, it is possible that they could decide to skip the visit altogether. Additionally, studies report that problems with transportation to care can lead some elders with cancer to forego chemotherapy or radiation (Guidry et al., 1997) or to choose more serious, more invasive surgery over less invasive options because the smaller surgeries require more follow-up treatment and trips to the doctor.³

Further, some older adults rely on emergency services in part because of issues accessing regular care. Poor and minority elderly, for example, use emergency services more frequently than other seniors, largely because of difficulties with accessibility and transportation to regular doctor's visits (Bazaragan, 1998; Baker et al., 1996). In addition, older adults visit emergency departments predominantly during workday hours, where their primary care providers are presumably also available. The elderly are also much more likely than younger adults to use emergency ambulances, and use them up to twice as frequently as younger

² Medicare Current Beneficiary Study data, 1996, as cited in Janes et al. (1999).
people for non-urgent problems and minor medical illnesses such as fevers and common colds (Dickinson et al., 1996; Etttinger et al., 1997). Transportation and access to health care issues contribute to these trends. These patterns of emergency service use are both more expensive than regular care and less efficient at promoting good health overall.

Lastly, in some communities, especially in low-density suburbs and in rural areas, there are often few transportation options to driving and older adults may have particular difficulty accessing medical care. The transportation alternatives that exist in these areas are often small-scale, with few vehicles and limited hours, and may be insufficient for demand. They often also require that passengers sign up a week or more in advance of a requested ride, and may be unable to accommodate ride requests made on short notice, even for trips to urgently needed care. Another issue in these areas is that seniors may need to travel farther for medical appointments and that this greater distance may further limit their transportation choices and their ability to make medical trips.

7.2 Future access to health care issues

In the future, the elderly may have more problems accessing health care than they do today. These difficulties are likely to result from expected demographic and societal changes and economic pressures. This section discusses these changes and the potential access issues they raise.

Over the next few decades, the number of elderly is expected to increase significantly. Not only will the elderly population as a whole expand (growing over 30 percent by 2020), but the number of people aged 85 and over – the oldest old – will be the fastest growing age group in the country. The increase in older adults, particularly the oldest old, is likely to lead to an increase as well in the number of adults who do not drive and to heightened demand for transportation assistance, especially to health care. The oldest old frequently have the most medical problems (which is part of the reason they drive the least) and the most need to see their doctors on a regular basis.

Current transportation providers may have difficulties increasing their services to meet the rising demand. Public and non-profit transit and paratransit systems in particular usually have operating losses and may be unable to secure funding to expand their operations. As a result of these constraints and of growing demand for transportation services, the elderly may find themselves with less access to these transit options and may have to increasingly rely on other transportation alternatives to driving for their trips.\footnote{Such options include driving themselves even if it is no longer safe for them to do so because they have no alternative.}

At present, non-driving elders depend on friends and family for the majority of their trips and use other transportation services rarely, if at all. The elderly today use automobiles, as passengers or drivers, for over 95 percent of their daily travel (Burkhardt et al., 1998). In the future, fewer friends and family may be available to help older adults who stop or limit their driving. As the overall population ages, more friends and family will be elderly themselves and may be facing the same travel and mobility issues. Also, in the future, more friends and family, even those above age 65, are likely to be working and less able to provide transportation, including rides for doctors’ visits and medical care.

In the future, the elderly may also have problems getting transportation help from volunteer organizations, such as the American Red Cross and the American Cancer Association, who currently provide it. As people work more and as the population ages, these sorts of organizations are likely to face shortages in volunteers and to be less able to assist older adults seeking rides. In addition, the majority of volunteers at these types of organizations are elderly themselves and may have own transportation problems.

Health care access issues will also arise with continuing suburbanization and the spatial dispersion of the elderly population. In most suburbs, there is little opportunity for seniors to walk to services such as health care, and there are few transportation alternatives to the automobile. In the Boston metro region, the elderly population in the communities beyond Interstate 95 is expected to grow by one-fifth between 1990 and 2010. Transportation services beyond I-95 are much more limited than within the I-95 corridor. Outside of the MBTA, whose subway and bus services operate primarily inside I-95, no other regional
transit authorities in the Boston area have weeknight or Sunday paratransit service. Most of the authorities also have no regular bus service or only limited service during these time periods. These authorities also run smaller operations than the MBTA with fewer vehicles and fewer routes. In addition, 54 towns in the region outside of I-95 have neither paratransit or fixed-route bus service provided by a transit authority. Between 1990 and 2010, the elderly population in these towns is expected to increase by almost 50 percent.

As the elderly population in suburban areas expands, the few transportation providers there may be stretched to capacity (Coughlin and Lacombe, 1997). First, as mentioned above, there is a public reticence to invest further in public transit services. Additionally, with spatial dispersion of the older population, it becomes more difficult to locate services for the elderly, including transportation and health care, so that most seniors have good access to them. Spatial dispersion also contributes to lower community cohesion and weaker social networks, which then further decrease the elderly’s ability to rely on friends and social organizations for help with transportation and other needs.

Another major issue that may also affect older adults’ future access to health care is the continuing, growing focus on rising health care costs and the cost-effectiveness of care. As policy makers and health care organizations work to improve health care efficiency and reduce future costs, two primary results are the consolidation of medical care providers into fewer physical locations and cutbacks in health care service. In the Boston metro area, for example, between 1987 and 1997, the number of hospitals declined by almost 20 percent and the number of physicians’ offices and clinics by more than 10 percent. Similarly, since substantial Medicare funding cuts in 1999, more than 2,500 home health care providers nationwide have gone out of business.\(^5\) In addition, between 1988 and 1996, the total number of emergency room facilities in this country decreased by close to 10 percent (American College of Emergency Physicians, 1999).

Funding cuts and service consolidations are likely to reduce the elderly’s access to medical care. The consolidation of health care services can lead to greater trip distances to care, particularly for elders in low-density suburban communities. These greater distances can present a significant access barrier to care for some older adults. For many seniors, especially those who don’t drive, finding transportation to go beyond their local communities can be a challenge, and any ride options may be inconvenient or expensive. Their transportation difficulties could lead them to forego some medical trips and preventative care. In addition, as emergency departments consolidate and close, and become more spatially concentrated, the elderly may have less access to urgent and emergency care as well.

7.3 Potential options for improving transportation access to care

The first alternative for improving the elderly’s transportation access to care is to expand transportation services to medical appointments. Better transportation could potentially encourage older adults to make more trips to the doctor for regular and preventative care. It could also decrease their use of emergency services. More regular care could prevent some medical emergencies from arising, especially since many elders come to emergency departments because of on-going chronic diseases and complications. In addition, better access to care could reduce the elderly’s use of emergency services in non-urgent situations.

It is unclear, however, how much the elderly would take advantage of expanded transportation services to health care. Few older adults (less than 5 percent) today use public or non-profit transportation as their primary means of daily travel. Over 95 percent of the elderly’s trips are made in private automobiles, as either drivers or passengers, and for medical trips this percentage is even higher (Damiano et al., 1994). The elderly have a number of reasons for not using transit more frequently, including inconvenience, difficulty getting to stops, lack of availability, concerns about crime, and negative perceptions about public transit users. Having more public transit and paratransit service will not address many of these issues. In addition, it can be expensive to increase transit service, especially in low-density suburbs where costs per trip and trip distances are greater than in higher-density areas.
Some types of ride services, such as the Independent Transportation Network (ITN) in Portland, Maine, which offers on-demand service door-to-door in private automobiles and runs 24 hours a day, 7 days a week, have more of the characteristics that the elderly desire in rides (Freund, 2000). However, it would be costly and probably unrealistic to implement them on a larger scale. A final concern with expanding transportation services to care is that only a small number of elders (6 percent) report problems reaching medical care with the existing services. Therefore, it is doubtful that better transportation options would significantly increase the elderly’s trips to regular medical care. This finding also suggests that if older adults are not visiting their doctors as often as they should, it is largely because of factors besides the availability of transportation alone such as inconvenience, lack of time, scheduling conflicts, expense, or discomfort around doctors.

The second proposed option for improving the elderly’s access to health care, telehealth home care services, has the potential to eliminate many of these barriers to care. Telehealth care helps empower patients, making them more involved in their own health care and giving them more control. Through telehealth technologies, patients can monitor their conditions and health on a daily basis and rely less on doctors and occasional office visits to tell them how they are doing. With telehealth home care, patients can also have more frequent interactions with health care professionals, without more medical trips. Telehealth is convenient because it reduces the need to travel to health care and the time spent accessing health services. Convenience and reducing travel time will be especially important for seniors in the future, many of whom will remain busy with jobs and activities well into their later years. Additionally, with the consolidation of health care services at the same time that the elderly population is becoming more spatially dispersed, the distances between services and patients are growing. The use of more remote home health technologies allow patients and their doctors to retain close contact even when they are significant physical distances apart. It can also permit elderly in remote low-density areas to receive health care services that they might not otherwise have access to.

Telehealth home care offers potential benefits to health care providers as well. It allows doctors to obtain a more complete picture of patients’ health and behavior and helps them
follow patient progress and status changes between in-person visits. In addition, compared with traditional home health care visits, telehealth care is much less expensive, costing only one-fifth to one-third as much. Also, telehealth home care reduces travel times for care providers, allowing them to check-in with up to 3 or 4 times as many patients per day. The ability to handle more patients per day can help providers expand their patient loads and reduce home care shortages. It can also help providers meet anticipated increases in demand as the population ages.

Another benefit of telehealth home care is that it can help improve patient outcomes and reduce the risk of complications and hospitalizations, particularly for patients who have serious, chronic on-going health problems. Most of the telehealth home care pilot studies to date have focused on patients who are the most at risk for hospitalization (or re-hospitalization) and health declines.6 These studies have generally found the telehealth programs to have a positive effect on patient health and to lead to reduced rates and days of hospitalization. In addition, studies that considered health care costs usually found expenses to be lower for the telehealth program participants despite the costs of telehealth care because of the reduced levels of hospitalization and complications. Further, from a national care expenditure perspective, by keeping people healthier and enabling them to provide more-self care, telehealth care has the potential to reduce the current projected growth in national health care spending and future Medicaid expenses.

So far, the number of telehealth home care studies has been small and more research on their benefits and costs is needed. In addition, there are currently a few issues such as restricted insurance reimbursements for telehealth home care that will have to be resolved before telehealth care can be implemented on a greater scale. In spite of these problems, telehealth home care has tremendous potential. Results of studies thus far suggest that telehealth care could be a good, cost-effective way for increasing the elderly’s access to health care services and overall level of care. Much of the potential of telehealth care lies in its ability to provide health care services remotely and reduce the amount of travel needed to receive care. As suburbanization continues and the elderly population centers continue to shift to low-density

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6 A number of studies are discussed in more detail in Section 6.3.

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communities, telehealth’s remote care features will become increasingly significant, and
telehealth care services may well become one of the few plausible ways to provide a majority
of older adults with good, convenient, access to health care.

7.4 Recommendations for future research

This section reviews data limitations of this research’s evaluation of the elderly’s
transportation access to health care services. It also recommends areas for additional research
which are key to improving our understanding of the role that transportation issues play in the
older adults’ patterns of health care service use and in health care expenditures for the elderly
population.

This research used GIS software to help evaluate the spatial relationship between elders and
transportation and health care services and to identify and explore potential disparities. GIS
software is a powerful analytical tool ideally suited for this type of spatial evaluation.
However, GIS’s capabilities can be limited by the availability and quality of data to underlie
the analysis. For this study, the scarcity and the lack of availability of certain spatial data
restricted the depth of the evaluation. Specific data issues included the lack of information on
the service areas for private ambulance and private transportation providers and the number of
vehicles they operate in each community. Data was also unavailable regarding the total level
of paratransit services — public, non-profit, and private — in different parts of the Boston metro
region. It is likely that some of this missing data could have been gathered by the researcher
through information requests to the individual providers and agencies. However such a data
collection effort was beyond the scope and timeframe of this study. One recommendation is
that public agencies and planning organizations gather more spatially-oriented information on
transportation and health care providers and services and service areas. This would make
more of this data centrally available for purposes such as this research. It would also help the
agencies with their own planning and improve their ability to identify where service
expansions may be needed.

Another limitation of the analysis is that the spatial bus route files available from Bridgewater
State College (in affiliation with the Federal Transit Administration) were inaccurate at the
local level. As a result, although they could be used to visually show the general bus routes pattern for the region, they were insufficient for more detailed spatial analysis such as estimating the number of elders living within a quarter mile of a bus stop.

In addition to research to address current inadequacies in available geographic information, it is also recommended that research on certain key topics elderly transportation and health care topics be undertaken and expanded. One particularly important area for investigation is how the elderly’s patterns of transportation service and health care use vary by community type (urban, suburban, rural) and by other community characteristics such as median income. Specific topics that should be examined include differences in elders’ typical travel modes and degree of reliance on friends and family for travel, their number of trips, their frequency of doctor visits, distances to receive medical care, and their use of emergency medical transport and facilities. As the number of elders living in suburbs grows substantially, variations in elderly behavior on these issues according to community type will take on increasing significance.

Another key area for further research is the elderly’s attitudes towards health care and health care access. Focus groups or surveys of seniors could help characterize their attitudes towards health care and their health care usage. The research should explore topics such as how important the elderly consider regular doctors’ visits and health screenings, whether they feel they have sufficient access to preventative and emergency medical care, what they identify as their major barriers to health care, and the ways in which the elderly think that their health care and access to care could be improved. The research should also evaluate the extent to which elders may be foregoing preventative care visits or certain treatments because of inadequate access to care or particular access barriers such as transportation, costs, and lack of convenience.

Further research should also be conducted to more fully assess and characterize health care costs for the elderly. Following up on current research, more studies should explore the cost impacts of additional preventative care and health screenings, and the extent to which costs of the increased preventative care can be offset by improved patient health and reductions in expenses for disease complications and disabilities. The studies should also specifically
examine the potential cost benefits of more frequent care for common chronic diseases such as diabetes and heart disease. These diseases, which are easily and inexpensively managed in their earlier stages, currently account for a substantial proportion of health care expenditures for the elderly. Many of these expenses result from the costly complications that can occur with poor preventative care and inadequate disease management.

Additional studies should also evaluate the costs of emergency room and emergency ambulance services. Few assessments of emergency medicine costs are present in the current literature. To the extent possible, these studies should explore how better preventative care and improved transportation access could reduce the demand for emergency services among the elderly population. Studies should also be undertaken to assess society’s full expenses for health care and chronic illnesses among older adults. These studies should incorporate the indirect costs, including lost work and productivity and travel expenses, that are currently typically excluded from health care accounting.

Lastly, research into telehealth technologies should be continued and expanded. Telehealth home care programs should be tested on a larger-scale and studies into the longer-term health and cost impacts of telehealth interventions should be undertaken. In addition, researchers should explore the elderly’s attitudes towards using telehealth technologies and work to develop telehealth systems that are both acceptable to patients and easy to use and implement.
REFERENCES


Centers for Disease Control, National Center for Chronic Disease Prevention and Health Promotion. Preventing Cardiovascular Disease: Addressing the Nation’s Leading Killer, at a glance 2000, Atlanta, GA. (2000a).


DATA REFERENCES ON THE INTERNET

Demographic data, including population estimates and projections

U.S. Census Bureau: www.census.gov
Special reports: http://www.census.gov/prod/www/abs/popula.html#popspec

Massachusetts Institute of Social and Economic Research: www.umass.edu/miser
Population projections: http://www.umass.edu/miser/population/miserproj.htm
Available data and reports: http://www.umass.edu/miser/dataop/data.htm

Transportation services

Transit agencies:
Massachusetts Bay Transportation Authority: www.mbta.com
Brockton Area Transit: http://people.delphi.com/appleblossom/BAT/BAT.html
Cape Ann Transportation Authority: http://www.geocities.com/CapitolHill/6488/CATA-hom.htm
Greater Attleboro Taunton Regional Transit Authority: http://www.gatra.org/
Lowell Regional Transit Authority: http://www.lrta.com/
Montachusett Regional Transit Authority: http://www.montachusetttra.org/
Merrimack Valley Transit Authority: http://www.mvp.org/mvrta.htm
Southeastern Regional Transit Authority: http://www.geocities.com/CapitolHill/6488/SRTA-hom.htm
Worcester Regional Transit Authority: http://www.therta.com/

Other transportation services:
Human services transportation coordination in Massachusetts: http://www.state.ma.us/hst/
Public transit in Massachusetts: http://www.geocities.com/CapitolHill/6488/MA-loclx.htm

Health care services

Data on providers in Massachusetts

Hospitals
Massachusetts Hospital Association, hospital directory:
Quadramed on-line hospital directory and data source: http://www.ahd.com/

Emergency services
Metropolitan Boston EMS Council: http://www.mbemsc.org/
Massachusetts Office of Emergency Medical Services:
   http://www.state.ma.us/dph/oems/oems.htm

Pharmacies
AARP Pharmacy: www.rpspharmacy.com
CVS: www.cvs.com
Drugstore.com: www.drugstore.com
RiteAid: www.riteaid.com
Save-on Drugs (includes Osco Drug, Lucky, Acme): www.save-ondrugs.com
Walgreens: www.walgreens.com

Health care costs
Health Care Financing Administration: http://www.hcfa.gov/stats/stats.htm

Health
National Center for Health Statistics: http://www.cdc.gov/nchs/default.htm
Massachusetts Department of Public Health: http://www.state.ma.us/dph/pubstats.htm
   Massachusetts Community Information Profile (MassCHIP):
      http://www.state.ma.us/dph/ose/mchip/home.htm
American Diabetes Association: http://www.diabetes.org/
American Heart Association: http://www.americanheart.org/

Telemedicine
Telemedicine Research Center, Portland, Oregon: http://trc.telemed.org/

Aging and the elderly
Research on aging
NCHS Research on Aging: http://www.cdc.gov/nchs/agingact.htm
National Institute on Aging: http://www.nih.gov/nia/
Administration on Aging National Aging Information Center:
   http://www.aoa.gov/naic/default.htm

Agencies for the elderly
Massachusetts Executive Office of Elder Affairs: http://www.state.ma.us/elder/
   Area Agencies on Aging: http://www.state.ma.us/elder/homecare.htm
   Councils on Aging: http://www.state.ma.us/elder/coa.htm

GIS spatial datasets
MassGIS: http://www.state.ma.us/mgis/
Bridgewater State College, J.J. Moakley Center for Technological Applications,
   GeoGraphics Laboratory: http://geolab.moakley.bridgew.edu/ftpserver/
   Bus routes files and transit agency service area maps for Massachusetts:
      ftp://geolab.bridgew.edu/dataproducts/ftabus/ma/
Computer Resource Laboratory at MIT: http://gis.mit.edu/metadata/
APPENDIX A: SPATIAL POPULATION DISTRIBUTION FOR BOSTON AND FIVE OTHER METROPOLITAN REGIONS

As discussed in Section 3.2.3, this research includes a brief examination of the population patterns of the Boston region and a comparison with the patterns for the metro areas of five other cities. These cities are Atlanta, Minneapolis-St. Paul, Dallas, Denver, and Seattle. Although these cities have some differences with Boston, for example their greater population growth, they also appear to have similar patterns of population distribution and sprawl. The maps here have been created to explore these similarities. The maps show the spatial concentration of four different adult age groups for each metro region. Four age groups are included – ages 75 and over, age 65 to 74, ages 55 to 64, and ages 45 to 54. The maps show the percentage of the total population in each age group by U.S. Census tracts using 1990 Census data.

The maps all display the same basic trend of each successive age group being concentrated in areas farther from the central city and more in the suburbs. This suggests that these metro regions may all experience similar patterns of suburban sprawl as the younger age groups based in suburbs become older and decide to age in place. It also suggests that the Boston-based analysis on transportation access to health care conducted for this research may potentially be a useful tool for helping other communities think about their own aging-in-suburbs and access to medical care issues.
Figure A-1: Distribution of Population, Boston Metropolitan Region, 1990
Percentage of Total Population in Certain Age Groups, by US Census Tract

Figure A-2: Distribution of Population, Atlanta Metropolitan Region, 1990
Percentage of Total Population in Certain Age Groups, by US Census Tract

Figure A-3: Distribution of Population, Twin Cities Metropolitan Region, 1990
Percentage of Total Population in Certain Age Groups, by US Census Tract

Figure A-4: Distribution of Population, Dallas Metropolitan Region, 1990

Percentage of Total Population in Certain Age Groups, by US Census Tract

Figure A-5: Distribution of Population, Denver Metropolitan Region, 1990
Percentage of Total Population in Certain Age Groups, by US Census Tract

Ages 75+

Ages 65-74

Ages 55-64

Ages 45-54

Figure A-6: Distribution of Population, Seattle Metropolitan Region, 1990
Percentage of Total Population in Certain Age Groups, by US Census Tract

APPENDIX B: TECHNICAL NOTES ON HEALTH CARE DATA FROM THE ECONOMIC CENSUS

The analysis in Section 4.3 uses, among other sources, information gathered from the national economic census. The U.S. Census Bureau conducts the economic census every five years, in years ending in 2 and 7. It was most recently held in 1992 and 1997. The economic census collects data at the firm level on all major sectors of the U.S. economy including health care. These data are then summarized for different geographic areas, including states, metropolitan areas, counties, and municipalities (cities, towns, and villages), and made available in electronic and paper forms.

Although the basic information collected by the economic census remains the same from year to year, it can be difficult to compare data from different time periods. A primary difficulty concerns changes as of the 1997 census in the definitions of the underlying economic sectors and industries. An additional difficulty arises when looking at metropolitan area level data because the boundaries of metropolitan areas can change across time periods. Both these issues affect the ability to evaluate changes in economic sectors over time for a region. These issues and their impact on this analysis are discussed in greater detail below.

B.1 Change in the definitions of economic sectors and services

Until 1997, data from the economic census were summarized and published based on the Standard Industrial Classification (SIC) system. Beginning in 1997, a change was made to group and publish this data according to the North American Industry Classification System (NAICS). Although many of the SIC industries correspond directly to industries defined under NAICS, others do not. For some businesses without a direct correlation, data can be manipulated to facilitate comparisons between data before and after 1997. In other cases, the changes in the classifications are too great to allow for meaningful comparisons across time periods.

The research presented here examined two types of health care services included in the economic census: doctor’s offices and clinics, and hospitals. The SIC and NAICS classifications for these services were not identical, but were similar enough to allow for comparison. (Table B-1). For doctor’s offices and clinics, businesses classified under NAICS codes 62111 (Offices of Physicians), 621491 (HMO Medical Centers), and 621493 (Freestanding Ambulatory Surgical and Emergency Centers) were combined and compared to those with SIC codes of either 8011 (Offices and Clinics of Doctors of Medicine) or 8031 (Offices and Clinics of Doctors of Osteopathy). For hospitals, only the general category of Hospitals was used for comparison. Hospitals are classified as NAICS code 622 and SIC code 806. Subgroups of hospitals, including general medical and surgical hospitals, psychiatric, and specialty hospitals, were not compared for different years because of slight variations in the NAICS and SIC definitions of these categories.
**Table B-1: Comparison of NAICS and SIC Classifications for Health Care Services**

<table>
<thead>
<tr>
<th>NAICS code</th>
<th>Description</th>
<th>SIC code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6211</td>
<td>Office of Physicians</td>
<td>8011*</td>
<td>Offices and Clinics of Doctors of Medicine (Except HMO centers and surgical and emergency centers)</td>
</tr>
<tr>
<td>621491</td>
<td>HMO Medical Centers</td>
<td>8011*</td>
<td>Offices and Clinics of Doctors (HMO centers)</td>
</tr>
<tr>
<td>621493</td>
<td>Freestanding Ambulatory Surgical and Emergency Centers</td>
<td>8011*</td>
<td>Offices and Clinics of Doctors (surgical and emergency centers)</td>
</tr>
</tbody>
</table>

| HOSPITALS | 622 | Hospitals | 806 | Hospitals |

*indicates part of an SIC code.

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### B.2 Change in the geographic area of analysis

In its use of economic census data, this research sought data that would cover approximately the same geographic area that served as the basis for the rest of its analysis. This area is referred to as the “Boston metropolitan region” throughout this document and includes all of Plymouth, Middlesex, Essex, Norfolk, and Suffolk Counties, 5 towns in Bristol County and 7 towns in Worcester County.

The ideal solution would have been to aggregate municipal level health service data for all the towns and cities in the Boston metropolitan region to develop regional estimates. Unfortunately however, complete information at the municipal level was not available. At the municipal level (as well as the county level), published data tables incorporate information only from firms that are subject to federal income tax and exclude firms that are tax-exempt. In addition, for the 1987 and 1992 economic censuses, the published results included municipal level data only for municipalities that had a total of at least 350 service industry establishments. There were only a small number of such places.

The next best option was to use data at the metropolitan statistical area (MSA) level as the basis for regional estimates. This alternative proved feasible and was used to generate the regional hospital and numbers presented in Section 4.3.

The definition of MSAs is overseen by the federal Office of Management and Budget (OMB). OMB updated its list of MSAs and the municipalities associated with each on a regular basis. Slight alterations are made to this list annually and more major changes occur after each decennial population census. In 1987, 1992, and 1997, the same four MSAs covered the towns in the Boston metropolitan region (BMR). All of the Brockton, MA primary metropolitan statistical area (PMSA) was included in the region. Parts of these three PMSAs
were also included: the Boston, MA-NH PMSA (which now incorporates the no longer existing Salem-Gloucester, MA PMSA); Brockton, MA PMSA, Lawrence, MA-NH PMSA; and Lowell, MA-NH PMSA. For this research, the aggregated area of these four PMSAs was used as a proxy for the region.

However, this aggregated area does not match the Boston metropolitan region exactly. Some towns included in this area are outside of the BMR. For example, three of the four PMSAs include municipalities from NH, which is not part of the BMR. Also, some towns are in the BMR, but not the aggregated area. In addition, between 1987 and 1992 OMB’s definition of all four MSAs changed, which also changed the boundaries of the aggregated area. In 1987, the aggregated area included 167 municipalities in total and 150 of the BMR’s 159 towns. In 1992 and 1997, the aggregated area had expanded to 177 towns, 153 of which were in the BMR. Towns that are in the BMR but not in any of the four MSAs are listed in Table B-2. Towns that are in these MSAs but not in the BMR are listed in Table B-3.

Table B-2: Towns in the defined Boston Metro Region that were Excluded from the 4 Boston Area MSAs in these Censuses

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashby, MA</td>
<td>2,717</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Marion, MA</td>
<td>4,496</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mattapoisett, MA</td>
<td>5,850</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Northborough, MA</td>
<td>11,929</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Plainville, MA</td>
<td>6,871</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Rochester, MA</td>
<td>3,921</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Taunton, MA</td>
<td>49,832</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Wareham, MA</td>
<td>19,232</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Westborough, MA</td>
<td>14,133</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Total Pop Excluded</strong></td>
<td><strong>118,981</strong></td>
<td></td>
<td><strong>43,046</strong></td>
</tr>
</tbody>
</table>

Although the aggregated area of the four Boston area MSAs that were used to approximate the Boston Metropolitan Region (BMR) don’t match it exactly, its population is close enough to make it a reasonable proxy. Table B-4 summarizes the differences in the 1990 population between the Boston Metropolitan Region (BMR) and these four MSAs. For the 1987 Economic Census, 21,129 more people (1990) were included in these MSAs than in the region. For the 1992 and 1997 Economic Census, the discrepancy increased to 127,969. Although this second number may seem large, it represents only 3 percent of the metropolitan region’s total population. Therefore, this analysis made slight downward adjustments of 3 percent to the 1997 economic census estimates (for the four MSA area) for hospitals and doctors’ offices and clinics. This adjustment is reflected in the hospital and doctors’ office and clinic counts in Sections 4.3.1 and 4.3.2.

The areas covered by the four MSAs in 1987 and in 1997 are shown in Figure B-1.
Table B-3: Towns in the Boston Area MSAs in these Censuses that are Outside of the Defined Boston Metro Region

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Berkley, MA</td>
<td>4,237</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Blackstone, MA</td>
<td>8,023</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Dighton, MA</td>
<td>5,631</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hopedale, MA</td>
<td>5,666</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lancaster, MA</td>
<td>6,661</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mendon, MA</td>
<td>4,010</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Millville, MA</td>
<td>2,236</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Upton, MA</td>
<td>4,677</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Atkinson, NH</td>
<td>5,188</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Brentwood, NH</td>
<td>2,590</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Chester, NH</td>
<td>2,691</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Danville, NH</td>
<td>2,534</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Derry, NH</td>
<td>29,603</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>East Kingston, NH</td>
<td>1,352</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Fremont, NH</td>
<td>2,576</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hampstead, NH</td>
<td>6,732</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Kingston, NH</td>
<td>5,591</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Newton, NH</td>
<td>3,473</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pelham, NH</td>
<td>9,408</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Plaistow, NH</td>
<td>7,316</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Raymond, NH</td>
<td>8,713</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Salem, NH</td>
<td>25,746</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sandown, NH</td>
<td>4,060</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Seabrook, NH</td>
<td>6,503</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>South Hampton, NH</td>
<td>740</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Windham, NH</td>
<td>9,000</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Total Extra Population Included</td>
<td>140,110</td>
<td>171,015</td>
<td></td>
</tr>
</tbody>
</table>

Table B-4: Overall Difference in Population Between the Boston Metro Region and the 4 Boston Area MSAs

<table>
<thead>
<tr>
<th></th>
<th>In the 1987 Economic Census</th>
<th>In the 1992 &amp; 1997 Economic Censuses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990 population of towns outside the Boston Metro Region that were included in the 4 MSAs</td>
<td>140,110</td>
<td>171,015</td>
</tr>
<tr>
<td>1990 population of towns in the Boston Metro Region that were excluded from the MSAs</td>
<td>118,981</td>
<td>43,046</td>
</tr>
<tr>
<td>Overall difference</td>
<td>21,129</td>
<td>127,969</td>
</tr>
</tbody>
</table>
Figure B-1: Towns in the 1987 and 1997 MSAs that Approximate the Boston Metro Area in the Rest of the Thesis Analysis

(a) 1987 MSAs

Difference between the 1990 population for the 1987 MSAs and for Boston metro area as defined is 21,129.

(b) 1997 MSAs

Difference between the 1990 population for the 1997 MSAs and for Boston metro area as defined is 127,969.


The MSAs included in these maps are Boston, MA-NH primary MSA (PMSA) (which incorporates the former Salem-Gloucester, MA PMSA), Brockton, MA PMSA, Lawrence-Haverhill, MA-NH PMSA, and Lowell, MA-NH PMSA. See the appendix text for more info on the MSA definitions and the changes from 1987 to 1997.