Aging and Disability: Implications for the Housing Industry and Public Policy in the United States

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ABSTRACT

The elderly population of the United States is large and growing rapidly. In 2000 there were 35 million persons age 65+, comprising 12% of the total population. By 2050 this population is projected to exceed 86 million, almost 21% of the total. Since disability rates increase with age, the aging of the population will bring substantial increases in the number of disabled persons and have a significant impact on the demand for housing. In this paper, we collect information on physical disabilities, particularly as they relate to mobility limitations. We analyze trends in disability rates over time and apply projected rates by age and sex to projections of the U.S. population to produce projections of the number of disabled persons. We follow a similar procedure to produce projections of the number of households with at least one disabled resident and develop an estimate of the probability that a newly built single-family detached unit will house at least one disabled resident during its lifetime. We extend the analysis to include the impact of "visitability," or the ability of a disabled person to visit the homes of friends and relatives without difficulty. We close with a discussion of the implications of the rapidly rising number of disabled persons for the housing industry and for public policy in the United States.

Introduction

The elderly population of the United States is large and growing rapidly. In 2000 there were 35 million persons age 65+, comprising 12% of the total population. This population is projected to exceed 86 million by 2050, almost 21% of the total population (U.S. Census Bureau, 2004). The oldest portion of the elderly population is growing particularly rapidly, as the population age 85+ is projected to grow more than fivefold between 2000 and 2050, from 4 million to 21 million. Since disability rates rise with age—with the largest increases occurring at the oldest ages—the aging of the population will bring large increases in the number of disabled persons. Both of these changes have major implications for the housing industry and for public policy.

In this paper, we analyze the links connecting aging, disability, and housing in the United States. We have three primary objectives: 1) Produce projections of the number of disabled persons and the number of households with at least one disabled resident; 2) Develop an estimate of the probability that a newly built single-family (SF) detached unit will house at least one disabled resident during its expected lifetime; and 3) Consider some of the implications of the growing number of disabled persons for the housing industry and for public policy in the United States.

To our knowledge, this is the first study to project the number of households with a disabled resident and the first to view the prevalence of disabilities from the perspective of a housing unit rather than an individual. We believe both of these innovations are essential for estimating the impact of aging and disability on the demand for housing and the formation of public policy. Although our focus is on the United States, we believe many of our findings are relevant to other countries as well.

We start by discussing several different measures of disability, particularly as they relate to mobility impairments. Our focus is on physical disabilities that limit a person's ability to enter, leave, or get around effectively at home, and for whom accessibility features such as ramps, handrails, and wider doorways might allow a person to live a longer time in that home than would otherwise be possible.

We collect data on several disability measures and analyze trends in disability rates over time. Based on this information and projections of the U.S. population by age and sex, we develop projections of the number of disabled persons from 2000 to 2050. We follow a similar procedure to develop projections of the number of households (i.e., occupied housing units) with at least one disabled resident over the same time period. Changes in the number of households with disabled residents have a substantial impact on the demand for accessibility features.

Population and household projections provide useful information regarding the potential market for accessible housing, but do not tell the whole story because housing units typically last for many years and are occupied by a number of different households over time. To deal with this issue, we collect information on the average lifespan of a SF detached unit and estimate the average length of residence for households occupying SF detached units. We focus on SF detached units because they constitute the majority of housing units in the United States and—in contrast to multifamily units—are seldom covered by federal accessibility legislation. Using this information, we develop an estimate of the probability that a newly built SF detached unit will have at least one disabled resident during its expected lifetime. We extend the analysis to include the concept of "visitability," or the ability of a disabled person to visit the home of a friend or relative without undue difficulty.

We conclude that there is a substantial probability that a newly built SF detached unit will house at least one disabled resident during its expected lifetime. Given the aging of the U.S. population and the desire of most older people to remain in their current home for as long as possible (e.g., Kochera et al., 2005; Lawler, 2001), we believe there is a large and growing demand for structural features that make housing units accessible and livable for occupants with disabilities. When the probability of having visitors with disabilities is factored in, the demand for such features is even greater. The high cost of institutionalization—both for individuals and for society as a whole—creates a strong economic incentive to incorporate home accessibility features as well. We believe rapid growth in the number of disabled persons will present formidable challenges to the housing industry and to the formation of public policy in the United States over the next several decades, but will present significant opportunities as well.

Disability Measures and Trends

Measures. A disability can be defined as "a physical or mental impairment that substantially limits one or more major life activities" (Steinmetz, 2006). Although the concept is clear, there is no single, standard way to measure the prevalence of disabilities within a population. Measures are often based on Activities of Daily Living (ADLs), which include activities such as bathing, dressing, eating, getting out of a chair or bed, walking across a room, and using the toilet (e.g., Freedman et al., 2004; Lakdawalla et al., 2003; Manton and Gu, 2001). Other measures—reflecting somewhat less-severe disabilities—are based on Instrumental Activities of Daily Living (IADLs), such as doing housework, preparing meals, shopping for groceries, taking medications, managing money, and using the telephone (e.g., Crimmins and Saito, 2000; Spillman, 2004; Waidmann and Liu, 2000).

Data on ADLs and IADLs have been collected through a number of surveys in recent decades. Even when data are drawn from the same sample, however, measures of disability can differ from each other because of differences in the specific activities included; the way disability is defined (e.g., having *difficulty* performing an activity vs. being *unable* to perform that activity without help); the threshold level chosen (e.g., difficulty performing at least one activity vs. difficulty performing two or more activities); and the time period covered (e.g., difficulty now vs. difficulty for at least three months).

In this paper, we develop four disability measures based on the ability to perform daily activities, two related to individuals and two to households. All are designed to focus on mobility limitations and are constructed using data from the 5% Public Use Microdata Sample (PUMS) file from Census 2000.

The first two measures refer to individuals. One (DIS-1) is based on whether the respondent has a long-lasting condition that substantially limits one or more physical activities such as walking, climbing stairs, reaching, lifting, or carrying. The other (DIS-2) is based on whether the respondent has a condition lasting six months or more that makes it difficult to dress, bathe, or get around inside the home. For both measures, disability rates are calculated for each age-sex group by dividing the number of persons with a disability by the number of persons in the group (see Table 1). It should be noted that these rates include persons living in institutions as well as those living in households, thereby covering the entire population.

(Table 1 about here)

Both measures show disability rates to increase rapidly with age. This nearly universal pattern has been reported frequently in the literature (e.g., Bhattacharya et al., 2004; Kaye et al., 2000; Steinmetz, 2006). Also, both measures show slightly lower rates for females than males in the youngest group but higher rates for females in all older groups, with the differences becoming larger as age increases. Similar patterns have been noted before (e.g., Kaye et al., 2000; Steinmetz, 2006). Rates for DIS-1 are substantially higher than for DIS-2, indicating that DIS-1 reflects less severe disabilities than DIS-2.

How do these rates compare with other disability measures? The rates for DIS-1 are similar to rates measuring severe disabilities published in a recent Census Bureau report, while the rates for DIS-2 are similar to rates measuring the need for personal assistance (Steinmetz, 2006). Also, the rates for DIS-2 are similar to those reported for users of mobility devices such as wheelchairs, scooters, walkers, canes, or crutches (Kaye et al., 2000). We interpret DIS-1 as measuring both moderate and severe mobility limitations and DIS-2 as measuring only the most severe mobility limitations. We believe these measures provide reasonable alternative estimates of the population for whom housing accessibility features might be beneficial.

The second two measures refer to households. One (HHDIS-1) is based on whether any resident of the household has a long-lasting condition that substantially limits one or more physical activities such as walking, climbing stairs, reaching, lifting, or carrying. The other (HHDIS-2) is based on whether any resident of the household has a condition lasting six months or more that makes it difficult to dress, bathe, or get around inside the home. Since these rates refer solely to the household population, they exclude the impact of persons living in institutions.

Household disability rates were calculated by dividing the number of households with at least one disabled resident by the number of households. These rates were calculated for each age group according to the age of the householder, but disabilities refer to anyone in the household regardless of age. Age groups were based on householders as defined in the ProFamy household projection model (Yi et al., 2006). Household disability rates by age of householder are shown in Table 2.

(Table 2 about here)

Whereas DIS-1 and DIS-2 show the proportion of the population in each age-sex group with a disability, HHDIS-1 and HHDIS-2 show the proportion of households in each age group with at least one disabled resident. Overall, household disability rates are roughly twice as large as individual disability rates. This is not surprising, of course, because most households have two or more occupants. Again, rates are found to increase rapidly with age and rates based on the first measure are substantially higher than rates based on the second.

All four disability measures are based on a widely used approach to measuring disability and utilize data from a well-recognized and reliable source. The measures based on individual data are consistent with the measures based on household data yet permit comparisons with measures discussed in other studies. Perhaps most important, the measures based on household data can be directly related to estimates and projections of the housing stock. We believe these measures provide a useful means for evaluating the relationships connecting aging, disability, and housing.

Trends over Time. How are disability rates likely to change over the next few decades? Before we can answer this question, it is important to consider the determinants of disability rates and how they have changed over the last few decades.

This task is complicated by the fact that disability is a social construct determined by an individual's physical, mental, and emotional condition and by a variety of environmental factors (Freedman et al., 2004). Consequently, disability rates are affected both by a person's underlying capacity to perform certain tasks and by the availability of technological or human assistance. Changes in disability rates over time reflect changes not only in the underlying physical and mental capacity of the population but also in the adaptations and accommodations made by individuals or provided by the environment.

Numerous studies of disability trends have been published in recent years, often focusing on the elderly population. Although they have relied on a variety of data sources and disability measures, many have reported declines in disability rates for older persons during the 1980s and 1990s (e.g., Cai and Lubitz, 2007; Manton and Gu, 2001; Martin et al., 2007; Spillman, 2004; Waidmann and Liu, 2000). These declines were often found to be large (1-2% per year) and statistically significant.

Not all studies have reported declines, however. Crimmins and Saito (2000) found declines in disability rates for older women between 1984 and 1994, but not for older men. They also found statistically significant increases in the prevalence of a number of diseases over this time period (e.g., heart disease, cancer, diabetes, arthritis, and osteoporosis). Freedman and Martin (2000) reported similar increases in the prevalence of diseases. Spillman (2004) noted that much of the decline in elderly disability rates observed during the 1980s and 1990s was confined to less severe disabilities and that the evidence for more severe disabilities was mixed.

Studies of the younger population have not reported declining disability rates. In fact, several have reported increasing rates. Bhattacharya et al. (2004) and Lakdawalla et al. (2004) found increases in disability rates among younger persons from the mid-1980s to the mid-1990s even as the older population became healthier. Kaye et al. (1996) reported increasing disability rates for younger persons during the early 1990s. Martin et al. (2007) reported mixed results regarding the health status of younger adults between 1982 and 2003.

There are several reasons for the mixed evidence regarding trends in disability rates. One is simply that different studies use different populations, data sets, and measures of disability; such differences are known to affect estimates of disability rates and trends over time (e.g., Freedman et al., 2004; Wolf et al., 2005). A second reason is more complex. Several analysts have reported disability rates that declined even as the prevalence of diseases increased (e.g., Crimmins and Saito, 2000; Freedman and Martin, 2000). This occurs because the relationship between disability and health is affected by factors such as the development of more effective diagnostic techniques, improvements in disease management, the introduction of better assistive devices, improvements in accessibility features, and changing perceptions of what constitutes a disability. Declining disability rates are not necessarily an indicator of improving health.

What does all this evidence suggest regarding future trends? Pointing to the magnitude of recent declines and to factors such as increases in educational levels, the development of new biotechnologies, more aggressive public health programs, a growing awareness of the importance of regular exercise and good nutrition, and the potential benefits of biomedical and epidemiological research, some analysts are optimistic that recent declines in disability rates for older persons will continue well into the future (e.g., Freedman and Martin, 2000; Singer and Manton, 1998; Waidmann and Lui, 2000). Such declines would have an important impact on overall disability rates because older people account for a disproportionately large share of the disabled population.

Others are less optimistic that rates will continue falling, either for the older population or the population as a whole. They point out that disability rates have increased for younger adults, a group that constitutes the majority of the population and will become the older population of future decades (e.g., Bhattacharya et al., 2004; Lakdawalla et al., 2004). They note that there have been substantial increases in the prevalence of obesity—a condition associated with elevated disability rates—among both older and younger adults (e.g., Arterburn et al., 2004; Reynolds et al., 2005). Furthermore, the pace of educational improvement—a factor that contributed significantly to disability declines over the last several decades—will slow in future decades (e.g., Freedman and Martin, 1999) and the largest racial and ethnic minorities—groups with persistently higher disability rates than non-Hispanic whites (e.g., Schoeni et at., 2005)—will increase as a proportion of the total population (U.S. Census Bureau, 2004). Consequently, some analysts have questioned the likelihood of continuing declines in disability rates (e.g., Bhattacharya et al., 2004; Spillman, 2004; Sturm et al., 2004; Wang et al., 2007; Wolf et al., 2005) and others have projected that rates will eventually rise (e.g., Lakdawalla et al., 2003).

We believe arguments for increasing disability rates are at least as convincing as arguments for persistently declining rates. We also note that when there is substantial uncertainty regarding the direction of future trends, it is generally advisable to hold rates constant when making projections (Smith et al., 2001, p. 84). Consequently, we base our medium projections on disability rates that remain constant at 2000 levels. We also evaluate projections based on rates that increase or decline by 5% per decade between 2000 and 2050; we refer to these as high and low scenarios, respectively. Given the trends in disability rates observed over the last several decades and the arguments for rising and falling rates discussed previously, we believe these scenarios provide a reasonable range of projections.

Projections

Our first objective is to produce projections of the number of disabled persons and the number of households with at least one disabled resident. We do this by applying the disability rates described above to population and household projections based on the ProFamy projection model (Yi et al., 2006). We use these projections because they were based on recent estimates and they cover both households and population (the U.S. Census Bureau has not released a set of household projections since the mid-1990s). A comparison of the ProFamy population projections with the most recent set released by the U.S. Census Bureau (2004) showed them to be very similar, differing by only 2.3% by 2050. The ProFamy projections were slightly lower in each projection year.

Population. Projections of total population and the number of disabled persons are shown in Table 3. Under the medium scenario, the number of disabled persons for both disability measures more than doubles between 2000 and 2050, a growth rate substantially higher than for the population as a whole. Consequently, the proportion of the population with disabilities increases from 8.2% in 2000 to 11.6% in 2050 for DIS-1 and from 2.9% to 4.6% for DIS-2.

(Table 3 about here)

Even under the low scenario, the number of disabled persons grows more rapidly than the population as a whole. For DIS-1, the number of disabled persons grows by 59% between 2000 and 2050; for DIS-2, it grows by 76%. Apparently, the aging of the population more than offsets the impact of declining disability rates. Under the high scenario, the number of disabled persons grows by 163% between 2000 and 2050 for DIS-1 and by 190% for DIS-2. Clearly, the combination of population aging and rising disability rates would lead to huge increases in the number of disabled persons.

Projections for abbreviated age groups under the medium scenario are shown in Table 4. The aging of the population is dramatic, as the population age 65+ rises from 12.4% of the total in 2000 to 21.5% in 2050. The population age 85+ grows almost five-fold, from 1.5% of the total population in 2000 to 5.3% in 2050. Although the number of disabled persons rises over time in each age group, the increases are much greater for the older population than the younger population. For DIS-1, persons age 65+ accounted for 46.7% of all disabled persons in 2000. By 2050, they are projected to account for 63.6%. For DIS-2, the proportion age 65+ is projected to rise from 52.0% to 70.9%.

(Table 4 about here)

Households. Projections of the number of households and the number of households with a disabled resident are shown in Table 5. Under the medium scenario, the number of households with a disabled resident almost doubles between 2000 and 2050 for HHDIS-1; for HHDIS-2, it more than doubles. The proportion of households with a disabled resident increases substantially between 2000 and 2050, from 16.5% to 21.2% for HHDIS-1 and from 5.4% to 7.2% for HHDIS-2.

(Table 5 about here)

Under the low scenario, the number of households with a disabled resident as measured by HHDIS-1 grows more rapidly than the total number of households through 2030 but more slowly thereafter. By 2050, it is a slightly lower proportion of the population than it was in 2000 but a substantially higher number. For HHDIS-2, the proportion of households with a disabled resident increases slowly through 2040 but declines slightly by 2050. Under the high scenario, the number of households with a disabled resident grows by approximately 150% between 2000 and 2050 for both HHDIS-1 and HHDIS-2. As a result of these high growth rates, the proportion of households with a disabled resident rises from 16.5% to 27.1% for HHDIS-1 and from 5.4% to 9.2% for HHDIS-2.

Projections by age of householder are shown in Table 6. Again, the impact of population aging is clearly visible, both in projections of households and the medium projections of households with at least one disabled resident. For HHDIS-1, householders age 65+ comprise 38.7% of all households with a disabled resident in 2000; by 2050, this proportion rises to 56.4%. For HHDIS-2, it rises from 39.6% to 59.5%.

(Table 6 about here)

Probability of a Disabled Resident

Our second objective is to estimate the probability that a newly built SF detached unit will house at least one disabled resident during its expected lifetime. We assume that all new units have an equal probability of being occupied by a household with a disabled resident because—at this point in the analysis—we are not interested in the features of individual units that make them more or less attractive to persons with disabilities.

We focus on SF detached units for two reasons. First, they constitute the majority of housing units in the United States and are particularly likely to house older persons, the group with the highest disability rates. In 2005, 63% of households and 68% of householders age 65+ lived in SF detached units (U.S. Census Bureau, 2006). Second, multi-unit structures—the second most common type of housing in the United States—are already subject to a number of federal accessibility requirements. Consequently, future policy changes affecting accessibility requirements will most likely be directed toward SF detached units.

In order to estimate the probability that a newly built SF detached unit will house at least one disabled resident, we need information regarding the average lifespan of SF detached units, the average length of residence in those units, and the projected proportion of households with a disabled resident. Regarding the first, we note that the lifespan of a housing unit (i.e., the period over which it provides dwelling services) is determined primarily by the quality of its design and construction; its exposure to hazards; and the extent of maintenance, renovation, and restoration it receives. Theoretically, the lifespan of a housing unit can be extended almost indefinitely if sufficient resources are devoted to that end. In reality, that is seldom the case. Estimates of the average lifespan of single-family and low-density multifamily units in the United

States generally range between 75 and 100 years (Baer, 1990). Estimates for Europe are often substantially higher (e.g., Bradley and Kohler, 2007; Johnstone, 2001). We use a range of 75 to 100 years in our calculations.

If length of residence and disability rates were the same for everybody and were projected to remain constant over time, we could estimate the probability that a newly built SF detached unit will house at least one disabled resident during its lifetime as:

(1) $PROB = 1 - [(1\text{-}r)^x]$

where r is the proportion of households with at least one disabled resident and x is the number of households occupying a SF unit over its expected lifetime.

We can illustrate this calculation using a hypothetical example based on the average of the medium disability proportions for HHDIS-1 from 2000-2050 shown in Table 5 (19.2%), the average length of residence for SF detached units in 2000 shown in Table 7 (13.7 years), and the midpoint of the 75-100 year lifespan range (87.5 years). The average number of households occupying a SF detached unit during its expected lifetime (a measure of housing turnover) can be estimated by dividing the lifespan by the length of residence (87.5/13.7 = 6.4). The probability that a newly built SF detached unit will have at least one disabled resident can then be estimated as:

(2) $PROB = 1 - [(1\text{-}.192)^{6.4}] = 1 - .256 = .744$ or 74.4%.

This estimate will not be valid, however, if disability rates and length of residence are not the same for everybody. We have already shown that disability rates differ substantially by age. Table 7 shows that the average length of residence in SF detached units also differs considerably by age, rising from 4.3 years for householders less than age 35 to 30.2 for householders age 85 or older.

(Table 7 about here)

The hypothetical example thus overstates the probability that a SF detached unit will house at least one disabled resident because disability rates are highest in the age groups with the greatest length of residence. How can this problem be solved? There is no perfect solution, but we can improve the estimate substantially by calculating an adjusted length of residence for each projection year, with the length of residence for each age group (shown in Table 7) weighted by the age distribution of households with at least one disabled resident (using an average of the distributions for HHDIS-1 and HHDIS-2 shown in Table 6). This adjustment accounts for the fact that the age groups with the highest disability rates are the groups with the longest length of residence.

The results of the weighting process are shown in Table 8. The weighted average length of residence for 2000 is 17.6 years, considerably longer than the unweighted average of 13.7 years. It increases slowly over the projection horizon, reaching 21.2 in 2050. This occurs because population aging leads to larger increases in disabled residents at older ages than at younger ages. Adjusted estimates are thus substantially larger than unadjusted estimates and increase over time; both of these results are consistent with the patterns noted previously.

(Table 8 about here)

We can now calculate a more realistic estimate of the probability that a newly built SF detached unit will house at least one disabled resident during its expected lifetime. A length of residence that rises from 17.6 in 2000 to 21.2 in 2050 implies that an average of four households would occupy a newly built SF detached unit over approximately an 80-year period. This is at the lower end of the 75-100 year range, but we use it as a conservative estimate of average lifespan of a SF detached unit. Taking the proportion of households with at least one disabled resident from the medium projections for 2010, 2030, and 2050 (and, by linear extrapolation, for 2070), we can calculate the probabilities for our two disability measures as:

(3) PROB(1) = 1 – [(1-.178)(1-.200)(1-.212)(1-.224)] = 1-.402 = .598 or 59.8%.

(4) PROB(2) = 1 – [(1-.058)(1-.065)(1-.072)(1-.079)] = 1-.753 = .247 or 24.7%.

That is, we estimate that 60% of newly built SF detached units will house at least one disabled resident under our first measure and 25% under our second. Following a similar procedure for the low and high projections, we estimate a range of 51-69% for the first measure and 20-30% for the second. Clearly, the prevalence of disabilities is substantially greater when measured over the lifetime of a housing unit than when measured at a given point in time for an individual.

Again, we note that these calculations are based on the assumption that all new SF detached units have an equal probability of occupancy by households with at least one disabled resident. They are intended to show the potential size of the long-term market for accessibility features, not to provide a prediction for any specific unit. If some units are inaccessible to persons with disabilities, they will have a lower probability than is shown here and the remaining units will have a higher probability.

Extension: Visitability

"Visitability" refers to the presence of features that make a home accessible to visitors with disabilities, most notably those with mobility impairments (Kaminski et al., 2006). Although features such as reachable electrical controls and lever door handles are sometimes included, the primary features that make a home visitable are a no-step entrance, a bathroom or half bath on the main floor, and interior doors at least 32 inches wide (Maisel, 2006). The objective of visitability advocates is to change construction practices so that virtually all new homes have a few basic features that make it easier for people with mobility impairments to visit or live there (Concrete Change, 2007a). We present a fuller discussion of the visitability movement in the next section.

Accounting for visitors as well as residents greatly expands our definition of the disabled population. It is very difficult to estimate this population, however, due to measurement and data collection issues. On the average, how many friends and relatives does a disabled person have? How many might they visit if accessibility were not a problem? It is difficult or impossible to answer these questions precisely.

We can develop an approximation, however, by making a few simplifying assumptions. First, we assume that members of all age groups have an equal probability of being visited by disabled friends or relatives. This seems reasonable because of the inter-generational nature of visits: although older people have substantially higher disability rates than younger people, younger people often have older visitors (e.g., parents visiting adult children). Consequently, we use the average length of residence in SF detached units for all persons (13.7), rather than weighting it according to the distribution of persons with disabilities. Dividing an average lifespan of 87.5 by 13.7 implies that 6.4 different households will occupy a SF detached unit over its expected lifespan.

Second, we assume there will be one visit to a non-disabled household for each household with a disabled resident during each occupancy period, with each non-disabled household receiving no more than one disabled visitor. Consequently, we double the proportion of households with a disabled resident to account for both residents and visitors. Given the large number of friends and relatives potentially associated with each disabled person, this is a very conservative assumption. However, it provides an indication of the impact of including disabled visitors in the calculations.

Using the medium projections and twice the proportion of households with a disabled resident in 2040—approximately the midpoint in the average lifespan of a unit built in 2000—we estimate the probability that a newly built SF detached unit will have at least one disabled resident or visitor during its lifetime as:

(5) PROB(1) = $1 – [(1-.418)^{6.4}] = 1 - .031 = .969$ or 96.9%.

(6) PROB(2) = $1 – [(1-.140)^{6.4}] = 1 - .381 = .619$ or 61.9%.

Under the first measure (HHDIS-1), there is a 97% probability that a newly built SF detached unit will have at least one disabled resident or visitor; that is, it is a near certainty. Even for the more restrictive measure (HHDIS-2), the probability is 62%. These are very subjective estimates, of course, but they illustrate the potential demand for accessible SF units when disabled visitors as well as disabled residents are accounted for in the calculations.

Discussion

Evaluating Estimates and Projections. Although several studies have developed projections of the disabled population (e.g., Singer and Manton, 1998; Waidmann and Liu, 2000; Wang et al., 2007), this is the first study (to our knowledge) to project the number of households with at least one disabled resident and to estimate the probability that a newly built unit will house at least one disabled resident during its expected lifetime. We believe estimates and projections of this type are essential for analyzing the links connecting aging, disability, and housing.

Under our medium assumptions, we projected that 21% of U.S. households will have at least one disabled resident in 2050 using the first disability measure and 7% using the second. We estimated that there is a 60% probability that a newly built SF detached unit will house at least one disabled resident during its lifetime using the first measure and a 25% probability using the second. When disabled visitors are accounted for, the probabilities rise to 97% and 62%, respectively. Given the size of these numbers and the millions of units that will be added to the nation's housing stock over each of the next few decades, we believe there is a large and growing market for features that make housing units accessible to persons with disabilities and that the public policy implications of this growth are significant.

The assumptions underlying our estimates and projections can be questioned, of course, and alternatives could be developed. However, we believe our assumptions are consistent with the historical evidence and that our estimates and projections are—if anything—likely to be a bit low. In addition to the possibility that disability rates might rise over time, we note that: 1) Disability rates were based on disability status at a single point in time, missing the impact of people who were previously disabled but had since recovered; 2) Household disability rates were not adjusted upward to account for the impact of people residing in nursing homes, who tend to have very high disability rates; and 3) Using the upper rather than the lower end of the 75-100 year lifespan range would have resulted in five rather than four households occupying a SF detached unit over its expected lifetime. Accounting for any of these factors would have raised the estimates and projections shown here.

Regardless of the assumptions used, two facts are beyond dispute: 1) The proportion of households with at least one disabled resident is substantially larger than the proportion of persons with disabilities, and 2) Most housing units are occupied by several households during their lifetimes. Analyses based on households and housing turnover thus indicate a substantially greater—and, in our view, more realistic—estimate of the prevalence of disability than might be inferred from analyses focusing solely on individuals. Furthermore, persistent population growth and the aging of the U.S. population mean that the number of households with a disabled resident is likely to grow rapidly as well. Regardless of the specific assumptions used, these factors point toward a large and growing demand for housing features that improve accessibility.

Demand and Cost. The demand for accessibility features comes not only from the currently disabled population, but from other groups as well. Many people who do not have disabilities have disabled friends and relatives they would like to accommodate when they come to visit (Bayer and Harper, 2000). Others have injuries or conditions that temporarily limit their ability to function, even though they eventually return to full functionality (Crimmins, 2004). Both of these groups contribute to the demand for accessibility features.

Perhaps more important, many people who do not currently have mobility impairments recognize the possibility that someday they will. Nearly one-fourth of the respondents to a recent survey of Americans age 45 and older thought it was likely that someone in their household would have difficulty getting around in the home within the next five years (Bayer and Harper, 2000). This population contributes to a potentially huge demand for accessibility features because the vast majority of older people want to continue living in their current homes as they age. Kochera and colleagues (2005) reported that 78% of persons aged 50-64, 91% of persons aged 65-74, and 95% of persons aged 75+ expressed a desire of to remain in their current home for as long as possible. In an attempt to do so, many have made structural modifications such as widening doors and installing ramps. More than two-thirds of those who have made such modifications believe those changes will allow them or some member of their household to live in that residence longer than they could have otherwise (Bayer and Harper, 2000).

What about the cost of accessibility features? The answer to this question depends on the specific features included and whether they are incorporated into the construction of new units or added as modifications to existing units. When incorporated into the construction of new units, the costs are very low. If the unit is designed with at least a half bathroom on the main floor, the additional cost of basic visitability features (a no-step entrance and wider interior doors) has been estimated to be less than $100 for homes built on a concrete slab and $300-$600 for homes with a basement (Concrete Change, 2007b). Even adding features such as wider hallways and wheel-in showers raises the cost of a new unit by only a few thousand dollars.

When modifications are made to units that have already been built, however, costs are often much higher, ranging from less than $100 for simple changes such as installing a handrail to $50,000 or more for major structural changes (Duncan, 1998; Pynoos and Nishita, 2003). Features that are very inexpensive when included in a new unit can be very expensive when added to existing units. For someone with no current disability, choosing a new home with built-in accessibility features is similar to buying an insurance policy: a small front-end cost may eliminate the need for expensive modifications at some point in the future.

When considering costs, it is important to consider not only the cost of incorporating accessibility features into the construction of new units or the modification of existing units, but also the cost of *not* doing so. Disabled people living in units without adequate accessibility features face a greater risk of injury than those living in units with adequate features, primarily due to a greater risk of falling (e.g., Close et al., 1999). Indeed, the fear of falling itself has severe negative consequences for the sense of well-being for many older persons (e.g., Gitlin et al., 2006). Also, disabled people living in units without adequate accessibility features are more likely to suffer from social isolation and loneliness (e.g., Hammel, 2005) and the lack of accessibility features places a burden on caregivers, making it more difficult for them to provide assistance (e.g., Saville-Smith et al., 2007). Finally, when people leave a hospital after sustaining a debilitating injury or disease, the lack of accessibility features may force them to enter a nursing home rather than return home, imposing high emotional and financial costs on the individual and—in many instances—a high financial cost on society as a whole. Some of these costs are psychological or emotional rather than economic, but all have a negative impact on personal well-being.

The cost of nursing home care is particularly important for an aging society. Cohen et al. (2005) reported that several studies have estimated that, at current rates, 40-50% of persons reaching age 65 will live in nursing homes as some point during their lifetimes. Total spending on nursing home care was $122 billion in 2005, with Medicaid accounting for 44% and Medicare for another 16% (U.S. Department of Health and Human Services, 2007). Public expenditures thus account for the majority of nursing home costs, which are large and growing rapidly. The average annual cost of nursing home care has been estimated as $74,000 for a private room and $64,000 for a semi-private room (MetLife, 2005). Numerous studies have concluded that costs of nursing home care are substantially higher than costs of home care, even when the value of assistive services are included in home care costs (e.g., Chappell et al., 2004; LaPlante et al., 2007; Redfoot, 1993). It is likely that helping people delay or avoid the need for nursing home care would lead to substantial economic savings, both for individuals and for society as a whole. Given the strong desire of most older people to remain in their current homes—and the dread many feel when confronted with moving to a nursing home (Redfoot, 1993)—there are substantial non-economic advantages as well.

Policy Measures. What has been done to promote the construction of accessible housing in the United States? At the federal level, Section 504 of the Rehabilitation Act of 1973 requires that recipients of federal funds make at least 5% of new or substantially rehabilitated multifamily units accessible to people with mobility impairments. The Fair Housing Amendments Act of 1988 prohibits housing discrimination on the basis of disability; requires landlords to allow tenants to make reasonable modifications to accommodate disabilities; and includes design and construction standards providing accessibility to all new or substantially rehabilitated multifamily units, regardless of whether federal funds were used in their construction. These standards include features such as an accessible entrance; wide interior doors; bathroom walls reinforced to accommodate the installation of grab bars; usable bathrooms and kitchens; and accessible light switches, electrical outlets, and environmental controls (Kochera, 2002).

The Americans with Disabilities Act (ADA) of 1990 also addresses accessibility issues but focuses primarily on public buildings and buildings requiring public access (Kaminski et al., 2006). However, Title II of the ADA and the Architectural Barriers Act of 1968 require that a small percentage of SF units built with federal funds be accessible to persons with disabilities.

Although federal accessibility requirements currently apply only to a small percentage of SF units, that may be about to change. H.R. 2353 (The Inclusive Home Design Act) was introduced in 2002 by Representative Jan Schakowsky (D-IL) and reintroduced as H.R. 1441 in 2005. This bill would require a no-step accessible entrance, 32 inch doorways on the main floor, and a bathroom that can accommodate wheelchairs in all new SF homes built using federal funds. As of 2006, the bill had some 36 cosponsors and more than 25 organizations supporting the legislation (Maisel, 2006).

The proposed federal legislation was inspired by the visitability movement, which promotes the idea that virtually all new homes should include features that make them accessible to visitors with mobility impairments. This movement arose independently in Europe and the United States during the 1980s. In the United States, it originated with Concrete Change, a disability advocacy group in Atlanta, GA. The movement in the United States is based on three fundamental principles: that accessibility is a civil right the improves everyone’s quality of life; that accessibility for new housing units can be achieved at minimal cost if good design practices are followed; and that focusing on a limited number of features will speed their adoption (Maisel, 2006).

The goal of the visitability movement is not to designate a fixed proportion of new housing units for people with disabilities, but rather is to add certain accessibility features to virtually *all* new housing units. The specific features championed by visitability advocates differ from place to place, but typically include a no-step accessible entrance, a bathroom or half bath on the main floor, and interior doors at least 32 inches wide (e.g., Concrete Change, 2007a). These features are a subset of those espoused by a broader movement promoting the idea that homes should be accessible and livable for people at all stages of their lives, even as they undergo declining health and increasing disability. The broader set of features includes those advocated by the visitability movement as well as features such as lower countertops, cabinets with pull-out shelves, higher toilet seats, and roll-in showers (Kaminski et al., 2006). Advocates of the broader movement (e.g., universal design, inclusive design, lifetime design, and barrier-free housing) often go beyond basic accessibility features to include energy efficiency, floor space, storage, and other issues (e.g., Milner and Madigan, 2004).

The visitability movement has achieved a number of successes. In 1989, Concrete Change influenced the Atlanta affiliate of Habitat for Humanity to include visitability features in virtually all their new houses. In 1992, Atlanta passed the first ordinance requiring visitability features in private SF homes or duplexes built with any type of public funds or financial benefits dispersed by the city. Similar legislation has since been passed in other cities and states, including Austin TX, San Antonio TX, Chicago IL, Urbana IL, and Scranton PA and the states of Georgia, Texas, and Kansas. Although most legislation applies only to houses built with some degree of public funding, a few local areas (e.g., Naperville IL, Bolingbrook IL, and Pima County AZ) have passed legislation that applies to all new housing, including units built solely with private funding. In addition to mandatory requirements, several cities and states have worked with developers and builders to establish voluntary programs. By 2006, 44 state and local governments had some type of visitability program in place and another 27 were in the process of developing such programs (Maisel, 2006).

There are active visitability and housing design movements in other countries as well. Italy, Spain, Greece, France, Denmark, Sweden, and the Netherlands have established accessibility policies for multifamily housing (Kochera, 2002). The United Kingdom has the most extensive accessibility requirements of any country, requiring *all* new housing units to have a no-step entrance, wide halls and doorways, a bathroom on the entrance level, and reachable electrical outlets and switches (Imrie, 2003). These requirements apply to SF as well as multifamily units and to those built with private as well as public funding. As is true for most visitability legislation in the United States, waivers may be granted based on the topography of the construction site.

Further Research. Much remains to be done in the study of aging, disability, and housing. What measures of disability are most closely related to the need for accessibility features? What are the primary determinants of different types of disability and how are disability rates likely to change over time? Which accessibility features are most essential to persons with disabilities? How much are people willing to pay for specific accessibility features? How cost effective is investment in accessible housing as an alternative to nursing home care? Does the lack of access features contribute to rates of institutionalization? These and other questions provide a rich field for further research.

Conclusions

Homebuilders often claim that the number of people with mobility impairments is too small to support the construction of large numbers of accessible housing units (e.g., Imrie, 2003; Kaminski et al., 2006). Given the findings reported here, we do not believe these claims are valid. Population growth and aging will substantially raise the number of U.S. households with at least one disabled resident over the next few decades, spurring the demand for homes with accessibility features. The desire to accommodate the needs of visitors and to age in place will add to that demand. Housing turnover will magnify the probability that any given unit will house a person with disabilities. When viewed from the perspective of households and housing units rather than individuals—which, in our view, is the relevant perspective—we believe there is a large and growing demand for homes with accessibility features.

The cost of incorporating accessibility features into the construction of new units is typically very low and several studies have shown that many people—including many with no disabilities—value those features and are willing to pay for them (e.g., Alonso, 2002; Kochera, 2002). Yet the vast majority of the housing stock in the United States and many other countries is currently inaccessible to persons with disabilities (e.g., Imrie, 2003; Maisel, 2006; Steinfeld et al., 1998). Given the strong consumer demand for accessibility features, the low cost of incorporating them into the construction of new units, the high cost of making modifications to existing units, and the high cost of living in a nursing home, we believe it is imperative to close this gap. We encourage the housing industry to include more accessibility features in new units and urge policy makers at all levels of government to develop and implement policies directed toward that end. We believe the inclusion of such features will be tremendously beneficial to currently disabled persons, to their families and friends, to those who become disabled in the future, and to society as a whole.

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Table 1. Disability Rates by Age & Sex, 2000

	Male			Female		
Age	Population	DIS-1	%	Population	DIS-1	%
< 35	60,949,682	1,121,581	1.8	58,747,107	1,024,801	1.7
35-44	22,795,548	1,244,430	5.5	23,124,437	1,303,179	5.6
45-54	18,432,972	1,644,908	8.9	19,172,397	1,812,554	9.5
55-64	11,582,552	1,814,774	15.7	12,590,270	2,039,293	16.2
65-74	8,245,839	1,794,954	21.8	9,989,648	2,313,961	23.2
75-84	4,815,313	1,507,354	31.3	7,577,579	2,760,742	36.4
85+	1,306,660	618,657	47.3	3,045,737	1,852,722	60.8
Total	128,128,566	9,746,658	7.6	134,247,175	13,107,252	9.8

	Male			Female		
Age	Population	DIS-2	%	Population	DIS-2	%
< 35	60,949,682	606,523	1.0	58,747,107	486,806	0.8
35-44	22,795,548	371,321	1.6	23,124,437	402,428	1.7
45-54	18,432,972	438,913	2.4	19,172,397	519,422	2.7
55-64	11,582,552	424,696	3.7	12,590,270	534,536	4.2
65-74	8,245,839	464,774	5.6	9,989,648	672,627	6.7
75-84	4,815,313	544,988	11.3	7,577,579	1,154,653	15.2
85+	1,306,660	322,841	24.7	3,045,737	1,147,017	37.7
Total	128,128,566	3,174,056	2.5	134,247,175	4,917,489	3.7

Note: Data are for the population age 5 and older.

Source: U.S. Census Bureau, 2000 Census of Population and Housing, 5% PUMS File.

Table 2. Household Disability Rates by Age of Householder, 2000

Age	Households	HHDIS-1	%	HHDIS-2	%
<35	26,122,015	1,367,226	5.2	478,632	1.8
35-44	24,863,576	2,581,240	10.4	895,912	3.6
45-54	20,957,677	3,378,321	16.1	1,081,680	5.2
55-64	13,508,638	3,388,779	25.1	970,670	7.2
65-74	10,518,944	3,255,093	30.9	927,412	8.8
75-84	7,417,732	2,852,307	38.5	962,314	13.0
85+	2,247,362	1,205,028	53.6	559,272	24.9
Total	105,635,944	18,027,994	17.1	5,875,892	5.6

Table 3. Projections of Total Population and Persons with Disabilities, 2000-2050

	2000	2010	2020	2030	2040	2050
Population	281,421,920	308,714,880	333,534,624	359,655,648	385,430,208	410,116,896
DIS-1						
Low	23,148,345	25,943,179	28,896,854	32,285,802	35,264,114	36,890,348
%	8.2	8.4	8.7	9.0	9.1	9.0
Medium	23,148,345	27,308,609	32,018,675	37,656,571	43,295,081	47,675,441
%	8.2	8.8	9.6	10.5	11.2	11.6
High	23,148,345	28,674,040	35,300,589	43,592,188	52,625,442	60,847,287
%	8.2	9.3	10.6	12.1	13.7	14.8
DIS-2						
Low	8,234,000	9,185,169	10,145,932	11,670,077	13,437,528	14,483,717
%	2.9	3.0	3.0	3.2	3.5	3.5
Medium	8,234,000	9,668,599	11,242,030	13,611,403	16,497,759	18,718,111
%	2.9	3.1	3.4	3.8	4.3	4.6
High	8,234,000	10,152,029	12,394,338	15,756,901	20,053,130	23,889,579
%	2.9	3.3	3.7	4.4	5.2	5.8

Table 4. Medium Projections of Total Population and Persons with Disabilities by Age, 2000-2050

Age	2000	2010	2020	2030	2040	2050
Population						
<45	184,477,532	188,011,118	195,987,135	206,336,363	217,170,837	231,408,738
45-64	61,952,635	80,712,933	83,491,440	81,842,489	87,376,575	90,641,779
65-84	30,752,166	34,014,724	47,062,880	62,023,829	65,280,624	66,445,748
85+	4,239,587	5,976,105	6,993,169	9,452,967	15,602,172	21,620,631
Total	281,421,920	308,714,880	333,534,624	359,655,648	385,430,208	410,116,896
DIS-1						
<45	5,003,240	4,917,831	5,118,722	5,430,388	5,611,733	6,006,713
45-64	7,334,217	9,842,922	10,554,961	10,169,709	10,813,260	11,352,155
65-84	8,397,390	9,171,618	12,412,248	16,760,916	18,154,832	18,268,850
85+	2,413,498	3,376,238	3,932,743	5,295,557	8,715,257	12,047,723
Total	23,148,345	27,308,609	32,018,675	37,656,571	43,295,081	47,675,441
DIS-2						
<45	2,033,485	2,035,562	2,119,840	2,240,163	2,336,459	2,495,259
45-64	1,923,284	2,565,572	2,731,485	2,638,984	2,807,150	2,940,724
65-84	2,839,540	3,065,702	4,065,644	5,609,065	6,223,406	6,200,466
85+	1,437,692	2,001,764	2,325,061	3,123,192	5,130,745	7,081,662
Total	8,234,000	9,668,599	11,242,030	13,611,403	16,497,759	18,718,111
Population (in %)						
<45	65.6	60.9	58.8	57.4	56.3	56.4
45-64	22.0	26.1	25.0	22.8	22.7	22.1
65-84	10.9	11.0	14.1	17.2	16.9	16.2
85+	1.5	1.9	2.1	2.6	4.0	5.3
Total	100	100	100	100	100	100
DIS-1 (in %)						
<45	21.6	18.0	16.0	14.4	13.0	12.6
45-64	31.7	36.0	33.0	27.0	25.0	23.8
65-84	36.3	33.6	38.8	44.5	41.9	38.3
85+	10.4	12.4	12.3	14.1	20.1	25.3
Total	100	100	100	100	100	100
DIS-2 (in %)						
<45	24.7	21.1	18.9	16.5	14.2	13.3
45-64	23.4	26.5	24.3	19.4	17.0	15.7
65-84	34.5	31.7	36.2	41.2	37.7	33.1
85+	17.5	20.7	20.7	22.9	31.1	37.8
Total	100	100	100	100	100	100

Table 5. Projections of Households and Households with at Least One Disabled Resident, 2000-2050

	2000	2010	2020	2030	2040	2050
Households	103,368,736	120,795,809	131,624,150	140,088,321	148,551,774	156,268,390
HHDIS-1						
Low	17,097,283	20,402,031	22,423,483	24,067,264	25,244,765	25,682,981
%	16.5	16.9	17.0	17.2	17.0	16.4
Medium	17,097,283	21,475,822	24,845,964	28,070,872	30,993,949	33,191,541
%	16.5	17.8	18.9	20.0	20.9	21.2
High	17,097,283	22,549,613	27,392,675	32,495,544	37,673,338	42,361,751
%	16.5	18.7	20.8	23.2	25.4	27.1
HHDIS-2						
Low	5,569,750	6,634,110	7,230,879	7,840,868	8,429,025	8,704,061
%	5.4	5.5	5.5	5.6	5.7	5.6
Medium	5,569,750	6,983,274	8,012,055	9,145,202	10,348,631	11,248,741
%	5.4	5.8	6.1	6.5	7.0	7.2
High	5,569,750	7,332,438	8,833,290	10,586,714	12,578,826	14,356,560
%	5.4	6.1	6.7	7.6	8.5	9.2

Note: These numbers exclude disabled persons living in group quarters.

Table 6. Medium Projections of Households and Households with at Least One Disabled Resident by Age of Householder, 2000-2050

Age	2000	2010	2020	2030	2040	2050
Households						
<45	51,719,959	52,735,162	54,167,172	54,496,539	55,464,646	58,575,301
45-64	33,328,331	44,509,952	45,889,413	44,561,131	47,469,150	49,033,225
65-84	16,361,825	20,252,720	27,796,377	36,090,244	37,572,488	37,649,117
85+	1,958,621	3,297,975	3,771,188	4,940,407	8,045,490	11,010,747
Total	103,368,736	120,795,809	131,624,150	140,088,321	148,551,774	156,268,390
HHDIS-1						
<45	3,979,661	3,884,806	4,008,399	4,109,596	4,127,649	4,372,436
45-64	6,510,796	8,983,241	9,536,397	9,121,471	9,674,956	10,102,608
65-84	5,553,614	6,853,519	9,300,722	12,218,253	12,922,761	12,877,053
85+	1,053,212	1,754,255	2,000,447	2,621,552	4,268,582	5,839,443
Total	17,097,283	21,475,822	24,845,964	28,070,872	30,993,949	33,191,541
HHDIS-2						
<45	1,386,986	1,353,754	1,396,245	1,430,973	1,437,573	1,522,828
45-64	1,979,764	2,707,866	2,853,493	2,739,118	2,908,067	3,028,914
65-84	1,713,642	2,110,040	2,837,812	3,763,400	4,030,121	3,998,537
85+	489,358	811,614	924,505	1,211,711	1,972,870	2,698,462
Total	5,569,750	6,983,274	8,012,055	9,145,202	10,348,631	11,248,741
Households (in %)						
<45	50.0	43.7	41.2	38.9	37.3	37.5
45-64	32.2	36.8	34.9	31.8	32.0	31.4
65-84	15.8	16.8	21.1	25.8	25.3	24.1
85+	1.9	2.7	2.9	3.5	5.4	7.0
Total	100	100	100	100	100	100
HHDIS-1 (in %)						
<45	23.3	18.1	16.1	14.6	13.3	13.2
45-64	38.1	41.8	38.4	32.5	31.2	30.4
65-84	32.5	31.9	37.4	43.5	41.7	38.8
85+	6.2	8.2	8.1	9.3	13.8	17.6
Total	100	100	100	100	100	100
HHDIS-2 (in %)						
<45	24.9	19.4	17.4	15.6	13.9	13.5
45-64	35.5	38.8	35.6	30.0	28.1	26.9
65-84	30.8	30.2	35.4	41.2	38.9	35.5
85+	8.8	11.6	11.5	13.2	19.1	24.0
Total	100	100	100	100	100	100

Note: These numbers exclude disabled persons living in group quarters.

Table 7. Average Length of Residence by Age of Householder, Single-Family Units, 2000

Age	Years
< 35	4.3
35-44	8.0
45-54	12.8
55-64	19.0
65-74	24.7
75-84	28.0
85+	30.2
Total	13.7

Table 8. Average Length of Residence, Single-Family Units, Weighted by Age Distribution of Persons with Physical Disabilities

Year	Length
2000	17.6
2010	18.4
2020	19.1
2030	20.1
2040	20.8
2050	21.2