ESTIMATING THE PREVALENCE OF LONG-TERM DISABILITY FOR AN AGING SOCIETY

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Office of the Assistant Secretary for Planning and Evaluation

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The aging of a nation has profound effects on all aspects of society. From the marketing of products, to retirement and employment patterns, to social relationships between generations, aging of a population results in dramatic changes in the way a society functions. Although these demographic changes have significant effects on every aspect of life in our society, one of the greatest challenges faced by an aging society lies in its ability to provide health and social service care of high quality, particularly for those with chronic needs.

Providing high quality long-term care services to disabled people in a society in which the number of people requiring those services is increasing rapidly raises difficult public policy decisions. Debates about the best approaches to providing long-term care, and equally difficult issues concerning what level of resources a society can allocate to this care, have already become common in industrialized nations! Projections of the need for long-term care are fundamental for sound public policy. "If our efforts to plan for our aging population are to become more intelligent and less feeble, the highest priority must be given to amassing data and making projections of health care needs" (Brody, et. al., 1987).

Projecting the size of the long-term care population in an aging America has become a subject of particular interest for researchers. Manton and Liu (1984) estimated the future growth of the long-term care population, using comprehensive national data. While this work served as an important data source, the projections were based on a static model; that is, the rates of disability and mortality were assumed to remain constant for the next half century. Given the research on potential changes in "active life expectancy" (Katz et. al. 1983), a model based on current rates lacks the comprehensiveness necessary for public policy analysis.

Two other recent studies are of interest. The Brookings Institution estimated future costs for long-term care. Estimates in this model were based both on the continuation of current policies, and on changes that could occur as a result of some of the various public and private initiatives currently being proposed (Rivlin et. al., 1988). This comprehensive study assumed that disability rates remained constant over the projection period. A sensitivity analysis was done to look at the effects of higher or lower disability, but the disability assumptions on which all cost estimates wer e based was constant. A second recent effort was conducted by researchers at the Urban Institute and used a model that incorporated potential changes in disability (McBride 1989). This work attempted to develop alternative scenarios in estimating disability. This study relied on the National Health Interview Survey, Supplement on Aging for non-institutional baseline data. Due to major variations in approaches to measuring disability and differences in sampling frame, data from the Urban Institute study and this work generate different baseline estimates and hence projections of disability for the older population.

The study presented in this paper extends the contributions made by the works noted above in two important ways. First, this study, like the Urban Institute project, employs a model in which both life expectancy and rates of disability can be altered

over time. Second, this research deals with projections of needs for long-term care as an issue related to, but separate from, where people live (in institutions or at home in the community). Since the mix of these two populations may change in the future, accurate projections of need for long-term care should be made separate from the issue of where and what type of care is currently provided. Since social and economic changes, and policy decisions made today and in the future may well alter the availability and utilization of institutional and community-based services, it is critical to know the numbers of people who will need various levels of long-term care, without regard to whether this care would be in an institutional or home setting.

In the remainder of this paper, projections of disability, and, by implication, need for long-term care, are detailed by age and sex, for the entire older population (not tied to current living arrangements or service utilization). The policy implications raised by these estimates are then discussed.

ESTIMATION METHODOLOGY

The projection model used in this research required the following tasks: 1) generating baseline estimates of the level of disability of the current older population; 2) formulating assumptions about the future of disability; 3) projecting the numbers of older people with need for long-term care under different disability and mortality scenarios. The following sections describe the data sets, disability measures, and procedures used to generate baseline data, the mortality-disability scenarios, and the projection methodology.

Data Sets: Two national data sets were used to generate the beginning rates of disability. The National Long Term Care Survey of 1982 (NLTCS) is a detailed interview study of the population age 65 and over who were residing in non-institutional settings. In addition to data on medical conditions, cognitive functioning, health care sources and costs, and demographic characteristics, the survey provides detailed data on the functional ability of this nationally representative population. General information on disability status was obtained by telephone from a sample of 35,790 persons from the Medicare master beneficiary files. Detailed information on the nature and extent of functional limitations was then gathered from in-person interviews with the 6088 persons who had reported a functional impairment.

The 1985 National Nursing Home Survey (NNHS) is a nationwide sample survey of residents and staff of nursing and related care homes. Information on a sample of 4595 current residents in the facilities included details about the nature and extent of functional limitations. Thus, the NNHS was the source of disability information on the institutionalized older population, while the NLTCS provided such data on the community-based older population.

Measurement of Disability: Defining and measuring long-term care disability was a critically important step in this study. In past research and in practice settings, two major approaches have been used to determine the number of individuals with long-term care disability: 1) a strategy that estimates disability based on the presence of an illness or disease that could result in chronic impairments; and, 2) a strategy that concentrates on the individual's ability to perform functional activities of daily living (such as ability to feed oneself, bathe, or dress oneself), without regard to clinical diagnosis. The primary method used to measure long-term care disability has been to examine functional ability because, although the presence of a chronic disease, such as arthritis, provides an indication that an individual may have a need for long-term care, the presence of the disease does not necessarily imply anything about level of need. In addition, because assessing the presence of disease often requires professional diagnosis, this measure is m ore likely to be affected by access to health care than is an assessment of functional ability. Criteria used for admission to nursing homes and to community-based long-term care demonstration programs have consistently emphasized the functional ability of the applicant (Rowland et. al. 1987; Kemper et. al.,

1987). The study presented in this paper also uses the functional approach for assessing disability.

Two principles guided the development of the disability measure for this study: 1) to distinguish between levels of disability, long-term disability should be classified into several categories, and 2) to the extent possible, the definition of disability should not be linked to an individual's place of residence.

Definitions of functional disability vary widely across long-term care programs, but all rely on "activities of daily living" (ADL) and "instrumental activities of daily living" (IADL) measures. Some programs consider an impairment in one IADL or ADL as in indicator of long-term disability. Others define long-term disability as impairment in three or more ADL's. Still other programs define disability quite specifically to include only those individuals who meet criteria for nursing home of care (Rowland et. al., 1988; Kane and Kane, 1987). In response to this disagreement, a number of studies have used an approach in which disability is divided into multiple levels (Rivlin et. al., 1988; Kane and Kane, 1987). Such a strategy provides an opportunity to answer questions about a range of disability levels.

Multiple levels of disability were used for this study. (See Figure 1) Specifically, the following three levels of disability were defined:

1. Severe disability--includes those individuals with at least two ADL impairments. Individuals at this level of disability generally meet the current state requirements for intermediate level nursing home care.

2. Moderate disability--includes those individuals experiencing at least one ADL impairment, *or* two IADL limitations. These individuals, in general, would not be disabled enough to meet the current nursing home level of care criteria.

3. Little or no disability--includes individuals with no functional impairment and those with one limitation in an IADL. It is assumed that individuals in this category currently experience no long-term disability.

Calculating Current Prevalence Rates of Disability: Using the measures described above, age- and-sex-specific rates of disability were calculated for the institutionalized older population using the NNHS data, and for the community-based older population using the NLTCS information. Since calculating disability rates for the entire over 65 population without regard to residence was a key objective of the study, it was necessary to combine the residence-specific disability information on the two populations. This was accomplished by weighting the disability rates for each of the two groups by their relative representation in the overall older population. These weights were age and sex-specific.

It should be noted that despite the importance of combining these two data sets, some limitations are encountered in such an approach. Because questionnaire wording,

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data items and data collection strategies varied between the two surveys, potential measurement problems arise when combining data from these two samples. For example, the data collection methods in the NLTCS rely primarily on self report, while the NNHS utilizes data collected from professional staff. Studies examining alternative data collection techniques have reported that such variations can result in apparent differences in functional ability of respondents, when no such differences actually exist (Brown, 1986). However, comparable data collection approaches have not been used in the existing long-term care data sets.

Projecting Disability: The age-sex specific disability rates calculated according to the methods described were combined with 1986 census estimates to form the baseline for our projections. The rates from the two surveys were applied to the census estimates for 1986, the most recent year available, to form the data base. Next, a disability trend (described below) was applied to the beginning rates. The result of this process was a matrix of disability rates by age and gender for the years 1986 to 2040. That is, based on our assumptions about what would happen to disability rates in the future, current disability rates were altered to give a new set of rates that increased, decreased, or remained constant over the next 55 years. These disability rates were then applied to census projections for the years in question (U.S. Bureau of the Census, 1988). The census projections were acted upon by varying mortality assumptions-- continuation of recent mortality trends, faster increase in life expectancy, slower increase in life expectancy. Thus, after mortality rates are applied to the population, the disability rate matrix produces disability projections specific to the disability-mortality assumptions that have been used. For each set of mortality-disability assumptions, projections were done in five year intervals from 1990 to 2040.

FIGURE 1. Disability Categories for LTC Projection Study		
Categories		
Severe	**Moderate**	**Little or None**
2 or more ADL's from below - eating - transferring - using toilet - dressing - incontinence - cognitive impairment	at least 1 ADL from below - eating - transferring - using toilet - dressing - bathing - incontinence or at least 2 IADL's (at least one must be from Group 1) *Group 1* - walking - shopping - meal preparation - housekeeping *Group 2* - phone use - travel	No ADL or IADL or 1 IADL from below - walking - shopping - meal preparation - housekeeping - travel - money management - phone use

Disability-Mortality Scenarios: Estimating rates of disability and mortality through the year 2040 is without question a speculative process. Numerous developments in such areas as public health, medical technology, the environment, and economic and social changes cannot be predicted with accuracy, yet will surely influence mortality and disability. Estimates for longevity did not have to be developed by the project, as they had been generated by the U.S. Bureau of the Census. The Census uses three different assumptions about the future of mortality (a rapid improvement life expectancy series, a middle mortality view, and a slow improvement series). The middle mortality scenario was estimated by examining mortality trends between 1940 and 1986. Census researchers identified variations in life expectancy improvements over that time period. During the 1970's life expectancy increased at a much higher rate 1han the time period 1982 to 1986. The middle mortality scenario thus, "represents the middle ground between sharply different recent trends" (Spencer, 1989, p. 24). The rapid improvement scenario assumes that mortality will decline 100 percent faster than in the middle series. Longevity in the slow- improvement series was originally assumed to decrease half as fast as the middle assumption. However, these estimates were modified because of the effects of Acquired Immunodeficiency Syndrome (AIDS). Under this latter assumption life expectancy is projected to show almost no increase.

A review of the research literature revealed very little agreement on the direction of change in disability rates or on the magnitude of potential changes. Predictions range from decline to improvement in disability rates among older people. A reduction in the rate of disability experienced by older cohorts is perhaps best represented by the work of Fries (1983; also Fries and Crapo, 1981), who suggests that medical advances would result in a compression of morbidity and mortality into the latest years of life. This theory took the position that life would be extended to its biological maximum and that the additional years of life would be relatively healthy and active. While such a theory has been proposed by others (Bjorksten, 1987), there is little research evidence to support such a scenario.

A more middle-ground position suggests that the current rates of disability will remain relatively constant. Represented by the works of several researchers (Brody, 1985; Chapman et. al. 1986; Manton 1986; Feldman 1983) this review of health trends for older people found relatively stable patterns of disability over the past few decades, suggesting that disability rates would remain constant.

A third scenario suggests that longer life expectancy will actually result in an increase in the rates of disability experienced by older people. Verbrugge (1984) suggested, for example, that longer life and the resultant higher prevalence rates for serious diseases would have a "pernicious effect ... since future new survivors will be even more ill and susceptible than those in earlier decades" (1984: 515). Thus, the extension of life would include more active days, but also more inactive or disabled days.

After identifying the continuum of possibilities for future disability trends, it was still necessary to quantify the possible changes in order to develop the estimation models. Unfortunately, there was little information available to aid in estimating the magnitude of potential changes. A review of the literature on disability identified a small number of studies that examined rates of disability over time. The studies used a range of measures such as the existence of an activity limitation, the number of days restricted in the home, and the number of days restricted to bed to assess disability.

The analysis of disability over time in the U.S. relied on the National Health Interview Survey. A detailed analysis of the survey between 1958 and 1980 examined several variables including the presence of total restricted activity, a major activity limitation, and any activity limitation (Verbrugge 1984). Results from this work showed that between 1958 and 1980 there was an increase in the proportion of the older population that reported experiencing disability. For the total restricted activity measure, men age 65 and over showed a 4 percent increase in days restricted, and women 65 and over had a 10.3 percent increase. A second measure which examined the presence of a major activity limitation, showed an 11 percent increase for women and a 1.1 percent increase for men age 65 and over. A third measure that examined the existence of any limitation showed a 13.8 percent increase for men age 65 and over and a 2.3 percent increase for women of comparable ages. This study also examined changes for the 45 to 64 age group. Larger increases in the proportion of those experiencing a disability were reported for this group. Men age 45 to 64 showed a 33 percent increase, while women of this group showed a 46 percent increase.

Although these numbers suggest increased disability, they need to be interpreted cautiously. Changes in questionnaire wording, data collection, and sampling procedures existed. For example, because the data from the survey are grouped in broad age categories as the population has aged over the course of the studies, the average age of the groupings has risen, thus causing an increase in group disability rates that is not necessarily related to increasing rates of disability for comparable age groups.

Several other studies have also used the National Health Interview Survey (Colvez and Blanchet, 1981; Ycas, 1985, Chapman, LaPlante, Wilensky, 1986; Culler, van Deen Daigle 1983). Although these studies examined different time periods (typically a smaller number of years), as expected the findings of these studies, while smaller in magnitude, were generally consistent with the study discussed above.

A second major data source was the Canadian Health Survey (Wilkins and Adams, 1983). Using measures of both the presence of a long-term disability and the number of disability days, the study examined changes between 1951 and 1978. Results also showed an increase in disability over time. Men age 65 and over showed a 15 percent increase, and women of comparable age were reported to show a 60 percent increase. The measure on disability days also showed an increase, but of smaller magnitude, in reported disability over time. For example, men age 65 and over were reported to have a 3.4 percent increase, and women of this age category had a 34 percent increase. The authors of this study pointed out several methodological

problems. The most serious problem appears to be the change in definition of long-term disability; from having permanent physical disability to the presence of any activity limitation. Other questionnaire wording and data collection changes and sample weighting problems were also noted.

In addition to these studies there were several other authors who speculated about future trends in disability (Fries, 1981; Manton, 1986; Brody, 1985; Schneider and Brody, 1983). These estimates were based on theoretical assumptions rather than data on trends in disability.

With these studies as background, we developed our estimates. Data from' the NHIS for the over 65 population had suggested disability increases for the over 65 population ranging from 1 to 14 percent, depending on the measure. Larger increases (33% men, 46% women) were reported for the 45-64 age group. The Canadian survey reported increases on the disability days measure of 3.4 percent for men and 34 percent for women and increases in any long term disability of 50 percent for the over 65 population.

Based on these numbers a 15 percent increase in disability was used to represent the estimates for the increasing disability scenario. No supporting numbers were available for estimating an improvement in disability. In order to represent an alternative hypothesis a 15 percent rate for the decreasing disability scenario was used as well. A best-guess scenario, which assumed a smaller increase (7.5%) in disability rates was also estimated. The rationale for the best-guess estimate was that while some increase in disability may have occurred, methodological concerns suggest that the increase has been over-estimated in the data presented. Yet it seems plausible that increases in longevity may result in a higher proportion of the population experiencing a disability. The disability changes were estimated for the next twenty-five years; after 2010, rates were held constant. The estimates did assume that the amount of change would be spread evenly over the twenty-five years, and evenly among the three levels of disability (little or none, moderate, severe). Disability rates were also assumed to be the same for men and women and spread evenly across the age range.

Models developed: From the combination of mortality and disability scenarios possible, four models were developed to generate projections: 1) a constant model-- with mortality and disability trends continuing under current rates; 2) a longer life/lower disability model--assuming faster improvement in mortality and lower levels of disability (compression of morbidity and mortality); 3) a longer life/higher disability model-- assuming faster improvements in mortality and higher levels of disability; 4) a moderately longer life/moderately higher disability model-- assuming the middle mortality rates and a higher level of disability than currently exists, but not as high as that assumed in the previous model. This last model represents our best guess for the future long-term care population. The selected scenarios are summarized in Figure 2.

MODEL ESTIMATES

Table 1 shows the beginning disability rates summarized by age and sex. Data for 1986 indicate that the vast majority of the population over age 65 (82.7%) experienced little or no disability. However, 8.9 percent of the over 65 population are classified as moderately impaired and 8.4 percent are placed in the severely disabled category. As might be expected, the proportion of the older population with little or no disability decreases with age, and the proportion with severe disability increases with age. For example, 4.4 percent of the 65-74 year old age group are classified as being severely impaired, compared to almost 29 percent for the over age 85 group. Examination of the category of individuals with no disability also highlights these differences. Almost 90 percent of the 65-74 age category are classified as having no disability, compared to just under 50 percent for the 85+ group.

For all age groups, the proportion of women with a severe disability is greater than that for males. For those age 85 and above, almost 32 percent of the women are classified as being severely disabled, while about 22 percent of the men are within this category. This reinforces an often-cited finding that women have higher rates of illness and disability than do men, even though in general women enjoy greater longevity than do men. To be certain that the higher rates of disability among women were not explained by their higher average age (and thus greater likelihood of living long enough to become disabled), we compared the proportions of men and women disabled within single years of age. The same pattern held; in fact, at higher ages, the difference between men and women was greater. Old-old women were much more likely than old-old men to be disabled, and this difference was greater at these older ages than at younger ages. Thus, the sex differential in disability is not "explained away" by the greater longevity, and thus higher average age of older women.

Using these 1986 numbers as a base (see Table 1), estimates were generated for the four different models described above. The importance of developing alternative models that allow for change in disability and mortality over the course of the projection period is illustrated by the range of estimates generated by the different scenarios. As seen in Table 2, the estimates of the numbers of older persons with severe disability for the year 2040 range from 7.6 million (in the constant model) to 12 million (for the high disability model). The reader will note that the lowest estimate of the number of older persons with severe disability in the year 2040 comes from the constant model rather than the longer life/lower disability model. This and other apparent discrepancies are explained by the fact that findings reflect three related but distinct forces: the force of population aging, the force of mortality, and the impact of disability. The estimates for severe disability are lower for the constant model than the longer life/lower disability model because the latter model assumes faster improvement in life expectancy. Thus, the longer life/lower disability scenario results in a very large old-old population. Although the scenario assumes improvements in disability, the higher number of people in the oldest age group results in a higher estimate of severely disabled persons than does the scenario with higher rates of disability.

FIGURE 2. Description of Estimation Scenarios		
Model	**Description**	**Disability and Mortality Rate Assumption**
Constant Model	Continuation of current rates of disability. Mortality estimates represent middle ground of diverging mortality trends.	Model assumes that current disability rates will remain constant in the future. Current rates of disability in 1986 are applied to the population estimates based on the middle series mortality projections.
Longer Life/ Less Disability Model	Improvement in mortality rates. Lowering of disability rates.	Model uses Census estimates for rapid improvement series in life expectancy. Disability rates are assumed to be lower than current rates (15% decrease). Assumptions made for first 25 years of projections only.
Longer Life/ Higher Disability Model	Improvement in mortality rates. Increase in disability rates.	Model uses Census estimates for rapid improvement series in life expectancy. Disability rates are assumed to be higher than current rates (15% increase). Assumptions made for first 25 years of projections.
Moderately Longer Life/ Moderately Higher Disability	Mortality uses middle series. Some increase projections in disability rates is expected to occur.	Model assumes the middle series rates of improvement in life expectancy. Disability is assumed to increase, but at slower rate than above (7.5%). Assumptions for first 25 years of projections.

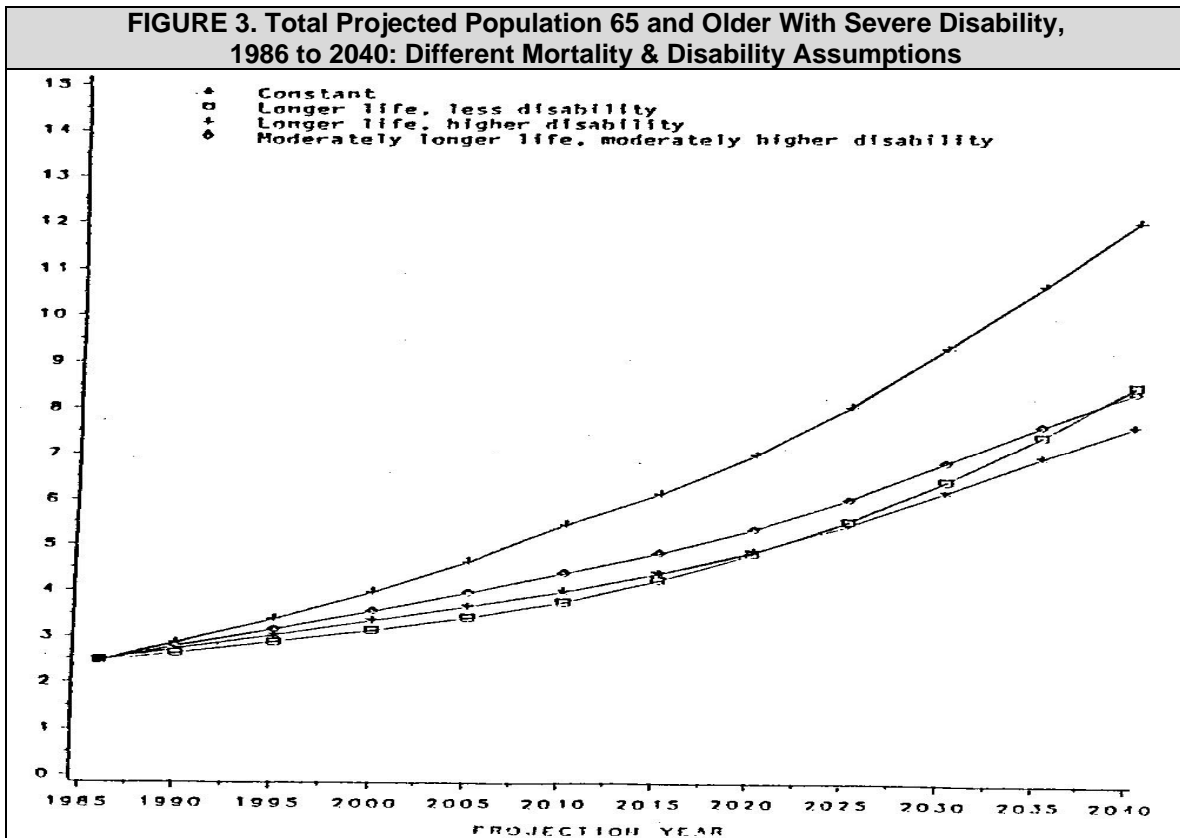| TABLE 1. Baseline (1986) Disability Proportions by Age Category and Sex* (proportions are given as percentages)				
Disability Category	**Age Range**	**Males**	**Females**	**Total**
Little or No Disability	65-74	90.9	89.0	89.9
	75-84	82.7	77.1	79.2
	85+	58.3	46.5	49.8
	All Ages	86.4	80.2	82.7
Moderate Disability	65-74	5.1	6.3	5.8
	75-84	9.1	12.1	11.0
	85+	19.9	21.8	21.3
	All Ages	7.2	10.0	8.9
Severe Disability	65-74	4.0	4.6	4.4
	75-84	8.2	10.8	9.9
	85+	21.7	31.7	28.9
	All Ages	6.4	9.8	8.4
* Estimates use data from the 1982 National Long-Term Care Survey and the 1985 National Nursing Home Survey that have been weighted and applied to 1986 Census population estimates.				

The models are graphically presented in Figure 3. The interaction of the forces of population aging, mortality, and disability explains the inter-relationships between the scenarios. For example, in Figure 3, the longer life/less disability line is quite close to the longer life and moderately higher disability model line due to differences in mortality rates between the two models. If mortality rates were the same for each model and only disability levels were manipulated, such a merging of estimates would not occur.

TABLE 2. Estimated Number (in millions) of Older People at Different Levels of Disability in 1986, 2000, 2020, and 2040 for Four Projection Scenarios				
Projected Year	Little or No Disability	Moderate Disability	Severe Disability	*Total Population
CONSTANT				
1986	24.1	2.6	2.5	29.3
2000	28.1	3.4	3.4	34.8
2020	42.4	4.8	4.9	52.1
2040	53.3	7.2	7.6	68.1
LONGER LIFE/LOWER DISABILITY				
1986	24.1	2.6	2.5	29.2
2000	29.7	3.1	3.2	36.0
2020	48.1	4.6	4.8	57.5
2040	64.1	7.5	8.5	80.1
LONGER LIFE/HIGHER DISABILITY				
1986	24.1	2.6	2.5	29.2
2000	28.1	3.9	4.0	36.0
2020	43.9	6.6	7.0	57.5
2040	57.5	10.6	12.0	80.1
LONGER LIFE/MODERATE DISABILITY (BEST GUESS)				
1986	24.1	2.6	2.5	29.2
2000	27.7	3.6	3.6	34.9
2020	41.5	5.3	5.4	52.1
2040	51.9	7.9	8.4	68.1
* Due to rounding errors total may not match the sum of individual disability categories.				

As presented in Table 2, the four scenarios generate a range of estimates concerning the projected size of the disabled population of older persons. Although the differences in the estimates generated by the various mortality-disability scenarios are clearly significant, what is most important is that the numbers generated under even the most conservative and most optimistic scenarios have enormous consequences for future long-term care needs. Current estimates indicate that about 2.6 million older people have a moderate disability and about 2.5 million are severely disabled. In the constant model, with no changes in current disability or mortality rates, the sheer force of population aging will result in 4.9 million older people estimated to have a severe disability by 2020; another 4.8 million will have moderate disability. The longer life/lower disability model generates the lowest estimates of disability for 2020, predicting 4.8 million severely disabled older people and 4.6 million with moderate levels of disability. Thus, by 2020, under the most conservative model, the population of older people experiencing disability is projected to increase about 84 percent, from the current 5.1 million to 9.4 million. Similarly the lowest estimates for disability for 2040 (generated under the constant model) are 14.8 million older people with a disability (an increase of about 190% from 1986). The longer life/higher disability model generates estimates of 7.0 million severely disabled older people by 2020 and 6.6 million moderately disabled older people, for an increase of approximately 167% in the elderly disabled population.

POLICY AND RESEARCH IMPLICATIONS

Most of us are aware of the children's story **Chicken Little** in which the main character is struck on the head by an acorn, then communicates to his fellow citizens that the sky is failing, creating a panic in the mythical animal community. Although we are not suggesting that the sky is failing, the policy and research implications of these estimates are clearly striking. Of particular importance is the finding that regardless of the scenario projected, by the year 2040 when the baby boomers reach their 80's and 90's, the number of older Americans with long-term disabilities will have increased significantly. Estimates of the over 65 population expected to have a long-term disability in 2040 range from 14.8 to 22.6 million people, compared to approximately 5.1 million older people experiencing a long-term disability in 1986, (an increase ranging from 190 to 343 percent).

FIGURE 3. Total Projected Population 65 and Older With Severe Disability, 1986 to 2040: Different Mortality & Disability Assumptions

These projections present a serious challenge for a long-term care system that has already been subject to a considerable amount of criticism, particularly concerning quality and financing. When combined with other social and demographic trends, such as lower fertility rates and changes in the structure and mobility patterns of the family, these estimates suggest that the challenges of providing adequate long-term care to an aging America are almost overwhelming. For example, a current problem that has implications for the future involves the adequacy of the labor force available to provide

long-term care. Many states are currently experiencing a shortage of long-term care personnel, both nurses and paraprofessionals. In some states, particularly those with low unemployment rates, these shortages are severe. At the same time, projections indicate that the pool of workers most likely to perform these jobs will decline in future years. if concerns about who will provide long-term care are real today, in future years such an issue will be of paramount importance.

The increase in the population experiencing long-term disabilities also has obvious implications for financing long-term care. Concern about whether American society can afford to provide adequate health and long-term care for our nation's elderly and disabled populations has now become a topic of national interest. Long-term care has undeniably come to the forefront of the American political system with numerous bills being proposed in the 100th Congress. If adequate funding for long-term care is a topic of debate in 1989, it is difficult to imagine how this challenge will be addressed in 2020 or 2040.

What then are the implications of these demographic changes for policy makers and researchers? Because the estimates show dramatic increases, a coherent set of public policies will be essential. A planning and research strategy that recognizes the future challenges facing the system needs to be developed. While some of the policy and research activities will follow current lines of thinking, others must clearly search for new horizons. For example, current research on personnel problems in long-term care has primarily focused on methods to reduce turnover of staff through various benefit changes. Future research will need to look past the current approach to entirely different ways to structure and deliver long-term care. A related topic involves the relationship between technology and long-term care. Exploration into different ways to deliver long-term care, such as through the use of robotics, smart houses, and other technological innovations, needs to be incorporated into our research agenda.

This work has also identified several specific research issues of significance. First, our review suggests that while the definition and measurement of disability is important both for the development of projections and in the operation of everyday programs, there is no agreement on what constitutes long-term disability, nor on exactly how to measure disability. In fact, the major national surveys, such as the National Nursing Home Survey, the National Long-Term Care Survey (used in this work), and the National Health Interview Survey, do not measure disability in a consistent manner. Because much of the proposed legislation for expanding coverage for long-term care provides benefits based on a specific definition of disability, this issue has direct relevance to the current public policy debate on long-term care.

Information on the duration of disability will also be an important research area. At one time the literature was dominated by the theme that once an individual needed long-term care that would always be the case. Book titles and articles such as, *Last Home For the Aged*, (Tobin & Lieberman 1976), were common. Longitudinal data from both nursing homes and disabled community residents suggests that although the majority of disabled older people do continue to experience impairments, approximately

25 to 30 percent of the disabled sample members improved their functional status (Branch, et al. 1984; Manton, 1988).

Although developing uniform definitions and measures will improve efforts to generate future projections, other enhancements are needed as well. For instance, it is important to examine additional social and economic variables such as marital status, living arrangement, family structure and mobility patterns, and economic status as part of the projections process. Speculation about these areas is perhaps even more difficult than forecasting disability, but these factors will undoubtedly have a major impact on the long-term care needs of our society,

Another research area for continued study is the differential rates of disability experienced by men and women. As noted, despite longer life expectancy, women experience higher rates of disability. Whether this is a by-product of gains in life expectancy achieved by women and is indicative of future trends, and whether such patterns can be altered are clearly questions of critical importance.

The issues raised in this paper are but a sampling of topics for future policy and research activities in long-term care. While the development of such an agenda is not straightforward, it is clear that the aging of America will have a phenomenal impact on the number of people experiencing long-term disabilities. Our policy and research agenda must now formulate a response to this demographic and social challenge.

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