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Morbidity Improvement and Its Impact on LTC Insurance Pricing and Valuation

Track: Long-Term Care

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Summary: Research results from the National Long-Term Care Survey and other surveys of the general elderly population indicate that age-specific morbidity (functional disability) prevalence rates dropped significantly since 1982, possibly faster than concurrent declines in age-specific mortality rates.

MR. P.J. ERIC STALLARD: Morbidity improvement is a topic that gets discussed quite frequently in informal conversations, but I don't recall it being given a full session in the long-term care (LTC) track. Hopefully, you will find today's presentations interesting and informative.

We have three objectives for the session. One is to quantify the nature of the temporal trends in disease morbidity and functional disability; I will define these terms more precisely in a few minutes. Second, we want to illustrate the potential impact of these temporal trends on long-term care insurance (LTCI) pricing and valuation. Third, we want to provide some guidance as to how this material could be used by LTCI actuaries.

What's really new in this session is that we begin to look at the joint impact of changes in disability and mortality and ask what the interactions of these two types of trends mean for LTCI pricing and valuation.

My presentation will be based on published and unpublished research looking at both long-term and short-term trends in disease morbidity, functional disability and mortality. I will present new calculations of short-term trends in disability and mortality and of the interactions of these two types of trends.

Ron Wolf will present practical considerations on the use of these findings in LTCI pricing and valuation, and share with you insights based on his extensive experience in this area.

Scott Weltz will discuss current methodologies and assumptions and will illustrate the impact of morbidity improvement on projected LTCI morbidity estimates. Scott will likewise share with you insights based on his extensive experience in this area.

Thus, the session consists of a sequence of three related presentations with varying perspectives on the nature and meaning of past and potential future improvements in LTC morbidity.

The first of four fundamental questions is what changes have actually occurred? People say that morbidity is improving. What exactly has improved? The second question is why have these changes occurred? The third question is will these changes continue? That's a very good question for people to ponder as they look at this material. The fourth question, which will be addressed more completely by Scott and Ron, is what do these changes imply for pricing and valuation of long-term-care insurance products?

What's a long-term trend? My view of a long-term trend is something on the order of eighty to one hundred years. In order to go back eighty or a hundred years, you need to go back to 1900 or 1910, to approximately the first decade of the 20th century. You then must consider what data are available. Researchers at the University of Chicago have assembled a very large publicly available data set containing the 1900 and 1910 medical examinations from the Union Army Pension Program. Those files contain detailed information on the health status of Union Army veterans who fought in the U.S. Civil War in the 1860s and who, at the turn of the century, were reaching retirement and older ages (Fogel and Costa, 1997).

The Union Army data will be used as the basis of the longest set of long-term trends in my presentation. If the length of the reference period is cut to, say, forty years, then there are substantially more data available for calculating long-term trends. For example, there are numerous national health surveys for the period beyond 1960, including the 1985–1988 National Health Interview Survey (NHIS), the 1988–

1994 National Health and Nutritional Examination Survey (NHANES), and various reports from National Center for Health Statistics (NCHS) for the period 1960–2002.

The first question is: What happened to mortality and morbidity over the period 1900–2000? Because of the high ages at which LTC is generally needed, it is reasonable to focus on the health and mortality experience of persons aged 65 years and older. Most of the tables in my presentation refer to these ages. Limitations on relevant available data occasionally required consideration of ages as young as 50 years.

Chart 1 displays age-adjusted central death rates at ages 65 years and older for the total population, and by sex, for 1900, 1910, 1990, and 1999. The rightmost column of the table displays the annual rates of decline in the age-adjusted central death rates. What you see is that the smallest annual rates of decline are approximately five-tenths to six-tenths of one percent (0.5 percent to 0.6percentpercent) per year for males. The key number to focus on in looking at the changes in this and subsequent tables is the rate of 0.6 percentpercent per year. Occasionally, we'll see 0.5 percentpercent, but 0.6 percentpercent is the fundamental comparator. In the University of Chicago analysis, 0.6 percentpercent per year was used to summarize the overall rate of decline in morbidity, and this same rate also turns out to be a fairly good estimate of the rate of decline in mortality.

Charts 2 and 3 display the prevalence rates for a range of chronic medical conditions or diseases among elderly male veterans in 1910 and 1985–88 along with the annual rates of decline in these prevalence rates. Chart 4 presents similar statistics for a range of functional limitations among middle-aged and elderly male veterans in 1900/10 and 1984–88.

Some clarification of the terminology is needed at this point to avoid confusion.

The prevalence rate of a chronic medical condition is defined as the fraction of the population alive on any given day with a current diagnosis of that condition. This contrasts with the incidence rate of a chronic medical condition, which is the fraction of the population alive and free of the condition on any given day that would receive a new diagnosis of that condition within, say, a one-year time period.

There is potential confusion over the use of the terms: (1) “morbidity;” (2) “chronic (medical) condition” or “chronic disease;” and (3) “functional limitation” or “functional disability”. When epidemiologists use the term morbidity, they generally mean chronic medical conditions or diseases such as those listed in Charts 2 and 3. When LTCI actuaries use the term morbidity, they generally mean a level of functional limitation or disability that would allow an LTCI policyholder to go on claim. The functional disability may or may not be associated with a specific medical condition; eligibility for LTCI benefits, however, is tied directly to the nature and

severity of the disability, not to any specific medical conditions that may be responsible for the disability.

The functional disabilities covered by tax-qualified LTCI policies are restricted to those resulting in limitations or impairments in any of six activities of daily living (ADLs: eating, toileting, transferring, bathing, dressing and continence) or severe cognitive impairment, as specified in the Health Insurance Portability and Accountability Act of 1996 (HIPAA). Because persons meeting the HIPAA criteria are defined to be "chronically ill individuals," the use of the term "morbidity" by LTCI actuaries to denote functional limitations, impairments, or disabilities is consistent with the terminology used in HIPAA.

The term "morbidity improvement" is a broad term that is reasonably interpreted to cover reductions in prevalence rates for chronic diseases, for functional disabilities, and for all intermediate states of ill health that can be measured along the pathways from disease to disability. My presentation reports on the long-term changes in chronic medical conditions and functional limitations.

The chronic disease prevalence rates in Charts 2 and 3 were rank ordered by the annual rate of decline. Cancer had a negative decline, that is, an increase over time, which means that things deteriorated for this disease. All of the other declines in chronic disease prevalence rates were at a rate greater than or equal 0.6 percent per year.

The prevalence rates for functional limitations in Chart 4 were similarly rank ordered by the annual rate of decline. For age 50–64, all of the rates of decline were above 0.6 percent. For the older ages, 60–74, the annual rates of decline for being deaf or blind were below 0.6percent; the rates for the other three limitations were above 0.6percent.

The results in Charts 2–4 can be summarized as follows. Except for cancer, chronic disease prevalence rates for older males declined at a rate of 0.6 percent per year or faster. Except for sensory losses, functional limitation prevalence rates for older males declined at a rate of 0.6 percent per year or faster. The rates of decline for chronic disease and functional limitation prevalence rates were generally faster than the 0.6 percent per year rate of decline in mortality for older males over the same period.

These results answer the first of the four questions identified previously: What changes have actually occurred?

The second question is: Why have these changes occurred? This is a more complex question and is best answered by reference to published analyses of the data underlying Charts 1–4.

With respect to mortality:

- 50 percent of the decline can be predicted by changes in height and weight (Fogel and Costa, 1997).

With respect to chronic medical conditions:

- 29 percent of the decline was due to occupational shifts (Costa, 2000)
- 18 percent of the decline was due to declines in infectious diseases (Costa, 2000).

With respect to functional limitations or disabilities:

- 37 percent of the decline was due to the reduced prevalence of chronic diseases (Costa, 2002)
- 24 percent of the decline was due to the reduced debilitating effects of chronic diseases (Costa, 2002).

Such quantitative estimates only begin to answer the question of why the mortality and morbidity decline occurred. The mortality decline is associated with changes in height and weight, and those may appear to be strange variables to use in generating an explanatory model. If you look at the source articles, however, you will find a discussion about the relationship between prenatal and postnatal nutrition and the ultimate height and weight attained at adult maturity.

Increases in height and weight are related to improvements in prenatal and postnatal nutrition and these improvements produce healthier babies, healthier adults, and healthier retirees. Over succeeding birth cohorts, each new generation has turned out to be more healthy than the previous generations. Height and weight can be summarized in a single variable, body mass index (BMI). Fogel and Costa (1997) showed that the trajectory of change in BMI for male cohorts in the United States increased from 22.8 kg/m^2 in 1910 to 26.4 kg/m^2 in 1985–88; they commented that these changes alone imply a decline of about 35 percent in the prevalence of chronic medical conditions for the later cohort.

The decline in chronic disease prevalence rates were plausibly related to shifts in occupation and to declines in infectious disease.

The declines in functional limitations were related to both the reduced prevalence of chronic medical conditions and to reductions in the debilitating effects of chronic diseases once they had become manifest.

Charts 5–11 display a range of data on mortality changes over the period 1960–2000. These results can be summarized as follows:

- Increases in life expectancy at age 65 were due to decreases in death rates from heart and cerebrovascular diseases
- Cancer death rates increased, but not enough to offset heart and cerebrovascular death rate decreases

- Cancer death rates peaked for males during the 1990s (with the female peak expected 10–20 years later)
- Residual causes at age 85+ increased from 27 percent to 40 percent of deaths as progress against the top three causes left a "void."

Chart 5 shows that unisex life expectancy at age 65 increased at a rate of approximately 0.6 percent per year. The 1960s was a relatively poor decade for males. The 1990s was a relatively poor decade for females, although the latest statistics showed that female life expectancy at age 65 increased from 19.2 to 19.5 years from 2000 to 2002, which, in two years, is as much an increase as in the entire prior decade. Such short-term fluctuations are to be expected.

Chart 6 shows that the rates of decline in age-specific unisex death rates are all above 0.6 percent per year. The younger elderly have more improvement than the older ones. The relative declines in the age-specific unisex death rates (Chart 6) are faster than the relative increases in the unisex life expectancies at age 65 (Chart 5). This observation is well known and results from the approximately exponential form of the death rates at older ages.

Charts 7–11 display age-specific unisex death rates for three specific causes of death (diseases of the heart, cancer, and cerebrovascular diseases) and for residual causes. Heart disease death rates have declined significantly (Chart 7). Cancer death rates have deteriorated significantly (Chart 8). Cerebrovascular disease death rates have declined even more than the heart disease death rates (Table 9). The death rates for the combination of all three diseases declined at a rate above 1.0 percent per year for all three age groups (Chart 10). The residual causes, which are all causes other than the three that I've isolated in Charts 7-10, have a mixed pattern of change over age with some deterioration above age 75 (Chart 11).

To restate the findings, heart disease and cerebrovascular diseases were the major components of the improvements in unisex death rates during 1960–2000 and cancer, even though it deteriorated, did not deteriorate enough to offset the other improvements.

The long-term trends are characterized by declines in overall mortality rates, declines in mortality rates for specific causes of death, declines in the prevalence of specific chronic medical conditions that can cause functional limitations or disabilities and death, and declines in the prevalence of functional limitations.
At this point it will be informative to revisit our second question: Why have these changes occurred? Specifically, we can ask: Are people changing their behaviors in ways that would account for some of the reductions in the major chronic diseases?

Charts 12–16 display a range of data on changes in modifiable risk factors over the period 1960–2000. The results can be summarized as follows:

- Substantial declines occurred for cigarette smoking, hypertension, and serum cholesterol
- Substantial increases occurred for obesity, but not enough to offset favorable declines in other risk factors.

Chart 12 shows that males at all ages above 45 years, and females at ages 45–64, had substantial declines in cigarette smoking – with the annual rate of change greatly exceeding the 0.6 percent level that we're using as a standard. When you look at hypertension (Chart 13), there are substantial declines, but they are slower than the 0.6 percent level. In contrast, the prevalence of high serum cholesterol (Chart15) declined very rapidly compared to the 0.6percent level. The decline in mean serum cholesterol (Chart 14) was substantial. Strictly speaking, the annual rate of decline in mean serum cholesterol is not comparable with the other rates of decline because the optimal mean value is not zero, but is believed to be in a range near but below 200 mg/dL.

Obesity has changed in the opposite direction (Chart16). That change has been widely reported in the news media; the table shows that there has been a significant deterioration in this risk factor. The impact of the increase in obesity, however, has not been enough to offset the favorable impacts of the declines in the other risk factors.

Now we turn our attention to the data on short-term trends in morbidity and mortality improvement. I consider short-term trends to be on the order of five to fifteen years. Good data on short-term trends are available from the National Long Term Care Surveys (NLTCS) of 1982, 1984, 1989, 1994, and 1999, which is funded by the National Institute on Aging under a grant to the Duke University Center for Demographic Studies. Field work at each wave of the survey has been performed by the U.S. Bureau of the Census. Response rates have consistently reached or exceeded 95 percent of eligible sample persons.

Details on the survey are provided at http://nltcs.cds.duke.edu/index.htm. Briefly, the NLTCS reports on the health and LTC characteristics of a nationally representative sample of elderly Medicare enrollees aged 65 years and older. The survey combined cross-sectional and longitudinal designs with stable instrumentation at each calendar year of delivery (Stallard, 2000; Stallard and Yee, 2000; Manton and Gu, 2001). Compared with a range of eight possible alternative data sources, the NLTCS was described as “One of the [two] best designed surveys for analyzing national disability trends” (Freedman et al., 2002). It has an advantage over the other “best survey” in that it covers both noninstitutional and institutional populations. Its only cited weakness was the five-year interval between replications.

I have worked with the NLTCS data for over 18 years and have good confidence in the results that it yields. Moreover, the data are publicly available so you could go

to the NLTCS Website, follow the indicated procedure to access the data, and replicate or fine-tune my results for your own purposes.

The age-specific and age-standardized unisex prevalence rates of disability based on (1) satisfying the HIPAA ADL trigger or (2) residence in an LTC institution are displayed in Tables 17 and 18, respectively. The HIPAA ADL trigger requires that the individual be unable to perform without substantial personal assistance at least two of the six specified ADLs. LTC institutions include nursing homes and similar facilities with at least three unrelated residents where there is a trained health professional on duty every day, but not necessarily for the full 24 hours in each day.

The annual rate of decline in the age-standardized HIPAA ADL disability rate over the period 1984–1999 was 1.64 percent per year, more than one percent faster than the comparison rate of 0.6 percent per year established for the long-term trends discussed earlier. The annual rate of decline in the age-standardized LTC institutionalization rate was 2.56 percent per year, nearly two percent faster than the comparison rate of 0.6 percent per year.

Charts 17–18 show that the declines appear to accelerate over successive five-year periods within the overall 15-year period. Use of the 15-year period for computing the trend is more conservative than using the most recent 5-year period.

The results in Charts 17–18 depend on the use of survey sampling weights. I actually calculated the tables in two ways:

- Using the standard cross-sectional weights on the NLTCS public use file[1];
- Using longitudinal weights derived from the 1984 cross-sectional weights, or for respondents aged 65–69 entering the sample after 1984, from the first available cross-sectional weight for each respondent.

The longitudinal weights yielded smaller rates of decline than obtained from the standard cross-sectional weights. The decline rate of the age-standardized HIPAA ADL disability rate decreased from 1.77 percent to 1.64 percent per year; the decline rate of the age-standardized LTC institutionalization rate decreased from 3.09 percent to 2.56 percent per year. In both sets of calculations, the age standardization was based on the 1984 NLTCS weighted population estimates. This ensured that the only differences in the calculations were the choices of the survey sampling weights.

All results in Charts 17–20 are based on the longitudinal weights. This differs from Manton and Gu (2001) who employed preliminary versions of the cross-sectional weights, based their age standardization on the 1999 NLTCS weighted population estimates, and included special equipment (in addition to personal assistance) in determining whether each of 6 ADLs (with continence replaced by indoor mobility)

[1] These are the "CDS Screener Cross Sectional Weights" in fields 97–148 of the CDS Analytic File distributed as part of the NLTCS Public Use CD (see http://nltcs.cds.duke.edu/data.htm).

was impaired. Despite these differences, the results in Charts 17–18 confirm Manton and Gu's (2001) widely-reported findings of substantial and accelerating declines in ADL and LTC institutional disability.

The cross-sectional weights employ "post-stratification" adjustments that require independent estimates of the sizes of specified population components, including that of the institutionalized population[2]. The longitudinal weights are constant from the time of initial assignment so they do not depend on such adjustments. Whereas the results for the HIPAA ADL improvement rates agreed to within 0.13 percent per year (1.77 percent vs. 1.64 percent), the LTC institutionalization improvement rates differed by 0.56percent per year (3.09percent vs. 2.56percent). Part of this difference may be attributable to the assumptions in the institutionalization post-stratification adjustments.

Use of the longitudinal weights in Charts 17-18 is conservative compared to the alternative. The finding that the short-term improvements in HIPAA ADL disability and LTC institutionalization rates are both substantially higher than the long-term comparison rate of 0.6 percent per year is a robust finding that would only be further strengthened by using the standard cross-sectional weights.

I found one anomaly in my analysis of the NLTCS based on the standard cross-sectional weights: There was no change in the age-standardized HIPAA ADL disability rate during the period 1984–1989. This contrasts with the finding in Table 17, based on the longitudinal weights, that the HIPAA ADL disability rate declined from 9.59 percent to 9.19 percent during the same period, equivalent to an annual rate of decline of 0.85 percent per year, which is slightly higher than the long-term comparison rate of 0.6 percent per year.

This analysis provides an explanation of prior findings that the morbidity declines in the NLTCS data in the 1980s did not appear to include the most severe levels represented by the HIPAA ADL trigger (e.g., Freedman and Soldo, 1994; and Freedman et al., 2004). In fact, such declines did occur in the NLTCS data and at a rate consistent with but slightly higher than the long-term comparison rate of 0.6 percent per year. The acceleration of the declines in the 1990s appears under both sets of weights and requires additional explanation.

One can approximate the standard errors of the estimates in Charts 17–18 with standard binomial or Poisson formulas considering that there are approximately 20,000 people represented in each of the survey years. The resulting standard errors are on the order of 3-4 percent of the size of the age-standardized rates, or approximately 2-3 year's improvement at the annual rate of decline computed for the 15-year period. The size of the standard errors is large enough that one could

[2] The CDS Screener Cross Sectional Weights did not use institutional post-stratification in 1982, 1984, or 1989; used institutional post-stratification in 1994; and used a modified form of institutional post-stratification in 1999 (see file WEIGHTS99.pdf on NLTCS Public Use CD for details).

have good confidence in the trend rates based on the full 15-year period but not on the trend rates based on the individual 5-year periods. The acceleration in the HIPAA ADL disability decline over the individual 5-year periods in Chart 17 may be, in part, an artifact of the statistical variability of the individual age-standardized rates.

The relatively larger fluctuations in the age-specific rates in Charts 17–18 are due to the smaller sample sizes and larger resulting standard errors of the component age groups.

There is a long list of explanatory factors that have been proposed to explain the short-term disability decline, some of which may also explain the apparent acceleration of the disability decline. A comprehensive summary can be found at the National Institute on Aging Website: http://www.nia.nih.gov/research/extramural/behavior/disabilityworkshop.pdf.

Among the many factors cited therein are the following:

- Improvements in physical health
- Improvements in cognitive health
- Improvements in diagnosis and treatment of chronic and disabling illnesses
- Innovations in preventive medicine
- Pharmaceutical innovation
- Expanded use of assistive devices and environmental supports
- Changes in reimbursement for home health care
- Expanded elder care and social support
- Improved levels of education
- Improved socioeconomic status.

Researchers have attempted to develop quantitative estimates of factors contributing to the disability decline. For example, Freedman and Martin (1998) found that changes in population composition, device use, survey design, role expectations and living environments did not account for changes in functional limitations during the period 1984–1993. Having eliminated these factors, they inferred that the trend was likely due to change in "underlying physiological capability." Freedman and Martin (1999) concluded that much of the disability decline was due to improved educational attainment, which accounted for 75 percent of the improvement in vision, 50 percent in lifting and climbing, and 25 percent in walking.

McClellan and Yan-Li (2000) reported that disability declines during 1989-1994 were due not to decreases in disease incidence (via Medicare reports; which actually increased), but to the reduced debilitating effects of disease. Yan-Li and McClellan (2001) replicated these results for the period 1992-1996 for self-reported conditions.

These quantitative analyses are important because they provide evidence that the risk factors antecedent to the development of chronic medical conditions and functional limitations are improving in a manner consistent with the measured improvements in HIPAA ADL disability.

The improvements in LTC institutionalization are likely to require more complex explanatory models due to the emergence of assisted living facilities with or without medical care as alternatives to nursing homes in the late 1990s. Because (1) the NLTCS sample included both noninstitutional and institutional population components and (2) ADL limitations were similarly assessed in both population components, measurements of the improvements in HIPAA ADL disability would have been unaffected by any changes in preferences for assisted living facilities over traditional nursing homes.

Freedman et al. (2002) cautioned that the short-term declines in severe disability seen in the NLTCS in the 1990s had not been confirmed in other national surveys that provided similar measurements. Possible reasons for this inconsistency included methodological differences in wording of questions, treatment of the institutional population in the sampling frame, cross-sectional versus longitudinal design, processing of missing data, nonresponse weights, and age-standardization.

I would add to this list that the NLTCS was the only national survey that was specifically designed to assess temporal changes in the prevalence of disability at all levels of severity. Resolving the inconsistency may help improve the design of these other surveys and it may lead to some modification of the estimates of the short-term declines in severe disability seen in the NLTCS. However, it would not affect the estimates of the long-term trends in morbidity and mortality.

I indicated earlier that we would look at the joint impact of changes in disability and mortality and ask what the interactions of these two types of trends means for LTCI pricing and valuation. To do this, we need to define a measure of the number of years of disability expected to be experienced by a person reaching his or her 65th birthday in a given calendar year. This measure, denoted by e_{Dx}, is termed the disabled life expectancy (DLE) at age *x*. The general form of the DLE equation for age *x* in calendar year *y* is as follows (Sullivan, 1971):

$$e_{Dx,y} = \int_0^\infty {}_t p_{x,y}\ \pi_{x+t,y}\ dt\ ,$$

where

${}_t p_{x,y} = l_{x+t,y} / l_{x,y}$ = the ratio of the life table survival functions at ages *x* and *x* + *t*,

and

$\pi_{x+t,y}$ = disability prevalence rate at age *x* + *t*.

Although this equation may not be familiar to most people, it is easily explained. Consider the survival function, ${}_t p_{x,y}$, which is the probability of surviving from age *x* to *x* + *t* in calendar year *y*. This function is typically seen in the standard formula for the residual (or remaining) life expectancy at age x. The above formula modifies the residual life expectancy formula by including the prevalence rate, $\pi_{x+t,y}$, at age *x* + *t* in calendar year *y*. Consequently, if one sets the disability prevalence rate equal to one, the expression simplifies to the standard formula for the residual life expectancy. Alternatively, if one sets the disability prevalence rate, $\pi_{x+t,y}$, equal to the percent of the population at age *x* + *t* that is HIPAA ADL disabled or residing in an LTC institution, the expression gives you a measure of the expected years of life in the indicated disability state.

Chart 19 displays the unisex residual life expectancy at age 65 in 1984 and 1999, and the corresponding DLEs based on (1) satisfying the HIPAA ADL trigger or (2) residence in an LTC institution. Also included are the annual rates of change for the three measures, with each expressed as a positive rate of change to indicate favorable mortality and morbidity improvements.

Life expectancy increased by 0.3 percent per year, about half of the long-term comparison rate of 0.6 percent per year, and nearly two-thirds of the 22-year rate of decline (0.47 percent) in Chart 5. The life tables used in these calculations were obtained from the Social Security tables prepared by Bell and Miller (2002), which differ from the life tables used in Chart 5. Bell and Miller's (2002) tables used a consistent methodology over all reported calendar years and this was more appropriate for the calculations I wanted to display in Chart19.

The DLE based on the HIPAA ADL trigger declined at a annual rate of 1.13 percent per year during the 15-year period 1984–1999; the corresponding decrease for the DLE based on residence in an LTC institution was 1.94percent per year. Both decreases are substantially larger than the long-term comparison rate of 0.6percent per year.

The interaction between mortality and morbidity improvement can be most easily seen by considering the equation for the change in the DLE between years y_0 and *y*:

$$e_{Dx,y} - e_{Dx,y_0} = \int_0^\infty \left({}_t p_{x,y}\ \pi_{x+t,y} - {}_t p_{x,y_0}\ \pi_{x+t,y_0} \right) dt \qquad \text{Net Change in DLE.}$$

This equation can be rewritten as the difference of two terms, as follows:

$$e_{Dx,y} - e_{Dx,y_0} = \int_0^\infty \left({}_t p_{x,y} - {}_t p_{x,y_0} \right) \pi_{x+t,y_0}\ dt \qquad \text{Survival Increment}$$

$$- \int_0^\infty {}_t p_{x,y} \left(\pi_{x+t,y_0} - \pi_{x+t,y} \right) dt \qquad \text{Morbidity Decrement.}$$

The first term is the survival increment. If mortality declines, which implies an increase in the survival function, ${}_t p_{x,y}$, and the age-specific morbidity rates, $\pi_{x+t,y}$, stay constant, then the DLE, $e_{Dx,y}$, will increase over time, and this effect can be termed a survival increment. The increase in DLE occurs even though the age-specific disability prevalence rates remain constant.

The second term is the morbidity decrement. If morbidity declines, which implies decreases in at least some of the age-specific disability prevalence rates, $\pi_{x+t,y}$, and the age-specific survival function, ${}_t p_{x,y}$, stays constant, then the DLE, $e_{Dx,y}$, will decrease over time, and this effect can be termed a morbidity decrement. The decrease in DLE occurs because the age-specific disability prevalence rates decline.

The net change in DLE will be favorable if the morbidity decrement exceeds the survival increment, and will be unfavorable if the survival increment exceeds the morbidity decrement. This effect characterizes the interaction between mortality and morbidity improvement. It is possible to have improvement in both mortality and morbidity and yet have unfavorable net changes in DLE.

Application of the above formulas to the calculations in Chart 19 yields the components of change shown in Chart 20. The increase in residual life expectancy at age 65 was 0.76 years. The decrease in DLE based on the HIPAA ADL trigger was 0.29 years which decomposed into a 0.13-year survival increment and a 0.42-year morbidity decrement. The decrease in DLE based on residence in an LTC institution was 0.28 years, which decomposed into a 0.09-year survival increment and a 0.37 year morbidity decrement.

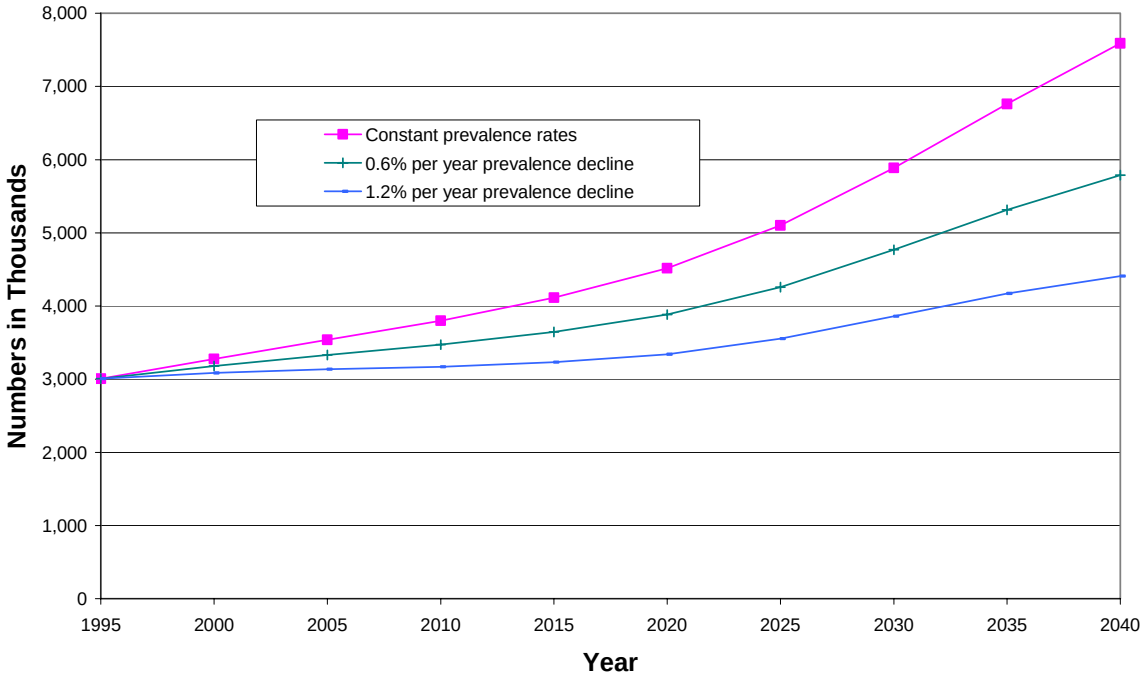
What happened, at least over the 1984–1999 time period, was that there was net decline in both types of DLE of approximately 0.3 years. Had the mortality rates remained constant the declines in DLE would have been closer to 0.4 years. The survival increment was approximately 25percent of the magnitude of the morbidity decrement. Given the relative sizes of the two components, the period 1984–99 could be characterized as highly favorable with respect to the net changes in DLE.

Prior analyses of the NLTCS have focused on morbidity declines using thresholds for disability that were substantially less severe than those used in the current analysis. Consequently, the question was left unanswered as to whether the NLTCS data provided evidence of disability declines under the HIPAA ADL trigger. The current results provide a strongly affirmative answer.

So how can we describe what has been happening? The prevailing view is that chronic disease morbidity, functional limitations and disability, and cause-specific or disease-specific mortality are all connected to an underlying complex

multidimensional health process. If you have changes in any one part of the health process, almost surely you will have changes in other parts. The different parts of the health process are linked and exhibit joint dependencies. Modeling this linkage could yield more accurate projections of the joint impacts of survival increments and morbidity decrements on DLE measures.

HIPAA ADL Disability Projections, United States 1995-2040, Unisex Age 65 Years and Older



The figure (on the previous page) illustrates the potential impact of the interactions between morbidity and mortality changes on the annual total number of persons aged 65 years and older who satisfy the HIPAA ADL trigger, starting with the 1995 prevalence estimates in Stallard (2000), and projecting future values for the period 2000–2040. Three projection scenarios are displayed in the figure:

1. Constant age-specific disability prevalence rates
2. Relative declines of 0.6 percent per year in age-specific disability prevalence rates
3. Relative declines of 1.2 percent per year in age-specific disability prevalence rates.

The 0.6 percent per year rate of disability decline was selected for the second scenario to approximate the rate of mortality decline assumed by the Social Security Administration in the population projections used conduct the calculations. The first scenario shows what happens if you do not assume that morbidity

improves. The third scenario shows what happens if you assume that morbidity improves at a rate of 1.2 percent per year, which, though double the 0.6 percent rate of mortality decline, is still less than the short-term rate of decline of 1.6 percent seen in Chart17.

The projections all start at 3.0 million persons as the estimate of the size of the HIPAA ADL disabled elderly population in 1995. Over time the three projections gradually diverge and become substantially different. By 2020, the low projection is 3.3 million versus 4.5 million in the high projection. By 2040, the low projection is 4.4 million versus 7.6 million in the high projection. From the perspective of the LTC insurance carriers, these differences would be significant, especially if you're paying an inflated value of perhaps $300 per person per day.

I would like to conclude my presentation by posing three questions:

- Can the rate of disability decline in the U.S. continue to be significantly larger than the rate of mortality decline?
- How will future biomedical research and health care expenditures affect disability and mortality rates?
- How will the trends in functional disability rates impact on LTCI pricing and valuation?

I find it hard to accept that the very large gap between the morbidity and mortality rates of decline seen in the short-term data will continue indefinitely for the long term. Nonetheless, even with some convergence, it may be reasonable to consider morbidity decline rates that are larger than the mortality decline rates. The billions spent each year on medical research and health care expenditures may help sustain the gap.

Finally, given the evidence just presented on long-term declines, short-term declines, and the substantial fluctuations in the various rates of decline, the ultimate question of interest is how those declines could impact on LTCI pricing and valuation.

MR. RONALD M. WOLF: I have some practical considerations to share with you on LTC morbidity improvements - some numbers, but mainly qualitative type information. Is the use of morbidity improvement material supportable for the insured population? When and how is it properly used? Finally, I will discuss some guidelines regarding morbidity improvement for your consideration.

In terms of materiality, consider four alternatives. One is no improvement. Two is improvement in morbidity, but not mortality. Three is lifetime improvement in both. Four is ten years of improvement in both. The measures that we will use are solving for premium and solving for an ROI (return on investment). The premiums are relative to a hundred dollars – not using absolute premiums. So, for example, if we assume morbidity improvement for life of 1.5 percent per year, according to the

calculation, we save about fourteen percent on our premium. There's a smaller number that would be the alternative for ten year improvement. We only save one percent under that alternative.

We have also measured the effect on ROI after tax and target surplus. We used an in-force model measuring present value of pre-tax, book profits for the four scenarios. The numbers vary with the relative value of 100 for scenario 1 (no improvement). What's the message here? The take away for me is that using lifetime morbidity improvement has a very material impact.

What about supportability? Is it appropriate to use morbidity improvement? Eric has given us some thoughts that this is a plausible, reasonable assumption at face value when considering the general population. It's been true for life insurance for some time now. I understand that improvement in mortality is typically assumed in pricing term life insurance.

Is improvement in long-term care morbidity supported by insured experience? I would answer no at this point in time, although I think such improvement may, indeed, happen. I'm not prepared to "take it to the bank" yet at this point. I think we do have some indication in the SOA morbidity study that there is some improvement at least by issue year and duration. I'm aware that some carriers have reported improving actual to expected ratios in their own business, but some have seen some deterioration. The interpretation is difficult due to changes in underwriting and to the steep selection curve by duration.

A number of companies are increasing premium rates not only on new business, but also for in-force business. In some cases, these cumulative rate increases are quite large. While the experience so far that I'm aware of would say that not a large number of people are lapsing due to these large rate increases, the long-term effect of very large cumulative rate increases on morbidity is unclear.

There are carriers who probably could justify an increase in rates on in-force business, but for reasons of their own have chosen not to do so, which essentially makes the product a non-cancelable product. New products, with lots of bells and whistles that may not only be complicated, but may be difficult to price, add more uncertainty to pricing assumptions. In these situations, the appropriateness of using morbidity improvement seems questionable.

In considering the appropriateness of using morbidity improvement, should we consider the context of other assumptions that we're using in our pricing and our forecasting? I think mortality, as Eric has indicated, certainly should be considered alongside. For lapse, I'm not so sure it needs to be considered unless there are major deviations. The ability of a company to measure its own morbidity up to the current time should be considered.

Perhaps the best way to express this is to consider two companies. One is a company that generally has good systems with which to measure its morbidity and seems to know what its morbidity is. The second is a company that doesn't have that capability, and when it is able to study its business, it seems to be worse every time. Would your comfort in assuming morbidity improvement be any different for these two companies? I would be more comfortable in using morbidity improvement for the company who knows or has a pretty good idea of where they are at already.

Regarding interest rates, if your product is well hedged on the investment side and you're comfortable with that, would that make you more comfortable with assuming some morbidity improvement in pricing? Would a general expectation of rising interest (aren't rates at a 40 year low now) make us feel better when assuming morbidity improvement?

Some of you may have attended the session at this meeting regarding investments for long-term-care insurance. One panelist offered the possibility that the U.S. could go to a Japan type situation where long-term interest rates might go to 2 percent–3 percent. That made me cautious about improving interest rates helping support an assumption of improving morbidity.

One more thing that I think we should consider in this matter is the nature of the work that we are doing. What's the task? What's the job we're working on? And what is the nature of the assumptions appropriate for that task?

Moderately adverse assumptions, whatever that means, are the norm for LTC pricing. Statutory active life reserves are in the process of change. We have no prescribed table. I recently had to deal with this in an assignment and had to focus on the requirements of a particular state that did not have a prescribed table, but had some specific words to the effect that whatever assumption is used, it should be sound or should create a sound value of the liabilities. Is the use of morbidity improvement – especially lifetime improvement – "sound"?

Regarding asset adequacy and cash flow testing, Actuarial Standard of Practice (ASOP) No. 22 guides us towards moderately adverse assumptions. I haven't done much dynamic financial condition analysis or solvency type testing. If such an analysis is being used for internal purposes, the analysis may be based on best-estimate assumptions; whereas a similar analysis for external use may be based on moderately adverse assumptions.

For appraisals, assumptions may be of a "best foot forward nature." Maybe the best way to explain that is there are seller's appraisals and there are buyer's appraisals. You can do with that what you wish.

How much morbidity improvement may be appropriate? If I read Eric's current research properly, something like one percent per year higher than the mortality

improvement appears consistent with population data. But there is a very material difference in the effect of lifetime improvement versus temporary improvement.

I've had the opportunity to be involved in a number of assignments where the use of morbidity improvement varied considerably. That has caused me to make sure to take into account all the things that might pertain to each unique situation.

In closing, I have some guidelines regarding the use of morbidity improvement for consideration by you and me. The first guideline is that morbidity improvement should not be used without mortality improvement. Second, consider the nature of the other key assumptions in your pricing or your forecasting. Third, consider the nature of the assignment – if you're doing pricing work, if you're doing asset adequacy or cash flow testing working work – and, the nature of assumptions appropriate for that assignment. Finally, lifetime morbidity improvement is not a moderately adverse assumption.

I hope these comments are useful to you in your LTC work.

MR. SCOTT WELTZ: I'm going to continue the discussion regarding morbidity improvement on an insured basis. Morbidity improvement is kind of like a religion. You either believe in it or you don't. It really brings out some very spirited discussions from long-term care actuaries. I personally believe in it. I think the work Eric has done is somewhat convincing in addition to the progress that's being made out there with regard to Alzheimer's cures and osteoporosis treatments, etc. Things of that nature should assist long-term care insurers in the future with regard to reduction in benefit payments to some extent.

However, I find the discussion of morbidity improvement a little bit absurd because one company may be explicitly making a morbidity improvement assumption, yet their underlying claim cost curve is far more conservative than another company's. So, in reality, a company may use morbidity improvement, but they are still the more conservative company relative to others in the industry. I'm going to get into this a little bit more in a minute.

Before entertaining the notion that morbidity could improve, I think you first need to really evaluate where your current experience is, then look at how you're projecting that experience before you contemplate morbidity improvement, and then consider the research that Eric has done and see if you believe morbidity improvement is relevant for your work.

A colleague and I recently performed a somewhat informal valuation survey of long-term care insurers. We obtained a good sampling of the industry with over roughly $4.6 billion in current in-force premium, including seventeen individual carriers and six group carriers. One of the questions in that survey was "Do you use morbidity improvement in your valuation assumptions on a statutory, tax, and GAAP

[generally accepted accounting principles] basis and/or do you use it in asset adequacy testing?" What we found is that there are a number of companies that use morbidity improvement. Eleven companies on a GAAP basis do not use it and another nine do in some fashion. Note that there were a number of mutuals and other companies in there that really didn't perform GAAP for best-estimate assumptions.

We did this survey late last year when the National Association of Insurance Commissioners (NAIC) was pretty certain that they weren't going to allow morbidity improvement any more on a statutory basis. That's one reason why you don't see as many companies with morbidity improvement assumptions on a statutory and tax basis.

With regard to the duration of morbidity improvement that was assumed, there are three companies that use it forever. There are two that were even using it forever on a statutory basis which is somewhat surprising given the nature of this valuation basis. Then there were a number of others in between.

I wanted to address the issue of what companies currently assume when developing long-term care claim costs. I took three carriers' actuarial memoranda that included long-term care claim costs and I was careful to make sure that they were very similar in nature: having similar claim characteristics, benefit periods, elimination periods, covered benefits, benefit triggers, and other things of that nature. They also happened to be clients of ours so I was very familiar with how they underwrote and they did have very similar underwriting criteria. I compared their nationwide rates if, in fact, they did have variations by geographic area at all. These all happened to be marketed through brokers so you won't have the potential difference in claims that some suspect there might be between career agencies and independent agents. They all had very similar claim adjudication practices at the time these memoranda were filed.

I compared the claim costs they used. In some respects, I was pretty pleased with the results. They are somewhat similar, but where I got really concerned was at the older attained ages. If you're Company C and you compare your claim costs to Company A, I would say you've implicitly assumed some sort of morbidity improvement. How can your claims be that much different if, in fact, it is a uniform set of data?

It is very, very difficult to get your hands on a uniform set of data with long-term-care insurance. This industry really hasn't been around that long given the risk we are valuing and pricing. In the last ten to fifteen years benefits have changed drastically. Underwriting has changed drastically. Claim management procedures are starting to improve quite a bit as well. Companies have gotten smarter. They know that it's a better risk to issue to married people than single people, things of

that nature. You know that you don't want to issue a nursing home only policy in the midwest, etc.

The conclusion is that to really extract this data and develop meaningful morbidity estimates is difficult unless you have a lot of it, which is where we had the advantage of being a consulting firm. What we did is develop an industry claim study of two billion dollars of insured claims experience with 4.6 million life years from twelve companies. We then developed industry benchmarks, while normalizing for the various risk characteristics just mentioned to benchmark against companies' actual experience. I happen to have the actual claims experience for the three companies previously mentioned. When I compared them to these industry benchmarks and normalized for everything else, low and behold, they were not all that different anymore. They were very similar at all the ages. I saw a little more variation at the upper ages, but still they are very, very similar. The take-away is that rigorous experience analysis allows us to develop reasonable morbidity estimates *today*. By *today* I mean for the early policy durations because, keep in mind, we are still only looking at ten to fifteen years of data at the most.

What really matters in this discussion of morbidity improvement is how a company is projecting their morbidity experience. There are a number of different projection methods that I've seen in practice. The predominant methods I've seen, and these are my own terms, are connect-the-dots, the underwriter's dream, and freelance. If you take away nothing else from this, go back to your office and graph your long-term care claim costs. I always find this exercise to be very enlightening when I first work with a long-term care company. One time I graphed a company's claim cost curve and the graph looked like a bell shaped curve because they had an aggressive morbidity improvement assumption along with several other questionable assumptions

Table I-a (Chart 21) shows actual claim cost experience for issue ages sixty-five, seventy-five and eighty-five on a policy year basis for approximately ten years. Now what actuaries who connect the dots do is just project an ultimate cost curve based on where morbidity appears to be going on an ultimate basis out there in durations five through ten. That seems pretty logical and is shown in Table I-b (Chart 22).

Now with the underwriter's dream shown in Table II-a (Chart 23), the actuary performs an experience analysis and develops ratios of actual to expected claim costs (where the expected basis ties to pricing estimates). The actuary then assumes the actual to expected ratio will continue into the future, although the ratios may be very different by issue age as seen inTable II-b (Chart 24). At the younger ages you might be running close to seventy percent of expected, albeit at very low claim costs. At issue age seventy-five, the experience in this example is close to expected levels on an ultimate basis. At the older ages the experience is running above expected.

What some actuaries will do is simply assume that the experience ratios at the ultimate policy durations (i.e. durations five through ten) will remain constant for the remainder of the contract, even though they vary drastically by issue age. This essentially translates to an implied level of “generational morbidity improvement” because experience is often very favorable at younger issue ages and worse at older issue ages. In other words, a policyholder with a younger issue age is projected to reach an ultimate morbidity level that is materially lower than the morbidity level for a policyholder with an older issue age. The result is shown in Table II-c (Chart 25).

Then others take a freelance approach to projecting long-term care morbidity as shown in Table III (Chart 26). This is a blend of the approaches shown in Table I and II. This shows a potentially longer selection curve at the younger ages. Naturally, you cannot verify this, but it may be reasonable. While some may argue that the eighty-five year-olds are more anti-select risks, I still cannot fathom why that eighty-five year-old who purchased a policy and now is a hundred years old will have significantly different experience from that sixty-five year-old who eventually becomes one hundred. I understand that initially there has to be significant anti-selection at the older issue ages; an eighty-five year-old often knows that a long-term care claim is right around the corner. But if the claim does not occur over the course of five to ten years from issue, then I would say the claim costs will probably regress back to the mean, if there is one out there.
Table IV-a (Chart 27) includes a comparison of all three of those projections for an issue age sixty-five year-old. As you can see, there are material differences on an ultimate basis, and we have not even included *any* morbidity improvement assumptions explicitly in any of these projections.

Now let's contemplate morbidity improvement. Assume that you are the actuary who connected the dots. You believe that this is a conservative approach. In addition, you have reviewed Eric Stallard’s work and believe that the results look reasonable. Therefore, you assume one percent morbidity improvement annually from issue. Now this actuary looks those other two who use the other methods and says, "It's absurd what you've done, even before explicitly including morbidity improvement." However, as Table IV-b (Chart 28) demonstrates, the connect-the-dots projection with one percent per year morbidity improvement assumed is now exactly the same as the freelance projection without morbidity improvement.

Moreover,

- Table IV-c (Chart 29) shows that the underwriter’s dream projection with one percent per year morbidity improvement assumed falls far below the other two projections without morbidity improvement; whereas,
- Table IV-d (Chart 30) shows that the underwriter’s dream projection without morbidity improvement is exactly the same as the freelance projection with 1 percent per year morbidity improvement assumed.

These comparisons illustrate the main problem with the discussions surrounding morbidity improvement right now. You have various insurers doing different things in their baseline claim cost assumptions and there is no consistent basis for comparisons when discussing a *rate* of morbidity improvement.

Table V (Chart 31) addresses the subject of varying morbidity improvement assumptions by issue age. If you think about it, morbidity improvement is the expected change in morbidity over the long haul. I think Eric's work is much more convincing over the long haul than the short haul. You get more reasonable patterns. But if you are a carrier issuing at the older ages, you have very little opportunity to benefit from any morbidity improvement that might occur because those policyholders are not going to be around that long. So, it may be more appropriate to assume little or no morbidity improvement at the older ages and assume higher levels of improvement at the younger ages. In Table V, I have assumed that morbidity improvement occurs for a limited period of time (15 policy durations at younger ages and five policy durations at older ages). This is a practice some use when pricing due to the moderately adverse regulations in place. Different assumptions may be appropriate for other valuation bases such as best estimate, GAAP, etc.

In summary, long-term care morbidity is definitely ever changing. However, I think what we must first do is evaluate the data we have, create reasonable projections and then, at that point, talk about what both Ron and Eric discussed in terms of looking at the population data trends and determining if morbidity improvement is appropriate given your underlying baseline morbidity projections. But certainly, do not contemplate the morbidity improvement assumption in a vacuum.

MR. JAMES M. ROBINSON: I was wondering if we could get some comments on other aspects of the morbidity trend beyond the disability rate. Of course, once you've projected how many people are going to be on one side or the other of the ADL trigger or the cognitive impairment trigger, you still have to address what percentage of them are going to be institutionalized versus using assisted living. If they're in the community, what's their intensity of use of formal care, etc., and all the other driving factors that end up being wrapped up into the total claim cost? While there seems to be convincing evidence that there has been an ongoing downward trend in disability rates, has anybody looked at any of the other aspects of the claim costs to see if things are also going down in those areas, remaining the same, or increasing to maybe offset some of this?

MR. STALLARD: I haven't but others have, at least for the general non-insured population. Two relevant source of information would be the National Nursing Home Surveys (NNHS) of 1973-1974, 1977, 1985, 1995, 1997, and 1999 available at http://www.cdc.gov/nchs/about/major/nnhsd/nnhsd.htm; and the Medical Expenditure Panel Surveys (MEPS) of 1987 and 1996 available at

http://www.meps.ahrq.gov. These sources indicate that the nursing home population has become older, frailer, and more costly over the decade of the 1990s.

I have one other comment regarding the morbidity improvements in the NLTCS and other data that I presented. You need to consider the entire set of results as a group. It's not at all clear to me how the different durations and types of trends will play out. I left this as an open question at the end of my presentation: What do you do when you have short-term trends that are different from the long-term trends? Long-term care insurance involves, by its very nature, a long-term projection. How do you blend the different sources of information into one coherent projection? To me, that's the big open question although, obviously, LTCI actuaries are dealing with that question right now. It may be worthwhile getting some response back from the other panelists and the audience.

MR. WOLF: I don't have any data, but I understood your question to be something like maybe we have some idea of where nursing home confinement or assisted living confinement might be going, but home health might be going in the other direction or something like that.

MR. WELTZ: I agree with that as well. I don't have any data to support it. Primarily the data we have is insured data and that becomes more complex because you're dealing with entirely different plans that were issued in, say, 1990 versus 2000. With regard to what you mentioned, I think it's valid. I think most insurers just use an aggregate morbidity improvement rate at this point and assume they're right in net. But, realistically, I think what you would see is a reduction in the institutional side or an increase in the home care side.

MR. STALLARD: If you look at the age-standardized LTC institutionalization rates in the NLTCS (Chart 32), you'll see the big drop was between 1994 and 1999 – with a very large drop there. There was a more modest drop prior to that. The NLTCS started measuring assisted living facility utilization in 1999 and will measure it again in 2004. For projections of future LTC institutionalization rates, I think one should be cautious regarding continuation of the 15-year trend when you see such a divergent trend for the latest 5-year period.

About 35 percent of residents in assisted living facilities in the 1999 NLTCS were classified as residents of LTC institutions because the assisted living facility provided substantial nursing care on site. The other 65 percent were classified as community dwelling, noninstitutional, or non–nursing-home residents.

Among the 65 percent of assisted living facility residents classified as community dwelling in the 1999 NLTCS, 26 percent satisfied the HIPAA ADL disability trigger and 90 percent satisfied the less stringent NLTCS ADL/IADL/Institutionalization disability triggers (see Stallard and Yee, 2000, Appendix II).

Among the 35 percent of assisted living facility residents classified as LTC institutional residents in the 1999 NLTCS, 77 percent satisfied the HIPAA ADL disability trigger and 100percent satisfied the NLTCS Institutionalization trigger.

ASOP No. 18 has a specific requirement that you look separately at assisted living. That is important to keep in mind when you're looking at my results because I did not have any way of assessing temporal trends in assisted living since assisted living was not measured in the NLTCS prior to 1999. After the 2004 NLTCS, we will be able to assess temporal trends in assisted living. I think that will be informative.

MR. WILLIAM C. WELLER: Particularly with regard to the dramatic drop in institutional prevalence trends, what is the relative number of institutional beds to the population study, the 1994 versus 1999? I mean is part of the change that we've had an increase in the population that's been much larger than the increase in number of available beds or places to go? Is that part of the reason why that part of it is improving much, much more than the ADL basis? Do you have any idea on that?

MR. STALLARD: That's a fairly complex question and I don't see how the NLTCS by itself could be informative with respect to that question. You would need to look at the NNHS or the MEPS data to see how the bed-occupancy rates were changing.

The overall NNHS occupancy rate declined from 91.8 percent in 1985 to 86.6 percent in 1999 (Jones, 2002, p. 2)[3], for an annual rate of decline of 0.4 percent per year. The overall MEPS occupancy rate declined from 92.3percent in 1987 to 88.8 percent in 1996 (Rhoades and Krauss, 1999, p. 12), also for an annual rate of decline of 0.4 percent per year. These results suggest the 15-year decline in the LTC institutionalization rate in the NLTCS was not a result of constraints on the availability of nursing home beds.

The interpretation of the more dramatic 5-year decline is less certain. The NNHS occupancy ratios for 1995 and 1997 were 87.4 percent and 88.4 percent, respectively, so that the 1995 occupancy rate appears out of line with the rest of the occupancy rates. Moreover, the NNHS estimated that the elderly nursing home population increased from 1.42 million to 1.47 million during 1995–1999. Thus, the NNHS data showed an increase in the nursing home population during the 5-year period when the NLTCS showed the largest decrease.

The NLTCS estimates of the elderly LTC institutional population sizes were 1.69 million (or 1.71 million; cross-sectional vs. longitudinal weights) in 1994 and 1.45 million (or 1.37 million; cross-sectional vs. longitudinal weights) in 1999. Thus, the NNHS and the NLTCS were in substantial agreement with respect to the 1999 estimates but not with respect to the 1994/1995 estimates.

[3] Note that the 91.8 percent occupancy-rate fixes a computational error in Jones' reported 1985 value.

The NLTCS estimate of 1.53 million for the elderly LTC institutional population in 1984 was about 16 percent larger than the NNHS estimate of 1.32 million for the elderly nursing home population in 1985. Similarly, the corresponding NLTCS estimate for 1994 was about 20 percent larger than the corresponding NNHS estimate for 1995. The puzzling result, then, is why the two types of estimates were so close for 1999.

Part of the solution may lie in design differences between the surveys.

The NNHS used a stratified two-stage probability design that may limit its use for population prevalence estimates. The sampling frames for all three NNHS surveys in the 1990s (i.e., 1995, 1997, and 1999) were based on the 1991 National Health Provider Inventory (NHPI) with periodic supplementation from the Health Care Financing Administration and other national organizations. NNHS sampling weights were post-stratified to match fixed totals whose accuracy depended on the accuracy of the updates to the sampling frame.
Bishop (1999, 2000) and Rhoades (2000) identified the lack of stability in the NNHS sampling frame during 1985–1995 as a significant limitation that would affect the accuracy of trend estimates derived from the NNHS. Bishop (1999, p. 154) concluded:

> "In the end, however, we need population-based surveys with sound identification of care environments. Statistics centered on persons with disabilities and their care, rather than on particular traditional sites of care, can track how well disability needs are being met…."

In contrast, and in anticipation of Bishop's (1999) recommendation, the sampling procedures in the NLTCS employed probabilistic selection from a list of Medicare enrollees. The LTC institutional prevalence estimates in Table 18 were based on a direct assessment of the nature of the living quarters of the respondent at the time of the in-person interview. The declines in the LTC institutional prevalence rates during 1994–1999 were seen with two forms of age-standardization (1984 vs. 1999 population standard) and with two sets of sampling weights, one of which (longitudinal weights) was frozen up to 10 years earlier.

These differences in design could account for the differences in results between the NLTCS and the NNHS with respect to the declines in LTC institutionalization rates during 1994–99. The fact that the results differ, however, should reaffirm the cautions raised earlier concerning the instabilities of short-term trends, especially trends based on five or fewer years of data. On the other hand, these differences have no effect on the estimates of the long-term trends in morbidity and mortality.

One comment made by Rhoades (2000) may help explain the large decline in LTC institutionalization in the late 1990s: Noncertified facilities classified as nursing and related care homes in the 1980s and early 1990s began to be reclassified as or

replaced by assisted living facilities in the late 1990s. Mollica (2002) reported a 30 percent increase in the number of licensed assisted living facilities between 1998 and 2000 – a period that includes the fieldwork of the 1999 NLTCS.

If the definition of institutionalization were expanded to include the 65 percent of assisted living facility residents classified as community dwelling in the 1999 NLTCS, then the 1999 age-standardized LTC institutionalization rate in Table 18 would increase from 3.71 percent to 4.23 percent and the annual rate of decline during 1984-1999 would decrease from 2.56 percent to 1.71 percent, nearly the same rate as the 1.64 percent decline in HIPAA ADL disability shown in Table 17. Moreover, the estimated total number of persons aged 65 and over in 1999 in the expanded institutional group would be 1.56 million – which, coincidently, would be identical to the number of nursing home residents aged 65 and over in the 2000 U.S. Census (Hetzel and Smith, 2001).

MR. WELLER: It seems to me that we're getting information that would suggest that, on Ron's basis, if you're just looking at best-estimate projections, there's probably some assumption with regard to a net value for the improvement of morbidity over that of mortality which would be useful. I think your analysis of splitting that out in terms of tiers – here's the mortality improvement and here's the morbidity improvement net of that afterwards – at age 65 is interesting. I'd be very interested in seeing those same numbers, Ron, if you started at age 75 and also the future expected value of those two net numbers at age 75 and maybe 85. It would be good to compare those to the other studies.

But in terms of the aspects of the long-term care business where experience is moderately adverse, I'm not sure that we've reached the level for that. It does seem to me that we have two-thirds of the needed ability over a fairly long term to say how we could deal with building in improvement in morbidity as experience develops on our in-force business.

The first way is that LTCI premium rate stabilization requires that you compare your new business rate to your in-force rate. If your new business rate is decreasing because of morbidity improvement, then you have to adjust your in-force rate. That suggests that if, twenty years from now, we have a lot more documentation and we want to use lower assumptions with regard to morbidity, then our current policyholders will have some LTCI premium reduction from that in terms of the rates that they pay. So there is some protection for the policyholders from using an assumption that is moderately adverse and that may have some built-in margins in it that aren't part of the expected experience.

The second way is that GAAP financial reporting is moving very close or fairly rapidly to fair value reporting. That suggests that at any point in time you're going to have to say: What's my estimate of the future? That's going to be: What's my

estimate at this point in time of future morbidity and mortality; and I run those estimates out. We're not talking about a lock-in GAAP number.

Those two areas seem to me to be moving to more of a place where continued use of assumptions reflecting morbidity improvement will allow some reflection in your in-force block.

The one area that I don't think that we've moved to is statutory accounting because that's still on an at-issue basis. *This* (whatever) is the assumption. If it turns out that you don't have margins, you have to increase the statutory reserve. But if it turns out that you have lots of margins, you have to continue the at-issue level and continue to build in that surplus stream.

I think as an industry, we need to look at how we can move on a statutory basis to a fair reflection. Particularly, if we're going to have to adjust premium rates down, how do we recognize what we do on a statutory reserve basis? I don't have the answers, but I think we're two-thirds of the way there and we need to make sure that we start talking about it if we don't reflect morbidity improvement in our gross premiums because of the need for margins for adverse experience. We don't include morbidity improvement in our statutory reserves because it's not allowed. We don't include morbidity improvement in our GAAP because we're not really convinced in many places that a best estimate over the next long period is a fair estimate of what the number is. We think morbidity is going to improve. We just don't know how much. We need to come up as an industry with a way to reflect that on a fair basis. That's a challenge to the industry, not just to the panel.

MR. WOLF: I think I would support Bill's comments and I picked up on a comment that was made in one of the sessions earlier where someone said, speaking broadly, that our product, our industry is perceived as expensive, but also is chronically underpriced. Hopefully, if, as you said, Bill, we do not close our eyes but continue to look at this and have an open mind about it, we can get to a better situation where maybe we're not being more expensive, and maybe we're even less expensive if this really happens, but also we're not being underpriced.

FROM THE FLOOR: I've got a question and then I'm going to ask the panel to speculate a bit. First, I was wondering to what extent do prescription drugs contribute to the morbidity improvement that you've seen?

Second, I'd ask the panel to just speculate whether or not they think the Medicare Part D benefit, the prescription drug benefit that will start in 2006, might play a role in accelerating the morbidity improvements you've seen? I heard earlier that medication errors can contribute to nursing home admissions. Maybe the prescription drug benefit could move things in the other direction.

MR. STALLARD: Prescription medications are one of the factors that were identified earlier as potentially responsible for the morbidity declines in the 1990s. The potential for a continuing impact of new prescription medications is enormous. If you're going to identify something that actually is going to be new in the 21st century, but that was somewhat primitive in the 20th century, it would be drug discovery and development. I think there's a very large potential there. Exactly how far into the century you have to go before you reach that potential is an emerging topic of investigation. People studying the pharmaceutical industry are beginning to consider to how it will impact long-term care.

MR. WELTZ: I agree that any advancements in prescription drugs should certainly assist with long-term care morbidity improvement.

With regard to the question if the Medicare Part D benefit will accelerate morbidity improvement at all, of course, this is merely speculation, but I think it should assist the private LTC industry from the perspective that it may accelerate the development of new drugs given the change in market conditions. However, ignoring this potential acceleration of drug development, do I think that it could potentially accelerate LTC morbidity improvement? Part D probably will not accelerate morbidity improvement because if, in fact, a drug therapy does come through, the long-term care insurers would have paid for it even if Medicare never had. But like I said, Part D itself may lead to the advancement of therapies that would not have occurred as quickly without the change in legislation.

FROM THE FLOOR: I think the two things that you said, perhaps, might have some impact on, let's say, the onset of disability, but is there also a possibility that it would prolong the life of somebody who was in a claim status? Might there be something that would go the other way as well?

MR. STALLARD: Obviously, the effect for any specific individual claimant could be in either direction. The concern from the point of view of LTCI pricing and valuation, however, is on the aggregate effect and that has been the focus of our discussion today. We talked about mortality improvement. We talked about morbidity improvement. We talked about the assumption that morbidity and mortality move in tandem, including the special case where neither morbidity nor mortality moves. We also talked about the assumption that morbidity improves at a somewhat more rapid rate than mortality.

However, we did not consider the assumption that morbidity improves at a less rapid rate than mortality, or that morbidity deteriorates over time even as mortality improves, and these are the types of assumptions that seem to be implied by your question.

I'm just wondering whether there's anybody here today who would take such a contrary view, which is to have mortality improving, but fixing the morbidity rate;

effectively implementing what I call the survival increment model shown in Chart 20. Is there anybody taking that as a conservative course of action? Or are there any proponents of that?

MR. WELTZ: I haven't seen anybody do that either and, given the current surplus strains and reserve strains on the product, I doubt that you will.

MR. STALLARD: The choices then appear to be to have neither one move, have them move in tandem, or possibly have a more rapid decline for morbidity than mortality. For the latter choice, one would need an estimate of the differential between the two rates of decline.

FROM THE FLOOR: Do you have any scenarios where you had no differential or a very small one such as one percent?
MR. STALLARD: Yes. At the end of my formal presentation I displayed graphs of three morbidity improvement scenarios each of which assumed that mortality improved at a common rate of about 0.6 percent per year over the period 1995–2040. The three scenarios were specified as follows:

1. Constant age-specific disability prevalence rates – with an implied morbidity differential of -0.6 percent
2. Relative declines of 0.6 percent per year in age-specific disability prevalence rates – with an implied morbidity differential of 0.0 percent
3. Relative declines of 1.2 percent per year in age-specific disability prevalence rates– with an implied morbidity differential of 0.6 percent.

In your question, you characterized a differential of 1.0 percent as a very small one, but it is nearly twice as large as the differential considered in the third scenario. The morbidity differential of 0.6 percent per year in the third scenario was selected to match the average decline rate of 0.6 percent per year in the Social Security mortality forecast. What I wanted to illustrate was that even though you would think of 0.6 percent, which is sixty basis points, as a small differential, when you put it into effect over twenty, thirty, or forty years, it turns out to have a tremendous impact. I do not feel people initially appreciated how much of an impact a differential of 0.6 percent could have. Obviously, a differential of 1.0 percent would have an even larger impact.

Chart 1

Table 1: Age-Adjusted Central Death Rates at Ages 65 Years and Older (per 100,000)

	Year				
Gender	1900	1910	1990	1999	Annual Rate of Decline
Male	10,612			6,154	0.55%
Female	9,749			4,157	0.86%
Total	10,079			4,898	0.73%
Male		10,444	6,526		0.59%
Female		9,606	4,055		1.07%
Total		9,937	4,986		0.86%

Source: Bell and Miller (2002, Table 1).

Chart 2

Table 2: Prevalence of Chronic Conditions Among Elderly Male Veterans Aged 65 Years and Older (%)

Condition	Union Army 1910	NHIS 1985-1988	Annual Rate of Decline
Digestive (Hernia/Diarrhea)	84.0	8.0	3.03%
Genito-Urinary	27.3	8.9	1.45%
Circulatory	90.1	40.0	1.06%
CNS, Endocrine, Metabolic, or Blood Disorders	24.2	12.6	0.85%
Musculoskeletal	67.7	42.5	0.61%
Respiratory	42.2	26.5	0.61%
Cancer	2.2	9.2	-1.89%

Source: Fogel and Costa (1997, Table 3).

Chart 3

Table 3: Prevalence of Chronic Conditions Among Elderly Male Veterans Aged 60-74 Years (%)

Condition	Union Army 1910	NHANES 1985-1988	Annual Rate of Decline
Heart murmur	39.2	3.8	3.00%
Irregular pulse	42.0	8.5	2.07%
Decreased breath or adventitious sounds	37.8	10.8	1.62%
Joint pain/tenderness/swelling	55.0	35.2	0.58%

Source: Costa (2000, Table 1).

Chart 4

Table 4: Prevalence of Functional Limitations Among Elderly Males (%)

Age	Condition	Union Army 1900/1910[1]	NHANES 1988-1994	Annual Rate of Decline
50-64 in 1900 or 1988-1994				
	Paralysis	4.8	0.9	1.82%
	Difficulty bending	39.0	7.5	1.80%
	Deaf (either/both ears)	2.9	1.4	0.80%
	Difficulty walking	20.9	10.4	0.76%
	Blind (either/both eyes)	2.8	1.5	0.68%
60-74 in 1910 or 1988-1994				
	Difficulty bending	49.7	16.1	1.38%
	Difficulty walking	30.9	13.8	0.99%
	Paralysis	6.0	2.7	0.98%
	Deaf (either/both ears)	3.8	2.7	0.42%
	Blind (either/both eyes)	3.8	3.1	0.25%

Note 1: Excludes wounded veterans, POWs, and disability discharges.
Source: Costa (2002, Table 3).

Chart 5

Table 5: Life Expectancy at Ages 65 and 75, United States, Select Years

Year	Unisex	Males	Females
	At Age 65		
1960	14.3	12.8	15.8
1970	15.2	13.1	17.0
1980	16.4	14.1	18.3
1990	17.2	15.1	18.9
2000	17.9	16.3	19.2
2002	18.2	16.6	19.5
Rate (% per yr.; 42 yr.)	0.58%	0.62%	0.50%
Rate (% per yr.; 22 yr.)	0.47%	0.74%	0.29%
	At Age 75		
1980	10.4	8.8	11.5
1990	10.9	9.4	12.0
2000	11.3	10.1	12.1
2002	11.6	10.4	12.5
Rate (% per yr.; 22 yr.)	0.50%	0.76%	0.38%

Source: NCHS (2003, Table 27); Kochanek et al. (2004, Table 6).

Chart 6

Table 6: Unisex Death Rates (per 100,000) for All Causes, United States

Age	1960	2000	Annual Rate of Decline
65-74	3822	2399	1.16%
75-84	8745	5667	1.08%
85+	19,858	15,524	0.61%

Source: NCHS (2003, Table 35).

Chart 7

Table 7: Unisex Death Rates (per 100,000) for Diseases of Heart, United States

	1960		2000		
Age	Death Rate	Percent of All Deaths	Death Rate	Percent of All Deaths	Annual Rate of Decline in Death Rate
65-74	1741	46%	666	28%	2.37%
75-84	4089	47%	1780	31%	2.06%
85+	9318	47%	5926	38%	1.13%

Source: NCHS (2003, Table 36).

Chart 8

Table 8: Unisex Death Rates (per 100,000) for Cancer, United States

	1960		2000		
Age	Death Rate	Percent of All Deaths	Death Rate	Percent of All Deaths	Annual Rate of Decline in Death Rate
65-74	714	19%	816	34%	-0.34%
75-84	1127	13%	1336	24%	-0.42%
85+	1450	7%	1819	12%	-0.57%

Source: NCHS (2003, Table 38).

Chart 9

Table 9: Unisex Death Rates (per 100,000) for Cerebrovascular Diseases, United States

	1960		2000		
Age	Death Rate	Percent of All Deaths	Death Rate	Percent of All Deaths	Annual Rate of Decline in Death Rate
65-74	469	12%	129	5%	3.18%
75-84	1491	17%	461	8%	2.89%
85+	3681	19%	1589	10%	2.08%

Source: NCHS (2003, Table 37).

Chart 10

Table 10: Unisex Death Rates (per 100,000) for Heart, Cancer, and Cerebrovascular Diseases, United States

	1960		2000		
Age	Death Rate	Percent of All Deaths	Death Rate	Percent of All Deaths	Annual Rate of Decline in Death Rate
65-74	2924	76%	1611	67%	1.48%
75-84	6708	77%	3577	63%	1.56%
85+	14,448	73%	9335	60%	1.09%

Source: NCHS (2003, Tables 36-38).

Chart 11

Table 11: Unisex Death Rates (per 100,000) for Residual Causes of Death, United States

	1960		2000		
Age	Death Rate	Percent of All Deaths	Death Rate	Percent of All Deaths	Annual Rate of Decline in Death Rate
65-74	899	24%	789	33%	0.33%
75-84	2037	23%	2089	37%	-0.06%
85+	5409	27%	6190	40%	-0.34%

Source: NCHS (2003, Tables 33-38).

Chart 12

Table 12: Current Cigarette Smoking (%) at Ages 45-64 and 65 Years and Older, United States

Gender	1965	2000	Annual Rate of Decline
	Age 45-64		
Male	51.9	26.4	1.91%
Female	32.0	21.6	1.12%
	Age 65+		
Male	28.5	10.2	2.89%
Female	9.6	9.3	0.09%

Source: NCHS (2003, Table 59).

Chart 13

Table 13: Prevalence of Hypertension (%; SBP >= 140, DBP >= 90, or Medicated) at Ages 55-64 and 65-74 Years, United States

Gender	1960-1962	1999-2000	Annual Rate of Decline
	Age 55-64		
Male	60.3	50.7	0.45%
Female	66.4	57.9	0.36%
	Age 65-74		
Male	68.8	68.3	0.02%
Female	81.5	73.4	0.27%

Source: NCHS (2003, Table 66).

Chart 14

Table 14: Mean Serum Cholesterol Levels (mg/dL) at Ages 55-64 and 65-74 Years, United States

Gender	1960-1962	1999-2000	Annual Rate of Decline
	Age 55-64		
Male	233	210	0.27%
Female	262	223	0.42%
	Age 65-74		
Male	230	210	0.24%
Female	266	229	0.39%

Source: NCHS (2003, Table 67).

Chart 15

Table 15: Prevalence of High Serum Cholesterol (%; SC >= 240 mg/dL) at Ages 55-64 and 65-74 Years, United States

Gender	1960-1962	1999-2000	Annual Rate of Decline
	Age 55-64		
Male	41.6	16.5	2.37%
Female	70.1	26.2	2.52%
	Age 65-74		
Male	38.0	19.2	1.76%
Female	68.5	37.4	1.56%

Source: NCHS (2003, Table 67).

Chart 16

Table 16: Prevalence of Obesity (%; BMI >= 30 kg/m^2) at Ages 55-64 and 65-74 Years, United States

Gender	1960-1962	1999-2000	Annual Rate of Decline
	Age 55-64		
Male	9.2	32.9	-3.37%
Female	24.4	43.1	-1.49%
	Age 65-74		
Male	10.4	33.4	-3.08%
Female	23.2	38.8	-1.34%

Source: NCHS (2003, Table 68).

Chart 17

Table 17: Unisex Prevalence (%) of Disability Satisfying HIPAA ADL Trigger, United States 1984 to 1999, Select Years

	Year				
Age	1984	1989	1994	1999	Annual Rate of Decline; 15 yr.
65-69	3.32	3.15	3.04	2.38	2.19%
70-74	5.15	4.64	4.11	4.12	1.48%
75-79	8.83	8.42	7.90	6.32	2.21%
80-84	15.95	15.87	13.30	12.61	1.55%
85-89	27.86	27.97	25.89	22.50	1.42%
90-94	46.89	42.52	45.30	39.04	1.21%
95-99	66.43	61.90	60.15	52.11	1.61%
Age standardized rate	9.59	9.19	8.49	7.48	1.64%

Source: Author's calculations based on NLTCS.

Chart 18

Table 18: Unisex Prevalence (%) of LTC Institutionalization, United States 1984 to 1999, Select Years

	Year				
Age	1984	1989	1994	1999	Annual Rate of Decline; 15 yr.
65-69	1.07	1.01	0.85	0.52	4.67%
70-74	2.16	2.09	1.84	1.64	1.84%
75-79	4.48	4.37	4.25	2.76	3.18%
80-84	9.85	9.43	8.45	6.35	2.88%
85-89	19.31	18.95	18.41	12.49	2.86%
90-94	34.13	31.38	32.91	27.81	1.36%
95-99	50.14	44.60	49.84	37.24	1.96%
Age standardized rate	5.47	5.25	5.01	3.71	2.56%

Source: Author's calculations based on NLTCS.

Chart 19

Table 19: Unisex Life Expectancy, HIPAA ADL Expectancy, and LTC Institutional Expectancy (in Years at Age 65), United States 1984 and 1999

	Year		
At Age 65	1984	1999	Annual Rate of Change
Life Expectancy	16.64	17.40	0.30%
HIPAA ADL Expectancy	1.86	1.57	1.13%
LTC Institutional Expectancy	1.11	0.83	1.94%

Source: Author's calculations based on NLTCS and life tables from Bell and Miller (2002).

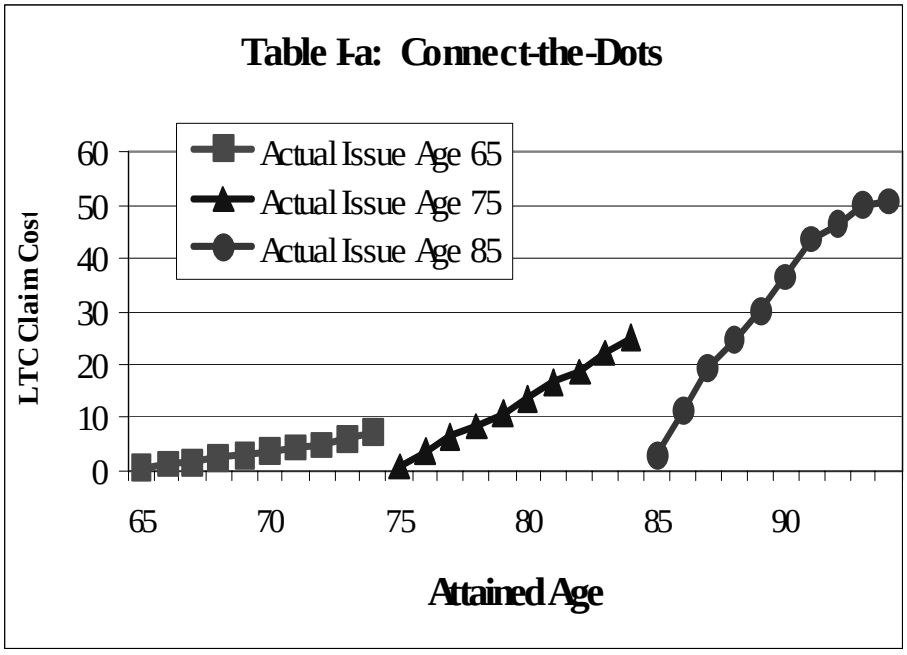
Chart 20

Table 20: Components of Change in Unisex Life Expectancy, HIPAA ADL Expectancy, and LTC Institutional Expectancy (in Years at Age 65), United States 1984 and 1999

	Year				
At Age 65	1984	1999	Change	Survival Increment	Morbidity Decrement
Life Expectancy	16.64	17.40	0.76	0.76	-
HIPAA ADL Expectancy	1.86	1.57	-0.29	0.13	0.42
LTC Institutional Expectancy	1.11	0.83	-0.28	0.09	0.37

Source: Author's calculations based on NLTCS and life tables from Bell and Miller (2002).

Chart 21



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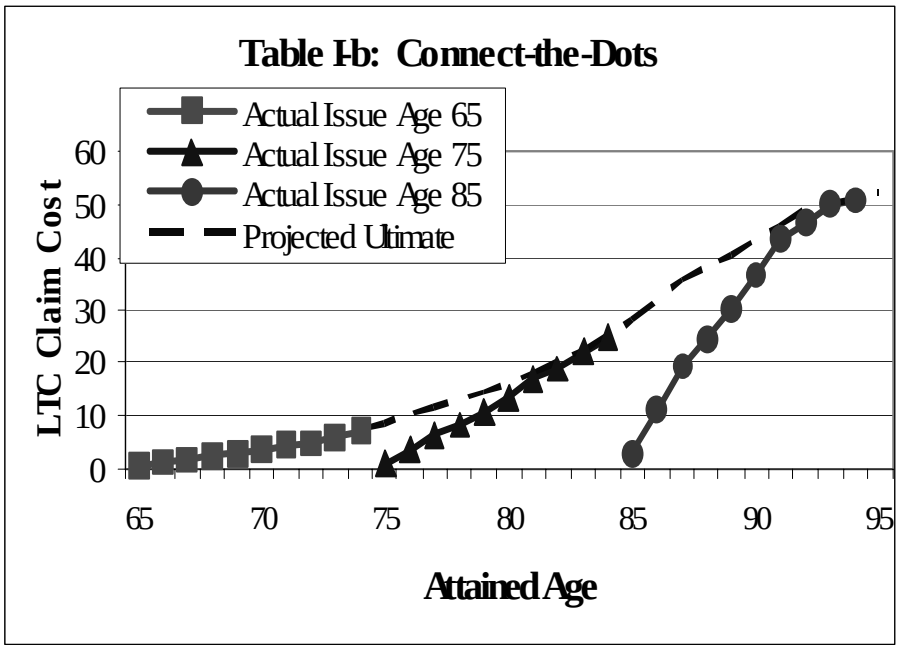

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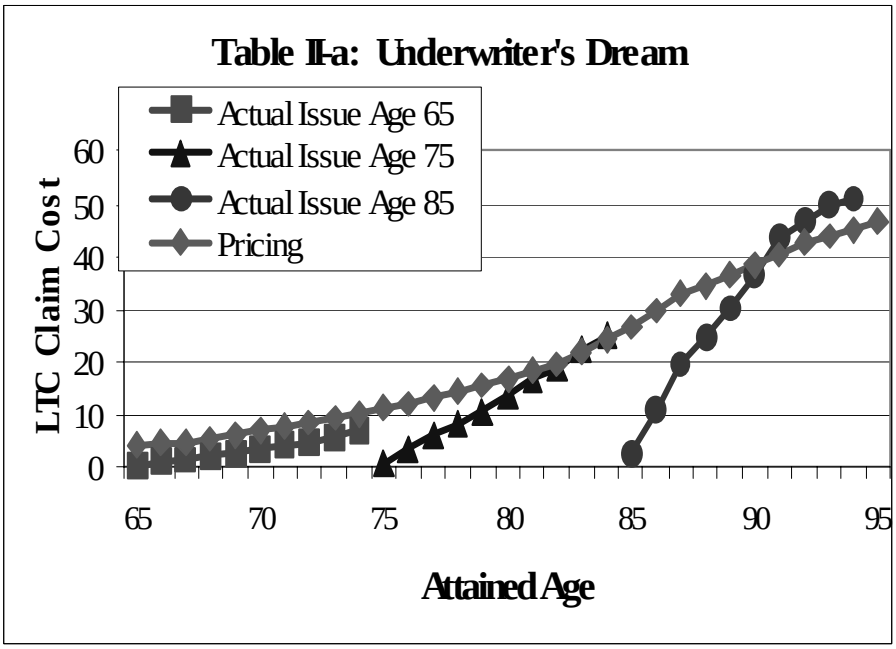

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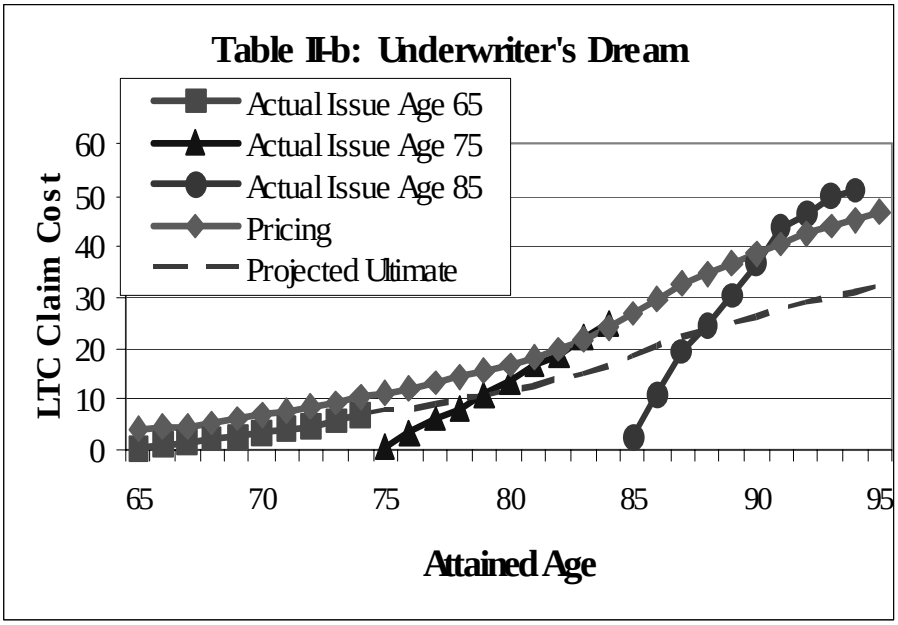

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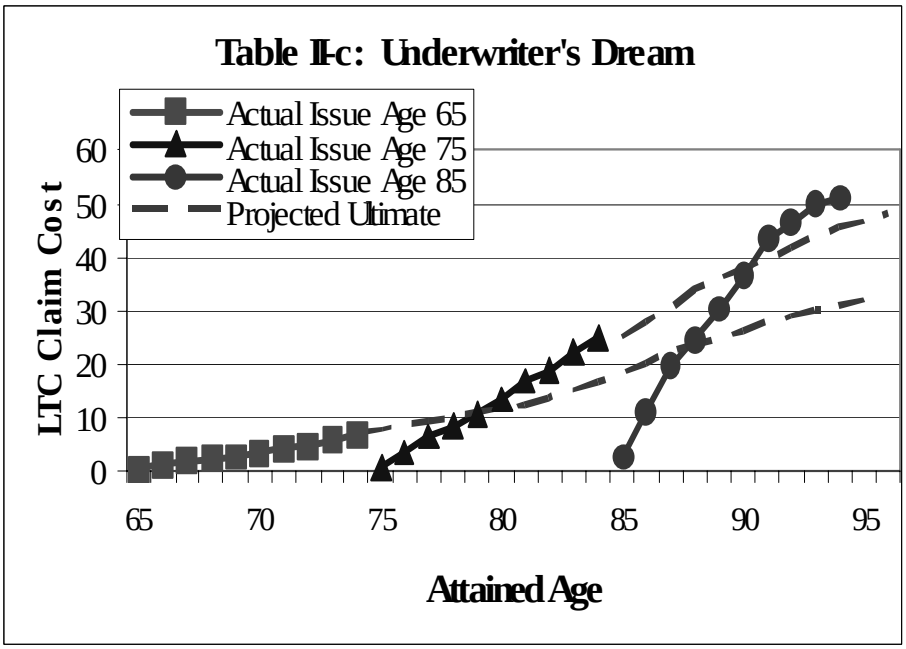

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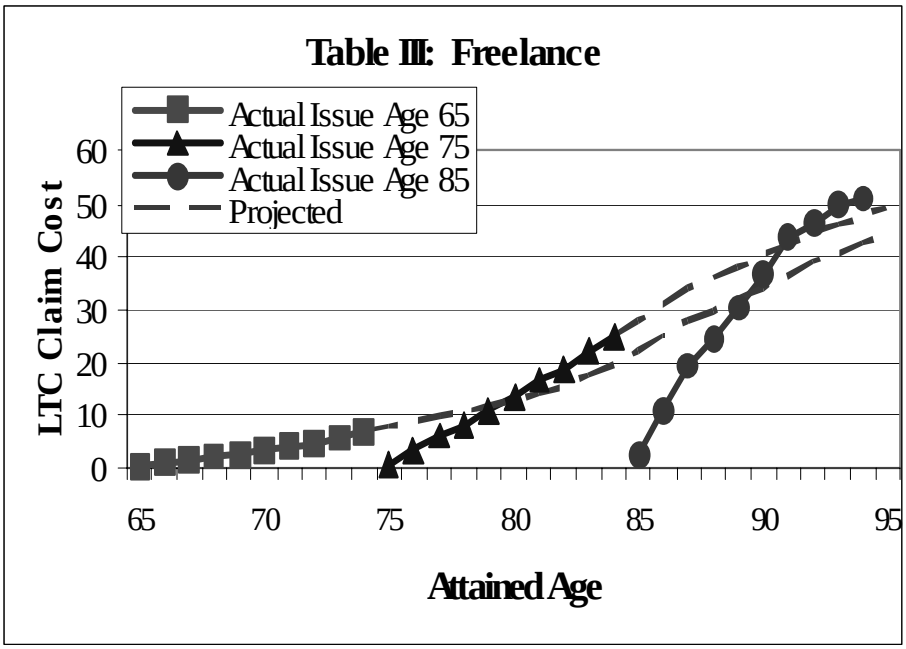


Chart 27

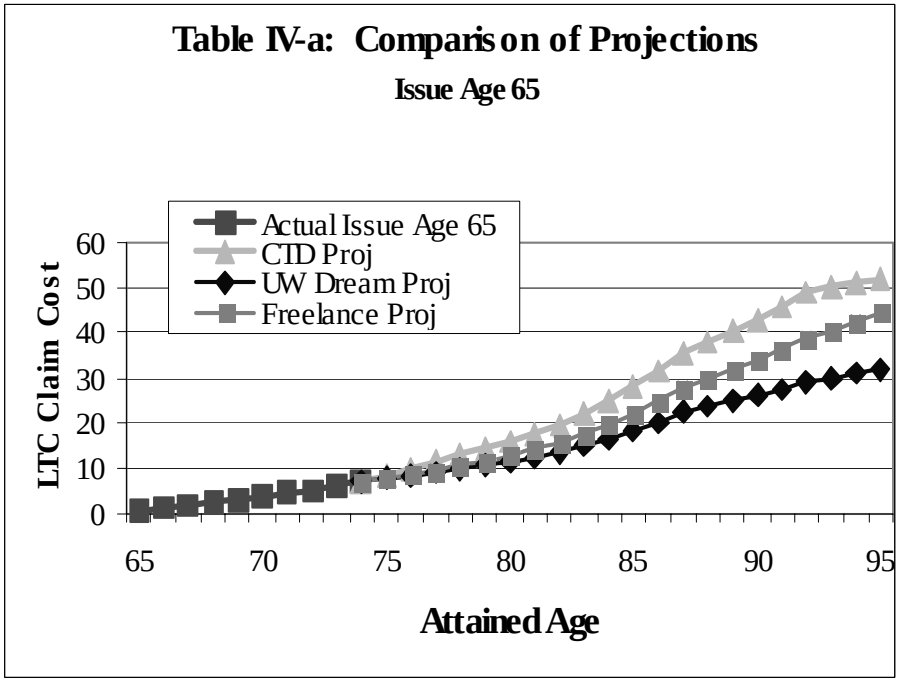
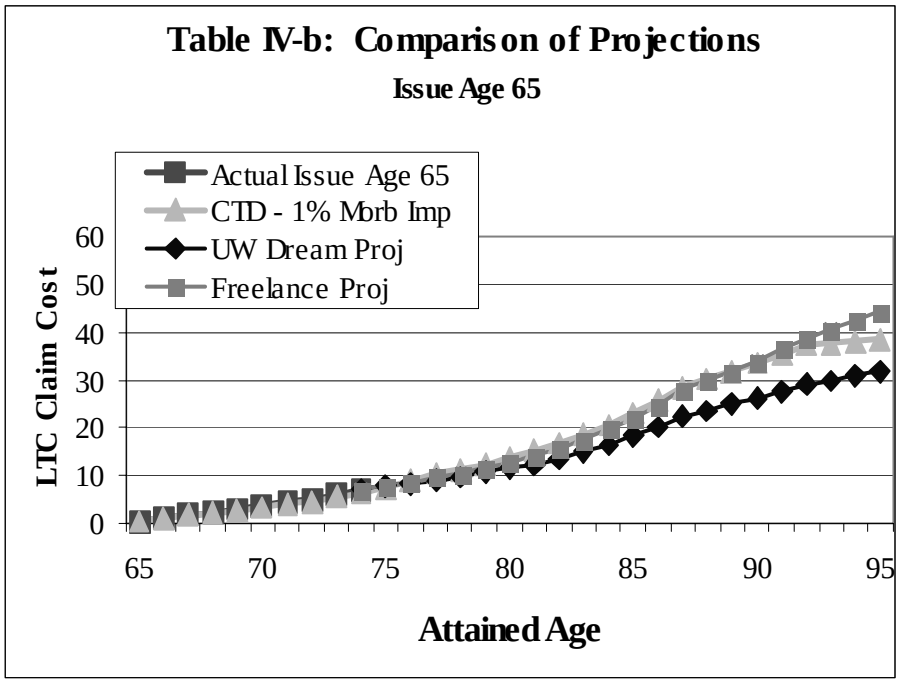


Chart 28



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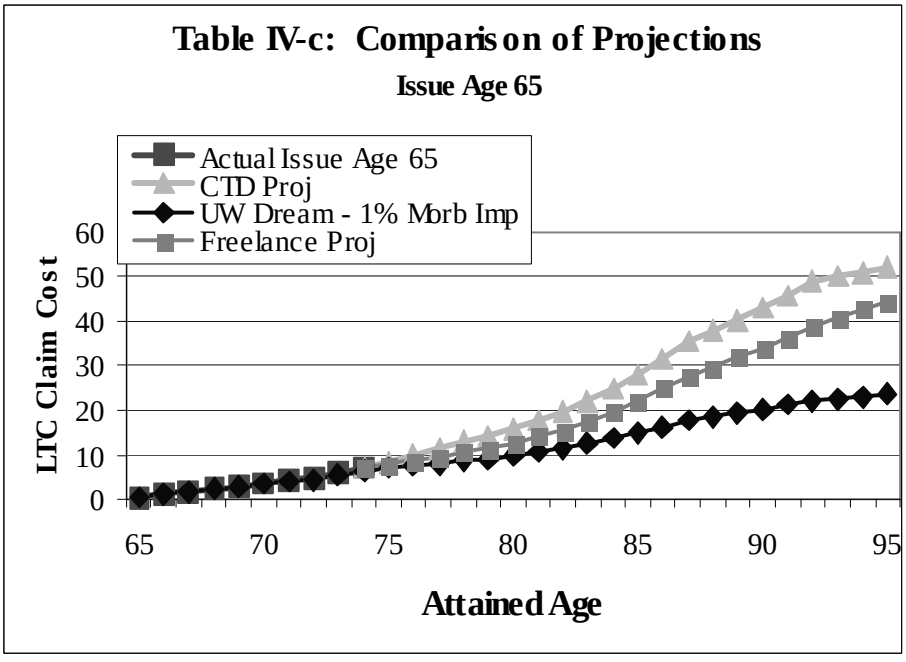

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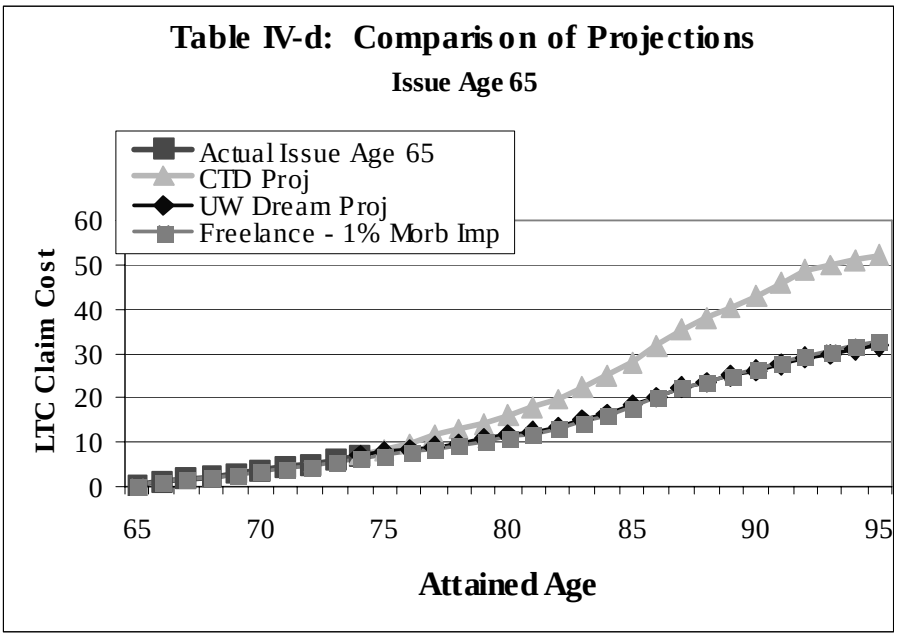

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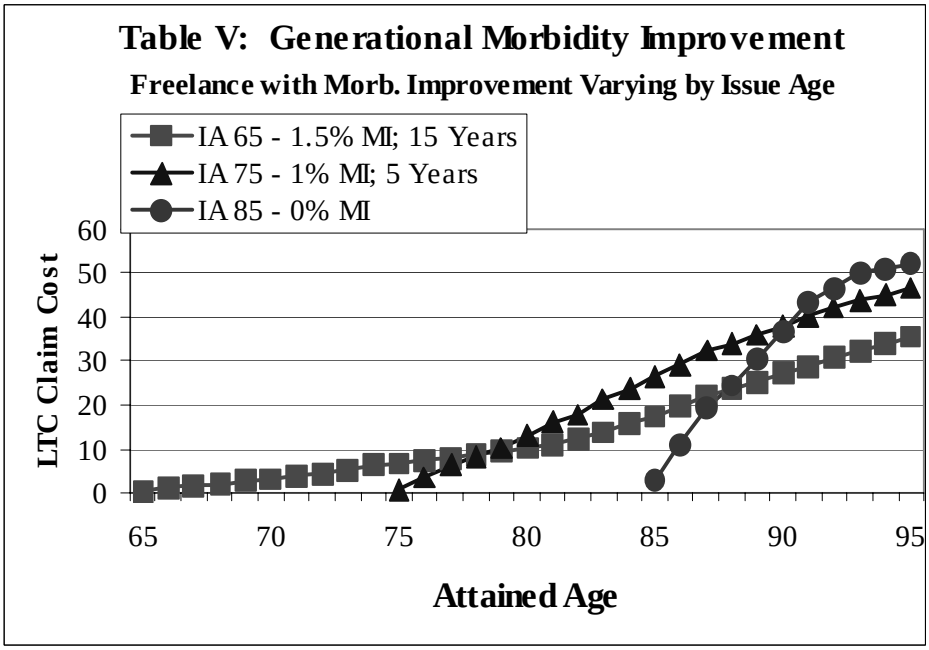

References

Bell FC, Miller ML. *Life Tables for the United States Social Security Area 1900–2100*. Actuarial Study No. 116, Social Security Administration, 2002.

Bishop CE. Missing nursing homes: The author responds. *Health Affairs* 19(5): 250, 2000.

Bishop CE. Where are the missing elders? The decline in nursing home use, 1985 and 1995. *Health Affairs* 18(4): 146–155, 1999.

Costa DL. Changing chronic disease rates and long-term declines in functional limitations among older men. *Demography* 39(1):119–137, 2002.

Costa DL. Understanding the twentieth-century decline in chronic conditions among older men. *Demography* 37(1):53–72, 2000.

Fogel RW, Costa DL. A theory of technophysio evolution, with some implications for forecasting population, health care costs, and pension costs. *Demography* 34(1): 49-66, 1997.

Freedman VA, Crimmins E, Schoeni RF, Spillman BC, Aykan H, Kramarow E, Land KL, Lubitz J, Manton K, Martin LG, Shinberg D, Waidmann T. Resolving inconsistencies in trends in old-age disability: Report from a technical working group. *Demography* 41(3):417–441, 2004.

Freedman VA, Martin LG. The role of education in explaining and forecasting trends in functional limitations among older Americans. *Demography* 36(4):461–473, 1999.

Freedman VA, Martin LG. Understanding trends in functional limitations among older Americans. *American Journal of Public Health* 88(10): 1457–1462, 1998.

Freedman VA, Martin LG, Schoeni RF. Recent trends in disability and functioning among older adults in the United States: A systematic review. *Journal of the American Medical Associatio*n 288(24):3137–3146, 2002.

Freedman VA, Soldo BJ. *Trends in Disability at Older Ages*. National Academy Press, Washington, DC, 1994.

Hetzel L, Smith A. *The 65 Years and Over Population: 2000*. Census 2000 Brief, C2KBR/01-10, Washington, DC, 2001.

Jones A. *The National Nursing Home Survey: 1999 Summary*. Vital Health Statistics Series 13, Number 152. National Center for Health Statistics. Hyattsville, MD, 2002.

Kochanek KD, Smith BL. *Deaths: Preliminary Data for 2002*. National Vital Statistics Reports Vol. 52 No. 13, National Center for Health Statistics, 2004.

Manton KG, Gu X. Changes in the prevalence of chronic disability in the United States black and nonblack population above age 65 from 1982 to 1999. *Proceedings of the National Academy of Sciences* 98(11):6354–6359, 2001.

McClellan M, Yan-Li LL. *Understanding disability trends in the U.S. elderly population: The role of disease management and disease prevention*. Paper presented at the Annual Meeting of the Population Association of America, Los Angeles, March 23-25, 2000.

Mollica RL. *State Assisted Living Policy: 2002*. National Academy for State Health Policy, Portland, ME, 2002.

National Center for Health Statistics (NCHS). *Health, United States, 2003*. NCHS, 2003.

Rhoades JA, Krauss NA. *Nursing Home Trends, 1987 and 1996*. MEPS Chartbook No. 3. Agency for Health Care Policy and Research, Rockville, MD, 1999.

Rhoades JA. Where are the missing nursing homes? *Health Affairs* 19(5): 249–250, 2000.

Stallard, E. Retirement and health: Estimates and projections of acute and long-term care needs and expenditures of the U.S. elderly population. Chapter 15 in *Retirement Needs Framework*, SOA Monograph M-RS00-1, Society of Actuaries, Schaumburg, IL, 2000.

Stallard E, Yee RK. *Non-Insured Home and Community-Based Long-Term Care Incidence and Continuance Tables*. Actuarial Report Issued by the Long-Term Care Experience Committee, Society of Actuaries, Schaumburg, IL, 2000.

Sullivan D. A single index of mortality and morbidity. *Health Services and Mental Health Administration (HSMHA) Health Reports* 86(4):347–354, National Center for Health Statistics (NCHS), 1971.

Yan-Li LL, McClellan M. *Disease management or disease prevention? Evidence regarding the causes of recent disability decline among American elderly from the Medicare Current Beneficiary Survey*. Paper presented at the Annual Meeting of the Population Association of America, Washington, DC, March 31, 2001.