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Disability and Health Care Expenditures among Medicare Beneficiaries

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Abstract

This paper forecasts the impact of changing disability rates on spending by Medicare beneficiaries. We adjust for differential changes in spending by the disabled because the composition of the disabled population and the intensity of their treatment are changing. Among community-dwelling elderly, spending growth among the least disabled grew more quickly than among the most disabled, which offsets some of the cost savings associated with declining disability rates. Using estimates of spending trends by disability category, we project that the cost savings associated with improved disability rates will not dramatically slow Medicare spending in the long run.

With the coming influx of the aging population into Medicare, the fiscal challenges posed by a larger elderly population will depend crucially on their health status. Studies have found that the medical expenditures of seniors are, to a large extent, determined by their disability status.[1] Compared with socio-demographic, psychosocial, and diagnosis variables, functional status demonstrated the strongest association with the medical utilization.[2] On a per capita basis, expenditure for persons with five or more activity limitations are nearly 5 times the amount incurred by those with only IADL conditions.[3]

Recent studies have shown that disability among the elderly has been falling over time.[4] According to Manton and Gu (2001), the decline in chronic disability prevalence accelerated from 1994 to 1999 compared with 1989 to 1994, and the institutionalization among elderly also dropped substantially during that period. Because less disabled individuals have lower mortality rates, the decline in disability may be associated with a decline in mortality, which would contribute to the increase the population of elderly. Waidmann and Liu suggest that if

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disability rates continue their current decline, the number of disabled elderly people will not grow either in absolute terms or relative to the size of the working-aged population, even in the face of the dramatic growth in the elderly population.[5]

A reduction in disability rates will tend to reduce health care expenditures because the less disabled spend less than individuals with greater disability. A recent study by Lubitz and his colleagues suggests the savings of improved health might offset the health care costs as the result of longer life.[6] Specifically, if disability trends continue, the expected cumulative health expenditures per elderly may not increase in the future, despite greater longevity. However, whether the improving disability trends among the elderly will continue is uncertain. Evidence suggests the disability rates among the young population increased over the past fifteen years.[7] As this population ages, it will likely generate a greater rate of disability among the elderly.

What is missing from all of this discussion is whether relative spending on the disabled is changing over time. The extent of the cost savings associated with lower rates of disability will depend on how much the less disabled spend. In this paper, our goal is to address this missing piece by investigating changes over time in the relationship between disability and spending.

The underlying technological and medical advances that have led to rising health care expenditures and improved health status among the elderly may not affect all subpopulations equally, and therefore might change the relationship between spending and disability. In fact if spending reduces the rates of transition to more disabled health states, the decline in rates of disability might reflect the effects of greater spending on the least disabled.

Cutler and Meara (1999) provide empirical support for the hypothesis that growth in medical spending may vary across sub populations. They find that medical spending for people aged 85 or over increased more rapidly than for those 65–69, as a result of increased use of post-acute care services among the oldest old. Moreover, they report that spending among the elderly increased rapidly between 1984 and 1995, despite the decline of disability rates during that period. Therefore, understanding the spending trends conditional on disability would be crucial for the projection of future Medicare expenditure.

We used data from the 1990s to estimate how the relationship between disability and spending changed during that period. Our analysis of disability is based on the two building blocks used to measure disability inmost empirical work: limitations in ADLs and IADLs. [10]

Our analysis of disability is based on the two building blocks used to measure disability in most empirical work: limitations in Activities of Daily Living (ADLS) and Instrumental Activities of Daily Living (IADLs).[8] Our analysis is based on six ADLs (eating, bathing, dressing, transferring from bed to chair, walking, and using the toilet) and six IADLs (using the phone, doing light housework, doing heavy housework, making meals, shopping, and managing money).[11] The level of ADL limitation reflects not only one’s health status but also one’s environment and social situation.

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Methods

The impact of improving disability rates on Medicare spending will reflect two offsetting factors, a case-mix effect and a mortality effect. The case-mix effect arises because individuals with less disability spend less, suggesting that improved disability rates will reduce spending. The mortality effect captures the fact that individuals with less disability tend to have lower mortality rates. As a result, program spending will rise as improved disability leads to a greater number of beneficiaries. The magnitude of these effects depends on the differential costs across disability group and the differential mortality rates. Both the cost differential and the mortality differential may change over time and influence the extent to which disability trends influence spending.

Our analysis of the impact of improved disability rates on spending by Medicare beneficiaries relies on a micro simulation model developed to forecast future disease, functional status, and spending of the elderly.[10] It is based on age specific transitions across health and disability states.[11] Spending is tied to health and demographic factors. The model allows us to alter the trajectory of disability and spending conditional on disability in order to forecast future spending. It also allows us to alter the hazard rates associated with transitions into disability states. In the model those hazard rates are a function of demographics and disease. Thus we are able to manipulate the transitions probabilities in aggregate (e.g., reduce the probability of becoming disabled by 10%) or alter the impact of any given illness on the probability of becoming disabled (e.g., assume that the relationship between heart disease and the likelihood of disability weakens).

There are several key components to the model. First, the model begins tracking individuals when they are 65. For this reason assumptions about entering cohorts are important. Our assumption is that the disability status of existing cohorts reflects current disability status of that age group and that entering cohorts enter with the same disability profile of current 65 year olds. Second, following the assumption of the Social Security Administration, we assume that mortality rates decline at a rate of .68 percent per year.[12] Although mortality rates differ by disability category, the relative decline in mortality is assumed to be the same across disability states.

To estimate the trends in spending by disability group among elderly, we model total spending by Medicare beneficiaries (program spending plus beneficiary out-of-pocket spending and spending by other payers) as a function of disability, other covariates (including disease burden), and a set of parameters. Changes in Medicare spending over time will reflect either changes in the distribution of covariates (including disability) or changes in the coefficients that relate those covariates to spending.

We estimate a single-equation generalized linear model (GLM).[13] Our initial specification included interactions of all explanatory variables with a linear time trend, thereby allowing the relationship between spending and all covariates (including disability and disease) to change over time. After running the fully interacted model, we dropped the time interactions for those domains and disease states in which the estimates suggested the coefficients were stable over time. These dropped interaction terms include the interactions of time with: age,

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education, gender, race, region of residence, marriage status, and smoking history. The dropping of the interaction terms signifies stability of the effects of these variables over time. The corresponding variables not interacted with time were retained in the model and were often important predictors of expenditures. The exclusion of these interactions did not substantively change the estimated cost trends by disability category.

We tested this model against other models of spending that made different functional form and distributional assumptions for spending.[14] Our tests were based on both a split sample approach and a set of models that were estimated on data from 1992 through a given year (t) and then used results to predict expenditures in periods after t through 1999. We estimated several such models using different years to define t. Our model selection criterion was based on mean average prediction errors.[15] We also tested a model using a nonlinear time trend, ln(t), instead of a linear term. The non-linear time trend model had a slightly greater mean average prediction error, so we use the linear time trend model for our analysis.

Because disability is a marker of disease, a portion of the association between spending and disability may not be causal. Higher spending on individuals with disabilities may reflect efforts to treat the underlying disease that caused the disability. If individuals with disabilities suffer disproportionately from diseases (or disease severity) that we cannot control for in our analysis, then higher spending may reflect efforts to treat the underlying medical conditions not otherwise controlled for.

To estimate the effects of disability trends on spending by Medicare beneficiaries, we estimate trends in program spending under three scenarios. First, we estimate spending under our baseline model which assumes the transition probabilities between disability and disease states match those observed in the 1990s. This model allows cost trends to differ by disability categories and other enrollee traits.

Second, we simulate spending assuming the hazard rates adjust such that the prevalence among community dwelling elderly of having 1 or more IADLs, 1 or 2 ADLs, 3 or 4 ADLs, and 5 or more ADLs decline by about 20% in steady-state. Third, we simulate spending assuming disability does not get worse (the hazard associated with a worsening level of disability is set to 0).

Data

We use data from the Medicare Current Beneficiary Survey (MCBS), a nationally representative study designed to ascertain utilization and expenditures for the Medicare population. The survey is a rotating panel design of 12 interviews over 3 years and has been ongoing since 1991. We use data from 1992 through 2000. The MCBS sample frame consists of aged and disabled beneficiaries enrolled in Medicare Part A and/or Part B, although we use only the aged for this analysis and the oldest-old (85 years of age or over) are over sampled. The MCBS contains demographic data such as age, sex, race, and educational attainment. It also contains detailed self-reported information on health, including the prevalence of various conditions, measures of physical limitations in

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performing daily activities (ADLs) and limitations in instrumental activities of daily living (IADLs).

Measuring costs

Our primary measure of health care spending represents total spending on health care by Medicare beneficiaries (including program expenditures, out of pocket costs and spending by other payers such as Medicaid and supplemental plans). We include spending for all health care services (inpatient, outpatient, physician, pharmaceutical, nursing home, and home care). The cost data is based on Medicare claims data, linked to the MCBS, combined with respondent self-reports.[16] For services covered by Medicare, the data captures both the spending by Medicare, other payers including Medicaid, and by the beneficiary. Spending for services not covered by Medicare is based on self-reports and may be under reported. All spending was adjusted to 2000 using the medical care component of the consumer price index, which results in a conservative estimate of cost growth.[17]

Measuring disability

For the purpose of this study, IADL disability was defined as requiring any supervision or assistance with any of the 6 IADLs. ADL disability was defined as requiring any supervision or assistance with any of the ADLs. Given the number of ADLs and IADLs, a global measure of disability must aggregate the individual measures. Research has shown that a simple count of ADL or IADL provides a reasonable good proxy for the hierarchical nature of the ADL items and, of the relative severity of person's disabilities.[18]

Our measure of the severity of disability for non-institutionalized population is based on five categories, which are commonly used in the literature[19]: non-disabled, those with IADL only, with 1 or 2 ADLs, with 3 or 4 ADLs, and those with 5 or more ADLs.

The MCBS does not collect ADL counts for individuals residing in nursing homes on a consistent basis. As such, we treat nursing home residence as an additional category of disability above those living in the community, but recognize that some community dwelling elderly may suffer from greater disability than some nursing home residents.

Measuring disease

The MCBS contains a wide array of self-reported diagnoses. We include binary variables measuring the presence of several important diseases often linked to expenditures: diabetes, cancer, heart disease, stroke, Alzheimer's disease, hypertension, osteoarthritis, and lung disease.

Other covariates

We also choose additional binary variables that have been found to be associated with health care spending. These variables include age (65–69, 70–74, 75–79, 80–84,85+), gender, marriage status, race (White, Black, Hispanic), education (<11, 12–15, 16+), geographical region (Midwest; West; Northeast; South; Puerto Rico or unknown), ever smoking, BMI category (obese, overweight, underweight), and supplemental health insurance coverage

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(Part A only, Part B only, Medicaid, Employer supplemental, Private supplemental and HMO).

Results

Trends in disability were falling over time for the Medicare population. Figure 1 shows the relative increase in the rate of non-disability (left panel) and the decrease in any disability (right panel) from 1992 to 2000. Over the study period the average number of ADLs per community dwelling Medicare beneficiary fell from 0.68 to 0.61, and the average number of IADL also dropped about 10%. Moreover the percent of community dwelling Medicare beneficiaries with at least 1 ADL fell from 30.4% to 27.8%.

In aggregate, spending per Medicare beneficiary rose 11 percent during this period. The increase in spending reflects an increase in spending within less disabled groups (Figure 2). Among community-dwelling beneficiaries, costs per beneficiary in the IADL-only group and the no-disability group rose 92 percent and 82 percent, respectively, compared with 58 percent for those with one or two ADLs, 45 percent for those with three or four ADLs, and 44 percent for those with five or more ADLs. As a result, the ratios of spending in the ADL disabled categories, relative to spending among the nondisabled, fell during the study period. After a rapid rise in spending among nursing home residents early in the study period, there was a decline starting in 1997. This might reflect changes in reimbursement rules. Overall, there was an 8.0 percent increase in spending among institutionalized beneficiaries.

The evidence that spending rose most rapidly among the least disabled may partially reflect changing disease mix within the disability categories. There is some evidence that the less disabled experience a greater increase in the prevalence of certain diseases than the higher disability categories. For example, between 1992 and 1999, a period prior to changes in the survey question regarding heart disease, there was a 22% increase in self-reported heart disease among the non-disabled, and only 12% among the most disabled. Between 1992 and 2000, self-reported diabetes within the non-disabled category increased 31% compared to only 5% among people with 3 or 4 ADLs. The evidence for cancer is mixed. The percent of individuals with cancer rose 12% among the ADL3–4 group, dropped 4% in the ADL1–2 group, and rose 6% in the non-disabled group, and dropped 6% in the group with 5 or more ADLs.

The multivariate analysis, which forms the basis for our inference and simulations, allows us to examine differences in cost levels by disability group — as well as cost trends — after adjusting for disease and other factors, including health behaviors, insurance status and sociodemographic status. Consistent with the literature, we find that costs among the more disabled are greater than among the less disabled. Among all the health and demographic characteristics, the variables ADL3–4, ADL5+ and nursing home status, whose coefficients are significantly greater than 1, demonstrate the strongest associations with total medical spending (Appendix A). The results indicate that total medical care spending of elderly with 1 or 2 ADLs was about twice that of the non-disabled. Elderly with 5 or more ADLs incurred 4 to 5 times the medical care spending of the non-disabled.

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We interacted disability status with the time trend to determine whether there were statistically significant differences in cost growth from 1992 to 2000. The results indicate that spending grew most rapidly among the least disabled groups. Adjusted spending by the non-disabled and IADL disabled groups grew 23% and 28% respectively, compared to a 10% increase for those with 1 or 2 ADLs, a 0.6% increase for those with 3 or 4 ADLs and a 10% decrease for most disabled. As a result the ratio of spending among the ADL disabled groups, relative to the non-disabled, declined over the study period.

In the GLM model, these findings hold irrespective of whether we also allow differential trends in spending by age, region, or other beneficiary traits. Thus, changes in spending are not explicitly tied to changes in the way we treat the oldest-old or diseases such as heart disease, and lend credence to a causal interpretation.

These results have implications for the potential cost savings from the overall decline in elderly disability. Figure 3 illustrates the beneficial impact of reduced disability on costs per beneficiary, assuming that the trends estimated in our model persist. The baseline curve reflects the status quo hazard rates. Scenario A adjusts the hazard rates such that the prevalence among community dwelling elderly of having 1 or more IADLs, 1 or 2 ADLs, 3 or 4 ADLs and 5 or more ADLs decline by about 20% in steady-state. Scenario B eliminates the hazard rate associated with a worsening level of disability and has the greatest impact on spending. Notice in both cases the savings associated with improved disability diminish over time. This is because the cost growth is greatest for the least disabled groups.

In aggregate, our projections suggest that improved disability trends will not slow total spending for Medicare beneficiaries (Figure 4). Improvements in disability may reduce current costs, but because of the associated greater longevity and rapid cost growth among the less disabled, total expected lifetime costs might not drop. Essentially, efforts to reduce disability are valuable, but, if current trends in spending by disability category continue, success at reducing disability will not result in substantial cost savings per beneficiary.

Limitations

There are several important limitations to our approach. First, our projections of spending trends are based on the experience from 1992 and 2000, which may not be typical. For example, our model does not adjust directly for Medicare reforms that undoubtedly affected the relationship between disability and spending over time. For example we do not directly adjust for changes on physician payment methodologies (the RBRVS system) nor do we adjust for the Balanced Budget Act of 1997 (BBA), which influenced payments, particularly for long term care services. Payment systems such as those implemented in the BBA can have a major affect on the convergence in spending. As a result, the trends imposed may not generalize to future experience, which will reflect future changes to the Medicare payment systems (including the effects of the Medicare Modernization Act, which we do not capture).

In fact, projections of past trends suggest that during our projection period spending may no longer rise monotonically with disability category. This may not be realistic, but we would

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need more detailed knowledge of the forces driving spending growth in the less disabled groups to better assess the plausibility of the convergence in spending by disability category.

Second, we have not differentiated mortality trends by disability category. Differential mortality trends could also affect the impact of changing disability rates on cost trends. Third, we have not distinguished between spending by the Medicare program and spending by the beneficiary. In part this is because future trends may differ in the share paid by the beneficiary because of the Medicare Modernization Act.

Finally, our measure of disability is very crude (based only on a rough aggregation of IADLs and ADLs). We cannot from this analysis provide greater insight regarding the clinical factors driving spending trends by disability group or distinguish clearly from causally related effects of disability trends on costs and effects arising because of important unobservable factors that relate to our disability measures. Although we control for major disease categories, unmeasured case mix changes within disability categories may be influencing our results.

Conclusions

With society aging, policy makers must be concerned with the fiscal responsibilities associated with an older population. Existing trends in disability suggest that the costs associated with aging will be lower than simple projections because the elderly of the future will likely be less disabled than the current cohort of seniors. However, the optimism contained in spending forecasts that assume substantial savings associated with reduced disability rates may be overstated. Our analysis suggests that while the less disabled spend less than the more disabled, the differential is narrowing over time. Significant cost growth has occurred in the least disabled population which, if predictive of future trends, will offset some of the savings associate with improved disability status.

A fundamental question in predicting future spending is whether the convergence of spending across disability groups among the elderly will continue. In the future convergence will reflect the changes in Medicare reimbursement policy and benefit design. It may also be the case that technical innovations affect the medical spending among the elderly unevenly across disability groups. As we are faced with a growing number of Medicare beneficiaries, policy makers will be challenged to design systems that promote efficiency in the delivery of care to Medicare beneficiaries. Our analysis indicates that it is unlikely that improved disability status among elderly will eliminate cost pressures, suggesting that tough choices will be necessary and the political pressures will be great.

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APPENDIX

Table A.1:

Descriptive Statistics

Covariates	1992 Mean	2000 Mean	Change
N	10634	10857	
Age70-74	0.252	0.246	−0.006
Age75-79	0.200	0.215	0.015
Age80-84	0.136	0.144	0.008
Age 85 and up	0.117	0.135	0.018
Died	0.048	0.049	0.001
Male	0.409	0.414	0.005
Black	0.083	0.086	0.003
Hispanics	0.048	0.063	0.015
Married	0.545	0.527	−0.018
High school	0.310	0.115	−0.196
Some college	0.130	0.054	−0.076
College and above	0.130	0.051	−0.079
Northeast region	0.219	0.202	−0.017
Midwest region	0.242	0.240	−0.002
West region	0.185	0.195	0.010
Other region	0.011	0.013	0.003
Urban	0.737	0.762	0.025
IADL	0.104	0.104	0.000
ADL1-2	0.192	0.165	−0.027
ADL3-4	0.057	0.056	−0.002
ADL5+	0.035	0.030	−0.005
Nursing home	0.066	0.063	−0.003
Diabetes	0.147	0.168	0.021
Cancer	0.171	0.173	0.002
Coronary heart disease	0.339	0.319	−0.020
Stoke	0.088	0.102	0.013
Alzheimer's	0.015	0.025	0.010
HBP	0.482	0.548	0.065
Osteoarthritis	0.490	0.542	0.052
Lung disease	0.123	0.132	0.008
Ever smoking	0.579	0.576	−0.003
Obesity	0.143	0.198	0.055
Overweight	0.358	0.368	0.010
Underweight	0.099	0.084	−0.016
Part A only	0.021	0.033	0.012
Part B only	0.011	0.012	0.000
Medicaid	0.132	0.122	−0.010
Employer provided insurance	0.396	0.397	0.001

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Covariates	1992 Mean	2000 Mean	Change
Private insurance	0.314	0.253	−0.060
Member of HMO	0.050	0.131	0.081

TABLE A.2:

Coefficients on the LEVEL terms

Level	Coefficient	Standard Error
Constant	7.661***	0.086
Age70-74	0.141***	0.049
Age75-79	0.058	0.050
Age80-84	−0.003	0.049
Age 85 and up	−0.061	0.049
Died	−0.041	0.045
Male	0.064***	0.025
Black	0.121***	0.034
Hispanics	0.132***	0.050
Married	0.002	0.027
High school	0.025	0.021
Some college	0.034	0.040
College and above	0.028	0.046
Northeast region	0.259***	0.027
Midwest region	0.014	0.018
West region	0.072***	0.027
Other region	−0.549***	0.083
Urban	0.212***	0.017
IADL only	0.380***	0.057
ADL1-2	0.622***	0.046
ADL3-4	1.057***	0.063
ADL5+	1.550***	0.073
Nursing home	2.563***	0.070
Diabetes	0.228***	0.037
Cancer	0.209***	0.039
Coronary heart disease	0.294***	0.034
Stroke	0.078*	0.042
Alzheimer's	−0.037	0.069
HBP	0.077***	0.029
Osteoarthritis	−0.067**	0.033
Lung disease	0.198***	0.042
Ever smoking	0.062*	0.037
Obesity	−0.073	0.048
Overweight	0.069	0.061

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Level	Coefficient	Standard Error
Underweight	0.044	0.033
Part A only	−0.337	0.231
Part B only	−0.478***	0.142
Medicaid	0.171***	0.046
Employer provided insurance	0.155**	0.065
Private insurance	0.066	0.055
Member of HMO	−0.344***	0.092

TABLE A.3:

Coefficients on the Time interaction terms

Time Interaction	Coefficient	Standard Error
Time	0.022	0.014
IADL only	0.002	0.012
ADL1-2	−0.014	0.009
ADL3-4	−0.027**	0.012
ADL5+	−0.045***	0.012
Nursing home	−0.003	0.012
Part A only	−0.040	0.037
Part B only	0.054**	0.026
Medicaid	−0.014*	0.008
Employer provided insurance	0.003	0.011
Private insurance	0.022*	0.013
Member of HMO	−0.005	0.017
Ever smoking	0.000	0.007
Obesity	−0.020**	0.009
Overweight	−0.027***	0.010
Underweight	−0.004	0.008
Diabetes	0.017***	0.005
Cancer	0.006	0.007
Coronary heart disease	0.019***	0.005
Stroke	0.005	0.005
Alzheimer's	−0.009**	0.004
HBP	0.008**	0.004
Osteoarthritis	−0.003	0.004
Lung disease	0.005	0.007
Died	−0.026***	0.010

* denotes statistically significant at p=.1;

** denotes statistically significant at p=.05;

*** denotes statistically significant at p=.01

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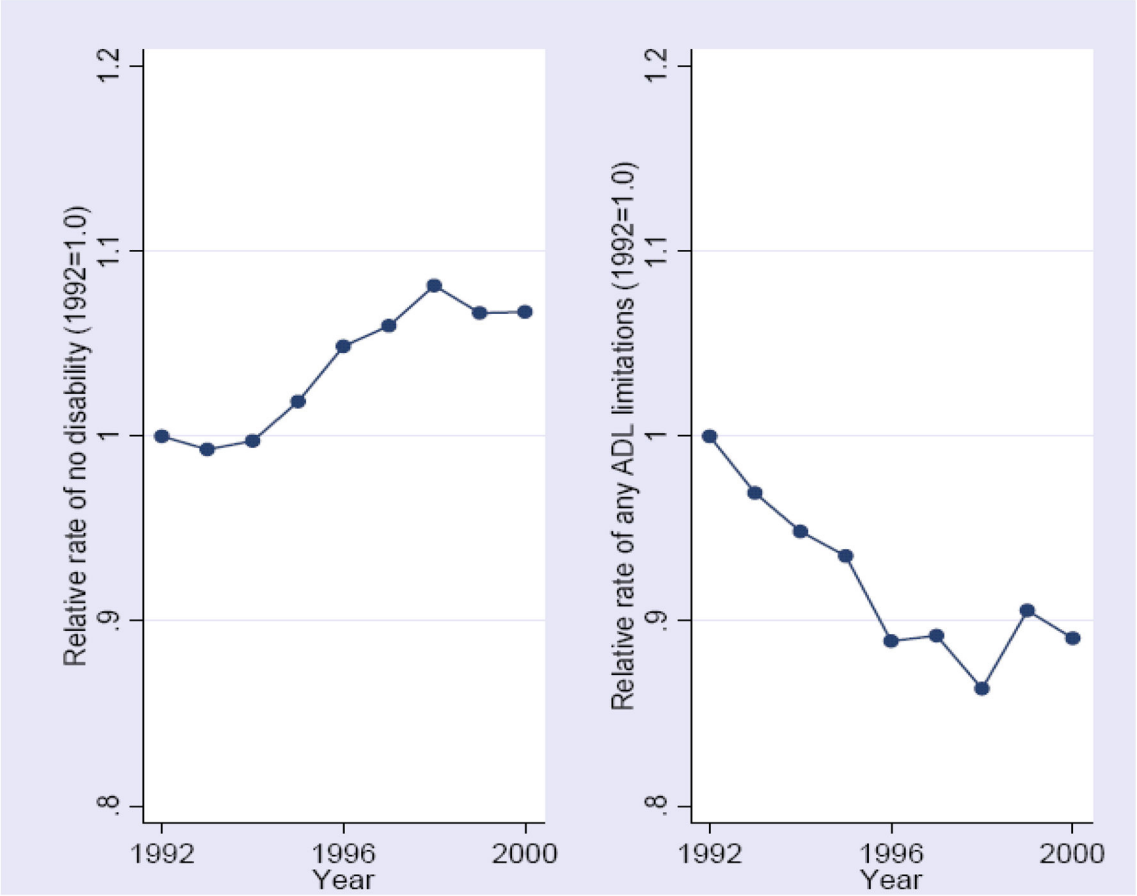

Figure 1: Trends in Disability
Source: Authors' tabulations from the MCBS.

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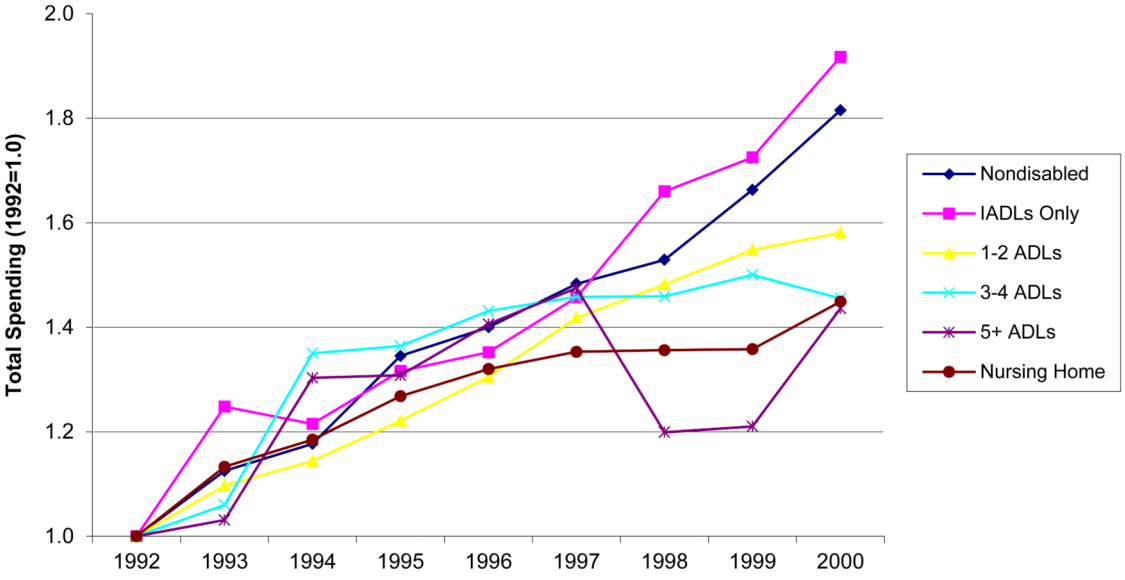

Figure 2: Unadjusted Spending by Disability Group
Source: Authors' tabulations from the MCBS.

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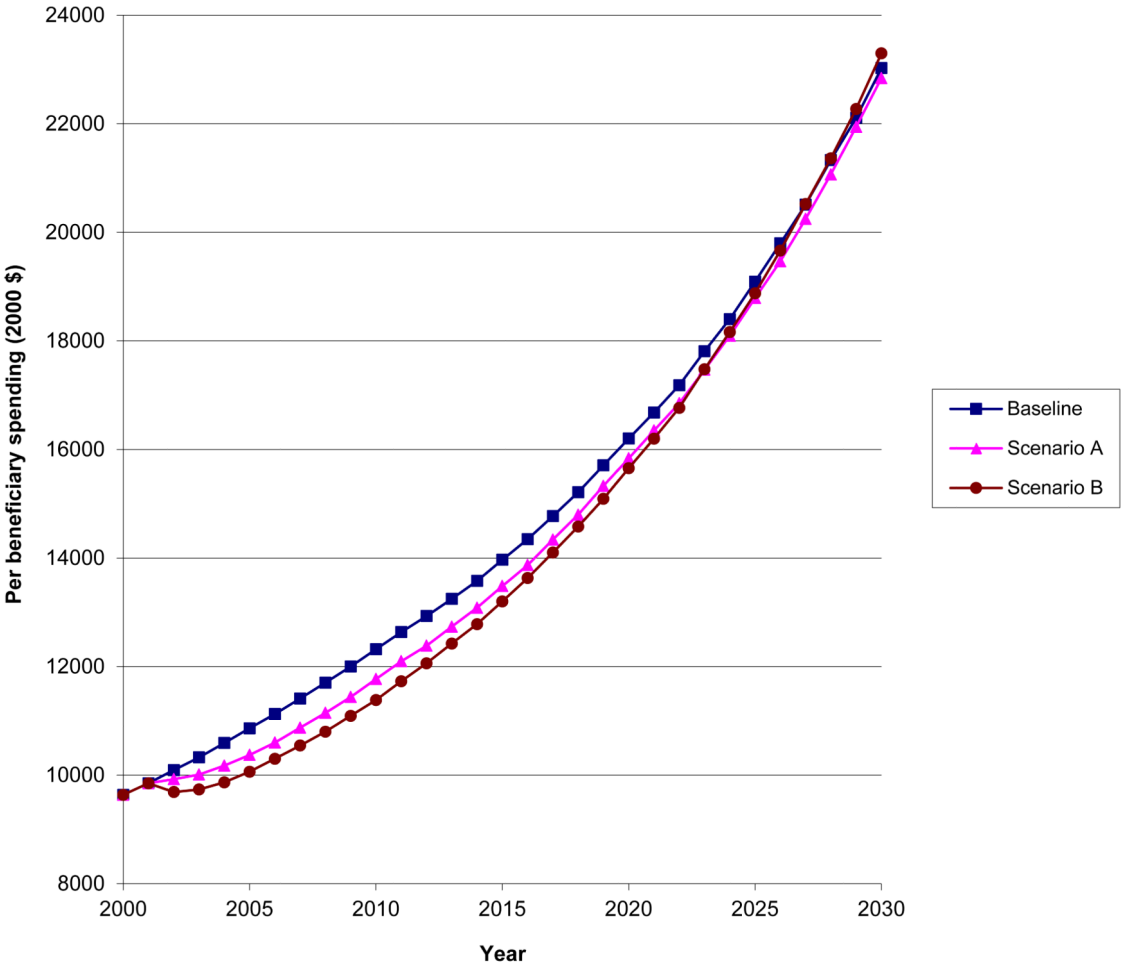

Figure 3: Per Beneficiary Spending under Various Scenarios

Scenario A: Adjust hazard rates such that the prevalence among community dwelling elderly of having 1 or more IADLs, 1 or 2 ADLs, 3 or 4 ADLs and 5 or more ADLs decline by about 20% in steady-state.

Scenario B: Prevent disability from getting worse by eliminating the hazard rate associated with a worsening level of disability.

Source: Authors' calculations

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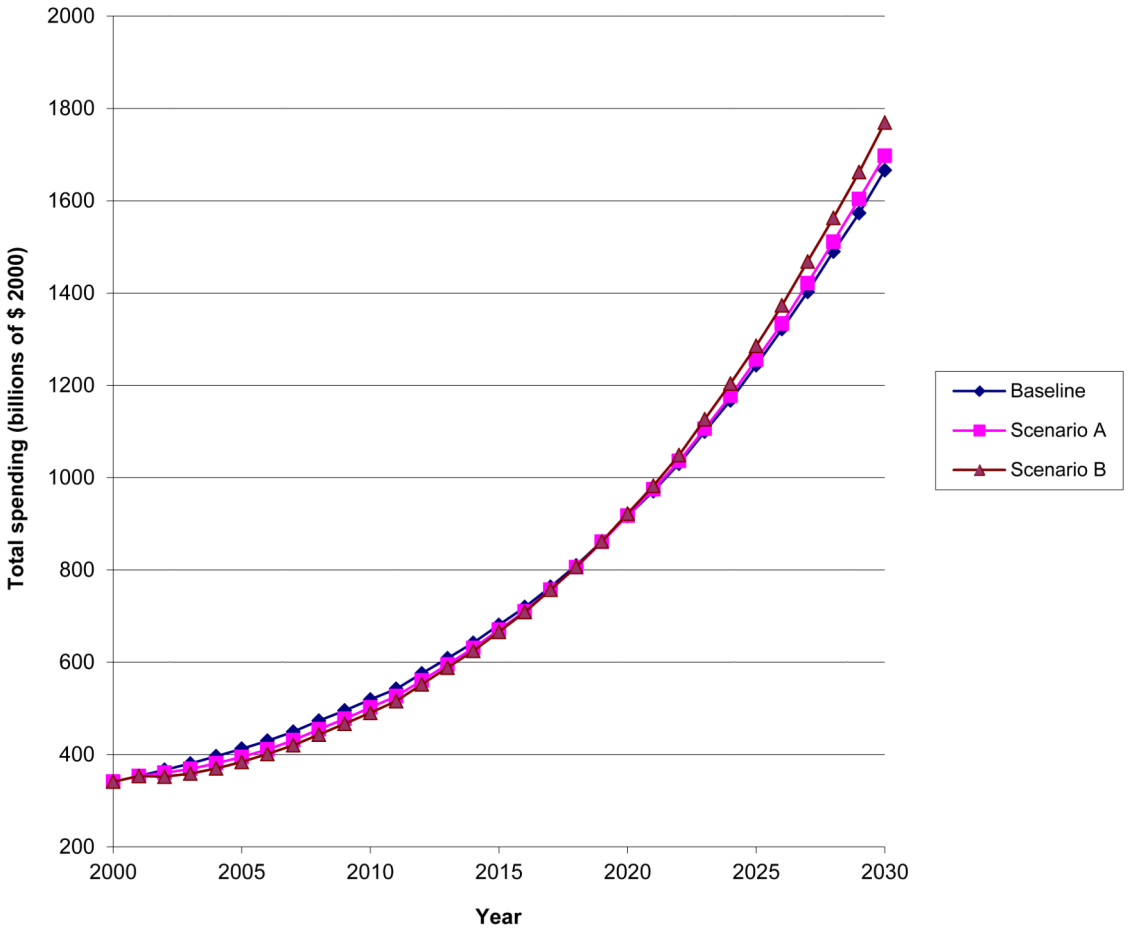

Figure 4: Total Spending under Various Scenarios

Scenario A: Adjust hazard rates such that the prevalence among community dwelling elderly of having 1 or more IADLs, 1 or 2 ADLs, 3 or 4 ADLs and 5 or more ADLs decline by about 20% in steady-state.

Scenario B: Prevent disability from getting worse by eliminating the hazard rate associated with a worsening level of disability.

Source: Authors' calculations