Functional Disability and Health Care Expenditures for Older Persons

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Background: The rapidly expanding proportion of the US population 65 years and older is anticipated to have a profound effect on health care expenditures. Whether the changing health status of older Americans will modulate this effect is not well understood. This study sought to determine the relationship between functional status and government-reimbursed health care services in older persons.

Methods: Longitudinal cohort study of a representative sample of community-dwelling persons 72 years or older. Clinical data were linked with data on 2-year expenditures for Medicare-reimbursed hospital, outpatient, and home care services and Medicare- and Medicaid-reimbursed nursing home services. Per capita expenditures associated with different functional status transitions were calculated, as were excess expenditures associated with functional disability adjusted for demographic, health, and psychosocial variables.

Results: The 19.6% of older persons who had stable functional dependence or who declined to dependence accounted for almost half (46.3%) of total expenditures. Persons in these groups had an excess of approximately $10000 in expenditures in 2 years compared with those who remained independent. The 9.6% of patients who were dependent at baseline accounted for more than 40.0% of home health and nursing home expenditures; the 10.0% who declined accounted for more than 20.0% of hospital, outpatient, and nursing home expenditures.

Conclusions: Functional dependence places a large burden on government-funded health care services. Whereas functional decline places this burden on short- and long-term care services, stable functional dependence places the burden predominantly on long-term care services. Declining rates of functional disability and interventions to prevent disability hold promise for ameliorating this burden.

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Persons 65 years and older currently comprise less than 13% of the US population but account for more than 35% of total health care expenditures. The rapid growth of this segment of the population and its increased demands on the health care system have led to concerns about Medicare’s financial solvency. A recent longitudinal study of the effect of longevity on short- and long-term care medical spending concluded that the growing number of people older than 65 years, rather than their increasing longevity, will have the largest effect on medical expenditures for the elderly. However, this study did not examine the relationship between the health status of older persons and their medical expenditures. As the population ages, it is also undergoing changes in health status, leading to speculation that these changes may modulate the effects of growing numbers of older persons on the health care system.

The relationship between functional status and health care expenditures may be a particularly important one. Functional status, as measured by activities of daily living (ADLs), is a key component of the health status of older adults. Functional status predicts many outcomes in older persons, including total mortality, mortality among hospitalized patients, recovery from intensive care, and recovery from acute illnesses, such as pneumonia.

Although functional dependence has been associated with an increased risk of nursing home placement and home health care use, studies have presented varying findings about the relationship between functional status and the use of short-term care services. Two studies demonstrated higher hospital use and cost among functionally dependent older per-
PARTICIPANTS AND METHODS

PARTICIPANTS

Potential participants were members of a representative cohort of noninstitutionalized persons 72 years and older living in New Haven, Conn, in 1989. The sampling technique, described in detail elsewhere,19 drew from 3 housing strata: age- and income-restricted public housing, age-restricted private housing, and housing from the remainder of the community. These individuals were matched to the Medicare Provider Analysis and Review (MEDPAR) file, Home Health Agency Standard Analytic File (SAF), and Outpatient SAF from the Health Care Financing Administration. They were also matched to the Connecticut Long-term Care Registry, which tracks the length of stay (LOS) and payer status for skilled and intermediate nursing facility services in Connecticut.

Of 1436 potential participants, 44 (3.1%) were ineligible because they did not speak English, Spanish, or Italian; could not follow simple commands; or were not ambulatory within their own home. Of the 1392 eligible participants, 1103 (79.2%) agreed to participate. Of the 1103 cohort members, 81 were excluded from our analysis because they could not be matched with their health care use data owing to a missing social security and Medicare number. The 81 excluded individuals did not differ significantly from study participants in terms of race, housing type, educational level, cognitive status, or functional status. Excluded individuals were more likely to be older than participants (82.5 vs 80.6 years; P=.07) and to be women (76% vs 64%; P=.09). An additional 179 individuals were excluded because their functional status was not ascertained at either baseline or follow-up interviews. These 179 individuals did not differ from participants according to age, race, sex, housing type, or educational level. The resulting sample included 843 participants.

FUNCTIONAL STATUS

Functional status was obtained from baseline interviews performed between September 1, 1990, and August 31, 1991, and from follow-up interviews conducted 2 years later. Functional status was measured by self-report of 7 basic ADLs: bathing, dressing, transferring, walking, eating, toileting, and grooming.20 The following set of variables was created to measure baseline functional status and functional status transitions: “Stable independence” indicates independence in all ADLs at baseline and at follow-up. “Stable difficulty” indicates difficulty in at least 1 ADL at baseline and at follow-up. “Stable dependence” indicates dependence in at least 1 ADL at baseline and at follow-up, with dependence defined as requiring personal assistance. “Decline to difficulty” indicates independence in all ADLs at baseline and difficulty in at least 1 ADL at follow-up. “Decline to dependence” indicates independence in all ADLs at baseline with or without difficulty and dependence in at least 1 ADL at follow-up. “Improved” indicates a better functional status at follow-up compared with baseline. “Died” indicates that the participant died before the follow-up interview, regardless of initial functional status.

COVARIATES

Additional independent variables obtained from baseline interviews were chosen as factors potentially associated with health care expenditures, as suggested in previous studies.13-17 These variables included age; sex; race; housing type (community vs age restricted); marital status (married vs never married, widowed, or divorced); self-rated health (“How would you rate your health at the present time?” answered as “excellent,” “good,” “fair,” “poor,” or “bad”) analyzed as a continuous variable; cognitive impairment (Folstein Mini-Mental State Examination score <24)21; depression (Center for Epidemiologic Studies Depression Scale score ≥16)25; availability of instrumental and emotional social support (“When you need some extra help, can you count on anyone to help with daily tasks?” and “Can you count on anyone to provide you with emotional support?”); and self-report of comorbid conditions, including cancer, diabetes mellitus, history of myocardial infarction, and history of stroke.

HEALTH CARE EXPENDITURES

Because we were interested in the economic burden of health care on the government, we examined the amount reimbursed by Medicare and Medicaid between the baseline and follow-up interviews, the same period during which the use of long-term care services, for which the principal source of government expenditures is Medicaid, an understanding of the effects of functional status changes on government-funded health care requires an examination of Medicare and Medicaid expenditures. Furthermore, the relationship between functional status and Medicare expenditures may vary according to the different types of services reimbursed by Medicare, such as hospitalization vs nursing home and home health care. Finally, previous studies have not examined the effect of transitions in functional status on health care expenditures. To determine the relationship between these transitions and the full range of health care expenditures, we used a longitudinal cohort of older persons for whom functional status and other clinical data were matched to health care utilization. We

Continued on next page
examinable expenditures for the major government-reimbursed health care services, namely, hospitalization, outpatient, home health care, and nursing home services.

RESULTS

The 843 participants had a mean ± SD age of 80.6 ± 0.3 years; most were women (63.7%) and white (86.3%). Participants had a mean ± SD level of education of 9.8 ± 0.2 years, and 37.6% were married. Most participants (79.0%) lived in community housing, 15.0% lived in private elderly housing, and 6.0% lived in public elderly housing. As given in Table 1, the 9.6% of participants who were dependent in at least 1 ADL at both baseline and follow-up comprised 22.5% of the total Medicare- and Medicaid-reimbursed costs incurred by all participants in the study. The 10.0% of participants who declined to dependence in at least 1 ADL accounted for 23.8% of total reimbursed costs. Taken together, these groups composed 20.0% of the total cohort, fewer than half the proportion of those who were independent, but accounted for roughly twice the total expenditures of the independent group.

Table 2 demonstrates that individuals with stable functional dependence and those with a decline to dependence accounted for different proportions of the total expenditures of each of the health care services. Those who had a stable dependence (9.6% of participants) accounted for 7.2% of hospital expenditures and 10.8% of outpatient expenditures but 44.3% of home health expenditures and close to half of nursing home expend-

Functional status was measured. Files from the Health Care Financing Administration were used to determine Medicare use and cost. The MEDPAR file provided hospital and Medicare-reimbursed nursing home use and cost. The Home Health Agency SAF provided home health care use and cost, and the Outpatient SAF provided use and cost of outpatient services, including emergency department visits, physical therapy, and outpatient diagnostic and therapeutic procedures.

Participants were matched to each Health Care Financing Administration file according to Medicare or social security number, sex, and date of birth within 10 years. This matching algorithm was validated against a more complex algorithm used in a previous study in which a match was required for Medicare or social security number, sex, race, age within 1 year, state of residence, and location of residence. If 1 or more items disagreed, other information, such as self-report of hospital use, was used to attempt to validate the match. For the MEDPAR data, the 2 methods provided the same match for 1733 of 1736 episodes of use.

The state-mandated Connecticut Long-term Care Registry, which tracks the LOS and payer status for skilled and intermediate nursing facility services in Connecticut, was used to determine nursing home reimbursement by Medicaid. Participants were matched to data in the registry according to social security number, name, birth date, sex, and race. Because reimbursements are not included in the registry, we used the average daily allowable charge by Medicaid for each calendar year examined in the study, provided by the Connecticut Department of Social Services, and multiplied this charge by the LOS. For participants whose stay spanned more than 1 calendar year, LOS in each year was calculated, and the average daily rate for that year was applied. Payer status was reported only at the beginning and end of each nursing home stay. For the source of payment changed from Medicare to Medicaid, then the Medicare-reimbursed LOS was determined from the MEDPAR file and the rest of the stay was assumed to be reimbursed by Medicaid. If the source of payment changed from self-pay to Medicaid, then half of the stay was assumed to be reimbursed by Medicaid.

All expenditures are stated in 1993 constant dollars. A monthly deflator was used, based on the Medical Care Component of the Consumer Price Index. For services lasting longer than 1 month, the deflator for the month at the midpoint of the service was used.

STATISTICAL ANALYSIS

All analyses were weighted to reflect the target population by using statistical software because of the stratified sampling technique used to assemble the cohort. The weighted proportions, weighted total costs, and weighted costs of the individual health services were calculated for each functional status group.

Because large proportions of persons in each functional status group did not use a given health care service, they had zero expenditures for that service. Therefore, expenditures independently associated with functional status were modeled in a 2-step process. Expenditures for a given service by individuals in a functional status group were modeled as conditional on use of the service. Adjusted probabilities of health care service use by individuals in a functional status group were obtained from multivariate logistic models of use, including all covariates associated with use in bivariate analysis (P < .10). Expenditures were log transformed to normalize their distribution, and adjusted expenditures were obtained from multivariate ordinary least squares models, including all covariates associated with expenditures in bivariate analysis with P < .10.

For each functional status category, per capita excess (or decreased) expenditures relative to the stable independence group were calculated for each health care service using a technique described in previous studies of the economic impact of illness. This technique involved weighting expenditures by the probability of use of the service by individuals in the functional status group (as distinct from weighting for the study design). Briefly, per capita excess (decreased) expenditures for a functional status group were calculated as the weighted mean expenditures, conditional on use of that service, for a particular health care service minus the weighted conditional mean expenditures of the stable independence group for the same health care service. To obtain more stable estimates for use and expenditures of nursing home services, given the small number of nonfunctionally dependent participants who used these services, the stable independence and improved categories were combined, as were the stable difficulty and decline to difficulty categories.
tures. In contrast, those who had a decline to dependence (10.0% of participants) accounted for 20.2% of hospital expenditures, 24.6% of outpatient expenditures, 17.2% of home health expenditures, and 34.0% of nursing home expenditures.

The effect of functional status on use of each of the 4 health care services is given in Table 3. Even after adjustment for sociodemographic factors, depression, cognitive status, self-rated health, and comorbidities, stable functional dependence and decline to dependence were significantly associated with use of hospital, home health, and nursing home services relative to independence. Decline to dependence but not stable dependence was significantly associated with use of outpatient services. Stable difficulty and improvement in function were also associated with use of home health services. In each model of use, the magnitude of the association between functional status and use was greater than for any of the covariates.

The effects of functional status on per capita expenditures during the study (approximately 2 years) are displayed in Table 4. Persons who had stable dependence or a decline to dependence had excess expenditures of approximately $10000 compared with those who had stable independence. Among those with stable dependence, almost three quarters of the excess expenditures (73%) were attributable to nursing home care. Among those who had a decline to dependence, almost half of the excess expenditures (46%) were attributable to hospitalization and an additional 43% to nursing home care.

The results of this study demonstrate that the burden of functional disability on government-reimbursed health care services is substantial. In this community-based sample of older persons, the 20% of participants who were functionally dependent at baseline or who developed functional dependence in 2 years accounted for almost 50% of Medicare hospital, outpatient, and home health and Medicare and Medicaid nursing home expenditures. Although the association between functional disability and health care use has been well established, the magnitude of the burden of functional disability on total health care expenditures and on expenditures for short- vs long-term care services has not been examined. Compared with those who had stable independence, persons in each of these 2 dependent groups incurred additional expenditures of approximately $10000 in 2 years.

The independent association between functional status and health care use argues that functional status may be one of the best measures of health status in the examination of health care expenditures. Compared with sociodemographic, psychosocial, and diagnosis variables, functional status demonstrated the strongest association with use of hospital, outpatient, home health, and nursing home services. Although measurement of comorbidities in the present study was limited to self-report, the accuracy of self-reported diagnoses leading to hospitalization has been demonstrated to be moderate to good for the diagnoses of ischemic heart disease, stroke, and a variety of cancers.26
It is possible that more sophisticated measures of comorbidity might perform better to predict use, as functional status measures and more complex comorbidity measures have been shown, for example, to be complementary predictors of hospital mortality.2 However, as a more easily obtained self-reported measure, the strength of the association between functional status and expenditures demonstrates its utility as a summary measure of health status.

The excess expenditures associated with a decline in functional status highlight the important effect of individuals' functional status transitions on government health care expenditures. As shown in previous studies,10,17 baseline functional disability was associated with increased health care expenditures compared with functional independence. In addition, this study demonstrates an equally large economic burden associated with functional decline. Whereas stable dependence was associated with predominantly long-term care expenditures, functional decline was associated with both short- and long-term care expenditures. This distribution of expenditures has several implications for interventions to decrease the high costs associated with functional disability. To the extent that the expenditures associated with stable dependence represent basic care needs, these expenditures may be resistant to intervention. In contrast to the extent that short-term care expenditures are modifiable, interventions directed toward those at greatest risk for functional decline may reduce the economic burden of disability. At the very least, the high costs associated with decline suggest that interventions designed to prevent disability can be cost-effective. An example of such a cost-effective intervention is a home-based strategy to prevent falls, which are effective. An example of such a cost-effective intervention. In contrast to the extent that short-term care expenditures are modifiable, interventions designed to prevent disability can be cost-effective. An example of such a cost-effective intervention.

### Table 3. Association Between Functional Status, Sociodemographic, Psychosocial, and Comorbidity Variables and Use of Health Care Services

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hospitalization</th>
<th>Outpatient</th>
<th>Home Health Care</th>
<th>Nursing Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable independence</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Improved</td>
<td>0.64 (0.32-1.25)</td>
<td>1.05 (0.63-1.77)</td>
<td>2.00 (1.00-4.00)</td>
<td>0.37 (0.05-2.95)</td>
</tr>
<tr>
<td>Stable difficulty</td>
<td>1.02 (0.54-1.93)</td>
<td>1.25 (0.72-2.17)</td>
<td>3.26 (1.67-6.36)</td>
<td>1.81 (0.54-6.08)</td>
</tr>
<tr>
<td>Decline to difficulty</td>
<td>0.91 (0.42-1.95)</td>
<td>1.71 (0.91-3.22)</td>
<td>2.13 (0.92-4.90)</td>
<td>0.60 (0.07-4.79)</td>
</tr>
<tr>
<td>Stable dependence</td>
<td>2.80 (1.53-5.11)</td>
<td>1.51 (0.85-2.69)</td>
<td>5.10 (2.60-10.01)</td>
<td>15.79 (6.66-37.45)</td>
</tr>
<tr>
<td>Decline to dependence</td>
<td>4.07 (2.38-6.97)</td>
<td>1.85 (1.09-3.15)</td>
<td>8.31 (4.56-15.16)</td>
<td>14.06 (6.23-31.71)</td>
</tr>
<tr>
<td>Died</td>
<td>5.78 (3.52-9.49)</td>
<td>1.30 (0.82-2.05)</td>
<td>3.57 (2.02-6.34)</td>
<td>7.47 (3.34-16.73)</td>
</tr>
</tbody>
</table>

### Table 4. Effects of Functional Status on Per Capita Expenditures: Excess (Decreased) Expenditures Relative to Stable Independence

<table>
<thead>
<tr>
<th>Functional Status Transition</th>
<th>Excess Expenditures, $</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospital</td>
</tr>
<tr>
<td>Stable independence</td>
<td>Reference</td>
</tr>
<tr>
<td>Improved</td>
<td>(967.67)</td>
</tr>
<tr>
<td>Stable difficulty</td>
<td>179.50</td>
</tr>
<tr>
<td>Decline to difficulty</td>
<td>(253.23)</td>
</tr>
<tr>
<td>Stable dependence</td>
<td>1036.26</td>
</tr>
<tr>
<td>Decline to dependence</td>
<td>4728.47</td>
</tr>
<tr>
<td>Died</td>
<td>5980.48</td>
</tr>
</tbody>
</table>

*Includes stable independence and improved.
†Includes stable difficulty and decline to difficulty.

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ing disability in older persons, these projections may be overly pessimistic. A recent population-based study estimated a modest per capita saving on Medicare expenditures ($98 in 4 years) associated with the decline in disability. Our finding of the excess long-term care expenditures associated with disability suggests that the savings to Medicare and Medicaid combined may be even larger. The relationship between disability trends and future government health care expenditures is likely to be complex, affected not only by change in disability itself but also by the effect of this change on life expectancy and subsequent effects on health care use. Nonetheless, the relationship among functional status, functional status transitions, and Medicare and Medicaid expenditures argues that projections of expenditures could be improved with incorporation of functional status measures.

This study has several limitations. First, although our study includes a much broader range of service expenditures than do previous studies, data were not available for several services, namely, physician services and durable medical equipment. Second, Medicare expenditures for managed Medicare recipients were excluded from the study because the Health Care Financing Administration does not have claims data for these patients. In 1993, however, less than 3% of Connecticut’s Medicare beneficiaries belonged to managed Medicare plans, so this omission is unlikely to have affected our results. Third, this cohort represents only one geographic area, and results may differ in other parts of the country. Finally, because of the changing health care environment, the distribution of expenditures for functionally dependent patients may be different today than it was during the study. Current shorter hospital stays and attempts to limit the use of Medicare home health care services may mean lower expenditures attributable to these services. However, the burden of functional dependence in terms of total expenditures is not likely to have changed, given the demonstration of the frequent substitution of nursing home services when other health care services such as hospitalization are curtailed.

By examining a community-based cohort for whom detailed demographic, clinical, and social support data were available, we demonstrate an independent association between disability and increased government reimburmed expenditures for health care. Declining ratios of functional disability and interventions designed to prevent disability may hold promise for ameliorating the projected burdens placed on Medicare and Medicaid spending by the aging population.

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