Health Status and Service Needs of the Oldest Old: Current Patterns and Future Trends

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C URRENT PUBLIC POLICY CONCERN WITH THE anticipated, rapid increase in the number of the oldest old is motivated, in part, by the potential impact of this trend on levels of federal expenditures, particularly for chronic care health services (Vladeck and Firman 1983; Fox and Clauser 1980; Freeland and Schendler 1981). A useful, albeit baseline understanding of such implications can be gleaned from relating the dynamics of demographic aging to current age-specific rates of use for various health services. Assuming no change in such rates for either morbidity or service use and only gradual, but sustained decline in rates of old-age mortality, by 2040 there would be a five-fold increase not only in the number aged 85 and over but also in the numbers of very old nursing home residents and the functionally dependent in the community (Manton and Liu 1984a; Rice and Feldman 1983; New York State Office of the Aging 1983). Put in terms of absolute numbers these changes would translate into an increase of from 2.6 to 13.3 million elderly aged 85 and over (Faber and Wilkin 1981), of whom slightly more than 4 million would require some type of personal care assistance in the community (Manton and Soldo 1985). Assuming sufficient growth in the supply of nursing home beds, those aged 85 and over

in such facilities could well number 2.7 million by 2040 (Manton and Soldo 1985).

In order to meet this demand, society would need to increase its production of long-term care services (LTC) from its current estimated base of 6.9 million to 19.8 million daily units of LTC services in 2040 (Manton and Liu 1984a). Although in 2040 persons aged 85 and over would account for only about one-fifth of the total elderly population (U.S. Bureau of the Census 1984) the very old would account for over half of the aggregate demand for all LTC services (Rice and Feldman 1983).

If current programs are not restructured, a major share of the costs incurred in meeting the future health care needs of the old and the very old would be borne by the public sector. Government programs (Medicare, Medicaid, and those of the Veterans' Administration) today absorb two-thirds of a $120 billion expenditure for the personal health care of those aged 65 and over. Nearly 75 percent of the government's total 1984 outlay of $80.5 billion was associated with the costs of reimbursable inpatient care for the elderly—$48.0 billion for hospital care and $12.1 billion for nursing home care (Waldo and Lazenby 1984). The costs of these inpatient services also have been growing at the fastest annual rate of any of the national health care cost categories (Freeland and Schendler 1983).

During the last seven years (1977 to 1984) the total costs of health care for all persons aged 65 and over have tripled. At the same time the relative share of the gross national product (GNP) allocated to these expenditures has increased from 2.3 to 3.3 percent (Waldo and Lazenby 1984). Historically, only a small share of the total increases have been attributed directly to growth in the size of the older age groups. Waldo and Lazenby (1984), for example, note that total health care spending by the elderly grew at an annual rate of 15.6 percent from 1977 to 1984 while the population aged 65 and over grew at the substantially lower rate of 2.3 percent per annum. Even the more robust growth of the segment of the population aged 85 and older (5.1 percent annually) is insufficient to account for the recent rate of increase in aggregate health care spending for the elderly.

But in the future, upward shifts in the age structure may have an effect on health care expenditure, particularly those for inpatient hospital and nursing home care (Rice and Feldman 1983), even beyond that anticipated from the sheer growth in that segment of our population

that even now has the highest rates of chronic-disease morbidity and associated inpatient service use. This may occur for two reasons. First, the growth of the older age groups has been accomplished primarily by dramatic reductions in old age mortality (National Center for Health Statistics 1984) and consequent increases in the duration and prevalence of chronic-disease morbidity at the older ages (Golini and Egidi 1981; Verbrugge 1984; Manton and Liu 1984b). Second, increasing survivor heterogeneity of younger cohorts may result in increased prevalence of extreme disability and consequent demand for long-term care services (Manton and Soldo 1985). Thus, the impact of increasing numbers of the very old in the future is likely to be magnified by its relationship to other demand factors, including increases in the intensity and duration of health care needs at the oldest ages.

Previously, we argued that the failure to take into consideration the dynamic linkage between structural change in the age composition of the population and modifications in the underlying age-related risks of dependency may cause serious underestimation of the needs of future elderly (Manton and Soldo 1985). In this paper we take the argument one step further: The same factors that are likely to transform the needs profile of future older populations (e.g., cohort differentiation and succession) may also combine with system changes (e.g., in the coverage and eligibility restrictions of third-party payers) to alter the demand for specific kinds of health care services, particularly the mix of long-term care services required by the population. Our approach also follows from that developed in the first paper. In that paper we initially established individual variability among the oldest old with respect to physiological rates of aging and then related these differences to the dynamics of population aging. In that effort we drew on a life-table model to display the relationship between individual age-related risks and the aggregate implications of changes in risks, both over age and across time.

In the current paper we similarly begin by developing a baseline understanding of the interrelationships among age, health care needs, and patterns of health service utilization. We then identify those factors that mediate these relationships at present and suggest ways in which the process of cohort flow may alter the distributions of these factors over time. Subsequently, we extend the life-table model of individual risks and population aging to allow for differences in the ways in which health-related needs are satisfied. This formulation

also provides an organizing framework for discussing changes in the structuring and coverage of various health care programs.

Our intent throughout these discussions is to focus specifically on the needs and patterns of health service use of the oldest old—those aged 85 and older. This has not been consistently possible, however. While those aged 85 and over are the fastest growing segment of the population and even now account for over one-third of all nursing home residents, this age group is but 1 percent of the total United States population at present (Rosenwaike 1985). Unless household surveys substantially oversample persons 85 years of age and older, there is often an insufficient number of cases for reliable estimates of characteristics for this important age group. Thus, at times it is necessary to present data with less age detail than desirable. Data pertaining to those 75 years of age and over, for example, are cited in some places in order to suggest the direction of age differences. As far as possible we also present estimates of standard errors to alert readers to potentially unreliable estimates that may compromise our interpretation.

Service Need, Use, and Age

The complex network of relationships linking age, health care need, and service use does not yield easily or neatly to analysis, no less to projections for long-range planning. In the behavioral model proposed by Andersen (1968; 1978) and his colleagues (Andersen and Newman 1973; Aday and Andersen 1974) use of health care services is seen as a joint function of the "need," "predisposing," and "enabling" characteristics of an individual. In this model, age is seen as a predisposing factor in that individuals of varying ages have differing patterns of illness which manifest themselves in terms of age-related patterns of health service use. Although this model was proposed as a general framework of service use, numerous investigators (e.g., Haug 1981; Branch et al. 1981; Coulton and Frost 1982; Wan and Arling 1983; Wolinsky and Coe 1984) have attempted to estimate the effects of the three sets of factors specifically on the use of physician and hospital services by the elderly. For this segment of the population, near universal Medicare coverage (Hatten 1980) substantially dampens the role of enabling (or resource) characteristics in predicting the elderly's

use of community medical services. Using nationally representative data, Wolinsky and Coe (1984) have recently estimated that nearly two-thirds of the variance in the use of physician services and three-quarters of the variance in hospital utilization among those aged 60 and over can be uniquely attributed to the "need" variables. Furthermore, in these analyses, age was the only statistically significant, predisposing characteristic of the six included, but only for the equations modeling hospital use.

Static component projections consistently indicate, however, that the rapid growth of the older population in general and the oldest old in particular will have their greatest health service impact on the nursing home sector (Russell 1981; Rice and Feldman 1983). Unlike discrete medical needs, per se, the chronic care needs of the elderly can be satisfied in a variety of ways. Extensive personal care assistance, for example, can be rendered either in a nursing home by paid attendants or in a community setting by relatives, friends, or agency personnel. Exactly how a specific LTC service need is met is influenced not only by the availability of formal care alternatives and differential third-party coverage of these service options, but also by the availability of informal care arrangements. Thus, for understanding the implications of the anticipated growth of the segment of the population aged 85 and over for nursing home use, Donabedian's (1973) model of the medical care process may be more fruitful. In contrast to Andersen, Donabedian's framework allows for effects of both patient ("client") and provider behaviors, including nonphysician providers.

For purposes of projecting the health care needs and service-use patterns of the oldest old, Donabedian's model also calls attention to the importance of considering changes in the availability and capacity of informal care providers who now provide the bulk of personal care services in the community, without compensation, compulsion, and oftentimes outside service assistance (Manton and Soldo 1985). This strategy—identifying the underlying factors which give rise to currently observed relationships and probable-change scenarios in them—largely defines the logic and organization of the following discussion. This strategy also is obvious in our preceding paper in which age-specific risks of functional disability were related to the progression of underlying pathologies. Insights from these analyses highlighted the importance of incorporating notions of survival heterogeneity and morbidity-

disability-mortality linkages into the development of health care policy for the oldest old.

Use of Health Services at Advanced Ages

It is a truism in the literature on aging that those 65 years of age and over disproportionately consume national health care expenditures and most types of health care services (e.g., Vladeck and Firman 1983; Fisher 1980). The force of this maxim is amplified for those aged 85 and over as suggested by the age-specific rates of use of selected health care services shown in table 1. Although rates of physician visits for those aged 65 to 69 and those 85 and over are not appreciably different (once again suggesting the relative insensitivity of this type of service consumption to increasing numbers of the oldest old), the rate of hospital days per 1,000 aged 85 and over is twice that of the young old. Rates of nursing home residents per 1,000 are 11 times higher for men aged 85 and over and 16 times higher for women of advanced age.

TABLE 1

Rates of Use of Selected Health Services per 1,000 Population,
by Age and Sex

	Rates per 1,000		
Sex and age	Hospital days of care*	Physician visits**	Nursing home residents***
Male			
65–74	3,370.0	5,539.5	12.7
75–84	5,476.4	6,799.3	47.4
85 +	7,674.4	6,362.0	140.0
Total 65 +	4,243.9	5,925.8	30.7
Female			
65–74	2,977.3	7,018.7	15.9
75–84	5,009.0	6,524.8	80.6
85 +	6,598.9	5,677.8	251.5
Total 65 +	3,999.8	6,763.5	59.7

Source: Rice and Feldman 1983, table 4.
* National Center for Health Statistics, 1980 Hospital Discharge Survey
** National Center for Health Statistics, 1980 National Health Interview Survey
*** National Center for Health Statistics, 1977, National Nursing Home Survey

Aggregate data such as those shown in table 1 obscure, however, the concentrated service demand of the most disabled in any age group. Recently released data from the National Health Care Expenditures Study (NHCES) shows that, among those 65 years of age and over, those with limitations in usual activity were considerably more likely than those not limited to have experienced at least one hospital admission or ambulatory physician contact in the 12 preceding months (National Center for Health Services Research 1984). When such contacts were made, the activity-limited elderly also were more likely to make more extensive use of the service. In addition, those limited were more likely to use ancillary services (e.g., contact with nonphysician providers, prescription medications, and purchased or rented medical equipment and supplies). Although these data do not provide finer age breaks than for those 65 years of age and over, for establishing the direction of age differences, it is important to note that the differential in service contacts between the limited and the nonlimited narrowed in the groups aged 65 and older in contrast to differences among the nonelderly. This finding may, at least in part, reflect the elderly's access to third-party reimbursements through Medicare, Medicaid, or private insurance.

Nonetheless, the finding that those with manifest disability make the most intensive use of health care services is consistent with results from related research efforts. Lubitz and Prihoda (1984) have reported concentrated use and higher Medicare expenditures in the last two years of life when chronic disability is presumably most extreme. Zook, Savickis, and Moore (1980) also have provided empirical support for Gruenberg's (1977) proposition that, because of increases in the severity or duration of chronic morbidity secondary to chronic mortality declines, repeated hospitalization and physician contacts by a small subset of patients may have a "remarkable cost-multiplier" effect. Local-area panel data provides even further evidence of concentrated service use of very few elderly, even in the oldest age group: over a five-year period, only 4 percent of those aged 85 and over accounted for nearly one-third of all acute hospital days, and 9 percent accounted for 57 percent of all acute and chronic care days consumed in this age group (Roos, Shapiro, and Roos 1984).

Thus, for policy making and planning, patterns of health service use defined in terms of broad age groups are insufficient for anticipating

the health care requirements of increasingly older populations. Rather, identifying the characteristics of intensive service users among the oldest old and probable changes in their number over time may be more productive. We begin such an inquiry in the next section by examining the relation between health status and health care needs.

Health Care Needs of the Oldest Old

Health "status" is distinct from the "need" for health care services (Kovar 1980). The former concept refers to self- or physician-appraisal of physical and mental well-being, while the latter concerns the diagnostic, treatment, rehabilitative, or compensatory regime for supporting or restoring well-being once compromised. Although health "status" and health care "need" are linked as cause and effect, empirically relating one to the other is difficult because both are multidimensional. Health status at a single point in time, for example, summarizes the operation of multiple age- and/or time-dependent processes, both physiologic and pathologic, that differ in terms of duration, severity, and trajectory (Manton and Soldo 1985). Similarly, health care needs, in response to even a single pathology as manifest at a specific point in time, can encompass an array of medical and personal care services, environmental modifications, medical equipment and supplies, and medications.

Health status can be related to health care needs at either the individual or population level. For purposes of health care policy and planning, the aggregate relationship is obviously the more important, although any understanding at this level must accurately reflect biomedical linkages at the clinical level. In order to establish the health care requirements of a population, two general approaches may be considered. It is important to note that neither of these specifically operationalize "need." Rather, "need" is inferred from either the patterns of service use or the behavioral consequences of ill health, i.e., disability.

The first of these two strategies identifies primarily the medical needs of a population with a unidimensional index of health: the distribution and mix of disease states within the population. For the older population this requires attention primarily to the chronic diseases which affect 4 out of every 5 elderly in the community and nearly

all of those in long-term care facilities (National Center for Health Statistics 1978). The most common chronic diseases of the elderly are shown in table 2.

These diseases are a heterogeneous collection of pathologies, ranging from only mildly uncomfortable conditions (e.g., chronic sinusitis), associated with minimal health care needs, to the life-threatening, chronic, degenerative diseases (e.g., malignant neoplasms and cerebro-vascular diseases), associated with extensive inpatient care needs. This is particularly true in the year preceding the death of patients aged 65 and older when malignant neoplasms and diseases of the heart and circulatory system account for 84 percent of their hospital episodes (Lubitz and Prihoda 1984). In addition, these three chronic conditions, together with diseases of the nervous system and sense organs, account

TABLE 2

Top Fifteen Chronic Conditions Affecting Persons 65 Years of Age and Over: Number of Persons Affected and Rate per 1,000 Persons, by Age: 1981 (numbers in thousands)

Chronic condition	No. of persons affected		Rate per 1,000 persons		
	All ages	65+	<45	45–64	65+
Arthritis	27,283	11,548	47.7	246.5	464.7
Hypertensive disease	25,524	9,407	54.2	243.7	378.6
Hearing impairments	18,666	7,051	43.8	142.9	283.8
Heart conditions	17,186	6,883	37.9	122.7	277.0
Chronic sinusitis	31,036	4,562	158.4	177.5	183.6
Visual impairments	9,084	3,395	27.4	55.2	136.6
Orthopedic impairments	18,417	3,186	90.5	117.5	128.2
Arteriosclerosis	3,398	2,410	.5	21.3	97.0
Diabetes	5,500	2,073	8.6	56.9	83.4
Varicose veins	6,130	2,067	19.0	50.1	83.2
Hemorrhoids	8,848	1,637	43.7	66.6	65.9
Frequent constipation	3,599	1,472	9.2	22.4	59.2
Diseases of urinary system	5,689	1,395	25.8	31.7	56.1
Hay fever	17,874	1,290	100.2	77.5	51.9
Corns and callosities	4,290	1,290	14.0	35.8	51.9
Hernia of abdominal cavity	3,698	1,220	8.9	33.1	49.1

Source: National Center for Health Statistics, unpublished data reported in the U.S. Senate. Select Committee on Aging 1984.

for more than one-third of the elderly's visits to physicians' offices (National Center for Health Statistics 1980). The data shown in table 3 also indicate that the major chronic degenerative diseases convey substantial age-related risks of an alternative marker of health care need—disability. For both men and women, the six chronic degenerative diseases included in table 3 are consistently associated with higher rates of activity limitations for those 75 years of age and over than for younger age groups. The disability impact of cerebrovascular disease is particularly striking. At age 75 and over, 87 percent of males and 61 percent of females with this type of disease are restricted in their usual activity.

The disease-specific approach to ascertaining the care needs of a population is frequently dismissed as inappropriate to the elderly where multiple chronic diseases interact with each other and with age-related physiologic changes in determining health care needs (Besdine 1984; Minaker and Rowe 1985). The disease-specific basis for assessing health care need, however, is explicit in the World Health Organization's (1980) morbidity model and in the design of Medicare's prospective payment system (PPS) for hospital services. Under this system, hospital reimbursements per case are tied to 470 "homogeneous" diagnosis-related groups (DRGs), adjusted for patient age and facility location (Grimaldi and Micheletti 1983).

Employing a model that explicitly recognizes the relation of chronic degenerative disease to the need for health services also has distinct advantages for forecasting. Physical health-status changes due to well-defined pathological processes can probably be projected more reliably using epidemiological data, relations, and concepts of disease etiology than can the distribution of functional disability. Better forecasts of the future distribution of functional disability may be achieved by first forecasting physical health changes and then determining what those distributions imply for the level and mix of functional disabilities and service needs in the population. This consideration also argues for the adaptation of the standard "medical/epidemiological model" to assess the implications of functional status changes at later ages (World Health Organization 1983).

The second strategy for accomplishing population-based need assessment reflects a multidimensional functional understanding of health and the need for specific personal or supportive care services (Becker and Cohen 1984). Measures of functional dependency summarize the

TABLE 3

Prevalence of Selected Chronic Diseases and of Condition-related
Disabilities, by Age and Sex: United States, 1980

Sex, condition and age	No. of persons with condition*	Percentage with condition	Percentage with condition who are limited
MALE			
Malignant neoplasm			
55–64	418,303	4.20	30.79**
65–74	500,938	7.72	54.48
75 +	269,404	8.96	72.02
Cerebrovascular disease			
55–64	205,978	2.07	79.82
65–74	330,980	5.10	87.15
75 +	290,507	9.66	86.86
Hypertensive disease			
55–64	2,447,523	24.55	27.02
65–74	1,945,281	29.99	55.88
75 +	846,963	28.18	72.24
Ischaemic heart disease			
55–64	674,777	6.77	49.06
65–74	455,933	7.03	68.23
75 +	351,203	11.68	76.40
Diseases of the upper respiratory tract			
55–64	1,780,606	17.86	22.13
65–74	1,114,449	17.18	41.83
75 +	445,974	14.84	61.35
Other respiratory diseases			
55–64	2,585,324	25.93	23.22
65–74	1,626,133	25.07	58.89
75 +	719,074	23.92	68.54
FEMALE			
Malignant neoplasm			
55–64	494,729	4.43	13.57**
65–74	352,518	4.06	44.51
75 +	353,401	6.67	52.95
Cerebrovascular disease			
55–64	223,728	2.00	62.01**
65–74	335,177	3.86	63.65
75 +	375,497	7.09	60.86
Hypertensive disease			
55–64	3,440,084	30.81	16.53
65–74	3,559,565	41.01	31.19
75 +	2,283,701	43.10	39.83

Table 3 (*continued*)

Sex, condition and age	No. of persons with condition*	Percentage with condition	Percentage with condition who are limited
Ischaemic heart disease			
55–64	389,620	3.49	35.95**
65–74	454,850	5.24	46.80
75 +	342,878	6.47	55.13
Diseases of the upper respiratory tract			
55–64	2,848,186	25.51	9.87
65–74	1,925,907	22.14	24.82
75 +	1,013,070	19.12	41.62
Other respiratory diseases			
55–64	3,217,022	28.81	14.47
65–74	2,254,001	25.97	34.81
75 +	1,126,300	21.26	39.87

Source: Preliminary estimates from 1980 National Medical Care Utilization and Expenditure Survey (NMCUES) prepared by the Research Triangle Institute at the request of the Health Care Financing Administration.
* Population weighted estimates.
** Relative standard error equals or exceeds 30% of estimate.

behavorial consequences of disease in terms of capacities to perform basic "activities of daily living" (ADL) (Katz 1983). Deficient capacities are viewed as relating directly to the need for assistance, usually from another person, in carrying out such basic functions as eating, bathing, and dressing. As shown in table 4, community residents aged 85 and over have very high rates of functional dependency. Nearly one-half of all these oldest old are functionally limited in some way, and one in ten is extremely limited in self-care capacity. In addition, nearly 30 percent of all nursing home residents aged 85 and older are dependent in all four of the ADLs measured in the National Nursing Home Survey (National Center for Health Statistics 1981).

Although chronic-disease morbidity is most likely to be associated with functional disability at the extremes of old age, the correlations between age and either morbidity or disability may not be sufficiently strong to warrant the use of the age group "85 and over" as a proxy for service need in a population. This may be particularly true for those aged 85 and over today. For these cohorts, the process of selective survivorship may have already claimed persons most vulnerable to the

TABLE 4

Persons 65 Years of Age and Over Living in the Community with
Functional Dependencies, by Age and Sex: 1982

Age and sex	Type of dependency				
	Only IADL limited*	ADL Score**			Total
		1–2	3–4	5–6	
65–74	4.5%	4.2%	1.8%	2.1%	12.6%
Male	4.2	3.4	1.7	2.4	11.7
Female	4.8	4.7	1.9	1.9	13.3
75–84	7.9	9.0	3.6	4.5	25.0
Male	7.1	6.5	2.5	4.6	20.9
Female	8.5	10.3	4.3	4.4	27.6
85 +	10.2	17.4	7.8	10.4	45.8
Male	9.9	15.7	7.7	7.5	40.8
Female	10.3	18.2	7.9	11.8	48.2
Total 65 +	6.0	6.6	2.8	3.5	18.9
Male	5.4	5.1	2.3	3.3	16.0
Female	6.4	7.7	3.2	3.6	20.9

Source: Tabulations from the 1982 Long-Term Care Survey prepared by the Center for Demographic Studies, Duke University.
* Need assistance with the instrumental activities of daily living (IADL): managing money, shopping, light housework, meal preparation, making a phone call and taking medication.
** Sum of the number of activities of daily living (ADL) with which respondent requires assistance.

chronic degenerative diseases that are associated with the highest levels of service need (Manton and Soldo 1985). The two population-based need-assessment strategies also are not fully adequate for identifying those with intensive service needs or suggesting future changes in the size or age distribution of this subgroup. These concerns assume even greater importance once the implications of individual variability in rates of aging are recognized and incorporated into program designs (Riley and Bond 1983). The "targeting" of limited health care resources to those most in need also is likely to become an increasingly important public concern as the eligibility criteria for program participation are reviewed for their cost-containment potential. Previous efforts have not been successful, however, in using a single-dimension approach (e.g., functional disability) to identify specific subgroups (e.g., those for whom home care services could prevent or delay nursing home

admission) (Weissert 1981). Rather, it seems clear that effective targeting requires the identification of groups that manifest internal consistency in terms of both need and service use.

In the preceding paper (Manton and Soldo 1985, tables 14, 15) we presented an innovative empirical strategy for identifying subgroups with similar kinds of health care needs, using a multivariate classification method, "grade of membership" (GOM) analysis, based on "fuzzy set" theory (Manton and Woodbury 1984). This analysis isolated the following four homogeneous subgroups using information on socio-demographic characteristics and disability measures for functionally impaired community elderly aged 65 and older:

Group 1: Relatively young (mean age of approximately 73 years), mostly married individuals with low levels of both instrumental activities of daily living (IADL) and activities of daily living (ADL) dependency. This group was not distinguished by its association with any specific chronic disease or disease groups.

Group 2: Very old, unmarried women, free of ADL-kinds of dependencies but with substantial IADL needs. This group, while characterized by very low risks of chronic disease in general, was the most strongly associated of the four with glaucoma and hip fracture. The pattern of IADL dependency in the absence of ADL care needs also may suggest unmeasured cognitive impairment in this group since this group also is associated with a high prevalence of "senility."

Group 3: Relatively young individuals distinguished primarily in terms of their mobility limitations. Members of this group had an above-average chance of having Parkinson's disease, diabetes, arteriosclerosis, permanent numbness or stiffness in limbs, or circulatory difficulties. Persons in this group, while not bedfast, were likely house-bound to a considerable degree.

Group 4: A substantially disabled group, disproportionately married but not distinguished by age or sex. Persons in this group were nearly totally dependent in all ADL and IADL activities. This group was identified with paralysis, cancer, and "senility" and would appear to be the group with the most concentrated care needs.

In order to examine the homogeneity of these groups with respect to patterns of service utilization the GOM analysis was extended to include measures of health service use. Both the service-use variables shown and the morbidity variables used initially to derive the four groups are from the 1982 National Long-Term Care Survey (NLTCS), a household-based survey of functionally limited individuals aged 65 and over. The sampling frame for this survey, sponsored by the Health Care Financing Administration (HCFA), was the HCFA Health Insurance Master File. A telephone screen of 36,000 persons yielded 6,393 community-based residents aged 65 and over who reported being limited in either the instrumental activities of daily living (IADL) or the activities of daily living (ADL). Personal interviews were completed with 5,580 persons with confirmed limitations. The sample is nationally representative of approximately 4.6 million functionally limited elderly.

The probability distribution of selected service-use variables for each of the four NLTCS subgroups described above is shown in table 5. Column 2 of this table shows the marginal proportion of each health-service-use variable for the full sample; the other columns show the probability of persons in each of the four groups described above having each service-use characteristic. In general, the health service profile of each group is appropriate to the group's health status/need profile described above.

Persons in group 1, the least functionally dependent of the four, are light consumers of health care services. Of the four groups, group 1 members are the least likely to have ever experienced a nursing home placement or be wait-listed for one. These individuals are most likely to depend on but a single person, usually a spouse, to provide minimal informal assistance. In contrast, group 4, the most disabled, exhibits patterns suggesting intensive use of hospital and nursing home facilities and paid home care attendants. This group also is distinguished in terms of intensive use of informal care services. Persons in this group require assistance from more than one person to sustain their community residence.

While the service-utilization profiles of these two extreme groups are largely predictable from their disability profiles, differences in service use are perhaps of most interest for groups 2 and 3. Group 2 is the cluster distinguished by IADL dependencies, sensory impairments, and, we speculated, cognitive impairment. Although persons in group 4 are far more likely to manifest the extreme functional

TABLE 5
The Probability of Four Analytically Defined Subgroups Having Specific
Service-utilization Characteristics*

Service-use characteristics	Sample proportion	Pure type**			
		Group 1: Minimal ADL or IADL dependency	Group 2: Substantial IADL dependency	Group 3: ADL + limited mobility	Group 4: Extreme ADL dependency
Living in community for older persons	0.086	0.072	0.086	0.152	0.019
Patient in nursing home at any time	0.072	0.024	0.084	0.061	0.153
On waiting list to go to nursing home	0.009	0.004	0.021	0.003	0.016
Patient in hospital overnight in last 12 months	0.364	0.274	0.192	0.404	0.576
HELPERS (INDIVIDUAL BINARY VARIABLES)					
Spouse	0.351	0.645	0.0	0.0	0.608
Offspring	0.446	0.109	0.818	0.579	0.487
Other relative	0.314	0.060	0.598	0.438	0.306
Friend	0.118	0.023	0.174	0.231	0.068
Others, unpaid	0.290	0.129	0.247	0.322	0.526
Paid helpers	0.253	0.118	0.195	0.295	0.449
NUMBER OF HELPERS					
None	0.050	0.155	0.0	0.0	0.0
One	0.378	0.649	0.220	0.296	0.220
Two	0.282	0.156	0.361	0.356	0.309
Three	0.157	0.033	0.224	0.212	0.212
Four +	0.133	0.007	0.195	0.136	0.259
TOTAL NUMBER OF DAYS PER WEEK HELPERS PROVIDE SOME ASSISTANCE					
None	0.117	0.298	0.007	0.064	0.0
1–5	0.214	0.278	0.013	0.461	0.002
6–7	0.336	0.364	0.369	0.294	0.322
8–12	0.174	0.037	0.315	0.127	0.315
13 +	0.159	0.023	0.296	0.054	0.361

Source: Analysis of the 1982 National Long-Term Care Survey (NLTCS), a household-based survey of 5,580 individuals 65 years of age and over with limitations in either an activity of daily living (ADL) or an instrumental activity of daily living (IADL).
* Subgroups defined through Grade of Membership Analysis using 33 sociodemographic and health characteristics. All variables shown in the table, however, were external to the analysis.
** Consult text for more complete description of the need profile of each group.

disabilities usually associated with nursing home placement, the risk of admission is actually greater in group 2. An analysis of other group characteristics suggests that the nursing home risk of persons in group 2 may be largely a function of deficiencies in their informal support network while the risk for group 4 is more directly related to their care needs. In support of this interpretation note that persons in group 2 are uniformly unmarried women of advanced age (over half are 85 years of age or older). In the absence of spousal care providers, persons in group 2 are disproportionately dependent on offspring and other relatives for substantial daily assistance. Unlike the situation of those in group 4, the burden of informal care-giving is less likely to be offset by paid home-care-service providers. This finding suggests that restricting home care services under Medicare or Medicaid to only those with advanced ADL dependencies will screen out a group of individuals whose nursing home admissions may be effectively deterred through the introduction of intensive community services.

Group 3 is distinguished primarily in terms of mobility restrictions. While unlikely to be wait-listed for a nursing home, persons in group 3 are more likely than those in group 2 to have experienced at least one hospital admission in the preceding 12 months. In addition, the probability of living in a structured community for the elderly is greatest in group 3, although even in this group the probability is not substantial. Perhaps because of their residential patterns, these mobility-restricted persons are more dependent on friends and neighbors for assistance than those in any other group. In spite of this, individuals in group 3 are still likely to receive assistance from offspring and other relatives. The service-utilization profile that emerges for this group is one of moderately intensive care needs met by multiple helpers. Their profile also suggests the feasibility of using special equipment or appliances or modifying the built environment (e.g., removal of interior thresholds) as compensation strategies.

Thus, the four homogeneous need-based groups derived in the preceding paper also appear to be internally consistent in terms of health services utilization. For purposes of assessing the health and service requirements of older populations the analysis also calls into question the use of observed or projected age distributions to indicate the volume of demand for health care services. Of the four groups, only the second IADL-dependent group was distinguished in terms of advanced old age. Our results also highlight the importance of the

qualitative aspects of aging, particularly living arrangements and the availability of informal care providers, in relating health status to the need for specific kinds of services, particularly long-term personal-care services. In the next section we consider in more detail how these qualitative factors condition the current demand for both formal long-term care (LTC) and nursing home services and how these factors may shape the future demand for both types of formal LTC services.

Qualitative Aspects of Aging and the Demand for LTC Services

At "low" levels of functional dependencies, the need for assistance is most likely to be satisfied in a community setting through the informal care-giving of family, friends, and neighbors (Cantor 1979). At "moderate" levels of dependency, the introduction of formal-care providers (e.g., home health aide) may be necessary to augment the care-giving capacity of the informal support network. At "advanced" levels of need, the benefits of a nursing home admission may offset the preference for continued community residence.

Because such generalizations provide little guidance for health care planning, considerable effort has been devoted to pinpointing precisely where along the need continuum these transitions occur. Most of this research has focused on predicting nursing home admission; only recently has the health policy research community turned to predicting use of formal services in the community.

Predicting Institutionalization

Numerous investigators have attempted to develop reliable algorithms that predict nursing home admission at the older ages. In surveying previous research in this area by way of introduction to their own longitudinal data analysis, Branch and Jette (1982) concluded that no one set of variables consistently differentiated nursing home residents from disabled community elderly. Neither age nor need (whether measured in terms of functional disability or medical condition), while statistically significant in most studies, uniformly correlated with the LTC setting. Data compiled by the 1980 Task Force on Long-Term Care shows that even among those aged 85 and over with substantial

ADL needs, there is at least 1 community resident for every 5 comparably disabled nursing home residents (Department of Health and Human Services 1981).

A majority of previous studies (including Branch and Jette's as well as more recent research by Weissert and Scanlon [1983]) identify as additional, significant predictors of institutionalization the absence of a viable informal support network and factors that are likely to undermine the care-giver's capacity or commitment to noninstitutional care. Among these latter factors are incontinence, need for nearly constant supervision, and the presence of cognitive impairments and/or behavioral problems (Smyer 1980).

For the very old, the effects of these conditions are compounded by the fact that their care-givers, even if adult children, are themselves likely to be elderly and experiencing some restriction in activity. This is particularly significant for very old women (the majority of whom are widowed) since they are considerably more dependent on offspring for care-giving than are men of comparable age and disability or younger, equally frail women. One in three care-givers to women aged 85 and older are adult children who contribute nearly half of all the supportive service days consumed by community-based ADL-dependent women in this age group (Manton and Soldo 1985).

Predicting Use of Community Services

The 1982 National Long-Term Care Survey indicates that about one-quarter (1.1 million persons) of all functionally restricted, community-based elderly receive some level of formal care services. The aggregate cost of these purchased services exceeds $99 million per month. Over three-quarters of all functionally limited elderly receiving such services finance all of the service costs out-of-pocket. Average, monthly out-of-pocket expenditures increase with age and disability, peaking at $466 per month for persons aged 85 and over with extreme ADL limitations (Manton and Soldo 1985).

The involvement of informal care-givers, however, minimizes the demand for formal or paid services in the community. Estimated probabilities of formal service receipt, by level of need, for disabled community-based persons aged 65 and over are shown in table 6. These probabilities were estimated under a logistic specification of data from the Home Care Supplement to the 1979 National Health

TABLE 6

Probability of Formal Service Receipt by Type of Living Arrangement
and Need, for Those Women 65 Years of Age and Over,
with Informal Supports*

| Type of need | Type of living arrangement | | | |
	Alone	With nonrelative	With spouse	With other relative
IADL need only	.17	.31	.08	.04
ADL need only	.27	.44	.14	.08
Medical need only	.31	.50	.17	.09
ADL & IADL need	.44	.62	.26	.14
ADL & medical need	.63	.79	.43	.27
ADL, IADL & medical needs	.78	.61	.44	.44
All types of need & incontinence problems	.84	.92	.71	.54
All types of need & supervision problems	.86	.93	.74	.58
All types of need & incontinence and supervision problems	.90	.95	.81	.68

Source: Analysis of the Home Care Supplement to the 1979 National Health Interview
Survey reported in Soldo 1985.
* Logistic function (Probability (P) $= 1/1 + e^{-xb}$) evaluated for modal group:
white, ever-married women residing in central cities with annual family incomes of
$5,000–$9,999 (in 1978 dollars) who did not participate in Medicaid in 12 months
preceding interview.

Interview Survey (National Center for Health Statistics 1983). The
complete variable list included multiple indicators of need as well as
"enabling" and "predisposing" indicators. Age was not statistically
significant after controlling for the need variables. The coeffecent for
receipt of informal care, however, was the largest of any of the 12
variables included in the analysis. Receipt of informal services decreased
the logged odds of formal service provision by 3.3; in contrast, the
next largest coefficient, for previous presence of medical needs, was
but 1.5. Estimates are shown only for white, ever-married women
with modal income, residence, and Medicaid status.

On one level, the probabilities shown in table 6 confirm the intuitively
obvious—the more complex the service need the more likely is the
receipt of formal services. Compared to either ADL or IADL needs,

medical care needs are much more likely to stimulate the use of formal services. Perhaps of most interest for anticipating the service requirements of a population are differences in the service-use probabilities across different types of households. At any level of need, the probability of formal service is lowest for those elders who live with either spouses or with other relatives.

If one identifies the level of need at which formal service use is more likely than not (i.e., $P \geqslant .60$), the data in table 6 appear to provide strong support for the differential tolerance or threshold hypothesis advanced by Cantor (1981). For those living with nonrelatives, formal service use is more probable to occur once ADL and IADL needs combine; for those living alone, this threshold is defined as the point at which ADL and medical needs are present. Frail women cared for by their spouses, however, do not cross this threshold until incontinence problems add to the care demands associated with IADL, ADL, and medical needs. The threshold for those cared for by other relatives (most likely adult children) is postponed still further and does not occur until both supervision and incontinence problems combine with IADL, ADL, and medical needs.

Two competing interpretations are tenable for the seemingly higher tolerance of nonspouse family care-givers. Since spouses of dependent elderly are themselves often elderly and experiencing a decline in capacity and stamina if not disability per se, spouse care-givers may require back-up assistance from community services at somewhat lower levels of disability than younger, and presumably more vigorous, kin care-givers. The second interpretation takes into account the cross-sectional nature of the data and posits that formal services are less likely to be introduced into the homes of nonspouse care-providers simply because these relatives are more likely to have opted for an earlier institutional placement.

These findings also suggest that the volume of demand for formal services in the community will be influenced by the distribution of the disabled elderly across different types of living arrangements. A number of factors must be considered: change in intergenerational attitudes, and increasing incidence of divorce and male-female differences in old-age mortality. Allowing only for change in the age structure, however, Glick (1979) has projected continued increases in the number of elderly, particularly older females living alone. By 1995 he projects that, even among households headed by persons aged 75 and over,

over one-half will be headed by an elderly woman living alone. Thus, the increases in the demand for community long-term care services may far outpace the growth of even the disabled portion of the population aged 85 and over.

On face value, these findings seem to provide empirical evidence for the position that publicly subsidized LTC services could be reoriented away from their current institutional bias without incurring the costs of inappropriate service use. Aside from the obvious measurement problems (e.g., inferring volume of service used or demanded from simple service receipt), other considerations mitigate against drawing this definitive a conclusion. Price-demand elasticities, for example, may be very sensitive to level of need. Reductions in out-of-pocket costs of community services may not alter the service-utilization patterns of the frail elderly and the care-givers, for example, but as the price to the consumer declines, the total demand could increase from those with lesser needs. Reductions in price could then have the effect of shifting downward the level of need at which community services are used extensively. More important, long-term care needs, by definition, generate enduring service demands. Thus, cross-sectional data are inadequate for fully displaying the long-range implications of a national LTC policy that would emphasize community alternatives.

Modeling Service Substitution

Recently, Luce, Liu, and Manton (1984) proposed a general framework for research on long-term care issues, the evaluation of interrelated health policy initiatives, and models that project the need for LTC services. This framework lends itself to formulation of a number of basic policy issues, but perhaps the most general concerns the substitution of one type of service for another. Policies that implicitly or explicitly promote service substitution ultimately affect the quality, cost, and efficiency of care in a variety of ways.

A current expression of the service-substitution issue focuses on the question: Will increased public financing of home care services diminish private-sector efforts (Greene 1983)? The risk of widespread transference of home care responsibilities from the informal sector is seen as considerable, if only because of the increased labor force participation of women (the traditional care-givers to the elderly) and the implications

of four-generation families for the age and vitality of potential care-givers (Treas 1977).

Before the issue of service substitution can be examined within the context of a life-table framework it is necessary to determine the age-specific prevalence of different limitations that might represent a need for specific services. In the preceding paper we presented survival curves of functional limitations as estimated from data on the non-institutionalized disabled population in 1982 (Manton and Soldo 1985). As with other definitions of health status change, there is a natural aging imperative underlying such functional transitions. Further analysis also indicates that there are considerable differences in the trajectory of age-related declines in disability, however. We also noted that, although functional disability is assumed to be caused by specific pathological changes, different morbid states could generate similar age patterns of functional limitations.

The life-table model presented in Manton and Soldo (1985) also can be used to examine the service-substitution issue and especially age changes in the implications of substitution. In figure 1 we extend the basic survival-curve model to include hypothetical age-specific probabilities of various LTC service configurations and the transition from one level of service to the next. In this figure, age is shown on the horizontal axis. The probability (expressed as a percent) of a member of the initial, hypothetical birth cohort (the radix) surviving to a given age without experiencing a critical health event or health service transition is shown on the vertical axis. The partitioned area (A–F) under the mortality curve corresponds to person-year estimates of time spent in a particular state. For example, the area marked F represents, for the cohort, the number of institutionalized person-years. Areas D, E, and F together provide time-weighted estimates of the long-term care service requirements of a population. In the preceding paper (Manton and Soldo 1985) we made use of the life-table survival curve formulation to display the implications of various understandings of morbidity-mortality linkages at the older ages; here we use the survival-curve concept to clarify the implications of alternative LTC service policies.

In figure 1 we assume a hypothetical but typical sequence of LTC service providers. Initially, and at low levels of need, care-giving is the sole responsibility of the informal support network. Either as a time- or need-dependent function, the efforts of family and friends
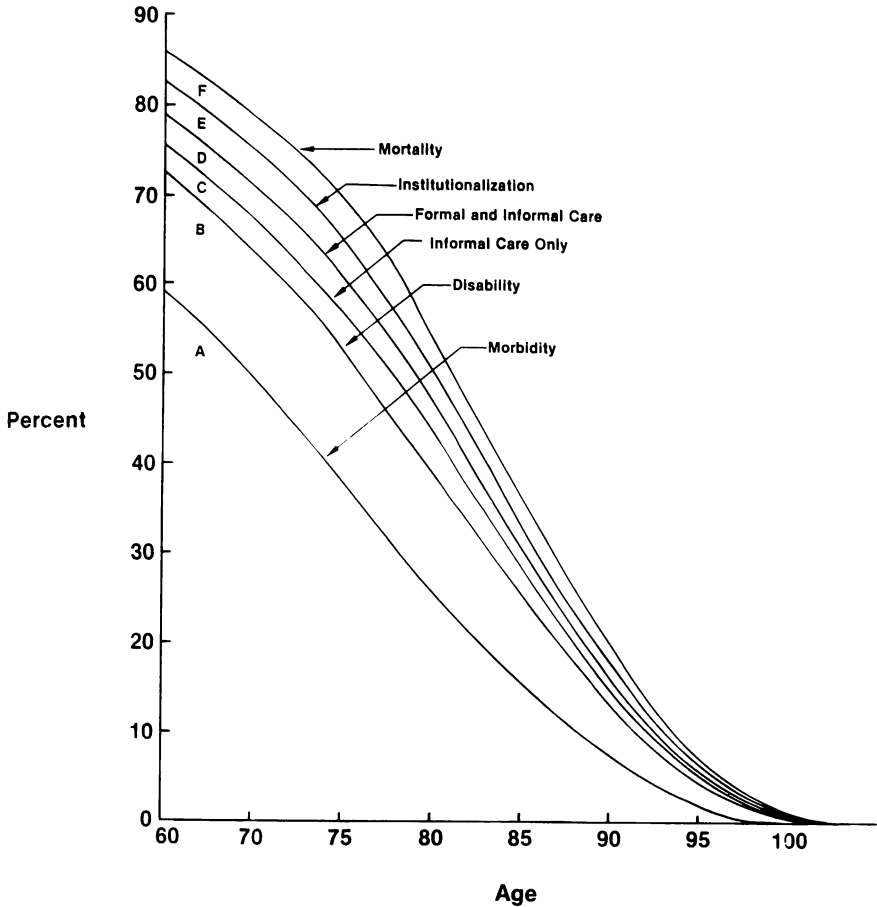
FIG. 1. The observed mortality and hypothetical morbidity, disability, and long-term-care service-use survival curves for U.S. females, 1980.

are augmented by services from the community, formal support network. As shown in figure 1, this mix of providers is most likely to occur at advanced levels of functional need or when medical care needs (e.g., physical therapy or regular injections) require expertise beyond the scope of family members. Ultimately, LTC needs may be satisfied only in an institutional setting.

Proposals now being considered are intended to alter the risk of specific service-use patterns at age X by shifting up the curve representing the risk of institutionalization and thereby increasing the number of disabled person-years spent in the community (Areas D + E). At issue in discussions of service substitution is how this time would be

partitioned between reliance solely on the family and on a mix of informal and formal providers.

Figure 1 makes it clear that the service substitution question is not one of short-run transference of effort (which is probably inevitable) but rather one of long-run service-utilization patterns. If Medicare or Medicaid changes were to reduce price and supply barriers to formal services, the curve for the combined service use would probably shift downward. Formal providers would be introduced into informal care-giving arrangements at lower levels of disability. The consequences of this for policy would be expressed in the relative positions of the other service-use curves. If, for example, the curve for the risk of institutionalization were unaltered by new policy directives, the objective of cost-containment through reduced rates of nursing home placement would be defeated. If, on the other hand, the institutionalization curve were displaced upward, short-run service substitution would ultimately serve the long-range objectives of public policy. Increases in life expectancy, however, might leave untouched the average duration of nursing home stay even while the average age at admission increased.

It is not our intent in this paper to forecast the substitution effects of alternative program options or to make specific policy recommen-dations. Rather, the above discussion simply highlights some of the nuances of the emerging policy debate. In particular, bringing to bear the survival-curve concept on the substitution issue demonstrates that simple prevalence rates of service use, and changes therein, are an inappropriate basis for decision making. Both the costs and benefits of various service substitutions are best estimated in terms of their effects on person-years of use. The model also raises issues of possible increases in the size and changes in the age structure of the disabled population as old-age life expectancy continues to increase.

The model further illustrates the implications of the increase in the absolute or relative number of the disabled in the community. As the population ages, the disabled will not only be older and possibly require more services, but their informal care providers also are more likely to be elderly themselves. Such changes are likely to rebound on family life (Brody 1984) since, as shown in table 7, the probability of young-elderly (aged 65 to 69) women having at least one surviving parent aged 85 or older will more than double over the next 60 years. As they begin their own retirement and the idealized "empty nest" stage in the family life cycle, a substantial number of these women

TABLE 7

Probability of Surviving Parents at Ages 65–69 by Birth Cohort: Women Only

Birth Cohort	1921–1925	1926–1930	1931–1935	1936–1940	1941–1945	1946–1950
Forecast year*	1990	1995	2000	2005	2010	2015
Father alive	.026	.034	.039	.048	.054	.060
Mother alive	.140	.174	.196	.225	.234	.243
Either alive	.154	.197	.222	.257	.269	.281
Average expected number of surviving parents	.166	.207	.235	.279	.288	.303

Source: Wolf 1983.
* Year in which birth cohort will be 65–69 years of age.

in their late 60s are likely to confront the stressful care-giving demands of a least one parent or parent-in-law aged 85 or older.

Future patterns of community LTC service use will be shaped not only by changes in LTC reimbursement policies and the availability of informal care-providers but also by the functional disabilities manifested by the oldest old in the future. Static-component (i.e., constant rate) projections of functional dependency were presented by age, sex, marital status, and type of care-giver in the preceding paper (Manton and Soldo 1985, table 12). These projections—expressed in terms of extra hours of work engendered by care-giving—indicated substantial increases in the volume of informal service consumption for women aged 85 and over. Under the constant-rate assumption the total volume of such services would increase from 1.8 million care hours per week for married women aged 85 and over to 8.7 million in 2040. For unmarried women at the extremes of old age, an increase from 14.3 to 74.8 million care hours was projected. Furthermore, offspring were projected to provide over half of all care hours to women aged 85 and over.

These projections probably correspond to the "worst case" scenario in that at least some degree of morbidity-disability reduction should follow from the assumed gradual, but sustained decline in mortality. To allow for this, an alternative set of informal care projections was prepared in which reductions in age- and sex-specific disability rates are proportionate to declines in old age mortality. These projections are summarized for offspring helpers to women aged 85 and over in table 8. Although these alternative projections show increases over time in the volume of offspring-provided care hours, the rate of increase is slowed. Between 2020 and 2040, when the large baby-boom cohorts will begin reaching the age of 85, the rate of increase under the constant-rate assumption is 67.1 percent in contrast to 53.6 percent under the declining-morbidity assumption. Perhaps more important, the total volume of offspring care services projected under assumed-morbidity declines (27.4 million hours per week) is but 61.8 percent of that required by women aged 85 and over if morbidity remains constant (44.4 million care hours per week).

Together these two sets of care-giving projections likely represent the upper and lower limits in the volume of offspring services needed to sustain older women of extreme age in the community. These

TABLE 8

Aggregate Number of Offspring Helper Hours per Week[a] for Women,
85 Years of Age and Over: Estimate 1980 and Projections, 1990–2040,
under Alternative Assumptions, by Level of Functional Dependency
(numbers in thousands)

Year and morbidity assumptions	Type of dependency					
	Only IADL limited[b]	ADL score[c]			Total[d]	Percent increase[e]
		1–2	3–4	5–6		
ESTIMATE						
1980	1,480	2,529	1,424	3,073	8,506	—
PROJECTIONS[f]						
1990						
Constant	2,132	3,728	2,087	4,477	12,425	46.1%
Declining	1,739	3,048	1,706	3,656	10,149	19.3
2000						
Constant	3,278	5,691	3,192	6,859	19,020	53.1
Declining	2,395	4,175	2,339	5,022	13,932	37.3
2020						
Constant	4,584	7,962	4,465	9,595	26,606	39.9
Declining	3,074	5,362	3,004	6,447	17,887	28.4
2040						
Constant	7,714	13,236	7,446	16,050	44,447	67.1
Declining	4,752	8,202	4,607	9,916	27,477	53.6

Source: Analysis of the 1982 National Long-Term Care Survey and the National Opinion Research Center Survey of Caregivers prepared by the Center for Demographic Studies, Duke University.
[a] Total number of care-giving service hours provided by offspring for women 85 years of age and over.
[b] Needs assistance with instrumental activities of daily living (IADL): managing money, shopping, light housework, meal preparation, making a phone call, or taking medication.
[c] Sum of the number of activities of daily living (ADL) with which respondent required assistance.
[d] Totals may reflect rounding error.
[e] Percent increase in total number of offspring helper hours per week over last projection date shown, by morbidity assumptions.
[f] Projections labeled "constant" assume 1980 age- and sex-specific rates of IADL and ADL limitations prevail; projections labeled "declining" assume reductions in age- and sex-specific rates of IADL and ADL limitations proportionate to mortality declines forecast by Faber and Wilkin (1981). Both sets of projections assume projected mortality rate declines (Faber and Wilkin 1981).

projections, however, assume continued rates of offspring care-giving—
an assumption that is likely to prove unrealistic unless offspring care-
givers, primarily daughters, have access to a variety of home care
services (Horowitz and Shindelman 1983).

Conclusion

In the preceding paper we argued for an interpretation of mortality-
morbidity dynamics which anticipates further progress in controlling
the rate of chronic disease progression and thereby reduces the severity
of the chronic degenerative diseases manifest at any age. This un-
derstanding implies increases in the number of productive, nondisabled
years of life but also any number of difficult tradeoffs between social
and individual benefits. By postponing the age at death, we also may
be postponing the period of intense service need until even later in
the life cycle where fewer financial and/or family resources may be
available to ameliorate the public costs of long-term care.

The dynamics of health status and life-expectancy changes have
particular significance for the organization of long-term care reim-
bursement systems. The vertical integration of health services seems
inevitable either as an implicit policy objective (e.g., the Long-Term
Care Channeling Demonstrations [Carcagno and Kemper 1983]) or
as a consequence of the DRG's effect on discharge planning (Brody
and Magel 1983). Whether a person remains in an acute-care facility,
is transferred to a nursing home, or is sent home with a specific
service package will be governed, to some degree, by the relative
benefits of different reimbursement policies for each type of service
option. Clearly, this calls for careful coordination of reimbursement
policies across service types. The need for various health care services
is governed, however, by the health status transitions described in
our life-table model. Thus, reimbursement policies also must take
the imperatives of health status change into account.

The near inevitability of chronic morbidity and disability at advanced
age means that there will be a natural evolution of the mix of services
required by an aging population. This evolution of the maturing
service needs of an aged population must be taken into account to
ensure the long-run fiscal viability of integrated health service systems.
Perhaps more important, this change must be factored into the design

of health care policies if we are to avert creating major disincentives to providers to serve select subgroups of the oldest old population.

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