Living Longer in the United States: Demographic Changes and Health Needs of the Elderly

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THE CHANGING AGE STRUCTURE OF THE AMERICAN population, with its growing number of elderly, has profound consequences for the nation's economic, social, and health institutions and services. Current discussions of the financing of Social Security and Medicare benefits for retired workers have highlighted the impact of the projected growth of the aged population. Statisticians, demographers, actuaries, epidemiologists, economists, physicians, biomedical researchers, geriatricians, policy makers, and others are heatedly debating the assumptions and concepts of morbidity and mortality, and various population projections are now available. We step into the arena with some trepidation, knowing full well that forecasting is open to immediate challenge, question, skepticism, and argument.

In this paper, we shall focus on the demographic consequences of assumptions of declining mortality and slightly increasing fertility over the next 60 years and what these demographic changes may mean for the nation in terms of the health status, use of health services, and expenditures for health care. Although assumptions and projections may be questioned, the past trends are irrefutable. To grasp where we are heading, we must understand the historical trends in morbidity,

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health status, and mortality, for it is the momentum of the recent past that will sweep us into the future.

Let us summarize the trends briefly:

- Since 1960 the population aged 65 and over has grown more than twice as fast as the younger population. The elderly increased from 16.7 million in 1960 to 25.9 million in 1980—a 55 percent increase; for the population under age 65, the increase was only 24 percent. The elderly have also increased as a proportion of the population, from 9.1 percent in 1960 to 11.1 percent twenty years later. The number of the very elderly is growing even more rapidly. In the same time span, those aged 75 to 84 rose 65 percent while the 85 years and over group rose 174 percent.* Declining death rates from heart disease, cerebrovascular disease, influenza, and other causes of death contributed to the growth in the elderly population (National Center for Health Statistics 1982a).
- As more people live longer, chronic diseases, most commonly conditions of middle and old age, have emerged as major causes of death and disability. There are now many more persons suffering from conditions that are managed or controlled rather than cured. These conditions cause afflictions for decades, impairing ability to function and requiring much medical care. Because these conditions are often of long duration, they create burdens for the individual and for society. Approximately 32 million persons, 15 percent of the noninstitutionalized population, report limitations of activity due to chronic diseases in 1979 (National Center for Health Statistics 1981a). The number suffering limitation of

* The 1980 population estimates used in this paper were prepared by the Social Security Administration (SSA) prior to the availability of the Bureau of the Census official 1980 counts. The SSA estimates are employed throughout this paper because they are the basis for the projections for the subsequent 60-year period. The official April 1, 1980, census count for the population aged 85 and over was 2,240,067. The July 1, 1980, census projection was approximately 2,265,000 or 12 percent lower than the SSA estimate. The increase in the population aged 85 and over between 1960 and 1980 according to the census estimate was about 140 percent. Because of differences in coverage, the official 1980 census percent of the population aged 65 and over was 11.3 rather than the 11.1 presented here.

activity increases with age, rising from 7.3 percent of the total under 45 years to 24.1 percent at ages 45 to 64 years, and 46 percent at age 65 and over.

- Only a small proportion—5 percent—of the elderly are in nursing homes, but 22 percent of the very old (85 years and over) are in nursing homes (National Center for Health Statistics 1981b). As expected, nursing home residents are older and more dependent than the noninstitutional elderly. Nursing home residents' median age, in 1977, was 81 years, and 35 percent were 85 years and older. In general, these elderly residents of nursing homes suffer from multiple chronic conditions and functional impairments. Almost one-third (32 percent) are senile, 35 percent have heart trouble, and 15 percent have diabetes. Orthopedic problems due to a variety of disease conditions are common; 37 percent are bedfast or chairfast and 26 percent are incontinent.
- Medical care utilization patterns among the elderly reflect their poorer health status. They visit physicians, and use hospital and nursing homes considerably more frequently than the younger population, and the use rates rise significantly for the very old (Kovar 1977). In 1981 the elderly comprised 11 percent of the noninstitutionalized population and consumed 29.8 percent of the hospital short-stay days of care (National Center for Health Statistics 1982b).
- Although the elderly comprised 10.9 percent of the population in 1978, 29.4 percent of the health care dollar is spent for their care. Persons aged 65 and over spent $2,026 per capita for health care—7 times the $286 per capita spending for persons under age 19, and 2 1/2 times the $764 per capita expenditure for persons aged 19 to 64 (Fisher 1980).
- The aging of the population is a worldwide phenomenon among industrialized nations and the age structure of the population is a consequence of the demographic history of the country. In 1980, for example, 6.4 percent of East Germany's population was aged 75 and over due to its wartime losses, postwar population shifts, and low birthrates in subsequent years; the proportion is estimated to decline to 5.8 by the year 2000 (table 1). By comparison, 4.4 percent of the United States population was in this older age group in 1980 and the United Nations estimates an increase to 5.5 percent in 2000, a significantly lower proportion

TABLE 1
Percentage of Population Age 75 and Over, Selected Countries, 1980 and 2000

Country	1980	2000
Israel	2.5	3.1
Yugoslavia	3.0	4.1
Japan	3.0	5.0
Canada	3.1	4.0
Australia	3.2	4.3
Poland	3.3	4.2
Spain	3.9	5.5
Netherlands	4.4	5.7
United States	4.4*	5.5*
Italy	4.8	6.8
Switzerland	5.2	6.6
Federal Republic of Germany	5.5	6.0
United Kingdom	5.5	6.7
France	5.6	5.9
Sweden	6.2	8.0
German Democratic Republic	6.4	5.8

* The figures representing the older age groups in the United States in the most recent U.N. projections were in error. The 1980 U.S. Census figure appears in the present table for 1980 and an earlier U.N. projection is given for 2000. The projection for the U.S. appeared in United Nations, *World Population and its Age-Sex Composition by Country, 1950–2000* [U.N. Pub. ESA/P/WP.65] (New York, 1980).
Source: United Nations, *Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980*. U.N. Pub. ST/ESA/SER.A/82. (New York, 1982).

than projected in this paper. The United Nations projection assumes that mortality rates in the older age groups will decline extremely slowly during the next two decades.

Projections Assumptions

Many other facts and figures could be presented that depict details relating to past trends of an aging population. How realistic is it to make projections based on past trends? One cannot be certain whether the momentum of the past will continue. Will death rates from diseases of the heart continue to decline? Will those for malignant

neoplasms continue to increase for the next two decades? Will the onset of chronic illness be delayed as a result of changes in lifestyle, as has been suggested by Fries (1980)? Will new technologies and therapies reduce or increase medical care utilization by the aged? There is currently widespread disagreement regarding these issues among our foremost authorities.

We shall here lay out a future course of events derived from what we consider to be a heuristically useful set of assumptions. We are presenting projections, not forecasts, that will reveal the implications for the health care system of the continuation of recent trends in fertility, mortality, and morbidity.

By 1978 the accelerated downturn in the previous decade in the death rates from cardiovascular diseases were impressive and we made population projections based on the assumption that the rapid reductions in mortality from 1968 to 1978 across the age range would continue for 25 more years (Rice 1978, 1979). More recently, the Social Security Administration (SSA) recognized the downturn by building into their population projections the assumption that mortality among the elderly would continue for the immediate future to decline at a relatively rapid rate. The SSA actuaries covered a range of alternative assumptions regarding the future course of fertility, mortality, and net immigration rates by publishing three sets of projections to the year 2080 (Faber and Wilkin 1981). For our projections of health status, utilization, and expenditures, we are employing the intermediate set of projections which were based on the following assumptions:

Fertility Rates (Births per woman): The 1980 rate of 1.845 would rise to 2.100 by 2005, remaining at that rate annually thereafter.

Mortality Rates: Between 1980 and 2005 for each cause of death group, the rates of decline that characterized the 1968 to 1978 period would gradually be transformed into ultimate conservative annual rates of decline during the period 2005 to 2080.

Net Immigration (Excess of immigration over emigration): A constant annual rate of 400,000 persons would occur.

The Bureau of the Census also published three sets of projections to the year 2050 (Bureau of the Census 1982) that are consistent with those prepared earlier by the SSA, except that the latter projections include certain small population groups not covered by the Bureau

of the Census, including residents of Puerto Rico, The Virgin Islands, Guam, American Samoa, and federal civilian employees and their dependents overseas.

The accuracy of population projections, regardless of their source, may be questioned. In part, they reflect different beliefs about the future course of mortality, fertility, and net immigration. Stoto (1983) recently evaluated past population projections of the Bureau of the Census and the United Nations by taking into account the length of the projection period and the size of the projected population. He concluded that there is a very large confidence interval associated with the projections made in the past by the Bureau of the Census. In spite of these inherent inaccuracies of population projections, they are key elements in planning and policy studies. The SSA projections are used in this paper to highlight the future impact of the aging of the population on health status, utilization, and expenditures. The precise numbers are less important than the need to recognize the problems facing the nation resulting from the aging population in the future.

Mortality Projections

The improvements in mortality by cause of death postulated for the 2005 to 2080 period by the SSA actuaries were established by considering a variety of factors including:

- Advances in research and the knowledge base regarding disease etiology;
- the development and application of new diagnostic and surgical techniques;
- the presence of environmental pollutants;
- the incidence of violence; and
- continued improvements in lifestyle such as exercise, improved nutrition, cessation of cigarette smoking, reduction of drug and alcohol abuse, as people assume increased responsibility for their own health.

Employing the above assumptions and methods, the death rates projected by the SSA for the elderly populations in 5-year age groups to the year 2040 are shown in table 2. The trend is downward for both men and women in these age groups. However, the rates for

TABLE 2

Number of Deaths per 100,000 Population by Five-Year Age Group for Selected Causes by Sex: United States, 1968–2040

Cause of Death and Age*	Males			Females		
	1968	2000	2040	1968	2000	2040
All Causes						
65–69 years of age	4,224.8	2,706.1	2,368.0	2,145.5	1,367.6	1,184.3
70–74 years of age	6,128.2	4,202.4	3,664.8	3,327.3	2,115.8	1,810.1
75–79 years of age	8,836.2	6,738.2	5,856.2	5,610.8	3,571.0	3,013.5
80–84 years of age	12,755.8	9,465.0	8,209.1	9,278.7	5,388.3	4,483.8
85 years and over	21,732.0	12,997.3	11,190.0	18,425.0	8,691.9	7,142.4
Diseases of the Heart						
65–69 years of age	1,883.0	941.5	738.0	870.6	369.5	289.6
70–74 years of age	2,747.8	1,488.7	1,166.9	1,467.5	679.2	532.3
75–79 years of age	4,000.1	2,443.9	1,915.9	2,583.4	1,333.5	1,045.0
80–84 years of age	5,854.8	3,542.8	2,777.3	4,396.1	2,255.3	1,767.5
85 years and over	10,078.0	5,256.6	4,120.5	8,850.1	4,105.7	3,217.6
Malignant Neoplasms						
65–69 years of age	875.7	1,042.8	965.1	495.0	596.6	530.4
70–74 years of age	1,158.5	1,518.3	1,405.4	623.3	763.5	678.9
75–79 years of age	1,436.1	2,132.3	1,973.8	813.4	996.0	885.5
80–84 years of age	1,674.9	2,557.0	2,367.0	963.6	1,119.1	994.7
85 years and over	1,936.1	2,557.2	2,367.3	1,223.6	1,049.7	931.6

Vascular Diseases						
65–69 years of age	533.7	180.4	130.4	341.9	103.8	75.1
70–74 years of age	948.8	348.1	251.6	630.1	208.2	150.5
75–79 years of age	1,622.7	692.3	500.5	1,250.2	444.0	320.9
80–84 years of age	2,752.5	1,095.3	791.9	2,388.1	849.1	613.7
85 years and over	5,443.9	1,770.3	1,279.8	5,261.5	1,649.4	1,192.2
Accidents, Suicides, and Homicides						
65–69 years of age	163.1	74.6	74.3	63.0	28.7	29.8
70–74 years of age	186.1	90.1	89.8	80.3	34.5	35.7
75–79 years of age	248.9	131.0	130.6	134.1	49.8	51.7
80–84 years of age	352.7	172.2	171.6	228.1	70.1	73.7
85 years and over	599.8	250.1	249.3	513.1	106.0	110.0
Respiratory Diseases						
65–69 years of age	319.2	202.1	218.2	89.7	86.5	93.5
70–74 years of age	495.7	384.9	415.9	135.6	141.7	153.2
75–79 years of age	716.4	750.3	811.4	250.7	236.0	255.1
80–84 years of age	993.1	1,236.1	1,341.6	478.5	345.9	373.7
85 years and over	1,823.2	1,903.2	2,066.4	1,210.6	629.6	679.9

* The cause of death codes based on the International Classification of Diseases, 8th revision, follow:
Diseases of the heart (390–398, 402, 404, 410–429)
Malignant neoplasms (140–209)
Vascular diseases (400–401, 403, 430–458, 582–584)
Accidents, suicide, and homicide (E800–E989)
Diseases of the respiratory system (460–519)

Source: Social Security Administration, Office of the Actuary. Unpublished.

all causes are significantly higher for males than females and the downward trend is postulated to be somewhat slower for males. For example, for the 75 to 79 age group, the male death rates in 1968 for all causes was 57 percent higher than those for females. By 2040 death rates for males are projected to decline 34 percent compared with a 46 percent decline for females in this age group. Thus, by 2040 mortality rates for men are almost double those for women.

The greatest reductions from 1968 to 2040 in mortality rates in the age group 75 to 79 are for vascular diseases—69 percent for males and 74 percent for females. Mortality from diseases of the heart and from accidents, suicides, and homicides also is projected to decline significantly, by approximately one-half for men and three-fifths for women from both causes of death. Malignant neoplasm death rates, by contrast, are projected to rise about one-third for men and one-tenth for women in this age group. Smaller increases are projected for mortality from respiratory diseases—13 percent for men and 2 percent for women. Projected mortality rates for the other elderly age groups show similar trends.

Population Projections

What is the effect of declining mortality rates for vascular and heart diseases and accidents on the age structure of the population? The aging of the United States population is illustrated in figure 1 which shows the population pyramids—the distribution of the population by 5-year age groups and by sex—in the 60 years ahead.

In 1980 the population totaled 233 million people—114 million men and 119 million women.* The postwar baby boom of the 1950s creates a bulge at ages 20 to 29, with the lower birthrates of the late 1960s and 1970s reflected in the narrow base. Persons aged 65 and over totaled 25.9 million and comprised 11.1 percent of the population in 1980 (table 3). Forty years earlier, the elderly numbered about 9

* The official Bureau of the Census figure for April 1, 1980, is 226.5 million people. The SSA figure includes Puerto Rico and the outlying areas, an undercount adjustment, and a number of other adjustments. Throughout this paper, we have presented the SSA estimates rather than the official census counts. This has been done for the sake of consistency with the projection.

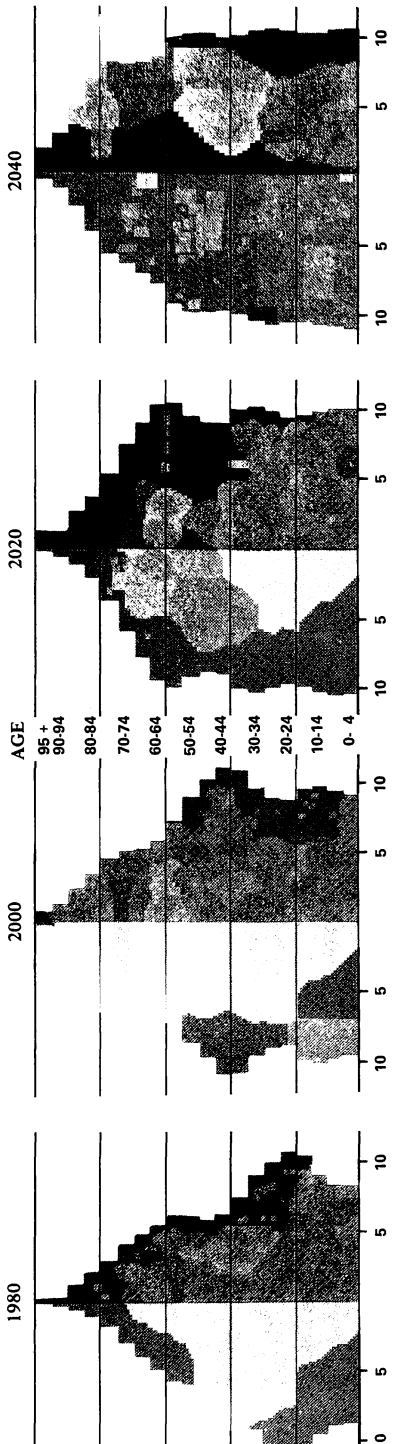

FIG. 1. Age structure of the U.S. population, populations in millions. (Source: Social Security Administration.)

TABLE 3
Projected Number of Persons by Age and Sex: United States, 1960–2040*

Age and Sex	1960	1980	2000	2020	2040
Total					
All ages	183,216	232,669	273,949	306,931	328,503
Under 20 years of age	70,828	74,045	77,001	80,376	84,234
20–44 years of age	59,216	87,145	98,261	97,345	102,160
45–64 years of age	36,466	45,587	62,435	76,557	74,853
65 years and over	16,706	25,892	36,252	52,653	67,256
65–74 years	11,094	15,627	18,334	30,093	29,425
75–84 years	4,671	7,688	12,496	14,909	24,565
85 and over	941	2,577	5,422	7,651	13,266
Male					
All ages	90,513	114,069	133,798	149,538	158,833
Under 20 years of age	35,957	37,807	39,334	41,067	43,045
20–44 years of age	29,126	43,754	49,424	49,063	51,513
45–64 years of age	17,852	22,086	30,592	37,616	36,935
65 years and over	7,578	10,422	14,448	21,792	27,340
65–74 years	5,168	6,819	8,250	13,779	13,559
75–84 years	2,043	2,838	4,741	5,907	9,895
85 and over	367	765	1,457	2,106	3,886
Female					
All ages	92,703	118,600	140,151	157,393	169,670
Under 20 years of age	34,871	36,238	37,667	39,309	41,189
20–44 years of age	30,090	43,391	48,837	48,282	50,647
45–64 years of age	18,614	23,501	31,843	38,941	37,918
65 years and over	9,128	15,470	21,804	30,861	39,916
65–74 years	5,926	8,808	10,084	16,314	15,866
75–84 years	2,628	4,850	7,755	9,002	14,670
85 and over	574	1,812	3,965	5,545	9,380

* Figures denote thousands.
Source: Social Security Administration, Office of the Actuary. *Actuarial Study No. 85*, July 1981.

million, over 6.8 percent of the total population. The aged population grew rapidly because of high birthrates during the early part of the twentieth century in combination with the long-term decline in mortality rates.

By the year 2000 the pyramid is quite distorted. A total of 274 million persons is projected—134 million men and 140 million women. The aged total 36.3 million and comprise 13.2 percent of the total population and elderly women far outnumber the men—21.8 million women and 14.4 million men. The birth cohort of the 1990s is estimated at the replacement-level fertility rate—2.1 children for each woman.

The pyramid for the year 2020 is almost rectangular through age 69. The children born during the post-World War II era are now aged 60 to 69 and the elderly population constitutes 17.2 percent of the total. The birth cohort of the 1950s is so large that the elderly will increase substantially between 2010 and 2020 regardless of whether fertility remains at its current low levels of 1.8 children per woman or takes an unexpected turn upward.

The pyramid for the year 2040 is almost rectangular rather than pyramidal. A child born in 1975 will be aged 65 in the year 2040. Of the 39 million children born between 1950 and 1960, 15 million are estimated to reach ages 80 to 89 in the year 2040. The aged population is at its peak at 67.3 million persons, or 20.5 percent of the total population. Aged women far outnumber the men—39.9 million women compared with 27.3 million men.

The projected changing age structure of the population is vividly seen in figure 2. Between 1980 and 2040 the population as a whole is projected to increase 41 percent. Of the younger population, those under age 45 will rise only 16 percent and decline in proportion to the total from 69 percent in 1980 to 57 percent in 2040. By contrast, persons aged 75 and over are projected to comprise 11 percent of the total in 2040, up from 4 percent in 1980. During this 60-year period, their numbers will almost quadruple from 3.6 million in 1980 to 13.8 million in 2040. It is important to note that the person reaching age 85 in 2040 was born in 1955 and is 28 years old today. A child born this year—1983—will reach age 65 in the year 2048.

Returning briefly to table 1 showing the proportion aged 75 and over in selected countries in the year 2000, it is noted that the United Nations projection for the United States is appreciably lower than that of the SSA actuaries—5.5 percent compared with 6.5 percent

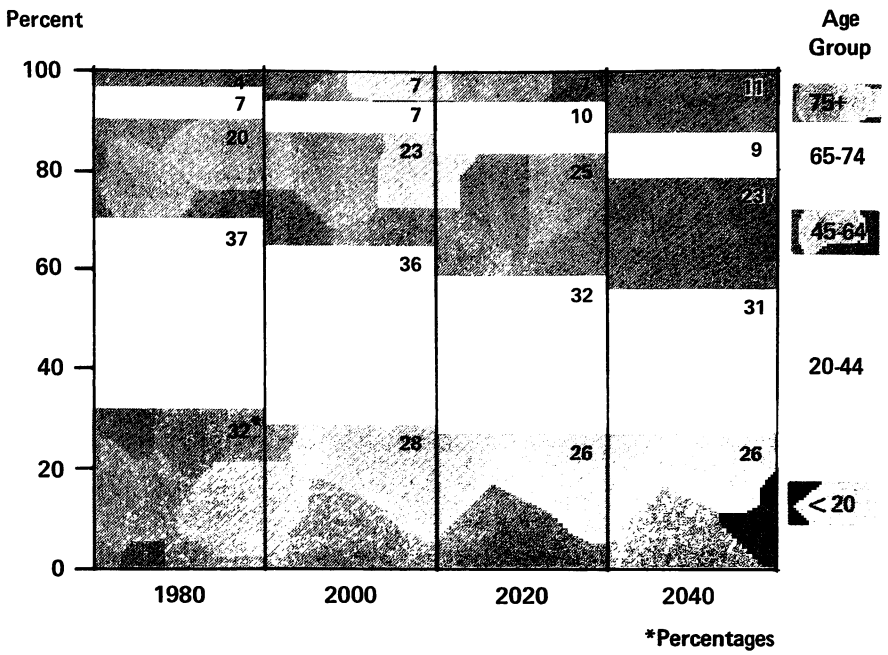

FIG. 2. Age distribution of U.S. population, selected years. (Source: Social Security Administration.)

respectively. Up to the present, United Nations demographers have not taken into account the speed with which mortality rates have been declining in the United States. While mortality rates among the elderly have also been dropping rapidly in Japan, Australia, and in a few other countries, it is far from a universal phenomenon among all industrialized nations. The UN projections involve only a slow decline in mortality rates at older age intervals, emphasizing how much difference the assumption of a rapid decline makes.

Projections of Health Status, Health Services Utilization, and Expenditures

What will these demographic changes mean for the nation in terms of health status, the use and cost of health care? We have not attempted to anticipate future trends in other factors that influence utilization of health services and expenditures for those services. Changes in levels

of morbidity, in therapies and technologies, in the availability and cost of care, in social and economic conditions, will contribute to patterns and levels of utilization of medical care services, as will mortality rates and changes in the age structure of the population. Some of these factors may work to increase utilization while others may decrease it. Whatever else happens, however, the projected changes in the size and age distribution of the population would alone have a significant impact on utilization and, consequently, on expenditures. And since older people tend to have more health problems than younger people, the implications of the aging of the population on the demand for medical care and on public policy are significant.

To make these estimates, we have applied current age-specific rates of activity limitation and utilization patterns to the projected populations in future years as shown in table 4. We realize full well that there is considerable conjecture and controversy regarding future morbidity patterns. Fries holds that the improved changes in lifestyle will result in a reduction in the prevalence of morbidity from chronic diseases and a compression of morbidity at the older ages (Fries 1980; Fries and Crapo 1981). He argues that there are biologic constraints on human mortality. He foresees a continued decline in premature death and the emergence of a pattern of natural death at the end of a natural life span. He states that the "rectangularization of the survival curve may be followed by rectangularization of the morbidity curve and by compression of morbidity."

Ernest Gruenberg (1977) and Morton Kramer (1980), on the other hand, believe that chronic disease prevalence and disability will increase as life expectancy is increased which will lead to a "pandemic" of mental disorders and chronic diseases. Thomas (1977) believes that the major diseases of human beings have become approachable biological puzzles, ultimately solvable. It follows from this that it is now possible to begin thinking about a human society relatively free of disease.

Manton (1982) elucidates the disagreement between the opposing viewpoints and points out that stability of morbidity and health status levels has characterized the aged population during the past decade. He views human aging and mortality as complex phenomena and as dynamic multidimensional processes in which chronic degenerative diseases play an essential role. His concept of "dynamic equilibrium" implies that the severity and rate of progression of chronic disease are directly related to mortality changes so that with mortality reductions

TABLE 4
Age Specific Rates Per 1,000 Population Used for Projections, by Sex

Sex and Age	Percent with Limitations in ADL[a]	Hospital Days of Care[b]	Physician Visits[c]	Nursing Home Residents[d]
Male				
Total	1.3	1,053.4	4,048.0	3.6
Under 20	0.2	357.0	4,224.3	
20–44	0.4	608.4	3,231.0	0.9
45–64	1.9	1,587.9	4,388.0	
65 and over	6.8	4,243.9	5,925.8	30.7
65–74	4.4	3,370.0	5,539.5	12.7
75–84	9.7	5,476.4	6,799.3	47.4
85 and over	21.7	7,674.4	6,362.0	140.0
Female				
Total	1.9	1,355.0	5,413.0	8.4
Under 20	0.2	388.7	4,294.2	
20–44	0.5	1,070.0	5,739.1	1.0
45–64	1.8	1,604.0	5,679.7	
65 and over	10.4	3,999.8	6,763.5	59.7
65–74	5.1	2,977.3	7,018.7	15.9
75–84	15.0	5,009.0	6,524.8	80.6
85 and over	34.6	6,598.9	5,677.8	251.5

[a] Limitations in one or more activities of daily living (ADL): walking, bathing, using the toilet, dressing, eating, and getting in and out of bed. National Health Interview Survey, 1980 (Home Care Supplement).
[b] National Hospital Discharge Survey, 1980.
[c] National Health Interview Survey, 1980.
[d] National Nursing Home Survey, 1977.

there is a corresponding reduction in the rate of progression of aging of the vital organ systems of the body. He believes that the severity of chronic diseases will be reduced or its rate of progression slowed, resulting in reduced mortality rates and an increase in life expectancy. Other researchers have raised similar challenging and important issues (Siegel 1980; Hayflick 1977; Keyfitz 1978).

An examination of past trends of health status indicators indicates little or no change in recent years. For example, there were 13.8 bed-disability days per person aged 65 and over in 1970 and in 1980 (National Center for Health Statistics 1972, 1982b). Medicare and Medicaid, enacted in 1965, have resulted in varying rates of increases in the use of hospitals and nursing homes. From 1967 to 1979 the number of short-stay hospital discharges per 1,000 persons under age 65 increased 11 percent; for the elderly, it rose 35 percent. During this same period the average length of stay declined throughout the age range so that the number of days of care per 1,000 persons under age 65 declined 6 percent, but increased 2 percent for the elderly (Lubitz and Deacon 1982). Nursing home use rates, however, have increased significantly. In 1969 there were 37.1 residents per 1,000 persons aged 65 and over in nursing homes and personal care homes; by 1977 the rate had risen to 47.9, a 29 percent increase (National Center for Health Statistics 1982c, 108). For our projections of health status and health care utilization, we are applying current, rather than increasing age-specific rates to the SSA population projections, which may well prove to be an underestimate.

An important measure of health status is the ability to perform the activities of daily living (ADL) such as walking, bathing, using the toilet, dressing, eating, and getting in and out of bed as reported in the National Center for Health Statistics' National Health Interview Survey (figure 3 and table 5). In 1980, 3.1 million noninstitutionalized persons were reported needing assistance in one or more of these activities. By 2040 the number is projected to more than double to a total of 7.9 million persons. The population will only increase during that period by two-fifths. The difference between the rates of growth in the population and in the number of persons with limitations in ADL is a reflection of the aging of the population. The impact of the aging of the population is shown clearly in the projected changing distribution by age. In 1980, 36 percent of the noninstitutionalized persons with limitations in ADL were aged 75 and over, by 2040 the proportion rises to 58 percent.

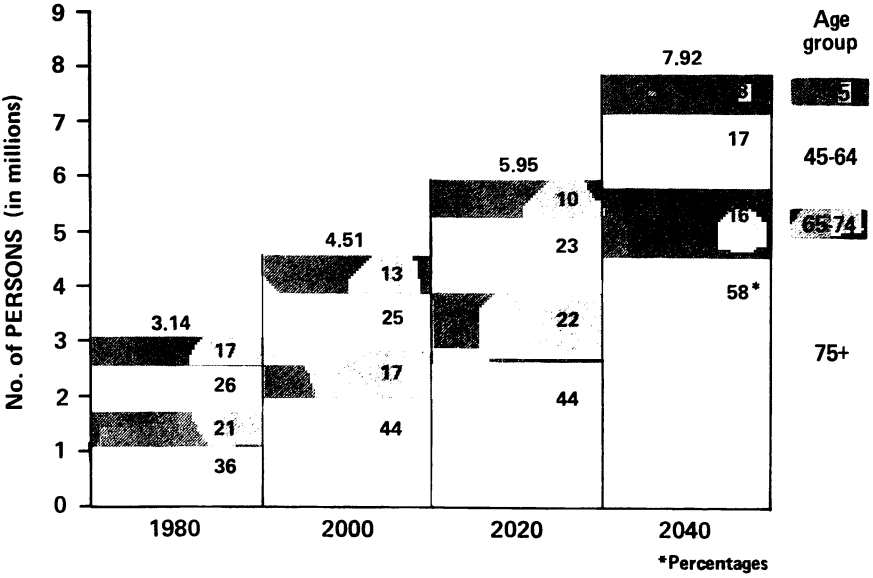

FIG. 3. Number and distribution of persons with limitations in activities of daily living. (Source: National Center for Health Statistics.)

How will the aging of the population affect the use of health services? Projections are presented for physician visits, hospital and nursing home care. The number of physician visits will increase in the future due to the aging of the population, but the increase will be less than for other measures of utilization because age-specific utilization rates do not vary as much for physician visits as, for example, for hospital care. Only 6 percent of the increase in visits from 1.1 billion in 1980 to 1.6 billion in 2040, an increase of 47 percent, results from the aging of the population. The distribution by age, however, will change (figure 4 and table 6). By 2040 persons aged 65 years and over will comprise 27 percent of the total visits compared with 15 percent in 1980.

The aging effect is quite different for hospital and nursing home care. Total short-stay hospital days will double, increasing from 274 million in 1980 to 549 million in 2040, with more than half the increase due to the aging of the population. Forty percent of the days of care in 2040 are projected for those aged 75 and over; in 1980 only 20 percent were in that age group (figure 5 and table 7).

TABLE 5
Projected Number of Persons with Limitations in Activities of Daily Living by Age and Sex: United States, 1980–2040*

Age and Sex	1980	2000	2020	2040
Total				
All ages	3,141.7	4,509.1	5,951.3	7,922.4
Under 45 years of age	545.0	602.1	605.9	635.8
45–64 years of age	817.2	1,131.9	1,391.8	1,366.6
65–74 years of age	647.8	783.7	1,309.0	1,288.1
75 and over	1,131.7	1,991.3	2,644.7	4,631.9
Male				
All ages	1,411.6	1,996.7	2,629.3	3,393.6
Under 45 years of age	250.6	276.4	278.4	292.2
45–64 years of age	419.6	581.2	714.7	701.8
65–74 years of age	300.0	363.0	606.3	596.6
75 and over	441.3	776.1	1,030.0	1,803.1
Female				
All ages	1,730.1	2,512.5	3,322.0	4,528.8
Under 45 years of age	294.4	325.8	327.4	343.7
45–64 years of age	397.5	550.7	677.1	664.8
65–74 years of age	347.8	420.8	702.7	691.5
75 and over	690.4	1,215.3	1,614.8	2,828.9

* Figures denote thousands.
Source: National Center for Health Statistics, Office of Analysis and Epidemiology.

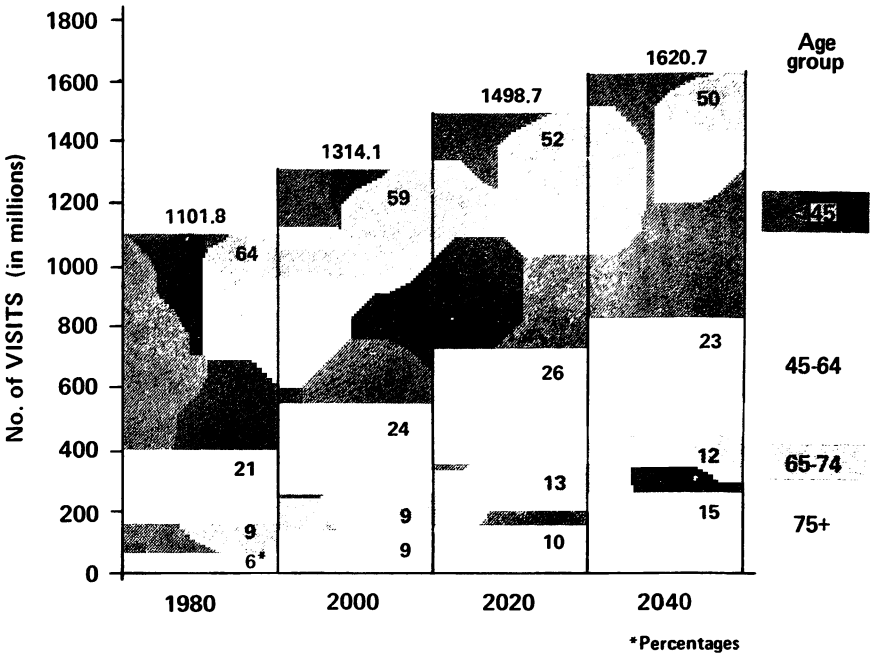

FIG. 4. Number and distribution of physician visits. (Source: National Center for Health Statistics.)

Again, assuming that current patterns of use prevail in the future, there will be very large increases in the number of nursing home residents. From 1.5 million in 1980, the number is projected to 5.2 million residents in 2040—a 3.5-fold increase (figure 6 and table 8). The increases are particularly large among residents 85 years of age and older where a 5-fold increase is projected in the number of residents. In 1980, 37 percent of the residents were aged 85 and over; by 2040 the proportion will be 56 percent. Adding the projected nursing residents aged 75 to 84, about 87 percent of the total residents will be aged 75 and over. It is evident that the aging of the population has a much greater impact on nursing home residents than on days of hospital care or physician visits.

Our final projections are expenditures for medical care. The Health Care Financing Administration annually estimates personal health care expenditures by type of expenditure, source of funds, and by age (Fisher 1980). The latest available expenditure data for three age groups—under 19 years, 19 to 64 years, and 65 years and over—are

TABLE 6
Projected Number of Physician Visits by Age and Sex: United States, 1980–2040*

Age and sex	1980	2000	2020	2040
Total				
All ages	1,101.8	1,314.1	1,498.7	1,620.7
Under 45 years of age	705.7	767.9	777.9	815.8
45–64 years of age	230.4	315.1	386.2	377.4
65–74 years of age	99.6	116.5	190.8	186.5
75 and over	66.1	114.6	143.8	241.0
Male				
All ages	459.9	547.3	627.0	677.5
Under 45 years of age	301.1	325.9	332.0	348.2
45–64 years of age	96.9	134.2	165.1	162.1
65–74 years of age	37.8	45.7	76.3	75.1
75 and over	24.2	41.5	53.6	92.0
Female				
All ages	641.9	766.8	871.8	943.2
Under 45 years of age	404.6	442.0	445.9	467.6
45–64 years of age	133.5	180.9	221.2	215.4
65–74 years of age	61.8	70.8	114.5	111.4
75 and over	41.9	73.1	90.2	149.0

* Figures denote millions.
Source: National Center for Health Statistics, Office of Analysis and Epidemiology.

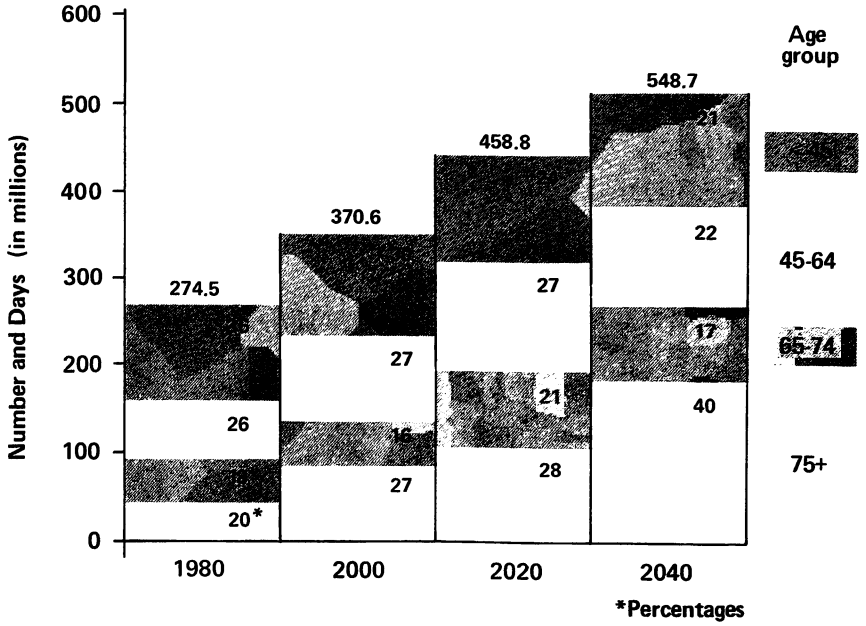

FIG. 5. Number of distribution of short-stay hospital days by age. (Source: National Center for Health Statistics.)

for 1978. We have projected the age breakdown for 1980 and subsequent years by applying the population projections to obtain the impact of the aging of the population (figure 7 and table 9). We also made no attempt to forecast future inflation rates; thus, the expenditures are in constant 1980 dollars.

As with the use of medical care services, the proportional increase in expenditures is projected to rise at a significantly faster rate at the older ages. Of the total $219 billion spent in 1980 for personal health care, $64.5 billion or 29 percent was spent in behalf of the elderly population aged 65 and over. This amount would rise to $167.5 billion in 2040—an increase of 159 percent, due to the aging of the population during that 60-year period. By contrast, for the population under age 65 expenditures are projected to increase 30 percent.

Figure 8 and table 9 enumerate the distribution of personal health care expenditures and population by age for 1980 and 2040. In 1980 11 percent of the population who are aged 65 and over consumed 29 percent of the expenditures; by 2040 the elderly are projected to

TABLE 7
Projected Number of Short-Stay Hospital Days by Age and Sex: United States, 1980–2040*

Age and sex	1980	2000	2020	2040
Total				
All ages	274.5	370.6	458.8	548.7
Under 45 years of age	98.2	111.0	111.4	116.9
45–64 years of age	71.0	99.7	122.2	119.5
65–74 years of age	49.2	57.8	95.0	92.9
75 and over	56.1	102.1	130.2	219.4
Male				
All ages	116.3	157.6	199.1	235.1
Under 45 years of age	38.7	44.1	44.5	46.7
45–64 years of age	33.6	48.6	59.7	58.7
65–74 years of age	22.9	27.8	46.4	45.7
75 and over	21.1	37.1	48.5	84.0
Female				
All ages	158.2	213.0	259.7	313.6
Under 45 years of age	59.5	66.9	66.9	70.2
45–64 years of age	37.4	51.1	62.5	60.8
65–74 years of age	26.3	30.0	48.6	47.2
75 and over	35.0	65.0	81.7	135.4

* Figures denote millions.
Source: National Center for Health Statistics, Office of Analysis and Epidemiology.

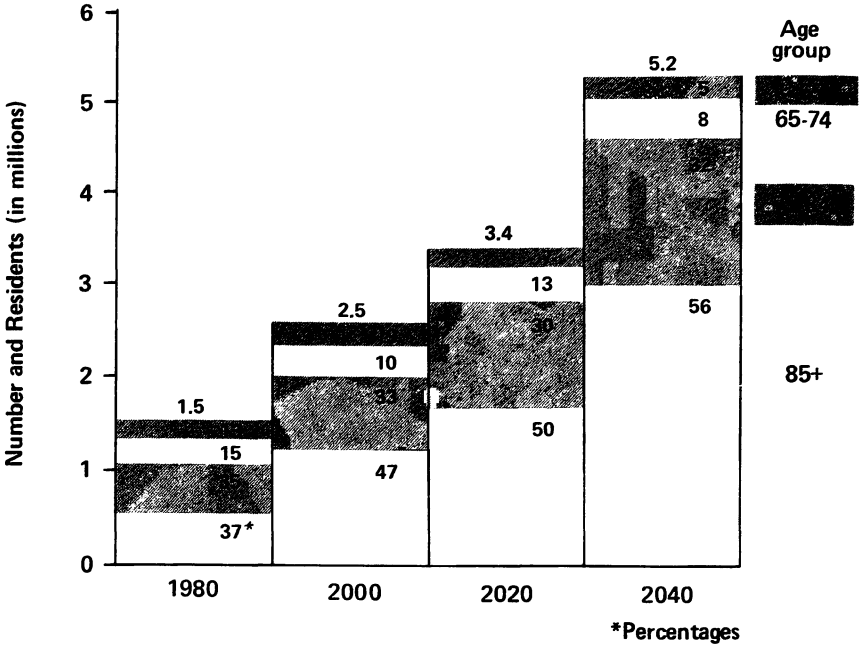

FIG. 6. Number and distribution of nursing home residents. (Source: National Center for Health Statistics, projected from 1977 estimates.)

comprise 21 percent of the population and almost half of the expenditures would be made in their behalf.

The projected growth in spending is greatest for nursing home care. In 1980 about $21 billion was spent for nursing home care, comprising 9.4 percent of total personal health care spending. Assuming constant 1980 dollars, nursing home care spending would more than double by 2040, rising to $48.3 billion and comprising 13 percent of total personal health care expenditures. For the elderly, nursing home expenditures are projected to constitute a quarter of total personal health care expenditures.

Discussion

Underlying our projections are assumptions pertaining to three relatively distinct future trends in: birth and death rates; prevalence of ill-health and functional limitations; and the use of health care services. It is

TABLE 8
Projected Number of Nursing Home Residents by Age and Sex: United States, 1980–2040*

Age and sex	1980	2000	2020	2040
Total				
All ages	1,511.3	2,541.8	3,370.8	5,227.1
Under 65 years of age	196.4	225.8	241.5	248.1
65 years and over	1,314.9	2,316.1	3,129.3	4,979.0
65–74 years of age	226.6	265.1	434.4	424.5
75–84 years of age	525.4	849.8	1,005.6	1,651.4
85 and over	562.8	1,201.2	1,689.4	2,903.1
Male				
All ages	421.5	640.9	864.8	1,303.6
Under 65 years of age	93.3	107.4	115.0	118.3
65 years and over	328.2	533.5	749.8	1,185.3
65–74 years of age	86.6	104.8	175.0	172.2
75–84 years of age	134.5	224.7	280.0	469.0
85 and over	107.1	204.0	294.8	544.0
Female				
All ages	1,089.8	1,900.9	2,506.1	3,923.5
Under 65 years of age	103.1	118.3	126.5	129.8
65 years and over	986.7	1,782.6	2,379.5	3,793.7
65–74 years of age	140.0	160.3	259.4	252.3
75–84 years of age	390.9	625.1	725.6	1,182.4
85 and over	455.7	997.2	1,394.6	2,359.1

* Figures denote thousands.
Source: National Center for Health Statistics, Office of Analysis and Epidemiology.

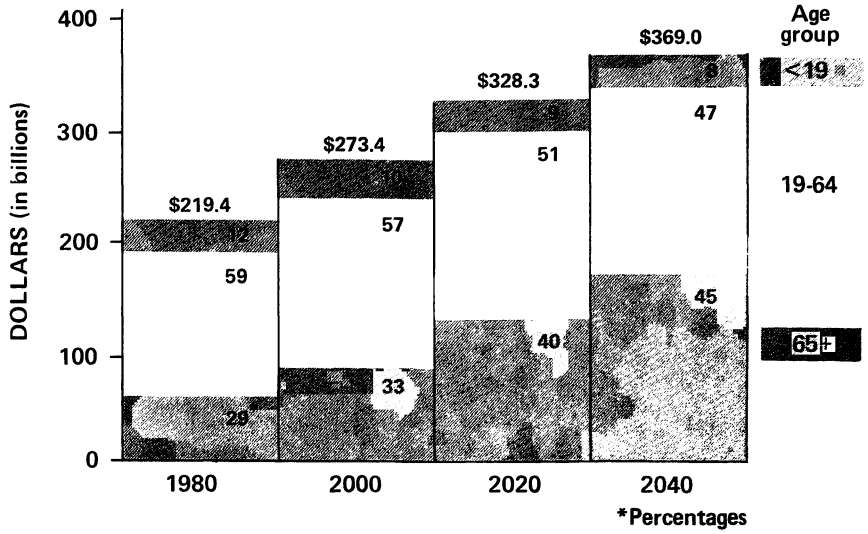

FIG. 7. Personal health care expenditures by age, in constant 1980 dollars. (Source: Projected from Health Care Financing Administration estimates for 1978.)

not until about 2050 that the assumptions regarding future birthrates influence the size of the population aged 65 and older. For 2040 and earlier, the population aged 65 or older has already been born. On the other hand, the projected population pyramids cover the entire age range and are highly sensitive to alternative assumptions regarding the birthrate. As indicated earlier, the projections presented here are based on an assumed upturn in the total fertility rate from the current 1.8 children per woman to 2.1 children per woman by the year 2005. Lower levels of fertility would result in fewer persons in the younger age groups.

The differential growth of the population by age can have important consequences for many of our social institutions, particularly in terms of dependency. Because the most slowly growing age group during the next half century will be those under 20 years, their proportionate share of the total population will diminish measurably.

Recent discussions of the financing of Social Security and Medicare benefits for retired workers and disabled persons have highlighted the long-run impact of the projected future demographic distribution of the population (Ball 1982; Clark, Kreps, and Spengler 1978; Federal

TABLE 9
Projected Personal Health Care and Nursing Home Expenditures by Age: United States, 1980–2040*

Age	1980	2000	2020	2040
Total Expenditures				
All ages	$219.4	$273.4	$328.3	$369.0
Under 19 years of age	25.9	26.9	28.1	29.5
19–64 years of age	129.0	156.2	169.0	172.0
65 years and over	64.5	90.3	131.2	167.5
Nursing Home Expenditures				
All ages	$ 20.6	$ 28.0	$ 38.9	$ 48.3
Under 19 years of age	0.1	0.1	0.1	0.1
19–64 years of age	4.0	4.8	5.2	5.3
65 years and over	16.5	23.1	33.6	42.9

* Figures denote billions, in constant 1980 dollars.
Source: Projected from Health Care Financing Administration estimates for 1978.

Old-Age and Survivors Insurance and Disability Insurance Trust Funds 1982; National Commission on Social Security Reform 1983). Since the future financing of the system depends on the number of retirees in relation to workers, dependency ratios serve as useful indexes of the burden on society of the aging of the population. The "aged dependency ratio" is defined as the population aged 65 and over divided by the population aged 20 to 64. Under the previously stated assumptions regarding fertility and mortality trends, the SSA actuaries estimated this ratio would increase from 195 persons aged 65 or older for every 1,000 persons aged 20 to 64 in 1980 to 380 persons in 2040, almost doubling the aged dependency ratio (table 10).

At the same time, low fertility rates will result in fewer young persons and, thus, in a declining young dependency ratio, defined as the population under age 20 divided by the population aged 20 to 64. This ratio is projected to decrease 15 percent from 558 in 1980 to 476 young persons per 1,000 persons aged 20 to 64 in 2040.

The "total dependency ratio," the sum of the above ratios, is a crude index of the total burden on the working population of its support of both the old and young dependents. Adding the population under age 20 to the aged shows the projected rise of the total dependency ratio from 753 persons dependent on 1,000 persons of working ages in 1980 to 856 in 2040—an increase of 14 percent.

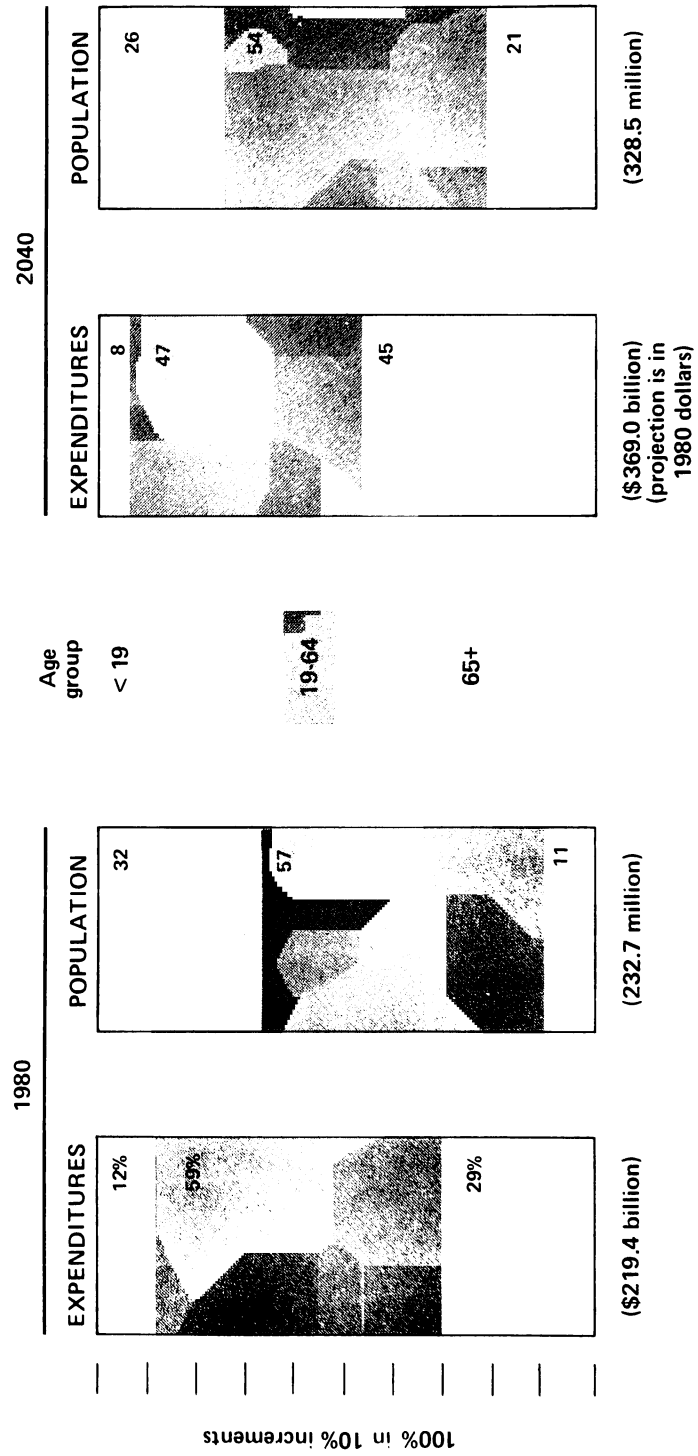

FIG. 8. Percent distribution of personal health care expenditures and population by age group and year. (Source: Projected from Health Care Financing Administration estimates for 1978.)

TABLE 10
Dependency Ratios, by Age, 1960–2040

Year	Young[a]	Aged[b]	Total[c]
1960	.741	.174	.915
1970	.716	.184	.900
1980	.558	.195	.753
1990	.494	.215	.709
2000	479	.226	.705
2010	447	.236	.683
2020	462	.303	.765
2030	481	.378	.859
2040	476	.380	.856

[a] Population under age 20 divided by the population aged 20–64.
[b] Population aged 65 and over divided by the population aged 20–64.
[c] Population under age 20 plus the population aged 65 and over divided by the population aged 20–64.
Source: Faber, F. and J.C. Wilkin, *Social Security Area Population Projections, 1981*. Social Security Administration, Actuarial Study No. 85. SSA Pub. No. 11–11532. (Washington, 1981).

However, the relative costs of supporting the aged versus the young is a crucial consideration. One estimate is that "about three times as much public money is spent, on the average, per aged dependent than is spent on a younger one" (Sheppard and Rix 1977). Since the aged will be the most rapidly growing age group and more costly, the burden on the working population to support young and old dependents is a major policy issue for both Social Security and the hospital insurance program under Medicare that are financed by payroll taxes.

How closely the population projections presented here will correspond to actual demographic events depends largely on the relation between actual and projected future mortality and fertility trends. Although the mortality rate projections are by no means simple extrapolations of past trends, the current situation and the experience of the recent past do exert a great deal of influence. The method traditionally used in the United States has been termed "population projection by reference to the informed guesses of experts" (Preston 1974). The short-run portions of the projections are, of course, dampened extrapolations, but the longer run portions reflect expert opinion which is generally molded by the status quo and the events of the recent past. For

example, mortality rates from vascular diseases have been declining very rapidly; it is assumed in the present projections that they will continue to decline very rapidly.

Should the mortality projections be treated as forecasts? Past experience suggests that great caution be exercised. After declining relatively steadily for many years, the mortality rates for males 15 to 54 years suddenly leveled off about 1955 and remained more or less level until the late 1960s. This change in trend came as a total surprise; it appeared to observers during the plateau period that earlier projections of male mortality reduction had been overly optimistic (Preston 1974). In the early 1970s an unanticipated decline in mortality rates for older men began; it has made all earlier projections for men appear to be too pessimistic. Mortality trend projections for women have generally been far too pessimistic; for the older age groups, mortality rates are already well below the levels that had been projected for the year 2000. It is impossible to gauge the likelihood of another surprise change in trend starting at some point in time during the next several decades. The SSA projected mortality trends still appear reasonable, but our understanding of the dynamics of mortality rates is, at best, rather poor. Since the causes of major trend reversals of the past, such as the mortality downturns for tuberculosis, stomach cancer, coronary heart disease, and stroke remain unclear, we cannot anticipate with any assurance when the next alteration in course will take place (Stallones 1979).

Similarly, projections of birthrates have corresponded quite well with reality when trends of the past have persisted into the future; changes in trend, however, have produced major discrepancies (Keyfitz 1981; Stoto 1983). Not many fertility projections accommodated the postwar baby boom; not many projections made in the midst of the boom accommodated its relatively abrupt end. Recent and anticipated advances in family planning sophistication suggest a closer correspondence in the future between actual and desired family size. The problem is, however, that we do not know how to foretell the fluctuations in desired family size that are going to be taking place (Lee 1980).

Our crystal ball becomes much cloudier when we begin to project future trends in the prevalence of ill health and infirmity. As indicated earlier, forecasts range from those of Fries, who anticipates a compression of the period of morbidity prior to death, to those of Gruenberg and Kramer, who anticipate an appreciable lengthening of the duration

of illness for at least certain segments of the population. It is, of course, quite possible that both phenomena will be taking place simultaneously; there may be an increasing proportion of individuals in quite good health up to the point of death and an increasing proportion with prolonged severe functional limitation, with a decline in the proportion with an only moderate degree of infirmity (Feldman 1982). What effect this would have on the prevalence of morbidity would, of course, depend on the relative magnitudes of the various changes. Unfortunately, our current knowledge of the natural history of most conditions is rather meager and we have little systematic information about terminal illnesses.

Most of the current data derive from cross-sectional observations while longitudinal observations are required for epidemiologic analysis. Although there have been several notable studies that have followed cohorts of older people over considerable periods of time, they have rarely focused on the parameters of morbidity, functional capacity, and mortality required for useful modeling activities. Furthermore, the samples for most of these studies have been too small to delineate the pathways from good health to death, to estimate the frequency with which the different paths are followed, and to estimate the duration of time spent at each stage along the way. Epidemiological techniques need to be applied to the study of the natural history of disease and the process of dying.

Turning finally to assumptions regarding the future use of health services, we plunge even deeper into the great abyss. Two additional demographic considerations are important to consider: 1) the rate of childlessness may well be increasing for cohorts born since the mid-1930s or so. Elderly people without children may require more long-term care services than those with children; and 2) for at least the next few decades, the members of each cohort entering the elderly population will have had, on the average, more years of education than its predecessors. The more highly educated tend to live longer, be in better health, but, relative to their health condition, use more medical care than the less educated.

Of even greater consequence than such demographic factors are, of course, changes in our value structure. Medical advances may enable us to keep highly moribund individuals alive for long periods of time. What will our social norms prescribe that we do with that knowledge? Will the application of heroic measures be indicated under even the

most dire of circumstances or will some minimal probability of recovery be required?

Our current public programs have great gaps in the types of services covered. Medicare tends to emphasize care for acute illnesses but does not provide for preventive care, extended nursing home care, or mental health services. Medicaid tends to emphasize nursing home care over in-home services and community alternatives. It is difficult to anticipate how the problems of long-term care will be handled in the future. Will alternative forms of long-term care replace long-term institutionalization for an appreciable proportion of the severely infirm?

We have begun to seek alternative solutions to institutionalization of the elderly and a variety have been developed—foster care homes, congregate housing and retirement communities, home care, personal care, homemaker and chore services, home delivered and congregate meals, and adult day-care centers. The goal with many of these services is to enable the elderly to maintain their independence as long as possible. The development and availability of these services is uneven around the country, and public funds, where available, are inadequate. The issue of coverage of noninstitutional care and social services by public and private health insurance is an important one. Health insurance traditionally has emphasized and paid for hospital care, thereby discouraging the use of alternatives to high costs of hospital care. More attention is being focused on alternative approaches to long-term care in recent years (Institute of Medicine 1977; Estes 1979; Congressional Budget Office 1977; Lee and Estes 1979; Somers 1980).

Given efforts at health promotion and higher educational attainment, it is possible that the elderly of the future may reach old age in better health status than the elderly of the past. The attractive concept set forth by Fries is that people in the future will have a longer disability-free life with a limit on the life span, perhaps reducing the pressure for long-term care services. As indicated earlier, Gruenberg and Kramer, on the other hand, believe that chronic disease prevalence and disability will increase as life expectancy is increased which will lead to a pandemic of mental disorders and chronic diseases. In any event, if these trends in morbidity and mortality argue for a healthy population, they also argue for development of the range of supportive services that the very old need even in the best of health. At the same time, we must realize that the availability of alternative services will not necessarily reduce expenditures for long-term care. "Some have estimated that for every person residing in a nursing home, as many as two or

three individuals who live in a community require an equivalent amount of care, which they are currently receiving, if at all, primarily from informal sources" (Health Care Financing Administration 1981). Alternative services may simply fill an, as yet, unmet need.

While it is certainly to be hoped that as time goes on we shall steadily become less dependent on halfway technologies, there may well be a relatively long transition period during which the armamentarium of moderately efficacious but extremely expensive procedures will grow and will be performed with increasing frequency. The assumption underlying our projections that age-specific utilization and expenditure levels will remain constant over time may well turn out to be overly optimistic.

In emphasizing the problematic character of a number of our assumptions, we may have left the impression that the future is totally indeterminate. Actually, the number of elderly will undoubtedly increase rapidly during the next half-century. As a consequence of such factors in our demographic history as past movements in birth and death rates and immigration, it is practically preordained that the number of elderly will grow rapidly. Even if there were not further declines in mortality rates, the number of individuals in the population aged 85 or older would approximately double during the next 25 years while the increase in the number of individuals in the 75 to 84 age bracket would be slightly slower. Younger age groups, however, are likely to be increasing at a far slower rate.

Since even the most optimistic predictions concerning changes in health practices and advances in medicine do not involve an immediate sharp decline in the incidence of illness or marked improvements in recovery rates, it is nearly certain that we shall be facing an increasing demand for medical services for at least the next several decades. Thus, while the projections presented here may possibly exaggerate the magnitude of the future changes, we can be certain that problems resulting from a rapid growth of the elderly population will be with us in the future.

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