Life Expectancy and Health Status of the Aged

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In 1983, Congress passed several amendments to the Social Security Act that will alter eligibility for the retirement program. The age of full benefit eligibility is scheduled to rise from 65 to 66 by two months per year, and again to age 67 between 2022 and 2027. The major objectives of the changes are to help ensure the financial solvency of the social security system, encourage private savings, and discourage early retirement. The amendments were prompted by increasing life expectancy, which placed enormous financial pressure on the system. The focus of this article is on the health of the people who will be directly affected by this legislation and on the usefulness of life expectancy or mortality trends as indicators of health status. The article assesses the potential burden that the amendment will create for future retirees.

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Traditionally, improvements in life expectancy have been regarded as an indicator of improving health status. This may be an appropriate conclusion when the causes of mortality are dominated by acute communicable disease. However, mortality is increasingly dominated by chronic diseases which differ markedly from acute diseases in their etiology and control. Whether improving longevity heralds more active and productive years of life or more years of disability and functional dependence is currently an issue of great debate. Some maintain that improved longevity is accompanied by a pandemic of disease and disability (Gruenberg, 1977; Kramer, 1980). Others argue that a greater percentage of the human life span is being lived free of disease (Fries, 1980; 1983). Still others have taken an intermediate position, claiming that while disease is not being prevented, therapeutic measures are increasingly effective in managing the progression of disease, controlling its severity, and consequently, disability (Manton, 1982).

The relative impact of the 1983 SSA amendments will depend on the health of the population age 62–66 after 2000, and 62–67 after 2022. The people that would be first affected, therefore, are now age 47. If the health of this and younger cohorts allows them to work 1 to 2 years longer (assuming jobs are available) than today's 62–67 year-olds, then the amendments will have created no additional burden. It should be acknowledged, however, that the health status is only one of the factors that will determine the impact of the amendments on future cohorts. Other factors include the job market, social attitudes toward retirement, and assets.

Organization of This Paper

The organization of this paper is as follows. First, we define the concepts of disability, morbidity, and mortality. Next we discuss the potential dynamics of their relationships. We argue that morbidity rates cannot be directly related to mortality rates and that several different models are required to describe disability, morbidity, and mortality dynamics. We then review current trends in mortality. This is followed by a section on trends in morbidity and disability. Next is a discussion of the determinants of morbidity and mortality. Finally, we summarize the observed trends and speculate on the future.

Definition of Concepts

Our primary focus is on the prevalence of disability of those who will be age 62–67, with a discussion of its relationship with morbidity and mortality trends. To sharpen this focus, we will define the concepts of morbidity, disability and mortality and problems in measuring them.

Morbidity refers to the presence of disease in individuals, regardless of severity. Measurement of the presence of chronic disease in populations is made difficult by the fact that many chronic diseases have lengthy presymptomatic stages.

Disability refers to the ability to perform important life functions, and because this is influenced by cultural and economic factors, it is difficult to measure objectively. Performance is affected not only by health but by motivation and effort required, which differ between individuals and environmental conditions. A stronger desire or cultural expectation to succeed in one individual than another may cause their disability status to diverge given the same level of physical impairment. However, if returning to work means having to put up with overly stressful demands, the individual may claim disabled status. Disability can range in severity from being limited in activities that do not preclude work or other essential functions (e.g., climbing stairs), to being unable to work, or to being unable to feed or clothe oneself without assistance from others.

Mortality is quite easily measured compared to morbidity or disability. Mortality is a distinct event, whereas morbidity and disability are best characterized as a process varying in severity over time.

For More Information

This article was originally prepared as one of three background papers to the Retirement Age Study. The other two background papers will be published in future issues of the **Social Security Bulletin.**

Technical appendices describing the data bases and techniques used to derive the estimates in the report as well as background papers commissioned as part of the study are available from the Publications Staff, Office of Research, Statistics, and International Policy, Social Security Administration, Room 921, Universal North Building, 1875 Connecticut Avenue, N.W., Washington, D.C. 20009 or by calling (202) 673–5579.

Morbidity, Disability, and Mortality Dynamics

The relationship between morbidity and mortality is variable, and should not be assumed. As in the past, when mortality is dominated by acute infectious disease, increasing life expectancy would seem to imply a greater number of active life years (i.e., years able to work), and thus, improving health. However, under a mortality structure dominated by chronic disease, increasing life expectancy does not necessarily imply improving health, since delaying death may result in an increased prevalence of morbidity and disability.

It would, however, be an oversimplification to conclude, even when mortality is dominated by chronic diseases, increasing life expectancy necessarily implies much about morbidity and disability. It is important to remember that many conditions (such as arthritis, ulcers, and presbycusis) are not fatal: on the basis of population data on disability, we calculate that on the order of only 36 to 41 percent of all disability is potentially related to "fatal" diseases (we use the same disease categories as Verbrugge (1984) in computing this estimate—see table I). The majority of disability is determined by nonfatal diseases and impairments. It is, therefore, incorrect to draw any conclusions about disability directly from mortality trends.

Mortality is further dissociated from morbidity by the fact that suicides, homicides, and accidents are not related to any particular illness. Suicidal, and homicidal acts and accidents, when not fatal, may lead to higher prevalence of impairments and disability. Furthermore, some deaths result from illnesses of very short duration that may not be reflected in changes in morbidity rates. If non-fatal morbidity rates change, there will be no corresponding change in mortality rates. It is therefore necessary to examine changes in morbidity, disability, and mortality on a cause-specific basis. Even so, care must be exercised since people do not always die from the conditions they suffer from. For example, people suffering from chronic conditions are at greater risk of dying from respiratory conditions.

There are two factors that affect morbidity prevalence for a particular illness: the number of people who contract the disease (incidence), and the rate of progression of the disease (duration). For fatal diseases, mortality is also a function of the incidence and duration of disease. However, incidence and duration affect morbidity prevalence and mortality differently, with the result that morbidity and mortality are not necessarily correlated. To see why, we first examine the possible reasons for changes in mortality rates.

The first is that disease incidence may change. All other things being equal, if fewer people contract an illness, then fewer people will die from it. Of course, there will be a time lag between changes in incidence and its impact on mortality—people do not usually die immediately upon acquiring a chronic disease. It has been argued (Fries, 1983) that the onset of disease may be postponed through

Table I.—Fatal[1] chronic diseases associated with range of reported disability, by severity of disability, 1974

Severity of disability	Percent of population with one or more fatal chronic diseases reported as a cause of limitation	
	Low estimate[2]	High estimate[3]
Limited, but not in major activity	19.8	26.3
Limited in amount or kind of major activity	32.2	46.7
Unable to perform major activity	41.5	70.8
Any disability	36.4	41.2

[1]We employ the same list of fatal diseases as did Verbrugge (1984). These include cancer, diabetes, heart disease, cerebrovascular disease, hypertension, other circulatory diseases, bronchitis, emphysema, hernia, digestive conditions, and kidney and ureter disease.

[2]Assuming people reporting secondary fatal conditions are the same people as those reporting fatal conditions as a main cause of disability.

[3]Assuming people reporting secondary fatal conditions are not the same people as those reporting fatal conditions as a main cause of disability.

Source: Wilder (1977), tables 2 and 3, pages 15–16.

risk factor modification, and serious morbidity "compressed" to later ages, thereby prolonging health. However, because it is hypothesized that this delay in onset occurs mainly for fatal diseases, it would result in both lower mortality rates and lower morbidity prevalence rates. Data on incidence is lacking, however, for many chronic diseases.

Another reason for changing mortality may be changing duration of disease. As the duration of fatal diseases increases, disease-specific mortality is postponed and rates decrease. An increase in the duration of a disease will also increase its prevalence.

It has been argued (Manton, 1982) that, primarily due to effective medical management, the rate of progression of many diseases has slowed. The implications of this for health status are not clear. For example, Manton cites diabetes as a condition that is now fairly well medically managed. This, he argues, has resulted in an increase in the average duration and hence prevalence of diabetes, as well as improved quality of life. Feldman (1983, p. 442) on the other hand, states:

> The greatly improved survival of diabetic patients has resulted in an extremely large increase in the prevalence of the condition and such disabling complications as vision loss and cardiovascular problems.

Therefore, it is not clear that delaying progression of disease will reduce disability.

Kramer (1980) and Gruenberg (1977) claim that life extension due to clinical successes in the treatment of the lethal sequelae of formerly fatal diseases has resulted in an increase in the prevalence of disabling chronic diseases (reduced case fatality but increased case-disability). Kramer also predicts that the prevalence of many chronic diseases may increase simply because people are living longer. Thus, like Manton, they predict the prevalence of diseases will increase. Unlike Manton, they argue that the prevalence of severe disease and disability may also increase.

The point of this discussion is that mortality and morbidity rates exhibit a variable relationship. One reason is that some diseases do not result in death, and some deaths are not the results of disease. Second, even for fatal diseases, varying morbidity incidence and duration makes the relationship between mortality and morbidity prevalence both complicated and unstable. Mortality can be declining for a given fatal disease because the incidence of the disease is declining, the duration of the disease is increasing, or both. It is possible that mortality can decline while incidence increases, if the increase in duration is large enough. This may occur as the result of medical breakthroughs. Similarly, mortality could decline while duration decreases, if incidence drops fast enough. This scenario would seem to be rare, however. Because morbidity prevalence is a function of incidence and duration, it cannot be reliably derived from mortality rates.

Because we are interested in the health of those age 62–67, changes in mortality and morbidity of people over

67 are not of direct concern to this paper. Rather, mortality and morbidity for people particularly under the age of 47 are relevant to this paper, for they represent age cohorts who will someday be in our relevant age bracket.

In order to properly measure these dynamics, longitudinal data on morbidity incidence and case-fatality rates are required. Unfortunately, longitudinal data are rare, and are unavailable for the Nation as a whole. Thus, we are forced to make use of population demographic data on morbidity prevalence, disability, and mortality. Even here, however, data on incidence and case-fatality are unavailable. What we wish to know is whether future morbidity and disability trends will be more or less pronounced for younger cohorts compared to the past experience of older cohorts. We first examine mortality and life expectancy trends, because they offer some clue as to morbidity trends—and because they are more accurately measured than morbidity or disability trends.

Trends in Mortality and Life Expectancy

Comparing changes in mortality and life expectancy with changes in morbidity can be helpful in evaluating alternative hypotheses of morbidity and mortality dynamics. For clarity's sake, it will be useful to distinguish between the concepts of mortality and life expectancy. Life expectancy is an estimate of the average number of future years of life remaining at a specific age and year. It is based on the assumption that, at any particular age in a given year, individuals will face the same mortality risks in the future as older individuals experienced in the same year. Thus, life expectancy, as the name implies, is a projection of the length of life of the population based on static cross-sectional age variation in mortality risks. Analyzing trends in life expectancy reveals whether the mortality risk at a given age is increasing, decreasing, or remaining constant with time.

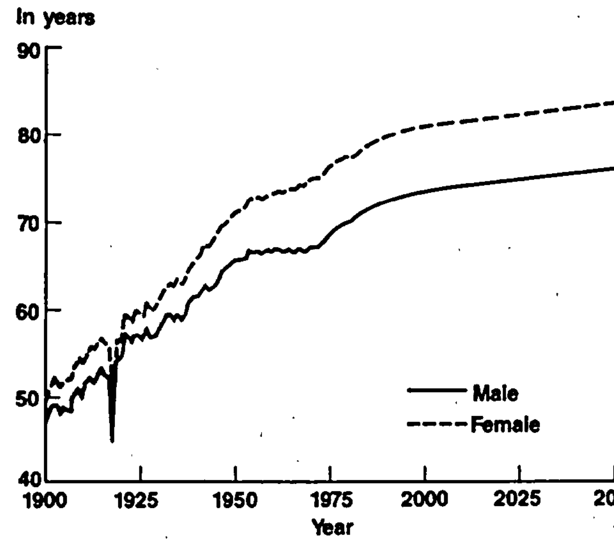
In 1935, when the social security pension system was implemented, significant differences in life expectancy existed. Life expectancy at birth was 61.0 for white males and 65.0 for white females. For blacks and other minorities, life expectancy at birth for males was 51.3 and 55.2 for females. Thus, in 1935, whites could expect at birth to live a decade longer than other races, but only white females could expect to live to the retirement age.

Life expectancy at age 20 is perhaps a better indicator of the likelihood of surviving to retirement, since it is independent of the mortality risks associated with infancy and early adulthood. Also, it is an age at which most adults have begun to work and pay into the trust fund. In 1935, whites of both sexes who survived to age 20 could expect to live to age 65. For nonwhite females, this transition occurred in the early 1940's; for nonwhite males in the mid 1950's. Sex and race differences have persisted, although they have changed over time. In 1982, of those surviving to age 20, white males could expect to live 8 year past age 65, white females 14.9 years, nonwhite males 3.8 years, and nonwhite females 11.8 years. These differences are also reflected in the probability of surviving to age 62 for those who have reached age 20. McMillen (1984) estimates that, in 1980, white females had the highest probability of surviving from age 20 to age 62 (0.89), followed by nonwhite females (0.87), white males (0.80), and nonwhite males (0.66). Thus, if greater life expectancy implies better health, a degradation in health status from white females to nonwhite males should exist. As shall be discussed later, such a degradation does not exist.

Although there are substantial differences by sex and race in the probability of reaching retirement age, in this paper we are concerned with the life expectancy and health status of those who reach age 62. However, before we can examine these further, it is necessary to discuss overall trends in life expectancy and mortality among different age groups over time. This is useful in understanding why life expectancy has changed in the past, and how it may change in the future.

The rate of improvement in life expectancy has varied considerably over this century. The most rapid gain in life expectancy at birth occurred from 1940 to 1954 as shown in chart 1. This gain was somewhat more accelerated for females, resulting in a further widening of the sex differential in life expectancy. From 1954 to 1968, the rate of improvement in life expectancy slowed for both sexes, but more so for males than females. (There is some recent indication that the sex differential in life expectancy may be decreasing. From 1978 to 1982, the annual rate of change for males has been 0.325 years, while that for females has

Chart 1. — Life expectancy at age 0, by sex and calendar year



Source: Faber and Wade (1983).

been 0.225 years (NCHS, 1984).) Table 1 presents average annual rates of change in life expectancy for selected periods by age and sex. We use social security actuarial data which, because it is based on Medicare program data, more accurately represents the actual age distribution of the population than do vital statistics data.

With the exception of the most recent period, improvements in female life expectancy have significantly outpaced males. Since 1968, the rate of improvement in life expectancy at birth has slowed more for females than males (35 percent of the rate prior to 1941 for females compared to 73 percent for males).

Of course, trends in life expectancy at birth have been dominated by improvements in survival at the early ages. Among the elderly, the picture is somewhat different. Faber and Wade published life expectancy annual trend data only for ages 60 and 65. Table 1 and chart 2 show that prior to 1941, life expectancy did not improve much for those surviving to age 65. Life expectancy for both sexes increased more rapidly from 1941 to 1953, about twice as fast for females as compared to males. From 1954 to 1968, the sex difference enlarged radically, a result of the differential risk of mortality from heart disease. Male life expectancy at age 65 actually decreased by 0.03 years annually while female life expectancy increased by 0.08 years annually. Whereas the rate of growth in life expectancy at birth was less after 1968 than from 1900 to 1940, for those surviving to age 65, the rate of growth in life expectancy after 1968 is higher than in the earlier period.

If we look at life expectancy at 60 years of age, a similar pattern exists. However, the rate of gain in life expectancy among males from 1968–80 as compared to 1940–54 is even faster than for males age 65. Nevertheless, the rate of improvement since 1968 in male life expectancy at age 60 continues to be outpaced by that of females though to a lesser extent than at age 65.

As noted above, this was not the case for life expectancy at birth which implies that the age dynamics of sex differences in life expectancy are worth examining further.

Table 2 presents annual rates of change in life expectancy at birth for four periods by race and sex. This data is based on Vital Statistics records. Improvements for nonwhites have been very rapid, about one and a half times that of whites, for each period, except the plateau from 1954 to 1968. During that period, life expectancy for black males decreased. In general, racial differences in the rate of improvement are independent of sex differences (i.e., there is no race-sex interaction). While these gains are impressive, even in 1982, black male life expectancy at birth (64.9 years) was still less than the retirement age. If the trends exhibited from 1970–82 continue, life expectancy of nonwhites at birth would catch up to whites within 2–3 decades. However, from 1980 to 1982, life expectancy from birth has improved less slowly for nonwhites than for whites (0.7 versus 0.5 years, respectively) (NCHS, 1984), which may indicate a much less optimistic trend. From this discussion, we have seen that there are significant period differences in the rate of life-expectancy gains and that although substantial race and sex differences exist, there is some indication that they have moderated recently.

Table 1.—Average annual change in life expectancy for selected periods, by age and sex

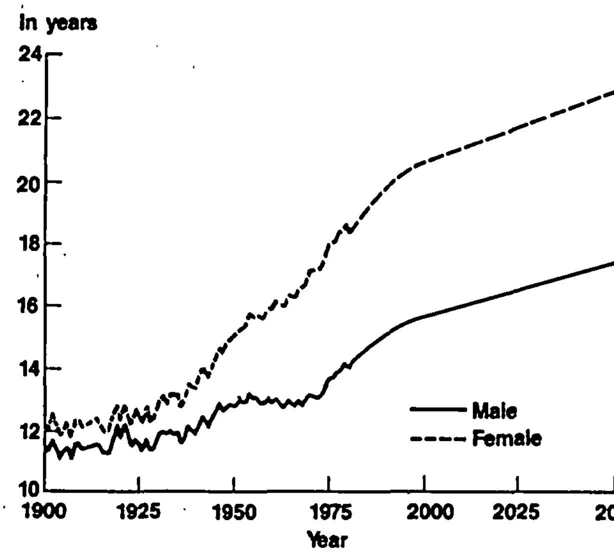
Period	Average annual change in life expectancy: Males	Females
A. At birth:		
1900–40	0.376	0.420
1940–54	.380	.500
1954–68	–.009	.104
1968–80	.278	.276
B. At age 65:		
1900–40	.014	.035
1940–54	.093	.166
1954–68	–.030	.082
1968–80	.103	.147
C. At age 60:		
1900–40	.017	.046
1940–54	.098	.189
1954–68	–.034	.066
1968–80	.132	.156

Source: Faber and Wade (1983).

Mortality Trends

Because life expectancy at a given age is measured using the cumulative survival probabilities computed over all older ages, the dynamics of mortality at specific ages are obscured. It is useful to examine previous trends in mortality at specific ages since this will provide a better sense of mortality risks in future periods, which is helpful in evaluating models of projected life expectancy.

Chart 2. — Life expectancy at age 65, by sex and calendar year



Source: Faber and Wade (1983).

Table 2.—Average annual change in life expectancy at birth for selected periods, by age, race, and sex

Period	Average annual change in life expectancy at birth			
	Whites		Nonwhites	
	Males	Females	Males	Females
1900–40	0.388	0.488	0.475	0.535
1940–54	.386	.507	.686	.786
1954–68	.000	.086	−.071	.114
1970–82	.292	.267	.458	.467

Source: Bureau of the Census (1975), NCHS (1984).

Crimmins (1981) analyzed trends in mortality rates from 1900 to 1978 by age, sex, and race. The pattern of change observed for life expectancy for the three periods discussed earlier are observed for mortality as well. Crimmins examined yearly average percent declines from base level mortality rates for these three periods. While mortality rates for each age, sex, and race group show the same general pattern of decline, plateau, and subsequent decline, there are significant differences in the rate of decline.

Because Crimmins' results for the most recent period of mortality decline are affected by nonrevised intercensal population estimates, we have extended the latter period from 1978 to 1982 (which avoids this problem). Chart 3 presents annual average percent declines from base level age specific mortality rates for the three 14 year periods 1940–54, 1954–68, and 1968–82.

Note that during the plateau period (1954–68), only the very young, under 15 years of age, experienced mortality declines. For the 15–44 and 85 or more age groups morality increased. Little change occurred for those ages 45–84. The mortality increase among 15–44 year olds is due to an increased rate of violent and external events. Among the oldest-old, 85 years and above, heart disease mortality increased substantially (Fingerhut, 1982).

Comparing the pre- and post-plateau periods, two aspects are notable. One is the failure of declines in the post-plateau period to keep pace with pre-plateau declines in children and young adults. Second, the rate of decline among adults over 35 years old is identical for the two periods. Previous conclusions by Crimmins (1981) and Rosenwaike (1980) that mortality declines among the extreme aged have since 1968 exceeded previous periods are not supported by more recent data. Their findings employed intercensal population estimates that substantially underestimated the population over age 74. Fingerhut (1982; 1984) has also noted that using revised population estimates virtually eliminates the variation among age groups over 64 in the annual percent change in mortality.

Sex: The previous discussion of life expectancy trends suggests that there have been substantial differences in the rate of mortality decline by sex. Charts 4 and 5 present the results of the analysis of age specific mortality trends for males and females, respectively. Note that mortality has declined faster from 1968–82 as compared to 1940–54 only for males ages 45–74, and only for females over 84 years old. For females between the ages 34–75, the rate of mortality decline has been less than in the pre-plateau period.

In examining trends in mortality sex differences, it is better to look at absolute, rather than relative changes. Table 3A presents the average annual rates of absolute change in mortality by age for males and females and table 3B presents sex differences in the rates of change by age for each of the three periods. During the 1940–54 period, the rate of change in mortality for females ages 15 and above exceeded that of males, with the exception of ages 35–44 and 85 and older. This is also true for the period 1954–68 with no exceptions. From 1968–82, however, the improvement in male mortality has clearly exceeded that of females at all ages except those over 74 years old.

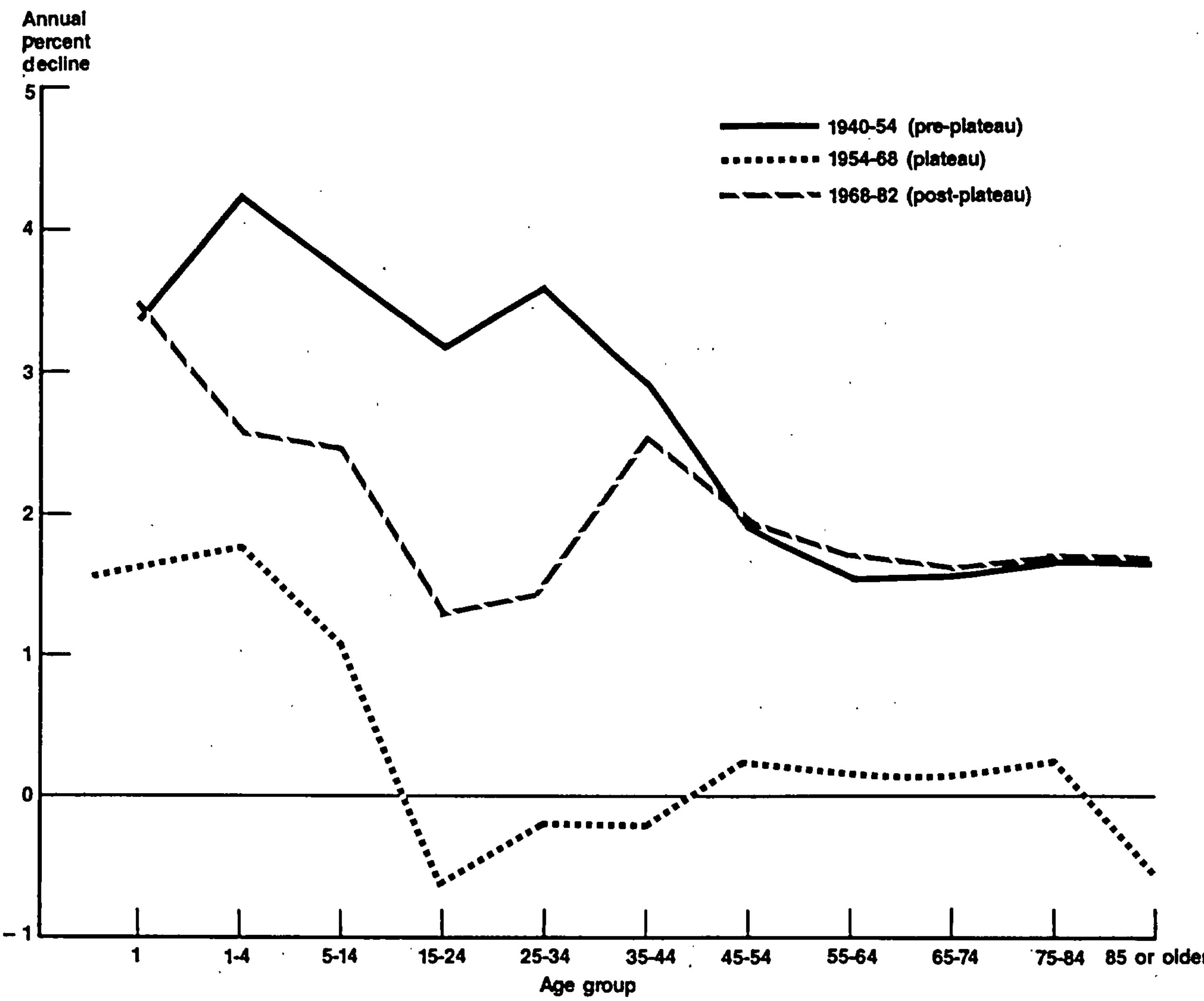
Recent evidence shows that male mortality has declined faster than female mortality even above the age of 74 from 1980 to 1982. Although this is an insufficiently long enough period from which to generalize, it may signal improving survival for males relative to females. These trends are important because they may have implications for various hypotheses concerning the relationship of mor-

Table 3A.—Average annual rates of decline in mortality, by age and sex, 1940–82

[Based on deaths per 100,000]

Age group	Males			Females		
	1940–54	1954–68	1968–82	1940–54	1954–68	1968–82
Less than 1	205.821	53.264	90.793	159.971	41.329	66.093
1–4	13.079	2.157	2.493	11.371	1.936	2.079
5–14	4.114	.564	1.300	3.493	.486	.793
15–24	4.657	−1.364	2.400	8.114	.079	1.057
25–34	10.157	−1.271	2.386	11.571	.679	2.314
35–44	15.064	−2.057	9.529	14.814	.471	6.700
45–54	18.693	−.114	19.164	20.836	2.864	9.929
55–64	25.557	−6.421	43.429	40.264	7.893	15.164
65–74	42.179	−26.807	79.993	88.793	21.314	42.571
75–84	166.129	−29.614	130.271	195.907	46.264	132.679
85 or older	421.064	−213.636	282.143	358.507	−48.929	323.557

Chart 3. — Annual percent decline in age-specific total mortality rates for three selected periods



Source: Grove and Hetzel (1968), NCHS (1982a, 1984).

tality and morbidity. If the risk of mortality is declining more quickly for males than females, what does this imply for morbidity? Are males becoming healthier or sicker compared to females?

Race and Sex

Analysis of trends in mortality by race and sex indicate the same general pattern for each of the four periods. Mortality increased most for nonwhite males during the plateau period. Absolute declines have been greatest for nonwhites of both sexes, which would also be of importance when examining morbidity trends. Morbidity trend data is lacking by race, and for this reason only, we do not explore this further. We do note, however, that such data would be valuable for future research.

To summarize, a distinct disruption in the rate of decline in mortality risks has been observed in the last half of this century. Although this pattern holds for both sexes, the arrest and subsequent decline in mortality has been greater for males, and especially nonwhite males.

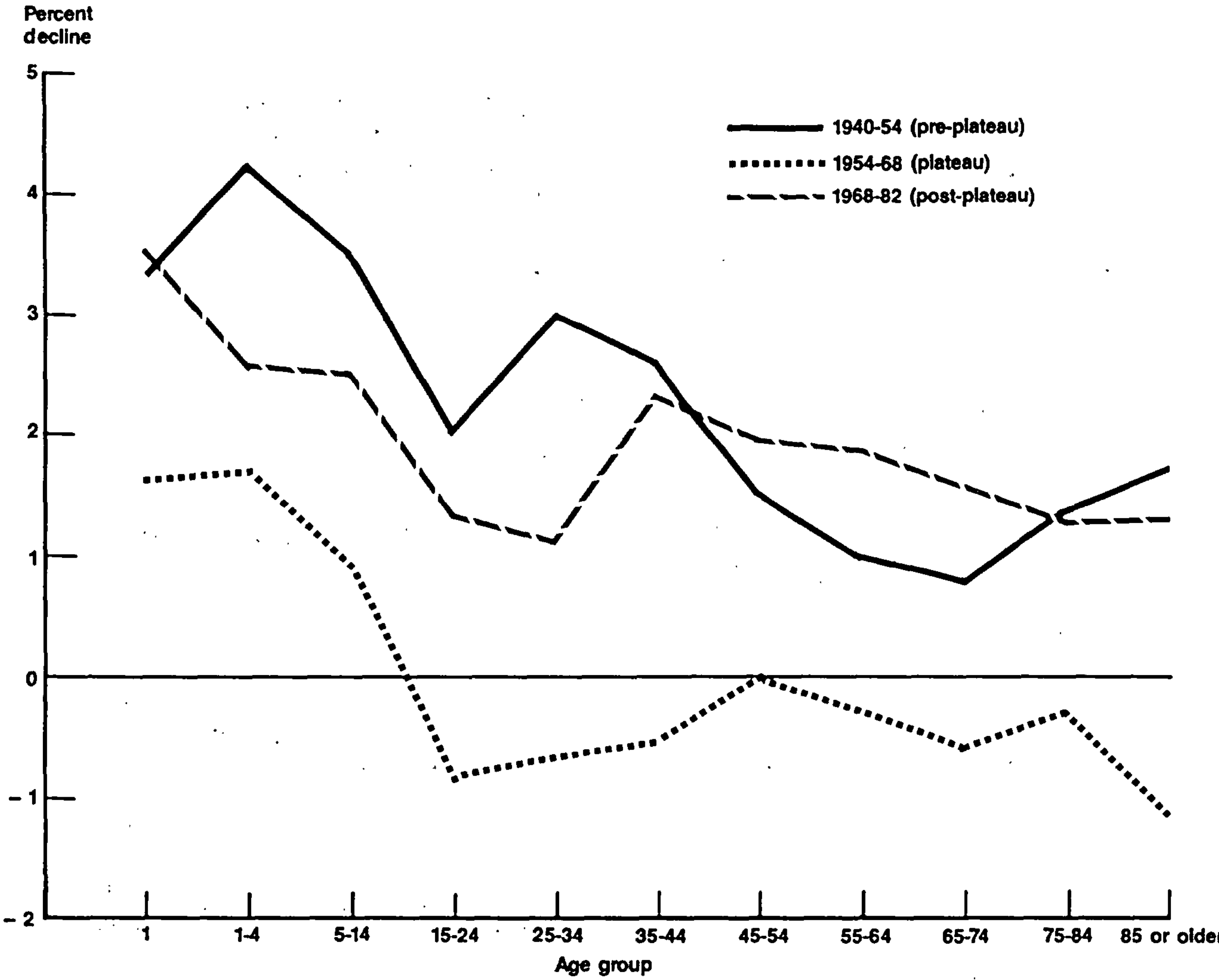
More than 67 percent of the decline in mortality from 1968 to 1980 among males has been due to declines in cardiovascular mortality, while the comparable figure for females is 65.6 percent. Heart disease itself makes up 44.8 percent of the total decline in mortality of males, and 38.0 percent of females. Stroke represents a larger part of the

Table 3B.—Sex differences in mortality decline, 1940–82 (male minus female rates of decline)

Age group	1940–54	1954–68	1968–82
Less than 1	45.850	11.936	24.700
1–4	1.707	.221	.414
5–14	.621	.079	.507
15–24	−3.457	−1.443	1.343
25–34	−1.414	−1.950	.071
35–44	.250	−2.529	2.829
45–54	−2.143	−2.979	9.236
55–64	−14.707	−14.314	28.264
65–74	−46.614	−48.121	37.421
75–84	−29.779	−75.879	−2.407
85 or older	62.557	−164.707	−41.414

Source: Grove and Hetzel (1968), NCHS (1982, 1984).

Chart 4. — Annual percent decline in age-specific total mortality rates of males for three selected periods



Source: Grove and Hetzel (1968), NCHS (1982a, 1984).

total decline for females (21.9 percent) than for males (17.5 percent). Thus, while there have been differences in the rates of mortality decline during the pre- and post-plateau periods between the sexes, the nature of declining mortality is quite similar.

There is an aspect of these trends that does not seem to have been acknowledged in the literature. Many other causes of death exhibit trends similar to those seen in total mortality. Accidents, for example, declined 23.6 percent from 1940 to 1954, increased 2.9 percent from 1954 to 1968, and declined by 30 percent from 1968 to 1982 (for a thorough discussion of trends in violent deaths, see Holinger and Klemen, 1982).

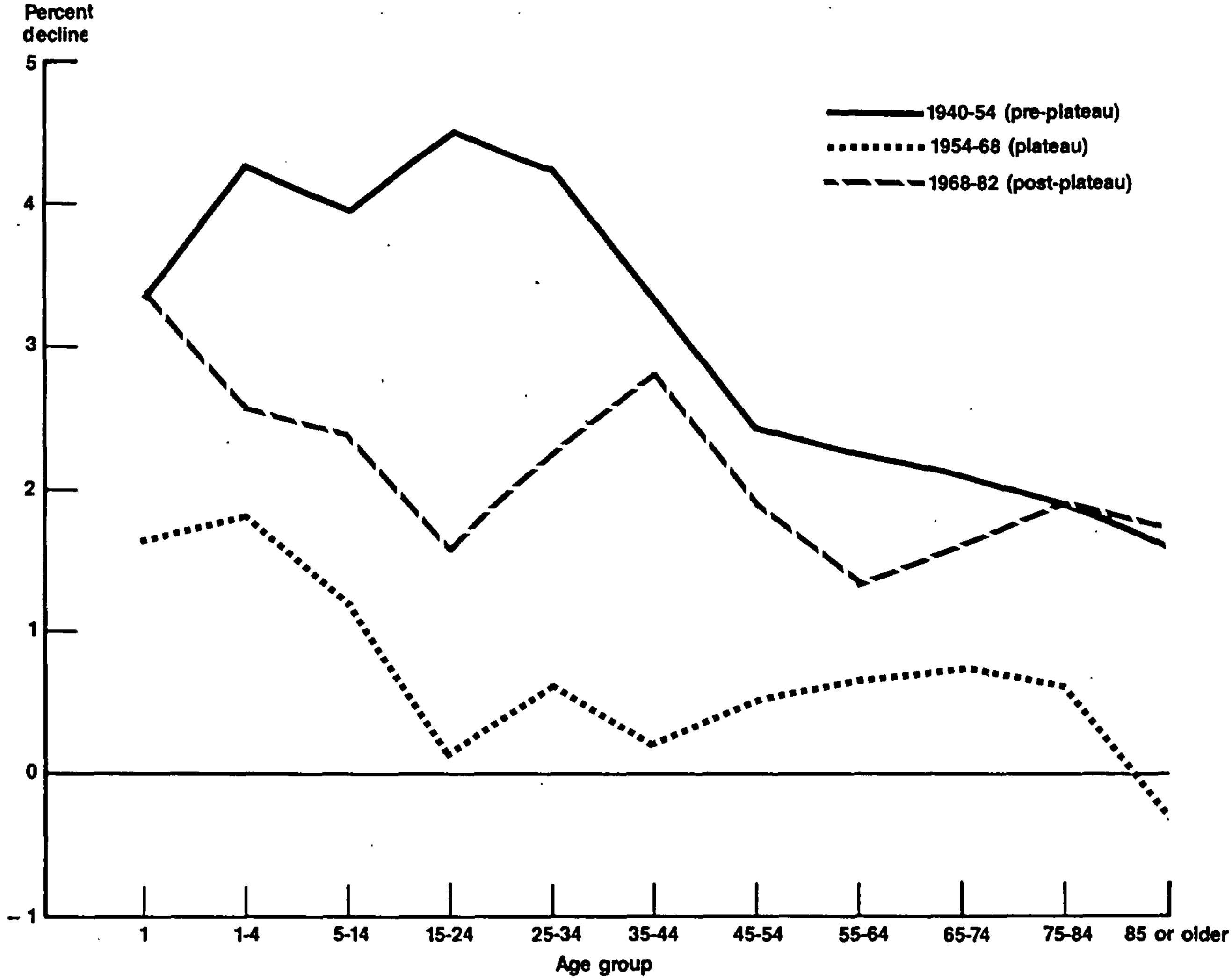
It could be that some unknown factor influenced many different types of death simultaneously. However, there is a more plausible explanation which recognizes that illness is itself a life event that causes additional stress and hardship for people. It is possible that people with chronic ailments are more likely to experience accidents than the healthy population. If this is so, an epidemic of heart disease might have a noticeable influence on accidental deaths. People limited by chronic conditions do have higher rates of injury than the non-limited population, especially those who are not completely disabled (Feller, 1981).

While heart disease is declining for all ages, a notable difference in trends by age is that of cancer. While cancer has continued to increase for cohorts above age 44, it has been declining since 1968 for ages 25–44.

Projected Life Expectancy

Several projections of life expectancy have been made recently, each using various assumptions to project mortality rates into the future. Although some projections are available by sex, no recent projections, to our knowledge, are available by race. Table 4 presents three sets of projections of life expectancy to the year 2000. These projections are influenced by the assumptions made concerning future trends in mortality.

Chart 5. — Annual percent decline in age-specific total mortality rates of females for three selected periods



Source: Grove and Hetzel (1968), NCHS (1982a, 1984).

Rice et al. (1983) and Crimmins (1981) assume that mortality will continue to decline at post-plateau rates by age until the year 2000. Crimmins, however, uses a component-causes method of projecting life expectancy, which projects separate trends in mortality for four major causes of death and a residual component within each age group. This produces a slightly higher estimate of life expectancy than Rice et al. It is also biased upward due to Crimmins' use of unrevised population estimates as her mortality rate denominators.

Table 4.—Life expectancy at birth and at age 65 in 1980 and projected under various assumptions, by sex

Life expectancy assumptions and source	Year	Total	Males	Females	At age 65	Males at age 65	Females at age 65
Base life expectancy	1980	73.7	70.0	77.5	16.4	14.1	18.3
Mortality continues to decline at '66–76 rates by age (Rice et al., 1983)	2003	79.3	74.2	84.2	(1)	16.6	23.9
Mortality continues to decline at '68–77 rates by cause and age (Crimmins, 1981)	2000	80.4	(1)	(1)	21.8	(1)	(1)
At one-half the rate of heart disease.....	2000	77.8	(1)	(1)	19.3	(1)	(1)
Mortality continues to decline gradually from '68–80 rates to converge to more moderate levels by 2008 by cause and age (Haber and Wade, 1983)	2000 2027	(1) (1)	73.7 75.1	81.1 82.6	(1) (1)	15.7 16.6	20.7 21.9

[1]Not available.

Crimmins made an alternative projection, assuming that heart disease mortality would decline at only one-half its previous rate. This resulted in a smaller projected increase in life expectancy, but still 4.1 years greater at birth than in 1980.

Faber and Wade (1983) postulate annual percentage improvements in mortality by sex and cause of death for the year 2008 and force the rates of mortality change to conform to these constraints gradually from the year 1980. Although this method is arbitrary, it is one way of projecting slower rates of mortality decline, and produces slightly lower estimates of life expectancy at birth and at age 65 than Rice et al. These projections yield somewhat different estimates of the sex differential in life expectancy. In 1980, the difference between males and females at birth was 7.5 years, at age 65, it was 4.2 years. According to Rice et al.'s projection, this difference could increase to 10 years at birth and 7.3 years at age 65. Faber and Wade project a constant difference at birth of 7.4 years, and a slight increase to 5.0 years at age 65.

In sum, the range of increases in life expectancy from 1980 to the year 2000 at birth is 3.7–4.2 years for males, 3.6–6.7 for females, and at age 65, 1.6–2.5 years for males and 2.4–5.6 years for females. Although projections by race do not exist, past mortality trends would seem to imply faster improvements in life expectancy for nonwhites, but this trend may be reversing. If future cohorts experience faster reductions in mortality than in the past, the above projections will turn out to be conservative.

Let us now look to morbidity trends. In doing so, we would like to draw some inferences as to the relationship of mortality and morbidity for the fatal diseases. On the basis of mortality trends, we would expect to see some differences in morbidity trends by age, race, and sex. However, we will also need to examine trends in nonfatal diseases which make up the bulk of disability in the population, and are therefore, the major influence on the ability to work.

Morbidity and Health Status Trends

Two published analyses of morbidity, health status and disability trends are particularly relevant to this paper. Both of these studies have examined various indicators derived from the Health Interview Survey (HIS).

The Health Interview Survey provides consistent and reliable information on a number of health status and morbidity measures. Its consistency is due to a core set of questions that have remained virtually unchanged since the survey was first introduced in 1957. Nonetheless, there are several problems with the data. First, disease specific prevalence has been consistently collected on an annual basis only for conditions that cause limitation of activity. Second, changes in the survey design to improve the reporting of non-limiting chronic conditions introduces inconsistencies over certain periods. Finally, information is self-reported and not verified by clinicians. Studies comparing interview responses with medical records have indicated that the HIS data suffer from a substantial amount of under reporting. However, the agreement between HIS data and medical records is highest for the most prevalent chronic illnesses, with the exception of cancer (NCHS, 1965; 1967; 1972; 1973). Thus, while the data have some limitations, there is reason to believe that they are useful for our purposes.

In the first of the two studies, Colvez and Blanchet (1981) examined trends in short term and long term disability for the period 1966–76. They found that for the total population, the number of bed disability days rose by 13 percent, restricted activity days by 19 percent and the prevalence of all long term disability by 25 percent. The prevalence of complete and partial disability rose by 67 percent. Colvez and Blanchet also examined trends in conditions causing limitation of activity.

In the second published analysis, Verbrugge (1984) reviewed trends in a much wider set of indicators derived from the HIS over the period 1958–81. These included self-rated health status, incidence of acute conditions and associated disability, restricted activity and bed disability days, limitations in usual activity due to all chronic conditions, the prevalence of chronic conditions and the prevalence of limitations due to specific conditions. Since Verbrugge's analysis neither differs in method nor findings from Colvez and Blanchet and is more comprehensive, we will focus on her study.

Verbrugge observed that incidence rates for all acute conditions have declined for men and women ages 45 and older. Most of this decline is due to a decline in acute respiratory conditions, which have been the cause of the greatest decline in mortality over this century. Thus, at least in the case of acute conditions, reductions in mortality are associated with reductions in incidence. Verbrugge notes, however, that short term disability associated with acute conditions (restricted activity and bed disability days) has not declined and concludes that middle age and older individuals are reducing activities more than ever before for acute conditions. Interestingly, short term disability due to acute conditions fell from 1957 to 1967, but has increased since then. The same trends are observed for younger adults (17–44), though they are less pronounced.

Verbrugge also finds, as first noted by Colvez and Blanchet (1981), that both short term and long term disability due to acute and chronic conditions have increased over time. Restricted activity days due to all conditions, after declining between 1958 and 1970, have increased substantially since 1970 for ages 45–64 and 65 and older. This pattern is similar to that for acute conditions alone. Work-loss rates, which are very low compared to the average number of restricted activity days (4.9 and 19.1, respectively, in 1981), have declined very slightly for older working men, but not for working women. More serious morbidity, as measured by bed disability days, has increased moderately for middle-aged men, and remained constant for older men and women over 64. Younger adults also show a moderate increase in bed disability days. Despite sex differences in mortality trends, no sex differences in these disability indicators are apparent. Why are disability days increasing? These trends could be due to increasing incidence or prevalence of chronic disease or because of changing health attitudes toward disease.

If people reduce activities at earlier stages of a disease or cut down activities due to flare ups of chronic conditions, limitation and restricted activity rates would increase. She maintains that people are probably more likely to adopt the sick role than in the past; that more social and economic supports are available for those who do; and that medical theories about the progression of chronic illness and reduction of activity as well as more empathetic public attitudes encourage increases in both short and long term disability.

Changing attitudes, however, cannot explain all of the increase in long term disability. Complete disability, the inability to perform one's usual activity due to a chronic health condition, has increased dramatically since the late 1950's for middle-aged people and, after decreasing somewhat from 1960 to 1970, has begun to increase again for those 65 and older after 1970. It is unlikely that such severe role accommodations would be made simply on the basis of attitudinal changes. A commonly raised argument is that disability has increased over time due to attitude changes prompted by the liberalization of disability benefits (Sunshine, 1981). However, disability trends in the HIS have persisted, despite the recent decline in social security disability beneficiaries. Thus, although changing attitudes are important, they do not fully account for HIS disability trends.

An alternative argument can be proposed that is consistent with increased restriction for both acute and chronic conditions. It has long been recognized that chronic ailments greatly increase the risk of fatality from influenza and possibly other acute respiratory ailments (Collins and Lehman, 1953). It is also likely that people suffering from non-fatal chronic diseases such as arthritis are more likely to experience difficulty recuperating from injuries. It is therefore possible that much of the restricted activity for acute conditions could occur among individuals with chronic disease. As people live longer, and are at greater risk of developing a limitation due to chronic conditions, the burden associated with acute conditions could increase, despite their declining incidence. Verbrugge did not investigate this possibility, which we feel needs to be evaluated before any greater weight is given to behavioral changes versus increased prevalence of chronic disease as explanations of these trends. It would be useful to decompose these trends in short term disability with respect to chronic conditions only, acute conditions only, and chronic and acute conditions combined. It would also be useful to decompose them further into fatal and non-fatal chronic and acute respiratory conditions and injuries. Since this can only be achieved by analyzing the HIS public-use tapes, this suggestion is relegated to future research.

Ycas (1985), in an unpublished monograph, has examined HIS trends in limitation by single years of age and sex and finds similar increases. For men, the prevalence of complete disability at age 62 has increased 73 percent from 1969 to 1981 and 35 percent for the age group 62–67. No clear trend is evident in partial disability. For females ages 62–67, the increase has been about 20 percent for both partial and complete disability. It is difficult, however, to place much confidence in these estimates since they are for single years of age for which standard errors are large.

Also, since there is a fairly high level of annual variability in the HIS data, due in part to fluctuations in acute conditions and changes in survey protocol, robust estimates of the degree of trend would be preferable. Ycas fitted linear and nonlinear time trends to the HIS data over the period 1969–81. For the population 62–67 years of age, Ycas finds significant (less than 0.05) positive linear trends for restricted activity days, bed disability days, work-loss days, hospital admissions, prevalence of limitation, and number of conditions reported to cause limitation. When a quadratic term was included, in many cases, a negative coefficient was obtained, implying that health status may have recently begun to improve for this age group. However, it is not unusual for HIS data to show a few decreasing years in an otherwise increasing series. The possibility that the regression results can be affected by one or two points in a very short series is very high. It is not clear at all, given the very short series that Ycas examined, that these points represent a significant change in trends.

Trends in the prevalence of specific diseases and impairments are perhaps less equivocal indicators of morbidity than self-assessments of health status. Both the prevalence and limitation rates of most chronic diseases associated with high mortality—diabetes, heart disease, bronchitis, emphysema, stroke, hernia, hypertension, and arteriosclerosis—have increased over time among middle-aged and elderly persons (Verbrugge, 1984).

Diabetes has increased in prevalence at all ages. In fact, the relative increase has been greatest for people under 45 years of age, for whom rates tripled between 1959 and 1978. Wilson and Drury (1984) conclude that both increased detection and survival are responsible. From HANES [the Health and Nutrition Examination Survey] data, there is evidence that a substantial number of diabetics remain undetected. At the same time, the rate of limitation due to diabetes has increased.

The prevalence of limitation due to cancer has increased for middle and older ages, but prevalence for those not limited by this disease is unavailable. These are all conditions for which mortality has declined during the same time frame, with the exception of cancer. Heart disease prevalence has increased 35 percent from 97.4 per 1,000 in 1972 to 131.8 per 1,000 in 1979 among men aged 45–64. The percent of all males in this age group with a limitation due to this condition has increased from 4.3 to 6.1 percent over the period 1962–78. Other diseases have increased in mortality and morbidity, such as diseases of the arteries (other than arteriosclerosis), bronchitis, emphysema, asthma, and cirrhosis of the liver (ages 65 and older). There is only one case where mortality has risen, but morbidity declined (cirrhosis, ages 65 plus) and two cases where both mortality and morbidity have declined (hernias and nephritis and nephrosis).

A drawback to Verbrugge's analysis is that she did not provide any tests of whether the trends for conditions were significant. This is made more problematic by the fact that the HIS moved to a different sampling scheme that increased the variance of estimates over previous years (Wilson and Drury, 1984), but it is likely that the direction of the trends is valid, at least for the most prevalent conditions.

Thus, in general, during the recent period of mortality decline, the prevalence of fatal disease and short term disability has increased for all ages. If this represents a true increase in morbidity, it would seem to refute Fries' position that a compression of morbidity is occurring, since reductions in prevalence are predicted for the middle age population.

Non-fatal disease and impairments have also increased in prevalence. Arthritis, which is seldom the cause of mortality, has risen in prevalence and as a cause of limitation. Certain skin conditions and respiratory conditions that are seldom causes of death have also increased. However, a few impairments have decreased in prevalence. Impairments from all causes of the lower extremities and hips have decreased by about 25–30 percent for all ages, and visual impairments have decreased for those 65 and above. Other data on impairments show no consistent trends.

Verbrugge's analysis makes it clear that despite declining mortality, the prevalence of morbidity and disability have increased for both fatal and nonfatal conditions. There are several plausible explanations for this apparent rise in morbidity and disability. First, increasing disease duration may mean that those with illnesses and disabilities are surviving longer. Second, illness incidence may be increasing. Third, changes in reporting could also account for part of these trends. Finally, data collection changes may have biased the data. Unfortunately, only the latter factor can be ruled out definitively.

Increased survival probably explains only a part of the increase in morbidity. For example, mortality from heart disease, the most important cause of death in males 45–64, was in 1970 3.8/1,000, and in 1979, 2.9/1,000. Yet prevalence rose from 97.4/1,000 in 1972 to 131.8/1,000 in 1979, an annual rate of increase 55 times higher than the decline in mortality. It is clear that increased duration can't explain this rise. Even if all survivors survived the full 7 year period, this would not account for the increase in prevalence. Either incidence must have increased as well, or reporting has improved. Survival has improved for some cancers, such as colorectal, breast, and uterine cancers, but has remained unchanged for stomach and lung cancers (Shapiro, 1983). And, as mentioned earlier, survival rates for diabetics have improved.

The second possible explanation—increased disease incidence—is more difficult to assess. Unfortunately, the Health Interview Survey does not publish estimates of the incidence of chronic conditions, and there is no generalizable source of incidence rates for all chronic disease. Hypertensive heart disease has increased from 1970 to 1979 by 69 percent for ages 45–64, and 93 percent for those 65 and above. Since mortality for hypertension is low, this increase in hypertension prevalence could reflect an increase in its incidence, as well as increases in reporting and awareness of the disease.

However, data from the National Health and Nutrition Examination Survey indicate that the true prevalence of hypertension has not changed significantly (Rowland and Roberts, 1982). Since mortality due to hypertension is declining, it is safe to assume that incidence is also declining at a comparable rate.

Although many studies have indicated a decline in the incidence of heart attacks, which may be responsible for a good part of the decline in mortality (Gillum, Folsom, and Blackburn, 1984), this does not imply that the incidence of chronic heart disease has necessarily decreased, only that acute myocardial events have.

Data on cancer incidence is variable. Colorectal and stomach cancer incidence have declined and because survival has not improved, declining mortality is largely a function of declining incidence. Mortality for breast cancer has remained unchanged, reflecting increases in incidence as well as survival. Uterine cancer mortality has declined, reflecting greater survival and moderately increased incidence (Shapiro, 1983).

Thus, the picture on incidence and survival is variable and incomplete. Although it seems that both reductions in incidence and improvements in survival are occurring for some diseases, it is impossible to assign a greater role to one over the other. This is especially true for chronic diseases as a whole where the data is very incomplete.

Although previous studies (Lilienfeld and Lilienfeld, 1980) have indicated that heart disease has been underreported in the HIS, no recent studies have been conducted (Wilson and Drury, 1984). This might explain the large increase in reported heart disease prevalence. If people are more aware of their conditions, underreporting should have declined over time. Finally, data collection is undoubtedly important, but cannot solely explain the observed trends. Survey changes may cause discrete jumps, but are unlikely reasons for longer term trends. Wilson and Drury (1984) also discuss a number of changes that have transpired in the collection of chronic illness prevalence and disability information in the Health Interview Survey. However, there have been no changes in survey methodology that would explain the overall trends in morbidity prevalence or disability.

We conclude that the rise in prevalence is probably due to increased incidence for certain diseases like cancer and non-fatal conditions, and, in general, improved survival, and increased awareness. With the data at hand, it is impossible to assign any greater weight to any of these hypotheses.

As mentioned earlier, Verbrugge also argues that the rise in short and long term disability may reflect increased accommodation to disease. The accommodation theory would seem to apply to both long term as well as short term disability. Examination of the rise in restricted activity days, however, indicates that virtually all of the increase hs occurred among the population limited in activity. As table 5 indicates, regardless of age, most of the increase in restricted activity has occurred among persons with activity limitations over the period 1974 to 1979. Since activity restriction is occurring more among those limited in performing usual activities, and not among those who are not limited, this argues against the accommodation theory. If the accommodation thesis is correct, we would expect some short term role reductions for people who are not limited, since many of these people, especially at older ages, do have chronic ailments, some of which may be severe but not severe enough to cause permanent activity reductions. Rather, the data seem to suggest that people of all ages who are limited in activity are experiencing greater restriction. This could be due to people surviving longer with chronic diseases who would also be expected to have higher rates of short term disability.

No significant differences can be observed in bed disability days for either the non-limited or the limited population over this same period. However, it must be pointed out that chronic disease much more often results in non-bed restriction of activity than bed restriction. This can be seen by the much steeper age curve of restricted activity days as compared to bed-disability days (Butler and Newacheck, 1981). Thus, if people are surviving longer, it is plausible that the greatest impact would be seen in restricted activity days rather than bed disability days.

Up to this point, we have discussed trends in population mortality and morbidity. Despite declining mortality, there is little indication that health status has improved. The data seem to contradict the prediction of Fries that prevalence should decline as life expectancy increases, and at odds with Manton's position that disability prevalence should be declining. More rigorous tests of these positions would re-

Table 5.—Number of restricted-activity days per person per year, by chronic activity limitation status, sex, and age, 1974 and 1979

Sex and age	All persons			With no limitation of activity			With limitation of activity: Total			With limitation of activity: Limited, but not in major[1] activity			With limitation of activity: Limited in amount or kind of major activity			With limitation of activity: Unable to carry on major activity		
	1974	1979	Percent change	1974	1979	Percent change	1974	1979	Percent change	1974	1979	Percent change	1974	1979	Percent change	1974	1979	Percent change
	Restricted-activity days per person per year																	
Both sexes																		
All ages	17.2	19.0	2.8	10.1	10.5	0	60.4	69.1	[2]8.7	26.3	33.9	7.6	55.7	63.8	8.1	106.5	115.4	8.9
Under 17 years	10.7	11.0	.3	9.9	9.9	0	33.2	37.5	4.3	25.2	29.0	6.8	38.4	43.4	5.0	58.5	58.3	−.2
17–44 years	13.5	15.0	1.5	9.8	10.6	.8	52.0	60.1	[2]8.1	26.0	33.8	7.8	53.8	61.2	7.4	124.7	134.1	9.4
45–64 years	23.6	26.0	2.4	10.4	10.4	0	65.2	75.3	[2]10.1	27.8	34.0	6.2	58.9	69.3	10.4	114.9	121.3	6.4
65 years and over	38.0	41.9	3.9	12.5	12.4	.1	68.1	76.4	[2]8.3	25.4	37.1	11.7	57.4	64.6	7.2	98.5	108.0	9.5
Male																		
All ages	15.6	16.9	1.3	9.4	9.3	−.1	53.1	60.6	[2]7.5	21.4	25.8	4.4	38.6	42.0	3.4	91.1	101.7	10.6
Under 17 years	11.1	10.8	−.3	10.3	9.8	.5	31.3	32.0	.7	23.9	24.1	.2	37.6	38.1	.5	(3)	(3)	(3)
17–44	11.4	13.0	−1.6	8.7	9.0	.3	41.5	51.6	[2]10.1	20.3	25.3	5.0	39.2	44.7	5.5	103.0	124.7	21.7
45–64 years	22.0	24.0	2.0	9.9	9.0	.9	58.0	68.5	[2]10.5	20.6	27.2	6.6	40.6	48.8	8.2	99.2	105.3	6.1
65 years and over	36.8	38.2	1.4	10.5	9.8	.7	63.4	67.5	[2]4.1	23.6	26.1	3.5	35.2	31.9	−3.3	84.1	94.0	9.9
Female																		
All ages	18.7	21.1	2.4	10.7	11.6	.9	67.4	77.1	[2]9.7	31.0	41.2	10.2	65.8	76.5	10.7	150.1	153.2	3.1
Under 17 years	10.3	11.2	.9	9.4	10.0	.6	35.7	44.8	9.1	26.7	35.6	8.9	39.3	50.7	11.4	(3)	(3)	(3)
17–44 years	15.5	16.9	1.4	11.1	12.1	1.0	62.4	69.0	[2]6.6	33.0	43.3	10.3	64.6	74.2	9.6	167.5	159.0	−8.5
45–64 years	25.1	27.8	2.7	10.9	11.6	.7	72.3	82.1	[2]9.8	35.1	39.9	4.8	69.7	80.7	11.0	177.3	184.9	7.6
65 years and over	38.8	44.5	5.7	13.7	14.0	.3	72.0	83.4	[2]11.4	26.2	42.1	15.9	66.0	77.4	11.4	135.5	140.4	4.9

[1]Major activity refers to ability to work, keep house, or engage in school or preschool activities.

[2]Trend different from zero, probability less than 0.01 (calculated for all types of limitation only).

[3]Greater than 30 percent relative error.

Source: Wilder (1976), page 22; Feller (1979), page 21.

quire longitudinal data on individuals. Verbrugge's analysis indicates no improvement in health even among younger cohorts. A similar trend has been noted by Newacheck et al. (1984) for children. Thus, even when we look at health status trends in younger cohorts, the data is not promising. We next discuss what is known about the determinants of mortality and health status and their demographic correlates.

Determinants of Mortality, Morbidity, and Health Status

The determinants of health have been identified through studies of disease occurrence in various populations, laboratory and natural experiments, survey research, and clinical and administrative records. Each of these sources of data has advantages and disadvantages. Since there is no one source that is definitive, all will be considered. The significance of certain factors has varied over time as the structure of mortality has changed. It should also be kept in mind that certain risks often interact to increase risk more than the sum of their separate effects. The effect of specific risk factors on mortality and morbidity trends is discussed below.

Genetics

Ultimately, length of life is limited by the genetic constitution of individuals. Genes determine longevity by placing constraints on the functioning of immunological and homeostatic mechanisms (McKeown, 1979). It is unlikely that these constraints on longevity can be extended unless the genes themselves or mechanisms of genetic regulation are altered.

The most significant class of diseases determined at fertilization are polygenic conditions that are manifested late in life such as degenerative impairments of vision and hearing. This class of conditions constitutes the genetic mechanisms underlying senescence.

More numerous by far are many common chronic diseases such as cancer, circulatory and lung diseases, and diabetes that arise through genetic susceptibility to certain environmental conditions. Their etiology is complex and the genetic mechanisms underlying chronic disease are currently obscure and are unlikely to provide a basis of intervention in the near future (McKeown, 1979).

While morbidity may be related to interaction between genetic coding and environmental demands, it also seems to depend on behavior and general lifestyle, social, and psychological factors. It is difficult to isolate biological environmental risks from other social and behavioral risk factors because social organization structures the environment and affects the prevalence of many forms of behavior. Also, many of these factors have varied together over time. Let us consider the role of environment in more detail before moving on to a discussion of these other factors.

Environment

Reductions in infectious diseases, particularly respiratory infections, are believed to have resulted in part from improvements in working and residential conditions. (McKeown, 1979; Omram, 1979). These improvements have attended economic modernization giving rise to an empirical association between economic affluence and mortality reductions that is observable historically within developed countries and among countries at various levels of economic development (Preston, 1975; 1977).

In the affluent countries, new illnesses have emerged, particularly circulatory diseases and cancer, which seem to be related to an excess, rather than deficit, of resources. It appears that some of the very factors responsible for declines in infectious mortality are behind the emergence of diseases of affluence: over-nutrition (particularly excess saturated fat consumption) and sedentary work activity. Both are related to elevated cholesterol and hypertension which are significant risk factors in heart disease. Additionally, environmental exposure to carcinogens and toxins are consequences of modernization. All are instances of environmental risks associated with affluence.

Behavior and Lifestyle

Behavior and lifestyle seem to be highly implicated both in the incidence and progression of chronic diseases. Smoking, for example, is the largest single preventable cause of illness and premature death in the U.S. (NCHS, 1983). Smokers have an overall mortality rate 70 percent higher than nonsmokers. Smoking is the most important risk factor in lung cancer and is a significant risk factor in heart disease. Smoking acts synergistically with alcohol to increase risks of cancer of the mouth and throat and contributes to accidental deaths. Smoking also illustrates the potential for interaction between behavior and environment. Epidemiological studies have indicated significantly increased risks among those exposed to industrial pollutants and atmospheric pollutants in urban areas who smoke (Shapiro, 1983) relative to non-smokers.

Smoking is a risk factor not only in heart disease, but respiratory cancer as well. Although the prevalence of all smoking has declined, respiratory cancer deaths have increased in time. Perhaps this cause is more closely related to the prevalence of heavy smoking, which has increased in time.

As mentioned earlier, among the cohort ages 25–44, both heart disease and cancer are declining. This contrasts with increasing cancer mortality trends for ages 45 and above. Smoking prevalence has declined as well for this younger cohort, and a greater proportion of adults are entering this cohort never having smoked. Furthermore, there are strong socioeconomic differentials in smoking trends. Reductions in smoking have been greatest for the more highly educated (NCHS, 1982b).

Exercise, aerobic activity in particular, has increased, but, as Shapiro (1983) points out, this change has involved only certain population groups and is not widespread. The longitudinal impact of changes in exercise habits on disease patterns is not established.

More freedom exists today in choice of dietary practices, and there has been a noticeable decrease in consumption of some sources of saturated fat and cholesterol (risk factors in heart disease) such as eggs and butter. However, red meat consumption has increased, as has total fat consumption, continuing the trend of excess caloric consumption.

Rowland et al. (1983) have examined changes in three major modifiable risk factors for adults 35–74 years of age over the period 1976–80. Over this period, elevated hypertension decreased substantially for white and black males and females. No significant changes in serum cholesterol were found. The prevalence of light to moderate smokers declined for men and black women, but not white women. However, the prevalence of heavy smokers increased for all groups. Using a multiple logistic risk function of coronary heart disease mortality based on results from the Framingham Heart Study, Rowland et al. predicted 41 percent of the decline in national rates of heart disease mortality for white men, 44 percent for white women, 67 percent for black women and 81 percent for black men. While the methodology is not definitive, the analysis does suggest that life-style modifications can have a dramatic benefit on population mortality due to heart disease.

Some positive changes in personal health habits are taking place, but whether this implies that a "compression of morbidity" is occurring remains unclear. The benefits of any change in behavior among young age cohorts would be felt throughout the middle and older years in terms of delayed incidence of heart disease and other chronic diseases related to lifestyle. This would mean that younger birth cohorts may face lower mortality risks than older cohorts have experienced, if the adoption of high risk behavioral practices can be prevented early in life.

This would result in even faster declines in mortality at the middle and older ages and a faster rate of growth in life expectancy than that predicted by assuming that mortality declines will continue at their present rate.

Social and Psychological Factors

Social support and coping are two factors that are particularly important in stress-linked disease processes. Many chronic diseases appear to be linked to stress, including heart disease, cancer, stroke, ulcers, etc. Both social support and coping appear instrumental in reducing the manifestations of stress (Pearlin et al., 1981).

With respect to heart disease, evidence seems most consistent that adverse risk is associated with hard-driving, compulsive behavior (Jenkins, 1976; 1982). It is not clear to what extent this trait is a random characteristic of individuals, is learned behavior, or is culturally linked. Individuals differ in their predisposition to adopt the Type A behavior pattern and environments differ in their ability to induce such behavior. Type A behavior has been shown to significantly increase adverse risk of heart attack and heart disease deaths in several prospective studies (Jenkins, 1982).

Another factor implicated in heart disease is work overload (Jenkins, 1982). Work overload may occur from working extended hours, incurring an increase in job responsibility, or being locked into a job with little responsibility. Occupational stress has been linked to coronary heart disease (CHD), which has a higher prevalence among males 35–64 years of age, and may be related to other chronic diseases as well (House, 1974). Workload and job pressures have been related to changes in heart disease risk factors. An early and well-known study of tax accountants observed their serum cholesterol levels increased as the April 15th tax deadline approached (Friedman et al., 1957). House (1972) showed in a community study that job pressures (overload, high responsibility for others' work, and role conflict) were significantly associated with greater CHD risk across almost the entire range of occupations studied, and particularly for males 45–65 years of age. Thus, under- and over-demanding work situations produce role strains that have been linked to CHD.

Stress is commonplace and variation in the incidence of stress-linked illness may depend critically on how people cope with stress. Pearlin et al. (1981) using longitudinal data find that work loss events (e.g., being fired, demoted) are significantly related to economic strain, erosion of self-concepts such as esteem and mastery, and increased depression. Coping serves to reduce depression while social support tends to mitigate erosion of self-concepts which is linked to depression.

Kitagawa and Hauser's study (1973) sheds some light on the role of social support. Single, widowed, and divorced individuals had higher mortality risks than married individuals, and these differences were greater for men than women. Divorced men had the highest risk, followed by single and widowed men.

The above discussion has covered a number of factors that affect the etiology of illness. By altering these risks it may be possible to delay or prevent the onset of illness. Thus, these are factors that influence the incidence of illness, although they undoubtedly influence its duration and severity as well. We next discuss the role medical care, which differs from these other factors in its emphasis on the progression and severity of disease.

Medical Care

There are two commonly perceived roles of medical care: curing disease and saving lives. Medical care has traditionally come into play only after the onset of illness.

Prophylactic immunization against communicable disease is one exception. Such interventions seldom occurred prior to the decline in mortality from specific infectious diseases, leading many analysts to conclude that the effectiveness of medicine has been greatly overemphasized (Dubos, 1959; McKeown, 1979; McKinlay and McKinlay, 1977). Few primary medical interventions now exist for the major chronic diseases. Therefore, the role of medicine has almost exclusively been that of secondary prevention, which attempts to control the progression of disease once manifest. Unfortunately, there are diseases, like AIDS (Acquired Immune Deficiency Syndrome) and certain cancers for which medical care has up to now had little ability to alter rates of progression.

Nevertheless, medicine's role in secondary prevention could be considerable for chronic diseases. Hadley (1982) estimates, on the basis of county rates of mortality and medical spending in 1970, that in general, for every 10 percent that communities spend over the norm, mortality is 1.5 percent less than the norm. He found that heart disease mortality was most sensitive to spending patterns and cancer least sensitive. This is consistent with the epidemiological literature that suggests that medical care has had some role in reducing the fatality of heart disease but little role in reducing cancer fatality (Shapiro, 1983). A disproportionately high number of deaths would be averted in the South which have the lowest amount of expenditures on medical care.

While this study indicates a strong role for medical care expenditures in reducing mortality, it also suggests that primary prevention is more efficient. A 10 percent reduction in smoking would avert deaths more efficiently than a 10 percent increase in medical care spending. There are, of course, problems with how such reductions can be achieved and how long they will persist, but the study does reinforce prior perceptions that primary prevention is more efficient than secondary prevention. Nevertheless, the study does seem to indicate that medical care spending has had an impact on mortality in the past and will continue to do so in the foreseeable future.

Little is known about the relative impact of medical care on mortality and morbidity versus the other determinants of health discussed earlier. One recent study is particularly relevant to this issue. Pell and Fayerweather (1985) have examined trends in both incidence and case-fatality rates for coronary heart disease among a large employed male population over the period 1957–83. This study included only cases of first heart attacks and did not examine other forms of chronic heart disease. They found that the incidence of heart attacks declined by 28 percent (from 3.19 to 2.29 per 1,000) over this period and that the case-fatality rate within the first 24 hours of heart attack declined by 31 percent (from 31.0 to 21.6 percent). The case-fatality rate for those surviving past the first 24 hours declined by 44 percent (from 5.5 to 3.1 percent). While the decline in incidence was fairly uniform over the entire period, the reductions in case fatality occurred mainly after 1972. The authors conclude that while improved medical care has probably contributed to the decline in mortality from coronary heart disease, the major contribution has been a decline in the incidence of the disease.

Unfortunately, the authors did not assess to what extent the decline in incidence was due to medical care or to risk reduction. Several studies have indicated a beneficial effect of drug therapy in controlling hypertension and reducing mortality from heart disease (Stamler and Stamler, 1984). Thus, medical control of hypertension could in part account for both the decline in elevated hypertension and incidence of heart attacks that Pell and Fayerweather observed.

Of special importance to this paper is the fact that the percent reduction in the incidence of heart attacks was greatest for the youngest cohorts. Pell and Fayerweather found that the incidence of heart attacks among males ages 25–34 declined by 50 percent (from .16 to .08 per 1,000) over the period studied. Although their population was not scientifically selected and their results not generalizable to the country as a whole, it does suggest that heart disease mortality and morbidity is declining faster for younger cohorts. To the extent the factors behind this trend persist, it may signal an improved health picture for this cohort as it approaches retirement.

In some ways, dividing the risk of disease into these separate categories (genetics, environment, behavior and lifestyle, social and psychological factors, and medical care) is arbitrary. They could be recombined (and have, see Hadley, 1982; Lee, 1985) for different purposes. Many factors independently contribute to disease risk as well as interact to increase risk by more than the sum of their independent impact. Perhaps the most important interactive effects concern those of poverty and behavioral risk factors. However, the separation of medicine from other risk factors is useful because it helps to focus attention on factors more highly implicated in disease risk (e.g., smoking) and factors more highly implicated in controlling the progression of disease once manifest (e.g., dialysis). Yet, prognosis after medical intervention may also be influenced by the duration of elevated risk. This is one reason why early diagnosis is emphasized so that risks can be modified earlier.

Demographic Factors in Mortality, Morbidity, and Health Status

Mortality and morbidity vary considerably between age, sex, race, and socioeconomic groups. Of course, these demographic categories may be proxies for the risk factors discussed previously, but may capture some unknown variables as well.

Age

Age variation in mortality reflects a mixture of the process of senescence and determinants of premature mortality. While high for infants, mortality rates decline at very young ages, reach a trough around 10 years, and increase in an approximately exponential fashion thereafter. Accordingly, using mortality as a measure, we might conclude that young children are the healthiest group of the population. Chronic and degenerative disease surpass accidents (which are the leading cause of death in young adults) as people reach their 50's and continue to dominate mortality thereafter.

Sex

Females can expect to live longer than males at all ages, although the sex difference tends to decrease at the very oldest ages. Male mortality is higher than females for many chronic diseases which is to some degree related to differences in behavioral practices. Lung cancer, emphysema, accident and homicide rates are particularly higher for men than women. Although women are apparently endowed with greater longevity than men, it has been consistently observed that women report greater levels of morbidity and disability (Verbrugge, 1982) and adult women have more physician visits than do men even at ages well past the reproductive years (Collins, 1983).

Data from the Health and Nutrition Examination Survey (HANES) illustrate the complexity of the relationship between sex and morbidity. Males are at greater risk for definite hypertension than females up to age 60. Thereafter, women are at greater risk (Roberts and Rowland, 1981). Moreover, HANES data also indicate that females are slightly more likely to show clinically observable signs of osteoarthritis of the hips, but were 3.6 times more likely to show signs of osteoarthritis of the knees above age 65.

Verbrugge (1982) observed excess morbidity for males as compared to females for 15 conditions which included most of the leading causes of death. Emphysema was found to have the highest male excess morbidity, closely followed by chronic respiratory conditions. Women have higher morbidity rates than men for mental and nervous conditions, hypertension, infective diseases, digestive, kidney, and genitourinary conditions, acute digestive and respiratory conditions, and varicose veins.

Race

Blacks experience significantly higher mortality than whites. In 1980, the age-adjusted mortality ratio for black males compared to white males was 1.18 and for black females to white females, 1.49. For both black males and females, mortality ratios are large at younger ages, but decline with increasingly older ages and actually crosses below 1 for those over 75 years old. Manton and Stallard (1984) argue the crossover is a result of differential selection of at risk individuals earlier in life for blacks, leaving a hardier cohort at later ages. This crossover phenomenon has not been extensively researched, although it would seem to have important implications for our understanding of the influence of social factors on health.

The race difference in life expectancy is reflected in slightly greater morbidity for blacks than whites. Blacks have slightly higher likelihood of being limited in activity, and higher incidence of work loss, bed disability days, and restricted activity days. These differences tend to be greater when adjusted for the lower survival rates of blacks and, consequently, younger population distribution (Trevino and Moss, 1984).

Blacks age 65 and over were 1.35 times as likely as whites over age 65 to indicate that they have a limitation of their major activity. This difference between whites and blacks does not vary by sex. However, blacks over age 65 who earn $10,000/year or more are only 1.13 times as likely to report a limitation of major activity as whites age 65 and over in the same income group (Trevino and Moss, 1984).

Socioeconomic Status

Despite striking life expectancy gains in the economically developed countries, it remains the case that the risk of death is significantly higher for individuals of lower socioeconomic position (Antonovsky, 1967; McKeown, 1979). The most recent significant study of socioeconomic mortality differences is that of Kittagawa and Hauser (1973) who matched death certificates with census records for the year 1960. They used educational attainment as a proxy for socioeconomic status. Socioeconomic differences were found greatest for middle-aged groups, followed by young adults, and the elderly. For middle-aged individuals, mortality risk varied with sex and education. Nonwhite females of low education (less than high school) had the highest risk, followed by nonwhite males, white females, and white males all of low education. White college-educated males and females had the lowest risk.

Laborers were found to have a much higher mortality risk than professional workers. Standardized mortality ratios among white males ages 25–64 were highest for service workers and laborers and lowest for agricultural workers and professionals. Statistically reliable mortality ratios could not be computed for other groups. Occupation is not consistently recorded on the U.S. death certificate, although, in England and Wales it has been recorded since mortality records were first kept. Antonovsky (1967) has found that differences between high and middle socioeconomic classes in England and Wales have diminished over time, but that risk remained significantly higher for the lowest class.

Because socioeconomic differences persist for a wide range of diseases, a greater general susceptibility to illness among those of lower socioeconomic status may exist (Syme and Berkman, 1976; Cassel, 1976; Hinckle, 1973). However, since many important risk factors are also more prevalent with lower socioeconomic status, it is likely that both the risk of exposure and the degree to which resistance is compromised vary inversely with position in the social structure.

A methodological problem with demographic studies of socioeconomic position and health is that health affects socioeconomic position and socioeconomic position affects health. Some people are poor because they are sick—what has been called the downward drift hypothesis (Dohrenwend, 1966). This tends to be more true to the extent that illness or injury is disabling.

That people with severe impairments do, in fact, drift from higher to lower socioeconomic positions is reflected in the fact that the prevalence of impairments has a stronger negative income gradient than other conditions, which increases with older ages. Luft (1978) has estimated that at least 9 to 18 percent of all poverty among the nonaged is caused by income reductions following the onset of a disabling chronic condition.

The relationship between health status and occupation is similarly complex. First, different types of jobs (e.g., blue collar, white collar, service sector, farming) have different effects on health status, which in turn influence what jobs people are capable of retaining or acquiring. For example, coal miners may have worse than average health status, which combined with the high physical demand of their job, encourages earlier retirement. Second, health status changes due to occupation may affect the inclination of the aged to continue working. This would include health status problems that are not disabling but make work unpleasant. Finally, employer perceptions of health status changes may affect the number and type of jobs offered to the aged. White collar workers (52.5 percent of all workers age 60–64) in 1982 seem to have higher health status than blue collar, service, or farm workers (47.5 percent of all workers age 60–64) in 1982 (Wilder, 1980). For ages 45–64, only 8.4 percent of white collar workers are limited in their major activity because of a chronic condition, compared to 10.0 percent of blue collar, 14.0 percent of service, and 16.3 percent of farm workers. For ages 65 and over, 16.4 percent of white collar workers are limited in their major activity, compared to 21.1 percent for blue collar workers, 22.4 percent for service, and 35.7 of farm workers. There is a problem with this indicator of health status, which is the possibility that blue collar, service, and farm jobs may be more physically demanding or hazardous than white collar jobs, raising the possibility that a person of given health status is unable to perform them.

However, a component of work loss days—bed disability days—may be a more accurate indicator of health status. Despite varying occupational requirements and opportunity costs between jobs, most people would not confine themselves to bed unless they were unable to do anything else. This measure indicates that there is not much difference in health status between white collar and other workers. For ages 45–64, white collar workers have 4.0 bed disability days a year, compared to 4.0 for blue collar, 5.5 for service, and 3.3 for farming workers. For ages 65 and over, white collar workers have 2.4 bed disability days a year, compared to 5.2* for blue collar, 3.0* for service, and 2.2* for farm workers.

There are at least two major problems with HIS data with respect to analysis of the relationship between health status and occupation. First, they do not measure employment histories—merely present occupation. This means that a person who spent 40 years as a truck driver who became a librarian by the time of the survey would be categorized as a librarian. A related problem is that only those who are still in the labor force are represented. No insight is gained into the health status of retired people who spent a large part of their lives in a particular occupation. It is this group that is most relevant to a discussion of raising the age of retirement, for it is a subset of this group that will be expected to work longer than they are currently.

Burtless' (1985) analysis of the Retirement History Survey (RHS), is an important supplement to the HIS data because the RHS data include retired people who worked for a long time in a particular occupation. Burtless identified 8,131 men between the ages of 58 and 63 in 1969 and stratified them by occupation—using the job held for the longest time as the criterion. Each person in the sample rated his own health status along several dimensions including whether his health is "worse than average" and whether he is disabled or not. Farmers, blue collar and service sector workers were more likely than white collar workers to report either disability or worse than average health. In fact, Burtless concludes that workers in the "healthiest and least demanding jobs" are up to 25 percent more likely to work until age 65 than workers in the least healthy, most physically demanding jobs. It also indicates that not only does occupation affect health, but also that health influences the decision to retire. Although one might reasonably conclude form the data that white collar jobs cause better health than other jobs, self-selection could be an issue: those attracted to different types of jobs may have different chances of being healthy to begin with. Education, race, income and sex varies between types of jobs, and may also affect health status. More research is needed in this area if further conclusions are to be drawn.

Risk factor dynamics are important to understand if we are to anticipate future health status trends, for it will be changes in the risk factors that will cause health status to change. Unfortunately, our current state of knowledge of risk factors is based almost exclusively on cross-sectional time series rather than longitudinal data. This means that we have only a vague idea of the effect on health of changes in any of these risk factors. Furthermore, we know very little about how these risk factors interact to affect health. For any projections of health, therefore, it is necessary to primarily consider past trends in health status, morbidity, and mortality, and temper them with assumptions about changing risk factors.

Summary and Conclusions

Further Research

There are several research issues which need further exploration if we are to better understand the implications of what appears to be increased levels of morbidity. Three general areas require additional research: the time of onset of chronic illness, the progression rate of illness, and the overlap and interaction between chronic and non-chronic conditions as well as multiple chronic conditions in a single individual.

A major reason for the present uncertainty about morbidity is that information is unavailable regarding the incidence of chronic illness.

However, incidence of chronic disease is difficult to measure unless there are either clear clinical indications or functional limitations. Work by survey researchers in defining initial reports of functional limitations associated with chronic illness would be very helpful. Furthermore, an understanding of incidence is necessary to further our understanding of the rate of progression of illness. The concept of a progression rate of illness makes sense only if we can have agreed upon measures of the onset of the illness.

Both of these issues clearly require the use of longitudinal data. In fact any serious attempt to predict changes in health status over time as well as to relate changing patterns of mortality with changing patterns of morbidity will require a longitudinal data base. The difficulty in establishing a longitudinal data base is not only the time and expense of follow given set of individuals over a prolonged period of time, but also the problem of having a sample large enough to include individuals with specific chronic conditions of illness. One way to resolve the problem of sufficient sample size may be to do a combined survey which includes both a national probability sample of individuals as well as a sample of individuals with specific chronic diseases. Monitoring a group of individuals known to have specific chronic conditions would provide information about the progression and impact of the disease over time. Including a national probability sample of the entire population would provide information on the impact over time of changing health conditions for the entire population. While screening for specific conditions is an expensive procedure, it is likely to be far cheaper than including a sample size large enough to provide reliable estimates for specific conditions based on a national probability sample. Because the effects of postponed social security benefit eligibility will not be felt for many years, the opportunity for fruitful research is great. For now, we will summarize what we know from current research.

The Past

The idea that the increasing longevity in this century has been associated with improved health status was—and still is—quite popular. This presumed relationship seemed reasonable when mortality was dominated by acute diseases, however, it is less clear now that mortality is dominated by chronic diseases. This issue involves the question of the relationship between mortality and morbidity, and also raises questions about morbidity and mortality trends.

In considering the relationship between morbidity and mortality two points need to be made very clear:

(1) some morbidity does not lead to mortality
(2) not all mortality is related to morbidity, e.g., homicides and accidents

While these two points seem quite obvious, the size of the populations that they represent is not. While accidents and homicides represent important causes of mortality primarily for younger groups, nonfatal morbidity represents a sizeable amount of all morbidity. Using population data on disability, we calculate that only 36 to 41 percent of all disability is related potentially to "fatal" diseases. Even though only a minority of morbidity is accounted for by fatal diseases, it is useful to consider the relationship between changes in mortality and changes in morbidity because mortality data is much more readily available than morbidity data. Unfortunately for predictive purposes, the relationship between mortality and morbidity even for fatal diseases can be very complex and subject to change over time.

A variety of theories have been developed relating morbidity and mortality. Fries has offered what he calls the "compression of morbidity" theory. The key features of this theory for our concern is that risk factor modification delays the onset of chronic diseases. This would mean that disease incidence and prevalence will decline, and that death will be postponed. For our relevant age group (62–67), the most important empirical implication of the theory is that there should be a direct correlation between morbidity and mortality.

A second theory about the relationship between morbidity and mortality is that of "dynamic equilibrium," developed by Manton. Under this theory there will be declining severity of illness as a result of secondary prevention and control. This will lower the rate of progression of chronic diseases and increase disease duration. Empirically, the dynamic equilibrium theory would predict a direct correlation between disability and mortality, in that the severe stages of disease would be postponed, as would death. The difference with respect to Fries is that you would expect to see an increase in prevalence of chronic disease.

A third theory which has been developed is that of "failures of success." This theory has been associated with Kramer and Gruenberg and predicts that the clinical successes in the treatment of formally fatal diseases will increase the survival rate but also result in an increased prevalence of chronic disease. The distinguishing feature of this model from Manton's is that it does not predict that the severe stages of disease will be postponed. However, as in the case of the dynamic equilibrium model, it predicts increased morbidity prevalence and reduced mortality.

Trends in mortality are frequently considered in terms of three periods: 1940–54, 1954–68, and 1968-82. During the first, life expectancy was increasing very rapidly, with the rate for females increasing at twice the rate as for males. Improvement in life expectancy for non-whites was rapid during this period, as well as between 1968–82. The 1954–68 period has usually been termed a plateau period: mortality declined only for those who were under 15. Comparing the pre- and post-plateau periods, two observations stand out. First, that declines in mortality rates for children and young adults were slower between 1968–82 than they were during 1940–65. Second, the rate of decline for those over 35 was the same during 1968–82 as it had been during 1940–54. Recent data have indicated that declines in death rates for the extreme aged were not much greater in the latter period than in the early period—contrary to some premature reports based on intercensal population estimates.

Although nonwhites continue to have lower life expectancies than whites, the trends from 1970–82 indicated that if the rate observed during that period continued, the interracial differences would disappear within 2–3 decades. Post 1982 data, however, indicate that the differences between races are likely to persist for the foreseeable future. While females also continue to have a higher life expectancy than males, male mortality rates in the 1980–82 period were declining faster than female mortality rates. It is not clear whether this trend is continuing.

Immediate causes for the reductions in mortality are of course easier to enumerate than associated factors. Approximately two-thirds of the decline in mortality rates for the 1968–80 period was due to reduction in cardiovascular mortality rates. The majority of this drop was from heart disease mortality rates, although reductions in death rates associated with strokes were a little larger for women than men. It would be very useful, especially for predictive purposes, if we knew whether the fundamental cause for the mortality rate reduction was improvements in medical care, changes in lifestyle, or some other factor or combination of factors. Unfortunately, the relative importance of each of these factors is very difficult to specify with any precision. When we focus on the mortality rates of the 25–47 year old age group, the group that will be the first to be directly affected by the social security amendment, we can also note a decline in the mortality rates associated with heart disease and cancer. While we know something about lifestyle changes for this group, e.g., that smoking prevalence declined and that the number who never smoked increased, this evidence is also not conclusive since the number of heavy smokers also increased. To the extent that lower mortality rates in the 25–44 year old group reflected healthier lifestyles, it seems likely that the reduced mortality rates might well be associated with an improved health status. To the extent that the mortality reductions resulted from medical interventions, the health status could be better or worse depending on whether the intervention primarily delayed death or reduced disease severity.

Differences in mortality rates are also observable by age, sex, socioeconomic status, and occupation. Some of these differences may prove useful in projections, particularly the findings that those with lower education levels are more likely to smoke, individuals with lower socioeconomic status have higher mortality rates, and that laborers have higher mortality rates than professional workers or agricultural workers. Marital status is also important; singles, widows and widowers, and divorcees have higher mortality rates than married individuals.

The major source of information on trends in morbidity comes from the Health Interview Survey. While it has been criticized on a number of grounds—mainly that the data are self-reported—it provides the only national data available on this subject.

Several studies using the Health Interview Survey have reported on trends in short term and long term disability. Colvez and Blanchet reported moderate increases in the number of bed disability days, restricted days, and in the prevalence of long term disability during the period 1966–76. The more recent study by Verbrugge focused on the period 1958–81. Among the many statistics reported, there were at least two findings of particular interest to this study. The first was that the incidence rates for acute conditions declined for both men and women over 45 while the short term disability days associated with acute conditions did not decline. This implies that individuals reduce their activity more now than in the past for acute conditions. The second finding was that short term and long term disability from chronic conditions increased. The restricted activity days increased substantially for those over 45. However, work-loss days changed only slightly for men and not at all for women, and bed disability days—presumably reflecting more severe disability—increased only moderately for the 45–64 year old group and was constant for the over 65 population. These two findings raise the question of changing attitudes toward and behavioral responses to disease as an alternative explanation to increasing severity of disease.

A third study (Ycas, 1985) reported substantial increases in the prevalence of complete disability for ages 62 to 67. Ycas also provides some empirical support for the idea that health status may have very recently begun to improve for the 62–67 year olds. This idea is based on a statistical finding reflecting experience in the last two years of data. Analysis of more years of data will be required before it is clear whether this finding was a statistical aberration or indeed a real trend.

The general determinants of morbidity are not difficult to enumerate. They include genetics, behavioral and lifestyle changes, environment, social and psychological stress, and medical care interventions. The difficulty comes in attempting to attach relative weights to each of these components. In addition to these determinants, there are a variety of demographic variables which are known correlates with morbidity. These include age, sex, race, socioeconomic status, and occupation. Females for example, report greater morbidity than males, although it is not clear how much of the difference is due to clinical differences and how much may be due to behavioral or reporting differences. Nonwhites report slightly more morbidity than whites. Those with lower social economic status report higher morbidity, although it has never been clear to what extent these individuals are poor because they are sick or sick because they are poor. The interrelationship between health status and occupation are also hard to disentangle. White collar workers, for example, have a higher health status than blue collar workers but it is unclear how much of the occupational choice caused the different health status measures. While there is a significant amount of information available about correlations between demographic variables and health status, the cause or relations are not sufficiently well enough understood to have produced useful models of future health status and disability.

How would we summarize past trends? Mortality rates have clearly declined, particularly during the periods 1940 to 1954, and 1968 to 1982. Morbidity and disability prevalence appears to have been increasing, although some types of disability, particularly bed disability days, have risen at a much smaller rate than other reported types of disability. How could mortality decline while morbidity and disability prevalence increases? First, we recall that the majority of disability is not related to fatal diseases, although data show that the prevalence of these diseases is increasing. Second, there is some evidence that people may be responding to morbidity more than they have previously. This conclusion is based on the finding that although the incidence of acute conditions has declined, the disability associated with acute conditions has not declined. It is possible, however, that those with acute conditions also have chronic conditions and that is why they are reporting more disability. Finally, survival seems to have increased. This may, however, introduce several complexities since lower mortality at earlier ages may increase the risk for contracting other unrelated chronic diseases at later ages.

The Future

Given the uncertainty with which we view the events of the past, what can we say about what is likely to happen in the future? Life expectancy is projected to continue to increase. One set of projections by Faber and Wade report life expectancy for males at age 62 to increase by 1.8 years between 1980 and the year 2000 and for females by 2.3 years during the same period. Life expectancy for males are projected to increase by 0.8 years during the period 2000–2020 and for females by 0.9 years during the same period. Since life expectancy for both males and females at age 62 in the year 1980 were already in the 70's, these increases in life expectancy put the age of expected death well beyond the relevant range. The implications of continued increases in life expectancy with regard to health status, however, are unclear. As we have indicated, much of morbidity is unrelated to mortality. Changes in this portion of morbidity will reflect changes in lifestyle and behavior, the effects of the environment and new medical care technologies and innovations. It is also unclear what can be expected for morbidity that is unrelated to mortality. The preponderance of evidence regarding the past 20 years seems to indicate that health status has declined while mortality has improved. We think some of this represents a change in behavior in response to morbidity but probably it also reflects the impact of increased survival. In the absence of other evidence, we would expect this trend to continue. There is, however, a possibility that health status is improving, as reported by Ycas.

While there seems reason to believe that the increase in life expectancy projected through the period 2020 will be accompanied by an increase in morbidity and disability, there are several reasons for some optimism about the future. The impact of innovations in therapeutic procedures and pharmaceutical products is very difficult to predict, but the industry is becoming more responsive to the aging of the population. There are predictions that drugs will be developed to better control chronic disease, and drugs which aim at affecting metabolic change rather than just the symptoms of disease. Whether or not this research will come to fruition, however, depends not only on the vagueries of innovation but also on the financial incentives associated with that innovation. These incentives are sending confusing signals to the industry, given the introduction of the prospective payment system by the Federal Government. A second cause for optimism is the decline in mortality rates from heart disease and cancer for the 25–44 year old population. To the extent that this decline primarily reflects medical care interventions, only time will tell whether these individuals have been primarily "cured" or whether their fatality has been arrested. To the extent that the mortality decline reflects changes in lifestyle, and particularly declines in smoking and other risk factors, these individuals may well experience greater health during their 60's.

Even if disability and morbidity prevalence increases among people age 62–67, most will be healthy and able to work. Whether this majority will work depends on the job market (which may suffer from a labor shortage as the "baby-boom" cohort retires), family and social support, retirement income versus work income, assets (total and liquifiable), discrimination, mandatory retirement, non-pecuniary benefits from working, non-pecuniary benefits from retirement, and social norms. Currently, there is a strong trend toward early retirement (Ycas, 1985) which cannot be explained by health trends alone.

For the minority of people age 62–67 who have disability, the burden of the amendments will be greater. The burden will increase with the severity of the disability for those who do not qualify for disability benefits. These people are most vulnerable to delayed retirement benefit eligibility.

Deferring eligibility for full retirement benefits to older ages is one response to the pressures brought on society by an aging population. As was the case before this change, however, it is necessary to make provisions for people who do not qualify for social security retirement benefits and who have difficulty holding a job because of health problems. These provisions cannot be made without an effective disability program, and a job market that allows job mobility to less physically demanding positions for the partially disabled. Even if the health status of people at the retirement age increases—and current data suggests that it has not—the number of people between ages 62–67 with health problems will be large enough to warrant policy attention in the future.

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