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Facts, Projections, and Gaps Concerning Data on Aging

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This article is based on the author's presentation at the Second Binational Symposium: United States–Israel, held in Bethesda, Md., October 17–19, 1983.

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Synopsis

In 1900, approximately 25 percent of all deaths occurred in people 65 years of age and over, while today the age at death has been pushed back so that, by 1980, 30 percent of deaths occurred in those over age 80. The greatest declines in age-specific mortality for those 65 and over occurred from 1920 to 1945 and since 1970.

Illness and disability rise with age, and there is some evidence that rates of disability in all age groups may be increasing. Measurement of morbidity and disability is

the area where data are weakest and our needs for data are perhaps greatest. Agreement is needed on the use, limitations, and interpretations of surveys and of data relating to functional status.

In a few years, medical students and physicians will be computer literate. We should plan now for a better utilization of the already available Federal data sets as well as implementation of computerized health care information on individual patients. Some modifications of privacy legislation will probably be necessary in order for physicians to give better care to their patients, and to provide epidemiologic research opportunities in critical areas of public health needs.

Caution is urged in order to maintain credibility in health promotion by avoiding overstatement of knowledge in areas where scientific evidence is weak or lacking. Better utilization and development of epidemiologic and statistical information as well as basic research in chronic diseases are urged to prepare for the year 2025, when there will be some 60 million Americans age 65 and over—about 20 percent of the total population.

AS AN EPIDEMIOLOGIST concerned with health policy, I have the heady sensation that we are riding a great surge forward in human health and longevity in the United States, albeit this surge is not entirely of our creation or even effective maintenance. In the words of leading economist George L. Stolnitz (1), “Demographically, these are the most dramatic times in our history. They are also, almost surely, the most unpredictable and problematic.”

“Impressive” and even “awesome” are adjectives that describe the growth of the American population age 65

and older in this century. Between 1900 and 1981, there was a greater than eightfold increase: from approximately 3.1 million people 65 and older in 1900 to 26 million in 1980 (2,3). This was accompanied by a rise in the percentage of those 65 and older from 4.1 to 11.3 percent of the total population. The U.S. Bureau of the Census projects that by the year 2000 the number of persons over age 65 will reach 33.5–36.6 million, accounting for about 13 percent of the total population (3). Within 41 years (by the year 2025), as the post-World War II “baby boom” cohort ages, those 65 and older will

number approximately 58.5 million and constitute 20 percent of the total population, barring major medical advances (3).

Americans over age 65 (currently 11.3 percent of the population) now account for 67.2 percent of all deaths (4), compared with 24.3 percent in 1900 (table). The population 80 years of age and older (2.3 percent of the total) accounts for 30.6 percent of all deaths, while persons age 85 and older, who constitute 1.0 percent of the total population, account for 16.8 percent of the total mortality.

The implications of the rapid increases in the number and percentage of elderly that will have occurred by the year 2025 are at best dimly perceived. There will be more of us, and we will die at later ages. The focal issue is whether in increasing life expectancy we are also improving health status and the quality of life.

The scientific community has produced conflicting data and opinions with which we may approach policy decisions concerning these matters. I will review some of these, present pertinent epidemiologic data, and make a few policy recommendations.

A gloomy perspective on the health status and quality of life of the elderly is seen in Gruenberg's paper "The Failure of Success" (5) and Kramer's paper "The Rising Pandemic of Mental Disorders and Associated Chronic Diseases and Disabilities" (6). Both advance disquieting arguments concerning the present and future conditions of the elderly. The authors observe that chronic diseases increase with age and that, because of postponement of death through medical interventions and because the elderly population is growing, the prevalence and absolute number of sick old people inevitably will rise.

Fries's perhaps utopian view is glimpsed in his rather startling but conceptually important statement that "predictions suggest that the number of very old persons will not increase, that the average period of diminished physical vigor will decrease, that chronic disease will occupy a smaller proportion of the typical life span, and that the need for medical care in later life will decrease" (7).

Colvez and Blanchet, who analyzed data from the National Health Interview Survey, conducted annually

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since 1957 by the National Center for Health Statistics (NCHS), found a disturbing general rise in recent years in morbidity and disability among persons of all age groups, but particularly those in middle life (8). Thus, while life expectancy increases, our best data suggest that disabilities are also increasing.

Wilson of the NCHS, in an editorial comment on the Colvez and Blanchet report (9), questions the ability "of health statistics to reflect what might really be happening to health status." He offers a series of possible explanations for the observed increases in morbidity and disabilities. These explanations range from artificially high results caused by an increased sensitivity of the screening instrument, to a change in attitude and self-reporting as a result of more liberal benefits for retirement for health reasons, to a real increase because of improved survival of the chronically ill. This accurate but untidy array of options concerning the measurement of health status—perhaps the most critical factor in health planning—emphasizes our need to be humble and to do better.

Mortality

Trends. Age-specific mortality rates have declined steadily since 1900. In figure 1, we note that by 1979 the mortality rate per 100,000 for persons of all ages had fallen from 1,720 (in 1900) to 870. Half of the decrease

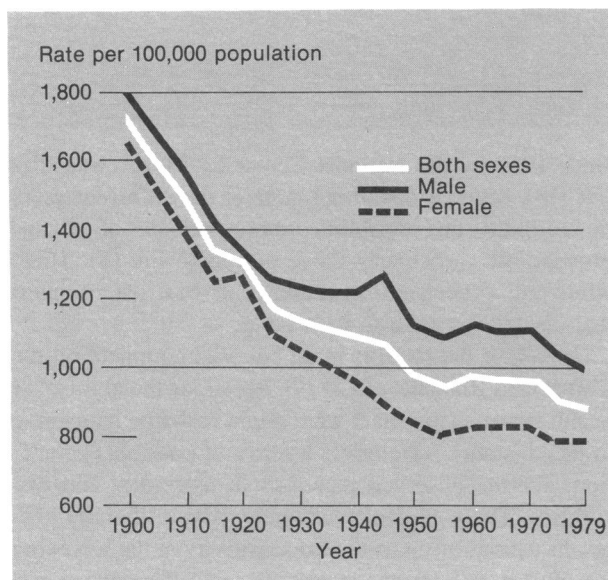
Percentage of elderly persons among total population and among total persons deceased, United States, 1900, 1940, 1975, and 1980

Year	Percentage of total population		Percentage of total persons deceased	
	Persons 65 years and older	Persons 80 years and older	Persons 65 years and older	Persons 80 years and older
1900.....	4.1	0.6	24.3	7.3
1940.....	6.9	0.9	45.8	14.1
1975.....	10.5	2.1	64.3	27.8
1980.....	11.3	2.3	67.2	30.6

SOURCE: National Center for Health Statistics.

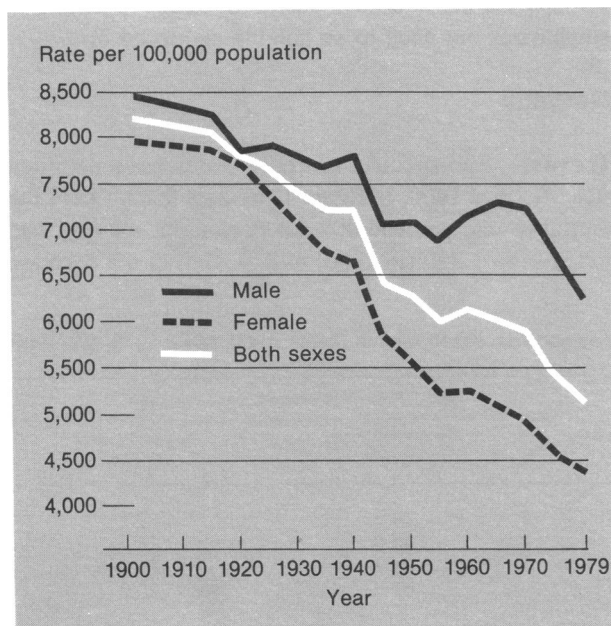
in this century was completed by about 1920, suggesting that improved living environments and better sanitation were probably the major factors in this decline. For those 65 and older (fig. 2), age-specific mortality had declined barely 5 percent by 1920; however, the decline had reached 50 percent by 1945. Thus, factors involved in the overall decline in mortality had a small effect on

Figure 1. Mortality rates for years 1900-1979, United States, by sex (all ages)



SOURCE: National Center for Health Statistics.

Figure 2. Mortality rates for years 1900-1979, United States, by sex (age 65 and older)



SOURCE: National Center for Health Statistics.

those already age 65 and older.

The elderly population made remarkable gains during the years from 1920 to 1945, a period that included Prohibition, the Great Depression, the beginning of Social Security, and World War II. While one may speculate that any number of events caused this decline in mortality by 1945, those related to specific medical or social interventions are not likely to have been major contributors (10). Since about 1968, a second accelerated decline in mortality rates for all age groups has occurred and is now leveling off (fig. 1). Declining mortality rates for persons age 65 and older (fig. 2) have been more pronounced and persistent. Thus, there has been a more rapid accumulation of elderly in relation to the entire population in recent years.

During the earlier part of the 20th century, major gains in life expectancy resulted from the decline in infant mortality and the control of infectious diseases. Since 1900, however, part of the gain has resulted from declines in mortality among those age 65 and older. Therefore, the aging of the elderly is becoming an increasingly important factor in the demographic profile of our society. In view of the population projections for the next half century, a rapid increase in the absolute number and proportion of deaths will occur in the population age 65 and older.

Age-specific mortality rates were consistently higher for males (figs. 1 and 2), although at birth males outnumber females 105 to 100. In 1940, life expectancy at birth for females exceeded that for males by 4.5 years, and by 1980 the difference was 7.9 years.

The survival advantage of females is increasing with time, despite the fact that both sexes are living longer. This is especially true for the elderly population (4,11). In 1940, the difference in life expectancy between males and females was 1.5 years (males 12.1, females 13.6). In 1980, the difference was 4.4 years (males 14.3, females 18.7). By the turn of the century, it is projected that the difference will be about 5.3 years (males 15.8, females 21.1), and by 2025 it will be about 5.65 years (males 16.55, females 22.2). This discrepancy widens with advancing age. There are 137 females per 100 males in the age group 65 to 74, and 224 females per 100 males for the population over age 85 years (H. B. Brotman, "Every Ninth American," prepared for "Developments in Aging, 1980," Special Committee on Aging, U.S. Senate).

Living arrangements are heavily influenced by discrepancies in sex-related survivorship. Most persons 65 years of age and older live in families typically consisting of an elderly married couple with no children or other relatives residing in their homes. In 1978, 16 percent of males and 40 percent of females were living alone (12). Among persons age 75 and older, half the female popula-

tion was living alone in 1978, compared with about one-fifth of the male group. No fewer than 5.5 million women and 1.5 million men over age 65 lived alone. Thus, fewer older women continue to live in a family setting in their old age, largely because the mortality rates for older men are much higher than those for older women (2).

While only 5 percent of persons age 65 and older reside in institutions (96 percent of these persons are in nursing homes), 20 percent of the population over age 80 is institutionalized. The median age of patients in nursing homes is 82 years, and two-thirds of the residents are female (2).

We do not understand the roles, combinations, and interactions of behavioral and social factors and genetic and biological elements that produce this sex-related discrepancy (11). Increased female survival is a phenomenon found in all advanced human societies, although few nations have differences as large as those seen in the United States. The survival advantage of females has been reported throughout the animal kingdom; it occurs in virtually every species as far down the phylogenetic scale as has been studied (13). Social factors such as smoking, excessive drinking, and stress-related activities are thought either to augment biological or genetic tendencies or to be the primary cause of the observed increased male mortality (14).

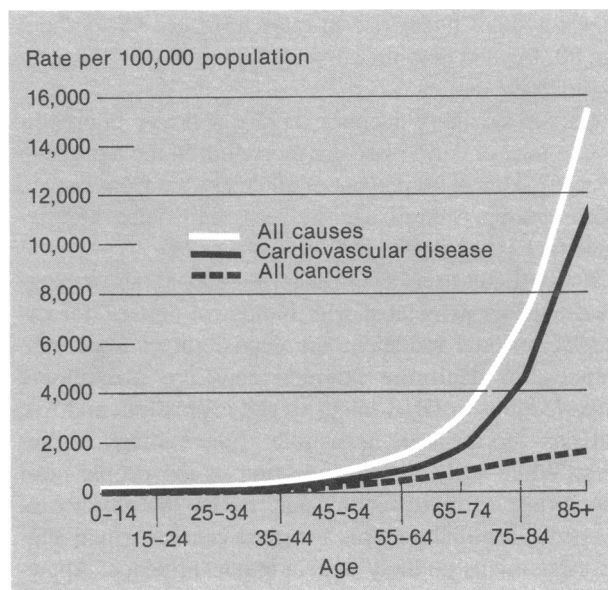
Social and medical strategies must be worked out to provide a structural basis that will improve the lives of elderly females, and basic research must be conducted to reduce premature deaths among males.

Causes of death. The seven leading causes of death among persons 65 years of age and older and the relationships among the causes of death have remained essentially the same for the past several decades. As reductions in death rates due to infectious and parasitic diseases occurred earlier in this century, chronic diseases and conditions became the dominant causes of death. Currently, cardiovascular diseases and malignant neoplasms occupy four of the five top rankings among causes of death and account for 77 percent of all deaths in the population age 65 and older.

Most deaths among the elderly fall into three categories of cardiovascular disease recognized by the International Classification of Diseases: diseases of the heart (which account for almost half of all deaths), cerebrovascular disease, and arteriosclerosis. These three causes constitute 97 percent of all deaths due to cardiovascular disease (4). The influence of these conditions on reported mortality is so great that 55 percent of the decline in overall mortality between 1950 and 1975 was due to the decline in the reported death rate for heart disease alone (15). The decline in heart disease mortality began earlier in this century for females than for males

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Figure 3. Mortality rates for selected causes of death, United States, 1976, by age group



SOURCE: National Center for Health Statistics.

(16). Mortality differentials between males and females have persisted, even though death rates for both sexes have decreased since 1965.

Much of the decline in mortality from coronary heart disease preceded the mass implementation of measures such as reduced smoking and dietary change for control of risk factors, and antihypertensive agents do not appear to prevent this condition (17). Scientists studying this momentous decline do not fully understand what caused it—or, more important, how to sustain and augment it. I concur with Stallones' suggestion that we should "direct our attention to more general environmental factors in a search for more effective and more acceptable means of prevention" (18).

In figure 3, mortality data for cardiovascular disease and cancer are presented for 1976, a typical year. The age-specific death rates for cardiovascular disease rose exponentially among successive age groups, in parallel with the age-specific death rates from all causes. Thus, cardiovascular disease is closely associated with aging and mortality. The cancer curve, on the other hand,

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shows a small linear rise in rates from age 65 to about age 80. Beyond that, the curve continues to rise, but at an even slower rate.

Cancer mortality declines rapidly with age in proportion to total or cardiovascular mortality. In the age group 65 to 69, almost 30 percent of all deaths are from cancer, while among persons age 80 years and older, approximately 1 in 10 deaths is from cancer (19).

It is difficult to relate cumulative endogenous or exogenous factors associated with biological aging—for example, residual radiation; the deposition of toxic substances; or declining immune capacity, progressive imperfections in DNA integrity and expression, and free radicals—to a simple linear role in the etiology of cancers. While early genetic selection of the people most susceptible to these factors may occur, the absence of pervasive familial patterns for most cancers would suggest that this is unlikely to be a major influence. Apparently, carcinogens become pathogenic under specific, and as yet poorly understood, circumstances. Furthermore, protective factors may come into play at older ages, when perhaps cellular mutations are expressed more slowly or are more difficult to induce.

Although death rates from cardiovascular disease have decreased substantially, cancer mortality rose modestly until 1979. In that year, for the first time, the age-adjusted death rates for cancer in the United States declined (20). This fact has produced surprisingly little comment. The decline could, of course, be an artifact of mortality statistics or a true sign that we are in a period in which therapeutic intervention is curing or postponing enough cancer deaths to produce this picture. It is possible, however, that since cancer causes a progressively smaller proportion of deaths in age groups 65 and older, the shift in deaths to older age groups (30 percent of all deaths now occur among persons over age 80) makes it inevitable that the total number and rate of cancer deaths would decline.

Whether artifactual or real, whether medical triumph or demographic shift, cancer mortality statistics should bear the closest scrutiny. It has been suggested that prevention trials for heart disease would have been de-

signed differently if the importance of early declines in heart disease mortality had been recognized (21).

Pneumonia and influenza together constitute the fourth leading cause of death among the elderly, accounting for 4 percent of all deaths among people 65 and older. Numbers will increase with the aging of the elderly and with the rapid increase in the size of this population. Prevention of these diseases through vaccination is a present and growing reality. However, the controversy concerning the efficacy of these vaccines in the elderly, and the question of how much, and at what cost, the available products can be improved, are research issues that must be addressed. The current policy of allowing Medicare to pay for pneumococcal vaccination and not for influenza vaccination perhaps needs rethinking—or at least more convincing justification.

Accidents are the seventh leading cause of death among the elderly. Death rates from accidents are eight times higher for persons age 85 and older than for those age 65 to 69. Among those 65 and older, a remarkable and not readily explainable decrease of about 50 percent in rates of mortality from accidents has occurred since 1950 (16). Possible contributors to the decline are better medical treatment and the fact that our elderly population is living longer and is less mobile. Evaluation and comparisons of patterns of current mortality and previous mortality could be instructive. In any event, the mortality, morbidity, and costs in suffering and in dollars are still unacceptable. While many approaches are needed, perhaps sensible areas for concentrated epidemiologic efforts are preventing hip fractures and alcohol- and drug-associated trauma.

Morbidity

Systematic data on morbidity and disability are limited, making assessment of the functional and health status of the elderly population imprecise. Morbidity data are available from such initiatives as the National Heart, Lung, and Blood Institute's Framingham Heart Study; the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program; the morbidity reporting system of the Centers for Disease Control; and the National Institute on Aging's three Established Populations for Epidemiologic Studies of the Elderly. But as valuable as these programs are, they provide neither the national coverage nor the comprehensive scope of illness and disabilities necessary to permit determination of the relationships among disease, disabilities, health status, and age.

Fillenbaum's excellent review (22) presents the survey approach in its numerous formats, which emphasizes various parameters of functional well-being and social and health needs rather than specific diseases. Clearly,

all the surveys discussed in her report have been used successfully in certain situations and have limitations that have prevented their becoming universally accepted.

The data systems of greatest potential are probably the national surveys conducted by the National Center for Health Statistics (NCHS). Using the Center's numerous data sources, we can document that indicators of compromised health increase progressively with age. The NCHS data for 1978 reveal that the percentages of elderly persons with limitations of activity due to chronic conditions, in the age groups 65 to 74 years, 75 to 84 years, and 85 years and older, were 41 percent, 51 percent, and 60 percent, respectively (23). For the same year, the rates of admission to short-stay hospitals per 1,000 population for persons in these age groups were 299, 451, and 507 (23), and the rates of admission to nursing homes per 1,000, for the same age groups, were 15, 68, and 216 (23).

Since 1957, the National Health Interview Survey (NHIS) has monitored long-term national trends by producing morbidity estimates based on an annual probability sample of 120,000 of the U.S. civilian noninstitutionalized population (24). Information gathered in household interviews includes self-reports of limitation of activity, physical mobility, and specific acute and chronic conditions, as well as a measure of the utilization of medical services and facilities. These data have been used extensively for monitoring self-perceived health status, and their general utility is great (16).

Wilson's question "Do health indicators indicate health?" (9), which referred to the trend analysis of NHIS data by Colvez and Blanchet, cannot easily be dismissed. Colvez and Blanchet (8) defend their observations with NHIS data of increased morbidity and disability from the years 1966 to 1976, stating that "It is one of the only sources that can be used in trying to determine whether, in increasing life expectancy, we are also improving the quality of life." Epidemiologists must overcome this seeming impasse by reason and research, since robust policies for the elderly require reliable and sensitive methods for assessing health status.

Recommendations

1. People are living longer. Currently, two-thirds of all deaths each year occur among those 65 years of age and older, and 30 percent occur among persons 80 years or older. Morbidity and disability increase steadily with age, and there are no generally accepted data that show whether age-specific prevalence of these conditions is decreasing or increasing. Quality of life and health costs are largely a function of these parameters.

The epidemiologist must provide the policymaker with more accurate and usable information. We must

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learn whether survey information and other health indicators do indicate health status. It is likely that practical measurement tools already exist or could be developed. A costly but necessary study is the medical and social validation and interpretation of health survey and health indicator data. A sense of urgency exists concerning the health status of our population age 65 and older, since U.S. Bureau of the Census data indicate that during the next 50 years the size of this population will more than double and that the proportion of those 65 and older, relative to the total population, will rise to about 20 percent.

2. Computer technology is making medical information concerning individual patients more available to physicians and health care givers. While progress in this area may be slow (25,26), the children of the home computer age will soon be matriculated in medical schools, and rapid gains in computerized medicine are inevitable.

The patient rarely knows what conditions he had in the past, or which tests were performed, or their results. Questions of invasion of privacy exist, but in these days of medical specialization—with the tendency of the elderly to be seen by more than one physician and, perhaps, to be receiving drugs from many sources—real dangers are present. As a society, we must weigh the issue of the right to privacy against the risks and costs to the patient, the doctor, and Medicare and other third-party payers.

The concept of privacy is not a static one (27). Given the necessity to computerize, both to improve health care and reduce costs, medical records should be computerized in a standard way to give physicians and patients comprehensive and immediately retrievable clinical information.

However, we must not stop there. We must use these computerized data for epidemiologic research. Medical data should be merged with data from other sources such as the NCHS surveys, the Social Security Administration, Medicare and Medicaid, the National Death Index, the U.S. Bureau of the Census, and the Internal Revenue

Service. This will permit us inexpensively to outline life events for our population. Then, with sophisticated analytical technology already available, we could make critical associations and develop new insights that would be beneficial to the individual and to society.

In the short run, we cannot afford to deny the physician and his or her patient access to information on the patient's prior health status and care. In the longer run, we cannot deny these data to researchers who can use them to understand better the implications of morbidity and mortality data and to develop tenable strategies for substantive health gains.

3. The value of health promotion among elderly persons, and of getting them more involved in self-care and in achieving wholesome lifestyles, is obvious. We may, however, be facing a credibility gap in furthering our goal. I would call attention to two general limitations of this strategy.

One hazard is an overstatement of knowledge in areas where scientific evidence is weak or lacking. In the face of the burgeoning number of old and very old people, we must admit to ourselves that scientific knowledge of the cause and prevention of most chronic diseases is limited (28). Only a fraction of the cancers, heart diseases, strokes, neurological diseases, and arthritides are understood, and we know virtually nothing about the causes and prevention of the senile dementias that will inexorably afflict 20 percent of our population 80 years of age and older (29). No one doubts that smoking and excessive drinking are harmful. Data on lowering blood pressure are robust, and at least one study has shown a preventive effect from lowering cholesterol levels (30). Data are softer relating to exercise, weight control, special diets, and salt restriction in the absence of hypertension. Nor do we know how great would be the reduction in morbidity and disability if we produced a population of paragons. We have an obligation to admit our ignorance of causation and our tendency to create guilt and anxiety among the elderly in areas in which benefits of specific preventive techniques have not been scientifically documented, if we are to maintain our credibility (31).

A second area of health promotion that requires rethinking is behavior modification through health education. While considerable benefits may be achievable by altering lifestyles, results have been uneven and equivocal (32,33). It is possible that a systematic obstacle exists in health education, related to the individual person's educational level or the actual number of years of school attended. The classic U.S. study by Kitagawa and Hauser shows a distinct survival advantage among the better educated (34) and is supported in the current literature (35,36). A recent British investigation reported

similar findings (37), which is especially significant because medical services have been available and free in Great Britain since 1948.

It appears that education (and, of course, its concomitants, all of which are harder to measure) exerts a disproportionately powerful effect on life expectancy. These data suggest that persons with minimal education are not reached by the available means of health education. Eliminating smoking, moderation in alcohol consumption, diet control, and surely other attempts at modification of lifestyle have bypassed this less educated group, and these people continue to inflict needless self-harm, adding to the frustration of health educators and planners and subtracting years from the average life expectancy. We need a new direction in behavior modification via health education, with the primary target being those with fewer years of education. While this is no easy task, we may be wasting much of our resources by failing to concentrate more effort on improving our ability to modify clearly harmful health practices in this difficult-to-reach, high-risk subpopulation.

4. Research in epidemiology as well as basic studies of the cause, prevention, and management of chronic diseases must be included in our health policy. The agenda is, of course, very long. Merely mentioning those topics discussed in this presentation, I would start with the sex disparity in survival. We must learn both how to improve the conditions of the ever-increasing number of isolated elderly females and how to reduce premature mortality among males. A better understanding is needed of the causes of the decline in cardiovascular disease and the means to perpetuate this trend. The diminished importance of cancer mortality with age and the decline in the cancer mortality rate in 1979 (the most recent year for which figures are available) are certainly promising areas where current explanations are lacking. Knowledge about vaccines against pneumococcal pneumonia and influenza must be clarified and, perhaps, expanded, and the current Medicare funding policy with respect to influenza vaccination deserves further attention. Epidemiologic studies of precipitating events leading to hip fractures, and of accidents associated with medications and with alcohol, offer promise for reduction of morbidity and mortality.

Behavior modification strategies should be targeted to the high-risk, less educated population. A wide range of research to make possible better measurement of morbidity and disability must be implemented. These studies should include social and medical validation of survey data and other health indicators and, crucially, a bold and imaginative utilization of modern computer technology to exploit data already available or soon to become available in large Federal data files, for life course research on

health outcomes and the social and physical environment.

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