The Current Burden of Illness in the United States (1977)

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THE CURRENT BURDEN OF ILLNESS IN THE UNITED STATES

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The burden of illness is a major concern for all societies. Measurement of that burden takes on special significance in the face of scarce resources. The setting of priorities for the allocation of these resources and the evaluation of biomedical and behavioral research and health service programs should be improved by such information. The multitude of health problems facing our nation today varies greatly in the amount and kind of medical care used and in the indirect effects on the community in terms of pain and suffering, and losses in productivity due to illness, disability, and death.

The program for this annual meeting of the Institute of Medicine is directed at an examination of the impact on the health of the public of research in the biomedical and behavioral sciences. To set the stage for this consideration of the potential contributions of research to health, we shall examine our disease and health problems and the burdens they impose on the health delivery system and on society in general.

What are the implications of the burden of illness for the allocation of public funds to biomedical and behavioral research on categorical diseases and health problems? Many policymakers believe that research directed to a particular disease or problem is the best way of developing the knowledge to prevent or treat the disease, and that the greater the relative burden of that disease, the larger the resource investment should be. The annual hearings before the Senate and House Appropriations Committees are replete with testimony of many advocates of support for research in specific categorical diseases,

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who present staggering figures on the magnitude and cost of their particular disease.[1] There apparently is increasing use of selected data on the burden or costs of specific diseases as a justification for biomedical research expenditures.

The purpose of this paper is to define, measure, and attach values to the various burdens of ill health in the United States. In carrying out this task, comparisons will be made with data for England and Wales. Such comparisons can provide insight into the determinants of the impact of a given disease on a given society. In the conclusion to this paper, we shall address the issue of the use of such data, limited as they are, for the allocation of resource funds.

Defining the Burden of Illness

Webster's Dictionary defines burden as "1 a. Something that is carried: LOAD b. DUTY, RESPONSIBILITY. 2. Something oppressive or worrisome: ENCUMBRANCE"[2] When applied to illness, the burden includes the heavy load borne by society in providing services to prevent, cure, and care for the sick. It also includes the substantial losses of output to the economy due to disease, disability and death. The burden on the family in caring for and accommodating a sick member of the household can also be severe. Finally, there is the burden of pain, discomfort, and suffering of each sick person and that of anguish and grief of relatives and friends.

The first two indicators of burden–the provision of direct services and the losses in output–are more easily measurable. The dimensions of the burden on the family and that of the individual's suffering are not so easily quantifiable. These are areas in which more research is needed.

The health care industry encompasses a wide variety of institutions, organizations, and personnel that provide the full gamut of preventive, medical, therapeutic, restorative, and related services. It is one of the largest industries in the United States today.

Approximately 4.7 million persons–more than five percent of the employed population–are health workers; nearly 35,000 facilities with 3.2 million beds provide inpatient care;[3] and $139.3 billion–8.6 percent of the gross national product–is estimated to have been spent for health care in Fiscal Year 1976.[4]

New estimates released by the Department of Health, Education, and Welfare predict that by 1980 the Nation's health spending will rise to $224 billion a year.[5] The direct monetary burden obviously grows larger and larger; the fact remains that ill health and the risk of ill health continue to plague our society.

There were 1.9 million deaths in 1976, a rate of 8.9 per 1,000 population.[6] Although the death rates for diseases of the heart have been declining during the past decade, they remain the leading cause of death. Heart condi-

tions account for 38 percent of the deaths in the United States; next are malignant neoplasms (19 percent) and cerebrovascular diseases (11 percent).[7] Although high death rates in the older ages are to be expected, the rates of death and disability for the younger population are at unacceptably high levels. The Overview Cluster of the President's Biomedical Research Panel maintains that "Human beings have within reach the capacity to control or prevent human disease." Others, such as Dubos, are less sanguine about these prospects.[8]

Special interest in the economic valuation of the burdens imposed by specific illnesses has a long history. In the United States, estimates of the costs of specific diseases have proliferated. Fein,[9] Weisbrod,[10] and Mushkin[11] pioneered the development of the methodology for valuation of the burdens of specific illnesses in economic terms by attaching dollar values to the loss in human life. Since then, the economic costs of many specific diseases or conditions have been undertaken, including studies of peptic ulcers,[12] heart disease,[13] alcoholism,[14] syphilis,[15] heart disease, cancer, stroke,[16] heart and circulatroy diseases,[17] cancer,[18] mental illness,[19] digestive diseases,[20] and influenza,[21] to name a few.

The National Institutes of Health is now funding studies on the incidence, prevalence and cost of cancer, neurological disorders, visual disorders and blindness, kidney diseases, infectious and allergic diseases, and children's illnesses. The rationale for support of such studies is to provide a basis for allocating public funds to biomedical research.[22] Our particular concern in this paper is that estimates of the burdens and costs of specific diseases may not be valid for comparative purposes since such estimates, when developed independently, are often based on differing assumptions and methods.

A decade ago, to establish comparability in disease costs, Rice developed and described a method for estimating costs for the major diagnostic categories. Data were developed employing 1963 as the base year.[23] Recent changes in treatment modalities, disease incidence and prevalence, and earnings distributions, as well as the development of new theoretical approaches to valuing a life indicated a need for more current estimates. As a result, the earlier data have been updated to 1972.[24]

NIH is also supporting "A Study of Trends in the Cost of Disease and Ill Health, 1900 to 2000 AD and Related Biomedical Research Expenditures" under the direction of Selma Mushkin. Among other tasks, the study is designed to estimate the direct and indirect economic cost of individual diseases and conditions of ill health from 1900 to the most recent years of record and to project the potential costs of these diseases to the year 2000. The justification for this study is based on the need to explore "the implications of the trends in and distribution of the costs of ill health for the allocation of public funds to biomedical research, to different categorical health problems, or to different research programs."[25] As part of this study, cost of illness estimates

for 1975 were calculated using a methodology similar to that of the 1963 and 1972 studies. The 1975 data will be discussed in more detail below.

Indices of Burden

Sir Douglas Black, Chief Scientist, and David Pole, Economist, Ministry of Health and Social Security in the United Kingdom, developed five indices of the burden attributable to 54 major groups of diseases as a basis for establishing priorities for biomedical research in Great Britain. The five indices included inpatient hospital days, referrals to outpatient clinics, consultations (i.e., visits) with general (primary family) practitioners, sickness benefit days, and years of life lost due to premature death. They found considerable variation among the rank orders of the 54 disease categories in their relative contributions to each of the five dimensions. However, for each dimension, the number of categories accounting for half of the total burden was not large, ranging from three to nine out of the possible 54.[26]

The indices of burden developed for England and Wales by Black and Pole are illustrative of types of health information and statistics that could be useful to decisionmakers in the United States for allocating scarce resources designed to reduce the overall burden of illness in this country. We believe that the Congress and the public should see the facts about health and disease, clearly displayed, to promote awareness of the multifaceted nature of burden. To make reasonable choices with regard to investments in biomedical and behavioral research and the allocation of medical care resources, "statistical information and statistical compassion are needed as guides."[27]

We have developed for this purpose an array of indices of burden, including those that approximate the Black and Pole measures. Thus, we provide cross-national comparisons for the following four dimensions: Potential years of life lost, inpatient days, primary care visits, and sickness benefit days in England and Wales and work-loss days in the United States. In addition, we have added a few indices that we consider important in understanding the total burden of illness in the United States. We shall examine the distribution by diagnosis of (1) persons with limitations of major activity, (2) bed disability days, (3) selected chronic conditions, and (4) the economic costs (direct costs plus loss of output).

Most of the data for the United States are taken from the several national data systems of the National Center for Health Statistics. Diagnostic data of varying degrees of precision, are available from the Vital Statistics System, Hospital Discharge Survey, Health Interview Survey, Ambulatory Medical Care Survey, Nursing Home Survey, and the Health Examination and Nutrition Survey.[28]

These indices will be presented in 16 major diagnostic groups, categorized according to the International Classification of Diseases, Adapted (ICDA).

Use of these diagnostic groups for comparisons with the Black and Pole data necessitated the grouping of several diseases. For example, hypertension, ischemic heart disease, cerebrovascular disease, and other diseases of heart and blood vessels are grouped under diseases of the circulatory system. Combining the 54 diseases identified by our British colleagues into the major ICDA groups makes the comparisons more manageable without unduly distorting the results (see Appendix A). It is important to understand that the differences in diagnostic and coding tradition will account for some degree of error, but it is, nevertheless, reasonable to discuss broad similarities and differences.

In the tables that follow, both numbers and percent distributions are shown. In making comparisons with the British data, it is helpful to remember that the population of the United States is about four times that of England and Wales, i.e., 210 million[29] compared to 49 million[30] during the years 1972-1974.

Potential Years of Life Lost

The oldest, and in many ways, the most reliable measure of the health status of a population is to count the number of deaths. As age-specific death rates decline, the expectation of life increases. Under the mortality conditions prevailing in the United States in 1975, a child born that year could expect to live 72.5 years, marking an unusually rapid increase in longevity during the past several years.[31] Comparison of life expectancy for the United States (1972) with England and Wales (1971-73) indicates that life expectancy of women was approximately equal in the two countries (75.2 years in England and Wales, 75.1 years in the United States) but that British men had a life expectancy a year and a half greater than that of men in the United States (69.0 years for England and Wales, 67.4 years for the United States).[32]

The total years of life lost shown in Table 1 is a function of the age distribution of the population and the age-specific mortality rates. The population of England and Wales is somewhat older than that of the United States. Distribution by diagnostic category shows very large differences between the countries in the relative contribution of three disease categories to the years lost measure: respiratory conditions account for a considerably larger share of the deaths in England and Wales than in the United States while the reverse is true for diseases of the digestive system and for accidents, poisonings, violence, and homicides. The larger contribution to the years of life lost measure by respiratory illnesses in England and Wales undoubtedly reflects environmental and behavioral factors—air pollution, amount and kind of cigarettes smoked, occupational exposures, and perhaps poorly heated homes. In the homicide subcategory, the death rate for males in the United States was fifteen times higher than for males in England and Wales. Males in the United

TABLE 1 Distribution of Potential Years of Life Lost by Disease Category of the Underlying Cause of Death—England and Wales, 1972, and United States, 1974[1]

	England and Wales[2]		United States[3]	
ICD Category	1,000's	Percent	1,000's	Percent
Total	8,417	100.0	32,829	100.0
Infective and parasitic diseases	108	1.3	423	1.3
Neoplasm	1,764	21.0	5,875	17.9
Endocrine, nutritional and metabolic diseases	110	1.3	692	2.1
Diseases of the Blood and blood-forming organs	26	0.3	111	0.3
Mental disorders	22	0.3	239	0.7
Diseases of the nervous system and sense organs	138	1.6	482	1.5
Diseases of the circulatory system	3,526	41.9	12,006	36.6
Diseases of the respiratory system	1,073	12.7	1,677	5.1
Diseases of the digestive system	209	2.5	1,398	4.3
Diseases of the genitourinary system	110	1.3	351	1.1
Pregnancy, childbirth, and the puerperium	5	0.1	22	0.1
Diseases of the skin and subcutaneous tissue	5	0.1	31	0.1
Diseases of the musculoskeletal system and connective tissue	36	0.4	89	0.3
Congenital anomalies	267	3.2	849	2.6
Accidents, poisonings and violence	548	6.5	5,623	17.1
Other	470	5.6	2,961	9.0

[1] The method used in this table for calculating Potential Years of Life Lost was based on the assumption that the current life expectancy at a particular age would have applied to all 1972 (1974) decedents at that age had the deaths in the reference year been averted. Five year age intervals were employed between ages 5 and 84. For the remainder of the population, the age groups were: less than one year, 1-4 years, and 85 and over. Life expectancy for the midpoint of the age interval, calculated by linear interpolation between the expectancy at the beginning of the next interval, was assigned to each death falling in that interval. The Years Lost were allocated to the specific disease categories on the basis of the underlying cause of death.

[2] Black, D. A. K. and Pole, J. D., "Priorities on biomedical research: Indices of Burden;" *British Journal of Preventive and Social Medicine*, (1975), 29, 222-227. 1972 data.

[3] National Center for Health Statistics. 1974 data.

States also had death rates from accidents and suicides approximately twice as high as did males in England and Wales. The high ratio of the United States to England and Wales in years lost due to diseases of the digestive system reflects the considerably higher death rates from cirrhosis of the liver in the United States, particularly in younger age groups; e.g., for individuals 35-44, the death rate for cirrhosis was nearly ten times as high in the United States

as in England and Wales while for the 45-54 age group the ratio was six to one.

The components of the years of life lost shown in Table 2 are also revealing. A difference between the United States and England and Wales in years of life lost per death may reflect the differences in the age distribution of the two populations, in the life expectancies at various ages, and in the profiles of age-disease specific mortality rates. For example, the 35.8 years lost per death for accidents, poisonings, and violence reflects the very high rate of deaths from such causes at young ages in the United States. Not only are the mortality rates from these causes much higher in the United States than in England and Wales, but also the deaths occur at younger ages.

TABLE 2 Years of Life Lost per Death[1] and Number of Deaths According to Disease Category of Underlying Cause of Death—England and Wales,1972, and United States, 1974

	England and Wales[2]		United States[3]	
ICD Category	Years	Deaths	Years	Deaths
Total	14.2	592,001	17.0	1,934,388
Infective and parasitic diseases	33.8	3,244	26.9	15,722
Neoplasms	14.7	120,285	16.1	365,532
Endocrine, nutritional and metabolic diseases	15.3	7,210	15.1	45,688
Diseases of the blood and blood-forming organs	13.7	1,908	20.6	5,354
Mental disorders	14.7	1,509	24.9	9,603
Diseases of the nervous system and sense organs	21.6	6,443	27.7	17,356
Diseases of the circulatory system	11.5	305,746	11.7	1,028,575
Diseases of the respiratory system	12.7	84,276	15.3	109,303
Diseases of the digestive system	14.6	14,332	19.1	73,195
Diseases of the genitourinary system	13.8	8,049	13.4	26,068
Pregnancy, childbirth, and the puerperium	47.2	112	46.7	462
Diseases of the skin and subcutaneous tissue	13.3	363	14.7	2,097
Diseases of the musculoskeletal system and connective tissue	13.3	2,747	17.8	5,045
Congenital anomalies	60.7	4,417	62.9	13,526
Accidents, poisonings and violence	25.1	21,796	35.8	156,931
Other	49.5	9,452	49.4	59,931

[1] See footnote 1 to Table 1 for method employed in calculating years lost.
[2] Derived from Black, D. A. K. and Pole, J. D., "Priorities in biomedical research: Indices of burden;" *British Journal of Preventive and Social Medicine*, (1975), 29, 222-227, 1972 data.
[3] National Center for Health Statistics. 1974 data.

Inpatient Days

The volume of hospital inpatient utilization in connection with particular categories of disease is currently the best indicator of relative burden in terms of demands on medical care resources. Hospital and nursing home care together account for more than half of the aggregate personal health care expenditures in the United States.[33] The share of personal health care expenditures for short-term and long-term inpatient care has been increasing relatively steadily for the past several decades, due in part to aging of the population and increasing utilization, but due primarily to more rapidly escalating charges for inpatient care than for other components of care throughout much of the period. Similarly, in the United Kingdom, expenditures for hospital services constitute considerably more than half the National Health Service aggregate and exhibit the same upward trend as in the United States.[34] Included in the hospital outlays for the United Kingdom, however, are payments to specialists employed in the hospital; by contrast, the vast majority of the physicians practicing in United States hospitals are paid separately and these outlays are classified under the physicians' services rubric.

In their analysis, Black and Pole have employed inpatient days as their measure of inpatient utilization (Table 3). They added days in short-term general hospitals and resident days in longer-term institutions, such as psychiatric hospitals, convalescent, and preconvalescent homes. The result is a heterogeneous measure in terms of resource use; an inpatient day during which open-heart surgery was performed is counted as equivalent to a day of residence in a psychiatric hospital by a patient who has been there for ten years. Nevertheless, for purposes of comparability to the British data, the United States inpatient days have been combined for short-term and long-term general and special hospitals, residential treatment centers for the emotionally disturbed, nursing homes, personal care homes, and homes for the mentally handicapped.

In England and Wales and in the United States, the mental disorder category, including mental retardation, accounts for the largest number of inpatient days. Both countries have been experiencing marked declines in the number of residents in long-term psychiatric facilities, reflecting a sharp reduction in the average duration of stay coupled with generally stable or only moderately increasing numbers of admissions per year. Inpatient days in long-term psychiatric facilities have been declining more rapidly in the United States than in England and Wales.[35] The trends in both countries can probably be accounted for in part by the advent of psychotropic drugs and a growing societal commitment to de-institutionalization rather than to changes in the incidence of severity of mental conditions.

In the United States, Medicaid coverage of nursing home care may have resulted in the transfer of many elderly from mental institutions to nursing

homes with an accompanying modification in principal diagnosis. Re-labeling may simply have led to the attribution of a substantial proportion of the days to circulatory diseases. Thus, the volume of inpatient care due to mental illness among the elderly may not be diminishing as rapidly as it appears. In any case, it is clear that the drain on resources attributable to a particular disease category is a function of a complex set of circumstances, with incidence, prevalence, severity, and duration in some instances playing no greater role than scientific and technological advances, societal, cultural, and legal factors. Perhaps the methods of paying for care also influence the differences substantially.

Although the focus of this discussion is on the proportion of inpatient days associated with the several disease categories, it is noteworthy that the number of inpatient days per unit of population is, according to the aggregated measure employed here, one and one half times as large in the United

TABLE 3 Distribution of Inpatient Days by Disease Category of Diagnosis—England and Wales, 1972, and United States, 1974

	England and Wales[1]		United States[2]	
ICD Category	1,000's	Percent	1,000's	Percent
Total	133,562	100.0	872,174	100.0
Infective and parasitic diseases	1,858	1.4	7,687	0.9
Neoplasms	6,538	4.9	33,725	3.9
Endocrine, nutritional and metabolic diseases	1,855	1.4	26,220	3.0
Diseases of the blood and blood-forming organs	683	0.5	4,981	0.6
Mental disorders	62,103	46.5	259,228	29.7
Diseases of the nervous system and sense organs	5,037	3.8	40,324	4.6
Diseases of the circulatory system	16,153	12.1	211,958	24.3
Diseases of the respiratory system	5,072	3.8	27,657	3.2
Diseases of the digestive system	5,079	3.8	39,566	4.5
Diseases of the genitourinary system	3,386	2.5	26,966	3.1
Pregnancy, childbirth, and the puerperium	6,186	4.6	16,768	1.9
Diseases of the skin and subcutaneous tissue	1,170	0.9	6,038	0.7
Diseases of the musculoskeletal system and connective tissue	4,357	3.3	43,993	5.1
Congenital anomalies	1,062	0.8	4,631	0.5
Accidents, poisonings and violence	4,600	3.4	48,146	5.5
Other	8,423	6.3	74,292	8.5

[1] Black, D. A. K., and Pole, J. D., "Priorities in biomedical research: Indices of burden." *British Journal of Preventive and Social Medicine*, (1975), 29, 222-227, 1972 data.
[2] National Center for Health Statistics. Includes patient days in short-stay hospitals (1974), nursing homes (estimated number of days utilized during a twelve-month period based on 1973-74 data), and other long-term care facilities (1973).

TABLE 4 Distribution of Inpatient Days by Disease Category of Diagnosis According to Type of Facility, United States, 1974

ICD Category	Short-Stay[1]		Nursing Homes[2]		Other Long Term[3]	
	1,000's	Percent	1,000's	Percent	1,000's	Percent
Total	255,688	100.0	391,974	100.0	224,512	100.0
Infective and parasitic diseases	5,301	2.1	–	–	2,386	1.1
Neoplasms	24,381	9.5	9,344	2.4		
Endocrine, nutritional and metabolic diseases	8,663	3.4	17,557	4.5		
Diseases of the blood and blood-forming organs	2,207	0.9	2,774	0.7		
Mental disorders	15,248	6.0	42,267	10.8	201,713[4]	89.8
Diseases of the nervous system and sense organs	8,990	3.5	23,433	6.0	7,901	3.5
Diseases of the circulatory system	47,598	18.6	164,360	41.9		
Diseases of the respiratory system	19,548	7.6	8,103	2.1		
Diseases of the digestive system	32,084	12.5	7,482	1.9		
Diseases of the genitourinary system	21,272	8.3	5,694	1.5		
Pregnancy, childbirth, and the puerperium	14,970	5.9	–	–	1,798	0.8
Diseases of the skin and subcutaneous tissue	3,848	1.5	2,190	0.6		
Diseases fo the musculoskeletal system and connective tissue	16,024	6.3	26,682	6.8	1,287	0.6
Congenital anomalies	2,212	0.9	1,132	0.3	1,287	0.6
Accidents, poisonings and violence	28,865	11.3	17,994	4.6	1,287	0.6
Other	4,477	1.8	62,962	16.1	6,853	3.1

[1] National Center for Health Statistics. Hospital Discharge Survey. 1974 data.
[2] National Center for Health Statistics. Nursing Home Survey. August 1973-April 1974 data.
[3] National Center for Health Statistics. 1973 Master Facility Inventory Survey.
[4] Includes inpatient days in psychiatric institutions, resident schools or homes for the emotionally disturbed, and alcohol/drug abuse facilities. Inpatient days in psychiatric institutions accounted for somewhat more than half the days in this category while days in facilities for the mentally retarded accounted for somewhat more than one-third.

States as in England and Wales—4.15 days per person per year compared with 2.73 days. This difference is due primarily to the heavy utilization in the United States of nursing homes, which have no counterpart in Great Britain. Although mental conditions represent 46 percent of the total days of care in England and Wales compared to 30 percent in the United States, the rate of inpatient utilization for mental conditions is approximately equal in the two countries. The apparent excess in the proportion of inpatient days attributable to mental conditions is simply due to the smaller denominator, average inpatient days per person per year for all conditions combined, in England and Wales.

In the United States, diseases of the circulatory system are responsible for nearly one-quarter of all inpatient days, nearly as large a proportion as that due to mental conditions. The proportion of hospital days for diseases of the circulatory system is only half as great in England and Wales as in the United States. The United States excess is due primarily to the very large number of nursing home residents whose institutionalization is attributed to generalized arteriosclerosis as well as to the appreciable numbers suffering impaired function due to a stroke or a heart condition. The prevalence of severe infirmities among the elderly is undoubtedly as great in Britain as in the United States but the pattern of resource use, or at least the labels attached to the phenomena in question, appear to be quite different in the two countries.

Another important difference in the use of resources between the two countries is the significantly higher rate of surgery in the United States. Rates for surgery in the United States are twice those in England and Wales; the differences have been attributed to the existence of twice the ratio of practicing surgeons to population in the United States as compared to England and Wales.[36]

The distribution of the days of care in the United States by type of facility is shown in Table 4. Short-stay inpatient days represent 29 percent, nursing homes represent 45 percent, and the remaining 26 percent of the days are in mental hospitals and other long-stay institutions. As expected, circulatory diseases represent the highest proportion of the days of care in both short-stay hospitals and nursing homes. Arteriosclerosis is the most frequent principal diagnosis among residents of nursing homes, followed by senility, stroke and mental disorders.

Primary Family or General Medical Care

For primary care, Black and Pole used a distribution of general practitioner consultations (i.e. visits) based on the results of a sample of 53 practices in which physicians kept a record on every contact with patients, including both home and office visits. It does not include care provided by physicians in hospitals (including outpatient clinics); such services are provided by special-

TABLE 5 Distribution of General Practitioner Contacts, England and Wales, 1970-71, and Distribution of Physician Office Visits, United States, 1973, by Disease Category of Diagnosis

	England and Wales[1]		United States[2]	
ICD Category	1,000's	Percent	1,000's	Percent
Total	121,805	100.0	521,102	100.0
Infective and parasitic diseases	4,987	4.1	25,233	4.8
Neoplasms	2,005	1.6	12,713	2.4
Endocrine, nutritional and metabolic diseases	2,949	2.4	26,099	5.0
Diseases of the blood and blood-forming organs	1,293	1.1	5,000	1.0
Mental disorders	13,317	10.9	29,064	5.6
Diseases of the nervous system and sense organs	9,267	7.6	50,841	9.8
Diseases of the circulatory system	11,379	9.3	59,240	11.4
Diseases of the respiratory system	25,407	20.9	97,383	18.7
Diseases of the digestive system	5,405	4.4	23,826	4.6
Diseases of the genitourinary system	6,873	5.6	37,744	7.2
Pregnancy, childbirth, and the puerperium	2,730	2.2	–	–
Diseases of the skin and subcutaneous tissue	8,708	7.1	34,099	6.5
Diseases of the musculoskeletal system and connective tissue	9,236	7.6	34,370	6.6
Congenital anomalies	183	0.2	–	–
Accidents, poisonings and violence	7,137	5.9	47,609	9.1
Other	10,927	9.9	37,881	7.3

[1] Derived from Black, D. A. K., and Pole, J. D., "Priorities in biomedical research: Indices of burden," *British Journal of Preventive and Social Medicine*, (1975), 29, 222-227, 1970-71 data.

[2] National Center for Health Statistics, National Ambulatory Medical Care Survey, May 1973-April 1974. Excludes prenatal, well-child, and other visits not related to illness.

ists. For purposes of the present comparisons, we have made some adjustments in the data published by Black and Pole.[37]

The data on physician visits shown in Table 5 for the United States are from the National Ambulatory Medical Care Survey, based on a national probability sample of 3,500 office-based, patient-care physicians, including general and family practice physicians, internists, general surgeons, and psychiatrists.[38] Excluded are visits or encounters in outpatient clinics, emergency rooms of hospitals, patient's homes, as well as telephone encounters.

The table shows that the overall rate of ambulatory visits of this restricted type is 2.5 visits per person per year for both countries. The distributions of visits are remarkably similar except for mental disorders, which are significantly higher in England and Wales, and accidents, poisonings and violence, which are higher in the United States.

Sickness-benefit days, Work-Loss days, and Limitation of Activity

Another index of the burden of illness used by Black and Pole is sickness-benefit days. Sickness benefits in England pay for both short-term and long-term illness to insured persons who are employed. The non-employed and non-insured population are excluded as are the first three days of work-loss, so that sickness-benefit days do not reflect all morbidity. Respiratory disorders account for more than one-fifth of the burden (Table 6). Diseases of the circulatory system and musculoskeletal disorders are also high, reflecting the fact that persons with long-term disabilities also get sickness benefits.

There is no one index of burden in the United States precisely comparable to that of sickness-benefit days in England and Wales. We use several measures. First, the distribution of work-loss days for the currently employed, derived from the Health Interview Survey and shown in Table 6, reflects only short-term or temporary illness. Respiratory disorders and accidents are the main causes of absence from work, accounting for almost half of the total work-loss days.

Another measure of disability in the United States, shown in Table 7, is based on the count of persons receiving Social Security disability allowances (converted to days by multiplying by 240). There were more than two million permanently disabled persons who were receiving Social Security disability benefits, accounting for 484 million days.[39] Diseases of the circulatory system are the greatest cause of permanent disability followed by diseases of the musculoskeletal system, mental disorders, and cancer. Together, these four categories account for over two-thirds of the total. Because of the nature of the eligibility requirements of the disability program, which applies only to persons under age 65, this measure reflects the burden on the family in terms of income reduction.

There are about 320,000 disabled dependent adult offspring, 18 years or older, of workers receiving Social Security benefits,[40] accounting for 77 million days of disability. Mental disorders account for almost four-fifths of the total disability days reflecting mental retardation and other mental disorders since childhood.

Two additional indices of burden in the United States are available from the Health Interview Survey—distributions of conditions that limit individuals in their major (i.e., normal or usual) activity and bed days of disability, shown in Table 8. About 22 million persons report some limitation in their major activity—in their ability to work, keep house, or engage in school or pre-school activities as a result of chronic disease or impairment. The major cause of limitation of activity is diseases of the circulatory system. Unfortunately, for purposes of the present discussion, for nearly one quarter of the individuals limited in their major activity, it is not currently possible to allocate the cause of limitation to a particular ICD category. Available tabula-

TABLE 6 Distribution of Sickness Benefit Days (England and Wales, 1973), and Distribution of Condition Work Loss Days (United States, 1974), by Disease Category of Cause of Absence from Work

	England and Wales[1]		United States[2]	
ICD Category	Days 1,000's	Percent	Condition Work-Loss Days[3] 1,000's	Percent
Total	271,216	100.0	461,489	100.0
Infective and parasitic diseases	10,400	3.8	21,158	4.6
Neoplasms	1,535	0.6	9,948	2.2
Endocrine, nutritional and metabolic diseases	3,544	1.3	6,551	1.4
Diseases of the blood and blood-forming organs	1,233	0.4	1,999	0.4
Mental disorders	26,447	9.8	13,502	2.9
Diseases of the nervous system and sense organs	18,596	6.9	14,186	3.0
Diseases of the circulatory system	38,724	14.3	37,938	8.2
Diseases of the respiratory system	58,189	21.4	135,055	29.3
Diseases of the digestive system	16,067	5.9	37,390	8.1
Diseases of the genitourinary system	5,437	2.0	24,022	5.2
Pregnancy, childbirth, and the puerperium	3,646	1.3	2,596	0.6
Diseases of the skin and subcutaneous tissue	4,640	1.7	6,078	1.3
Diseases of the musculoskeletal system and connective tissue	29,453	10.9	25,061	5.4
Congenital anomalies	316	0.1	552	0.1
Accidents, poisonings and violence	23,897	8.8	84,115	18.2
Other	29,092	10.7	41,338	9.0

[1] Black, D. A. K., and Pole, J. D., "Priorities in biomedical research: Indices of burden," *British Journal of Preventive and Social Medicine*, (1975), 29, 222-227. 1973 data. Includes both short-term work absence and long-term invalidity.

[2] National Center for Health Statistics. Health Interview Survey, 1974 data. Work-loss days are counted only for individuals who are currently employed. Thus, the days of long-term work disability resulting in long-term or short-term nonparticipation in the labor force and the causes of that disability are excluded from this table.

[3] A given work-loss day can be attributed to more than one medical condition and is thereby counted more than once in the count of condition work-loss days. The unduplicated estimate of person work-loss days in 1974 was 414,302,000. On the average, each work-loss day is counted 1.11 times in this table. It was not possible to ascertain the principal cause of the work absence in cases where more than one cause was given. However, given the relatively infrequent reference to multiple causes, the percentage distribution is a satisfactory approximation of the work-loss day burden attributable to the various disease categories.

tions are based on classification for which the primary emphasis is on the immediate cause of the limitation, i.e., the impairment that would have to be overcome for a return to major activity, rather than the underlying disease process that had caused the impairment and consequently the limitation of activity.

Respiratory illnesses are the main cause of days of bed disability, accounting for 28.5 percent of the total. Episodes of bed disability for respiratory illness are generally of short duration; the large total represents a great many short episodes. For several other categories, such as circulatory, neoplastic and musculoskeletal diseases, individual episodes tend to be of longer dura-

TABLE 7 Distribution of Days Lost from Work by Social Security Disability Insurance Beneficiaries by Disease Category of Primary Cause of Disability, United States, 1973

	Workers[1]		Childhood[1]	
ICD Category	1,000's	Percent	1000's	Percent
Total	483,990	100.0	76,797	100.0
Infective and parasitic diseases	12,100	2.5	1,152	1.5
Neoplasms	49,851	10.3	307	0.4
Endocrine, nutritional and metabolic diseases	18,392	3.8	461	0.6
Diseases of the blood and blood-forming organs	–	–	230	0.3
Mental disorders	53,239	11.0	60,363	78.6
Diseases of the nervous system and sense organs	30,975	6.4	10,214	13.3
Diseases of the circulatory system	150,521	31.1	384	0.5
Diseases of the respiratory system	33,395	6.9	–	–
Diseases of the digestive system	12,584	2.6	–	–
Diseases of the genitourinary system	3,872	0.8	–	–
Pregnancy, childbirth, and the puerperium	–	–	–	–
Diseases of the skin and subcutaneous tissue	–	–	–	–
Diseases of the musculoskeletal system and connective tissue	72,114	14.9	768	1.0
Congenital anomalies	4,840	1.0	1,843	2.4
Accidents, poisonings and violence	39,203	8.1	768	1.0
Other	3,388	0.7	384	0.5

[1] Derived from *Social Security Disability Applicant Statistics 1970* and from 1973 beneficiary counts. The calculations are based on the assumption that the diagnostic distribution of current beneficiaries (prevalence) is the same as the diagnostic distribution of new allowances (incidence). Considering termination rates due to deaths, return to work, and attainment of retirement age, the average duration in beneficiary status undoubtedly varies somewhat by diagnosis. Thus, the current diagnostic distribution probably differs somewhat from the distribution for new allowances, but the data necessary to make a more satisfactory estimate are not available.

TABLE 8 Distribution of Chronic Conditions Causing Major Activity Limitation and Distribution of Conditions Bed-Days by Disease Category, United States, 1974[1]

ICD Category	Conditions Causing Limitation of Major Activity[2]		Condition Bed-Days[3]	
	1,000's	Percent	1,000's	Percent
Total	33,694	100.0	1,783,034	100.0
Infective and parasitic diseases	236	0.7	93,606	5.2
Neoplasms	772	2.3	66,907	3.8
Endocrine, nutritional and metabolic diseases	1,294	3.8	42,705	2.4
Diseases of the blood and blood-forming organs	277	0.8	14,246	0.8
Mental disorders	1,234	3.7	48,497	2.7
Diseases of the nervous system and sense organs	1,832	5.4	68,792	3.9
Diseases of the circulatory system	7,817	23.2	234,116	13.1
Diseases of the respiratory system	2,572	7.6	508,489	28.5
Diseases of the digestive system	1,820	5.4	116,579	6.5
Diseases of the genitourinary system	712	2.1	84,655	4.7
Pregnancy, childbirth, and the puerperium	–	–	23,227	1.3
Diseases of the skin and subcutaneous tissue	299	0.9	16,450	0.9
Diseases of the musculoskeletal system and connective tissue	4,957	14.7	121,872	6.8
Congenital anomalies	569	1.7	9,261	0.5
Accidents, poisonings and violence	1,421	4.2	156,221	8.8
Other	7,882	23.4	177,411	10.0

[1] National Center for Health Statistics. Health Interview Survey, 1974 data.
[2] There were an estimated 21,996,000 individuals who, due to one or more chronic conditions, were unable to carry on their major activity or were limited in the kind or amount of their major activity that they were able to carry on. An average of 1.53 chronic conditions per person were reported as being responsible for the major activity limitation. The present estimates are counts of conditions causing a limitation of major activity; an individual for whom multiple conditions were reported as responsible for the limitation would be represented in the condition count two or more times.
[3] There were an estimated 1,391,702,000 bed-days. A bed-day attributed to multiple conditions is counted two or more times. On the average, each bed-day was counted 1.28 times. (See footnote 2 and Table 6.)

tion but there are many fewer episodes than for respiratory disease. The measure we are using here equates ten three-day episodes of bed disability with one thirty-day episode. It may be that the burden, disutility, or social cost of the one long episode is greater than that of the sum of ten short episodes.

Impact of Selected Chronic Conditions

Now we shall consider specific chronic conditions, rather than broad diagnostic groups (Table 9). Among the chronic conditions reported in interviews of the civilian non-institutionalized population, sinusitis and arthritis are the most common. Heart diseases, however, cause long-term limitation of activity for a larger number of individuals and more bed days than any other condition. Hypertension results in the largest number of individuals seeing a doctor during the year. Although sinusitis was not the cause of much limitation of activity or of many bed days, the largest number of people report being at least occasionally bothered by it.

Table 9 also shows that 12.3 million persons suffer from hypertension without heart conditions. The National Center for Health Statistics has released new estimates of hypertension from two surveys—the Health and Nutrition Examination Survey (HANES) and the Health Interview Survey (HIS). HANES reports estimated 23.4 million persons aged 12-74, including 23.2 million of 18.1 percent of adults aged 18-74, have definite hypertension.[41] According to HIS estimates, 22.6 million persons aged 17 and over, or 15.7 percent, reported being told by a physician that they have hypertension.[42] Both surveys show that the prevalence of hypertension increases with age and that proportionately more blacks than whites have hypertension.

Public Concern

In the foregoing discussion, we have differentiated among medical conditions largely in terms of their impact on individuals actually afflicted by the particular conditions. The level of concern about possible *future* affliction can also be an important determinant of society's priorities. Some conditions are more widely and intensely dreaded than are others. Table 10 provides information on trends in the prevalence of differential concern over a period of nearly four decades.

Owing to changes in question formulation, the estimates for different points in time are not precisely comparable. Respondents to the 1939, 1965, and 1976 surveys were presented lists of specific conditions from which to choose. The 1947 survey employed an open-ended question which asked for the single worst condition while the 1955 survey employed an open-ended question which asked that several conditions be mentioned. In spite of the comparability problem, it is clear that throughout the entire period cancer has, by an overwhelming margin, been the most widely dreaded condition. The data suggest, however, a gradual diminution in cancer's predominance.

The marked decline in the frequency with which tuberculosis is mentioned is also noteworthy. In 1965 and in 1976, only one percent of the respondents designated tuberculosis as the worst disease as compared to 13 percent in

TABLE 9. Impact of Selected Chronic Conditions–United States[1]

Condition	Prevalence	Causing limitation of activity	Medical attention in past year	Number of bed days per year	Bothered a great deal or some	Now under treatment or medication recommended by doctor
			Numbers in 1000's			
All heart conditions	10,291	4,281	7,729	129,667	4,847	6,031
Coronary heart	3,307	1,988	2,880	52,912	1,915	2,613
Arthritis	18,339	3,228	7,629	66,020	13,864	6,675
Back Problems	8,018	1,964	2,646	32,072	5,573	N/A
Diabetes	4,191	1,245	3,462	24,308	1,425	3,085
Hypertension w/o heart	12,271	1,092	9,890	24,542	3,792	7,301
Asthma	6,031	1,031	3,637	34,980	4,746	3,100
Stroke	1,534	782	1,118	38,503	845	973
Emphysema	1,313	590	785	19,038	847	566
Hernia	3,191	511	1,781	15,636	1,420	594
Ulcer	3,360	366	1,979	21,163	2,369	2,053
Bronchitis	6,526	261	4,666	23,494	4,953	1,299
Hayfever	10,826	162	3,800	6,496	8,314	3,692
Sinusitis	20,582	144	6,710	14,407	15,169	4,507
Hemorrhoids	9,744	68	2,777	6,821	5,661	1,871

[1] National Center for Health Statistics, Health Interview Survey. Selected years 1968-1972.

TABLE 10 Public Concern About Diseases

Question	First Rank	Second Rank
Which of these diseases would you hate most to have? (1939 AIPO) Tuberculosis, Heart Trouble, Cancer, Pneumonia	Cancer 76%	Tuberculosis 13%
What disease or illness would you mind having most? (1947 AIPO)	Cancer 57%	Tuberculosis 15%
What do you think are the most dangerous diseases or illnesses facing the people in this country today? (1955 ACS)	Cancer 76%	Heart Disease 48%
Of these, which would you say is the worst that could happen to you? (1965 AIPO) Cancer, Blindness, Heart Disease, Arthritis, Polio, Loss of Limb, Tuberculosis, Deafness	Cancer 62%	Blindness 18%
What is the worst thing that can happen to you? (1976 AIPO) Cancer, Blindness, Heart Disease, Arthritis, Polio, Loss of Limb, Tuberculosis, Deafness	Cancer 58%	Blindness 21%

1939. The downward trend in public concern clearly reflects the downturn in case fatality and mortality rates for tuberculosis; for the 25-34 years age-group, for instance, mortality rates from tuberculosis dropped from nearly 300 per 100,000 population in 1900 to 165 in 1920, 56 in 1940, 2.4 in 1960, and 0.3 in 1975. Except in instances of dramatic breakthrough, such as the development of the polio vaccine, trends in the public apprehension may, nevertheless, lag some years behind trends in more objective indicators of disease impact.[43]

Cost of Illness

The various indices of the burden of illness that have been presented measure the impact of illness, disease, and disability on the use of resources and on the amount of days lost from work or from major activity. To assess the impact in economic terms, dollar values must be attached to the direct use of resources–hospitals, nursing homes, physicians, dentists and other medical personnel, etc. In addition, the losses in output for the ill person or the person who died prematurely from a disease can be valued.

TABLE 11. Distribution of Direct and Indirect Economic Costs of Illness by Disease Category of Diagnosis, United States, 1975[1]

ICD Category	Direct costs	Indirect costs	
		Morbidity	Mortality[3]
Total dollars in millions	$99,374[2]	$57,846	$87,926
Total–Percent distribution	100.0	100.0	100.0
Infective and parasitic diseases	2.0	2.7	1.2
Neoplasms	5.3	1.9	18.2
Endocrine, nutritional and metabolic diseases	3.4	2.9	1.9
Diseases of the blood and blood-forming organs	0.7	0.5	0.3
Mental disorders	9.5	15.1	1.2
Diseases of the nervous system and sense organs	7.5	9.9	1.6
Diseases of the circulatory system	16.1	15.1	29.2
Diseases of the respiratory system	7.6	14.8	4.1
Diseases of the digestive system	14.7	5.9	5.5
Diseases of the genitourinary system	5.6	3.1	1.0
Pregnancy, childbirth, and the puerperium	3.4	0.3	0.1
Diseases of the skin and subcutaneous tissue	2.1	0.7	0.1
Diseases of the musculoskeletal system and connective tissue	5.2	12.7	0.3
Congenital anomalies	0.4	0.8	1.8
Accidents, poisonings and violence	6.9	9.8	26.9
Other	9.6	3.8	6.6

[1] Public Services Laboratory, Georgetown University, "Costs of Illness, Fiscal Year 1975," prepared for the National Institutes of Health under Contract #NO1-OD-5-2121, Report Number Two, January 1977.
[2] Includes only personal health care expenditures allocated to diagnoses (84 percent of total direct health care expenditures).
[3] Based on a 4 percent discount rate.

About ten years ago, Rice developed and described a method for estimating the economic cost of illness for the major diagnostic categories.[44] The economic cost of illness is measured by the direct expenditures for prevention, detection, and treatment and the indirect costs or loss in output due to disability (morbidity) or premature death (mortality).

Morbidity losses are incurred when illness results in absence from employment, prevents the performance of household duties, or results in disability that keeps someone from working at all. The lost earnings and the dollar value of the unperformed housekeeping services are the morbidity costs. Calculation of morbidity costs involves applying current average earnings by age and sex to work-loss years for those in the labor force, attaching a dollar value to household services and applying it to related bed-days, and applying labor-force participation or work-experience rates and average earnings, by age and sex, to persons in and out of institutions who are too sick to be employed or keep house.

Calculation of mortality costs takes into account earnings over the decedent's potential active work-life, because an individual would have continued to be productive for a number of years had he not died. It is the present value of these future losses that is taken as the measure of earnings lost. The estimating procedure for the development of lifetime earnings takes into account life expectancy for different age, sex, and race groups, varying labor-force participation or work experience rates, the current changing pattern of earnings at successive ages, imputed value of household services, and a discount rate.

As noted previously, the cost of illness estimates have been calculated for 1975;[45] only the final results are shown in Table 11. Of the $99 billion allocated for direct costs, diseases of the circulatory system represented the largest share—16.1 percent. Diseases of the digestive system were the next most costly (14.7 percent). Half of these funds, however, went for dentists' services, which are included in this category.

Morbidity costs include losses for the institutional and three non-institutional population groups combined—currently employed, unable to work, and keeping house. In Fiscal Year 1975, productivity losses cost the nation $58 billion. Of this total, about $21 billion represented losses of currently employed individuals who were unable to work because of short-term illness, $24 billion for those unable to work at all, and $4 billion for full-time housewives unable to perform their household activities. The balance represented imputed losses for institutionalized persons and housekeeping duties of employed persons. Mental disorders and diseases of the circulatory and respiratory systems took the largest toll. Together, these three diagnostic categories accounted for almost half of the morbidity costs.

Measurement of mortality costs—losses due to premature death—has aroused much discussion in recent years. Attaching a dollar figure to death—

TABLE 12. Total Burden (England and Wales) and Economic Costs (United States)

ICD Category	Black and Pole[1]	Georgetown University[2]	
	Percent	Amount in millions	Percent
Total	100.0	$245,145	100.0
Infective and parasitic diseases	2.5	4,648	1.9
Neoplasms	7.3	22,358	9.1
Endocrine, nutritional and metabolic diseases	1.6	6,731	2.7
Diseases of the blood and blood-forming organs	0.5	1,255	0.5
Mental disorders	16.5	19,187	7.8
Diseases of the nervous system and sense organs	5.4	14,566	5.9
Diseases of the circulatory system	19.3	50,408	20.6
Diseases of the respiratory system	13.7	19,752	8.1
Diseases of the digestive system	4.4	22,803	9.3
Diseases of the genitourinary system	3.2	8,205	3.3
Pregnancy, childbirth, and the puerperium	2.0	3,660	1.5
Diseases of the skin and subcutaneous tissue	2.4	2,594	1.1
Diseases of the musculoskeletal system and connective tissue	5.8	12,717	5.2
Congenital anomalies	1.1	2,500	1.0
Accidents, poisonings and violence	6.3	36,196	14.8
Other	7.9	17,565	7.2

[1] Derived from Black, D.A.K. and Pole, J.D., "Priorities in biomedical research: Indices of burden," *British Journal of Preventive and Social Medicine*, (1975), 222-227. 1972 data.

[2] Public Services Laboratory, Georgetown University, "Costs of Illness, Fiscal Year 1975," Prepared for the National Institutes of Health Under Contract #No1-OD-5-2121, Report Number Two, January 1977.

that is, determining how much a life is worth—is an emotion-laden issue. Some people refuse to make such a determination, either because to them life is priceless or is not valued properly by any existing procedure. Nevertheless, whenever public spending decisions are made, values are implicitly attached to life.

The "human capital" approach was used in the 1963, 1972, and 1975 estimates, but there are other approaches to valuing a life, including explicit statements of value by individuals or the "willingness to pay."[46] Employing the human capital approach, one's life is valued according to one's earnings or, in the case of household services, according to the market value of those duties. It dates back to 1915 and is the most commonly used formal method.[47]

In 1975, there were nearly 2 million deaths, representing over 35 million years of life lost. Application of lifetime earnings to the deaths yielded almost $88 billion in losses, at a four percent discount rate.

The greatest losses were for circulatory disorders. More than half of the deaths, slightly more than one-third of the lost years, and slightly less than one-third of the lost earnings were caused by diseases in this one diagnostic category. As was shown in Table 2, decedents from diseases of the circulatory system are, on the average, older than those dying from other types of diseases. The relatively few years of remaining life and the reduced employment and earnings level at older ages result in low lost earnings per death, but a very large aggregate number of years due to the predominance of circulatory conditions among the causes of death.

Deaths from accidents were also very costly to the nation. Ranking second in lost years and earnings, accidental deaths resulted in a $23.7 billion loss to the economy. Although only eight percent of the deaths were attributed to accidents, poisonings, and violence, nearly 27 percent of lost earnings due to mortality derived from this category, because the decedents were relatively young and would have had many productive years ahead of them. The third largest mortality losses were for cancer. Ranking second in deaths, cancer deaths caused over 5.5 million lost years and cost $16 billion.

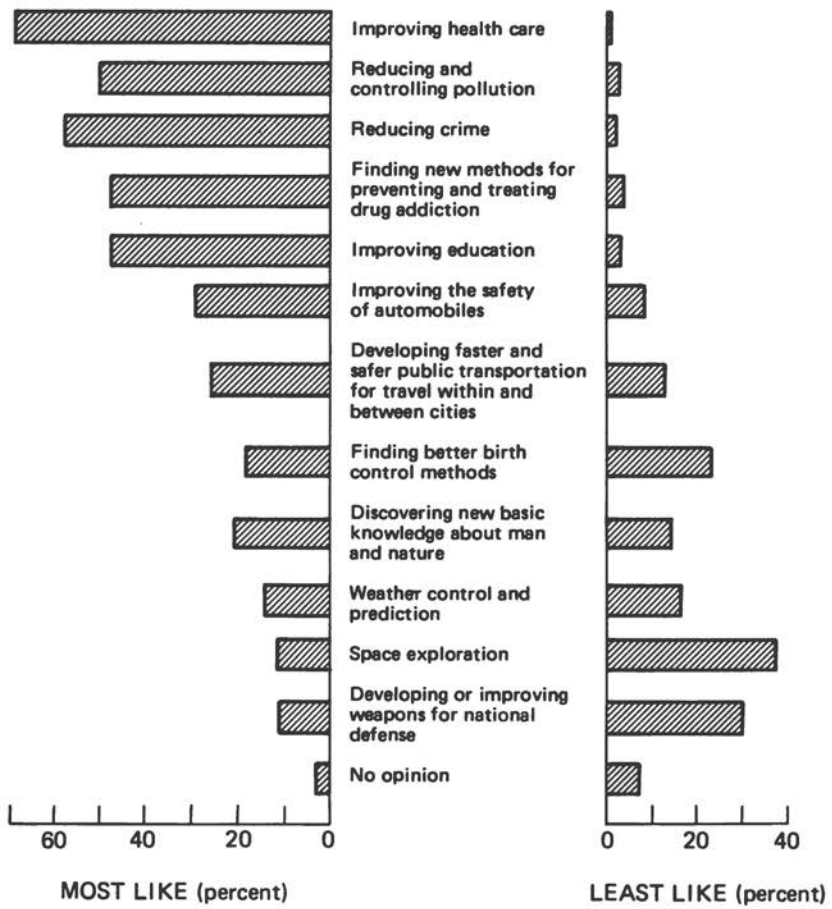
When all types of disease costs are combined—mortality, morbidity and direct—the total cost of illness for 1975 reached more than $245 billion, at a four percent discount rate (Table 12). About $50 billion, or one-fifth, was for persons with diseases of the circulatory system. Accidents and violence cost $36 billion, and were followed by diseases of the digestive system and cancer, each costing about $22 to $23 billion.

We have compared the distribution of the total economic costs of illness with the total burden presented by Black and Pole. They used a simple arithmetic average of the five percentages of indices of burden (inpatient days, outpatient referrals, primary family practice, sickness-benefit days, and years of life lost due to premature death), thus according equal weight to the five indicators.

Comparison of the distributions of the burden of illness by Black and Pole with that obtained by attaching appropriate economic costs to each of the measures shows that circulatory diseases rank highest in both countries, constituting about one-fifth of the total burden.

Mental disorders, followed closely by respiratory illness, rank next on the Black and Pole scale, while accidents rank second in total costs for the United States. Cancer is fourth in both rankings.

CHART 1 "In which of the areas listed would you most like (and least like) to have your taxes spent for science and technology?"–1974



SOURCE: *Status: A Monthly Chartbook of Social and Demographic Trends*, October 1976, U.S. Department of Commerce, Bureau of the Census, p. 81. See reference 49 for demographic cross-tabulations.

Public Attitudes Toward Medical Research

Doubts have been expressed as to the actual and potential impact of scientific advances on the health of the population.[48] How widespread is this skepticism? To answer this and related questions, the National Science Foundation has sponsored interview surveys bearing on public attitudes toward science and technology.[49] In response to the July 1974 survey, the belief that science and technology have changed life for the better was expressed by 75 percent of the public. Also, about three-fourths of the public remained confident that science and technology would eventually solve at least some of the major problems facing the nation, such as pollution, disease, drug abuse and crime. Of more specific pertinence to the public's view of health research were the following questions:

–Science and technology can be directed toward solving problems in many different areas. In which of the areas listed on this card would you *most* like to have your taxes spent for science and technology?

–Please tell me in which of these areas you would *least* like to have your taxes spent for science and technology.

The distributions of responses to these questions are shown in Chart I. Improvement of health care is the most widely agreed upon priority with the control of pollution and the prevention and treatment of drug addiction also ranking high. Areas in which the public indicated they would least like their taxes spent for science and technology were "space explorations" and "developing weapons for national defense."

Conclusions

What conclusions can we draw from the data presented in this paper? What are the implications for allocation of the biomedical and behavioral research dollars, or, indeed, for our entire investments in an effort to solve the health, disease, and medical care problems that beset all societies?

Research support has a very long tradition as an accepted Federal role in health, second only to communicable disease control. The Office of Management and Budget estimates that Federal expenditures for health-related research will total almost $3.6 billion in Fiscal Year 1978, up from the $3.3 billion for Fiscal Year 1977 and the $3.1 billion outlay for Fiscal Year 1976.[50] Although overall funds for biomedical and behavioral research are growing, investment in this field, as well as in health services research, is declining as a percentage of total health expenditures, in 1975 down to approximately 3.9 percent from nearly 5.0 percent in 1965.[51]

The Fiscal Year 1978 budget further estimates that the National Institutes

of Health (NIH) will spend about three-fifths of the $3.6 billion proposed Federal outlays for health-related research. The Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA), will spend an additional 5 percent. The distribution of the NIH/ADAMHA 1978 budget estimate for research only, exclusive of training, community programs, construction, and management and administration, follows:

Agency/Institute	FY 1978 Estimate: Research Budget* (in thousands)	Percent Distribution
Total	$2,109,630	100.0
NIH		
National Cancer Institute	651,932	30.9
National Heart, Lung and Blood Institute	363,414	17.2
National Institute of Dental Research	48,776	2.3
National Institute of Arthritis, Metabolism, and Digestive Diseases	197,054	9.3
National Institute of Neurological and Communicative Disorders and Stroke	143,145	6.8
National Institute of Allergy and Infectious Diseases	138,764	6.6
National Institute of General Medical Sciences	171,355	8.1
National Institute of Child Health and Human Development	137,126	6.5
National Institute on Aging	30,213	1.4
National Eye Institute	57,948	2.8
National Institute of Environmental Health Sciences	54,046	2.6
ADAMHA	115,857	5.5

*Includes grants, research and development contracts, and intramural research.

Cancer research accounts for almost one-third of the NIH/ADAMHA research budget and almost one-fifth of the 1978 estimated Federal research dollars. By contrast, the Heart, Lung, and Blood Institute is allocated about one-sixth of the total NIH/ADAMHA budget, or a little over half that of the Cancer Institute. Compare these amounts with the 1978 budget estimate of $116 million for the Alcohol, Drug Abuse, and Mental Health Administration, and $22.5 million for health services research in the Health Resources Administration.[53]

The ranking of the 16 diagnostic categories among eight indices of burden is summarized in Table 13. It is interesting to note that diseases of the circulatory system ranked highest in three of the eight indices of burden (potential years of life lost, SSA worker allowances, and total economic costs), and sec-

TABLE 13 Ranking of Diagnostic Categories According to Dimensions of Burden, United States

ICD Category	Potential Years of Life Lost	Inpatient Days	Physician Office Visits	Work-Loss Days	SSA Disability	Limitation of Major Activity	Bed Days	Total Economics Costs
Infective and parasitic diseases	10	13	11	7	10	15	7	12
Neoplasms	2	8	13	11	4	10	10	4
Endocrine, nutritional and metabolic diseases	8	11	10	12	8	8	12	11
Diseases of the blood and blood-forming organs	13	15	14	15	–	14	15	16
Mental disorders	12	1	9	10	3	9	11	6
Diseases of the nervous system and sense organs	9	6	3	9	7	5	9	8
Diseases of the circulatory system	1	2	2	4	1	2	2	1
Diseases of the respiratory system	5	9	1	1	6	4	1	5
Diseases of the digestive system	6	7	12	5	9	6	6	3
Diseases of the genitourinary system	11	10	6	7	12	11	8	10
Pregnancy, childbirth, and the puerperium	16	12	–	14	–	–	13	13
Diseases of the skin and subcutaneous tissue	15	14	8	13	–	13	14	14
Diseases of the musculoskeletal system and connective tissue	14	5	7	6	2	3	5	9
Congenital anomalies	7	16	–	16	11	12	16	15
Accidents, poisonings and violence	3	4	4	2	5	7	4	2
Other	4	3	5	3	13	1	3	7

ond in four other indices. Respiratory illness ranked first in three indices.

The burden due to cancer is less clear, ranking second in only one index of burden (potential years of life lost), fourth in two indices (SSA worker allowances and total economic costs), and eighth to thirteenth in six other indices. The fact that a malignancy either causes death within a relatively short time after diagnosis or else is considered cured results in relatively low cancer period prevalence rates for short-time intervals. The low prevalence of cancer depresses its ranking with respect to measures such as inpatient days, primary care utilization, work-loss days, limitation of activity, etc. On the other hand, there are, at any particular instant, appreciable numbers of living individuals who are currently classified as suffering from hypertension, heart disease, diabetes, arthritis, or other conditions that are managed or controlled rather than cured, but that have far more favorable survival curves than most cancers. Thus, alive at any time are individuals who may be viewed as having had a particular chronic condition continuously for twenty years or more—in some instances, as long as sixty or seventy years. For such conditions, the current prevalence contains, unlike cancer, an accumulation of survivors of many years' incidence.

Circulatory conditions rank high on a wide variety of measures of burden because accompanying moderately high incidence rates are long durations of affliction, during which, as a consequence of a number of the specific diseases in the category, there is impaired functioning and continual indications for medical care. The more common conditions in the respiratory category generally exhibit extremely high incidence rates but short durations. Several of the particular indices of burden considered here are sensitive to the large volume of acute episodes of respiratory illness.

In contrast, cancer ranks highest among the diseases most dreaded. If individual preferences could be quantified so that they are useful in planning public policy with respect to investments in biomedical and behavioral research, perhaps cancer would rank highest. For example, an individual can say that he would pay some amount to reduce his chance of death or illness by a small amount. The use of this "willingness-to-pay" approach may illuminate to some degree values of individuals with respect to life and health and may be helpful in improved understanding of social preferences.[54]

The 1978-82 Forward Plan for Health states that research priorities continue to be established in relation to three broad categories of initiatives:[55]

"important fundamental, cross-cutting areas of knowledge (immunology, virology, basic genetics, nutrition, epidemiology, endocrinology, neurophysiology and neuropharmacology, and the molecular biology of disease);

new and expanded legislative mandates (aging; diabetes, arthritis; occupational and environmental hazards; child health, sudden infant death syndrome; genetic diseases; alcoholism and drug abuse; and health services research);

sustaining national priorities for cancer and heart, lung and blood diseases."

The Forward Plan further states:

"Among the factors which determine research priorities within these broad categories at a particular time are:

- the magnitude of the health problem;
- the public's perception of the importance of the health problem;
- the scientific opportunity."

As the President's Biomedical Research Panel concluded, continuing support of basic biomedical and behavioral research is essential for developing the fundamental science base required to prevent or ameliorate disease. Medical science and technology have in the past provided knowledge for preventing some conditions and for controlling others and, undoubtedly, will continue to do so. Partisans of basic research will and should continue to exert pressure on the system to allocate a reasonable share of scarce resources to "nonmission-oriented" scientific activities.

We can also anticipate vigorous advocacy of more specific targeting of appropriations by the various pressure groups organized to focus attention on particular diseases and to channel resources into the conquest—or at least the abatement of the impact—of these enemies. However, we support Black and Pole's contention that, in addition to the arguments of the proponents of various emphases, statistical information on "the relative burden of different diseases is a legitimate component in the consideration of priorities for biomedical research."[5,6] The consequences of such a perspective depend, of course, on the relative magnitude of the weights attached to the different types of burden. Should the share of the budget targeted toward research related to the prevention and treatment of acute upper respiratory infections be greatly increased at the expense, for instance, of cancer research? The incidence rate of the common cold and similar disorders is extremely high, resulting in the aggregate, in many days spent in bed, a great many days of work and school missed, a very large number of physician visits, and a great many different people suffering episodes of discomfort during a year. On the other hand, such an illness is generally of short duration, there is only rarely any permanent damage to the individual's health or quality of life, and the afflicted tend to experience misery rather than dread. Although it is by no means clear to us by what calculus these diverse considerations should be taken jointly into account, we are nevertheless convinced of the desirability of doing so.

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APPENDIX A

Listing of Major Diagnostic Categories and Selected Subclassifications

Diagnosis	ICDA Code*
Infective and parasitic diseases	000-136
Tuberculosis	
Venereal diseases	
Infectious diseases and other bacterial diseases	
Virus-caused diseases	
Typhus, malaria and other infective and parasitic diseases	
Neoplasms, malignant, benign, and unspecified	140-239
Endocrine, nutritional, and metabolic diseases	240-279
Diseases of thyroid gland	
Diabetes mellitus	
Diseases of other endocrine glands	
Avitaminoses and metabolic diseases	
Diseases of blood and blood-forming organs	280-289
Mental disorders	290-315
Psychoses	
Neuroses and personality disorders	
Mental retardation	
Diseases of the nervous system and sense organs	320-389
Inflammatory and other diseases of central nervous system	
Diseases of nerves and peripheral ganglia	
Diseases of eye, ear, and mastoid process	
Diseases of the circulatory system	390-458
Rheumatic fever and rheumatic heart disease	
Ischemic heart disease	
Hypertension	
Cerebrovascular disease	
Diseases of arteries and veins and other diseases of the circulatory system	
Diseases of the respiratory system	460-519
Diseases of the digestive system	520-577
Buccal cavity and esophagus, including dental diseases	
Stomach and duodenum	
Appendicitis	
Hernia of abdominal cavity	
Other diseases of intestines and peritoneum	
Liver, gallbladder and pancreas	
Diseases of the genitourinary system	580-629
Urinary system	
Male genital organs	
Female genital organs	

Diagnosis	ICDA Code*
Deliveries and complications of pregnancy, childbirth, and puerperium	630-678
Diseases of the skin and subcutaneous tissue	680-686
Diseases of the musculoskeletal system and connective tissue	710-738
Arthritis and rheumatism (except rheumatic fever)	
Osteomyelitis and other diseases of bone and joint	
Other diseases of musculoskeletal system	
Congenital anomalies	740-759
Accidents, poisonings and violence	800-999
Fractures, dislocation, and sprains	
Lacerations, contusion	
Burn and adverse effect of chemicals	
Other	760-796
Certain causes of perinatal morbidity and mortality	
Symptoms, senility and ill-defined conditions	

*U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, *International Classification of Diseases Adapted*, Public Health Service Publication No. 1693, 1967.

REFERENCES AND NOTES

1. Subcommittee of the Committee on Appropriations, House of Representatives, 94th Congress. "Hearings on the Departments of Labor and Health, Education, and Welfare Appropriations for 1977," Arthritis–$4 billion, p. 246; Asthma–$187 million, p. 549; Blindness and visual disorders–$5.2 billion, p. 812; Cancer–$15 to $25 billion, p. 115; Digestive diseases–$16.4 billion, p. 288; Epilepsy–$4.25 billion, p. 1222; Heart, lung, and blood diseases–$58 billion, p. 620; Influenza–$700 million, p. 513.
2. Webster's Seventh New Collegiate Dictionary, G & C Merriam Company, Springfield, Mass., 1965, p. 111.
3. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics "Excerpts from Health Resources Statistics, 1975," DHEW Pub. No. (HRA) 76-1509-1, July 1976.
4. U.S. Department of Health, Education and Welfare, Social Security Administration, "HEW News," December 22, 1976.
5. Trapnell, Gordon R. "A Comparison of the Costs of Major National Health Insurance Proposals," Office of the Secretary, U.S. DHEW, January 1976.
6. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "Births, Marriages, Divorces, and Deaths for July 1976," *Monthly Vital Statistics Report*, (HRA 76-1120, Vol. 25, No. 7, September 24, 1976.
7. U.S. Department of Health, Education, and Welfare, Health Resources Administration, "Papers on the National Health Guidelines: Baselines for Setting Health Goals and Standards, September 1976." DHEW Pub. No. (HRA) 76-640, p. 54.
8. U.S. Department of Health, Education, and Welfare, Public Health Service, "Report of the President's Biomedical Research Panel Submitted to the President and the Congress of the United States, April 30, 1976." DHEW Pub. No. (OS) 76-500, and Dubos, Rene, "The Mirage of Health: Utopias, Progress, and Biological Change." Garden City; Anchor Books, 1959.
9. Fein, Rashi. *Economics of Mental Illness.* New York: Basic Books, 1958.
10. Weisbrod, Burton A. *Economics of Public Health.* Philadelphia, Pa.; University of Pennsylvania Press, 1961.
11. Mushkin, Selma J. "Health as an Investment." *Journal of Political Economy*, Vol. 70, No. 5, Part 2, Supplement, October 1962. pp. 129–157.
12. Blumenthal, I. S. *Social Cost of Peptic Ulcer.* Rand Corporation, Santa Monica, April 1967.
13. Klarman, Herbert E. "Socioeconomic Impact of Heart Disease." In: *The Heart and Circulation.* Second National Conference on Cardiovascular Diseases, Washington, D.C., 1964. Vol. II, chap. 2, pp. 693-707.
14. Holtmann, A. G., Jr., "Estimating the Demand for Public Health Service. The Alcoholism Case." *Public Finance,* Vol. 9, No. 4, 1964.

15. Klarman, Herbert E. "Syphilis Control Program." In: *Measuring Benefits of Government Investments.* Ed., Dorfman, Robert. The Brookings Institution, Washington, D.C., 1965, pp. 367-410.
16. Rice, Dorothy P. "Economic Costs of Cardiovascular Diseases and Cancer, 1962," U.S. Department of Health, Education, and Welfare, Health Economics Series No. 5, PHS Pub. No. 947-5, 1965.
17. Acton, Jan P. "Measuring the Social Impact of Heart and Circulatory Disease Programs: Preliminary Framework and Estimates." Rand Corporation, April 1975. See also Jan Paul Acton, "Evaluating Public Programs To Save Lives: The Case of Heart Attacks," Rand Corporation, Jan. 1973.
18. Hodgson, Thomas A. "The Economic Costs of Cancer," in *Cancer Epidemiology and Prevention* by David Schottenfeld, Charles C. Thomas, 1973, pp. 29-59.
19. Levine, Daniel S. and Willnes, Shirley G. "The Cost of Mental Illness, 1974," Mental Health Statistical Note No. 125, Feb. 1976, U.S. Department of Health, Education, and Welfare, National Institutes of Mental Health, DHEW Publication No. (ADM) 76-158.
20. Second Conference on Digestive Disease as a National Problem, *Gastroenterology,* Vol. 68, No. 5, Part 2, May 1975, pp. 1345-1416.
21. Kavet, Joel. "Influenza and Public Policy," unpublished dissertation, Harvard University, School of Public Health, Boston, 1972.
22. Woolley, Herbert B. "Studies of Economic and Social Costs of Disease and Ill-Health," Department of Health, Education, and Welfare, and National Institute of Health, unpublished paper, 1976.
23. Rice, Dorothy P. "Estimating the Cost of Illness," *Health Economics Series No. 6,* U.S. Public Health Service, 1966.
24. Cooper, Barbara S. and Rice, Dorothy P. "The Economic Cost of Illness Revisited," *Social Security Bulletin,* February 1976, pp. 21-34.
25. Woolley, Herbert B. op. cit., p. 1.
26. Black, D. A. K., and Pole, J. D. "Priorities in Biomedical Research," British Journal of Preventive Social Medicine, Vol. 29, 1975, pp. 222-227.
27. White, Kerr L. Statement before the Senate Committee on Labor and Public Welfare Subcommittee on Health, June 17, 1976.
28. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "Current Listing and Topical Index to the Vital and Health Statistics Series, 1962-1975," DHEW Publication No. (HRA) 76-1301; U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "NCHS Publication Note: Publications Issued January 1976 through June 1976," DHEW Publication No. (HRA) 76-1309.
29. U.S. Department of Commerce, Bureau of the Census, "Statistical Abstract of the U.S., 1975," 1973 U.S. Population–209,844,000, Table No. 11, p. 12.
30. Great Britain Department of Health and Social Security, "Health and Personal Social Services Statistics for England 1975," 1971 England and Wales Population–48,854,000, Table 1.2, p. 14.

31. U.S. Department of Health, Education, and Welfare, Health Resources Administration, "Papers on the National Guidelines: Baselines for Setting Health Goals and Standards," Sept. 1976. DHEW Publication No. (HRA) 76-640, p. 57.
32. Great Britain Department of Health and Social Security, op. cit., p. 17. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "Vital Statistics of the United States, 1972" Vol. II, Part A, DHEW Publication No. (HRA) 76-1101, Table 5-1.
33. Mueller, Marjorie S. and Gibson, Robert M. "National Health Expenditures, Fiscal Year 1975," *Social Security Bulletin,* February 1976.
34. Cooper, Michael H., "Health Costs and Expenditures in the United Kingdom," In: *International Health Costs and Expenditures,* Ed. Hu, Teh-wei, U.S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, DHEW, Publication No. (NIH) 76-1067, p. 97. p. 97.
35. The ratio of long-term psychiatric facility residents to total population dropped nearly one-third in England and Wales and somewhat over one-half in the United States between 1955 and 1970, in spite of aging populations. In more recent years, the rate of decline has accelerated markedly in the United States while the rate of decline in England and Wales has increased only slightly. The rate of long-term psychiatric facility inpatient-days had been slightly greater for the United States than for England and Wales in 1955 but, reflecting the relative rates of decline over the past two decades, it is currently appreciably higher for England and Wales, particularly among the elderly. However, compensating for the recent rapid decline in the United States, has been the increased rate of institutionalization of psychiatric patients in nursing homes.

    Great Britain Department of Health and Social Security, op. cit., p. 134.

    Great Britain Department of Health and Social Security, "Psychiatric Hospitals and Units in England and Wales," Statistical and Research Report Series No. 4, HMSO, London, 1972, p. 80.

    Bransby, E. R., "Mental Illness and the Psychiatric Services," In: Great Britain Central Statistical Office, "Social Trends, 1973," No. 4, HMSO, 1973, pp. 51-60.

    Kramer, Morton, and Pollack, Earl S., et al., *Mental Disorders/Suicide,* Cambridge: Harvard University Press, 1972.

    Taube, Carl A., "Change in the Age, Sex, and Diagnostic Composition of the Resident Population of State and County Mental Hospitals, United States, 1964-1973," National Institute of Mental Health, Statistical Note 112, March 1975.
36. Bunker, John. "Surgical Manpower: A Comparison of Operations and Surgeons in the United States and in England and Wales." *New England Journal of Medicine,* 1970, Vol. 282, pp. 135-144.
37. Black and Pole weighted the diagnostic distribution of home visits by a factor of five. Home visit diagnoses, weighted by four, were added to the distribution of diagnoses for surgery consultation and home visits

combined. The diagnostic distribution of general practitioner contacts in Table 5 of the present paper accords equal weight to surgery consultations and home visits for purposes of comparability to the United States data.

The 1970-71 National Morbidity Survey employed a disease-based recording system. Thus, the publications based on the survey reflect the "number of times a disease or condition was the subject of consultation" rather than the number of separate face-to-face consultations. On the assumption that each disease category was as likely to be involved in a multiple-diagnosis consultation as every other disease category, a constant correction factor was applied in developing our estimates, presented in Table 5, of the volume of consultations by diagnosis. Great Britain Office of Population Censuses and Surveys, "Morbidity Statistics from General Practice, Second National Study, 1970-71," Studies on Medical and Population Subjects No. 26, HMSO, 1974, pp. 36-37, and Table 10.

38. U.S. Department of Health, Education and Welfare, National Center for Health Statistics. "The National Ambulatory Medical Care Survey: 1973 Summary, U.S." May 1973-April 1974, (HRA) 76-1772.
39. Social Security Administration, Office of Research and Statistics, "Social Security Annual Statistical Supplement, 1973," Table 90, p. 116.
40. Ibid., Table 94, p. 119.
41. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "Blood Pressure of Persons 6-74 Years of Age in the U.S." *Advance Data from Vital and Health Statistics of the National Center for Health Statistics*, No. 1, October 18, 1976.
42. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "Hypertension: United States, 1974," *Advance Data from Vital and Health Statistics of the National Center for Health Statistics*, No. 2, November 8, 1976.
43. Feldman, Jacob J., *The Dissemination of Health Information.* Chicago, Illinois; Aldine Publishing Co., 1966, pp. 100-101.
Simonds, Scott K., "Public Opinion Surveys About Cancer: An Overview," *Health Education Monographs*, No. 30, 1970, p. 16.
44. Rice, Dorothy P., "Estimating the Cost of Illness," op. cit.
45. Public Services Laboratory, Georgetown University, "Costs of Illness and Disease, Fiscal Year 1975," prepared for the National Institutes of Health Under Contract #NO1-OD-5-2121, Report Number Two, January 1977.
46. Schelling, Thomas C., "The Life You Save May Be Your Own," *Problems in Public Expenditure Analysis*, Samuel B. Chase, ed., The Brookings Institution, Washington, D.C. 1968.
47. Crammond, Edgar, "The Cost of the War," Journal of the Royal Statistical Society (Series A), May 1915.
48. Starr, Paul, "The Politics of Therapeutic Nihilism," *Hastings Center Report*, October 1976.

49. Opinion Research Corporation, "Attitudes of the U.S. Public Toward Science and Technology; Research Findings Prepared for the National Science Foundation," Study II, July 1974, Princeton, N.J.
50. *Special Analyses, Budget of the United States Government, 1978*, "Special Analysis K, Federal Health Programs," Office of Management and Budget, January 1977.
51. U.S. Department of Health, Education, and Welfare, Public Health Service, *Forward Plan for Health, FY 1978-82*, DHEW Publication No. (OS) 76-50046, p. 84.
52. U.S. Department of Health, Education and Welfare, Public Health Service, *Justification of Appropriation Estimates for Committee on Appropriations*, Vols. II, III, Revised, 1977.
53. Office of Management and Budget, The Budget of the United States, Government Fiscal Year 1977, Appendix, p. 323.
54. Williams, A.P., et al., "Policy Analysis for Federal Biomedical Research," prepared for the President's Biomedical Research Panel, R-1945-PBRP/RC, March 1976.
55. U.S. Department of Health, Education and Welfare, Public Health Service, *Forward Plan for Health, FY 1978-82*. DHEW Publication No. (OS) 76-50046, p. 84.
56. Black, D.A.K. and Pole, J.D., op. cit. and Black, D.A.K. "The Use of Research," *Journal of the Royal College of Surgeons of Edinburgh*, 20 (6): 355-64, November 1975.