Health Care Utilization and Costs of Adult Cardiovascular Conditions United States, 1980

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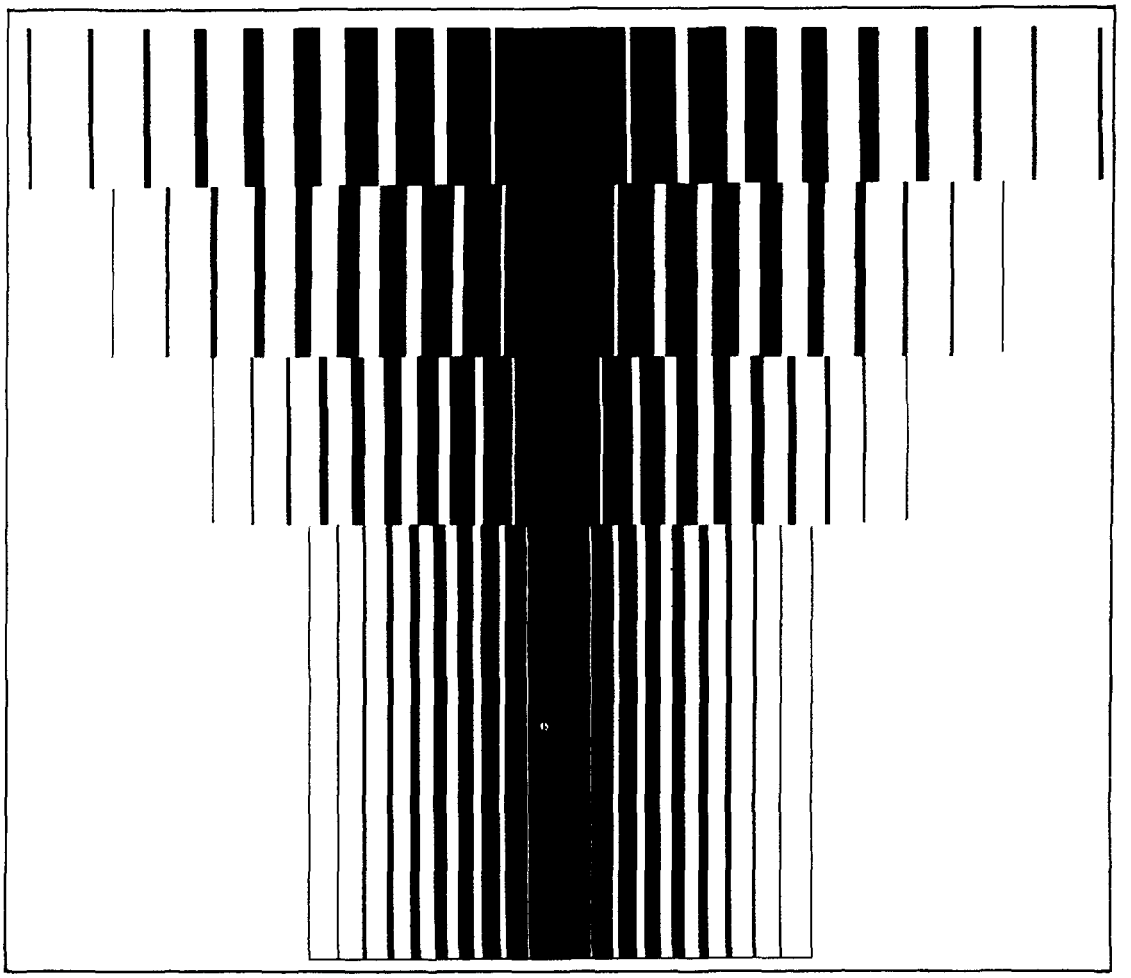

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National Medical Care Utilization and Expenditure Survey

The National Medical Care Utilization and Expenditure Survey (NMCUES) is a unique source of detailed national estimates on the utilization of and expenditures for various types of medical care. NMCUES is designed to be directly responsive to the continuing need for statistical information on health care expenditures associated with health services utilization for the entire U.S. population.

NMCUES will produce comparable estimates over time for evaluation of the impact of legislation and programs on health status, costs, utilization, and illness-related behavior in the medical care delivery system. In addition to national estimates for the civilian noninstitutionalized population, it will also provide separate estimates for the Medicaid-eligible populations in four States.

The first cycle of NMCUES, which covers calendar year 1980, was designed and conducted as a collaborative effort between the National Center for Health Statistics, Public Health Service, and the Office of Research and Demonstrations, Health Care Financing Administration. Data were obtained from three survey components. The first was a national household survey and the second was a survey of Medicaid enrollees in four States (California, Michigan, Texas, and New York). Both of these components involved five interviews over a period of 15 months to obtain information on medical care utilization and expenditures and other health-related information. The third component was an administrative records survey that verified the eligibility status of respondents for the Medicare and Medicaid programs and supplemented the household data with claims data for the Medicare and Medicaid populations.

Data collection was accomplished by Research Triangle Institute, Research Triangle Park, N.C., and its subcontractors, the National Opinion Research Center of the University of Chicago, Ill., and SysteMetrics, Inc., Berkeley, Calif., under Contract No. 233–79–2032.

Co-Project Officers for the Survey were Robert R. Fuchsberg of the National Center for Health Statistics (NCHS) and Allen Dobson of the Health Care Financing Administration (HCFA). Robert A. Wright of NCHS and Larry Corder of HCFA also had major responsibilities. Daniel G. Horvitz of Research Triangle Institute was the Project Director primarily responsible for data collection, along with Associate Project Directors Esther Fleishman of the National Opinion Research Center, Robert H. Thornton of Research Triangle Institute, and James S. Lubalin of SysteMetrics, Inc. Barbara Moser of Research Triangle Institute was the Project Director primarily responsible for data processing.

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Symbols

--- Data not available

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– Quantity zero

0.0 Quantity more than zero but less than 0.05

† Sample size is less than 50

‡ Sample size is less than 25

NOTE: Data estimates in tables may not add to totals because of rounding.

Health Care Utilization and Costs of Adult Cardiovascular Conditions

By William R. Harlan, University of Michigan; P. Ellen Parsons, National Center for Health Statistics (formerly of the University of Michigan); and J. William Thomas, Hillary A. Murt, James M. Lepkowski, Kenneth E. Guire, S. E. Berki, and J. Richard Landis, University of Michigan

Executive Summary

Cardiovascular conditions have a major economic as well as health impact on adults in the United States. In the National Medical Care Utilization and Expenditure Survey, conducted during 1980, health service data were obtained from a national sample of 17,123 civilian noninstitutionalized individuals. These data have been analyzed to define the impact and demographic patterns of health care utilization and costs attributable to adult cardiovascular conditions.

Approximately 28 million persons in the United States, or 17.3 percent of the total civilian noninstitutionalized population 17 years of age and over, had a cardiovascular condition during 1980. Cardiovascular conditions were reported with increasing frequency in successively older age groups and were reported most frequently by black persons. The prevalence and economic impact differed by specific type of cardiovascular condition and whether the condition was complicated by another disease. To examine these differences, persons reporting cardiovascular conditions were categorized into four mutually exclusive groups: persons with hypertension alone, persons with arteriosclerotic cardiovascular and cerebrovascular disease associated with hypertension, persons with arteriosclerotic cardiovascular disease alone, and persons with cardiovascular disease associated with other conditions that might alter medical care utilization and disability. The disability, service utilization, and health care charges were compared among these groups, and data for each group were compared with those for the overall U.S. population.

Survey participants were asked to rate their health relative to that of other people their age. The self-rating of persons reporting hypertension alone was lower than the national average. Only 17 percent of the general population rated their health as "fair" or "poor," but 27 percent of persons with hypertension alone used these descriptions. Overall, persons with hypertension alone were much less likely to be employed than the general population (52.2 percent versus 71.6 percent). However, when controlling for age, it was found that persons with hypertension alone were about as likely to be employed as the general population. On the average, persons with hypertension reported only slightly more work-loss days than did the general population (6.5 versus 4.9 days). A modest restriction of activity was reported by those with hypertension alone (20.1 days per year on the average compared with 15.6 for the general population). The mean number of ambulatory visits per year for those with hypertension alone was 7.9, only slightly greater than the 5.7 average for the overall population. The number of hospital days reported per 1,000 persons with hypertension alone did not differ significantly from the overall population rate. Annual per capita health care charges for persons with hypertension were $819, an average not significantly different from the per capita charges of $837 for the overall population. Persons reporting hypertension as the only cardiovascular condition constituted the largest subcategory of persons with cardiovascular conditions, but the functional impact of hypertension was minimal, the costs of care small, and the service utilization primarily ambulatory.

Persons with each of the other three subcategories of cardiovascular conditions, or cardiovascular disease, reported significantly more disability, greater service utilization, and higher charges than persons with hypertension alone or than the general population. These subcategories include the arteriosclerotic complications of cardiovascular disease and accompanying comorbid conditions. More than one-half of those with cardiovascular

NOTES: The authors are grateful for the support received during all stages of the preparation of this document, both from colleagues at the University of Michigan and from the staff of the National Center for Health Statistics. At the University of Michigan, Sharon Stehouwer contributed greatly to initial analyses of the NMCUES data and to identification and correction of several problems encountered in the data base. Drs. Catherine McLaughlin, Richard Lichtenstein, and Leon Wyszewianski provided valuable conceptual help. Quality secretarial support in the preparation of the many tables included in the report came from Jan Feldman, Carolyn Parker, Johanna Haaxma-Jurek, and Patrice H. Somerville. At the Institute for Social Research, University of Michigan, Nan Collier developed software for calculating sampling errors, and Judy Connors performed many of the analyses for generating sampling errors for national estimates.

Continual support was received from the National Center for Health Statistics. The project officer, Dr. Mary Grace Kovar, Special Assistant for Data Policy and Analysis, was instrumental in providing focus to the project and critical review of the report. The authors are indebted to Robert J. Casady, Chief of the Statistical Methods Staff, for writing the major section in Appendix I in which the NMCUES survey design and estimation methodology are described. When potential errors in the data were identified during the analyses, Robert Wright and Michele Chyba quickly solved the problems. Editors in the Publications Branch provided valuable assistance during all stages of the report, especially preparation of the detailed tables.

disease rated their health as only fair or poor. Mean work-loss days were also greater for these groups, ranging from 7 to 19 days. A greater proportion of persons in these subcategories (20–23 percent) were unable to work because of health. Service utilization was greater for these groups, with hospital admission rates being about three times higher than the rates for those with hypertension alone or for the overall population. Total health care charges for persons with cardiovascular diseases were more than $2,500 per capita, or three times greater than per capita charges for the overall population. Surgical rates for persons with cardiovascular diseases were more than twice as high as the rates for persons with hypertension alone, and charges for surgery were an important source of total charges for these persons.

In contrast to health care charges for the U.S. population and for persons with hypertension alone, charges for persons with cardiovascular diseases did not increase with age but were similar for those under 44 years of age, 44–65 years of age, and 65 years of age and over. Although total charges are similar for each age group, the number of persons with cardiovascular disease in each age group varies. There are far more older persons than younger persons who have cardiovascular disease. Therefore, per capita charges for the younger age group are higher than for their older counterparts because the same total charge amount is divided by a much smaller number of affected persons.

The strikingly greater disability, service utilization, and charges of persons with cardiovascular diseases compared with the overall population or with persons having hypertension alone suggest the cost effectiveness of primary prevention, such as treatment of hypertension. Comparison of the direct and indirect costs for hypertension alone and hypertension complicated by arteriosclerotic disease indicates that the cost of 10 years of hypertension management is equivalent to the cost of 1 year of management of hypertension associated with arteriosclerotic disease.

There were few significant differences by sex or race in disability, service utilization, or health care charges for cardiovascular conditions, but the sample sizes were often small and the estimates consequently unstable. Black persons with cardiovascular conditions tended to report more functional impairment, more ambulatory visits, and more condition-related hospital admissions, but the differences were not statistically significant. This greater service utilization for black persons was concordant with the greater prevalence of hypertension in this population. Women with cardiovascular conditions had more ambulatory visits than men and an equivalent number of hospital admissions but fewer cardiovascular surgical procedures. There were no significant differences by sex in per capita charges for cardiovascular conditions. In this survey, no disparities in cardiovascular care among large segments of the population were identified. The sample size was not large enough to permit identification of differences in care among small segments of the population.

Cardiovascular conditions account for a major proportion of the impact of disease in the U.S. population. Persons reporting these conditions had one-third of all bed-disability days, about one-third of all ambulatory visits and hospital days, and one-third of total health care charges. The impact of cardiovascular conditions is greatest for those with arteriosclerotic manifestations or associated comorbid conditions. Strategies aimed at primary prevention of arteriosclerotic complications could have an important financial impact on the costs of health care, particularly for the aging U.S. population.

Introduction

Cardiovascular disease is the leading cause of death and disability in the United States and has a major economic impact. Within the broad rubric of cardiovascular conditions are several common conditions that differ in prevalence, medical treatment, and disability. More than 40 percent of all deaths that occur each year in the United States are attributable to cardiovascular and related diseases, more deaths than from any other single cause (National Center for Health Statistics, 1980; National Center for Health Statistics, 1982).

Hypertension (high blood pressure) is the most prevalent chronic disorder in the country, and successful treatment of this disorder is associated with decreased mortality and morbidity. More than one-quarter of adults 45 years of age and over in the United States, and nearly 40 percent of those 65 years of age and over, are believed to suffer from hypertensive disease (Roberts and Rowland, 1981). Compared with persons with normal blood pressure, hypertensives have been found to have almost three times the risk of coronary heart disease, seven times the risk of stroke, four times the risk of peripheral vascular disease, and five times the risk of congestive heart failure (Castelli, 1980). The other cardiovascular conditions, including coronary heart disease, cerebrovascular disease, and myocardial infarction, generally represent arteriosclerotic disease of the arteries and may follow untreated hypertension. The arteriosclerotic conditions generally require expensive medical care and are associated with considerable disability.

Cardiovascular diseases consume a significant portion of the Nation's health care resources. It has been estimated that diseases in this category accounted for $33 billion in personal health care expenditures in 1980, more than the costs for any other type of illness (Hodgson and Kopstein, 1984). The costs of these diseases to individuals and to society—direct health care expenditures, indirect costs (lost productivity and disability), and mortality—might be reduced through effective preventive programs or through early recognition and management of predisposing conditions, such as hypertension. The mortality rate from cardiovascular disease has decreased steadily since 1970; this has been attributed to reductions in risk factors in the population, improved medical care, and perhaps better access to care (National Center for Health Statistics, 1980).

Despite this progress, cardiovascular conditions continue to be a major concern of national health policy. This report provides information on the costs of cardiovascular conditions based on data from the 1980 National Medical Care Utilization and Expenditure Survey (NMCUES). Data on health service utilization and associated charges and estimates of disability costs are also presented. The information on health care costs is unique by virtue of the survey design and scope. Data on the use of personal health services and the direct costs of health care are more likely to be complete and accurate when obtained from a panel using multiple interviews over time, as done in NMCUES, than when gathered through a one-time cross-sectional survey. Estimates of health care costs and disability that are generated from special study groups related to intervention trials are likely to be distorted by the selected nature of the study population and the tendency to focus on the single condition under study. Health care costs and disability for cardiovascular conditions can be estimated more accurately and can be compared with costs for other diseases when costs and disability are obtained for all causes, as in NMCUES. This places the costs for cardiovascular conditions in the broad context of costs for all conditions.

The utilization of services and the direct and indirect health care costs of cardiovascular conditions in adults (persons 17 years of age and over) are examined in this report. In the following section, the collection of NMCUES data and limitations of these data relevant to this report are described briefly. Next, the magnitude of the health problem is examined as reflected by persons affected, national productivity losses, and other factors. The impact of cardiovascular conditions on disability and activity levels is described. Estimates of health service utilization, health care charges, and indirect costs are developed. Each area is analyzed for all adult cardiovascular diseases and for specific condition subcategories. Comparisons of costs and disability are made across demographic distributions of age, sex, race, and income.

Sources and Limitations of Data

The National Medical Care Utilization and Expenditure Survey

Data for this study come from the public use files of the National Medical Care Utilization and Expenditure Survey, a national household survey conducted from early 1980 through early 1981. Specific details concerning the sample design and data collection are outlined in Appendix I.

From February 1980 through April 1981, data on 17,123 persons in 6,798 families were collected at approximately 3-month intervals. A total of five interviews, two personal interviews followed by two telephone interviews and a final personal interview, were conducted. At the conclusion of the first interview, survey participants were provided with a specially designed calendar diary for recording data about medical events and costs in preparation for subsequent rounds of interviewing. Prior to each interview but the first, respondents were sent a summary sheet showing all medical events and costs reported in previous interviews.

Public Use Tapes

NMCUES public use tapes consist of six files: the person, medical visit, dental visit, hospital stay, prescribed medicines and other medical expenses, and condition files. The person file has one record for each of the 17,123 responding eligible persons with data describing the person's demographic characteristics, health care coverage, employment, income, and usual source of care; numbers of visits, hospitalizations, and other medical events reported for 1980; total charges for each category of care; and limitations and disabilities, including identification of conditions. Data from the other five files, which have more detailed information about events summarized in the person file, can be linked to records in the person file through a unique identification number assigned to each person.

The medical visit file contains one record for every visit reported by people in the person file. A total of 86,594 visits are in the file, which includes visits to providers' offices, hospital outpatient departments, and emergency rooms. Each record contains the identifying number of the person making the visit, the place of visit, type of physician or nonphysician seen, type of services provided, conditions causing or associated with the visit, procedures performed during the visit, associated charges, and sources of payment. Similar data on dental visits and hospital admissions are provided in the dental visit and hospital stay files, respectively.

The prescribed medicines and other medical expenses file contains one record for each purchase of prescribed medications or other medical expense incurred by survey participants during 1980. Data include the identifying number of the person for whom the purchase was made, date of purchase, prescribed medicine codes, codes for conditions leading to the purchase or other expense, and associated charges and sources of payment.

If a medical condition caused any limitation in a person's activities (e.g., staying in bed, staying home from work) or caused the person to seek medical care, then a condition record appears in the condition file. For each condition, the condition file record contains the identifying number of the person, codes from the 9th Revision of the International Classification of Diseases (World Health Organization, 1977), dates of onset of conditions, counts of visit types, prescribed medicines and other medical expenses, associated charges, and, if applicable, the reasons for not seeing a physician.

Modifications to the public use files that were made by the University of Michigan in the course of this analysis are presented in Appendix II. Analytical strategies appropriate for NMCUES are presented in Appendix III. Sampling errors for estimators used throughout this report can be estimated using procedures outlined in Appendix IV. Definitions of terms used in this report are listed in Appendix V.

Limitations of the Data

Estimates of prevalence—In NMCUES, a particular medical condition was noted only when it caused some type of disability or resulted in an ambulatory visit, hospital admission, purchase of a prescribed medication, or other encounter with the health care system. Hence, conditions that usually require treatment or which cause some sort of disability will be better reported. In the context of cardiovascular conditions, the severity and

persistence of symptoms may minimize underreporting. However, one subcategory, hypertension alone, is often asymptomatic, and a person with this condition may be unaware of its presence and therefore not report it.

The diagnostic accuracy of reported problems depends on both information that the respondent obtained from the health care provider and the respondent's ability to accurately convey this information to the interviewer. In the absence of medical care, the respondent's previous experience or education may affect the diagnostic accuracy of reporting. In cases where the condition resulted in limitation of activity but was never medically attended, the diagnostic accuracy of the reporting may be suspect, particularly for new conditions. However, for chronic conditions requiring multiple medical visits and long-term medication, the likelihood is good that the person will report the condition with sufficient specificity to provide appropriate subcategorization.

Estimates of disability—Obtaining detailed information about the annual number of disability days associated with each medical condition is complicated by the manner in which the public use files were constructed. For each condition group discussed in this report, the number of associated disability days (restricted-activity days, bed-disability days, and work-loss days) is of interest. Respondents could list more than one underlying condition for a disability day. It is possible to compute the number of disability days listed for each condition in the condition file, but duplication exists for days reported as caused by two or more conditions. Also, the structure of the public use files does not permit linkage of a specific disability day with all the associated illnesses. The person file contains an unduplicated count of disability days for each respondent but no information on conditions causing disability. This problem is important with regard to cardiovascular conditions because they are common and frequently aggravate or coexist with other medical problems. Separate subcategories were developed to estimate the cost impact of the most frequently coexisting conditions. For the other conditions, a procedure was devised to allow estimation of condition-related disability days for persons reporting more than one condition.

Estimation of disability days attributable to a given condition was accomplished by a two-step process. First, for each person, the ratio of the number of disability days in the person file (an unduplicated count) to the total number of disability days in the condition file (a duplicated count) was computed. Second, this ratio was multiplied by the number of disability days listed in the condition file for each medical condition. The result is an estimate of disability days attributable to each condition. The major criticism of this method is that it uniformly reduces the proportion of duplicated days for all conditions. Therefore, variability in actual illness behavior across medical conditions is minimized.

Utilization of health services—For each medical encounter recorded in the survey, respondents could report up to four medical conditions. The public use files show that approximately 10 percent of medical visits have two conditions recorded; multiple conditions are listed for about 12 percent of all hospital stays; and 4 percent of the prescribed medication records have two conditions recorded.

On one hand, listing multiple conditions on the event record permits analysis of patterns of care-seeking behavior associated with different conditions. Such data should reveal, for example, whether certain conditions are generally treated by themselves or are treated along with other conditions during a medical visit or hospitalization.

On the other hand, the NMCUES survey instrument does not designate "principal diagnosis" or primary reason for each medical encounter. Therefore, when multiple conditions are reported, it is difficult to attribute health service use to a specific diagnosis. For this report, a condition-related medical service is defined as one for which the respondent identified cardiovascular condition as the only reason or as one of several reasons for seeking medical care. Services that are not condition related are defined as those for which none of the cardiovascular conditions was listed.

Cost of health services—The NMCUES data contain a number of improbably low values of total charges for ambulatory visits, prescribed medications, and hospital stays. In many cases, the reported data may not correspond to the total charges for the service received but instead may represent out-of-pocket expenses incurred by patients. To the extent that some respondents reported out-of-pocket expenses as total charges for services, estimates of total expenditures are biased downward.

As noted earlier, people are often treated for more than one condition when they seek medical care. As a result, it is difficult to isolate those charges that are specific to a given condition. Thus, for these analyses, condition-related charges are defined as charges for health services for which cardiovascular conditions were listed as the only reason or as one of several reasons for seeking care. Because these charges may also reflect the treatment of other conditions, they may overestimate the economic impact of cardiovascular conditions, both for the population as a whole and for individuals suffering from these conditions.

Indirect costs—The indirect cost of illness and injury is the loss of resources resulting from them. Resource loss is generally calculated as lost productive capacity, the loss of potential economic output because of morbidity and mortality. Indirect costs are usually estimated on the basis of the amount of time by which the individual's productivity is diminished or lost and the monetary value of that lost productive time.

In calculating the indirect costs of morbidity for 1980, the first necessary calculation is the number of years of productive activity lost by individuals with illness or injury. This measure deals with lost productivity, so the convention is to count only persons 17 years of age and over who were either working or keeping

house at the time of their illness or injury or who were unable to engage in these activities because of illness or injury. However, persons who were unable to work for health reasons for the entire year are excluded from calculations in this report because in NMCUES no condition was associated with such long-term disability. Individuals who were not in the work force for other reasons, e.g., students or retirees, are also not part of the population "at risk" in these calculations.

The unit for calculation of lost productive time is productive person years. Productive years lost, a nonmonetary measure of morbidity costs, is defined as the number of productive days lost because of illness in a year divided by the number of productive days in a year. For this report, lost productive time is calculated for all employed persons and homemakers. Persons who were employed at any time in 1980 were classified as employed in the NMCUES data files. Homemakers are defined as persons who were not employed or disabled in 1980 and who claimed "keeping house" as their primary activity in 1979. For employed persons, reported work-loss days are divided by 245, the average number of workdays in a year, to determine productive time lost. In this study, calculations of lost output for homemakers were performed for both bed-disability days and restricted-activity days because the former underestimates lost productivity and the latter overestimates lost productivity. The appropriate denominator to analyze days lost for either of these calculations is 365 because homemakers can perform their work every day of the year. By performing both sets of calculations, a range of lost productivity with upper and lower bounds can be constructed for homemakers. Estimates in this report are given both for the more restrictive unit of measure, bed-disability days, and for restricted-activity days, which yield somewhat higher estimates of lost productivity. Measures of lost productive time for employed individuals and homemakers have been weighted and aggregated to produce national estimates of productive person years for these two population groups.

Estimates of the indirect costs of morbidity are calculated by multiplying an individual's reported work-loss time by his or her reported earnings, when available. Reported earnings do not include employee benefits, so earnings are adjusted by a factor of 1.172 to account for the additional value represented by fringe benefits. The adjustment factor is based on the mean percent of earnings represented by employee benefits (17.2 percent) in 1980 (*Survey of Current Business*, 1981). Lost earnings for employed persons whose earnings were not reported are estimated using U.S. Department of Labor 1980 data for mean annual earnings and are specific to the individual's age, sex, race, and employment status (full or part time). Again, figures are adjusted to include the value of employee benefits. Lost productivity for homemakers, whose labor is not reimbursed, is estimated using the market-value approach. The value of lost homemaker services is approximated by estimating the cost of replacing those services with services purchased in the market. The values employed are derived from time-use studies and relevant wage rates (Hodgson and Rice, 1984; Walker and Gauger, 1973). Details of the estimation procedures used in the calculation of indirect costs, including tables of values used to estimate these costs, are presented in "Costs of Illness, United States, 1980," Appendix V (Parsons et al., 1986).

Definition of Disease Categories

Disease-specific data can be analyzed by diagnosis (e.g., ischemic heart disease), by general diagnostic category (e.g., diseases of the circulatory system), or by disease entities that are grouped so as to maximize contrasts by some particular characteristic, such as health care costs. For this report, the choice was to make comparisons among subgroups of cardiovascular conditions. Sample size constraints and imprecision of diagnoses reported by household informants limit the utility of specific diagnostic entities for such analyses in surveys of the general population. On the other hand, analyses of cardiovascular conditions as a single category would not disclose important differences among subcategories with respect to hospital versus ambulatory charges and different levels of disability.

Adults reporting a cardiovascular condition were separated into four mutually exclusive subcategories: persons reporting hypertension as the only cardiovascular condition, persons reporting hypertension and cardiovascular or cerebrovascular disease, persons reporting cardiovascular or cerebrovascular disease without accompanying hypertension, and persons reporting both hypertension or cardiovascular-cerebrovascular conditions and other conditions that are potentially aggravating to or aggravated by cardiovascular disease. This last category was developed because several conditions—for example, pregnancy-related hypertension or chronic conditions such as diabetes mellitus and renal disease—often coexist with cardiovascular disease and can contribute to health care costs.

The subcategories were designated so that each person would be in one subcategory. Each subcategory was relatively homogeneous with respect to service utilization, costs, and disability, but adequate sample size was maintained for analysis by age, race, and sex distributions.

The specific subcategories were determined as follows:

1. *Hypertension alone* includes only those hypertensives who do not have aggravated organ damage or other chronic diseases associated with hypertension. This subcategory is composed of persons who have a condition with an International Classification of Diseases, 9th Revision, Clinical Modification, ICD-9 (Public Health Service and Health Care Financing Administration, 1980), diagnosis code of 401 and who have none of the diagnoses listed for subcategories 2–4 (following).
2. *Cardiovascular disease with hypertension* includes individuals with a diagnosis of hypertension and one or more vascular diseases:
   - Ischemic heart disease and complications.
   - Cerebrovascular disease.
   - Hypertensive cardiovascular disease.
   - Cardiac failure.
   - Aneurysm.
   - Peripheral arterial vascular disease.

   This subcategory is composed of persons having a condition with an ICD-9-CM diagnosis of (a) 402, 403, or 404; or (b) 401 and one or more diagnoses in the following ranges: 410–414, 426–429, 430–438, and 440–442.
3. *Cardiovascular disease alone* includes persons who have a condition with one or more cardiovascular or cerebrovascular diagnoses and who do not have hypertension or the conditions in subcategory 4. The subcategory is composed of persons with one or more cardiovascular diagnoses (410–414, 422, 425–429, 430–438, and 440–447) but with none of the following diagnoses: 401–404, 250, 255, 272, 274, 278, 580–587, 590, 642.
4. *Cardiovascular disease with complicating conditions* includes persons with a diagnosis of hypertension (401–404) or cardiovascular disease (410–414, 422, 425–438, 440–447) and one or more of the following complicating conditions:
   - Diabetes mellitus (250, 252).
   - Chronic renal disease (272, 274, 278).
   - Adrenal disorder, obesity (580–587, 590).
   - Eclampsia (642).

The focus of these analyses was adult cardiovascular conditions in the U.S. population. Therefore, persons 17 years of age and over were the population at risk, and this population base was used as the denominator for rates in all analyses.

Impact of Cardiovascular Conditions in the United States

According to statistics from NMCUES, more than 27 million persons, or approximately 17.3 percent of the total U.S. civilian noninstitutionalized population 17 years of age and over, had hypertension or cardiovascular disease in 1980 (Table A). Nearly 14 million persons, or approximately one-half of all persons with cardiovascular conditions, had hypertension alone. An approximately equal number of persons (14 million) had other subcategories of cardiovascular conditions. These estimates from NMCUES are generally consistent with other estimates. For example, Goldberg (1980) estimated that 20–25 million adults in the United States had hypertension.

The impact of cardiovascular conditions on health and productivity in the adult population is striking (Figure 1). Although only 17.3 percent of persons reported cardiovascular conditions, these individuals accounted for 35.8 percent of all days spent in bed from illness and 35.6 percent of all reported restricted-activity days (Table 1). Approximately 98 million days of work were lost during 1980 by persons with cardiovascular conditions, accounting for 17.1 percent of total work-loss days. Disability differed among subcategories.

The numbers of bed-disability days, work-loss days, and restricted-activity days reported by persons with hypertension alone were similar to those for the general adult population (Table 1). Disability days specifically attributable to hypertension constituted 0.6 percent of bed-disability days reported for the U.S. population. Hypertension alone accounted directly for only 0.9 percent of work-loss days and 1.2 percent of restricted-activity days.

Disability impact was considerably greater for the other subcategories. Disability days were approximately three times greater for persons with cardiovascular diseases than for the general population (Table 1). For example, persons with cardiovascular disease alone represented 3.4 percent of the adult population but accounted for 10 percent of bed-disability days and 10 percent of restricted-activity days reported for the U.S. adult civilian noninstitutionalized population in 1980.

The influence of cardiovascular conditions on health service utilization is indicated in Figure 2 and Table 2. Persons reporting cardiovascular conditions accounted for 31 percent of all ambulatory visits in 1980, 36 percent of all hospital admissions, and 43 percent of all hospital days. These NMCUES estimates exceed those from the National Ambulatory Medical Care Survey (NAMCS) conducted in 1975–76 (Cypress, 1979). Hypertension, coronary heart disease, cerebrovascular disease, and other cardiovascular conditions were responsible for 9.6 percent of all physician office visits during the 2-year period surveyed by NAMCS. Condition-related visits from NMCUES (Table 2) account for a higher percent (13.8) of the U.S. total, a difference that may be attributable to the broader definition of visits chosen for this report and the fact that NAMCS was limited to a survey of office-based physicians.

The subcategories of cardiovascular conditions differed with respect to utilization of health services (Table 2). Each subcategory, particularly hypertension alone, was associated with high use of ambulatory visits. However, there were striking differences among disease groupings for inpatient services. Of the 31 million re-

Table A

Number of persons 17 years of age and over with cardiovascular conditions and rate per 1,000 population, by condition: United States, 1980

Condition	Number in thousands	Rate per 1,000 population
All persons	161,236	---
Persons with cardiovascular conditions	27,860	172.8
Hypertension alone	13,775	85.4
Cardiovascular disease:		
With hypertension	3,398	21.1
Alone	5,456	33.8
With complicating conditions	5,231	32.4

Figure 1

Percent of total disability days for persons 17 years of age and over accounted for by persons with cardiovascular conditions, by type of disability day and condition: United States, 1980

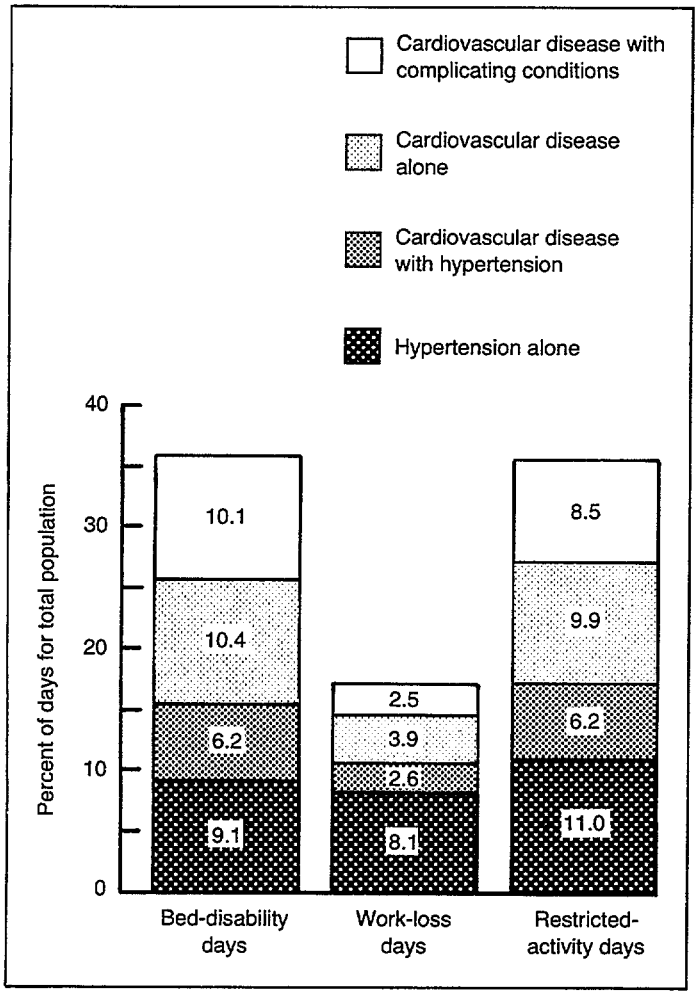
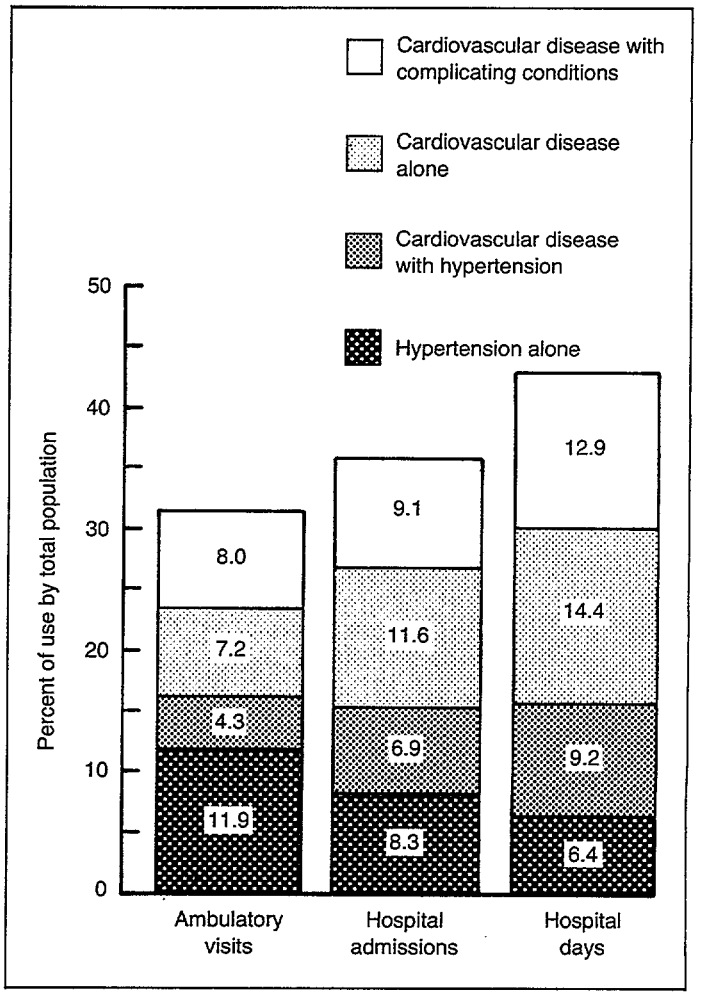


Figure 2

Percent of health care services utilization for persons 17 years of age and over accounted for by persons with cardiovascular conditions, by type of service and condition: United States, 1980



ported hospital admissions in the United States in 1980, about 1 percent was specifically related to hypertension alone. The other subcategories of cardiovascular conditions were associated with a disproportionately large share of hospital care, affecting 8.7 percent of the adult population but accounting for 19.7 percent of hospital days.

The cost impact of cardiovascular conditions in the United States was considerable. The 17.3 percent of the adult U.S. population with cardiovascular conditions (Table 1) incurred 36.4 percent of the Nation's total estimated health care costs for adults (Table B). There were major differences in costs among the cardiovascular conditions (Figure 3). Persons with hypertension alone incurred charges on a par with the charges that would be expected based on this group's proportion of the population. Health care charges for persons in the other three groups were disproportionately large, and this resulted in part from greater utilization of inpatient care. The cardiovascular disease subcategories generated health care charges that were three times greater than would be expected, given their proportionate representations in the population.

The prevalence of reported cardiovascular conditions varied by age and sex (Tables C and 3). Hypertension alone was the most commonly reported problem for both men and women. Hypertension was reported 1½ times more frequently by women than by men; the disparity was greatest for those 65 years of age and over. This reported frequency contrasts with estimates from population surveys, in which hypertension is reportedly slightly more common in men. The disparity may be attributed to women making more health care visits in which blood pressures are recorded and to women's greater concern about monitoring and treatment of high blood pressure. Men, particularly those under 65 years of age, have higher rates of unrecognized or untreated hypertension than women have. In NMCUES, disease was recorded as being present only when disability or medical events were reported. This approach would be expected to lead to lower prevalence rates than those obtained from surveys in which physical examinations

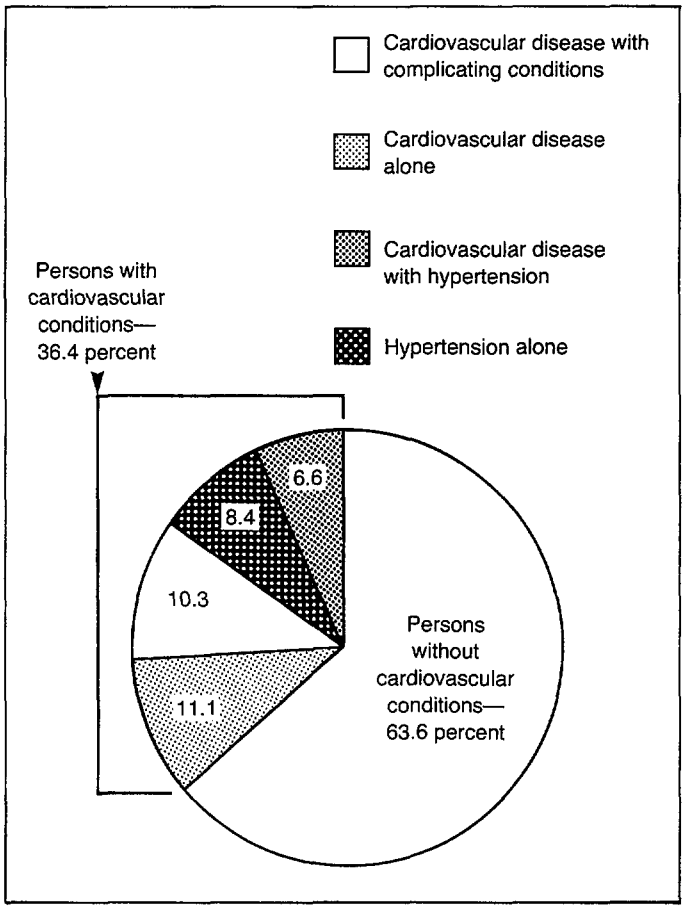
Table B

Amount and percent of total and condition-related charges for persons 17 years of age and over with cardiovascular conditions, by condition: United States, 1980

Condition	Total charges		Condition-related charges	
	Amount in millions	Percent	Amount in millions	Percent
All persons	$134,976	100.0	$21,490	15.9
Persons with cardiovascular conditions	49,084	36.4	21,490	15.9
Hypertension alone	11,282	8.4	1,950	1.4
Cardiovascular disease:				
With hypertension	8,971	6.6	4,225	3.1
Alone	14,945	11.1	7,560	5.6
With complicating conditions	13,886	10.3	7,755	5.7

Figure 3

Percent of total charges for health care services for persons 17 years of age and over accounted for by persons with cardiovascular conditions, by condition: United States, 1980



of sampled persons are conducted, particularly if the condition is without disabling symptoms.

In contrast, the rates for the other cardiovascular conditions were relatively similar for men and women, and the only striking sex differences by age were found for cardiovascular disease alone (which is primarily arteriosclerotic). For this subcategory, the rates among persons 45 years of age and over were substantially higher for men than for women. Because the subcategories of cardiovascular conditions other than hypertension alone are symptomatic and may be associated with functional impairment or expensive treatment, the prevalence rates from cost surveys are likely to approximate the rates from examination surveys.

Racial differences by age and sex were found only for persons with hypertension alone (Tables D and E). Overall, hypertension alone was higher for black males than for white and other males (88.9 and 67.0 per 1,000 population, respectively). Hypertension rates were also higher among black women than among white and other women (122.5 and 97.1 per 1,000 population, respectively). These data, which are consistent with findings from other recent studies (Gillum, 1982), suggest that black women are at higher risk for hypertension than are women or men of white and other races or black men. No conclusions can be drawn regarding racial differences by age category among men or women with hypertension alone or among men or women in the other condition categories because the sample sizes were insufficient to produce stable estimates.

These data from NMCUES document the major impact of adult cardiovascular disease in the U.S. population. These conditions are common, and the associated medical care and disability increase with increasing age. Persons reporting cardiovascular conditions accounted for about one-third of all bed-disability days, ambulatory health care visits, hospital admissions, and charges for health care reported for 1980.

There are major differences in the patterns of care, disability, and charges by cardiovascular condition subcategories. Hypertension alone was the most prevalent condition. Because of its predominantly ambulatory care pattern, hypertension alone accounted for proportionately lower health care charges and was associated with less functional impairment than the other subcategories. These groups, comprising primarily arteriosclerotic disease, were associated with more inpatient medical care, more functional impairment, and higher charges. The differential impacts are analyzed further by demographic factors in subsequent sections of this report.

Table C

Rate of cardiovascular conditions among persons 17 years of age and over, by condition, sex, and age: United States, 1980

Sex and age	Hypertension alone	Cardiovascular disease		
		With hypertension	Alone	With complicating conditions
	Rate per 1,000 population			
Male				
All ages 17 years and over	69.1	18.7	38.0	27.4
17–44 years	30.6	‡0.5	‡6.9	‡5.3
45–64 years	118.7	†27.3	58.5	48.1
65 years and over	145.5	86.9	142.8	88.2
Female				
All ages 17 years and over	99.9	23.2	30.1	37.0
17–44 years	22.6	‡2.4	†8.0	†7.2
45–64 years	181.8	†26.2	†26.3	57.6
65 years and over	235.5	90.9	112.3	106.8

Table D

Rate of cardiovascular conditions among males 17 years of age and over, by condition, race, and age: United States, 1980

Race and age	Hypertension alone	Cardiovascular disease		
		With hypertension	Alone	With complicating conditions
	Rate per 1,000 population			
Black	88.9	‡10.6	‡33.1	‡36.7
17–44 years	†72.4	‡0.0	‡6.5	‡5.4
45–64 years	‡85.7	‡19.6	‡47.3	‡107.0
65 years and over	‡199.1	‡55.4	‡164.6	‡65.5
White and other	67.0	19.5	38.6	26.4
17–44 years	25.7	‡0.6	‡6.9	‡5.2
45–64 years	121.9	†28.0	59.6	42.4
65 years and over	140.7	89.8	140.9	90.3

Table E

Rate of cardiovascular conditions among females 17 years of age and over, by condition, race, and age: United States, 1980

Race and age	Hypertension alone	Cardiovascular disease		
		With hypertension	Alone	With complicating conditions
	Rate per 1,000 population			
Black	122.5	‡32.5	†34.6	†52.1
17–44 years	†54.6	‡1.7	‡20.0	‡13.1
45–64 years	†248.0	‡70.8	‡36.5	‡108.9
65 years and over	‡232.6	‡116.3	‡104.9	‡142.9
White and other	97.1	22.1	29.5	35.1
17–44 years	18.1	‡2.5	‡6.3	‡6.4
45–64 years	174.7	†21.4	†25.2	52.1
65 years and over	235.8	88.5	113.0	103.4

Functional Disability

Common indicators of health status and functioning were obtained in NMCUES, and these have been used to profile functional impairment associated with reported cardiovascular conditions. Comparisons of several types of disability are made between persons reporting cardiovascular disease and the general population and among cardiovascular condition subcategories.

The functional limitation score is an assessment of ability to perform various common daily activities, such as walking, driving a car, and climbing stairs. The scale ranges from 0 (indicating no limitation) to 8 (indicating severe limitation) and 9 (indicating death during the survey period). Surveyed persons were asked also to rate their health compared with that of other persons the same age. The perceived health assessment is subjective and reflects not only limitations, pain, and other physical manifestations of disease but also the respondent's emotional tone and emotional response to illness.

The mean functional limitation score for adults in the United States was 1.7 (Table F). The mean score of 2.3 for persons reporting hypertension alone was slightly but significantly higher than the U.S. average, but it was significantly lower than the mean scores for the other three condition groups. Hypertension alone was associated with only slight functional limitation, and the self-limitation and side effects of medications could not be separated from the effects imposed by disease. The other subcategories had greater degrees of functional impairment that, on average, would have a major impact on lifestyle.

The mean functional limitation scores were generally consistent with respondents' perceptions of their health. Although only 16.6 percent of all respondents described their health as "fair" or "poor," about 27 percent of the group with hypertension alone used these descriptions. More importantly, more than one-half of persons who reported other subcategories of cardiovascular conditions rated their health as fair or poor.

As expected, both health indicators worsened with age for the entire U.S. population (Table 4). As age increases, the functional limitation scores increase, but the perceptions of health status decline. Among persons reporting hypertension alone, the functional limitation score was not significantly different from the U.S. average for those 45–64 years of age or 65 years of age and over but was significantly higher (1.7 versus 1.3) for the youngest group, those under 45 years of age. For each of the other cardiovascular categories, functional limitation scores were higher (worse) for successively older age categories, but when stratified by age and condition the sample sizes were small and the estimates unstable.

The health perceptions of persons with hypertension alone approximated those of the entire adult civilian noninstitutionalized population, 83 percent of whom rated their health as excellent or good. Among persons 45–64 years of age, 22.8 percent of the general population rated their health as fair or poor, compared with 24.1 percent of those with hypertension alone. In the category 65 years of age and over, the percents were

Table F

Functional limitation score for persons 17 years of age and over with cardiovascular conditions and percent distribution by perceived health status, according to condition: United States, 1980

Condition	Functional limitation score	Perceived health status				
		Total	Excellent	Good	Fair	Poor
		Percent distribution				
All persons	1.7	100.0	45.2	38.2	11.7	4.9
Persons with cardiovascular conditions						
Hypertension alone	2.3	100.0	26.5	46.7	20.5	6.4
Cardiovascular disease:						
With hypertension	4.0	100.0	13.3	31.3	34.0	21.3
Alone	3.8	100.0	15.6	33.3	27.8	23.3
With complicating conditions	3.6	100.0	14.2	34.4	29.2	22.1

37.2 and 32.3 for the overall U.S. population and the hypertensive population, respectively. However, in the group under 45 years of age, hypertensives reported significantly poorer health perceptions than others in the population; 23.9 percent of hypertensive persons rated their health as fair or poor, compared with only 8.5 percent of the general population. The health perceptions of persons in the other three cardiovascular subcategories were similar, with more than one-half reporting their health status as poor or fair. The effect of age on perceived health status was especially marked in these subcategories.

Men and women did not differ in functional scores, except for persons in the subcategory of cardiovascular disease with complicating conditions (Table 5). In this group, women had significantly higher mean functional limitation scores, and their perceived health was also worse. Sixty-one percent of women in this condition group rated their health as only fair or poor, compared with 36.6 percent of men.

No significant difference between racial groups was found for functional limitation scores in any of the four condition groups. However, health perceptions followed a consistent pattern across condition subcategories, with a higher proportion of black than white and other persons rating their health as only fair or poor.

The economic impact of functional disability was quantified in terms of annual productivity and activity measures (Tables G, 6, and 7). Almost three-fourths of the adult civilian noninstitutionalized population worked outside of the home at some time during the survey period. Only 4.9 percent were retired for health reasons at the beginning of the survey period or were unable to work for health reasons throughout the survey period. Among the adults surveyed, there were 4.9 mean work-loss days per year, 15.6 mean restricted-activity days, and 5.6 mean bed-disability days.

Persons reporting hypertension alone were less likely to be employed (52.2 percent) than were persons in the general population (71.6 percent) (Table G). Moreover, the proportion of people who reported being unable to work because of health problems was greater for those with hypertension alone than for the overall population (7.9 percent and 4.9 percent, respectively). The average number of work-loss days per person per year was somewhat greater for those with hypertension alone than for the overall population (6.5 versus 4.9). Similarly, persons with hypertension alone reported slightly more bed-disability days per year than the total population, but the difference was not significant. However, the number of restricted-activity days per year for persons reporting hypertension alone (20.1) was significantly larger than the number for the general population (15.6). In summary, persons with hypertension alone continued to work and did not have more days in bed than persons without cardiovascular conditions had, but their usual activities were adversely affected to a greater degree than experienced by others in the population.

Persons in the other subcategories of cardiovascular disease were significantly less likely to be employed and more likely to be unable to work than those in the general population or those with hypertension alone. Their activity measures also indicated considerably greater impairment. Among persons with cardiovascular conditions, persons having cardiovascular disease with hypertension had the most disability: the lowest percent employed, the greatest mean work-loss days, and a large proportion unable to work. The very low proportion of persons employed among those having cardiovascular disease with hypertension indicates the serious influence of this set of conditions on the functioning ability of persons. The other subcategories also had significantly greater proportions of persons unable to work and work-loss days than the general population had, but they did not report as many work-loss days as those with cardiovascular disease with hypertension.

The impact of cardiovascular conditions was most apparent during the period of greatest economic productivity, 45–64 years of age. In this age range, 70 percent of the general U.S. population and a slightly lower proportion (65 percent) of those with hypertension were employed. However, in the same age range, only 45–52 percent of those with other cardiovascular conditions were employed, and a high proportion of persons (23–31 percent) in these subcategories reported being unable to work (Table 6).

Table G

Annual productivity and activity measures for persons 17 years of age and over with cardiovascular conditions, by condition: United States, 1980

Condition	Productivity measures			Activity measures	
	Percent employed	Percent unable to work	Mean work-loss days	Mean restricted-activity days	Mean bed-disability days
All persons	71.6	4.9	4.9	15.6	5.6
Persons with cardiovascular conditions					
Hypertension alone	52.2	7.9	6.5	20.1	6.0
Cardiovascular disease:					
With hypertension	23.4	21.6	19.0	46.1	16.7
Alone	33.5	23.2	12.0	45.7	17.3
With complicating conditions	38.6	20.2	7.1	41.0	17.6

The impact of cardiovascular conditions on productivity was less pronounced for those 65 years of age and over. Only 18.3 percent of the U.S. population in this age range reported employment. For those with hypertension alone, there was no significant impingement on employability. However, the percent employed among those 65 years of age and over was significantly lower for the other condition groups. Mean work-loss days for employed persons were lowest in the strata 65 years of age and over. This was true for all cardiovascular condition groups, except that the difference between age categories was not significant for persons having cardiovascular disease with complicating conditions. The most likely explanation is that only the healthiest people in this age category are still working.

The effects of sex and race on productivity and activity level indicators are shown in Table 7. A significantly greater proportion of men than women were unable to work for every condition group except cardiovascular disease with complicating conditions, where the trend was similar but the difference not significant. More than 60 percent of women in the overall population were employed in 1980, but the proportion of women having cardiovascular disease with hypertension who were employed was only 14.5 percent. Employment rates in Table 7 are not age adjusted, and some of this difference is attributable to age effects. The proportion of men in this condition group who were employed is also lower than the proportion for the overall population, but the difference is not as great as that for women.

Mean work-loss days differed significantly by sex only for cardiovascular disease with hypertension (24.2 days for females versus 16.0 for males). Generally, mean restricted-activity days did not differ between men and women. However, for the group with complicating conditions, women had greater restricted activity: For this group, women averaged nearly 50 days of restricted activity per year, compared with less than 30 days for men. The difference between men and women in this group is consistent with differences by sex in functional limitation scores and health status perceptions (Table 5). The average number of bed-disability days for this subcategory also shows a pattern by sex, with women reporting nearly twice as many bed-disability days as men reported. This subcategory includes diabetes mellitus and chronic renal disease, which may have greater health impacts on women than on men.

Black persons tended to have a greater number of restricted-activity days, bed-disability days, and work-loss days than white persons and persons of other races in the same cardiovascular condition group, and a larger proportion of black persons were unable to work because of health problems. These data are consistent with differences by race in health perceptions (Table 5). Racial differences in productivity and activity measures were most prominent in the subcategory with cardiovascular disease alone, but the sample size for black persons was too small to produce reliable estimates, and therefore statistical significance cannot be determined.

The economic impact of cardiovascular conditions was determined using persons reporting cardiovascular conditions as the unit of study. The impact on these individuals could be related to cardiovascular disease or to some other condition. In Table H, estimates are shown of mean annual *condition-related* work-loss days, restricted-activity days, and bed-disability days for each group. "Condition-related" days are defined as days for which the respondent listed a cardiovascular condition as the primary, secondary, or tertiary reason for staying home from work, restricting usual activities, or staying in bed. The procedures used to calculate condition-related disability are outlined in "Estimates of disability" in the section "Sources and Limitations of Data."

For persons reporting hypertension alone, mean work-loss days and bed-disability days were only slightly higher than U.S. averages for the civilian noninstitutionalized population. Less than 1 work-loss or bed-disability day can be attributed to hypertension (Table H). Mean total restricted-activity days were significantly greater for persons with hypertension alone than for the overall population (20.1 compared with 15.6 days) (Table G), but only 2.2 days of this difference were directly attributable to hypertension itself.

For the other cardiovascular subcategories, a large proportion of total restricted-activity days, work-loss days, and bed-disability days were attributable to the cardiovascular condition (Table H). Estimates of mean total disability days for these subcategories were also significantly greater than the mean total days for the overall population (Table G). This suggests that car-

Table H

Mean annual condition-related disability days reported for persons 17 years of age and over with cardiovascular conditions, by condition: United States, 1980

Condition	Work-loss days	Restricted-activity days	Bed-disability days
		Mean days	
Hypertension alone	0.4	2.2	0.7
Cardiovascular disease:			
With hypertension	5.3	19.5	7.6
Alone	7.5	17.0	4.7
With complicating conditions	5.6	14.5	3.0

diovascular disease adversely affects overall health and propensity to disability from other conditions.

The estimated economic costs associated with condition-related productivity losses are shown for each of the four condition groups in Table 8. Indirect costs represent productivity lost to society because of illness or disability. For employed persons, the value of lost productivity is calculated by multiplying each person's work-loss days by his or her daily salary and fringe benefit rate. Two estimates of the value of lost productivity are provided for homemakers, one of which defines lost productivity in terms of bed-disability days and the second in terms of restricted-activity days (Parsons et al., 1986). The wage rate used in each of these calculations represents the estimated daily value of housekeeping services by the homemaker's age. Two estimates are given of the value of condition-related lost productivity. The larger of these is the sum of the costs for employed persons plus the costs for homemakers estimated using restricted-activity days; the other is the sum of costs for employed persons plus the costs for homemakers estimated using bed-disability days.

The highest cost of lost productivity is for the group with cardiovascular disease and complicating conditions (Table 8). For this group, total productivity losses are estimated to be $644 million (based on the restricted-activity-day estimate for homemakers). Direct health care costs for this group are $7.8 billion, or about 12 times the costs of lost productivity (Table B). Using restricted-activity-day estimates for homemakers, productivity losses attributable to hypertension alone total $435 million. By contrast, as shown in Table B, direct condition-related health care costs for this group are approximately $2 billion, more than four times higher than indirect morbidity costs. The morbidity effects of cardiovascular conditions are important in terms of health and functioning and are reflected in the indirect costs, but the direct costs of illness are considerably greater. This relationship differs from that for acute respiratory conditions, for which direct costs are small but indirect costs are great (Harlan et al., 1986).

Health Services Utilization and Associated Charges

Cardiovascular conditions account for a major proportion of health services utilization and related charges. The national impact is given in the initial section of this report. The orientation in this section is toward the effect on individuals. Persons reporting cardiovascular conditions are described in terms of the health care services they use, the service charges they incur, and their sources of payment for these services.

Utilization of Health Services

The average number of ambulatory visits for all persons in the United States was 5.7 during 1980. In each subcategory, the mean number of ambulatory visits for persons reporting cardiovascular conditions was significantly higher than the mean for all persons (Table J). The means for the subcategories ranged from 7.9 to 13.9 visits per year. Total mean visits (left column in Table J) comprises both visits related to cardiovascular conditions and those related to other conditions. For this and subsequent tables, a condition-related visit is one for which the respondent identified one of the cardiovascular conditions as the primary, secondary, or tertiary reason for seeking medical care. Visits not related to the indexed condition are those for which none of these diagnoses was listed.

Persons with hypertension alone averaged 2.4 condition-related visits, which was significantly less than the mean for each of the other three cardiovascular condition groups. The mean numbers of condition-related visits for the other subcategories were two to four times greater than the number for hypertension alone. This is consistent with the personal health perceptions and reported disability of these groups. The number of visits that were not condition related approximated the average number of visits for the general population (5.7 visits). This indicates that persons with cardiovascular conditions seek noncardiovascular care at rates roughly parallel to those for others in the population. The only cardiovascular condition group with a greater number of non-condition-related visits than the average for the general population was cardiovascular disease alone (7.6 visits).

Hospital utilization is summarized in Table K. The hospital admission rate for persons with hypertension alone was not significantly different from that for the U.S. civilian noninstitutionalized population (188.8 versus 194.0 admissions per 1,000 population), but the number of hospital days per 1,000 population was significantly lower (1,133 compared with 1,517 days). In other words, persons with hypertension alone were admitted to the hospital as frequently as persons in the general population but were likely to have a shorter than average stay in the hospital (6.0 versus 7.8 days per stay). Among those with hypertension alone, less than 12 percent of admissions and hospital days during 1980 were used specifically for the care of hypertension.

For persons with the other cardiovascular conditions,

Table J

Mean ambulatory visits for persons 17 years of age and over with cardiovascular conditions, by whether or not condition related and condition: United States, 1980

Condition	Total	Condition related	Not condition related
		Mean visits	
All persons	5.7	---	---
Persons with cardiovascular conditions			
Hypertension alone	7.9	2.4	5.4
Cardiovascular disease:			
With hypertension	11.6	6.3	5.3
Alone	12.1	4.5	7.6
With complicating conditions	13.9	8.9	5.1

Table K

Hospital utilization for persons 17 years of age and over with cardiovascular conditions, by condition: United States, 1980

Condition	Hospital admissions			Hospital days			Average length of stay	
	Total	Condition related	Percent condition related	Total	Condition related	Percent condition related	Total	Condition related
	Rate per 1,000 population						Stay in days	
All persons	194.0	---	---	1,517.4	---	---	7.8	---
Persons with cardiovascular conditions								
Hypertension alone	188.8	22.0	11.7	1,133.0	134.5	11.9	6.0	6.1
Cardiovascular disease:								
With hypertension	634.6	337.0	53.1	6,636.9	2,937.7	44.3	10.5	8.7
Alone	677.1	342.7	50.6	6,455.9	3,863.8	59.8	9.5	11.3
With complicating conditions	542.7	276.0	50.9	6,047.7	3,269.1	54.1	11.1	11.8

Table L

Total and condition-related surgical procedure rates for persons 17 years of age and over with cardiovascular conditions, by condition: United States, 1980

Condition	Number of persons in thousands	Surgical procedures		
		Total	Condition related	Percent condition related
		Rate per 1,000 population		
All persons	161,236	136.5	3.6	2.6
Persons with cardiovascular conditions	27,860	238.8	13.4	5.6
Hypertension alone	13,775	141.5	-	0.0
Cardiovascular disease:				
With hypertension	3,398	348.5	38.6	11.1
Alone	5,456	343.7	28.7	8.4
With complicating conditions	5,231	314.3	16.6	5.1

hospital admission rates were about three times greater than the national average. The average length of hospital stay was also longer for those with cardiovascular disease than for the general population (9.5–11.1 versus 7.8 days per stay). These data indicate that persons with cardiovascular disease are sick enough to require hospitalization much more frequently than are persons with hypertension alone or persons without any cardiovascular conditions and that they tend to require longer hospital stays.

An important reason for high hospital utilization rates and longer lengths of stay for persons with cardiovascular disease is high surgical rates (Table L). The rate of surgical procedures for persons with any cardiovascular condition was nearly twice that for persons in the general population (238.8 versus 136.5 per 1,000 population). Although persons with hypertension alone required surgical procedures at a rate no higher than the general population, rates for persons in the three subcategories of cardiovascular disease were about 2.5 times the rate for the general population. Only 11.1 percent of surgical procedures for persons with cardiovascular disease with hypertension and 8.4 percent of surgical procedures for persons with cardiovascular disease alone were condition related. About 5 percent of surgical procedures for persons with cardiovascular disease and hypertension were condition related—close to the overall proportion of condition-related surgery for all persons with cardiovascular conditions. Persons with hypertension alone reported no condition-related surgery. Despite relatively low levels of condition-related surgery, the high overall surgical rates confirm that the health status of many persons suffering from cardiovascular conditions has been seriously compromised.

Service utilization differences by age are given in Tables M and N, with Table M displaying total utilization and Table N, condition-related utilization. For the total U.S. population, ambulatory visits, hospital admissions, hospital days, and average lengths of hospital stay were higher for successively older age groups (Tables M and 9). This pattern was generally present for persons with cardiovascular conditions. However, there is some indication that, relative to their older counterparts, rates may be higher for younger adults (17–44 years of age) who have cardiovascular conditions than for younger persons in the general population. No overall conclusions

Table M

Ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular conditions, by condition and age: United States, 1980

Condition and age	Mean ambulatory visits	Hospital admissions per 1,000 population	Hospital days per 1,000 population	Average length of stay in days
All persons				
All ages 17 years and over	5.7	194	1,517	7.8
17–44 years	4.7	150	831	5.5
45–64 years	6.1	186	1,616	8.7
65 years and over	8.6	386	4,092	10.6
Persons with cardiovascular conditions				
Hypertension alone	7.9	189	1,133	6.0
17–44 years	7.2	251	1,043	4.2
45–64 years	7.0	129	740	5.7
65 years and over	9.4	241	1,737	7.2
Cardiovascular disease:				
With hypertension	11.6	635	6,637	10.5
17–44 years	‡10.4	‡972	‡3,699	‡3.8
45–64 years	9.9	487	3,949	8.1
65 years and over	12.6	694	8,326	12.0
Alone	12.1	667	6,456	9.7
17–44 years	13.8	477	3,516	7.4
45–64 years	9.8	580	4,764	8.2
65 years and over	13.1	770	8,245	10.7
With complicating conditions	13.9	543	6,048	11.1
17–44 years	†14.0	†384	†6,277	†16.3
45–64 years	13.2	487	4,777	9.8
65 years and over	14.6	639	7,251	11.3

Table N

Condition-related ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular conditions, by condition and age: United States, 1980

Condition and age	Mean ambulatory visits	Percent condition related	Hospital admissions per 1,000 population	Percent condition related	Hospital days per 1,000 population	Percent condition related	Average length of stay in days
Hypertension alone	2.4	30.4	22	11.6	135	11.9	6.1
17–44 years	2.7	37.5	37	14.7	211	20.2	5.7
45–64 years	2.1	30.0	18	14.0	103	13.9	5.7
65 years and over	2.7	28.7	20	8.3	138	7.9	6.9
Cardiovascular disease:							
With hypertension	6.3	54.3	337	53.1	2,938	44.3	8.7
17–44 years	‡3.9	‡37.5	‡698	‡71.8	‡2,680	‡72.5	‡3.8
45–64 years	5.4	54.5	318	65.3	2,243	56.8	7.1
65 years and over	6.9	54.8	324	46.7	3,341	40.1	10.3
Alone	4.5	37.2	343	51.4	3,864	59.9	11.3
17–44 years	6.6	47.8	287	60.2	2,110	60.0	7.4
45–64 years	4.1	41.8	286	49.3	2,474	51.9	8.7
65 years and over	4.3	32.8	393	51.0	5,168	62.7	13.2
With complicating conditions	8.9	64.0	276	50.8	3,269	54.1	11.8
17–44 years	†8.9	†63.6	†185	†48.2	†3,819	†60.8	†20.6
45–64 years	8.2	62.1	274	56.3	2,687	56.2	9.8
65 years and over	9.5	65.1	301	47.1	3,708	51.1	12.3

can be drawn because the sample sizes were often too small to produce reliable estimates for the youngest age category. With the exception of persons with hypertension alone, utilization rates and lengths of stay among persons 65 years of age and over were higher for those with any cardiovascular condition than for their counterparts in the general population. This was true for total use as well as for condition-related use (Table N).

The most striking utilization differences among the cardiovascular condition subcategories concern hospitalizations and hospital days. For each of the three condition subcategories associated with arteriosclerotic complications, condition-related hospital utilization for each age group was 10–40 times higher than utilization for the corresponding age group with hypertension alone (Table N). Condition-related ambulatory use rates were only 2–4 times greater for the arteriosclerotic condition subcategories. The percents of hospital admissions and days that were condition related were also substantially higher among those with cardiovascular disease (40–65 percent) than among those with hypertension alone (8–20 percent).

Black persons had a greater number of condition-related ambulatory visits than white and other persons had, but the differences were small (Table O). Differences by race in the use of inpatient services tended to be greater, with black persons utilizing more services per person. In every condition and utilization subcategory, the percent of use represented by condition-related care was higher for black persons than for white persons and persons of other races. However, in two of the subcategories (cardiovascular disease alone and with hypertension), small sample sizes preclude assessment of statistical significance for any of these differences. Nevertheless, these trends are consistent with the poorer perceived health status of black persons. Moreover, the prevalence of hypertension is greater among black persons, so one would expect greater service utilization by black persons. Although it is not possible to determine from these data whether service utilization levels are appropriate, it appears that black persons utilize more ambulatory and hospital services for the care of cardiovascular conditions than white and other persons do.

Although women are generally more likely to use health care services than are men (Table 9), sex differences among those with cardiovascular conditions do not always follow this pattern. In general, women with cardiovascular conditions did make more ambulatory visits than men did, both with respect to total visits and with respect to visits specifically for cardiovascular conditions. With the exception of the subcategory cardiovascular disease alone, women with cardiovascular conditions reported more condition-related ambulatory visits, on average, than did men (Tables 10–13). The greatest differences were observed among those with cardiovascular disease and complicating conditions (Table P). In contrast, condition-related hospital admissions and days were greater for men than for women in all subcategories and total hospital use was greater in most subcategories (Tables 10–13). These findings for women are compati-

Table O

Total and condition-related ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular conditions, by condition and race: United States, 1980

Condition and race	Mean ambulatory visits			Hospital admissions per 1,000 population			Hospital days per 1,000 population		
	Total	Condition related	Percent condition related	Total	Condition related	Percent condition related	Total	Condition related	Percent condition related
All persons									
Total	5.7	---	---	194.0	---	---	1,517.4	---	---
Black	5.4	---	---	204.5	---	---	1,935.3	---	---
White and other	5.7	---	---	192.7	---	---	1,468.6	---	---
Persons with cardiovascular conditions									
Hypertension alone	7.9	2.4	30.4	188.8	22.0	11.7	1,133.0	134.5	11.9
Black	7.0	2.8	40.0	246.5	45.2	18.3	1,476.9	295.9	20.0
White and other	8.0	2.4	30.0	180.1	18.5	10.3	1,080.8	110.0	10.2
Cardiovascular disease:									
With hypertension	11.6	6.3	54.3	634.6	337.0	53.1	6,636.9	2,937.7	44.3
Black	†12.5	†7.3	†58.4	†609.0	†430.7	†70.7	†7,069.1	†3,944.3	†55.8
White and other	11.5	6.2	53.9	637.8	325.1	51.0	6,581.8	2,809.2	42.7
Alone	12.1	4.5	37.2	667.1	342.7	51.4	6,455.9	3,863.8	59.8
Black	†14.3	†5.5	†38.5	†548.8	†370.5	†67.5	†4,929.5	†3,402.0	†69.0
White and other	11.8	4.4	37.3	680.9	339.4	49.8	6,634.9	3,917.9	59.0
With complicating conditions	13.9	8.9	64.0	542.7	276.0	50.9	6,047.7	3,269.1	54.1
Black	14.9	10.6	71.1	466.1	320.2	68.7	5,667.2	3,906.4	68.9
White and other	13.8	8.6	62.3	555.8	268.5	48.3	6,112.6	3,160.3	51.7

ble with the greater number of ambulatory visits for all causes and the greater awareness and medical management of hypertension in women (Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure, 1984). On the other hand, men develop hypertension and arteriosclerotic complications earlier in adult life and in greater numbers. Men less frequently are under care for hypertension but more frequently are hospitalized for myocardial infarction and cardiovascular surgery.

The relationship between income status and health service utilization for the U.S. civilian noninstitutionalized population 17 years of age and over is shown in Table 9. Similar data for persons with cardiovascular conditions are shown in Tables 10–13. No consistent patterns were evident for hospital service utilization by either the entire population or those with cardiovascular conditions. For persons reporting hypertension alone or cardiovascular disease with complicating conditions, levels of family income were not related to the use of ambulatory services (Table Q). However, for the other two subcategories that involve arteriosclerotic complications, there were differences in ambulatory service utilization among income levels. For these condition groups, the mean number of ambulatory visits for all causes was 10–12 per year for persons in each income category below $35,000. The range for condition-related visits among persons with incomes of less than $35,000 was 3–6 per year. It is noteworthy that persons in the lowest income category do not average significantly fewer visits than others with incomes below $35,000. However, the average number of visits, both total and condition specific, was greater for persons with family incomes of $35,000 or more than for those below this income level. Although the sample size is too small to allow calculation of significance for persons with cardiovascular disease and hypertension in the high-income range, this trend suggests that utilization patterns are different at higher income levels. Apparently, persons with relatively high incomes, if they have cardiovascular disease, are likely to purchase significantly more medical care than are others with the same illness.

Two conflicting mechanisms can be hypothesized to be operating to produce these income effects on utilization patterns: affordability and need. Affordability of services is an important dimension of access to ambulatory care because such care is often not fully covered by health insurance. Persons with higher incomes are able to purchase incremental ambulatory care or more comprehensive health insurance coverage than those at lower income levels. This seems to be the case with cardiovascular conditions with major symptomatic complications that prompt visits. Poor persons might be expected to use less care because they can't afford it. However, health care need is also a major determinant of service utilization; persons at lower income levels report poorer health and hence have greater perceived

Table P

Mean total and condition-related ambulatory visits for persons 17 years of age and over with cardiovascular disease and complicating conditions, by sex and age: United States, 1980

Sex and age	Total	Condition related	Percent condition related
	Mean visits		
Both sexes	13.9	8.9	64.0
Male	10.0	6.1	61.0
17–44 years	‡4.6	‡2.2	†47.8
45–64 years	9.7	6.4	66.0
65 years and over	12.0	6.9	57.5
Female	16.5	10.7	64.8
17–44 years	†20.5	†13.6	†66.3
45–64 years	15.9	9.5	59.7
65 years and over	16.1	11.0	68.3

Table Q

Mean total and condition-related ambulatory visits for persons 17 years of age and over with cardiovascular conditions, by condition and family income: United States, 1980

Condition and family income	Total	Condition related	Percent condition related
All persons	Mean visits		
All incomes	5.7	---	---
Less than $10,000	6.9	---	---
$10,000–$19,999	5.6	---	---
$20,000–34,999	5.2	---	---
$35,000 or more	5.2	---	---
Persons with cardiovascular conditions			
Hypertension alone	7.9	2.4	30.4
Less than $10,000	8.2	2.8	34.1
$10,000–$19,999	7.2	2.3	31.9
$20,000–34,999	8.6	2.5	29.1
$35,000 or more	7.4	2.1	28.4
Cardiovascular disease:			
With hypertension	11.6	6.3	54.3
Less than $10,000	10.9	6.1	56.0
$10,000–$19,999	10.6	5.1	48.1
$20,000–34,999	†11.0	†5.2	†47.3
$35,000 or more	†16.9	†11.2	†66.3
Alone	12.1	4.5	37.2
Less than $10,000	11.4	3.4	29.8
$10,000–$19,999	11.6	3.9	33.6
$20,000–34,999	10.2	5.0	49.0
$35,000 or more	18.4	8.0	43.5
With complicating conditions	13.9	8.9	64.0
Less than $10,000	15.0	9.8	65.3
$10,000–$19,999	13.1	8.0	61.2
$20,000–34,999	13.3	7.9	59.4
$35,000 or more	13.9	9.4	67.6

need for services. Further, many low-income persons are covered for ambulatory health care services by public programs, although access may still be limited by nonfinancial considerations, such as overcrowding in public health care facilities. The greater need for care combined with public health care coverage for persons in the lowest income category may account for utilization levels comparable to those of persons in the middle income categories.

Ambulatory service utilization and type of health care coverage are shown in Tables 14–18. No clear general relationships between utilization and coverage were found for the cardiovascular subcategories. The number of persons in most of the coverage categories is relatively small, and the reliability of estimated visit rates in most cases does not support general statements concerning the significance of the observed differences. This limitation also applies to hospital days and admission rates.

Charges and Out-of-Pocket Expenditures for Health Services

The affordability of care is determined, from an individual's perspective, less by the total amount of charges for services than by the proportion of those charges that must be paid out of pocket. For persons who have generous health care coverage, this proportion may be quite low. Persons covered by the Medicaid program, for example, can expect to pay little for covered services because in many States Medicaid coverage is quite broad. Charges for physician office visits are generally covered under Medicaid and are covered with a 20-percent coinsurance requirement under Medicare, but ambulatory services are not usually covered under private insurance policies.

Per capita charges and out-of-pocket expenditures therefore provide the best indication of the personal economic impact of medical treatment (Tables R and S). Total per capita charges and the proportion paid out of pocket for persons reporting cardiovascular conditions are given in Table R, and the same charges specifically attributable to cardiovascular conditions are given in Table S. For persons with hypertension alone, total charges for all health services averaged $819, which is not significantly different from the $837 average for the overall population 17 years of age and over. For each of the other three condition groups, total charges per person were more than three times greater than the national average, exceeding $2,600.

When persons with hypertension alone are compared with the total U.S. population (Table R), charges for the hypertensive group are seen to be higher only for prescribed medications and ambulatory visits. These findings reflect medical practice related to blood pressure control in 1980. The higher proportion of out-of-pocket expenditures for condition-related care in hypertensives than in other subcategories is consistent with routine medical visits for blood pressure checkups and with reliance on outpatient prescribed medications, which private insurance policies typically do not cover. The other cardiovascular subcategories had greater charges than hypertension alone but a lesser proportion of out-of-pocket expenditures for all types of services.

The three subcategories of cardiovascular disease had remarkably similar total and condition-related charges and out-of-pocket payments. The distribution of charges by type of health service was also similar across condition subcategories. As in the case of utilization, per capita charges for persons with hypertension alone are marginally lower than those for the general population, but the charges for persons with the three subcategories of cardiovascular disease are considerably greater in most cases.

The relationships of age to per capita charges and to per capita condition-related charges are given in Tables T and U. The distribution of these charges by type of service, age, sex, and race is provided in Tables 19 and 20. The pattern in the total U.S. population 17 years of age and over was for higher charges at

Table R

Per capita charges for persons 17 years of age and over with cardiovascular conditions and percent paid out of pocket, by type of health service and condition: United States, 1980

Condition	All services		Hospital admissions		Prescribed medications		Ambulatory visits		Other health services[1]	
	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket
All persons	$ 837	26.7	$ 496	10.9	$ 44	64.7	$195	37.5	$103	65.9
Persons with cardiovascular conditions:										
Hypertension alone	819	34.8	376	12.9	96	66.5	257	39.7	90	78.8
Cardiovascular disease:										
With hypertension	2,640	19.4	1,951	9.8	187	60.8	415	34.8	88	69.3
Alone	2,739	16.9	2,091	9.0	127	61.2	411	31.2	110	62.3
With complicating conditions	2,654	18.5	1,830	9.6	209	58.1	486	24.7	129	56.6

[1]Includes dental and other health services, such as eyeglasses, orthopedic appliances, hearing aids, diabetic supplies, and ambulance services.

Table S

Condition-related per capita charges for persons 17 years of age and over with cardiovascular conditions and percent paid out of pocket, by type of health service and condition: United States, 1980

Condition	All services		Hospital admissions		Prescribed medications		Ambulatory visits		Other health services[1]	
	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket
Hypertension alone	$ 142	48.1	$ 35	14.4	$ 52	68.2	$ 54	50.5	---	---
Cardiovascular disease:										
With hypertension	1,243	16.9	924	7.9	111	60.9	197	32.7	$11	41.1
Alone	1,386	16.2	1,156	11.6	57	65.9	162	30.2	10	35.8
With complicating conditions	1,482	17.9	1,029	10.8	130	59.4	294	21.6	30	45.6

[1]Includes dental and other health services, such as eyeglasses, orthopedic appliances, hearing aids, diabetic supplies, and ambulance services.

Table T

Per capita charges for persons 17 years of age and over with cardiovascular conditions and percent paid out of pocket, by condition and age: United States, 1980

Condition and age	Per capita charge	Percent out of pocket
All persons		
All ages 17 years and over	$ 837	26.7
17–44 years	596	31.4
45–64 years	911	26.9
65 years and over	1,670	19.7
Persons with cardiovascular conditions		
Hypertension alone	819	34.8
17–44 years	780	28.2
45–64 years	682	40.7
65 years and over	1,034	32.0
Cardiovascular disease:		
With hypertension	2,640	19.4
17–44 years	‡3,163	‡12.7
45–64 years	2,032	22.9
65 years and over	2,943	18.5
Alone	2,739	16.9
17–44 years	2,097	26.8
45–64 years	2,354	16.6
65 years and over	3,145	15.5
With complicating conditions	2,654	18.5
17–44 years	†2,307	†38.9
45–64 years	2,261	18.3
65 years and over	3,133	14.8

Table U

Condition-related per capita charges for persons 17 years of age and over with cardiovascular conditions and percent paid out of pocket, by condition and age: United States, 1980

Condition and age	Per capita charge	Percent out of pocket
Hypertension alone	$ 142	48.1
17–44 years	169	38.3
45–64 years	125	49.5
65 years and over	150	52.5
Cardiovascular disease:		
With hypertension	1,243	16.9
17–44 years	‡2,444	‡5.9
45–64 years	1,225	21.2
65 years and over	1,174	15.9
Alone	1,386	16.2
17–44 years	1,342	26.3
45–64 years	1,105	12.0
65 years and over	1,576	16.0
With complicating conditions	1,482	17.9
17–44 years	†1,469	†44.8
45–64 years	1,274	15.8
65 years and over	1,693	13.6

older ages, slightly greater charges for women than for men, and slightly greater charges for white and other persons than for black persons. The proportion of out-of-pocket payments declined significantly for persons 65 years of age and over because most persons in that age range have Medicare. These patterns can be compared with those for the cardiovascular subcategories.

The pattern of charges for persons with hypertension alone differed somewhat from that for the general population, but no distinct pattern is evident (Table 19). The proportion of out-of-pocket expenditures in this subcategory was relatively constant across age, sex, and race groups and accounted for one-third of total charges. Condition-related charges for persons with hypertension alone were similar in all age groups (Table 20). There were no significant sex differences and no differences by race in condition-related charges for hypertension alone. However, the percent paid out of pocket for condition-related care increased with age, was higher for females than for males, and was higher for white and other persons than for black persons.

For the other subcategories of cardiovascular conditions, neither total nor condition-related charges differed consistently by age group. However, the size of the population affected differs considerably by age, i.e., there are far more older than younger persons with cardiovascular disease (Table 3). This finding suggests that, when cardiovascular disease develops among those under

65 years of age, the affected persons bear a disproportionately greater burden of health service charges on a per capita basis than do those 65 years and over who are similarly afflicted. Although the proportion of out-of-pocket expenditures was less (by about one-half) for these subcategories of cardiovascular disease than for hypertension alone, the nearly tenfold greater total charges mean that the personal burden of health care costs was disproportionately great (Table U and Table 20).

The rates and costs for cardiovascular procedures and for all surgical procedures are given in Table W. No cardiovascular procedures were reported for persons with hypertension alone. For each of the other cardiovascular subcategories, the rates ranged from 16.6 per 1,000 to 38.6 per 1,000, and the associated charges per user ranged from $7,731 to $10,730. Both rates and mean charges increased progressively with age for the total population 17 years of age and over. Men had significantly higher rates (4.7 per 1,000) and mean charges ($9,400) for cardiovascular procedures than women had (2.5 per 1,000 and $4,899, respectively). However, for all procedures women had higher rates but lower mean charges. The sex differential for cardiovascular procedures is probably not related to economic impediments. Women tend to develop arteriosclerotic disease later in life than do men and therefore may be less likely to be selected for surgery. There were no significant differences by race or income in the rate of cardiovascular procedures. These data confirm the important cost impact of cardiovascular procedures, which cost $4.4 billion in 1980, or about 5.5 percent of the cost of all surgical procedures.

There were few significant differences by race in health care charges. Because of more frequent hospital admissions, black persons with hypertension alone had higher condition-related hospitalization charges than did white and other persons with the same condition. This racial pattern was reversed for cardiovascular disease with complicating conditions (Table 20). Total health care charges (Table 19) were higher for white and other persons than for black persons in each subcategory. However, sample sizes for black persons with cardiovascular disease alone or with hypertension are too small to produce reliable estimates. Thus, the statistical significance of these differences by race cannot be assessed for these two condition subcategories.

Out-of-pocket charges for black persons tend to be lower than those for white and other persons. Both in

Table W

Total and condition-related surgical procedures for persons 17 years of age and over, by condition and selected characteristics: United States, 1980

Characteristic	Number of persons in thousands	Total surgical procedures: Rate per 1,000 population	Total surgical procedures: Charges: Amount in millons	Total surgical procedures: Charges: Mean user	Condition-related surgical procedures: Rate per 1,000 population	Condition-related surgical procedures: Charges: Amount in millions	Condition-related surgical procedures: Charges: Mean user
All persons	161,236	136.5	$79,914	$3,632	3.6	$4,415	$ 7,706
Age							
17–44 years	94,201	119.8	29,290	2,595	1.0	424	4,566
45–64 years	43,578	128.0	22,444	4,025	6.5	2,098	7,431
65 years and over	23,455	219.2	28,179	5,481	8.4	1,892	9,575
Sex							
Male	75,882	111.1	35,739	4,240	4.7	3,358	9,400
Female	85,353	159.0	44,175	3,254	2.5	1,056	4,899
Race							
Black	16,863	148.4	8,012	3,201	4.5	426	5,633
White and other	144,372	135.1	71,902	3,687	3.4	3,989	8,021
Family income							
Less than $10,000	32,099	185.9	26,001	4,357	4.4	586	4,198
$10,000–$19,999	44,143	144.0	21,514	3,384	5.0	1,650	7,511
$20,000–$34,999	51,134	118.1	18,088	2,995	2.5	1,370	10,682
$35,000 or more	33,858	107.4	14,311	3,934	2.5	809	9,480
Persons with cardiovascular conditions							
Total	27,860	238.8	32,786	4,931	13.4	3,480	9,298
Hypertension alone	13,775	141.5	5,177	2,655	–	–	–
Cardiovascular disease:							
With hypertension	3,398	348.5	6,628	5,598	38.6	1,015	7,731
Alone	5,456	343.7	11,408	6,100	28.7	1,535	9,819
With complicating conditions	5,231	314.3	9,572	5,821	16.6	930	10,730

the overall population and for those with cardiovascular conditions, a larger proportion of black persons than white and other persons were covered by Medicaid, and Medicaid is one of the few third-party payers covering the costs of ambulatory office visits and prescription medications. Black persons having cardiovascular disease with complicating conditions paid a greater percent of total and condition-related health service charges than white persons in this subcategory (Tables 19 and 20).

Condition-related charges for the cardiovascular subcategories and the sources of payment are given in Table 21. Almost one-half of the total condition-related charges for hypertension alone were paid out of pocket. This reflects the primarily ambulatory nature of medical care for this condition. The major sources of payment for condition-related services for the other three subcategories were private insurance and Medicare. Medicare covered 28.2 percent of condition-related charges for persons with cardiovascular disease with hypertension, 36.2 percent for persons with cardiovascular disease alone, and 33.0 percent for those with cardiovascular disease and complicating conditions. Also noteworthy is the relatively large proportion of Medicaid payments for persons with cardiovascular disease and complicating conditions. Although this condition group does not include a disproportionately large percent of low-income persons, Medicaid covers nearly 20 percent of condition-related charges for persons in this subcategory. When Medicare and other government sources are considered in addition to Medicaid, it is seen that these public programs pay 60 percent of condition-related charges for persons with complicating conditions associated with cardiovascular disease. The complicating conditions may lead to greater dependence on public coverage.

Discussion

Cardiovascular conditions not only are the most common cause of death and disability in the United States but also constitute a major source of health care costs. The data from NMCUES provide striking documentation of these costs in the context of total health care costs in the United States and indicate as well the economic implications of functional disability. A total of $21,490 million in health care charges during 1980 can be ascribed to adult cardiovascular conditions. This represents 15.9 percent of all adult health care charges.

The indirect economic impact of cardiovascular morbidity can be assessed in terms of unemployability, work-loss days, and lost productivity. These measures can be compared with the same measures for the general population in the same age range. For all subcategories of adults with cardiovascular conditions, there was a range of 7.5 to 31.3 percent unable to work for health reasons in the age group 45–64 years, compared with 9.2 percent in the general population. In this age group, 6.7–16.9 workdays were lost per capita for persons with cardiovascular conditions, compared with 5.9 days lost per capita for the total adult population. Lost productivity from cardiovascular disease was estimated to be $1,652 million. It is clear that the direct health care costs as well as the indirect costs of illness were high.

Moreover, the approximately 30-percent decline in the mortality rate from cardiovascular disease in the past 20 years and the concomitant increase in life expectancy should increase the demands for cardiovascular care in the future rather than diminish the demand. The decline in mortality has resulted from improved survival of cardiovascular disease events and forestalling or prevention of events. These chronic conditions typically occur in middle and late adult life and require continuing medical management after becoming manifest. Therefore, the declining age-adjusted mortality rates will not decrease the need for or utilization of services and could be associated with increased costs. An appropriate health strategy is to focus on prevention and management of early manifestations of disease. This strategy could also be cost effective if ambulatory care were substituted for much of the hospital care. From this perspective, it is important to identify the source of medical costs, particularly high costs, to link these costs to effectiveness of medical care, and to seek economically efficient approaches that maintain good health outcomes (Goodman and Cook, 1984).

To determine the sources of cardiovascular costs, cardiovascular conditions occurring among adults were separated into subcategories that were likely to be relatively homogeneous internally with respect to medical care utilization and costs. Cost comparisons across subcategories provide interesting findings because of different service needs among subcategories.

One common condition, hypertension alone, is both a cardiovascular condition and a risk factor for the development of other cardiovascular disorders that often require different and more expensive approaches for management. According to current evidence from clinical trials, successful treatment of hypertension can forestall or prevent development of severe morbidity and death (Hypertension Detection and Follow-up Program Cooperative Group, 1979). The strategy of national commitment to recognition and treatment of hypertension has a sound medical rationale but, as confirmed by NMCUES data, also has a basis in cost effectiveness. Considerable health and economic importance is attached to hypertension because of its high prevalence and the demonstrated ability of relatively inexpensive treatment to prevent permanent structural damage. Once structural damage has occurred, the cost of care increases greatly and functional losses compromise economic productivity. During 1980, the per capita charges for treatment of hypertension among persons 17 years of age and over were $142, but the per capita charges for treatment of hypertension associated with arteriosclerotic complications were $1,243. This almost tenfold difference in charges indicates the cost effectiveness of early treatment and of forestalling organ damage. The differences in costs reflect the nature of treatment for hypertension alone and hypertension with complications. Treatment of hypertension alone is primarily ambulatory, but the complications of hypertension require expensive hospital care.

The data from NMCUES also provide a national perspective on the frequency of treatment for hypertension and the functional disability associated with this asymptomatic condition. In this survey, the reported service utilization and functional impairment related to hypertension, either as the single reported diagnosis or

associated with other cardiovascular disease, were close to the prevalence estimates from the National Health and Nutrition Examination Surveys, which were based on physical examinations (Drizd, Dannenberg, and Engel, 1986). This indicates a high personal recognition of the condition and of the importance of seeking medical care. However, no information is available from NMCUES regarding adequacy or effectiveness of treatment. Thus, no comment can be made regarding the effectiveness of blood pressure control.

The distribution of sociodemographic characteristics of those reporting treatment for hypertension generally resembled the distribution of characteristics reported for hypertensive persons in prevalence surveys of the general population. Black persons have a greater prevalence of hypertension, and in NMCUES, black persons reported more medical care, disability, and charges for treatment of this disorder than white and other persons did. Women made more visits and had greater charges for hypertension than men and reported more hypertension than did men in NMCUES. The higher condition-related service use of women may be a function of higher utilization levels for women for all causes, leading to better recognition of the presence of hypertension. In addition, women may be combining treatment for this disorder with other procedures in a single visit. Therefore, the pattern of service utilization for hypertension was consistent either with the prevalence of the condition in the case of race or with general use patterns in the case of sex. No major deficit in medical care for hypertension in major segments of the population can be identified from NMCUES data, but it should be noted that the survey data allowed for only coarse discrimination.

Service utilization for hypertension alone was relatively similar for persons at all family income levels less than $35,000. Important financial barriers to hypertension treatment were not apparent. Consistent with this finding, no relationships were found between utilization of ambulatory service and type of health care coverage. These findings indicate that hypertension was recognized as a health problem by a large proportion of those having the condition and that the health services obtained were proportionate to the distribution of the condition in the population. No major widespread financial or access barriers could be identified, although even large surveys may miss segments of the population with inadequate access to care.

The personal and economic impact of hypertension therapy was surprisingly small, given the requirement for long-term therapy with medications that can alter life patterns and may cause more symptoms than the disease itself. Moreover, the significant threat of mortality and morbidity from complications may also alter the personal view of health, the ability to work, and the utilization of medical care.

With respect to disability measures, persons with hypertension as the only reported cardiovascular condition differed only slightly from the general population. Perceived health status and functional limitation scores in the age group 17–44 years were somewhat worse for hypertensive persons than for the general population, but the differences were minimal or even reversed at older ages. Persons reporting hypertension alone had slightly more work-loss days than the total population. Bed-disability days were also slightly higher for this group, but the difference was not statistically significant. More importantly, among persons 45–64 years of age, restricted-activity days and bed-disability days for the group with hypertension alone were less than the national average, and hypertensives had only slightly more work-loss days (6.7) than the general population had (5.9). Perhaps more striking was the disability specifically attributable to hypertension alone. Work loss from hypertension averaged only 0.4 day; restricted activity, 2.2 days; and bed disability, only 0.7 day for persons 17 years of age and over. No major differences by sex or race were found in these patterns.

These findings indicate that middle-aged hypertensive persons in the United States perceived their health as remarkably good relative to others with cardiovascular conditions and experienced little disability specifically related to being hypertensive. Some decrease in functional limitation and perceived health would be anticipated because of the side effects of antihypertensive medications and the attention to diet and physical activity levels. However, the functional cost was minimal.

The charges attributable to treatment of hypertension alone were surprisingly small. The annual hypertension-related per capita charges of $142 were modest and included physician costs and prescriptions. These relatively low charges are consistent with the ambulatory nature of treatment and the reliance on low-cost diuretic agents that characterized treatment in 1980 (Stason, 1986). A relatively greater proportion of expenses for hypertension alone than for other cardiovascular conditions were out of pocket (48 percent), as might be anticipated from the preponderance of ambulatory treatment and the lack of complete health care coverage for outpatient care. The cost of illness for hypertension alone with respect to associated functional disability, work loss, and unemployability can also be termed modest, with only a slight decrease in functional activity and no important differences in economic productivity. Therefore, both direct health costs and indirect costs related to hypertension alone are small. When compared with the costs for cardiovascular disease that may develop, the investment in treatment would appear to be cost effective.

In contrast, cardiovascular conditions other than hypertension alone were associated with considerably higher levels of disability, greater service utilization, and higher charges for care. Functional limitation scores for persons with these conditions were twice as great as scores for the general population and at least 1½ times as great as scores for those with hypertension alone. About one-half of persons with these conditions,

compared with one-quarter of persons with hypertension alone, rated their health as only fair or poor. Persons in these subcategories also had about twice as many work-loss, restricted-activity, and bed-disability days as persons with hypertension alone had. These findings provide documentation that treatment of hypertension as a means of preventing other cardiovascular conditions is associated with only minor functional disability, but that the advent of cardiovascular disease or superimposition of comorbid conditions results in considerably increased disability and impairment.

The utilization of health services by cardiovascular condition group followed the same general pattern as disability did. The mean annual number of ambulatory visits specifically attributable to hypertension alone was 2.4, and for other cardiovascular subcategories the mean ranged from 4.5 to 8.9 visits. The major differences in service utilization and costs between hypertension alone and the other cardiovascular subcategories related to hospitalization and surgery. Hospital admissions and hospital days attributed to cardiovascular conditions were about 12–15 and 22–29 times higher, respectively, when cardiovascular diseases (primarily arteriosclerotic) were reported than when only hypertension was reported. Condition-related hospitalization represented about 50 percent of hospital care for those with cardiovascular disease, compared with less than 12 percent for hypertension alone. No condition-related surgical procedures were reported by persons with hypertension alone. Condition-related surgical rates for the other cardiovascular subcategories ranged from 16.6 to 38.6 per 1,000. The comparable rate for the general adult population was 3.6 per 1,000. Total surgical rates for persons with cardiovascular disease were 2.5 times those for the general population or for those with hypertension alone. Thus, the differences in hospitalization rates among the cardiovascular subcategories are in part attributable to higher surgical rates among those with cardiovascular disease.

Adults in the cardiovascular subcategories exclusive of hypertension alone also had greater per capita hospital charges than those with hypertension alone had. This finding reflects the higher rates of hospital admissions and of surgical procedures among those with cardiovascular disease. Interestingly, the burden of charges, hospital admissions, and surgical procedures was relatively constant across adult age groups for those with cardiovascular disease. This contrasts with the general pattern for most other conditions, for which costs and health care services generally increase for successively older age groups. Therefore, the burden is proportionally greater on persons under 65 years of age with cardiovascular disease, because this age group has a lower prevalence of cardiovascular conditions but higher costs per affected person than the older group has.

Among persons with cardiovascular disease, there were few differences in hospitalizations or charges by sex or race except for cardiovascular procedures. Men have a greater prevalence of arteriosclerotic disease than women under 65 years of age, and they have more cardiovascular surgical procedures than women. The rates of condition-related surgical procedures were 4.7 per 1,000 for men and 2.5 per 1,000 for women, although for all surgical procedures (including deliveries) women had rates nearly 1.5 times those for men. The per capita costs for condition-related surgical procedures were $9,400 for men and $4,899 for women. Although black persons tend to use more inpatient care than do white and other persons, especially condition-related care, small sample sizes restrict the ability to draw statistically significant conclusions. There were no significant differences in cardiovascular procedures across income strata. Therefore, the only major sociodemographic difference was in cardiovascular surgery, and this may relate to case selection rather than to lack of access or cost impediment.

Several implications are suggested by these data. First, the economic and health impact of cardiovascular conditions is great and is likely to increase. Cardiovascular mortality rates have declined and life expectancy for the U.S. population has increased over the past two decades, and the trends are continuing. Part of the decreased cardiovascular mortality results from increased survival after the initial event and part from decreased incidence of first events, although the proportion of each is controversial (Goodman and Cook, 1984). Nevertheless, more persons will survive initial events and require hospitalization, surgery, and followup care, which are increasingly technologically based and economically costly. Therefore, the costs of treating an increasing number of survivors will increase as a price for successful treatment. Because of the increasing age of the population, the total burden of disease and the costs of care will increase.

Moreover, the beneficial effects of identification and management of cardiovascular risk factors such as hypertension are clear. The cost differences are clear from this survey with respect to management of hypertension alone and management of complications resulting from hypertension. Rough estimates of the cost effectiveness of hypertension treatment indicate that 10 years of prevention can be purchased for the same cost as 1 year of treatment for arteriosclerotic complications of hypertension. The public has responded to this preventive message by seeking hypertensive treatment, and the system appears to provide case management without major differences by race or sex. Although the individual or unit cost is modest, the prevalence is high and the aggregate cost is relatively great. Therefore, current primary and secondary prevention has favorable health effects and is cost effective, but success in this area will probably be associated with further increases in expenditures for cardiovascular conditions.

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List of Detailed Tables

Table 1

Number and percent distribution of total and condition-related disability days for persons 17 years of age and over with cardiovascular conditions by condition, according to type of disability day: United States, 1980

Condition	Number of persons	Bed-disability days		Work-loss days		Restricted-activity days	
		Total	Condition related	Total	Condition related	Total	Condition related
	Number in thousands						
All persons	161,236	909,965	93,712	570,241	26,089	2,520,720	264,627
Persons with cardiovascular conditions	27,860	325,926	93,712	97,707	26,089	897,470	264,627
Hypertension alone	13,775	82,627	5,436	46,386	5,302	277,385	30,026
Cardiovascular disease:							
With hypertension	3,398	56,864	18,111	15,105	6,067	156,719	66,158
Alone	5,456	94,495	41,055	21,985	8,574	249,125	92,666
With complicating conditions	5,231	91,940	29,109	14,231	6,146	214,241	75,777
	Percent distribution						
All persons	100.0	100.0	10.3	100.0	4.6	100.0	10.5
Persons with cardiovascular conditions	17.3	35.8	10.3	17.1	4.6	35.6	10.5
Hypertension alone	8.5	9.1	0.6	8.1	0.9	11.0	1.2
Cardiovascular disease:							
With hypertension	2.1	6.2	2.0	2.6	1.1	6.2	2.6
Alone	3.4	10.4	4.5	3.9	1.5	9.9	3.7
With complicating conditions	3.2	10.1	3.2	2.5	1.1	8.5	3.0

Table 2

Number and percent distribution of total and condition-related ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular conditions by condition: United States, 1980

Condition	Ambulatory visits		Hospital admissions		Hospital days	
	Total	Condition related	Total	Condition related	Total	Condition related
	Number in thousands					
All persons	911,440	125,772	31,272	4,762	244,658	50,016
Persons with cardiovascular conditions	286,313	125,772	11,236	4,762	105,020	50,016
Hypertension alone	108,196	33,587	2,601	303	15,607	1,852
Cardiovascular disease:						
With hypertension	39,373	21,324	2,156	1,145	22,553	9,982
Alone	65,821	24,561	3,639	1,870	35,222	21,080
With complicating conditions	72,920	46,300	2,839	1,444	31,637	17,102
	Percent distribution					
All persons	100.0	13.8	100.0	15.2	100.0	20.4
Persons with cardiovascular conditions	31.4	13.8	35.9	15.2	42.9	20.4
Hypertension alone	11.9	3.7	8.3	1.0	6.4	0.8
Cardiovascular disease:						
With hypertension	4.3	2.3	6.9	3.7	9.2	4.1
Alone	7.2	2.7	11.6	6.0	14.4	8.6
With complicating conditions	8.0	5.1	9.1	4.6	12.9	7.0

Table 3

Number of persons 17 years of age and over with cardiovascular conditions and rate per 1,000 population, by sex, race, condition, and age: United States, 1980

Condition and age	Male			Female		
	Total	Black	White and other	Total	Black	White and other
	Number in thousands					
Hypertension alone	5,247	665	4,582	8,528	1,151	7,377
17–44 years	1,396	†351	1,045	1,100	†328	772
45–64 years	2,472	‡157	2,314	4,136	†545	3,591
65 years and over	1,379	‡156	1,223	3,292	‡278	3,014
Cardiovascular disease:						
With hypertension	1,416	‡79	1,336	1,982	‡305	1,677
17–44 years	‡24	‡–	‡24	‡116	‡10	‡105
45–64 years	†568	‡36	†532	†596	‡156	†441
65 years and over	824	‡43	781	1,270	‡139	1,131
Alone	2,886	‡247	2,639	2,570	†325	2,244
17–44 years	‡314	‡32	‡282	†389	‡120	‡269
45–64 years	1,219	‡87	1,132	†597	‡80	†517
65 years and over	1,354	‡129	1,225	1,569	‡125	1,444
With complicating conditions	2,077	‡274	1,803	3,154	†489	2,665
17–44 years	‡239	‡26	‡213	†351	‡79	‡272
45–64 years	1,002	‡197	805	1,311	‡239	1,072
65 years and over	836	‡51	785	1,492	‡171	1,321
	Rate per 1,000 population					
Hypertension alone	69.1	88.9	67.0	99.9	122.5	97.1
17–44 years	30.6	†72.4	25.7	22.6	†54.6	18.1
45–64 years	118.7	‡85.7	121.9	181.8	†248.0	174.7
65 years and over	145.5	‡199.1	140.7	235.5	‡232.6	235.8
Cardiovascular disease:						
With hypertension	18.7	‡10.6	19.5	23.2	‡32.5	22.1
17–44 years	‡0.5	‡0.0	‡0.6	‡2.4	‡1.7	‡2.5
45–64 years	†27.3	‡19.6	†28.0	†26.2	‡70.8	†21.4
65 years and over	86.9	‡55.4	89.8	90.9	‡116.3	88.5
Alone	38.0	‡33.1	38.6	30.1	†34.6	29.5
17–44 years	‡6.9	‡6.5	‡6.9	†8.0	‡20.0	‡6.3
45–64 years	58.5	‡47.3	59.6	†26.3	‡36.5	†25.2
65 years and over	142.8	‡164.6	140.9	112.3	‡104.9	113.0
With complicating conditions	27.4	‡36.7	26.4	37.0	†52.1	35.1
17–44 years	‡5.3	‡5.4	‡5.2	†7.2	‡13.1	‡6.4
45–64 years	48.1	‡107.0	42.4	57.6	‡108.9	52.1
65 years and over	88.2	‡65.5	90.3	106.8	‡142.9	103.4

Table 4

Functional limitation score for persons 17 years of age and over with cardiovascular conditions and percent distribution by perceived health status, according to condition and age: United States, 1980

Condition and age	Functional limitation score	Perceived health status				
		Total	Excellent	Good	Fair	Poor
All persons		Percent distribution				
All ages 17 years and over	1.7	100.0	45.2	38.2	11.7	4.9
17–44 years	1.3	100.0	54.1	37.3	6.8	1.7
45–64 years	1.9	100.0	36.4	40.8	15.1	7.7
65 years and over	3.2	100.0	25.8	37.0	25.0	12.2
Persons with cardiovascular conditions						
Hypertension alone	2.3	100.0	26.5	46.7	20.5	6.4
17–44 years	1.7	100.0	29.7	46.4	15.9	8.0
45–64 years	2.0	100.0	26.4	49.5	19.1	5.0
65 years and over	3.1	100.0	24.8	42.8	24.9	7.4
Cardiovascular disease:						
With hypertension	4.0	100.0	13.3	31.3	34.0	21.3
17–44 years	‡2.5	‡100.0	‡28.3	‡28.0	‡37.1	‡6.7
45–64 years	3.6	100.0	10.1	30.2	33.9	25.8
65 years and over	4.4	100.0	14.1	32.1	33.9	19.8
Alone	3.8	100.0	15.6	33.3	27.8	23.3
17–44 years	2.2	100.0	23.1	34.3	16.4	26.2
45–64 years	3.2	100.0	11.5	35.8	29.3	23.4
65 years and over	4.5	100.0	15.9	31.7	29.8	22.6
With complicating conditions	3.6	100.0	14.2	34.4	29.2	22.1
17–44 years	†2.4	†100.0	†10.8	†54.2	†18.9	†16.1
45–64 years	3.3	100.0	14.0	34.3	29.2	22.6
65 years and over	4.3	100.0	15.4	29.6	31.9	23.1

Table 5

Functional limitation score for persons 17 years of age and over with cardiovascular conditions and percent distribution by perceived health status, according to condition, sex, and race: United States, 1980

Condition, sex, and race	Functional limitation score	Perceived health status				
		Total	Excellent	Good	Fair	Poor
All persons		Percent distribution				
Total	1.7	100.0	45.2	38.2	11.7	4.9
Sex:						
Male	1.7	100.0	49.4	35.6	10.3	4.7
Female	1.8	100.0	41.5	40.6	12.9	5.1
Race:						
Black	1.8	100.0	37.5	39.7	15.2	7.7
White and other	1.7	100.0	46.1	38.1	11.3	4.5
Persons with cardiovascular conditions						
Hypertension alone	2.3	100.0	26.5	46.7	20.5	6.4
Sex:						
Male	2.2	100.0	28.0	48.6	18.3	5.1
Female	2.4	100.0	25.5	45.5	21.8	7.1
Race:						
Black	2.3	100.0	28.7	39.0	23.0	9.3
White and other	2.3	100.0	26.1	47.9	20.1	5.9
Cardiovascular disease:						
With hypertension	4.0	100.0	13.3	31.3	34.0	21.3
Sex:						
Male	4.1	100.0	9.6	38.1	31.2	21.2
Female	4.0	100.0	16.0	26.5	36.1	21.4
Race:						
Black	†4.3	†100.0	†13.0	†16.3	†40.1	†30.6
White and other	4.0	100.0	13.4	33.2	33.3	20.1
Alone	3.8	100.0	15.6	33.3	27.8	23.3
Sex:						
Male	3.6	100.0	14.1	36.1	24.2	25.7
Female	3.9	100.0	17.2	30.2	31.9	20.7
Race:						
Black	†3.9	†100.0	†10.7	†25.4	†17.5	†46.5
White and other	3.7	100.0	16.1	34.3	29.0	20.6
With complicating conditions	3.6	100.0	14.2	34.4	29.2	22.1
Sex:						
Male	3.0	100.0	23.5	39.9	22.0	14.6
Female	4.1	100.0	8.1	30.9	34.0	27.0
Race:						
Black	3.8	100.0	8.6	30.8	28.5	32.2
White and other	3.6	100.0	15.2	35.0	29.4	20.4

Table 6

Productivity and activity measures for persons 17 years of age and over with cardiovascular conditions, by condition and age: United States, 1980

Condition and age	Productivity measures			Activity measures	
	Percent employed	Percent unable to work	Mean work-loss days	Mean restricted-activity days	Mean bed-disability days
All persons					
All ages 17 years and over	71.6	4.9	4.9	15.6	5.6
17–44 years	85.9	0.9	4.6	10.9	4.2
45–64 years	69.5	9.2	5.9	18.5	6.1
65 years and over	18.3	12.7	4.5	29.1	10.6
Persons with cardiovascular conditions					
Hypertension alone	52.2	7.9	6.5	20.1	6.0
17–44 years	83.4	3.6	7.4	18.3	6.8
45–64 years	65.2	7.5	6.7	17.0	5.0
65 years and over	17.1	10.7	2.5	25.6	6.9
Cardiovascular disease:					
With hypertension	23.4	21.6	19.0	46.1	16.7
17–44 years	‡46.3	‡7.5	‡84.2	‡44.4	‡21.9
45–64 years	44.9	27.5	16.9	41.9	12.8
65 years and over	9.9	19.3	4.2	48.6	18.6
Alone	33.5	23.2	12.0	45.7	17.3
17–44 years	79.4	6.3	13.9	47.8	16.1
45–64 years	51.7	31.3	14.0	45.1	14.3
65 years and over	11.3	22.2	3.3	45.7	19.5
With complicating conditions	38.6	20.2	7.1	41.0	17.6
17–44 years	†84.4	†8.6	†6.9	†30.0	†23.1
45–64 years	52.1	22.8	7.6	40.3	14.3
65 years and over	13.5	20.6	5.4	44.3	19.5

Table 7

Productivity and activity measures for persons 17 years of age and over with cardiovascular conditions, by condition, sex, and race: United States, 1980

Condition, sex, and race	Productivity measures			Activity measures	
	Percent employed	Percent unable to work	Mean work-loss days	Mean restricted-activity days	Mean bed-disability days
All persons					
Total	71.6	4.9	4.9	15.6	5.6
Sex:					
Male	83.1	5.5	4.9	14.2	4.7
Female	61.5	4.3	5.0	16.9	6.5
Race:					
Black	70.5	6.8	6.8	18.5	8.1
White and other	71.8	4.7	4.7	15.3	5.4
Persons with cardiovascular conditions					
Hypertension alone	52.2	7.9	6.5	20.1	6.0
Sex:					
Male	69.0	10.8	6.3	18.1	4.0
Female	41.9	6.1	6.6	21.4	7.2
Race:					
Black	64.3	12.4	11.7	28.3	10.7
White and other	50.4	7.2	5.4	18.9	5.3
Cardiovascular disease:					
With hypertension	23.4	21.6	19.0	46.1	16.7
Sex:					
Male	35.8	28.3	16.0	44.8	16.2
Female	14.5	16.8	24.2	47.1	17.1
Race:					
Black	†15.4	†46.5	†9.9	†59.7	†25.4
White and other	24.4	18.4	19.7	44.4	15.6
Alone	33.5	23.2	12.0	45.7	17.3
Sex:					
Male	40.0	28.6	12.8	45.6	15.6
Female	26.2	17.0	10.8	45.7	19.2
Race:					
Black	†27.1	†27.6	†31.3	†59.7	†37.3
White and other	34.2	22.7	10.2	44.4	15.0
With complicating conditions	38.6	20.2	7.1	41.0	17.6
Sex:					
Male	53.3	21.3	6.3	28.2	11.3
Female	28.8	19.5	8.0	49.3	21.7
Race:					
Black	42.8	28.1	8.4	40.8	21.4
White and other	37.8	18.8	6.8	41.0	16.9

Table 8

Estimated value of productivity lost as a result of condition-related morbidity for persons 17 years of age and over with cardiovascular conditions, by condition: United States, 1980

Condition	Total			Homemakers	
	Bed-disability[1]	Restricted-activity[2]	Employed	Bed-disability[1]	Restricted-activity[2]
	Amount in millions				
Total	$1,652	$2,080	$1,467	$184	$613
Hypertension alone	324	435	292	32	143
Cardiovascular disease:					
With hypertension	414	536	385	29	151
Alone	377	465	313	64	152
With complicating conditions	537	644	477	60	167

[1]Calculated using bed-disability days as measure of lost productivity for homemakers.
[2]Calculated using restricted-activity days as measure of lost productivity for homemakers.

Note: "Employed" refers to persons employed at any time in 1980; "homemakers" refers to persons who did not work for all of 1980 but were not disabled and claimed homemaking as their major activity in 1979.

Table 9

Ambulatory care and hospital utilization for persons 17 years of age and over, by selected characteristics: United States, 1980

Characteristic	Number of persons in thousands	Mean ambulatory visits	Hospital admissions per 1,000 population	Hospital days per 1,000 population
Total	161,236	5.7	194	1,517
Age				
17–44 years	94,202	4.7	150	831
45–64 years	43,578	6.1	186	1,616
65 years and over	23,456	8.6	386	4,092
Sex				
Male	75,882	4.5	167	1,455
Female	85,353	6.7	218	1,573
Race				
Black	16,864	5.4	205	1,935
White and other	144,372	5.7	193	1,469
Poverty status				
Below poverty level	14,661	6.4	275	2,319
Poverty level to 199 percent poverty level	30,364	6.2	258	2,245
200–299 percent poverty level	35,600	5.1	191	1,443
300 percent poverty level or more	80,612	5.6	156	1,130
Family income				
Less than $10,000	32,100	6.9	299	2,755
$10,000–$19,999	44,144	5.6	200	1,447
$20,000–$34,999	51,134	5.2	154	1,065
$35,000 or more	33,858	5.2	148	1,120
Perceived health status				
Excellent	72,903	3.8	111	657
Good	61,646	5.6	174	1,238
Fair or poor	26,687	10.8	468	4,515
Education of head of family				
Not high school graduate	53,912	5.6	246	2,123
High school graduate	54,580	5.5	181	1,318
Some college	52,744	5.8	155	1,105

Table 10

Ambulatory care and hospital utilization for persons 17 years of age and over with hypertension alone, by selected characteristics: United States, 1980

Characteristic	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
Total	13,775	7.9	2.4	189	22	1,133	135
Age							
17–44 years	2,496	7.2	2.7	251	37	1,043	211
45–64 years	6,608	7.0	2.1	129	18	740	103
65 years and over	4,671	9.4	2.7	241	20	1,737	138
Sex							
Male	5,247	7.7	2.3	169	22	748	143
Female	8,528	8.0	2.5	201	22	1,370	129
Race							
Black	1,815	7.0	2.8	247	45	1,477	296
White and other	11,960	8.0	2.4	180	19	1,081	110
Poverty status							
Below poverty level	1,544	7.7	3.5	197	39	1,157	292
Poverty level to 199 percent poverty level	2,842	8.3	2.4	226	13	1,770	75
200–299 percent poverty level	2,764	7.3	2.3	246	43	1,557	223
300 percent poverty level or more	6,626	7.9	2.2	147	13	678	86
Family income							
Less than $10,000	3,881	8.2	2.8	216	18	1,631	128
$10,000–$19,999	3,845	7.2	2.3	189	21	1,133	121
$20,000–$34,999	3,343	8.6	2.5	248	40	1,153	222
$35,000 or more	2,706	7.4	2.1	77	6	394	55
Perceived health status							
Excellent	3,644	6.0	2.2	125	16	656	73
Good	6,431	7.6	2.1	160	11	784	72
Fair or poor	3,700	10.1	3.4	301	46	2,209	304
Education of head of family							
Not high school graduate	6,133	8.1	2.6	199	26	1,177	167
High school graduate	4,319	7.6	2.2	179	26	1,012	159
Some college	3,323	7.8	2.4	184	9	1,209	42

Table 11

Ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular disease and hypertension, by selected characteristics: United States, 1980

Characteristic	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
Total	3,398	11.6	6.3	635	337	6,637	2,938
Age							
17–44 years	‡139	‡10.4	‡3.9	‡972	‡698	‡3,699	‡2,680
45–64 years	1,164	9.9	5.4	487	318	3,949	2,243
65 years and over	2,095	12.6	6.9	694	324	8,326	3,341
Sex							
Male	1,416	10.2	5.1	728	373	7,909	3,119
Female	1,982	12.6	7.1	568	312	5,729	2,808
Race							
Black	†384	†12.5	†7.3	†609	†431	†7,069	†3,944
White and other	3,014	11.5	6.2	638	325	6,582	2,809
Poverty status							
Below poverty level	†455	†9.8	†5.8	†531	†216	†7,233	†3,212
Poverty level to 199 percent poverty level	936	10.0	5.5	571	311	6,696	2,336
200–299 percent poverty level	699	12.1	5.8	797	491	6,518	3,829
300 percent poverty level or more	1,309	13.1	7.3	629	316	6,452	2,797
Family income							
Less than $10,000	1,303	10.9	6.1	584	246	7,694	2,618
$10,000–$19,999	1,133	10.6	5.1	759	468	5,308	3,345
$20,000–$34,999	†517	†11.0	†5.2	†491	†177	†6,245	†1,748
$35,000 or more	†445	†16.9	†11.2	†633	†457	†7,381	†4,219
Perceived health status							
Excellent	†453	†9.0	†4.6	†583	†333	†4,733	†3,564
Good	1,064	10.7	5.1	586	282	6,624	2,561
Fair or poor	1,881	12.7	7.3	675	369	7,103	3,000
Education of head of family							
Not high school graduate	1,874	10.8	5.3	648	319	5,875	2,512
High school graduate	893	11.0	6.1	645	393	7,540	3,853
Some college	†631	†14.8	†9.3	†579	†312	†7,623	†2,906

Table 12

Ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular disease alone, by selected characteristics: United States, 1980

Characteristic	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
Total	5,456	12.1	4.5	667	343	6,456	3,864
Age							
17–44 years	703	13.8	6.6	477	287	3,516	2,110
45–64 years	1,816	9.8	4.1	580	286	4,764	2,474
65 years and over	2,923	13.1	4.3	770	393	8,245	5,168
Sex							
Male	2,886	10.7	4.5	682	355	6,897	4,124
Female	2,570	13.6	4.5	651	329	5,961	3,571
Race							
Black	†573	†14.3	†5.5	†549	†371	†4,930	†3,402
White and other	4,883	11.8	4.4	681	339	6,635	3,918
Poverty status							
Below poverty level	660	14.2	4.5	542	334	5,115	3,419
Poverty level to 199 percent poverty level	1,501	11.0	3.2	817	326	9,870	4,904
200–299 percent poverty level	1,233	8.7	3.8	530	330	5,692	3,856
300 percent poverty level or more	2,062	14.2	5.9	680	365	4,856	3,254
Family income							
Less than $10,000	2,000	11.4	3.4	700	328	8,326	4,568
$10,000–$19,999	1,561	11.6	3.9	646	332	6,566	4,198
$20,000–$34,999	1,194	10.2	5.0	479	306	4,176	2,437
$35,000 or more	700	18.4	8.0	943	473	4,760	3,540
Perceived health status							
Excellent	848	7.6	2.6	508	323	4,847	3,255
Good	1,818	10.2	4.0	517	267	4,773	3,212
Fair or poor	2,790	14.7	5.4	814	398	8,042	4,474
Education of head of family							
Not high school graduate	2,818	10.5	3.5	739	397	8,192	4,724
High school graduate	1,261	14.2	5.4	640	295	4,885	3,234
Some college	1,376	13.2	5.8	545	276	4,341	2,679

Table 13

Ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular disease and complicating conditions, by selected characteristics: United States, 1980

Characteristic	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
Total	5,231	13.9	8.9	543	276	6,048	3,269
Age							
17–44 years	†590	†14.0	†8.9	†384	†185	†6,277	†3,819
45–64 years	2,313	13.2	8.2	487	274	4,777	2,687
65 years and over	2,328	14.6	9.5	639	301	7,251	3,708
Sex							
Male	2,077	10.0	6.1	523	307	5,434	3,770
Female	3,154	16.5	10.7	556	256	6,452	2,939
Race							
Black	763	14.9	10.6	466	320	5,667	3,906
White and other	4,469	13.8	8.6	556	269	6,113	3,160
Poverty status							
Below poverty level	814	13.7	9.3	634	395	7,542	4,625
Poverty level to 199 percent poverty level	1,291	16.0	9.9	681	367	7,266	4,685
200–299 percent poverty level	1,199	12.5	8.7	391	187	4,034	1,910
300 percent poverty level or more	1,928	13.5	8.0	506	220	5,853	2,594
Family income							
Less than $10,000	1,944	15.0	9.8	670	385	7,324	4,531
$10,000–$19,999	1,479	13.1	8.0	514	204	5,463	2,084
$20,000–$34,999	1,060	13.3	7.9	435	221	6,009	3,325
$35,000 or more	747	13.9	9.4	421	213	3,939	2,252
Perceived health status							
Excellent	744	7.7	3.7	456	170	4,057	1,893
Good	1,801	11.4	6.9	314	154	4,355	2,356
Fair or poor	2,686	17.3	11.6	720	388	7,735	4,263
Education of head of family							
Not high school graduate	2,989	13.1	7.9	607	319	6,721	3,576
High school graduate	1,092	15.3	10.8	573	270	5,422	3,787
Some college	1,150	14.8	9.4	347	171	4,892	1,981

Table 14

Ambulatory care and hospital utilization for persons 17 years of age and over, by age and type of health care coverage: United States, 1980

Age and health care coverage	Number of persons in thousands	Mean ambulatory visits	Hospital admissions per 1,000 population	Hospital days per 1,000 population
17–64 years				
Full-year coverage:				
Private insurance only	91,632	5.0	145	922
Public program only:				
Medicaid only	3,758	7.3	335	2,437
Other	2,453	6.7	243	1,948
Mixed:				
Public and private	10,717	8.6	233	1,981
More than 1 public	2,806	9.8	582	4,676
Part-year coverage	14,168	4.2	146	777
No coverage	12,247	2.5	74	402
65 years and over				
Medicare:				
Alone	3,836	6.0	248	2,467
With private	15,681	9.4	395	3,976
With other public only	2,647	10.0	680	8,713
Other coverage	1,033	4.4	68	622
No coverage	‡259	‡1.0	‡130	‡1,810

Table 15

Ambulatory care and hospital utilization for persons 17 years of age and over with hypertension alone, by age and type of health care coverage: United States, 1980

Age and health care coverage	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
17–64 years							
Full-year coverage:							
Private insurance only	5,950	7.0	2.2	149	24	613	152
Public program only:							
Medicaid only	‡218	‡10.4	‡2.9	‡500	‡53	‡3,834	‡–
Other	‡211	‡7.6	‡2.2	‡223	‡–	‡2,148	‡–
Mixed:							
Public and private	1,204	8.0	2.6	101	12	683	80
More than 1 public	‡322	‡9.3	‡5.1	‡454	‡65	‡2,649	‡391
Part-year coverage	†620	†5.9	†1.8	†169	†35	†657	†130
No coverage	†579	†4.5	†1.8	†110	†–	†829	†–
65 years and over							
Medicare:							
Alone	798	8.5	2.7	211	17	1,704	172
With private	3,166	10.2	2.8	263	21	1,885	131
With other public only	†459	†8.3	†2.6	†264	†25	†1,712	†197
Other coverage	‡237	‡4.1	‡2.0	‡–	‡–	‡–	‡–
No coverage	‡11	‡5.0	‡5.0	‡–	‡–	‡–	‡–

Table 16

Ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular disease and hypertension, by age and type of health care coverage: United States, 1980

Age and health care coverage	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
17–64 years							
Full-year coverage:							
Private insurance only	759	10.1	4.8	608	412	4,713	2,480
Public program only:							
Medicaid	‡74	‡9.8	‡5.7	‡599	‡340	‡1,966	‡1,189
Other	‡71	‡12.9	‡7.2	‡624	‡624	‡3,857	‡3,857
Mixed:							
Public and private	‡214	‡9.5	‡7.2	‡264	‡197	‡2,661	‡2,258
More than 1 public	‡79	‡11.2	‡3.5	‡1,051	‡392	‡5,667	‡1,977
Part-year coverage	‡24	‡7.0	‡5.1	‡523	‡523	‡4,184	‡4,184
No coverage	‡83	‡7.3	‡3.9	‡–	‡–	‡–	‡–
65 years and over							
Medicare:							
Alone	‡213	‡18.5	‡11.9	‡639	‡121	‡7,288	‡893
With private	1,564	12.5	6.7	668	330	7,730	3,652
With other public only	‡206	‡10.1	‡5.5	‡1,197	‡601	‡17,868	‡4,877
Other coverage	‡87	‡8.2	‡3.6	‡311	‡134	‡1,425	‡1,071
No coverage	‡25	‡4.1	‡2.1	‡–	‡–	‡–	‡–

Table 17

Ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular disease alone, by age and type of health care coverage: United States, 1980

Age and health care coverage	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
17–64 years							
Full-year coverage:							
Private insurance only	1,245	11.5	4.6	457	235	2,766	1,651
Public program only:							
Medicaid only	‡67	‡5.0	‡1.1	‡568	‡366	‡7,135	‡6,325
Other	‡180	‡18.0	‡10.0	‡911	‡402	‡8,881	‡2,082
Mixed:							
Public and private	†459	†9.4	†5.2	†536	†284	†4,928	†2,168
More than 1 public	‡150	‡19.5	‡7.8	‡1,889	‡1,028	‡18,295	‡11,006
Part-year coverage	‡232	‡6.0	‡2.6	‡266	‡146	‡2,109	‡1,816
No coverage	‡186	‡4.8	‡1.4	‡138	‡76	‡612	‡304
65 years and over							
Medicare:							
Alone	†430	†4.2	†2.1	†258	†161	†2,744	†1,819
With private	1,998	14.9	4.6	784	365	7,962	4,757
With other public only	†381	†15.6	†5.4	†1,454	†864	†17,352	†11,588
Other coverage	‡114	‡6.0	‡2.6	‡–	‡–	‡–	‡–
No coverage	‡–	‡–	‡–	‡–	‡–	‡–	‡–

Table 18

Ambulatory care and hospital utilization for persons 17 years of age and over with cardiovascular disease and complicating conditions, by age and type of health care coverage: United States, 1980

Age and health care coverage	Number of persons in thousands	Mean ambulatory visits		Hospital admissions per 1,000 population		Hospital days per 1,000 population	
		Total	Condition related	Total	Condition related	Total	Condition related
17–64 years							
Full-year coverage:							
Private insurance only	1,737	9.3	5.2	311	153	3,109	1,749
Public program only:							
Medicaid	‡105	‡17.6	‡14.9	‡783	‡466	‡12,686	‡7,401
Other	‡45	‡46.9	‡41.7	‡1,395	‡1,081	‡25,523	‡22,376
Mixed:							
Public and private	†505	†24.7	†16.2	†849	†589	†8,721	†5,736
More than 1 public	‡180	‡14.3	‡6.1	‡756	‡244	‡10,170	‡2,626
Part-year coverage	‡255	‡11.3	‡6.9	‡304	‡116	‡1,411	‡548
No coverage	‡76	‡9.7	‡7.3	‡324	‡113	‡3,588	‡1,690
65 years and over							
Medicare:							
Alone	‡273	‡13.8	‡9.7	‡657	‡309	‡4,750	‡2,080
With private	1,520	15.2	9.9	572	249	6,394	2,681
With other public only	†489	†13.5	†8.1	†858	†449	†11,606	†7,764
Other coverage	‡46	‡12.6	‡10.1	‡412	‡412	‡4,118	‡4,118
No coverage	‡–	‡–	‡–	‡–	‡–	‡–	‡–

Table 19

Per capita charges for persons 17 years of age and over with cardiovascular conditions and percent paid out of pocket, by type of service and selected characteristics: United States, 1980

Characteristic	All services		Hospital admissions		Prescribed medications		Ambulatory visits		Other health services[1]	
	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket
All persons										
Total	$ 837	26.7	$ 496	10.9	$ 44	64.7	$195	37.5	$103	65.9
Age:										
17–44 years	596	31.4	311	14.8	22	67.7	163	39.7	99	61.8
45–64 years	911	26.9	515	9.0	63	59.7	217	37.4	116	69.2
65 years and over	1,670	19.7	1,201	8.5	97	67.9	281	32.7	91	76.0
Sex:										
Male	760	25.3	471	11.2	35	63.5	158	35.3	97	64.0
Female	906	27.7	518	10.7	53	65.3	228	38.9	108	67.3
Race:										
Black	776	23.2	475	13.2	38	60.2	197	30.2	66	52.3
White and other	844	27.1	498	10.7	45	65.1	195	38.4	107	66.9

See footnote at end of table.

Table 19—Continued

Per capita charges for persons 17 years of age and over with cardiovascular conditions and percent paid out of pocket, by type of service and selected characteristics: United States, 1980

Characteristic	All services		Hospital admissions		Prescribed medications		Ambulatory visits		Other health services[1]	
	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket
Hypertension alone										
Total	$ 819	34.8	$ 376	12.9	$ 96	66.5	$257	39.7	$ 90	78.8
Age:										
17–44 years	780	28.2	412	11.1	76	57.9	213	36.6	80	65.8
45–64 years	682	40.7	250	18.2	95	61.8	237	40.8	99	77.2
65 years and over	1,034	32.0	534	10.2	109	75.6	310	39.7	82	88.1
Sex:										
Male	723	35.1	297	10.9	86	66.0	256	39.0	84	77.0
Female	878	34.7	424	13.8	102	66.8	258	40.1	93	79.7
Race:										
Black	789	33.1	401	17.8	78	71.9	256	37.4	54	69.4
White and other	824	35.1	372	12.1	99	65.9	258	40.0	95	79.6
Cardiovascular disease with hypertension										
Total	2,640	19.4	1,951	9.8	187	60.8	415	34.8	88	69.3
Age:										
17–44 years	‡3,163	‡12.7	‡2,337	‡6.4	‡117	‡30.7	‡632	‡22.4	‡77	‡95.5
45–64 years	2,032	22.9	1,264	10.2	221	50.8	458	36.9	89	60.7
65 years and over	2,943	18.5	2,307	10.0	173	69.3	376	34.8	88	72.6
Sex:										
Male	3,079	20.5	2,384	12.8	188	61.9	416	34.0	91	74.2
Female	2,327	18.3	1,641	6.8	186	60.0	414	35.5	86	65.6
Race:										
Black	†2,074	†13.0	†1,430	†4.6	†141	†41.1	†433	†22.4	†69	†68.4
White and other	2,712	20.0	2,017	10.3	193	62.7	412	36.5	90	69.4
Cardiovascular disease alone										
Total	2,739	16.9	2,091	9.0	127	61.2	411	31.2	110	62.3
Age:										
17–44 years	2,097	26.8	1,443	19.2	70	65.2	464	41.9	120	37.8
45–64 years	2,354	16.6	1,734	6.8	129	58.4	369	30.0	122	70.8
65 years and over	3,145	15.5	2,479	8.6	140	62.4	425	29.0	101	63.0
Sex:										
Male	2,976	16.4	2,337	10.8	124	55.2	387	24.9	128	56.9
Female	2,474	17.6	1,815	6.5	130	67.7	438	37.4	90	70.9
Race:										
Black	†2,113	†12.0	†1,414	†5.6	†108	†36.6	†514	†20.6	†76	†39.2
White and other	2,813	17.3	2,170	9.3	129	63.7	399	32.8	114	64.1
Cardiovascular disease with complicating conditions										
Total	2,654	18.5	1,830	9.6	209	58.1	486	24.7	129	56.6
Age:										
17–44 years	†2,307	†38.9	†1,559	†34.5	†147	†80.2	†433	†42.4	†168	†35.2
45–64 years	2,261	18.3	1,457	6.9	218	54.4	472	24.9	114	67.2
65 years and over	3,133	14.8	2,269	7.0	215	57.9	514	20.7	135	54.4
Sex:										
Male	2,281	22.0	1,641	12.7	172	58.1	311	33.2	157	57.3
Female	2,900	16.6	1,954	7.9	233	58.1	602	21.8	111	55.9
Race:										
Black	2,004	26.4	1,033	27.0	170	55.8	707	15.0	94	52.5
White and other	2,765	17.5	1,966	8.0	216	58.4	449	27.3	135	57.1

[1]Includes dental and other health services, such as eyeglasses, orthopedic appliances, hearing aids, diabetic supplies, and ambulance services.

Table 20

Per capita condition-related charges for persons 17 years of age and over with cardiovascular conditions and percent paid out of pocket, by type of service and selected characteristics: United States, 1980

Characteristic	All services		Hospital admissions		Prescribed medications		Ambulatory visits		Other health services[1]	
	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket	Per capita charge	Percent out of pocket
Hypertension alone										
Total	$ 142	48.1	$ 35	14.4	$ 52	68.2	$ 54	50.5	[2]$ 0	68.2
Age:										
17–44 years	169	38.3	66	18.0	39	65.0	63	41.9	1	100.0
45–64 years	125	49.5	23	9.6	55	63.5	47	52.5	1	53.9
65 years and over	150	52.5	36	15.1	56	75.9	58	53.2	–	–
Sex:										
Male	136	44.0	36	3.9	51	69.4	50	47.1	–	–
Female	145	50.5	35	21.0	53	67.5	56	52.4	1	68.2
Race:										
Black	185	39.9	82	15.0	45	74.0	58	48.8	–	–
White and other	135	49.8	28	14.1	53	67.5	53	50.8	1	68.2
Cardiovascular disease with hypertension										
Total	1,243	16.9	924	7.9	111	60.9	197	32.7	11	41.1
Age:										
17–44 years	‡2,444	‡5.9	‡2,064	‡4.4	‡78	‡26.4	‡302	‡10.3	‡–	‡–
45–64 years	1,225	21.2	863	11.4	139	53.1	211	39.4	11	41.6
65 years and over	1,174	15.9	883	6.6	97	68.9	183	30.8	11	40.8
Sex:										
Male	1,455	16.6	1,171	8.7	119	65.9	161	35.9	4	76.5
Female	1,092	17.2	748	7.1	106	56.9	223	31.0	15	34.2
Race:										
Black	†1,278	†11.6	†946	†7.0	†88	†44.7	†227	†16.0	†18	†34.3
White and other	1,239	17.6	922	8.1	114	62.5	194	35.2	10	42.7
Cardiovascular disease alone										
Total	1,386	16.2	1,156	11.6	57	65.9	162	30.2	10	35.8
Age:										
17–44 years	1,342	26.3	1,082	24.0	27	47.6	215	36.4	18	13.3
45–64 years	1,105	12.0	878	6.2	57	66.3	166	22.7	4	58.4
65 years and over	1,576	16.0	1,353	11.4	65	67.5	147	33.4	12	39.3
Sex:										
Male	1,574	18.5	1,337	16.0	63	60.0	163	22.5	11	27.7
Female	1,174	12.7	953	4.7	50	74.2	161	38.9	9	47.1
Race:										
Black	†1,278	†10.2	†1,046	†7.4	†34	†37.5	†180	†22.0	†17	†0.7
White and other	1,398	16.9	1,169	12.1	60	67.8	160	31.2	9	43.6
Cardiovascular disease with complicating conditions										
Total	1,482	17.9	1,029	10.8	130	59.4	294	21.6	30	45.6
Age:										
17–44 years	†1,469	†44.8	†1,194	†41.3	†81	†85.3	†182	†49.7	†12	†50.8
45–64 years	1,274	15.8	826	5.1	138	56.4	287	23.4	23	59.5
65 years and over	1,693	13.6	1,188	7.0	134	58.5	329	16.0	41	37.3
Sex:										
Male	1,430	21.5	1,136	15.2	118	58.6	151	37.1	25	40.9
Female	1,517	15.7	958	7.4	138	59.9	388	17.6	32	48.0
Race:										
Black	1,346	32.2	723	38.4	107	64.4	486	13.6	30	69.9
White and other	1,506	15.7	1,081	7.7	134	58.7	261	24.1	30	41.4

[1]Includes dental and other health services, such as eyeglasses, orthopedic appliances, hearing aids, diabetic supplies, and ambulance services.
[2]Quantity is less than $0.50 and was rounded to $0.

Table 21

Condition-related charges for persons 17 years of age and over with cardiovascular conditions and percent distribution by source of payment, according to condition: United States, 1980

Condition	Total charges in millions	Total	Out of pocket	Private insurance[1]	Medicaid	Medicare	Other public programs[2]	Other sources[3]
		Percent distribution						
Hypertension alone	$1,949	100.0	48.1	25.7	5.3	12.1	5.0	1.0
Cardiovascular disease:								
With hypertension	4,246	100.0	16.8	37.6	7.5	28.2	6.1	1.0
Alone	7,560	100.0	16.2	28.5	11.6	36.2	5.6	1.2
With complicating conditions	7,757	100.0	17.9	20.5	19.6	33.0	7.1	0.6

[1]Private insurance sources include Blue Cross-Blue Shield, commercial health insurance carriers, employer and union plans, and health maintenance organizations.
[2]Other public programs include military, Civilian Health and Medical Program of the Uniformed Services, Civilian Health and Medical Program of the Veterans' Administration, Indian Health Service, or other Federal, State, or local government program.
[3]Other sources include payments by relatives or other individuals, school clinics, philanthropy, and others not identified in footnotes 1 and 2.

Appendixes

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Appendix I. Sample Design, Data Collection, and Processing

Introduction

The National Medical Care Utilization and Expenditure Survey (NMCUES) was designed to collect data about the U.S. civilian noninstitutionalized population during 1980. Because of the complexity of the survey, the analyst must be familiar with a range of design features, both to determine appropriate analytic methods and to investigate the impact that the design may have on a particular analysis. Several topics are addressed in this appendix: The overall design of NMCUES, the survey background, sampling methods, data collection methods, weighting, and compensation procedures for missing data. In these descriptions, the NMCUES data are presented essentially as they are available to the user of the public use data tape. This appendix draws heavily from a paper in the Proceedings of the 19th National Meeting of the Public Health Conference on Records and Statistics (Casady, 1983).

Survey Background

During the course of NMCUES, information was obtained on health, access to and use of medical services, associated charges and sources of payment, and health care coverage. The survey was cosponsored by the National Center for Health Statistics (NCHS) and the Health Care Financing Administration (HCFA). Data collection was provided under contract by the Research Triangle Institute (RTI) and its subcontractors, National Opinion Research Center (NORC) and SysteMetrics, Inc.

The basic survey plan for NMCUES drew heavily on two previous national surveys: The National Health Interview Survey (NHIS), which is conducted by NCHS, and the National Medical Care Expenditure Survey (NMCES), which was cosponsored by the National Center for Health Services Research and NCHS.

NHIS is a continuing multipurpose health survey first conducted in 1957. The primary purpose of NHIS is to collect information on illness, disability, and the use of medical care. Although some information on medical charges and insurance payments has been collected in NHIS, the cross-sectional nature of the NHIS survey design is not well suited for providing annual data on charges and payments.

NMCES was a panel survey in which sample households were interviewed six times over an 18-month period in 1977 and 1978. NMCES was designed specifically to provide comprehensive data on how health services were used and paid for in the United States in 1977.

NMCUES is similar to NMCES in survey design and question wording, so that analysis of change during the years between 1977 and 1980 is possible. Both NMCUES and NMCES are similar to NHIS in terms of question wording in areas common to the three surveys. Together they provide extensive information on illness, disability, use of medical care, costs of medical care, sources of payment for medical care, and health care coverage at two points in time.

Sample Design

General plan—The NMCUES sample of housing units and group quarters, hereafter jointly referred to as dwelling units, is a concatenation of two independently selected national samples, one provided by RTI and the other by NORC. The sample designs used by RTI and NORC are quite similar with respect to principal design features: Both can be characterized as stratified, multistage area probability designs. The principal differences between the two designs are the type of stratification variables and the specific definitions of sampling units at each stage.

Target population—All persons living in a sample dwelling unit at the time of the first interview became part of the national sample. Unmarried students 17–22 years of age who lived away from home were included in the sample if their parent or guardian was included in the sample. In addition, persons who died or were institutionalized between January 1 and the date of first interview were included in the sample if they were related to persons living in the sampled dwelling units and were living in the sample dwelling before their death or institutionalization. All of these persons were considered "key" persons, and data were collected for them for the full 12 months of 1980 or for the portion of time that they were part of the U.S. civilian noninstitutionalized population. In addition, children born to key persons during 1980 were considered key persons, and data were collected for them from the time of birth.

Relatives from outside the original population (i.e., institutionalized, in the Armed Forces, or outside the United States from January 1 up to the first interview) who moved in with key persons after the first interview were also considered key persons, and data were collected for them from the time they joined the key person. Relatives who moved in with key persons after the first interview but were part of the civilian noninstitutionalized population on January 1, 1980, were classified as "nonkey" persons. Data were collected for nonkey persons for the time that they lived with a key person, but because they had a chance of selection in the initial sample, their data are not used for general analysis of persons. However, data for nonkey persons are used in an analysis of families because they contribute to the family's utilization of and charges for health care during the time they are part of the family. Family analysis is not part of this investigation, though, and will not be discussed further.

Persons included in the sample were grouped into "reporting units" for data collection purposes. Reporting units were defined as all persons related to each other by blood, marriage, adoption, or foster care status who lived in the same dwelling unit. The combined NMCUES sample consisted of approximately 7,200 reporting units, of which nearly 6,600 agreed to participate in the survey. In total, complete data were obtained on 17,123 key persons. The RTI sample yielded approximately 8,300 respondents and the NORC sample 8,800.

Research Triangle Institute Sample Design

Primary sampling units (PSU's)—A PSU was defined as a county, a group of contiguous counties, or parts of counties with a combined minimum 1970 population size of 20,000. A total of 1,686 nonoverlapping RTI PSU's cover the entire land area of the 50 States and Washington, D.C. The PSU's were classified as one of two types. The 16 largest standard metropolitan statistical areas (SMSA's) were designated as self-representing PSU's, and the remaining 1,670 PSU's in the primary sampling frame were designated as non-self-representing PSU's.

Stratification of PSU's—PSU's were grouped into strata whose members tend to be relatively alike within strata and relatively unlike between strata. PSU's derived from the 16 largest SMSA's were of sufficient 1970 population size to be treated as primary strata. The 1,659 non-self-representing PSU's from the continental United States were stratified into 42 approximately equal-sized primary strata. Each primary stratum had a 1970 population size of about 3.3 million. One supplementary primary stratum of 11 PSU's, with a 1970 population size of about 1 million, was added to the RTI primary frame to include Alaska and Hawaii.

First-stage selection of PSU's—The total RTI primary sample consisted of 59 PSU's, of which 16 were self-representing. The non-self-representing PSU's were obtained by selecting 1 PSU from each of the 43 non-self-representing primary strata. These PSU's were selected with probability proportional to 1970 population size.

Secondary stratification—In each of 59 sample PSU's, the entire PSU was divided into nonoverlapping smaller area units called secondary sampling units (SSU's). Each SSU consisted of one or more 1970 census-defined enumeration districts (ED's) or block groups (BG's). Within each PSU the SSU's were ordered and then partitioned to form approximately equal-sized secondary strata. Two secondary strata were formed in the non-self-representing PSU drawn from Alaska and Hawaii, and four secondary strata were formed in each of the remaining 42 non-self-representing PSU's. Thus, the non-self-representing PSU's were partitioned into a total of 170 secondary strata. In a similar manner the 16 self-representing PSU's were partitioned into 144 secondary strata.

Second-stage selection of SSU's—One SSU was selected from each of the 144 secondary strata covering the self-representing PSU's, and two SSU's were selected from each of the remaining secondary strata. All second-stage sampling was with replacement and with probability proportional to the SSU's total noninstitutionalized population in 1970. The total number of sample SSU's was $2 \times 170 + 144 = 484$.

Third-stage selection of areas and segments—Each SSU was divided into smaller nonoverlapping geographic areas, and one area within the SSU was selected with probability proportional to the 1970 total number of housing units. Next, one or more nonoverlapping segments of at least 60 housing units (HU's) were formed in the selected area. One segment was selected from each SSU with probability proportional to the segment HU count. In response to the sponsoring agencies' request that the expected household sample size be reduced, a systematic sample of one-sixth of the segments was deleted from the household sample. Thus, the total third-stage sample was reduced to 404 segments.

Fourth-stage selection of housing units—All dwelling units within the segment were listed, and a systematic sample of dwelling units was selected. The procedures used to determine the sampling rate for segments guaranteed that all dwelling units had an approximately equal probability of selection. All reporting units within the selected dwelling units were included in the sample.

National Opinion Research Center Sample Design

Primary sampling units—The land area of the 50 States and Washington, D.C., was divided into nonoverlapping PSU's. A PSU consisted of SMSA's, parts of SMSA's, counties, parts of counties, or independent cities. Grouping of counties into a single PSU occurred when individual counties had a 1970 population of less than 10,000.

Zoning of PSU's—The PSU's were classified into two groups according to metropolitan status (SMSA or not SMSA). These two groups were individually ordered and then partitioned into zones with a 1970 census population size of 1 million persons.

First-stage zone selection of PSU's—A single PSU was selected within each zone with a probability proportional to its 1970 population. It should be noted that this procedure allows a PSU to be selected more than one time. For instance, an SMSA PSU with a population of 3 million will be selected at least twice and possibly as many as four times. The full general-purpose sample contained 204 PSU's, which were systematically allocated to 4 subsamples of 51 PSU's. The final set of 76 sample PSU's was chosen by randomly selecting 2 complete subsamples of 51 PSU's; 1 subsample was included in its entirety, and 25 PSU's in the other subsample were selected systematically for inclusion in NMCUES.

Second-stage zone selection of SSU's—Each PSU selected in the first stage was partitioned into a nonoverlapping set of SSU's defined by BG's, ED's, or a combination of the two types of census units. SSU's were selected from the ordered list of these SSU's. The cumulative number of households in the second-stage frame for each PSU was divided into 18 zones of equal width. An SSU could be selected more than once, as was the case in the PSU selection. If a PSU had been hit more than once in the first stage, then the second-stage selection process was repeated as many times as there were first-stage hits. Some 405 SSU's were identified by selecting 5 SSU's from each of the 51 PSU's in the subsample that was included in its entirety and 6 SSU's from each of the 25 PSU's in the subsample for which one-half of the PSU's were included.

Third-stage selection of segments—The selected SSU's were subdivided into area segments with a minimum size of 100 housing units. One segment was then selected with probability proportional to the estimated number of housing units.

Fourth-stage selection of housing units—Sample selection at this level was essentially the same as for the RTI design.

Data Collection

Field operations for NMCUES were performed by RTI and NORC under specifications established by the cosponsoring agencies. Persons in the sample dwelling units were interviewed at approximately 3-month intervals beginning in February 1980 and ending in March 1981. The core questionnaire was administered during each of the five interview rounds to collect data on health, health care, health care charges, sources of payment, and health care coverage. A summary of responses was used to update information reported in previous rounds. Supplements to the core questionnaire were used during the first, third, and fifth interview rounds to collect data that did not change during the year or that were needed only once. Approximately 80 percent of the third- and fourth-round interviews were conducted by telephone; all remaining interviews were conducted in person. The respondent for the interview was required to be a household member 17 years of age and over. A nonhousehold proxy respondent was permitted only if all eligible household members were unable to respond because of health, language, or mental condition.

Weighting

For the analysis of NMCUES data, sample weights are required to compensate for unequal probabilities of selection, to adjust for the potentially biasing effects of failure to obtain data from some persons or reporting units (RU's) (i.e., nonresponse), and failure to cover some portions of the population because the sampling frame did not include them (i.e., undercoverage).

Basic sample design weights—Development of weights reflecting the sample design of NMCUES was the first step in the development of weights for each person in the survey. The basic sample design weight for a dwelling unit is the product of four components that correspond to the four stages of sample selection. Each of the four weight components is the inverse of the probability of selection at that stage when sampling was without replacement, or the inverse of the expected number of selections when sampling was with replacement, and multiple selection of the sample unit was possible.

Two-sample adjustment factor—As previously discussed, the NMCUES sample is composed of two independently selected samples. Each sample, together with its basic sample design weights, yields independent unbiased estimates of population parameters. Because the two NMCUES samples were of approximately equal size, a simple average of the two independent estimators was used for the combined sample estimator. This is equivalent to computing an adjusted basic sample design weight by dividing each basic sample design weight by 2. In the subsequent discussion, only the combined sample design weights are considered.

Total nonresponse and undercoverage adjustment—A weight adjustment factor was computed at the RU level to compensate for RU-level nonresponse and undercoverage. Because every RU within a dwelling unit is included in the sample, the adjusted basic sample design weight assigned to an RU is simply the adjusted basic sample design weight for the dwelling unit in which the RU is located. An RU was classified as responding if members of the RU initially agreed to participate in NMCUES and as nonresponding otherwise.

Initially, 96 RU weight-adjustment cells were formed by cross-classifying the following variables: Race of RU head (white or all other), type of RU head (female,

male, or husband-wife), age of RU head (four levels), and size of RU (four levels). These cells were then collapsed to 63 cells so that each cell contained at least 20 responding RU's. Within each cell an adjustment factor was computed so that the sum of adjusted basic sample design weights would equal the March 1980 Current Population Survey estimate for the same population. The weight for nonresponse and undercoverage was computed for each RU as the product of the adjusted basic sample design weight and the nonresponse-undercoverage adjustment factor for the cell containing the RU.

Poststratification adjustment—Once the nonresponse-undercoverage adjusted RU weights were computed, a poststratification adjusted weight was computed at the person level. Because each person within an RU is included in the sample, the nonresponse and undercoverage adjusted weight for a sample person is the nonresponse-undercoverage adjusted weight for the RU in which the person resides. Each person was classified as responding or nonresponding, as discussed subsequently in the section on attrition imputation.

Sixty poststrata were formed by cross-classifying age (15 levels), race (2 levels), and sex (2 levels). One poststratum (black males 75 years of age and over) had fewer than 20 respondents, so it was combined with an adjacent poststratum (black males 65–74 years of age), resulting in 59 poststrata.

Estimates based on population projections from the 1980 census were obtained from the Bureau of the Census for the U.S. civilian noninstitutionalized population by age, race, and sex poststrata for February 1, May 1, August 1, and November 1, 1980. The mean of these midquarter population estimates for each of the poststrata was computed and used as the 1980 average target population for calculating the poststrata adjustment factors.

Survey-based estimates of the average poststrata population were developed using the nonresponse- and undercoverage-adjusted weights. First, a survey-based estimate of the target population of each poststratum for each quarter was computed by summing the nonresponse- and undercoverage-adjusted weights for respondents eligible for the survey on the midquarter date. Then the survey-based estimate of the 1980 average population was computed as the mean of the four midquarter estimates. Finally, the poststratification adjustment factor in each poststratum was computed as the ratio of the 1980 average target population (obtained from Bureau of the Census data) to the NMCUES 1980 average population. The poststratified weight for each respondent was then computed as the product of the nonresponse- and undercoverage-adjusted weight and the poststratification adjustment factor for the poststratum containing the respondent.

Thus, the weighting procedure is composed of three steps: Development of base sample design weights for each RU, adjustment for RU-level nonresponse and undercoverage, and adjustment for person-level nonresponse and undercoverage. A further adjustment for the number of days a person was an eligible member of the U.S. civilian noninstitutionalized population was made, but this adjustment affects only certain types of estimates from NMCUES and is discussed in Appendix III.

Survey Nonresponse

Nonresponse in panel surveys such as NMCUES occurs when sample individuals refuse to participate in the survey (total nonresponse), when initially participating individuals drop out of the survey (attrition nonresponse), or when data for specific items on the questionnaire are not collected (item nonresponse). Response rates for RU's and persons in NMCUES were high, with approximately 90 percent of the sample RU's agreeing to participate in the survey and approximately 94 percent of the individuals in the participating RU's supplying complete information. Even though the overall response rates are high, survey-based estimates of means and proportions may be biased if nonrespondents tend to have different health care experiences than respondents or if there is a substantial response rate differential across subgroups of the target population. Furthermore, annual totals tend to be underestimated unless allowance is made for the loss of data attributable to nonresponse.

Two methods commonly used to compensate for survey nonresponse are data imputation and adjustment of sampling weights. For NMCUES, data imputation was used to compensate for attrition and item nonresponse, and weight adjustment was used to compensate for total nonresponse. The calculation of the weight adjustment factors was discussed in the previous section.

Attrition Imputation

A special form of the sequential hot-deck imputation method (Cox, 1980) was used for attrition imputation. First, each sample person with incomplete annual data (referred to as a "recipient") was linked to a sample person with similar demographic and socioeconomic characteristics who had complete annual data (referred to as a "donor"). Second, the time periods for which the recipient had missing data were divided into two categories: Imputed eligible days and imputed ineligible days. Imputed eligible days were those days for which the donor was eligible (i.e., in scope), and imputed ineligible days were those days for which the donor was ineligible (i.e., out of scope). The donor's medical care experiences, such as medical provider visits, dental visits, and hospital stays, during the imputed eligible days were imputed into the recipient's record for eligible days. Finally, the results of the attrition imputation were used to make the final determination of a person's respondent status. If more than two-thirds of the person's total

eligible days (both reported and imputed) were imputed eligible days, then the person was considered a total nonrespondent, and the data for the person were removed from the data file.

Item Nonresponse and Imputation

Persons classified as respondents may fail to provide information for some or many items in the questionnaire. In NMCUES, item nonresponse was particularly a problem for health care charges, income, and other sensitive topics. The extent of missing data varied by question, and imputation for all items in the data file would have been expensive. Imputations were made for missing data on key demographic, economic, and charge items across five of the six data files in the public use data tape (all except the condition file). Table I illustrates the extent of the item nonresponse problem for selected survey measures that received imputations in four data files used in NMCUES reports.

Demographic items tend to require the least amount of imputation. Some, such as age, sex, and education, had insignificant levels of imputation. Income items had higher levels of nonresponse. Nearly one-third of the persons required imputation for at least one component of total personal income, which is a cumulation of earned income and 11 sources of unearned income. The bed-disability days, work-loss days, and cut-down days have levels of imputation between those for the demographic and income items.

Table I

Percent of data imputed for selected survey items in 4 of the NMCUES public use data files: United States, 1980

Tape location	Description	Percent imputed
	Person file (n = 17,123)	
P54	Age	0.1
P57	Race	[1]20.0
P59	Sex	0.1
P62	Highest grade attended	0.1
P67	Perceived health status	0.8
P592	Functional limitation score	3.2
P125	Number of bed-disability days	7.9
P128	Number of work-loss days	8.9
P135	Number of cut-down days	8.2
P399	Wages, salary, business income	9.7
P434	Pension income	3.5
P445	Interest income	21.6
P462	Total personal income	[2]30.4
	Medical visit file (n = 86,594)	
M117	Total charge	25.9
M123	First source of payment	1.8
M125	First source of payment amount	11.6
	Hospital stay file (n = 2,946)	
H252	Nights hospitalized	3.1
H124	Total charge	36.3
H130	First source of payment	2.2
H132	First source of payment amount	17.6
	Medical expenses file (n = 58,544)	
E117	Total charge	19.4
E123	First source of payment	2.8
E125	First source of payment amount	10.0

[1]Race for children under 17 years of age imputed from race of head of reporting unit.
[2]Cumulative across 12 types of income.

The highest levels of imputation occurred for the important charge items on the various visit, hospital stay, and medical expenses files. Total charges for medical visits, hospital stays, and prescribed medicines and other medical expenses were imputed for 25.9 percent, 36.3 percent, and 19.4 percent of the events, respectively. Among the source-of-payment data, the imputation rates for the source of payment were small, but the rates for the amount paid by the first source of payment were generally subject to high rates of imputation. The number of nights hospitalized on the hospital stay file was imputed at a rate comparable to that for first source of payment.

The methods used to impute for missing items were diverse and tailored to the measure requiring imputation. Three types of imputation predominate: Edit or logical imputations, a sequential hot deck, and a weighted sequential hot deck. The edit or logical imputations were used to eliminate missing data that could reasonably be determined from other data items that provided overlapping information for the given item. The sequential hot deck was used primarily for small numbers of imputations for the demographic items; the weighted sequential hot deck was used more extensively and for virtually all other items for which imputations were made.

The edit or logical imputation is a process in which the value of a missing item is deduced from other available information in the data file. For example, race was not recorded for children under 17 years of age during the survey. Instead, a logical imputation was made during data processing that assigned the race of the head of the reporting unit to the child. Similarly, extensive editing was performed for the charge data before any imputations were made. If first source of payment was available, only one source of payment was given; and if total charge was missing, the value of the first source of payment amount was assigned to the total charge item.

In the sequential hot-deck procedure, the data are grouped within imputation classes formed by variables thought to be correlated with the item to be imputed. An additional sorting within imputation classes by variables also thought to be correlated with the imputed item is typically used. An initial value, such as the mean of the nonmissing cases for the item, is assigned as a "cold-deck" value. The first record in the file is then examined. If it is missing, the "cold-deck" value replaces the missing data code; if it is real (not missing), the real value replaces the "cold-deck" value and becomes a "hot-deck" value. Then the next record is examined. Again, the "hot-deck" value is used to replace missing

data; if the value is real, it becomes the "hot-deck" value. The process continues sequentially through the sorted file. The weighted hot deck, a modification of the sequential hot deck, uses weights to determine which real values are used to impute for a particular record needing imputation.

The imputation process will be described for two items to illustrate the nature of imputation for NMCUES. For Hispanic origin, two different imputation procedures were used: Logical and sequential hot deck. Because Hispanic origin was not recorded during the interview for children under 17 years of age, a logical imputation was made by assigning to the child the Hispanic origin of the wife of the head of the reporting unit, if present, and the origin of the head of the reporting unit otherwise. For the remaining cases that were not assigned a value by this procedure, the data were grouped into classes by observed race of the head of the reporting unit; within classes, the data were sorted by reporting unit identification number, primary sampling unit, and segment. An unweighted sequential hot deck was used to impute values of Hispanic origin for the remaining cases with missing values.

The imputations for medical visit total charge were made after extensive editing had been done to eliminate as many inconsistencies as possible between sources of payment and total charges. The medical visit records were then separated into three types: Emergency room, hospital outpatient department, and doctor visits. Within each type, the records were classed and sorted by several measures, which differed across visit types, prior to a weighted hot-deck imputation. For example, the records for doctor visits were classified by reason for visit, type of doctor seen, whether work was done by a physician, and age of the individual. Within the groups formed by these classificatiom variables, the records were then sorted by type of health care coverage and month of visit. Finally, the weighted hot-deck procedure was used to impute for missing total charge, sources of payment, and source-of-payment amounts for the classified and sorted data file.

Because imputations were made for missing items for a large number of the important items in NMCUES, they can be expected to influence the results of the survey in several ways. In general, the weighted hot deck is expected to preserve the means of the nonmissing observations when those means are for the total sample or classes within which imputations were made. However, means for other subgroups, particularly small subgroups, may be changed substantially by imputation. In addition, sampling variances can be substantially underestimated when imputed values are used in the estimation process. For a variable with one-quarter of its values imputed, for instance, sampling variances based on all cases will be based on one-third more values than were actually collected in the survey for the given item. That is, the variance would be too small by a factor of at least one-third. Finally, the strength of relationships between measures that received imputations can be substantially attenuated by the imputation. A more complete discussion of these issues can be found in Lepkowski, Stehouwer, and Landis (1984).

Appendix II. Data Modifications to Public Use Files

During the preparation of this report, a number of problems were discovered in the NMCUES public use files that required modification of the data. Eight sets of problems were identified:

(1) Sampling weights for 68 newborns (i.e., persons born in 1980) were in error.

(2) Six respondents had extremely high hospital stay charges.

(3) Forty-seven respondents had health care coverage categories inconsistent with source of payment for some medical events.

(4) For 173 respondents, fewer bed-disability days than hospital nights were reported. (Length-of-stay data were recorded in terms of the number of nights—as opposed to days—spent in the hospital.)

(5) Four respondents had extremely long lengths of stay in the hospital as a result of incorrect hospital admission dates.

(6) Four respondents had poverty status categories that were inconsistent with their poverty status level.

(7) Nine respondents were coded as deliveries in the hospital file but had inconsistent values for other hospital stay data.

(8) One respondent had duplicate hospital stay records.

Details of the changes made to correct these problems may be obtained from NCHS. Detailed descriptions of the specific changes are provided in the NMCUES series report by Lepkowski et al. (1988). General information on the problems and changes is outlined below.

(1) Records for 68 newborns were incorrectly coded as eligible for the entire survey period (all 366 days) although born after January 1, 1980. These errors were corrected by changing the eligible time-adjustment factor and the person time-adjusted weight for each of the 68 records.

(2) After careful examination, the University of Michigan and NCHS determined that six hospital stay records, each with charges of at least $90,000, were incorrect and should be changed. These six records and related information in the person file (e.g., hospital stay charges, total charges) were changed to conform with records in the Medicare best estimate file or with other information about each of the six respondents' hospitalizations contained in the hospital stay file.

(3) Discrepancies between source of payment and health care coverage were noted in the course of analysis. All of the discrepancies involved Medicare coverage. Forty-seven respondents reporting Medicare as a source of payment in the medical visit, hospital stay, or prescribed medicine file were not properly coded as covered by Medicare. Health care coverage for these respondents was reclassified strictly according to source-of-payment data. Respondents originally coded as covered by private insurance but whose records did not show private insurance as a source of payment for any services were coded as having Medicare and private insurance coverage. When reassignment based on imputed data for source of payment would conflict with real data for health care coverage, the real data were used in preference to the imputed data.

(4) For 173 cases, the value for hospital nights was greater than the value for bed-disability days. According to interviewer instructions for the NMCUES questionnaire, hospital nights should be included in bed-disability days, except for newborns. Therefore, the value of bed-disability days was adjusted to equal hospital nights for these 173 cases, a procedure used in National Health Interview Survey processing. However, this adjustment does not fully compensate for the errors in recording or computing bed-disability days. It is likely that bed-disability days are still underestimated for these 173 cases after the edit. The edit was performed without regard to the imputation status of either bed-disability days or hospital nights.

(5) Four cases with discrepancies between bed-disability days and hospital nights also had improperly coded hospital admission dates, which led to the recording of excessively long lengths of stay. In these cases, the admission dates and hospital nights were corrected, and the bed-disability days edit was not necessary.

(6) Comparison of the continuous and the categorical poverty status variables on the public use file identified four respondents whose categorical poverty status was inconsistent with their continuous poverty status value. The categorical variable was changed to correspond to their poverty status on the continuous variable.

(7) A variety of problems were discovered on nine records coded as deliveries in the hospital stay file.

(a) Two deliveries were attributed to male respondents. Examination of the data files suggested that the sex variable was incorrectly coded in these two cases; the sex was therefore recoded to female. A third delivery attributed to a male was actually that of the respondent's spouse. In this case, the hospital record was reassigned and appropriate changes made in the person file for both respondents.

(b) Four hospitalizations for newborns were incorrectly coded as deliveries. These were recoded in the hospital stay file. A fifth newborn's hospital record was attributed to its mother. In this case, the hospital record was transferred to the newborn, and appropriate changes were made in the person file for both respondents.

(c) One delivery was attributed to a 74-year-old woman. Following an NCHS recommendation, the response was recoded to reflect signs, symptoms, and ill-defined conditions as the admitting condition.

(8) Two sets of duplicate records (four records in total) in the hospital stay file were discovered for one respondent. The two duplicates were deleted in the hospital stay file, and necessary changes were made in the person file. Three of the four records had been imputed to another respondent for reasons of attrition. No changes were made in the records for the respondent receiving the attrition-imputed records.

Appendix III.
Analytical Strategies

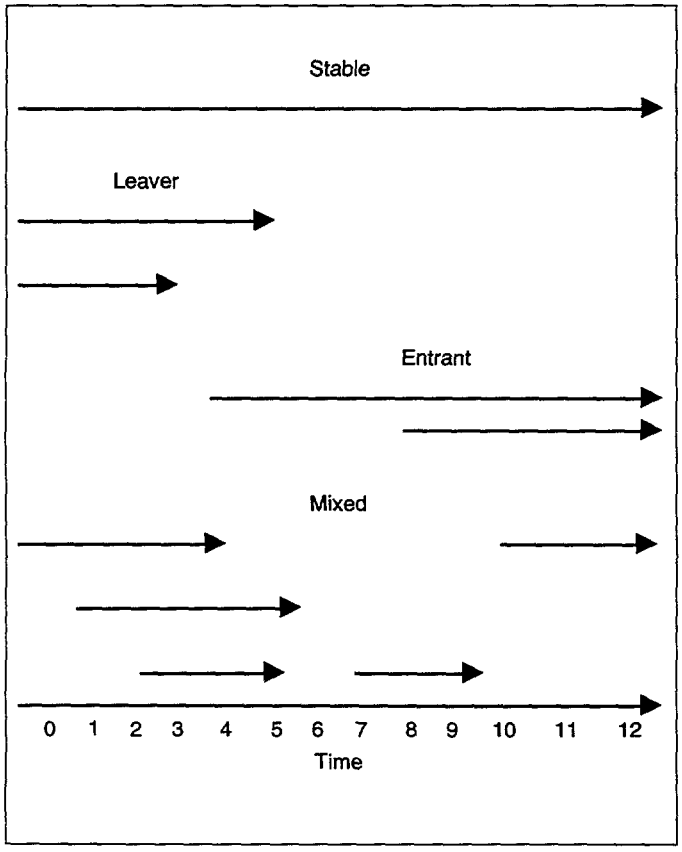
Notion of an Average Population

NMCUES was a panel survey in which members of the population were followed during the panel period (calendar year 1980). The nature of a dynamic population over time influences the rules used to determine who should be followed and for how long. It also has significant implications for the form of estimators for characteristics of the population during the panel period. Before discussing estimation strategies for NMCUES data, it is useful to review the nature of a dynamic population over time.

The nature of a longitudinal population as members move in and out of eligibility is illustrated in Figure I. Stable members of the population appear at the beginning and at every time point during the life of the longitudinal time period. Even though these persons are termed "stable," they may, of course, change residence during the panel period and may be quite difficult to trace. Leavers are persons who are eligible at the beginning of a time period but become ineligible at some later time. Leaving may occur through events such as death, institutionalization, or moving outside the geographic boundary of the population. At the same time, new members (entrants) may enter the population through births or through returns from institutions or from outside the geographic boundary of the population. Finally, there also will be mixed population elements that are both entrants and leavers from the population during different time periods. The majority of the population typically will be stable in nature, but it is the entrants and leavers, persons who may be experiencing major changes in their lives, who are often of particular interest to analysts of panel survey data. In order to assure adequate coverage of all elements in the dynamic population considered over the entire time period, NMCUES followup rules were carefully specified to include entrants, leavers, and mixed population elements properly.

Figure I

Dynamic population for 12 time period panel survey



As an illustration, consider a person who was in the Armed Forces on January 1, 1980, and was discharged on June 1, 1980, thus becoming a key person (i.e., one to be followed for the rest of the year while eligible) in the NMCUES panel. Because NMCUES was designed to provide information about the civilian population, medical care use and charges during the first 5 months of 1980 for this person are outside the scope of the survey. Data about health care use and charges were not collected unless they occurred after June 1. At the same time, this person was eligible for only 7 months of the year, and he was also "at risk" of incurring health care use or charges for only 7 of the 12 months. This person thus contributes only 7/12 or 0.58 of a year of eligibility (person year) to the study. This quantity is referred to as the "time-adjustment factor" in the documentation and throughout these appendixes.

For readers not familiar with the concept of "person years of risk," it may be useful to consider briefly the rules that were used to determine eligibility for a given person at a given moment during 1980. There were essentially two ways of becoming eligible for or entering

the NMCUES eligible population. One way was to be a member of the U.S. civilian noninstitutionalized population on January 1, 1980, and hence a member of the original or base cohort about which inferences were to be made. The second way was to enter after January 1 through birth or through rejoining the civilian noninstitutionalized population during the year by returning from an institution, from the Armed Forces, or from outside the United States. There were also several ways by which persons who were eligible members of the population could become ineligible. Death obviously removes a person from further followup, as does institutionalization, joining the Armed Forces, or moving to a residence outside the United States. Information was collected to monitor the exact number of days that each person selected for NMCUES was eligible during the year. These eligibility periods are summarized by the time-adjustment factor on each record.

The use of "person years" to form sample estimates requires careful assessment of the characteristic to be estimated. Estimates that use only data collected from persons during periods of eligibility (e.g., total number of doctor visits, total charges for health care) do not need to account for time adjustments. Estimates for person characteristics (e.g., total population, proportion of the population in a given subgroup) must be based on person years to obtain estimates that correspond to those for health care estimates. Some estimates require the use of the time-adjustment factor in the denominator but not in the numerator. For example, an estimate of the mean total charge for health care during 1980 must use the total charges for health care as a numerator without time adjustment, but the denominator must be the number of person years that the U.S. population was exposed to the risk of such charges during 1980, a time-adjusted measure. The mean in this case is actually a rate of health care charges per person year of exposure for the eligible population in 1980.

When making estimates in which person years are important, the effect of the time-adjustment factor will vary depending on the subpopulation of interest (Table II). A cross-sectional cohort of N persons selected from the U.S. population on January 1, 1980, and followed for the entire year will contribute a total number of person years for 1980 that is smaller than N because of removals (i.e., deaths, institutionalization, and so on). If entrants are added to the initial cohort during the year, the person years contributed by the initial cohort and the entrants may well exceed N, but it will still be less than the number of original cohort members plus the number of entrants.

The difference between persons and person years will vary by subgroups as well. Females 25–29 years of age on January 1 constitute a cohort for which few additions are expected because of entrants from institutions, the Armed Forces, or living abroad. Few removals are expected because of death, institutionalization, joining the Armed Forces, or moving abroad. On the other hand, males 80 years of age and over on January 1 will contribute a much smaller number of person years to the population than the total number of persons in the cohort at the beginning of the year, because a large number of the cohort will die during the year.

Role of Weights and Imputation

Estimated means and sampling errors from NMCUES for bed-disability days, work-loss days, work-loss days in bed, cut-down days, and restricted-activity days are presented in Table III. For each survey measure, separate estimates were computed using all data (i.e., both real and imputed) and using only the real data. The unweighted and weighted mean, unweighted and weighted simple random sampling standard error of the mean, and the weighted complex standard error, which accounts for the stratified, multistage nature of the design, are presented.

For each measure, the weighted means computed using all the data and using only the real data are quite similar. This similarity is not unexpected given that the weighted hot-deck imputation procedure is designed to preserve the weighted mean for overall sample estimates. The simple random sampling standard errors, however, are smaller when all data are used simply because the simple random sampling variance is inversely related to the sample size. For the complex standard error, three of the five measures have smaller standard errors when all data are used, and the other two measures show the opposite relationship. Weighting and imputation for the disability measures have little or no effect on estimated means or their standard errors for the total

Table II

Effect of person-year adjustment on counts and sampling weights, by 4 population groups: United States, 1980

Population group	Sample size	Person years	Sum of sampling weights	
			Basic weight in thousands	Adjusted weight in thousands
Total population	17,123	16,862.84	226,368	222,824
Females 25–29 years of age	702	699.39	9,529	9,494
Males 80 years of age and over	113	104.05	1,384	1,274
All persons born during 1980	251	121.02	3,560	1,713

Table III

Sample size, means, and standard errors for 5 disability measures, by all and real data subgroups: United States, 1980

Estimates in this table are presented for illustrative purposes. Calculations were made prior to data modifications described in Appendix II.

Disability measure and data type	Sample size	Unweighted estimates		Weighted estimates		
		Mean	Simple random sampling standard error	Mean	Simple random sampling standard error	Complex standard error
Bed-disability days						
All data	17,123	5.303	0.1279	5.268	0.1269	0.1540
Real data	15,777	5.253	0.1326	5.228	0.1319	0.1599
Work-loss days						
All data	13,069	3.614	0.1221	3.696	0.1220	0.1629
Real data	11,537	3.510	0.1284	3.574	0.1277	0.1716
Work-loss days in bed						
All data	13,069	1.516	0.0508	1.568	0.0518	0.0592
Real data	10,970	1.530	0.0556	1.578	0.0568	0.0652
Cut-down days						
All data	17,123	6.831	0.1681	6.881	0.1697	0.3343
Real data	15,724	6.609	0.1721	6.639	0.1735	0.3322
Restricted-activity days						
All data	17,123	13.746	0.2559	13.805	0.2573	0.4716
Real data	14,049	13.036	0.2732	13.064	0.2742	0.4658

Table IV

Sample size, means, standard errors, and element variance for total charge for a hospital outpatient department visit, by data type: United States, 1980

Estimates in this table are presented for illustrative purposes. Calculations were made prior to data modifications described in Appendix II.

Data type	Sample size	Unweighted estimates		Weighted estimates			Element variance ($\times 10^{-3}$)
		Mean	Simple random sampling standard error	Mean	Simple random sampling standard error	Complex standard error	
All data	9,529	51.86	1.030	51.61	1.018	1.914	9.87
Real data only	4,688	52.28	1.436	52.27	1.430	2.936	9.59
Imputed data	4,841	51.45	1.476	50.98	1.447	1.600	10.14
Real data							
Not donor	929	47.83	2.108	48.53	2.117	3.935	4.17
Donor once	2,789	55.85	2.016	55.76	1.982	3.386	11.00
Donor twice	841	48.61	3.525	49.37	3.579	4.879	10.78
Donor 3–5 times	120	29.45	7.340	28.97	7.987	11.64	7.66

population because the amount of missing data for these measures is small (approximately 7 or 8 percent).

For other measures that have larger amounts of missing data, imputation has larger effects. Consider the means and standard errors for total charge for a hospital outpatient department visit shown in Table IV. Of 9,529 hospital outpatient department visits (real visit records plus those generated from the attrition imputation process), 4,841 have a total charge that was imputed from one of the other hospital outpatient department visit records. Thus, more than one-half of the total charges were missing for this particular medical event. Despite the large amount of missing data, the weighted means using all the data and using only real values are quite similar; weighting does not affect the estimated means. However, sampling errors are changed substantially when imputed values are added to real values to form an estimate. The weighted and unweighted simple random sampling standard errors are markedly smaller for all data than for the real data.

To investigate whether this decrease in sampling error is caused by changes in sample size, changes in the element variance, or both, the element or total variances were estimated by multiplying the weighted simple random sampling variances by the sample sizes. Inspection of Table IV suggests that the element variances

are quite similar using all data and real data; the differences in standard error when all data and only real data are used can be attributed mostly to the loss in sample size when going from all data to real data.

Not all of the real data were used as donors for imputation, and some of the real data were used as donors several times. Table IV also suggests that those real values not used as donors have a lower mean total charge than those used as donors, but values used as donors more than twice tend to have even smaller mean total charges. The means for donors used once, twice, or more frequently are a function of the use of imputation classes, within which the mean total charge and the amount of missing data varied.

The difference in complex standard errors between all data and the real data in Table IV illustrates the large effects of imputation. However, neither the complex standard error computed using all the data nor that computed using only the real data is the correct standard error for the weighted mean estimated using all the data. The mean computed using all data includes 4,841 values that were actually subsampled with replacment from the 4,688 real values. In addition, imputations were made across the primary sampling units and strata used in both the sample selection process and the variance estimation procedure. It is assumed in the variance estimation procedure that the observations were selected independently from primary sampling units and strata. That assumption is incorrect in this case. Hence, the complex standard error for all data shown in Table IV fails to account for two sources of variability: the double sampling used to select values for imputation and the correlation between primary sampling units and strata induced by imputation. At the same time, the complex standard error for the weighted mean computed using only the real data is an incorrect estimate of the standard error of the mean based on all the data. The actual sampling error of the weighted mean for all the data is probably larger than that shown for the mean estimated using all the data; it may even be larger than the sampling error computed using only the real data.

Figure II

Estimated mean charges per hospital outpatient department visit, by 4 family income classes for all and real data: United States, 1980

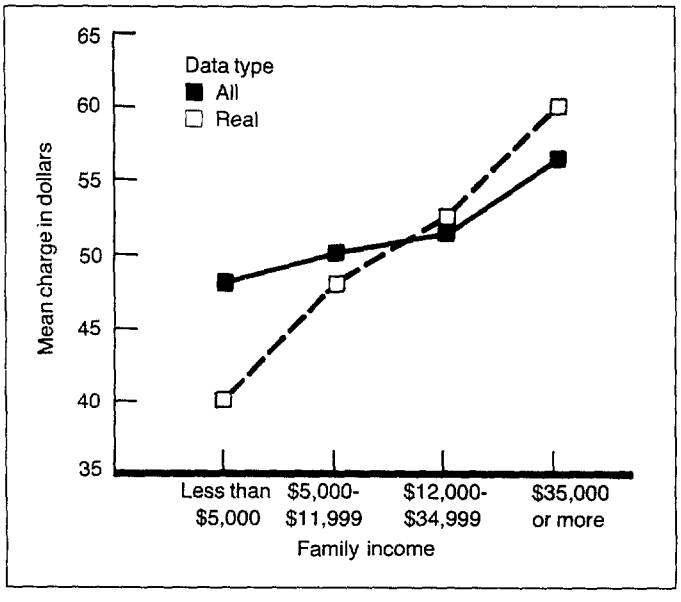
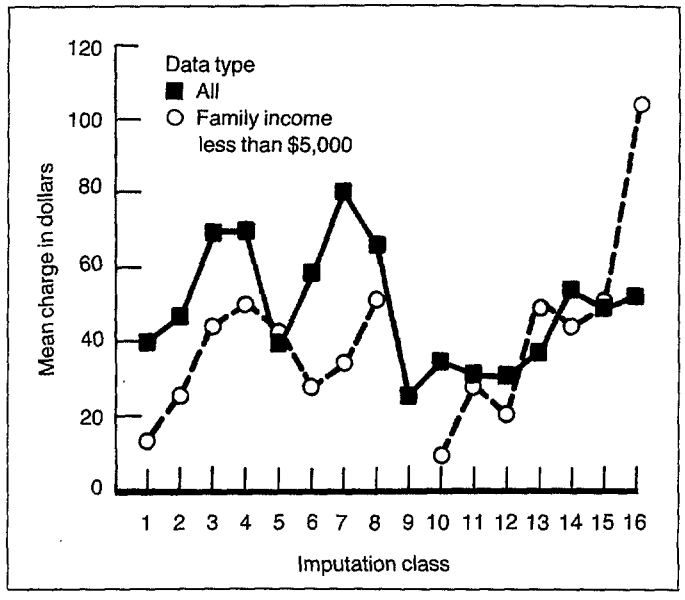


Figure III

Estimated mean charges per hospital outpatient department visit, by 16 imputation classes for all persons and for persons in families with income less than $5,000: United States, 1980



As a final illustration of the effects that imputation can have on survey results, Figure II presents estimated mean charges per hospital outpatient department visit for four family income groups computed using all the data and using only the real data. For the real data, the mean charge per visit increases in a linear fashion as the family income increases. However, when all the data are used to estimate the mean charge per visit, the mean charge does not increase as rapidly with increasing family income. The strong relationship between family income and mean charge per hospital outpatient department visit in the real data has been attenuated by the imputed values.

The reason for this attenuation is shown in Figure III. Sixteen imputation classes were formed for the imputation of total charges for hospital outpatient department visits. Figure III shows mean charge by imputation class for real data for the total sample and for the subgroup with family incomes less than $5,000 in 1980. The low-income group has lower mean charges than the total sample. Because family income was not one of the variables used to form imputation classes, low family income persons within an imputation class with missing hospital outpatient department visit total charges were imputed a charge that was, on average, higher than the mean charge for low-income persons with real data. This occurs in almost every imputation class. When the real and imputed data are combined for persons with family in-

comes less than $5,000, the effect of imputation is to increase the mean charge for this subgroup. Conversely, for persons with family incomes of $35,000 or more, total hospital outpatient department visit charges for persons with real data tend to be larger than values imputed to persons with missing charges. The overall impact of the imputation process on the relationship between charges for hospital outpatient department visits and family income is a regression toward the mean charge for real data for low- and high-income subgroups.

The results in Tables III and IV and Figure II demonstrate the effect that imputation can have on estimated means, on estimated sampling errors, and on relationships between variables. Several strategies for handling imputation in estimation are suggested by these findings. It is beyond the scope of this discussion to evaluate various strategies and indicate the reasons why one was chosen for this report. The strategy used in preparing estimates for this report was to use all the data in all estimates despite the sizable effects caused by imputation. This strategy means that estimated means and totals presented in the report have been adjusted for item nonresponse, but sampling errors and relationships among some variables may be adversely affected by the imputation process. The reader should keep in mind that sampling errors for estimates that are subject to large amounts of item nonresponse may be underestimated, and the strength of relationships between a variable receiving imputed values and a variable that was not used to form imputation classes may be attenuated by the imputation process.

Estimation Procedures

Sample estimators from the NMCUES data, regardless of whether they are totals, means, medians, proportions, or standard errors, must account for the complexity of the sample survey design. Totals, means, and other estimates must include sampling weights to compensate for unequal probabilities of selection, nonresponse, and undercoverage. Stratification, clustering, and weighting must also be accounted for in the estimation of sampling errors. In addition, consideration must be given to time-adjustment factors to account for persons not eligible for the entire year and to imputations that were made to compensate for missing items.

A variety of estimators were used for the descriptive analyses. To illustrate the role of time adjustments, consider the following six specific estimates that were used in the analysis:

- Estimated total charges for a selected subgroup (e.g., persons with hypertension alone).
- Estimated total population.
- Mean charge per visit.
- Mean charge per person.
- Proportion of charges that fall in a certain range of charges.
- Proportion of persons whose charges are less than or equal to a fixed level.

To define these estimators, the following notation for these quantities for the ith person is used:

y_i = total charges for health care in 1980;

x_i = total number of medical visits for 1980;

w_i = nonresponse- and undercoverage-adjusted person weight;

t_i = time-adjustment factor (i.e., the proportion of days in 1980 that the person was an eligible member of the population);

$$d_i = \begin{cases} 1, \text{ if total charges are less than or equal to a fixed value,} \\ 0, \text{ otherwise;} \end{cases}$$

$$e_i = \begin{cases} 1, \text{ if the total charge is between two fixed values,} \\ 0, \text{ otherwise; and} \end{cases}$$

$$\delta_i = \begin{cases} 1, \text{ if the } i\text{th person is a member of a designated subgroup of the population,} \\ 0, \text{ otherwise.} \end{cases}$$

Estimating total charges, or any quantity from NMCUES that was recorded only during periods when the person was a noninstitutionalized civilian in the United States, is a relatively straightforward task requiring only a weighted sum of charge values. In particular,

$$\hat{y} = \sum w_i y_i \delta_i$$

is the estimated total charge for a particular service for a selected subgroup. On the other hand, for estimates of total population, a time-adjusted estimator is required such as

$$\hat{y}' = \sum w_i t_i \delta_i .$$

Thus, $\hat{y}'$ denotes an estimate of the 1980 average subgroup population, and $\hat{y}$ denotes the 1980 charges for a subgroup of the noninstitutionalized civilian population.

Estimated means may or may not need to include a time-adjustment factor in the denominator. For example, to estimate the mean charge *per visit* during 1980, no time adjustment is needed. Hence,

$$\bar{y} = \sum w_i y_i / \sum w_i x_i$$

can be used to estimate mean charge per visit. However, to estimate mean charge *per person,* a time adjustment is required in the denominator because the denominator is actually an estimate of the total average population in 1980. In particular, the estimator has the form

$$\bar{y}' = \sum w_i y_i / \sum w_i t_i .$$

Estimates of mean charges for subgroups have a similar form, with the indicator variable δ_i included in the numerator and denominator for the appropriate subgroup of interest.

Estimated proportions are means that have an indicator variable in the numerator and a count variable in the denominator. Proportions may have time adjustments not only in the denominator but also in the numerator. For example, to estimate the proportion of persons who had charges less than or equal to a fixed value, an estimate of the form

$$p' = \sum w_i d_i t_i / \sum w_i t_i$$

was used. Approximate indicator variables were added to the numerator and denominator to make estimates for selected subgroups.

On the other hand, the estimated proportion of total charges between two fixed levels of charges does not require time adjustments in the numerator or the denominator. In particular,

$$p = \sum w_i y_i e_i / \sum w_i y_i$$

is the estimated proportion of all charges for persons that occurred between two levels of charges.

Appendix IV. Sampling Errors

The NMCUES sample was one of a large number of samples that could have been selected from the U.S. civilian noninstitutionalized population using the same sampling procedures. Each possible sample could provide an estimate that might differ from the same estimate from another sample. The variability among the estimates from all possible samples that could have been selected is defined as the standard error of the estimate, or the sampling error. The standard error can be used to assess the precision of the estimate itself by creating a confidence interval. For each interval, there is a specified probability that the average estimate over all possible samples selected from the population using the same sampling procedures will be in the interval.

Preparation of sampling errors for every estimate in this report would be a sizable task, as would be presentation of sampling error estimates for every estimate. Rather than compute and display standard errors for every estimate in this report, standard errors were computed for a subset of estimates. A set of functions was fit to these estimated standard errors to identify a model that would allow computation of a standard error that would be reasonably close to the estimated standard error.

This appendix provides summary formulas derived from the estimated standard errors that can be used to approximate the standard error for any given estimate in the report. The formulas have been designed to allow computation of an estimated standard error using an electronic calculator with basic arithmetic operators and a square root function. The computed estimate will be an average or smoothed estimate of the actual standard error of the estimate.

The formulas for standard error estimates are presented for three types of estimates found in the report:

- Totals or aggregates (e.g., total charges for all health services used in 1980; total person years for males).
- Means (e.g., mean number of ambulatory visits; per capita charges for ambulatory visits).
- Proportions, percents, and prevalence rates (e.g., proportion of total charges paid out of pocket; percent of persons with hospital admissions; prevalence rate of hypertension for males 45–64 years of age).

Comparisons can also be made between point estimates from two different subgroups of the population. Formulas are given for computing standard errors for two types of comparisons:

- Comparisons of two mutually exclusive subgroups (e.g., comparing mean number of ambulatory visits for males and females, male and female subgroups having no members in common).
- Comparisons between a subgroup and a larger group in which the subgroup is contained (e.g., comparing proportion of hospital stay charges paid out of pocket for the hypertension alone subgroup with the proportion for all persons with cardiovascular conditions).

The standard error of a difference is based on the standard error of the totals, means, proportions, percents, or prevalence rates of interest. Certain covariances between estimates, which typically are small relative to the standard errors of the estimates themselves, are ignored.

The standard errors calculated from the formulas in this appendix can be used to form intervals about which confidence statements can be made for estimates from all possible samples drawn in exactly the same way as NMCUES was. The confidence level is determined by multiplying the estimated standard error by a constant derived from the standardized normal probability distribution. In particular, for the estimate $\hat{\theta}$ with estimated standard error $S_{\hat{\theta}}$, the upper limit for a $(1-\alpha) \times 100$-percent confidence interval can be formed by adding $z_{\alpha/2}$ times S_{θ} to θ. The lower limit is formed by subtracting $z_{\alpha/2}$ times $S_{\hat{\theta}}$ from $\hat{\theta}$. The value of $z_{\alpha/2}$ is obtained from the standard normal probability distribution. For example, a 95-percent confidence interval corresponding to $\alpha = 0.05$ can be formed with $z_{0.025} = 1.96$; a 99-percent confidence interval ($\alpha = 0.01$) uses $z_{0.005} = 2.346$. Illustrations of these calculations are provided in the discussion section for each formula.

Confidence intervals for comparisons of estimates between two subgroups allow inferences to be made about whether the difference is statistically significant. If a $(1-\alpha) \times 100$-percent confidence interval does not include the value zero, the difference is significantly different from zero.

Totals

Let $\hat{y}$ denote the estimated total or aggregate for which a standard error is desired. The standard error for the estimate can be calculated by the expression

$$S_{\hat{y}} = [a\hat{y} + b\hat{y}^2]^{1/2},$$

where a and b are constants chosen from Table V for the particular estimate of interest. This formula was derived from a study of the relationship between the estimated total $\hat{y}$ and its standard error $S^2_{\hat{y}}$ in which a parabolic or quadratic relationship was observed.

As an illustration of the use of this formula, suppose that the standard error of the estimated number of persons 17 years of age and over with hypertension alone is needed. From Table 1, $\hat{y} = 13{,}775{,}000$, the estimated total number of person years accumulated in 1980 by persons with hypertension alone. Table V contains the coefficients for person years, $a = 30{,}476$ and $b = 4.7081 \times 10^{-4}$. The estimated standard error is then computed as

$$\begin{aligned} S\hat{y} &= [(30{,}476)(13{,}775{,}000) + \\ &\quad (4.7081 \times 10^{-4})(13{,}775{,}000)^2]^{1/2} \\ &= [(4.1981 \times 10^{11}) + (8.9336 \times 10^{10})]^{1/2} \\ &= 713{,}545. \end{aligned}$$

This estimated standard error for the total $\hat{y}$ can be used to create confidence intervals for the number of persons 17 years of age and over with hypertension alone. For example, a 68-percent confidence interval is obtained by adding and subtracting the standard error from the estimate. In this case, in 68 out of 100 samples drawn exactly in the same way as in NMCUES, the estimated number of persons with hypertension alone will range from 13,061,455 to 14,488,545. Similarly, a 95-percent confidence interval can be obtained by adding and subtracting from the estimate 1.96 times the standard error. Thus, for 95 of 100 samples drawn in the same way as in NMCUES, the estimated number of persons with hypertension alone would be from 12,376,452 to 15,173,548.

Table V

Coefficients for standard error formula for estimated aggregates or totals, by estimator

Estimator	Coefficient	
	a	b
Person years	3.0476×10^{4}	4.7081×10^{-4}
Charges	1.0986×10^{8}	4.5524×10^{-4}
Lost productivity and value of lost productivity	1.1593×10^{1}	9.1757×10^{-4}
Visits, prescription acquisitions, or disability days	4.6408×10^{2}	5.7634×10^{-1}

Means

A large number of means for different types of measures are presented in this report. Despite the variety of measures presented, a single formula is recommended for calculating an estimated standard error for a mean. The formula given here is based on the assumption that the standard error of the mean is determined by two quantities, the population variance and the effect of the sample design on the variances. The population variance for weighted survey data with weights w_i is estimated as

$$\hat{s}^2 = \frac{\sum w_i (y_i - \bar{y})^2}{\sum w_i - 1},$$

where $\sum w_i$ is the sum of the weights, y_i denotes the value of the characteristic Y for the ith sample person, and $\bar{y}$ is the weighted sample mean. The effect of the sample design on the variance of a sample mean is called the design effect, or "deff" (Kish, 1965), and is often expressed as

$$\text{deff} = [1 + [(n/a) - 1]\, roh],$$

where a is the number of clusters in the sample design and roh is a measure of within-cluster similarity among observations from the same cluster.

The estimated standard error for a mean $\bar{y}$ can be calculated as

$$S_{\bar{y}} = \left[\text{deff} \cdot \frac{\hat{s}^2}{\hat{n}}\right]^{1/2}$$

$$= \left[\left[1 + \left[\frac{\hat{n}}{1{,}795{,}637} - 1\right] roh\right] \cdot \frac{\hat{s}^2}{\hat{n}}\right]^{1/2},$$

where $\hat{n}$ is the estimated population total for the subgroup under consideration and 1,795,637 represents the number of clusters ($a = 138$) times the average basic person weight. Consequently, $\hat{n}/1{,}795{,}637$ is an estimator for n/a in the expression for deff. The values of roh and $\hat{s}^2$ for a variety of means appearing in this report can be obtained from Table VI. The table provides, for example, values of roh and $\hat{s}^2$ for mean charges and mean utilization measures of various types.

As an illustration, consider the standard error of the per capita charges for all health care in 1980 for all persons. From Table R, for all persons $\bar{y} = \$837$, and from Table VI, under the entry "Mean charges per person, All charges, Total," the values $roh = 0.029644$ and $\hat{s}^2 = 7.2407 \times 10^{10}$ are obtained. There were an estimated $\hat{n} = 13{,}775{,}000$ persons with hypertension

Table VI

Values for *roh* and $\hat{s}^2$ for standard error formula for estimated means, by estimator

Estimator	*roh*	$\hat{s}^2$
Mean charges per person		
All charges:		
Ambulatory visits	0.029644	2.4952×10^{9}
Hospital stays	0.029644	6.1652×10^{10}
Physician visits	0.029644	6.1914×10^{8}
Total	0.029644	7.2407×10^{10}
Emergency room visits	0.029644	9.9816×10^{7}
Prescribed medications	0.029644	9.6458×10^{7}
Hospital outpatient visits	0.031367	7.6646×10^{8}
Independent provider visits	0.031367	2.6559×10^{7}
Hospital outpatient visits (nonphysician provider)	0.031367	4.2419×10^{8}
Physician visits (nonphysician provider)	0.031367	5.3375×10^{7}
Dental and other medical expenses	0.031367	8.8305×10^{7}
Charges paid out of pocket:		
Ambulatory visits	0.029644	2.4323×10^{8}
Hospital stays	0.029644	2.4068×10^{9}
Physician visits	0.029644	1.0745×10^{8}
Total	0.029644	3.5873×10^{9}
Emergency room visits	0.029644	1.0038×10^{7}
Prescribed medications	0.029644	4.5416×10^{7}
Hospital outpatient visits	0.031367	8.6571×10^{6}
Independent provider visits	0.031367	2.4996×10^{8}
Hospital outpatient visits (nonphysician provider)	0.031367	2.5341×10^{7}
Physician visits (nonphysician provider)	0.031367	6.7847×10^{8}
Dental and other medical expenses	0.031367	3.8943×10^{8}
Mean charges per user		
All charges:		
Ambulatory visits	0.043633	3.0423×10^{9}
Hospital stays	0.043633	3.0044×10^{11}
Physician visits	0.043633	1.1955×10^{9}
Total	0.043633	8.7587×10^{10}
Emergency room visits	0.043633	3.3067×10^{8}
Prescribed medications	0.043633	1.2535×10^{8}
Charges paid out of pocket:		
Ambulatory visits	0.043633	2.9046×10^{8}
Hospital stays	0.043633	1.6296×10^{10}
Physician visits	0.043633	1.5871×10^{8}
Total	0.043633	5.3877×10^{9}
Emergency room visits	0.043633	7.5825×10^{7}
Prescribed medications	0.043633	6.2806×10^{7}

Estimator	*roh*	$\hat{s}^2$
Mean charges per visit		
All charges:		
Ambulatory visits	0.018777	3.7690×10^{7}
Hospital stays	0.018777	8.4926×10^{11}
Physician visits	0.018777	2.4686×10^{7}
Emergency room visits	0.018777	9.7896×10^{8}
Prescribed medications	0.018777	6.7348×10^{5}
Charges paid out of pocket:		
Ambulatory visits	0.018777	8.8152×10^{6}
Hospital stays	0.018777	9.4998×10^{10}
Physician visits	0.018777	9.2576×10^{6}
Emergency room visits	0.018777	1.1109×10^{8}
Prescribed medications	0.018777	7.8309×10^{5}
Mean visits per user		
Ambulatory visits	0.048246	1.4117×10^{6}
Hospital stays	0.048246	4.3009×10^{3}
Physician visits	0.048246	4.4788×10^{5}
Emergency room visits	0.048246	7.9937×10^{3}
Prescribed medications	0.048246	1.3402×10^{6}
Mean visits per person		
Ambulatory visits	0.048246	1.6398×10^{6}
Hospital stays	0.048246	1.0029×10^{4}
Physician visits	0.048246	5.5650×10^{5}
Emergency room visits	0.048246	1.6024×10^{4}
Prescribed medications	0.048246	1.6651×10^{6}
Mean percent paid out of pocket		
Ambulatory visits	0.051674	2.3071×10^{3}
Hospital stays	0.011724	1.7959×10^{2}
Prescribed medications	0.056569	2.7935×10^{3}
Dental and other medical expenses	0.053301	2.6150×10^{3}
Mean length of hospital stay	0.013098	8.5018×10^{5}
Mean bed-disability days	0.023772	7.6885×10^{6}
Mean work-loss days	0.026868	5.2013×10^{6}
Mean restricted-activity days	0.058349	3.4354×10^{7}
Mean functional limitation score	0.050066	4.9489×10^{4}
Mean number of surgical procedures	0.0	1.4628×10^{8}

alone in 1980 (Table 1). Substituting these values into the expression for $S_{\bar{y}}$,

$$S_{\bar{y}} = \left[\left[1+\left(\frac{13{,}775{,}000}{1{,}795{,}637}-1\right)(0.029644)\right] \cdot \frac{7.2407 \times 10^{10}}{13{,}775{,}000}\right]^{1/2}$$

$$= \left[\left[1+(7.6714-1)(0.029644)\right](5{,}256.407)\right]^{1/2}$$

$$= [(1.1978)(5{,}256.407)]^{1/2}$$

$$= 79.35.$$

The standard error of the per capita charges for all persons 17 years of age and over with hypertension alone is $79.35.

Approximate confidence intervals may be constructed for the population mean by adding to and subtracting from the estimated mean a constant times the estimated standard error. For example, to form a 95-percent confidence interval for the estimated per capita charges for persons with hypertension alone, 1.96 times the estimated standard error ($79.35) is added to and subtracted from the estimated mean $\bar{y}=\$837$. In this case, the 95-percent interval ranges from $681 to $993.

When the estimated sample size is about the same size as or smaller than the constant 1,795,637 in the standard error formula, the design effect effectively becomes equal to 1. Thus, when $\hat{n} \leq 1{,}796{,}000$, the design effect portion of the standard error formula is not necessary, and the estimated standard error can be calculated simply as

$$S_{\bar{y}} = \left[\hat{s}^2/\hat{n}\right]^{1/2},$$

where $\hat{s}^2$ is again chosen from Table VI.

For example, there are an estimated $\hat{n}=1{,}164{,}000$ persons 45–64 years of age with cardiovascular disease with hypertension (Table 3). To estimate the standard error of the mean charges for all health care for these persons in 1980 ($\bar{y}=\$2{,}032$ from Table T), the value $\hat{s}^2=7.2407 \times 10^{10}$ is obtained from Table VI as before, and

$$S_{\bar{y}} = \left[\frac{7.2407 \times 10^{10}}{1{,}164{,}000}\right]^{1/2}$$

$$= 249.41.$$

To form an approximate 95-percent confidence interval for the mean charges, 1.96 times the standard error ($249.41) is added to and subtracted from the estimated mean, $\bar{y}=\$2{,}032$. The 95-percent interval thus ranges from $1,543 to $2,521.

Proportions, Percents, and Prevalence Rates

The standard error of a proportion is computed using a formula similar to that recommended for the standard error of a mean. Let $\hat{p}$ denote the estimated proportion for which a standard error is needed. The standard error for $\hat{p}$ is calculated as

$$S_{\hat{p}} = \left[\left[1 + \left[\frac{\hat{n}}{1{,}795{,}637} - 1\right] roh\right] \frac{13{,}012\,\hat{p}(1-\hat{p})}{\hat{n}}\right]^{1/2},$$

where $\hat{n}$ is the estimated sample size on which the proportion is based, *roh* is a value selected from Table VII,

Table VII

Values of *roh* for standard error formula for estimated proportions, by estimator

Estimator	*roh*
Person years	0.069992
Charges	0.041917
Charges paid out of pocket	0.019816
Visits	0.084014

and the constant 13,012 is the average time-adjusted weight for all persons in the sample. For proportions, the population variance can be estimated simply as

$$\hat{s}^2 = \hat{p}(1-\hat{p}),$$

and hence can be estimated directly from the sample proportions themselves (i.e., no value of $\hat{s}^2$ is needed in Table VII). The design effect, the ratio of the actual sampling variance for the estimated proportion to the variance that would be achieved for a simple random sample of the same size, is calculated for proportions in the same way as it was calculated for means.

As an illustration of the use of the formula for $S_{\hat{p}}$, consider obtaining the standard error for the proportion of persons 65 years of age and over who have hypertension alone and who rate their health as excellent (Table 4), 24.8 percent. To calculate the standard error for percents, the same formula can be used as for proportions after the percent has been divided by 100. Thus, $\hat{p}=24.8 \div 100 = 0.248$. There are an estimated $\hat{n}=$ 4,671,000 persons in the category (Table 3), and $roh=0.069992$ is obtained from Table VII. Substituting these values into the formula for $S_{\hat{p}}$,

$$S_{\hat{p}} = \left[\left[1 + \left(\frac{4{,}671{,}000}{1{,}795{,}637} - 1\right)(0.069992)\right] \cdot \frac{13{,}012(0.248)(1-0.248)}{4{,}671{,}000}\right]^{1/2}$$

$$= \left[\left[1 + (1.6013)(0.069992)\right] \frac{2{,}426.7}{4{,}671{,}000}\right]^{1/2}$$

$$= \left[(1.1121)(5.1952 \times 10^{-5})\right]^{1/2}$$

$$= 0.024037.$$

Because $S_{\hat{p}}=0.024037$ is the estimated standard error for the proportion $\hat{p}=0.248$, simply multiply $S_{\hat{p}}$ by 100 for a standard error of 2.4037 for the percent 24.8.

An approximate 95-percent confidence interval for the percent can now be calculated by adding to and subtracting from the estimated percent 1.96 times the estimated standard error. In this case, the 95-percent interval ranges from 20.1 to 29.5 percent of those 65 years of age and over with hypertension alone who rate their health as excellent.

When the estimated sample size is less than or equal to 1,795,637, the design effect is close to 1 and the formula can be simplified to

$$S_{\hat{p}} = \left[\frac{13{,}012\,\hat{p}(1-\hat{p})}{\hat{n}}\right]^{1/2},$$

as described for the standard error of a mean in the previous section. For example, 10.1 percent of persons 45–64 years of age with cardiovascular disease and hypertension rate their health as excellent (Table 4). For the $\hat{n}=1{,}164{,}000$ estimated persons in this subcategory, the standard error of the proportion associated with this percent is estimated as

$$\left[\frac{13{,}012\cdot(0.101)(1\ -\ 0.101)}{1{,}164{,}000}\right]^{1/2} = 0.031859.$$

A 95-percent confidence interval for the estimated percent is calculated by multiplying this estimated standard error by $100\cdot(1.96)=196$ and adding the result to and subtracting the result from the percent. Thus, the 95-percent interval ranges from 3.9 to 16.3 percent.

The same procedure can be used to calculate standard errors for prevalence rates. Prevalence rates are handled in the same way as percents are except that the rate is divided by 1,000 rather than 100 to obtain a proportion to use in the formula. For example, to obtain the estimated standard error for the prevalence rate for hypertension alone among males in Table 3 (a rate of 69.1 per 1,000 person years), divide the rate by 1,000 (69.1/1,000=0.691) and observe that $\hat{n}=75{,}822{,}000$ (males 17 years of age and over) and $roh=0.069992$ from Table VII for person years. The estimated standard error can be calculated for this prevalence rate as

$$S_{\hat{p}} = \left[\left[1 + \left(\frac{75{,}822{,}000}{1{,}795{,}637} - 1\right)(0.069992)\right]\right.$$

$$\left.\left[\frac{13{,}012\cdot(0.0691)(1\ -\ 0.0691)}{75{,}822{,}000}\right]\right]^{1/2}$$

$$= \left[\left[1\ +\ (41.259)(0.069992)\right]\frac{836.999}{75{,}822{,}000}\right]^{1/2}$$

$$= \left[(3.8878)(11.03\ \times\ 10^{-6})\right]^{1/2}$$

$$= 0.006548.$$

This standard error is multiplied by 1,000, and the 95-percent confidence interval for the estimated prevalence rate ranges from 62.6 to 75.7 per 1,000.

Mutually Exclusive Subgroup Differences

Many comparisons between the same estimate for two different subgroups in the population are made in this report. Let $\hat{d}=\hat{\theta}_1-\hat{\theta}_2$ denote the difference between two subgroup estimates, where $\hat{\theta}_1$ and $\hat{\theta}_2$ are the estimates for the two subgroups. For example, suppose that the mean charge for persons 17–44 years of age with hypertension alone is to be compared with the mean charge for persons 45–64 years of age with hypertension alone (Table 19). Then $\hat{\theta}_1=\bar{y}_1=\$780$ for persons 17–44 years of age, $\hat{\theta}_2=\bar{y}_2=\$682$ for persons 45–64 years of age, and $\hat{d}=\bar{y}_1-\bar{y}_2=\$98$. The standard error of this difference is computed as

$$S_{\hat{d}}=\left[S^2_{\hat{\theta}_1}+S^2_{\hat{\theta}_2}\right]^{1/2},$$

where $S^2_{\hat{\theta}_1}$ and $S^2_{\hat{\theta}_2}$ are the estimated sampling variances for $\hat{\theta}_1$ and $\hat{\theta}_2$, respectively. (This formula ignores the nonzero covariance between $\hat{\theta}_1$ and $\hat{\theta}_2$ that arises in complex samples such as NMCUES. This covariance is typically positive and small relative to the variances themselves. Ignoring the covariance will result in standard errors for differences that are on average somewhat larger than the actual standard errors.)

From Table 3, $\hat{n}_1=2{,}946{,}000$ and $\hat{n}_2=6{,}608{,}000$; from Table VI, $roh=0.029644$ and $\hat{s}^2=7.2407\times10^{10}$. Hence,

$$S_{\bar{y}_1} = \left[\left[1 + \left(\frac{2{,}496{,}000}{1{,}795{,}637} - 1\right)(0.029644)\right]\right.$$

$$\left.\cdot\ \frac{7.2407\ \times\ 10^{10}}{2{,}496{,}000}\right]^{1/2}$$

$$= 171.374$$

and

$$S_{\bar{y}_2} = \left[\left[1 + \left(\frac{6{,}608{,}000}{1{,}795{,}637} - 1\right)(0.029644)\right] \cdot \frac{7.2407 \times 10^{10}}{6{,}608{,}000}\right]^{1/2}$$

$$= 108.869.$$

Therefore, the standard error of the difference is computed as

$$S_{\hat{d}} = [(171.374)^2 + (108.869)^2]^{1/2} = 203.03.$$

This standard error can be used to form an approximate confidence interval for the difference in the same manner as described previously for estimates of totals, means, proportions, and percents. In this instance, the 95-percent confidence interval for the difference in mean charges is from −$299.9 to $495.9. Because this interval does include the value zero, it can be concluded with 95-percent confidence that mean charges do not differ for the two age groups.

Subgroup to Total Group Differences

Another type of comparison made in this report is between an estimate for a subgroup and the same estimate for a group that contains the subgroup. Let $\hat{d} = \hat{\theta}_1 - \hat{\theta}_T$ denote the difference between a subgroup estimate and the estimate for a group in which the subgroup is contained, where $\hat{\theta}_1$ is the subgroup estimate and $\hat{\theta}_T$ is the estimate for the larger group. The standard error of this difference is computed as

$$S_{\hat{d}} = S_{\hat{\theta}_1}[1 - (\hat{n}_1/\hat{n}_T)]^{1/2},$$

where $S_{\hat{\theta}_1}$ denotes the standard error of the estimator $\hat{\theta}_1$ and $\hat{n}_1$ and $\hat{n}_T$ denote the estimated sample sizes for the subgroup and for the larger group, respectively. (This formula is based on an assumption that the covariance between $\hat{\theta}_1$ and $\hat{\theta}_T$ is the same as the variance of $\hat{\theta}_1$, i.e., $S^2_{\hat{\theta}_1}$. This assumption results in an estimated standard error for the difference that is on average somewhat larger than the actual standard error.)

For example, suppose that the standard error of the difference between mean charges for black persons with hypertension alone and mean charges for all persons with hypertension alone is needed. From Table 19, $\hat{\theta}_1 = \bar{y}_1 = \$776$, $\hat{\theta}_T = \bar{y}_T = \$819$, and from Table 3, $\hat{n}_1 = 1{,}816{,}000$, and $\hat{n}_T = 13{,}775{,}000$. Using the formula for estimating the standard error of the mean and values from Table VI under "Mean charges per person, All charges, Total" (i.e., $\hat{s}^2 = 7.2407 \times 10^{10}$ and $roh = 0.029644$),

$$S_{\bar{y}_1} = \left[\left[1 + \left(\frac{1{,}816{,}000}{1{,}795{,}637} - 1\right)(0.029644)\right] \frac{7.2407 \times 10^{10}}{1{,}816{,}000}\right]^{1/2}$$

$$= 199.71.$$

Hence, the standard error of the difference, $\hat{d} = \$776 - \$819 = -\$43$, is computed as

$$S_{\hat{d}} = 199.71[1 - (1{,}816{,}000/13{,}775{,}000)]^{1/2} = 186.08.$$

A 95-percent confidence interval can be constructed for the difference by adding to and subtracting from the estimated difference 1.96 times the estimated standard error of the difference. In this instance, the 95-percent confidence interval is from −$407 to $322. It can be concluded with 95-percent confidence that black persons with hypertension alone have the same per capita charges as do all persons with hypertension alone because this confidence interval includes zero.

Appendix V.
Definition of Terms

Age—This is the age of the person as of January 1, 1980. Babies born during the survey period were included in the youngest age category.

Ambulatory care visit—A direct personal exchange between an ambulatory patient and a health care provider is an ambulatory care visit. The visit may take place in the provider's office, hospital outpatient department, emergency room, clinic, health center, or the patient's home. Services may be rendered by a physician, chiropractor, podiatrist, optometrist, psychologist, social worker, nurse, or other ancillary personnel.

Average length of stay—The average length of stay is the total number of hospital days accumulated at time of discharge by patients discharged during the year divided by the number of patients discharged.

Bed-disability day—A bed-disability day is one on which a person stays in bed more than half of the daylight hours because of a specific illness or injury. All hospital days for inpatients are considered to be bed-disability days even if the patient was not actually in bed at the hospital.

Condition—Any entry on the questionnaire that describes a departure from a state of physical or mental well-being is included. A condition is any illness, injury, complaint, impairment, or problem perceived by the respondent as inhibiting usual activities or requiring medical treatment. Pregnancy, vasectomy, and tubal ligation were not considered to be conditions; however, related medical care was recorded as if they were conditions. Neoplasms were classified without regard to site. Conditions, except impairments, were classified by type according to the Ninth Revision of the International Classification of Diseases (World Health Organization, 1977) as modified by the National Health Interview Survey Medical Coding Manual; these modifications make the code more suitable for a household interview survey. Impairments are chronic or permanent defects, usually static in nature, that result from disease, injury, or congenital malformation. They represent decrease or loss of ability to perform various functions, particularly those of the musculoskeletal system and the sense organs. Impairments are classified by using a supplementary code specified in the coding manual. In the supplementary code, impairments are grouped according to type of functional impairment and etiology.

Condition-related disability day—Condition-related disability days include work-loss days, restricted-activity days, and bed-disability days for which the respondent listed the indexed condition as an underlying cause for staying home from work, cutting down on usual activities, or staying in bed.

Condition-related visit or hospital admission—Ambulatory visits or hospital admissions for which the respondent listed the indexed condition as an underlying reason for seeking medical services are classified as condition related.

Disability—Disability is the general term used to describe any temporary or long-term reduction of a person's activity as a result of an acute or chronic condition.

Disability day—Short-term disability days are classified according to whether they are restricted-activity days, bed-disability days, hospital days, or work-loss days. All hospital days are by definition days of bed disability; all days of bed disability are by definition days of restricted activity. The converse form of these statements is, of course, not true. Days lost from work apply only to the working population. Work-loss days are also days of restricted activity. Hence, the restricted-activity day is the most inclusive term used to describe disability days.

Education of head of family—The years of school completed by the head of family, if the family head was 17 years of age and over, is classified. Only years completed in regular schools, where persons are given a formal education, were included. A "regular" school is one that advances a person toward an elementary or high school diploma or a college, university, or professional school degree. Thus, education in vocational, trade, or business schools outside the regular school system was not counted in determining the highest grade of school completed.

Employed—An individual is classified as employed if he or she worked at any time in 1980.

Family—A group of people living together and related to each other by blood, marriage, adoption, or foster care status is considered a family. An unmarried student 17–22 years of age living away from home was also considered part of the family even though his or her residence was in a different location during the school year.

Family head—At the time of the first interview, the respondent for the family was asked to designate a "family head." If no head was designated or this information was missing, a family head was imputed.

Family income in 1980—Each member of a family is classified according to the total income of the family of which he or she is a member. Because some persons changed families during the year, their family income is defined as the income of the family they were a member of the longest. If a family did not exist for the entire year, the family income is adjusted to an annual basis by dividing actual income by the proportion of the year the family existed. Unrelated persons are classified according to their own income. For each person, 12 categories of income were collected, including income from employment for persons 14 years of age and over and income from various government programs, pensions, alimony or child support, interest, and net rental income. When information was missing, data were imputed. The total income of persons who were members of more than one family was allocated to each family in proportion to the amount of time they were in that family.

Health care coverage—Twelve mutually exclusive categories of health care coverage were developed. Because of the importance and extent of Medicare coverage for persons 65 years of age and over, the population was first divided into those under 65 years of age and those 65 years of age and over. For persons under 65 years of age, coverage is divided into four mutually exclusive categories: coverage all year from a single source, coverage all year from a mixture of sources, coverage only part of the year, and no health care coverage. For those under 65 years of age and covered all year from a single source, three subcategories of coverage were designated: private insurance only, such as a commercial carrier or Blue Cross; Medicaid only; and other public programs, including Medicare, Civilian Health and Medical Program of the Uniformed Services or of the Veterans Administration (CHAMPUS/CHAMPVA), Indian Health Service, and other programs covering the cost of health care. Persons in the part-year-coverage category had health care coverage under either a private policy or public program, but the coverage did not extend throughout the year.

People 65 years of age and over are partitioned into two major coverage categories: those covered under Medicare and those not having Medicare coverage. The former group is subdivided into persons having only Medicare coverage, those who have supplemented their Medicare with private policies, and those who are covered not only by Medicare but also by Medicaid, the Indian Health Service, or another public program. The second subgroup, those not having Medicare, is divided into persons who have some other type of health care coverage, whether private or public, and those who have no coverage at all.

Homemaker—An individual is classified as a homemaker if he or she did not work at all in 1980 (unemployed or not in the labor force) and claimed housekeeping as his or her main activity in 1979. Disabled homemakers are not included. (See "Unable to work for health reasons.")

Hospital admission—This is the formal acceptance by a hospital of a patient who is provided room, board, and regular nursing care in a unit of the hospital. A patient admitted to the hospital and discharged on the same day is considered to have had a hospital admission. Also included is a hospital stay resulting from an emergency department visit.

Hospital days—The total number of inpatient days accumulated at time of discharge by patients discharged from short-stay hospitals during a year constitutes hospital days. A stay of less than 1 day (patient admission and discharge on the same day) is counted as zero days in the summation of hospital days. For patients admitted and discharged on different days, the number of days of care is computed by counting all days from (and including) the date of admission to (but not including) the date of discharge.

Household—Occupants of group quarters or of a housing unit that was included in the sample constitute a household. A household can comprise one person, a family of related people, a number of unrelated people, or a combination of related and unrelated people.

Housing unit—A group of rooms or a single room occupied or intended for occupancy as separate living quarters is a housing unit if the occupants do not live and eat with any other persons in the structure and if there is either direct access from the outside or through a common hall or there are complete kitchen facilities for the use of the occupants only.

Key person—A key person was (1) an occupant of a national household sample housing unit or group quarters at the time of the first interview; (2) a person related to and living with a State Medicaid household case member at the time of the first interview; (3) an unmarried student 17–22 years of age living away from home and related to a person in one of the first two groups; (4) a related person who had lived with a person in the first two groups between January 1, 1980, and the round 1 interview but was deceased or had been institutionalized; (5) a baby born to a key person during 1980; or (6) a person who was living outside the United States, was in the Armed Forces, or was in an institution at the time of the round 1 interview but who had joined a related key person.

Limitation of activity—A functional limitation score was developed for classifying limitation of activity. It ranges from 0, indicating no limitation of activity, to 8, meaning severe activity limitation, and 9, indicating death during the survey period. The functional limitation score was developed from responses to a battery of questions designed to assess ability to perform various

common functions such as walking, driving a car, and climbing stairs. For NMCUES, these questions were asked of persons 17 years of age and over.

Nonkey person—A person related to a key person who joined him or her after the round 1 interview but was part of the civilian noninstitutionalized population of the United States at the date of the first interview is considered nonkey.

Patient—A person who is formally admitted to the inpatient service of a short-stay hospital for observation, care, diagnosis, or treatment is considered a patient. In this report, the number of patients refers to the number of discharges during the year, including any multiple discharges of the same individual from one or more short-stay hospitals. The terms "patient" and "inpatient" are used synonymously.

Per capita charges—These charges were calculated by dividing the total charges by the number of people in the reference population.

Perceived health status—This measure is the family respondent's judgment of the health of the person compared with others the same age, as reported at the time of the first interview. The categories are excellent, good, fair, and poor.

Poverty status—Poverty status in 1980 was calculated by dividing the person's family income in 1980 by the appropriate 1980 nonfarm poverty level threshold and converting it to a percent. These thresholds, as used by the U.S. Bureau of Census, are determined by the age and sex of the family head and the average number of persons in the family.

Prevalence of conditions—In general, prevalence of conditions is the estimated number of conditions of a specified type existing at a specified time or the average number existing during a specified interval of time—in the case of this survey, during 1980.

Race—The race of people 17 years of age and over was reported by the family respondent; the race of those under 17 was derived from the race of other family members. If the head of the family was male and had a wife who was living in the household, her race was assigned to any children under 17 years of age. In all other cases, the race of the head of the family (male or female) was assigned to any children under 17 years of age. Race is classified as "white," "black," or "other." The "other" race category includes American Indian, Alaskan Native, Asian, and Pacific Islander. The category "white and other" includes the categories "white" and "other."

Reporting unit—This is the basic unit for reporting data in the household component of NMCUES. A reporting unit consists of all related people residing in the same housing unit or group quarters. One person could give information for all members of the reporting unit.

Restricted-activity day—A restricted-activity day is one on which a person cuts down on his usual activities for the whole day because of an illness or an injury. The term "usual activities" for any day means the things that the person would ordinarily do on that day. A day spent in bed or a day home from work because of illness or injury is, of course, a restricted-activity day.

Round—A round was the administrative term used to designate all interviews that occurred within a given period of time and that used the same instruments and procedures.

Surgery—Surgery is a procedure involving incision and examination or removal of tissue for diagnostic or therapeutic purposes.

Unable to work for health reasons—This category includes persons who were retired for health reasons at the beginning of the survey (and for all of 1980) as well as homemakers and others who stated that they were disabled and therefore unable to work or keep house for all of 1980 for health reasons. Persons who were unable to work for health reasons for only part of the year are not included.

Work-loss day—A work-loss day is a day on which a person did not work at his or her job or business because of a specific illness or injury. The number of days lost from work is determined only for persons 17 years of age and over who reported that at any time during the survey period they either worked at or had a job or business.

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