

Estimating the Direct Costs of Illness

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MOST OF THE DISCUSSION AND CONTROVERSY about estimating the costs of illness has centered around the relative advantages and disadvantages of the two basic methodologies used or proposed—the “human capital” method as against “willingness to pay.” Very briefly, the human capital approach requires estimating the direct costs of illness, i.e., the costs of prevention, detection, treatment, and rehabilitation, as well as the indirect costs to society due to lost earnings resulting from morbidity and premature mortality. Willingness-to-pay estimates, by contrast, are based on the amounts persons would be willing to pay to reduce their risk of incurring, or dying from, a given disease or diseases. Although this latter approach is more satisfactory on theoretical grounds, lack of appropriate data has so far limited its use in practice, and most estimates of the costs of illness made to date have used the human capital approach.

The controversy over these two methodologies has overshadowed the important question of the quality of the data on direct costs. As a result, there seems to be a general impression that estimates of direct costs, whether of total direct costs (i.e., total national health care expenditures) or of direct costs of specific illnesses or groups of

illnesses, are relatively straightforward and problem-free, quite accurate and reliable. Unfortunately, this is not the case. While estimates of national health care expenditures have been made for over 25 years (first by the Social Security Administration [SSA] and, since 1978, by the Health Care Financing Administration [HCFA]), and the methodology has been refined so that the aggregate estimates are probably fairly accurate, the more detailed estimates of expenditures by type of service are not without problems. When it comes to estimating direct costs of specific illnesses or groups of illnesses, the problems are even more serious.

Having accurate measures of direct costs is not just a matter of accounting nicety. Mushkin (1979), using the human capital method of estimating the economic costs of illness, has shown that there has been a major shift from indirect to direct costs in the United States in this century "which has received far less attention than the ever mounting size of the nation's health bill." According to her estimates, direct costs represented 10 percent of total costs in current dollars in 1900, rose to 13 percent in 1930, reached 37 percent in 1975, and are expected to climb to 50 percent in the year 2000. In constant 1975 dollars, the increase is even more dramatic, from 5 percent in 1900 to an estimated 60 percent in the year 2000.

Moreover, although the willingness-to-pay method does not require explicit estimates of direct costs of illness, a good case can be made in favor of reliable estimates of such costs even if this method were to supplant the human capital method. The willingness-to-pay approach assumes that direct costs are included in the amount a person is willing to pay for a reduction in the risk of suffering or dying from an illness. Whether this is a justifiable assumption at a time when most people have broad coverage of medical expenditures through insurance is very dubious. In addition, regardless of which method is used for estimating total costs of illness, good data on health care expenditures by type of service and by disease categories are essential for monitoring and, if necessary, developing policies for constraining medical care expenditures.

Thus, a review and evaluation of the methods of estimating direct costs of illness seem amply justified. We shall begin with a discussion and evaluation of the methodology used by HCFA* to estimate na-

* We shall refer to the national health care expenditure data as HCFA data rather than SSA data, although the methodology for these estimates was developed by SSA.

tional health care expenditures. Then we will deal with the problems of estimating direct costs by diagnosis or diagnostic groups. A final section will suggest some of the data needs for improving both the estimates of national health care expenditures and those of the direct costs of specific illnesses or groups of illnesses.

Estimating Total Direct Costs of Illness: National Health Care Expenditures

Description of Methodology

The HCFA estimates of national health care expenditures are compiled annually by type of service (i.e., hospital care, physicians' services, etc.) and by source of funds (public and private). Table 1 shows the types of services for which estimates are produced and the dollar

TABLE 1
National Health Expenditures by Type of Expenditure, 1977-1979
(in millions of dollars)*

Type of Expenditure	1977	1978	1979
Total	\$169,875	\$188,643	\$212,199
Health services and supplies	160,794	179,113	202,313
Personal health care	147,968	166,627	188,551
Hospital care	67,721	75,842	85,342
Physicians' services	31,852	35,802	40,599
Dentists' services	10,535	11,894	13,607
Other professional services	3,566	4,080	4,687
Drugs and medical sundries	13,987	15,374	16,975
Eyeglasses and appliances	3,491	3,945	4,353
Nursing home care	12,810	15,102	17,807
Other health services	4,006	4,587	5,180
Prepayment and administration	8,511	7,202	7,720
Government public health activities	4,316	5,284	6,047
Research and construction of medical facilities	9,081	9,529	9,882
Research	3,809	4,323	4,615
Construction	5,272	5,206	5,267

* Adapted from *Health Care Financing Review*, Summer 1980, Table 3, p. 21. Figures have been rounded.

estimates for the years 1977 through 1979. Different data sources, of varying quality and reliability, are used for the estimates of expenditures for the different types of services. Since the methodology is described in detail at the end of the annual articles on national health care expenditures published by HCFA (Gibson, 1980), only a brief summary will be given here.

Expenditures for hospital services, the largest single item of health care costs, are estimated chiefly on the basis of data on hospital finances collected by the American Hospital Association (AHA) in its Annual Survey of Hospitals. Most hospitals are affiliated with the AHA, and the response rate to its questionnaires is well over 90 percent. Certain adjustments are made to the AHA figures to take account of the small number of community hospitals, as well as osteopathic hospitals not included in the national totals. For federal hospitals, data supplied by the relevant government agencies are used (e.g., Veterans Administration, Department of Defense). It should be noted that the composite estimate represents all spending for hospital services, inpatient as well as outpatient, and includes salaries and some other payments to medical and dental residents, physicians, and dentists on hospital staffs, as well as the costs of drugs and other supplies.

Estimates of expenditures for physicians' services, the second largest item of health care costs, are based largely on the gross income from self-employment reported by physicians to the Internal Revenue Service (IRS). The total also includes that portion of spending for outpatient independent laboratory services billed directly to patients and the estimated expenses of group-practice prepayment plans in providing physicians' services to the extent that these are not included in physicians' income from self-employment. Expenditures for dentists' services and the services of other professionals (such as private-duty nurses, chiropractors, and optometrists) also are estimated on the basis of IRS income tax returns. As pointed out above, salaries of physicians and dentists on the staffs of hospitals are included in hospital expenditures. The salaries of physicians and dentists serving in the field services of the Armed Forces are included in "other health services." Expenditures for the education and training of medical personnel are excluded where this is possible since they are not considered part of health care costs.

Expenditures for drugs and medical sundries, eyeglasses, and appliances include only those items purchased by consumers in retail

outlets. Items provided to hospital inpatients and outpatients, patients in nursing homes, or through physicians' offices are excluded. The basic source of these statistics is the estimate of personal consumption expenditures compiled by the Department of Commerce as part of the national income accounts.

Expenditures for nursing home care include spending in all facilities providing some level of nursing care, whether or not they are certified by Medicare or Medicaid. Estimates of these expenditures are based on periodic surveys of nursing homes conducted by the National Center for Health Statistics (NCHS), which collect data on nursing home facilities, utilization and costs, and on ratios of revenues to costs estimated from IRS and other sources. As already noted, these estimates include expenditures for drugs dispensed in nursing homes.

The above categories have represented 85 percent of total health care expenditures in recent years. Because the remaining categories—other health services, prepayment and administration, government public health activities, research, and medical facilities construction—account for such a small percentage of the total, and their estimates are derived from a wide variety of sources, we have omitted them from our review. Over- or under-estimates of expenditures for any one of these items are unlikely to be of major importance.

Main Shortcomings of the Estimates

The estimates of costs of national health care are not entirely successful in allocating expenditures to the appropriate category of service. As has been noted above, the estimates of hospital expenditures include salaries and other payments to medical and dental residents, and to physicians and dentists on hospital staffs, as well as expenditures for drugs dispensed to hospital inpatients and outpatients. Similarly, the costs of drugs dispensed to nursing home patients are included in nursing home expenditures. This results in overestimates of hospital and nursing home expenditures and underestimates of expenditures for physicians' and dentists' services and for drugs. In addition, there is some evidence that the HCFA estimates of expenditures for drugs and medical sundries even as defined (i.e., limited to consumer expenditures in retail outlets) err on the low side. Furthermore, the quality of the estimates of nursing home expenditures may be somewhat questionable. Finally, it has been suggested that illness also

imposes nonhealth-sector costs on society, both direct costs such as, for example, costs of transportation to medical care providers, and indirect costs. These are currently not included either in the estimates of total costs of illness or of specific illnesses.

Before examining the estimates in more detail and evaluating the possible magnitude of the misallocation of expenditures between different types of health care services, we should note that one might argue that there is no reason that hospital expenditures cannot be defined to include payments to physicians and dentists, and expenses for drugs, that expenditures for physicians' services cannot be limited to expenditures for the services of office-based physicians, and that drug expenditures should not be limited to expenditures as defined in the HCFA estimates. This would, indeed, be acceptable if we could assume that the relative importance of expenditures for one type of service allocated to another type in the HCFA estimates (e.g., expenditures for the services of hospital-based physicians allocated to hospital expenditures instead of to physician expenditures) remained constant over time so that year-to-year comparisons of expenditures by type of service legitimately could be made. This assumption, however, is unrealistic.

For example, American Medical Association (AMA) (1980) data indicate that the number of hospital-based physicians, after declining slightly both in absolute terms and as a percentage of all physicians (as well as of physicians in patient care), has recently risen again. Shifts also are probably occurring in the remuneration of physicians employed by hospitals. To cite another example, a recent French study by Le Centre de Recherche pour l'Etude et l'Observation des Conditions de Vie (CREDOC) in France and the United States (Glarmet-Lenoir and Herisson, 1980) indicates that in the United States total expenditures for prescription drugs dispensed in hospitals to inpatients and outpatients increased from 28.6 percent of total drug expenditures in 1973 to 32.2 percent in 1978. It seems highly desirable, therefore, once the decision has been made to estimate health care expenditures by type of service, to make every effort to attribute expenditures to the appropriate category of service.

Overestimate of Hospital Expenditures. We have attempted to estimate the magnitude of the HCFA overstatement of expenditures for hospital services due to the inclusion of salaries and other payments to physicians and dentists, and of the costs of drugs dispensed in hospitals.

Our estimate of expenditures for physicians and dentists on hospital staffs is most tentative, as it is based on data from a number of sources of varying quality, supplemented by what we hope are educated guesses. For an estimate of expenditures for drugs dispensed in hospitals we are using the estimate made by the authors of the CREDOC study referred to above.

Our estimates of payments to hospital-based physicians and dentists, including residents, are based on information from the AMA, the American Dental Association (ADA), and the American Hospital Association. Data on the number of medical residents and salaried physicians on hospital staffs are published annually by the American Medical Association (1979, 1980), data on the number of dental residents by the American Dental Association (1980). The AMA does not have data, however, on the number of physicians on hospital staffs who are nonsalaried and reimbursed in other ways, generally either on a fee-for-service or on a percentage of gross or net revenue basis; and the ADA does not have data on the number of dentists, salaried or otherwise, on the staff of and paid by hospitals. In a survey conducted for the year 1977, however, the ADA collected data on the number of hospitals which had a dental department, the average number of dentists on hospital staffs (part-time or full-time), the average number of dental visits to dentists in private practice, and the average number of hospital dental visits (American Dental Association, 1978). On the basis of these data, we made a rough estimate of the number of full-time dentists on the staff of and reimbursed by hospitals. We arrived at our estimate of the number of nonsalaried full-time physicians on hospital staffs by subtracting from the American Hospital Association figures (1979) of full-time equivalent (FTE) physicians and dentists on hospital staffs the AMA figure of salaried physicians on hospital staffs and our estimate of the number of full-time dentists on hospital staffs.

The AMA and ADA currently do not have data on salaries of hospital medical and dental residents or of physicians and dentists on hospital staffs, nor on payments other than salaries to physicians and dentists on hospital staffs. Accordingly, we had to base our estimates on income data for physicians and dentists in private practice, which we modified on the basis of what we were able to learn from fragmentary data on hospital salaries and from experts in the research departments of the AMA and ADA. Neither of these or-

ganizations is in any way responsible for our estimates. The persons with whom we talked were very helpful in answering our questions but did not endorse any specific dollar figures.

On the basis of these data, which range from firm (number of medical and dental residents, and of salaried physicians on hospital staffs) to very soft (salaries and other payments to residents, physicians, and dentists on hospital staffs), we have estimated that, in 1978, \$3.9 billion of the \$75.8 billion expenditure for hospital services represented salaries and other payments to residents, physicians, and dentists. This is 5.2 percent of total hospital expenditures in 1978. The estimated total of \$3.9 billion is broken down as shown in Table 2.

TABLE 2
Estimated Hospital Expenditures for Residents and Staff
Physicians and Dentists in 1978

Salaries of medical residents and physicians	\$3.3 billion
Payments other than salaries to physicians	.4 billion
Salaries and other payments to dental residents and dentists	.2 billion
Total	\$3.9 billion

The CREDOC study (Glarmet-Lenoir and Herisson, 1980), which is the most careful, thorough, and painstaking study of expenditures for drugs in the United States that we found, estimates hospital expenditures for prescription drugs, in retail prices, at \$5.5 billion in 1978. This total is made up of \$1.5 billion for outpatient and \$4.0 billion for inpatient prescription drugs. Thus, according to this estimate, 7.3 percent of total hospital expenditures in 1978 represented expenditures for prescription drugs. The CREDOC study does not contain an estimate of hospital expenditures for nonprescription drugs and medical sundries. Thus, total hospital expenditures for drugs and medical sundries in 1978 very probably exceeded \$5.5 billion, although it is difficult to say by how much.

To sum up, HCFA's overestimate of hospital expenditures resulting from the inclusion of payments to physicians and dentists on hospital staffs and of drug expenditures amounted to at least \$9.4 billion in 1978, or 12.4 percent of total hospital expenditures. This is a conservative estimate. In addition, the AHA data on which the HCFA

estimate of hospital expenditures is based represent total hospital expenditures; they include a certain amount of nonhealth care expenditures, such as some expenses for research and training, that cannot be separated from patient care expenses, as well as net revenues from nonpatient care activities like gift shops and restaurants (Luft, 1976; Cooper, 1971). No estimates are available on the magnitude of the upward bias in the hospital estimates resulting from the inclusion of such expenditures, and we have been unable to obtain any data on which to base even a rough estimate.

Underestimate of Expenditures for Physicians' and Dentists' Services. As discussed above, expenses for the services of physicians and dentists on hospital staffs are included in HCFA's estimate of hospital expenditures. Their inclusion in the hospital category results in an underestimate of the separate HCFA expenditure figures for the services of these two groups of providers. The underestimate is minor in the case of dentists' services, amounting according to our estimate to only \$210 million, or 1.8 percent of the \$11.9 billion in expenditures for dentists' services in 1978. In the case of physicians' services, however, it is far from negligible. Total payments to physicians (including residents) on hospital staffs were estimated at \$3.7 billion, of which \$3.3 billion were for salaries and \$0.4 billion for other payments to physicians. It is likely that this latter amount, while an overestimate of hospital expenditures, represents only in part an underestimate of expenditures for physicians' services, since at least some of it may have been reported by physicians as income from self-employment and is thus already included in the HCFA figure for expenditures for physicians' services. In other words, a part of this amount probably represents double-counting rather than an underestimation of expenditures for physicians' services. To be on the conservative side, we shall consider only the \$3.3 billion of salaries of residents and physicians included in the HCFA hospital expenditures figures as an underestimate of expenditures for physicians' services. This is equivalent to somewhat more than 9 percent of the HCFA figure of \$35.8 billion for physician expenditures in 1978.

An additional factor that may lead to an underestimate of expenditures for physicians' and dentists' services is the source of the data. As Luft (1976) points out, "The Internal Revenue Service is not an impartial statistical agency; there are substantial incentives to minimize reported income. This can be particularly important in medical

practice in which most of the receipts are composed of small cash payments." No estimate of such possible underreporting is available; all that can be said is that the HCFA estimate for expenditures for physicians' services in 1978 probably underestimates these expenditures by at least 9 percent as calculated above.

Underestimate of Expenditures for Drugs and Medical Sundries. The inclusion in the HCFA hospital figures of expenditures for drugs dispensed in hospitals results in a corresponding underestimate of their estimates for drugs and medical sundries. As cited above, the CREDOC study estimates hospital expenditures for prescription drugs alone at \$5.5 billion in 1978. This corresponds to over one-third of the \$15.1 billion total expenditures for drugs and medical sundries estimated by HCFA for that year. In addition, the CREDOC study, after carefully weighing different data sources, concludes that HCFA underestimates expenditures for prescription drugs purchased by consumers in retail outlets (which HCFA estimates at 56 percent of total expenditures for drugs and medical sundries); however, this underestimate is partially offset by the somewhat lower CREDOC estimate of expenditures for nonprescription drugs and medical sundries. Finally, the CREDOC study also estimates expenditures for prescription drugs dispensed in nursing homes and for those purchased by patients from physicians, which HCFA includes with nursing home and physicians' expenditures, respectively. The CREDOC estimate of total expenditures for drugs and medical sundries (excluding only expenditures for nonprescription drugs and medical sundries dispensed in hospitals and nursing homes) comes to \$22.5 billion for 1978, or almost 50 percent more than the HCFA estimate. Shown below are the HCFA and CREDOC drug expenditure estimates by type of drug for 1978.

Expenditures for Nursing Home Care. The overestimate of nursing home expenditures due to the inclusion of expenditures for prescription drugs is minor, amounting according to the CREDOC estimate for 1978 to just under \$550 million, or 3.5 percent of total nursing home expenditures in that year. The main problem with these estimates is that the data supplied by the nursing homes are not strictly comparable. Some nursing homes include in their charges practically all nursing services provided, in some instances even such services as physical therapy; others charge extra not only for such items as personal laundry but also for medical supplies, special help with feeding, and

TABLE 3
Expenditures for Drugs and Medical Sundries,
HCFA and CREDOC Estimates, 1978
(in millions of dollars)

Type of Expenditure	(1) HCFA	(2) CREDOC	(3) (2) as % of (1)
Consumer expenditures of prescription drugs in retail outlets	\$ 8,455	\$10,419	123.2
Consumer expenditures of nonprescription drugs and medical sundries in retail outlets	6,643	5,279	79.5
Subtotal, retail outlets	\$15,098	\$15,698	104.0
Prescription drugs dispensed in:			
Hospitals	—	5,535	—
Nursing homes	—	491	—
Physicians' offices	—	730	—
Subtotal, other than retail outlets	—	\$ 6,756	—
Grand Total	\$15,098	\$22,454	148.7

extra bed linen for incontinent patients. The relative infrequency of the NCHS nursing home surveys, which necessitates estimates based on indexes of prices paid by nursing homes for labor and nonlabor resources and on indicators of utilization for the years for which no survey data are available, is another weakness of the estimates, especially in recent years when there has been a rapid expansion of the nursing home industry.

Exclusion of Nonhealth Sector Costs. Finally, there are nonhealth sector costs connected with illness which the national estimates of total health care expenditures do not include. Direct costs of this type include costs of transportation to and from medical care providers, special diets, extra household help to care for sick family members, retraining and reeducation, alterations to housing to accommodate invalids (such as ramps or elevators), and counseling services to both the sick and their families. Mushkin (1979) has tentatively estimated total direct and indirect nonhealth sector costs in fiscal year 1975 at between \$29.2 billion and \$37.8 billion. Of these sums, between \$12 billion and \$19 billion may be regarded as direct costs. This would add between 10 percent and 16 percent to the HCFA figure of \$118.5 billion for total direct health care expenditures in 1975.

Estimating Direct Costs of Illness by Diagnosis or Diagnostic Groups

When estimating direct costs of illness by the human capital method two general approaches can be used to estimate costs by diagnosis or diagnostic groups. The first and by far the most commonly employed is the prevalence approach. This involves estimating for any disease or group of diseases the direct and indirect costs attributable to all cases of the condition or group of conditions occurring (prevalent) in a given year. Several studies using this approach were carried out in the late 1950s and early 1960s (Fein, 1958; Mushkin and Collings, 1959; Weisbrod, 1961; Klarman, 1965), but it was Dorothy Rice who fully developed the methodology (1966) and, in cooperation with her colleagues Barbara Cooper (1976) at SSA and Thomas Hodgson (1978) at NCHS, further refined it. Very briefly, her method of estimating the direct costs of illness by diagnosis involves allocating the HCFA estimates of total national health care expenditures by type of care (i.e., hospital care, physicians' services, etc.) among the sixteen disease categories of the International Classification of Diseases (ICD). Expenditures for the various types of care are allocated among the different categories of diseases on the basis of data on the use of and charges for the different types of health care services by diagnosis. All costs are allocated to the primary diagnosis.

The other general approach is the incidence approach. This involves estimating the lifetime direct and indirect costs of the *new* cases of a condition or group of conditions which have their onset (incidence) in a given year. To estimate direct costs using this approach, it is necessary to estimate not only the direct costs of these new cases accruing in the first year, but also the present value of direct costs which may accrue in the future, until the patient dies. While the incidence approach has occasionally been used in various small studies of the costs of specific illnesses, a generally applicable methodology was not developed until the recent work by Hartunian et al. (1981) who refined and expanded a method developed earlier by Smart and Saunders (1976). It should be noted that the two methods yield the same estimates of the direct costs of acute conditions having a short duration and even of chronic conditions in a steady-state situation. However, they will produce quite different results in a time of transition when, for example, a breakthrough in the treatment of some conditions may drastically reduce their incidence.

Each method has its advantages and is useful for different purposes. Prevalence-based estimates indicate the current costs of different conditions and can serve as the basis for various kinds of policy decisions, such as how to control costs of medical care. Incidence-based estimates, on the other hand, are more useful for estimating the benefits which can be derived from preventing or reducing the incidence of specific conditions. One great advantage of prevalence-based estimates is that, by definition, they total national health care expenditures and thus avoid double-counting, which is a danger when using the incidence-based approach, especially when estimating the costs of only some specific diseases. In the following, we shall review both methods and their principal problems and shortcomings.

Methodology of Prevalence-Based Estimates

The types of health care expenditures which, according to the Cooper and Rice methodology, are allocated among the sixteen disease categories of the ICD are those for hospital care, physicians' services, dentists' services, services of other health care professionals, nursing home care, drugs and medical sundries, and eyeglasses and appliances; these last two categories of expenditures were not allocated in the original study (Rice, 1966) but were distributed by disease category in the follow-up study (Cooper and Rice, 1976). Not allocated in either study are expenditures for other health services, prepayment and administration, government public health activities, and research and medical facilities construction. The allocated expenditures accounted for 83.2 percent of total national health care expenditures in 1972 (the year to which the estimates of the 1976 Cooper and Rice study refer) and currently account for about 85 percent. Different methods are used for allocating the different types of expenditures among disease categories.

Hospital Care. Separate estimates, using slightly different methods, are made for expenditures in different types of hospitals. Community hospital expenditures, which represent the bulk of hospital expenditures (about 82 percent of all hospital expenditures and 90 percent of nonfederal hospital expenditures in the past few years) are distributed by days of care for each diagnostic group, weighted by expense per patient day. This weighting was not done in the 1966 study because no data were available on expense per patient day by diagnosis, and it was assumed that the cost per patient day was the same for

all diagnoses. Data on days of care by primary diagnosis come from the Hospital Discharge Survey conducted by NCHS. Expenditures per patient day for the population under age 65 are estimated on the basis of data on expense per patient day by diagnosis obtained from Aetna for its enrollees in the Federal Employee Health Benefit Plan. Estimates for expenses per patient day for the population aged 65 and over are based on Medicare data. In the 1978 Rice and Hodgson study of costs of cancer by site, a slightly different method was used for the population under age 65. The Medicare data on costs per patient day by cancer site (used for the estimates for the population aged 65 and over) were adjusted by the ratio of average daily payments for patients under 65 years at the time of diagnosis to average daily payments for patients 65 years and over observed in the Third National Cancer Survey of the National Cancer Institute.

Expenditures for care in nonfederal psychiatric and tuberculosis hospitals (accounting for about 7 percent of total hospital expenditures in recent years) are attributed to the diagnoses their names imply. Expenditures in federal hospitals (representing about 10 percent of total hospital expenditures) are allocated among diagnoses according to number of days of care as reported by the various agencies (Veterans Administration, Department of Defense, Public Health Service, and St. Elizabeth's Hospital). Since the same daily charge is used in all federal hospitals, no weighting by different daily costs is possible.

Physicians' Services. Expenditures for physicians' services are allocated among diagnoses according to the distribution of physician visits by diagnosis reported by the National Disease and Therapeutic Index (NDTI), a continuing survey of private medical practice in the United States prepared by IMS America Ltd. (Ambler, Pennsylvania). In this survey, data are obtained from a representative panel of physicians who report case-history information, including type of visit (hospital, initial office visit, follow-up office visit) and the number and kinds of drugs prescribed or ordered. In both the 1966 and 1976 studies, it is assumed that the cost of all types of physician visits is the same.

In their 1978 cancer-by-site study, Rice and Hodgson used a somewhat more refined method of allocating physician expenditures among different cancer sites. They first separated total national expenditures for physicians' services in 1975 into those resulting from surgery in the hospital and all other expenditures. This estimate was based on data from a 1970 survey on medical care utilization and expenditures

conducted by the University of Chicago's Center for Health Administration Studies and the National Opinion Research Center (Andersen et al., 1976), which found that 24 percent of physician expenditures were for in-hospital surgery. The estimated expenditures for in-hospital surgery were then allocated by cancer site according to the distribution of hospital discharges with surgery reported for each site by the Hospital Discharge Survey of NCHS. In other words, it was assumed that all hospital surgical procedures cost the same.

The remaining 76 percent of total national expenditures for physicians' services were then distributed among three types of physician services—hospital visits, initial office visits, and follow-up office visits—according to the distribution of physician visits among these three types of visits, weighted by the average fees for each type of visit. Data on the distribution of visits by type of visit came from the NDTI, and data on fees by type of visit from the AMA's *Profile of Medical Practice*. Finally, total expenditures for each type of visit were then distributed among sites according to the number of visits reported for each site in the NDTI. As in the case of hospital surgery, it was assumed that average fees for each of the three types of physician visits were the same for all diseases.

Dentists' Services and Other Professional Services. All expenditures for dentists' services are allocated to the category of diseases of the digestive system. Various methods are used for allocating expenditures for other professional services, depending on the type of service. For example, expenditures for private-duty nurses are allocated by diagnosis according to the distribution of hospital days by diagnosis on the assumption that most of such nursing services are rendered in the hospital. Expenditures for chiropractors are allocated to the category of diseases of the musculoskeletal system, those for optometrists to diseases of the nervous system and sense organs.

Drugs and Medical Sundries, Eyeglasses and Appliances. The NDTI collects data on the type of drug prescribed for each patient seen. On the basis of this information, it prepares a listing of the number of times each therapeutic category is prescribed for each diagnosis. These figures are then weighted on the basis of data on average wholesale charges per prescription by therapeutic category, as reported by the National Prescription Audit of R.A. Gosselin, Inc. All expenses for eyeglasses and appliances are allocated to the category of diseases of the nervous system and sense organs.

Nursing Home Care. Expenditures for nursing home care are allocated among diagnoses according to the number of nursing home residents in each diagnostic group and the average monthly charge for each diagnosis as reported in the periodic nursing home surveys conducted by NCHS. In the 1976 Cooper and Rice study, the 1969 nursing home survey was used.

Shortcomings of Prevalence-Based Estimates

Shortcomings of National Health Care Expenditure Estimates. The shortcomings of the HCFA national health care expenditure estimates discussed earlier obviously also affect the estimates of expenditures by disease group. The overestimate of hospital expenditures and underestimation of expenditures for physicians' services and drugs clearly result in a misallocation of direct costs between different disease categories. Other things being equal, the costs of conditions requiring hospital care will be overestimated and those of conditions necessitating only ambulatory care will be underestimated.

Similarly, the exclusion of nonhealth sector costs also biases the estimates of costs by disease category, since different diseases or groups of diseases may have quite different nonhealth sector costs. For example, such costs are likely to be minor for acute conditions but relatively heavy for some chronic conditions such as arthritis, some forms of cancer, and any lengthy terminal illness. Thus, their exclusion from total direct costs of illness distorts the estimates of the relative economic burden of different illnesses. At present, however, we have no adequate data for assessing the magnitude and direction of this distortion.

Multiple Conditions. Another general problem of the method, and perhaps its most serious shortcoming, is that all direct costs (as well as indirect costs) are attributed to the primary diagnosis. This obviously leads to biases and distortions in the allocation of all types of direct costs but is most serious in the case of expenditures for hospital and nursing home care. It is a major problem in the case of expenditures for hospital care partly because they account for such a large percentage of total national health care expenditures (40 percent in 1978) and partly because data for 1975 (representing 30 percent of all hospitalizations in the United States) have shown that 52 percent of all hospital discharges involved patients with multiple diagnoses

and that these patients accounted for 67 percent of all hospital days (Commission on Professional and Hospital Activities, 1976). It is an important problem in the case of expenditures for nursing home care because such a high percentage of nursing home residents have multiple conditions. According to the 1969 NCHS nursing home survey (1973), 85.7 percent of all residents in nursing homes in the United States had more than one chronic condition, and the average number of chronic conditions per resident was 3.5. While expenditures for nursing home care accounted for only just over 8 percent of total national health care expenditures in 1978, they have been rising more rapidly than any other category of health care costs and are likely to continue to increase in importance as the population of the United States ages.

Another way of illustrating the seriousness and magnitude of the problem of multiple conditions is to look at some data on chronic conditions. The nursing home data just cited above show the importance of the problem in the case of a large section of the institutionalized population. But it is also a serious problem in the case of the noninstitutionalized population. According to a National Center for Health Statistics survey for 1965-1967 (1971), 49.5 percent of the civilian noninstitutionalized population of the United States reported one or more chronic conditions, and the average number of chronic conditions per person with a chronic condition was 2.2. Furthermore, NCHS has estimated that about 60 percent of the total direct costs of care are for chronic conditions (personal communication).

The magnitude and direction of the misallocation of direct costs among different diagnoses resulting from attributing all costs to the primary diagnosis are difficult to assess, not only because of lack of adequate data but because of the complexity of the interrelationship among different conditions. Some diseases aggravate others. For example, a diabetic who has, say, pneumonia or appendicitis is likely to have a longer hospital stay and more expenses for other medical services than a patient with no other condition. Yet according to the current methodology, all costs are allocated to the pneumonia or the appendicitis, thus resulting in some overestimate of the costs of pneumonia and appendicitis and an underestimate of the costs of diabetes. In other instances, one disease causes another. Alcoholism can lead to cirrhosis of the liver, diabetes to renal failure. In this instance, all direct costs may be allocated to the cirrhosis and the renal failure,

respectively, when a good case could be made for allocating the entire costs to alcoholism and diabetes, respectively. In yet other instances, the exact relationship between different conditions is unknown, and we cannot even guess to which of two or more conditions the direct costs should probably be allocated. If we are interested in allocating direct costs only among the sixteen diagnostic categories of the ICD, the problem is not too serious when the multiple coexisting conditions belong to the same diagnostic category. But, as the illustrations cited here show, this is frequently not the case. For example, diabetes is a metabolic disease, renal failure a disease of the genito-urinary system; alcoholism is classified as a mental disorder, cirrhosis of the liver as a disease of the digestive system. Thus the failure to take account of multiple conditions may lead to a distortion of the distribution of direct costs even among the broad categories of the ICD, but by how much and in what way it is impossible to say at this state.

Hospital Expenditures. To turn to more specific problems of the allocation of different types of health care expenditures among diagnostic groups, and abstracting from the general problems discussed so far, the Cooper and Rice methodology is probably most nearly successful in allocating expenditures for hospital care. This is due to the fact that we have more and better data on the use of and charges for hospital services by diagnostic group than for any other type of health care service. As Hodgson (1980) points out, “. . . use of short-term hospitals by diagnosis . . . is derived by appropriate statistical sampling techniques and is reliably estimated at least for the broad three digit ICD categories and for many sub-categories.” While he feels that estimates of hospital charges by diagnosis for the under-65-year-old population need to be improved, he finds the data for the over-65-year-old population satisfactory because “the Health Care Financing Administration can provide very good estimates, from a large sample, of per diem hospital charges by diagnosis for Medicare beneficiaries, those age 65 and over and the disabled.”

Yet even the allocation of hospital expenditures among diagnoses is not without serious problems. For one thing, there is some doubt about the reliability of the hospital diagnostic data. Three recent studies by the Institute of Medicine (IOM) (1977a, 1977b, 1980), in which IOM teams reabstracted previously coded abstracts of hospital data, found substantial discrepancies in coding mainly involving the selection of primary diagnosis rather than errors in assigning a code

number. Comparing four-digit ICD codes, it was found that discrepancies in the three studies ranged from 35 percent to 43 percent of the original abstracts. The proportion of discrepancies decreased somewhat when three-digit rather than four-digit ICD (Demlo et al., 1978) codes were compared, and it decreased to 14 percent when the comparison was reduced to the sixteen disease categories of the ICD (Institute of Medicine, 1980).

An equally if not more serious problem with the allocation of hospital expenditures among diagnoses is the fact that total hospital expenditures are allocated on the basis of days of inpatient care by diagnosis. Total hospital expenditures, however, include a substantial amount of expenditures for outpatient care, and the case mix of outpatient care is likely to be very different from that of inpatient care. In 1977 and 1978, just under 13 percent of the total gross revenues of community hospitals were derived from outpatient services. If we assume that this proportion holds true for all hospitals, almost \$10 billion of the \$75.8 billion total hospital expenditures in 1978 represent expenditures for outpatient care. To the extent that the case mix of outpatient care differs from that of inpatient care, at least some portion of the \$10 billion is misallocated among different diseases when hospital expenditures are allocated on the basis of inpatient case mix alone, leading to an overestimate of expenses for conditions requiring hospital care and an underestimate of those requiring only ambulatory care. Until we have better data on hospital outpatient case mix, it is impossible to estimate the magnitude of this misallocation. Since the share of hospital revenue from outpatient services has been increasing in the past decade—it was only 11 percent in 1972—and is likely to continue to increase, this is a problem which should be dealt with.

Expenditures for Physicians' Services. The data on diagnoses, utilization, and charges used for allocating expenditures for physicians' services among different diseases are considerably weaker than those which form the basis for the allocation of hospital expenditures. The NDTI sample of physicians which provides data on the use of physician visits by diagnosis is much smaller relative to the sample of hospital days of care, and the diagnostic data also are probably less reliable than the hospital diagnostic data. But the weakest element of the estimates is the assumption, made in both the 1966 Rice study and the 1976 Cooper and Rice study, of equal charges for all types of

physicians' services. This clearly leads to misallocations of physician expenditures among different diagnostic groups. Yet even the more refined methodology used in the Rice and Hodgson (1978) study of costs of cancer by site leaves much to be desired, since it assumes equal charges for all diagnoses within each of the four types of physicians' services into which physician expenditures are broken down (i.e., hospital surgical procedures, hospital medical visits, initial office visits, and follow-up office visits). Again, as in the case of other factors leading to misallocations of various types of expenditures among different diagnoses, it is impossible at this stage to assess the magnitude and direction of the misallocation which this assumption causes. However, a comparison of an estimate made in the Rice and Hodgson study of costs of cancer by site with an estimate made on a different basis may shed some light on the problem.

Some time ago, we made an estimate of the direct costs of breast cancer in the United States in 1975 (Scitovsky and McCall, 1976). Our estimate was based largely, though not exclusively, on our study of the costs of treatment of new cases of breast cancer for six months, by which time treatment of the initial episode had been completed in all cases in our study (Scitovsky and McCall, 1977). We obtained out data on inputs of different types of services, and on charges for these services, from the medical records and bills of the patients, and directly from the patients for such out-of-pocket expenditures as drugs and appliances. Table 4 below compares our estimate with that obtained by Rice and Hodgson (1978).

TABLE 4
Direct Costs of Breast Cancer, 1975

Type of Expense	Rice and Hodgson		Scitovsky and McCall	
	\$ (millions)	%	\$ (millions)	%
Hospital expenses	344.3	80.3	400	58.8
Physicians' expenses	84.3	19.7	281	41.2
Total	428.6	100.0	682	100.0

As the figures show, our estimate of hospital expenses is surprisingly close to the Rice and Hodgson estimate, ours being about 16 percent higher. But our estimate of expenses for physicians' services is very

much higher, more than three times that of Rice and Hodgson. As a result, while expenses for hospital care represent 80 percent of total breast cancer costs on the basis of the Rice and Hodgson method, they represent just under 60 percent using our method.

While we would hesitate to claim a high degree of reliability for our estimates, we believe that our estimate of physician expenditures for breast cancer may be closer to actual costs than the Rice and Hodgson estimate because the data we used for physicians' charges for different types of services are more refined than those used in the Rice and Hodgson study. In particular, we used the actual average charge for a breast cancer office visit, and our data suggest that this is considerably higher than the average fee for all office visits since it includes relatively expensive visits for radiotherapy.

This example suggests that the assumption of equal charges for all physicians' services (or even the more refined assumptions about charges made in the Rice and Hodgson cancer study) may lead to an overestimate of physician expenditures for acute infectious diseases, which require few physicians' services other than routine office visits, and to an underestimate of physician expenditures for conditions requiring extensive outpatient diagnostic and therapeutic services (laboratory tests, X-rays, and office surgical procedures such as endoscopies and radiotherapy) and—unless the Rice and Hodgson method used for cancer is employed—also for conditions requiring hospital surgery. Whether, and to what extent, this misallocation of physician expenditures either offsets or reinforces the possible overestimate of conditions requiring hospital care and underestimate of conditions treated on the ambulatory basis discussed above is impossible to say, given currently available data.

Other Health Care Expenditures. Expenditures for hospital care and physicians' services account for almost 60 percent of total national health care expenditures and 68 percent of the health care expenditures allocated among the different disease categories by the Cooper and Rice method. The allocation of expenditures for dentists' services, accounting for 7 percent of the total and 8 percent of allocated health care expenditures, and the allocation of expenditures for eyeglasses and appliances, which are 2 percent and 2.4 percent, respectively, of the total and of allocated health care expenditures, present no special problems. However, the allocation of expenses for nursing home care and drugs, each accounting for 8 percent of the total and

just over 9 percent of allocated health care expenditures, is more problematical, although it is difficult to evaluate the quality of the data on which the allocations are based. If hospital diagnostic data have shortcomings, as the three IOM studies indicate, it is likely that nursing home diagnostic data are considerably less reliable, even apart from the problem of multiple diagnoses that is especially severe in the case of nursing home patients. We have found no evaluation of the NDTI data on prescriptions by diagnosis and on the price data used in the allocation of expenditures for drugs and prescriptions and are in no position to express an opinion regarding their reliability.

Incidence-Based Estimates

In their study of the costs of motor-vehicle-related spinal cord injuries, Smart and Saunders (1976) began to formulate a general methodology for incidence-based estimates of the costs of specific diseases. This method has been refined and further developed by Hartunian et al. (1981) and applied to the major disease categories of cancer, coronary heart disease, stroke, and motor vehicle injuries. Their work is an important step forward in the field of estimating costs of illness because for the first time a detailed and systematic methodology for incidence-based estimates is presented which can be applied to any type of disease or disease category.

The authors' estimates of the direct costs of specific conditions involve four basic steps: 1) estimating the incidence of the conditions, 2) estimating mortality rates and life expectancies of patients who survive the initial attack of the illness, 3) estimating the direct costs of all patients (i.e., of those who die as well as those who survive) in the first year as well as the future direct costs of those who survive the first year but remain impaired, and 4) selection of a discount rate for converting future direct costs into their present value.

It is clear from the authors' estimates of the costs of the conditions covered by their study that the incidence approach requires far more extensive, detailed, and specific data than the prevalence approach as developed by Rice. Moreover, much of the data needed for each step of their calculations is either not available at all or difficult to obtain. To begin with, there is a lack of data on the incidence of diseases. While NCHS has good data on the incidence of acute conditions, data on the incidence of chronic conditions are currently lacking,

apart from data on some forms of cancer available from cancer registries. Second, there is the problem of estimating life expectancies of patients who survive the initial attack of illness. Even assuming no change over time in current methods of treatment, very few hard data are presently available on the life expectancy of patients stricken with a specific chronic illness. Considering that medical technology is constantly changing and that medical breakthroughs may drastically change the course of a disease and with it the life expectancy of its victims, estimates of the life expectancies of patients stricken with different chronic diseases are subject to considerable uncertainties.

Estimating first-year and future direct costs of medical treatment presents a third set of problems. Incidence-based estimates of costs in the first year are subject to the same data inadequacies on the use of and charges for different types of medical care services by diagnosis which we discussed in our section on prevalence-based estimates. Estimating future costs of a disease poses even more problems because there is uncertainty not only about the progress of the disease, recurrence rates, future forms of treatment, and life expectancies of patients, but also about future charges for different medical care services. Because they realized the great difficulty of predicting future price changes, the authors priced future costs in base-year prices. But this is not an entirely satisfactory solution, especially if it is likely that there will be future shifts in the relative charges for different medical services.

Finally, there is the problem of which discount rate to use for future direct costs, a problem which the prevalence approach faces only with regard to indirect costs. This adds a further degree of uncertainty to incidence-based estimates.

To sum up, the lack of adequate data is an even more serious problem in the case of incidence-based than in that of prevalence-based estimates of direct costs. More important still is the uncertainty attached to any estimates which depend so much on future developments such as mortality and survival rates, degrees and duration of impairment of patients who survive the initial illness, and methods of medical treatment. Despite these problems, further incidence-based estimates of the costs of specific illnesses are to be encouraged, partly because, as mentioned earlier, they serve a different purpose than prevalence-based estimates, and partly because they can serve as a valuable check on the latter.

Conclusion

It should be clear from the foregoing discussion that there is considerable room for improving the current estimates of direct costs of illness, both estimates of national health care expenditures by type of service and estimates of the direct costs of specific illnesses or groups of illnesses. As far as the estimates of national health care expenditures are concerned, a high priority should be given to eliminating from hospital expenditures expenses for physicians' and dentists' services and for drugs used in hospitals, and to allocating these expenses to the appropriate categories of services. The AMA is planning to collect economic data on physicians employed in hospitals, which will provide information on salaries and other payments to such physicians, data which currently are unavailable. It also should be possible to make some estimate of expenditures for drugs—prescription as well as nonprescription—used in hospitals. A fuller exploration and use of currently available data sources should make a reasonably accurate estimate feasible.

In addition, it would be desirable to begin to estimate at least some of the more important nonhealth sector costs associated with illness, such as costs of transportation and of the time that family members devote to the care of a sick individual. With the increase in the percentage of women who work outside the home, this latter cost may become a very important item.

As regards the estimates of direct costs of illness by diagnosis or diagnostic groups, whether or not the prevalence or the incidence approach is used, the problem of multiple diagnoses should be given a high priority. At least for hospital costs, some data are currently available that should make it possible to estimate the hospital costs of a given diagnosis with and without the presence of other conditions. The Commission on Professional and Hospital Activities (1976) publishes data on average length of stay by diagnosis that distinguish between single and multiple diagnoses. While the data come from only a sample of hospitals, they should be adequate for at least some tentative estimates of hospital costs by diagnosis with and without other complicating conditions. There also may be Medicare data that could be utilized.

Concerted efforts should be made also to secure better data on utilization of and charges for different health care services by diagnosis. Again, this is a requirement regardless of whether or not the prevalence

or incidence approach is used to estimate costs by diagnosis. As Hodgson (1980) points out, some of the currently available data sources should be explored more fully—third-party payers like Aetna, Blue Cross and Blue Shield; fee schedules of some of the commercial plans; Medicare Part B data; the National Medical Care Expenditure Survey; the National Medical Care Utilization and Expenditure Survey; and the National Ambulatory Medical Care Survey. Finally, additional in-depth studies of the costs of treatment of entire episodes of illness (of the kind conducted by us at the Palo Alto Medical Foundation) should be conducted since they can be very useful in indicating the ratios of different types of expenditures for specific diagnoses.

In the cases of the Cooper and Rice, and Rice and Hodgson types of prevalence-based estimates of the direct costs of illness by diagnosis, an attempt should be made to separate hospital expenditures into expenditures for inpatient care and for outpatient care. The former could then be allocated among different diseases on the basis of inpatient days by diagnosis, as is currently done, but the latter could be allocated on the basis of the distribution of physician visits by diagnosis that is used for allocating physician expenditures. The case mix of hospital outpatient departments and of physicians in private practice may, of course, be different, and efforts should be made to gain information about hospital outpatient case mix. But even without such information, a separate allocation of hospital inpatient and outpatient expenditures, based on different criteria, would be an improvement.

When using the incidence approach to estimating costs of illness, the direct costs of those who die from a given disease should be calculated on a net basis, i.e., the discounted value of direct costs such individuals would have been expected to incur over their lifetimes, if they had not died of the disease, should be deducted from their total direct costs. This has not been done in studies using this approach to date, and thus, direct costs may have been overestimated to some extent.

The difference between net direct costs and total direct costs, and its implications for estimates of costs of illness, is explained in some detail in a study of the Institute of Medicine (1981):

The distinction between net direct costs and total direct costs can be illustrated by considering two men, one age 80 and the other age 50. Each enjoys "average" health for his age. What would be

the cost if each suffered an accidental death involving no medical expenditures? Total direct costs of these two accidental deaths would be the same for each. But since the older man would be expected to incur lower direct costs over his remaining lifetime—mainly because he would be expected to die sooner—his net direct costs would be quite different from those of the 50-year-old. If, in addition, the 50-year-old suffered from chronic diseases requiring exceptionally costly treatments, the difference in net direct costs would be more pronounced. Thus, the accidental death might bring about a large reduction in medical expenditures in this case.

It is entirely possible that elimination of some diseases will ultimately lead to greater national health care expenditures; this does not imply that it is not valuable to eliminate these diseases. But the benefits would be reflected in the savings of indirect costs, rather than direct costs. If a disease that incurs low direct costs is eliminated, people may die later of diseases that involve much greater medical expenditures. Use of total direct costs rather than net direct costs would exaggerate the savings in medical expenditures that could be realized by elimination of some diseases, since society may incur a savings in medical expenditures if the prevalence of some fatal illnesses increases.

In conclusion, and to end on a more positive note, it should be pointed out that, despite the problems and shortcomings of the estimates of the direct costs of illness discussed here, the estimates of total national health care expenditures made in the United States are as good as any which have been made in other countries. And, in the area of estimating costs of specific illnesses or groups of illnesses, the United States leads the way and has made most of the contributions toward developing methodologies. The purpose of this paper is not to criticize the estimates and estimators but to point to some of the areas where further improvements are needed. In addition, it is always well to bear in mind the limitations of data lest they assume an air of certainty that is unwarranted.

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