

# Determination of VA Health Care Costs

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*In the absence of billing data, alternative methods are used to estimate the cost of hospital stays, outpatient visits, and treatment innovations in the U.S. Department of Veterans Affairs (VA). The choice of method represents a trade-off between accuracy and research cost. The direct measurement method gathers information on staff activities, supplies, equipment, space, and workload. Since it is expensive, direct measurement should be reserved for finding short-run costs, evaluating provider efficiency, or determining the cost of treatments that are innovative or unique to VA. The pseudo-bill method combines utilization data with a non-VA reimbursement schedule. The cost regression method estimates the cost of VA hospital stays by applying the relationship between cost and characteristics of non-VA hospitalizations. The Health Economics Resource Center uses pseudo-bill and cost regression methods to create an encounter-level database of VA costs. Researchers are also beginning to use the VA activity-based cost allocation system.*

**Keywords:** *cost; economics; billing; charges; reimbursement; average costs; micro costs; veterans; VA*

Economics is an increasingly important part of health care decision making. Accurate determination of health care cost is an essential part of this process. This article provides an overview of methods of determining the cost of

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services provided by one of the nation's largest integrated providers of care, the U.S. Department of Veterans Affairs (VA).

VA operates a national network of hospitals and clinics. Clinical trials and health services research are important missions in the VA system. These studies are facilitated by an advanced system of electronic medical record keeping and by national databases of health care use. Health economists normally use billing data to estimate the cost of many U.S. health services, but VA does not routinely bill patients for their care. In the absence of billing data, economics researchers have developed alternate strategies for estimating the cost of VA services. This article describes these strategies, with emphasis on recent improvements to VA cost determination data and methods.

Cost determination relies on systems of financial and utilization data. To provide the reader with essential background, this article begins by describing VA cost and utilization databases. The article then turns to its focus: five different methods of finding the cost of VA health services. The first method described is direct measurement, a method that is especially valuable for determining the cost of new interventions and care unique to VA. The next method is itemized list costing, also known as the pseudo-bill method. This method relies on utilization data and a charge or reimbursement schedule from outside VA to estimate cost. The third method is cost regression. A regression is used to determine the relationship between the cost and characteristics of non-VA hospital stays and apply it to VA data. Two new VA encounter-level cost data sources are described. This description is followed by a discussion comparing the alternative methods and data sources and a presentation of plans to improve the accuracy of VA utilization data and cost estimates.

#### **NEW CONTRIBUTION**

This article updates a previous review of VA cost determination methods (Barnett 1999) with information on improved methods, newly published studies, and two new sources of VA cost data. These are the average cost data sets created by the VA Health Economics Resource Center (HERC) and the national extracts of the Decision Support System (DSS), an activity-based cost system implemented by VA. These new cost data sets are easier to use than the traditional methods of finding VA costs. Researchers are provided with recommendations about the appropriate use of each method and source of cost data.

## VA COST AND UTILIZATION DATA

This section provides the reader with essential background on VA databases used to determine the cost of VA care. It describes VA's general ledger, department cost allocation system, and national utilization databases.

VA tracks its health care expenditures in a general ledger and a cost allocation report. The VA general ledger is called the Financial Management System (FMS). FMS reports the cost of supplies and the quantity and cost of each type of staff at each medical center. Expenses are tracked by cost center, an accounting category that corresponds to a VA administrative unit such as the medical, nursing, or psychiatry service. Cost centers do not correspond to patient care departments. For example, the nursing service cost center does not distinguish the nursing costs of inpatient wards from those of outpatient clinics.

VA has a cost allocation system that estimates the cost of each department at each VA medical center. It is called the Cost Distribution Report (CDR). CDR is based on time allocation estimates of VA service chiefs. For example, the head of nursing service estimates the number of staff assigned to different wards and clinics. These estimates are used to allocate personnel costs reported in FMS to cost distribution accounts in CDR. CDR accounts correspond to departments that provide patient care; additional accounts provide the cost of administrative overhead and facility support. CDR does not completely distribute overhead to patient care departments. It does reconcile to FMS, and it is the only historical source of department-level estimates of VA costs, but concerns have been expressed that CDR may not be accurate or up to date (Swindle, Beattie, and Barnett 1996).

VA has adopted one of the nation's most sophisticated systems of electronic medical records. Called the Veterans Integrated Health Systems Technology & Architecture (VISTA), it contains detailed clinical and utilization data. This system is decentralized; each VA medical center and health care system operates an independent computer system. Because of this, there is no single access point to VISTA. To extract data from these records requires cooperation from some 140 VA health care systems, each with its own independent human subjects review panel. Fortunately, VA extracts data from the VISTA system and uses it to create inpatient and outpatient utilization data sets.

The patient treatment file (PTF) is a database of hospital discharges. It characterizes patients and all care involving an overnight stay in any VA facility, including acute medical and psychiatric hospitalizations, rehabilitation, long-term care, residential stays, and domiciliary stays. The PTF also includes care provided in observation units; this care does not ordinarily involve overnight stays.

The outpatient care file is a database of outpatient visits provided by VA. It includes patient demographics and characterizes encounters with diagnosis and procedures codes.

The VISTA system is also extracted to create national databases on pharmacy, prosthetic devices, and contract care. It is also the source of much of the data in DSS, the activity-based cost allocation system described below.

### DIRECT MEASUREMENT

Direct measurement is a useful and potentially accurate means of determining health care cost. This method is ordinarily used to determine the cost of new interventions and programs unique to VA. It can be used to find the cost of a diagnostic test, procedure, or other service. Direct cost measurement methods have been used to find the cost of innovative interventions, including adult day health programs (Chapko et al. 1993) and specialized geriatric (Toseland et al. 1997) and hypertension clinics (Stason et al. 1994). Another article in this issue describes this method and its application to the VA in greater detail (Smith and Barnett 2003 [this issue]).

To find the cost of a unit of service, the total direct cost of providing the service is divided by the number of units of service produced. An activity analysis is used to determine the quantity of labor employed. The analyst may directly observe staff time, have staff keep diaries of their activities, or conduct a survey of managers. The cost of each type of staff is determined from accounting data, such as FMS.

The cost of capital can sometimes be found by surveying the market to learn rental rates (Rosenheck, Frisman, and Neale 1994). It is not possible to use this method to find the capital costs of every service. For example, there is no rental market for hospital operating rooms.

The volume of services may be obtained by survey or from administrative records. For example, the unit cost of a visit to a specific outpatient clinic is found by dividing the total cost of the clinic by the number of outpatient visits that it provides.

The analyst may need to find the unit cost of several different health care products. It is often not appropriate to assume that all products have the same cost. In the above example, some visits to the clinic might last 15 minutes and others an hour or more. When heterogeneous products are produced, the analyst may use direct measurement methods to find the relative quantity of resources used in creating each health care product. A charge or reimbursement schedule might also be used as the measure of relative value, but this requires the assumption that the schedule has the correct values for the ser-

vices being studied. Regardless of the source of relative values, determining the cost of any product requires that the analyst find the average cost per unit of relative value. This requires that the analyst determine a relative value and find the total quantity of every service of the program being studied.

Direct measurement of cost has the advantage that it does not rely on the assumptions required by other cost methods. The drawback to this method is that it is labor intensive. Because of the diversity of health care, few studies rely entirely on the direct measurement method. Other methods are used to measure overhead costs or other health care costs incurred by patients.

The overhead associated with providing patient care includes the cost of services such as administration, housekeeping, maintenance, medical records, and other departments that support patient care. Although a direct cost study can determine the cost and workload of a specific program or department, when care is provided in a hospital, it is beyond the scope of most studies to directly measure the cost of all departments and how much overhead should be distributed to each. Most analysts turn to a hospital cost report for this information. There are two possible sources of VA data: CDR and DSS department-level cost data.

Direct measurement may be used to find the cost of a new intervention. Since cost-effectiveness analysis is concerned with the impact of the intervention on all health care cost, the analyst must also gather information on subsequent ambulatory care, hospital stays, long-term care, and other services used by study participants. Because of the expense of direct cost measurement, other methods are used to find these costs. These methods are described below.

#### **ITEMIZED LIST COSTING (PSEUDO-BILL)**

The second cost determination method considered in this article combines utilization data with a reimbursement or charge schedule. The resulting list of services used by a specific patient is analogous to the itemized bills of health care providers. As a result, this method is sometimes referred to as the "pseudo-bill" method. The unit cost of each item may be the Medicare reimbursement rate, the charge rates of an affiliated university medical center, or some other non-VA source. This method has been used in a variety of studies, to find the costs associated with Alzheimer's disease (Volicer et al. 1994), colon cancer (Wade et al. 1996), and heart disease (Kessler, Kessler, and Myerburg 1995).

Since outpatient bills are considerably less complex than bills for hospital stays, this section first considers construction of a pseudo-bill for outpatient services. It considers the physician bill and then describes how a pseudo-bill

can be constructed for the ambulatory care provided by health care facilities, such as hospital-based emergency rooms and clinics, ambulatory surgery centers, and freestanding diagnostic centers. The discussion then turns to creating pseudo-bills for the hospital and physician components of inpatient hospital stays.

### **Outpatient Pseudo-Bills**

VA characterizes outpatient services using the same codes that private U.S. providers use to bill for their services, making it possible to create a pseudo-bill for VA ambulatory care that is analogous to a private sector bill. VA uses current procedures and terminology (CPT) codes to characterize services provided by physicians and other providers. It uses Medicare Health Care Procedures Coding System codes to characterize medical supplies, devices, and certain specialized services. Medicare and other health care payers have reimbursement schedules that are based on these codes. Medicare reimbursement rates are the most accessible, as they are public and well documented. Medicare is a national program that accounts for a substantial portion of U.S. health care expenditures; other health care payers often follow Medicare payment methodologies.

Yet Medicare charge schedules do not include reimbursement rates for all types of care provided by VA, for example, preventive services, dental procedures, and telephone consultations. The charge schedules of other payers are needed to prepare a pseudo-bill for these services.

It is important to note that Medicare provides higher physician payments when services are provided in a doctor's office than when they are provided in a health care facility. The office-based physician is reimbursed for both physician services and practice expense. When care is provided in an outpatient facility, such as a hospital clinic, an ambulatory surgery center, or a freestanding diagnostic center, the facility prepares its own bill. Facility payments may also be estimated using Medicare payment methods. In the past, Medicare paid facilities their cost-adjusted charges, and there was no schedule of facility reimbursements associated with different procedures. Medicare adopted a prospective payment system for facility fees in 2000 (U.S. Department of Health and Human Services 2000). Medicare now pays facilities according to the ambulatory payment category assigned to the procedure.

The pseudo-bill represents an estimate of charges or reimbursement. It is not the economic cost of providing the service. Health care providers usually set charges to be higher than their costs, hoping to earn revenues that can be used to subsidize uninsured patients or provide profit to shareholders. Reimbursements, which are usually less than charges, are not necessarily equal to

the cost of providing care; they do represent costs from the perspective of the payer. Analysts may want to adjust the pseudo-bill to reflect actual economic costs. One way for VA investigators to do this is to find all ambulatory charges at a medical center and adjust them so that they are equal to the total ambulatory costs reported in the VA department-level cost report, CDR.

### **Inpatient Pseudo-Bills**

The large number of services provided in a hospital stay makes it much more difficult to prepare a pseudo-bill for this care. It would be very expensive for a VA investigator to do this, as VA does not gather the same level of detail on the resources used in a hospital stay that is needed for an itemized bill.

A simpler alternative is to estimate the Medicare reimbursement under the rules of the prospective payment system. Medicare pays hospitals based on the diagnosis related group (DRG) associated with the stay. Each DRG is assigned a relative weight, and the weight is multiplied by a factor to arrive at the reimbursement. Further adjustments are made for costs of medical education, capital, uninsured patients, and very lengthy stays. Cost estimates based on DRG weights have been used for VA studies, including evaluation of the cost effectiveness of cholesterol-lowering drugs (Nyman et al. 2002).

Estimates of the cost of acute medical surgical stays based on DRG weights capture more of the variation in resource use than estimates that are based on length of stay (Barnett 1997). DRG weight cost estimates may not be sensitive to all of the effects of an intervention on hospital costs, however. Resource use may vary in ways not captured by the DRG assignment; for example, the patient may have a longer or more complex stay than is typical for that DRG, or the study may be evaluating an intervention that increases cost without changing the DRG.

Preparation of a pseudo-bill for physician services to hospitalized patients is challenging in the VA environment, as physician services to inpatients are incompletely recorded in VA databases. Inpatient physician care is characterized in VA databases with the International Classification of Diseases (ICD)-9 codes. Physicians who practice in non-VA hospitals use CPT codes to bill for their services. Medicare and other payers do not have schedules of the physician reimbursement associated with ICD-9 procedure codes, which are less specific than CPT codes. VA hospital discharge data include codes for surgeries but often exclude medical procedures, including invasive procedures performed by cardiologists, pulmonologists, and gastroenterologists. The data also exclude physician consultations and daily visits. To prepare a pseudo-bill requires that the analyst directly record physician activity.

## Summary

The pseudo-bill method provides a useful method of estimating the cost of ambulatory care. Medicare reimbursement rates are easily accessed and can be used to estimate costs. The drawback of this method is the complexity of Medicare payment methods. Medicare does not cover many services provided by VA. Reimbursement rates for some services must be obtained from other payers. To be used as an estimate of the cost of care, the reimbursement needs to be adjusted to reflect actual VA costs. Estimation of the cost of VA outpatient visits has been systematically undertaken by the VA HERC, and the results are described below and in more detail by Phibbs et al. (2003 [this issue]).

VA does not gather the data needed to prepare detailed inpatient pseudo-bills. Medicare reimbursement rates can be used to estimate hospitals costs, but these estimates do not fully capture the variation in resource use in hospital stays. Analysts who need more accurate information on hospital cost should consider using the cost regression method.

## COST REGRESSION

The third cost determination method considered in this article, cost regression, is a useful way to estimate the cost of hospital stays. A regression is estimated using data from non-VA hospital stays. The dependent variable is cost-adjusted charges. The independent variables are the characteristics of the stay, such as diagnosis and length of stay. The regression model parameters are then applied to VA utilization data to simulate the cost-adjusted charges of VA stays. Cost regressions have been used to estimate the cost of hospital stays of patients with leukemia (Welch and Larson 1989) and the cost of VA stays for acute myocardial infarction (Barnett et al. 2002). Since this method uses the limited number of characteristics of hospital stays that explain most of the variation in their cost, it requires much less detailed data than creation of an inpatient pseudo-bill.

The cost regression method requires data on non-VA patients with comparable conditions. Such data may be available from hospital discharge data sets. If a suitable data source can be found, this method represents a relatively economical means of estimating VA hospital costs. The approach requires the assumption that the pattern of resource use in the non-VA sample is the same as in the VA sample. Explanatory variables are limited to those that occur in both the VA and non-VA data sets. The choice of model can have a substantial impact on the predicted cost (Andersen, Andersen, and Kragh-Sorensen 2000).

Cost regressions are ordinarily estimated from cost-adjusted charges reported in hospital discharge data. These data sets exclude physician services, as physicians bill payers separately. Although it would be possible to estimate a separate cost regression for physician services, it is difficult to access physician claims and associate them with a particular hospital stay.

One approach is to simply assume the physician services are proportionate to the hospital bill. The average cost of physician services for inpatient care can be expressed as a percentage of the hospital bill and added to the estimate of the hospital cost.

An alternative method is to use data on the average payment for physician services found in other studies. Two studies have examined the average Medicare reimbursement for physician services provided to hospitalized patients for each DRG (Mitchell et al. 1995; Miller and Welch 1993). Such estimates need to be adjusted for inflation. They may also need to be adjusted to reflect physician costs that differ from the average for that DRG. For example, VA hospital stays are longer than Medicare stays. This requires additional days of physician service.

Cost regression is a practical method of estimating the cost of hospital stays. The analyst must find a comparable non-VA data set, model the relationship between cost and the characteristics of the stay, combine the model with VA data to estimate predicted cost, and then adjust the result to reflect total VA expenditures. HERC has used this method to estimate the cost of VA stays for acute medical-surgical care, as described in the following section of this article and in more detail by Wagner, Chen, and Barnett (2003 [this issue]).

Cost estimates based on regression models do not capture all of the variation in the resources used in hospital stays. The analyst must also decide whether it is appropriate to adopt the assumptions used to employ the cost regression method. Since there is no easily accessed source of physician reimbursements associated with hospital stays, available cost regression studies of the physician component of inpatient stays are now quite dated.

### **HERC AVERAGE COST DATA SETS**

One of the two VA data sources with the cost of individual VA health care encounters was created by HERC. The cost estimates are based on the costs reported in CDR, utilization from the PTF and outpatient care file, and non-VA data on the relative costs of health care encounters. Estimates of the cost of acute medical and surgical inpatient stays were constructed using a cost regression. Estimates of the cost of ambulatory care were constructed using the pseudo-bill method.

The HERC cost estimates rely on the assumptions that VA providers use the same relative quantity of resources as non-VA providers and that encounters with the same characteristics have the same relative cost. HERC has created files of all care that has occurred since 1 October 1997; methods for earlier years have been described, but comprehensive estimates have not been prepared (Barnett, Chen, and Wagner 2000; Barnett 1997).

The methods used to prepare these estimates are described in other articles in this issue. The cost of acute medical and surgical care was estimated using measures of relative value estimated from a cost regression estimated from veterans' stays in Medicare hospitals (Wagner, Chen, and Barnett 2003). The cost of long-term care was based on estimates of the relative resource use associated with case mix measures from periodic assessment of VA long-term care patients (Yu et al. 2003). The cost of outpatient visits was estimated using the payments from Medicare and other payers as a measure of relative value (Phibbs et al. 2003). The HERC outpatient cost data set does not include the cost of prescription drugs. These costs may be obtained from VA prescription databases described in another article in this issue (Smith and Joseph 2003 [this issue]).

The HERC average cost data sets are available to researchers who obtain permission to access data in the national VA computer center. HERC has estimated the cost of each health care encounter using the national average cost of similar encounters. It has also provided a local cost estimate, reflecting expenditures reported for that facility in CDR. These estimates might be useful to researchers interested in determining the economic consequences of an intervention using the cost of a specific medical center. Because of the vagaries of CDR, these local cost estimates are less reliable than the national estimates. For medical-surgical stays and outpatient visits, the HERC files also contain an estimate of the cost of the care had it been provided in the non-VA setting.

Analysts need to be aware of the limitations of the HERC data sets that stem from the assumptions needed to create them. The HERC data sets were created by assuming that the relative cost of hospital care in VA is the same as in Medicare hospitals and that the relative cost of outpatient care is the same as in the Medicare reimbursement schedules. The data sets were named the "average cost" data sets because they are based on the assumption that every encounter has the average cost of all encounters identified by the same characteristics in the utilization databases. For this reason, these data sets cannot be used to study the efficiency of a particular health care provider, for example, to learn if a particular medical center has lower than average cost in caring for patients in a certain DRG. The average cost data sets may not be useful for evaluating the impact of an intervention that might change the cost of a

hospital stay or an outpatient visit. The analyst should use direct measurement to estimate these types of impacts.

### DSS

The second data source with the cost of VA health care encounters is DSS. VA has implemented this activity-based costing system to determine the cost of VA departments, intermediate health care products, hospital stays, and outpatient encounters. It was implemented throughout VA health care systems by 1 October 1998, but at the time this article was written, systemwide standardization had not been achieved. DSS data have been used to study treatment for heart attack (Barnett et al. 2002) and the consequences of complications of warfarin therapy (Hamby, Weeks, and Malikowski 2000).

DSS extracts costs from the VA payroll and general ledger. Costs are assigned to departments based on periodic reports from physician staff and managers. Six categories of labor and supply expense are distributed. Overhead (the cost of departments that do not produce patient care) is distributed to patient care departments using a step-down allocation method. Direct cost or the number of square feet of occupied space is used as the basis of the allocation.

Costs of intermediate products are then determined. Examples of intermediate products are a chest X ray, a unit of blood, a 15-minute clinic visit, or a day of stay in the intensive care unit. They are called intermediate products to distinguish them from the final product, a patient encounter, which is a bundle of intermediate products.

DSS relies on VISTA, the system of VA electronic medical records, for information on intermediate products provided. Relative value units (RVUs) are assigned to each product based on an estimate of the relative costs of the resources needed to produce it. The department's cost per RVU is calculated and multiplied by the RVUs assigned to the intermediate product to determine its cost.

In a final step, intermediate products are associated with stays and outpatient visits to determine encounter-level cost. The encounter-level cost can be found in national extract files. These extracts report the cost of individual VA hospital stays, the total cost of care received from a single outpatient clinic received by each patient on a single day, and the total outpatient pharmacy cost incurred by each patient in a single day. Although data are available beginning with the 1998 fiscal year, early years are especially unreliable. These files have been described elsewhere along with preliminary validity tests (Yu and Barnett 2002). A national extract file has also been created with the department-level costs of each medical center.

The cost and quantity of intermediate products used in each health care encounter are not found in the national files. These data are decentralized in the DSS production system, making them considerably more difficult to access.

DSS has the potential of providing cost estimates that are far more accurate than methods currently used in VA cost-effectiveness studies. Indeed, if the system is properly implemented, the cost estimates should be more sensitive to variation in resource use than the cost-adjusted charges used in non-VA cost-effectiveness studies. Analysts will still need to use direct measurement to evaluate the cost of most new interventions.

There are several concerns about the accuracy of DSS (Barnett 1999). DSS has been implemented relatively recently by VA. It is not known if facilities accurately distribute staff costs among departments or estimate the relative effort required to produce different health care products. Because VA physicians do not bill for their services, they do not have the same incentive that non-VA physicians have to document their work; VA databases do not reflect the same level of detail found in non-VA physician claims databases, which list billable services. For example, some VA sites do not record cardiac catheterization procedures in a way that allows DSS to determine their cost (Barnett 1999). At the present writing, DSS data have not been sufficiently validated for research proposals to rely exclusively on this source.

### **DISCUSSION: WHICH METHOD TO EMPLOY?**

The choice of cost determination method depends on the goals of the study, its time frame, and its perspective. The choice invariably involves a trade-off between accuracy and the resources available to conduct the study. All of the methods have their appropriate use, depending on the study hypothesis. A mix of methods is needed for many studies.

The advantages and disadvantages of the methods described in this article are listed in Table 1. Direct measurement is an accurate method of finding the cost for care that is innovative or otherwise unique to VA. It is too labor intensive to be used for all health care; other methods must be used to find the overhead cost associated with hospital-based programs and the cost of other types of health care obtained by study participants.

Direct measurement is needed by analysts examining provider efficiency, for example, in a study of whether a particular medical center has higher than expected costs of providing hospital stays for a specific DRG. The HERC average cost estimates cannot be used for this purpose, as they are created with the assumption that all hospitals use the same relative quantity of resources to provide a stay with a given DRG. Cost estimates from DSS may prove useful in

TABLE 1 Comparison of VA Cost Determination Methods

<i>Method</i>	<i>Source of Data</i>	<i>Assumption</i>	<i>Advantage</i>	<i>Disadvantage</i>
Direct measurement	Staff activity analysis; payroll data on labor cost; estimate of supply costs	May assume all utilization uses the same amount of resources	Useful to determine cost of a program that is unique to VA	Limited to small number of programs; cannot find indirect costs; cannot find total health care cost
Itemized list costing (pseudo-bill)	Detailed utilization data; schedule of charges adjusted for cost	Schedule of charges reflects relative resource use; cost-adjusted charges reflect VA costs	Captures effect of intervention on pattern of care within an encounter	Expense of obtaining detailed utilization data; charge schedule may not represent VA costs; difficulty of preparing inpatient pseudo-bill
Cost regression based on non-VA data	Previous study with cost-adjusted charges and detailed utilization; reduced list of utilization measures previously identified as important	Same as for pseudo-bill; the relation between cost and utilization is the same in the current study as in the previous study	Less effort to obtain reduced list of utilization measures than to prepare pseudo-bill	Must have detailed data from prior study; may result in error or bias
HERC average cost of acute medical and surgical stays method	CDR matched to patient treatment file; relative values from analysis of cost of veterans' Medicare stays	VA use of resources for different diagnoses and lengths of stay same as for non-VA hospitals	Avoids bias of assuming all days of equal cost; can estimate cost from administrative data	Only appropriate for acute medical and surgical stays; not sensitive to all sources of variation in resource use cost

TABLE 1 (continued)

<i>Method</i>	<i>Source of Data</i>	<i>Assumption</i>	<i>Advantage</i>	<i>Disadvantage</i>
HERC average cost of long-term care method	CDR matched to patient treatment file and patient assessment file	Cost of long-term care days is proportionate to weighted work units assigned in long-term care patient assessment	Captures variation associated with resource case mix intensity of long-term care patients	Method has greater complexity; relies on patient assessment data and assumptions about resource used to care for patients in each assessment category
HERC outpatient average cost method: charges based on CPT codes adjusted for costs in CDR	CDR matched to outpatient care file	All visits with the same CPT codes have the same cost	Can estimate cost from administrative data	Assumes that VA characterizes care with appropriate CPT codes and that non-VA charge schedules represent VA relative cost of production
DSS	DSS national extract or DSS production data	Accurately assigns costs; finds relative value units; identifies utilization	Staff at each facility develop estimates of cost of department, products, and encounters	Needs to be validated; some known problems

Note: VA = U.S. Department of Veterans Affairs; HERC = Health Economics Resource Center; CDR = Cost Distribution Report; CPT = current procedures and terminology; DSS = Decision Support System.

this type of study, but the analyst must be aware of one important deficiency at many DSS sites: the lack of data on nonsurgical procedures.

Evaluations of the short-run consequences of managerial decisions also require direct measurement of costs. The short-run perspective ignores costs that are fixed, such as capital costs and many labor costs. Direct measurement is needed to distinguish fixed costs from those that are variable in the short term. In the short run, the incremental cost is less than average cost. The DSS may prove useful for this type of research, as it distinguishes fixed from variable cost. The distinction between fixed and variable cost made in DSS may

not be appropriate for all studies that need an estimate of short-run incremental costs, however.

When studying the cost effectiveness of new health care interventions, direct measurement is often needed to assess the cost of the intervention itself. The assumptions used to create pseudo-bills and cost regressions preclude their use for this purpose. It is also unlikely that DSS cost estimates will reflect the impact of innovation on cost.

Simpler methods can be used to find the cost of other care obtained by study participants. The pseudo-bill method can be used to find the cost of ambulatory care. The pseudo-bill method assumes that the Medicare reimbursement schedule reflects the relative cost of different services and that VA resource use is proportionate to the Medicare reimbursement rates. The analyst may wish to adjust the pseudo-bill by a constant so that the resulting cost estimate is equal to the provider's long-run incremental cost. VA does not gather data needed to prepare inpatient pseudo-bills.

Cost regressions can be used to find the cost of inpatient care. The cost regression method assumes that the relationship between costs and characteristics of hospital stays is the same in VA as in non-VA hospitals. This method does not capture all of the variation in resource use in hospital stays.

HERC has created comprehensive data sets with estimates of the cost of all VA care provided since 1 October 1997. Outpatient costs were estimated with a pseudo-bill. The costs of acute medical-surgical hospital stays were estimated with a cost regression. These estimates were adjusted to reflect VA costs as reported in CDR. They do not capture the full cost of VA capital or malpractice expense, as these are not completely reported in CDR.

The HERC cost estimates are called the average cost data sets because all encounters with the same characteristics are assigned their average cost. They are a useful source of data on the costs incurred by populations of patients, for example, in a study of how annual health care costs vary with patient case mix. These cost estimates may not fully reflect how an intervention affects resource use or how provider efficiencies differ from the mean.

VA has implemented DSS, an activity-based costing system. The national encounter-level cost databases from this system promise to be highly useful for researchers as known problems are resolved. As DSS becomes more accurate, it will become the standard source of follow-up costs and population-based costing.

Analysts conducting cost studies are frequently confronted with less than perfect data. When accuracy is uncertain, data should be validated from an independent source. All assumptions should be articulated. The analyst may need to use alternate utilization data and alternative cost-finding methods

and conduct sensitivity analyses to determine if findings are affected by the data sources or analytic assumptions.

### **DISCUSSION: PLANS FOR IMPROVEMENT**

The accuracy of VA cost estimates will improve as current deficiencies in centralized VA databases are understood and corrected. VA inpatient files do not completely record physician services; medical procedures may be excluded; daily visits and consultations are not recorded at all. VA is developing new software to record physician services to inpatients.

VA outpatient files may understate laboratory tests and prosthetic supplies. Software limitations exclude a small percentage of procedures from the national outpatient data sets. HERC is working with the Veterans Health Administration to evaluate the codes used to characterize outpatient care. HERC is evaluating whether estimates of the cost of prosthetics can be improved by using data from the VA national prosthetics database. Contract providers render an increasing share of VA care; HERC is documenting the VA contract care databases. HERC is also working to improve surveys used to assess patient incurred cost and instruments used to ask patients to report the cost of care they receive from non-VA providers.

The methods used to create CDR are far from adequate, and some medical centers are known to have suspect data. This limits the usefulness of data that depend on CDR, including the HERC average cost data sets. The local cost estimates in the HERC file are especially affected by this concern. The solution to this problem is the replacement of CDR by DSS data. A new national DSS department-level extract may supplant the use of CDR in the near future.

The DSS national extracts exclude some care; some sites have biased data, and others have estimates that are clearly in error. HERC is conducting validation studies of DSS and working with the national DSS program office to identify ways in which DSS data can be improved. HERC also plans systematic comparison of the HERC average cost data set to the DSS national extracts.

Plans to improve the quality of VA data are part of a larger effort to improve the completeness and accuracy of VA health care cost estimates. The goal of this effort is to improve the quality of VA health economics research and to make it easier to undertake.

Most health care interventions have been adopted with little information about their economic consequences or their cost effectiveness. Additional cost-effectiveness research will provide information needed by medical decision makers and ensure that the best possible use is made of finite health care resources.

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