A MODEL TO SIMULATE ALTERNATIVE MEDICARE PHYSICIAN REIMBURSEMENT METHODS

M. Susan Marquis, Donald P. Henry, Daniel J. Byrne, Paul B. Ginsburg, Peter McMenamin, Robert F. Teitel

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This Note describes a microcomputer model developed for the Congressional Research Service (CRS) to simulate the effects of changing the way physicians are reimbursed for services provided to Medicare beneficiaries. The model allows the user to investigate the effects on Medicare expenditures, on providers, and on beneficiaries of replacing the current Medicare physician reimbursement system with a fee schedule. Some illustrative results are presented, using data from two states, to compare the effects of a fee schedule based on current allowed charges and one based on estimates of resource costs.

The Note describes the model for CRS staff members who will use it to simulate various fee-schedule proposals, provides information for those who will work with the simulations, and furnishes an agenda for expanding the model to answer additional policy questions about fee schedules.

Development of the model was supported by the Congressional Research Service under Contract CRS 85-36.
SUMMARY

Many believe that Medicare's current system of paying for physicians' services--called CPR for Customary, Prevailing, and Reasonable--has contributed to the rise in Medicare expenditures and has led to inequitable variation in payments to physicians of different specialties and in different geographic areas. As a result, Congress is considering options to reform Medicare's payment methods.

In evaluating alternative methods, Congress will want to know:

- What will be the effect on total Medicare reimbursements and the mix of services reimbursed?
- Will the reimbursement policy affect beneficiaries' copayments, liability for excess charges, and access to care?
- Does the payment system fairly reward efficient providers; how are changes in revenue distributed among physicians?

This note describes a prototype simulation model that we developed for the Congressional Research Service (CRS) to use in assisting Congress to analyze the effects of physician payment options. The model simulates the effects of replacing the CPR reimbursement system with a fee schedule. Under a fee schedule, all similarly situated providers are paid the same fee for the same service. A fee schedule can be described in terms of a Relative Value Scale (RVS), a weight given to each procedure, and a conversion factor that translates the RVS into the allowed fee.

The model was developed for implementation on a microcomputer and was written in dBase III. It is structured to allow existing charge patterns to be converted into an RVS or to allow the user to input an independent RVS. The model will calculate a conversion factor for a specified Medicare Part B budget target or will accept a fixed conversion factor. The model also allows for various adjustments to the conversion factor that Congress might consider to satisfy standards of "fairness" to providers--specifically, region or pricing locality
adjustments and specialty adjustments. Baseline adjustment factors that are based on current charge patterns are part of the input to the simulation model, but the model enables the user to modify or eliminate these adjustments.

Given input data on the specific services provided to Medicare beneficiaries, the RVS for the services, the adjustments, and the conversion factor, the model computes changes in Medicare outlays, beneficiary liability, and physician revenues. Another module of the simulation package calculates the distribution of physicians by the amount of their gain or loss in Medicare revenues. The model also allows the user to investigate the effects of alternative assumptions about how physicians' decisions to accept assignment respond to changes in allowed fees. However, the prototype model assumes that the number and mix of procedures performed is not affected by changes in reimbursement policy. Future model development work would include adding modules to allow users to test the sensitivity of results to varying assumptions about the elasticity of supply with respect to changes in the own price and the price of other procedures.
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I. INTRODUCTION

The Medicare Supplementary Medical Insurance Program (Part B of Medicare) is a voluntary program that provides the aged and certain disabled persons with insurance for physicians' care and other medical services. Federal expenditures for Part B covered services have grown markedly in recent years, increasing an estimated 145 percent between 1977 and 1982. Because of concern about the rise in Part B expenditures and because of perceived inequities and inefficiencies in the current physician reimbursement system, policymakers are considering strategies for changing Medicare's physician reimbursement policies.

Medicare's current payment system is called CPR, for Customary, Prevailing, and Reasonable. Under CPR reimbursement, Medicare pays 80 percent of allowed charges, subject to an annual deductible. The allowed charge is the lesser of the physician's actual charge, the physician's customary charge (the physician's median historical charge for that procedure), or the prevailing charge (the 75th percentile of customary charges in the area, subject to a limit).

Because CPR is based on historical charges, it is thought that current reimbursement policy has contributed to the rapid increase in Part B costs. Under CPR, charges for a newly introduced procedure tend to become the basis for future reimbursements, even if technological improvements and increased volume reduce the cost of the procedure. It is also believed that this policy has produced distortions in the relative reward for, and hence the incentive to perform, technology-intensive versus time-intensive procedures and inpatient versus outpatient services. In addition, because current billings in part determine future allowed charges, this, rather than cost, may influence the size of the physician's bill.

The CPR system is also very complex and its implementation varies among the insurance carriers that administer Medicare. Some carriers establish separate prevailing charge screens for different geographic areas (localities) in their jurisdiction (often a state); others establish screens that apply to the entire state. Some carriers
incorporate specialty differentials in calculating prevailing fee
screens; others do not. Many believe this system has resulted in
inequitable locality and specialty differentials.

In an effort to contain Part B costs, Congress has imposed
constraints on the increase in physician payments in the past. The 1972
Social Security Amendments tied the maximum annual increase in
prevailing charge levels for all localities to a national economic
index. In June 1984, Congress imposed a 15-month freeze on prevailing
and customary fees, which are normally updated annually, and signaled an
interest in moving quickly to adopt reforms in the Part B payment
system.

Congress also expressed its intention that the reforms should place
the burden of cost containment on physicians and other providers, and
not be transferred to beneficiaries as additional out-of-pocket costs.
Congress established a Medicare participating provider program as part
of the Deficit Reduction Act of 1984 that provides incentives to
physicians to agree to accept the Medicare established charge as payment
in full for all covered services rendered to all Medicare patients,
billing patients only for the deductible and 20 percent coinsurance.
(Those who do so are called "participating physicians.")
Non-participating physicians continue to decide on a case-by-case basis
whether to accept assignment; for non-assigned claims the patient is
liable for the difference between the physician's billed charge and the
Medicare allowed charge.

Proposed reforms in the Part B payment system typically involve
setting fixed reimbursement amounts for some unit of service—the
individual procedure, or "bundles" of procedures such as physician
services during a hospital stay (e.g., physician diagnosis-related
groups, DRGs) or episodes of illness—or a fixed reimbursement per
patient (capitation). In evaluating alternative methods, Congress will
want to know:

- What will be the effect on total Medicare reimbursements and
  the mix of services reimbursed?
- 3 -

- Will the reimbursement policy affect beneficiaries' copayments, liability for excess charges, and access to care?
- Does the payment system fairly reward efficient providers; how are changes in revenue distributed among physicians?

To deal with these questions, the Congressional Research Service (CRS) wishes to develop the capability to simulate outcomes under different reimbursement policies. This Note describes a prototype computer model developed by Rand for CRS to simulate the effects of replacing the CPR system with fee schedules of different types.

The remainder of the Note is organized as follows: Sec. II inventories the data required for simulating changes in Part B reimbursement policy and discusses the data files used to meet those needs. The structure of the prototype simulation model and the economic assumptions embodied in it are discussed in Sec. III. Some illustrative results from the prototype model are presented in Sec. IV. The prototype model assumes that physicians' practice styles do not change in response to changes in Medicare reimbursement policy. In Sec. V, we review available existing literature concerning the type and magnitude of behavioral response that a change in Part B reimbursement policy might induce. The concluding section discusses ways in which the prototype might be extended to incorporate behavioral change and to investigate other effects of Medicare physician reimbursement policy.
II. DATA NEEDS AND DATA AVAILABILITY

DATA NEEDS

The prototype model that we developed simulates the effects of replacing the CPR reimbursement system with a fee schedule. A fee schedule pays all similarly situated providers the same fee for the same procedure. A fee schedule can, but need not, include adjustments for physician specialty and/or locality. Although a fee schedule can be imposed on any bundle of procedures, the prototype model retains the current practice of paying for individual procedures. Hence we require information about the specific procedures that are provided to Medicare beneficiaries. Information about the distribution of current submitted charges or allowed charges for these procedures is required if the new reimbursement formula replaces the CPR system with a more uniform fee schedule based on existing charge practices, as some advocate.

The model needs to address the concerns of Congress about new reimbursement policies, namely, the effects on Federal expenditures and the fairness of the policy to beneficiaries and to physicians. The kinds of effects to be estimated are illustrated in Fig. 1. As the figure indicates, the output includes aggregate changes in reimbursements, beneficiary burden, and physician revenues, and also information about how changes in revenue are distributed among physicians and how changes in patient liability are distributed among beneficiaries. The latter objectives require that we have data on specific services provided by a sample of physicians and on specific services received by a sample of beneficiaries, as well as program-wide data on the services provided to beneficiaries.

THE BMAD FILES

The data-needs of the model were met using the Part B Medicare Data (BMAD) files. There are four BMAD files: a procedure file, a provider file, a beneficiary file, and a prevailing charge file. These files, together with other data sources that contain information about physician reimbursement, are discussed in detail in the Appendix. The
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<th>Change in Beneficiary Burden</th>
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Fig. 1 -- Model Outputs

actual BMAD files were not available when the model was constructed. Instead, we created synthetic BMAD files using data from two states: South Carolina and Washington. The model is designed to use the full, national BMAD files when they become available. For the simulation model, the most relevant data elements in the BMAD files are:

- procedure code and modifier
- HCPCS indicator (coding system was or was not HCPCS)
- type of service
- place of service
- Medicare pricing locality
- region
- provider specialty
- type of provider
- number of services
- submitted charge
- allowed charge
- provider ID number (provider and beneficiary files)
- provider zip code (provider file)
- beneficiary claim number (beneficiary file)
- beneficiary sex code (beneficiary file)
- reason for entitlement (beneficiary file)
- number of services assigned (procedure file) or assignment indicator (provider and beneficiary file).

ADVANTAGES AND DISADVANTAGES OF BMAD

The BMAD file appears to be the most viable data source for studying the effects of reimbursement policies that establish rates for specific procedures. The advantages of the BMAD data file are as follows:

- BMAD files provide a national data base. This allows for the development of both national estimates of changes in utilization, charges, etc., and also analyses of interregional differences.
- BMAD data include information on specific physician procedures. Although only 16 carriers were using HCPCS during 1983, this number will increase over time until all of the carriers have converted to this system. Only seven carrier jurisdictions were not coded in HCPCS in 1984 (although these seven included several states with large Medicare beneficiary populations.)
- The design of the sampling selection rules for both the provider file and the beneficiary files allows for the development of longitudinal data on individual physician practices and individual beneficiaries. As a result, analysis of BMAD data can focus on the effect of program policy changes on individual units of observation in addition to allowing estimation of aggregate impacts.
Nevertheless, there are some shortcomings of the BMAD files that limit the capabilities of the simulation model. These are:

• Reimbursement amounts may be double-counted in the BMAD procedure file. Reimbursed amounts for a particular service may include the total amount reimbursed for a set of claims that includes the particular service, not just the reimbursement for the service. Therefore, allowed amounts applied toward beneficiaries' deductible cannot be accurately calculated; and consequently, the level of Medicare reimbursement and beneficiary burden in a new payment system cannot be estimated without external data. Changes in reimbursement and beneficiary burden from current levels, however, can be calculated.

• Claims history data in the provider file do not include information for all of a physician's practice locations for cases in which different identifiers are assigned for each practice location. Consequently, in estimating the distribution of physicians who realize reserve gains or losses as a result of a change of reimbursement methods, we must assume that each practice location provides a representative sample of the physician's total Medicare practice. Furthermore, we are unable to estimate the actual magnitudes of the revenue change for each physician, though we can estimate the percentage change in revenue.

• BMAD files do not contain diagnostic information that would be needed to simulate proposals that base the unit of payment on episodes of illness.

• BMAD files, like all HCFA data files, include data only for beneficiaries whose annual expenditures exceed the deductible and who submit claims. Generated reports on the distribution of beneficiaries is therefore restricted to beneficiaries whose allowed charges exceed the deductible.
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- BMAD files do not include data on the amount of the customary charge screens. These data are needed to simulate policies that retain physician-specific screens.
- BMAD procedure files provide aggregate information on allowed charges for services during a calendar year, but file screen years do not correspond to calendar years.

Despite these shortcomings, the BMAD files do provide a rich data source for evaluating changes in reimbursement policy. We have developed the simulation model assuming that it will be implemented using BMAD files. For this developmental phase, the computer model was tested and evaluated using 1983 data from the carriers with jurisdictions covering South Carolina and Washington. Using these data, we constructed synthetic files that correspond to the content and structure of the BMAD files.
III. THE PROTOTYPE SIMULATION MODEL

OVERVIEW

The prototype model is designed to simulate the effects of replacing CPR with a fee schedule or relative value schedule (RVS) for procedures—that is, changes in physician reimbursement system that retain the current unit of payments. Any fee schedule can be broken down into an RVS and a conversion factor that translates the RVS into the allowed fee for a procedure, so we will discuss the prototype in terms of these concepts.

The model is structured to allow existing charge patterns to be converted into an RVS or to allow the user to input an independent RVS. The model will calculate a conversion factor for a specified level of Medicare Part B physician payments, or will accept a fixed conversion factor. The model also allows for various adjustments to the conversion factor that might be considered by Congress to satisfy standards of fairness to providers—specifically, region or pricing locality adjustments and specialty adjustments. Baseline adjustment factors that are based on current charge patterns are part of the input to the simulation model, but the model permits the user to modify or eliminate these adjustments.

Given input data on the specific procedures provided to Medicare beneficiaries, the RVS for the procedures, the adjustments, and the conversion factor, the model computes changes in Medicare expenditures, beneficiary liability, and physician revenues. All of these calculations are based on an assumption that the use of procedures is unaffected by the change in reimbursement policy. Another module of the simulation package calculates the distribution of physicians by the amount of their gain or loss in Medicare revenues.\(^1\)

\(^1\)The prototype model developed within the scope of this study does not include a simulation of the distribution of beneficiaries by the change in their liability. This extension is discussed in Sec. VI.
The simulation model was developed for implementation on an IBM PC compatible microcomputer and was written in dBase III.\textsuperscript{2} The required input data for the simulation model are summary files derived from the BMAD data base. Use of summary files achieves great gains in efficiency and enables the user to simulate variations in reimbursement policy quickly. In the remainder of this section, we first describe the construction of the summary input files and then turn to a description of the simulation model.

INPUT DATA FILES

The simulation model requires five input data files: one containing summary data from the BMAD procedure file; one containing summary data from the BMAD provider file; a file of baseline locality price indices; a file of baseline specialty price differentials; and a file of baseline relative values.

Summary Procedure File

Each row of the summary procedure file represents a unique combination of four classification variables: procedure cluster, geographic region, specialty type of the provider delivering the service, and the place in which the service was delivered. The classification or grouping variables used in developing the prototype model are shown in Figs. 2 and 3. The columns of the file contain codes for the classification variables and aggregate information about the allowed and billed charges for services in the cell provided to Medicare beneficiaries, the number of services provided, and the number of services for which assignment was accepted.\textsuperscript{3}

\textsuperscript{2}IBM PC is a registered trademark of International Business Machines; dBase III is a registered trademark of Ashton-Tate.

\textsuperscript{3}Throughout, a procedure is defined by the HCPCS code plus the associated modifier. Anesthesiology procedures are distinguished from surgical procedures on the basis of modifier codes and/or the BMAD type of service code.
CODES 01-12: MEDICAL
   01. AMBULATORY NON-MENTAL HEALTH VISITS
       EXCEPT EMERGENCY ROOM VISITS
   02. EMERGENCY ROOM VISITS
   03. AMBULATORY MENTAL HEALTH VISITS
   04. INPATIENT HOSPITAL VISITS
   05. SKILLED NURSING FACILITY VISITS
   06. (NOT USED)
   07. DIALYSIS
   08. EKG
   09. OTHER DIAGNOSTIC CARDIOVASCULAR SERVICES
   10. (NOT USED)
   11. OTHER DIAGNOSTIC SERVICES
   12. THERAPEUTIC SERVICES

CODES 20-22: RADIOLOGY
   20. CHEST X-RAYS
   21. OTHER X-RAYS
   22. ULTRA-SOUND, THERAPEUTIC RADIOLOGY, NUCLEAR MEDICINE

CODES 30-37: PATHOLOGY
   30. URINALYSIS
   31. BLOOD CHEMISTRY, INCLUDING AUTOMATED
       MULTICHANNEL TESTS
   32. CELL COUNTS, INCLUDING CBC
   33. OTHER HEMATOLOGY
   34. PAP SMEARS
   35. COLLECTION
   36. ORGAN OR DISEASE ORIENTED PANELS
   37. OTHER PATHOLOGY

CODES 40-50: SURGERY
   40. CORONARY ARTERY BYPASS
   41. UGI ENDOSCOPY
   42. TUR
   43. CATARACT REMOVAL
   44. PROCEDURES REIMBURSED AT 100% IF IN AMBULATORY
       SURGICAL CENTER (except 41, 42, 43)
   45. OTHER MUSCULOSKELETAL SURGERY
   46. OTHER CARDIOVASCULAR SURGERY
   47. OTHER DIGESTIVE SYSTEM SURGERY
   48. OTHER URINARY SYSTEM SURGERY
   49. OTHER EYE SURGERY
   50. OTHER SURGERY

CODES 60-61: ANESTHESIOLOGY
   60. ANESTHESIOLOGY FOR PROCEDURES REIMBURSED
       AT 100% IF IN AMBULATORY SURGICAL CENTERS
   61. OTHER ANESTHESIOLOGY

Fig. 2 -- Procedure clusters
SPECIALTY TYPE OF PROVIDER
01. GENERAL PRACTICE, FAMILY PRACTICE
02. GENERAL SURGERY
03. INTERNAL MEDICINE
04. ORTHOPEDIC SURGERY
05. OPHTHALMOLOGY
06. RADIOLOGY
07. PATHOLOGY
08. ANESTHESIOLOGY
09. LABORATORY
10. (not used)
11. CARDIOLOGY
12. THORACIC SURGERY
13. UROLOGY
14. CHIROPRACTOR
15. PODIATRY
16. OTHER SURGICAL
17. OTHER MEDICAL

REGION
9 CENSUS REGIONS

PLACE OF SERVICE
1. OFFICE AND HOME
2. INPATIENT HOSPITAL (INCLUDES SNF)
3. OUTPATIENT HOSPITAL
4. LABORATORY
5. OTHER (AMBULATORY SURGICAL CENTER,
   KIDNEY DISEASE CENTER, OTHER)

Fig. 3 -- Other classification variables

Aggregating data about specific procedures to a procedure cluster reduces the tremendous volume of BMAD data, increasing the efficiency of the model. The synthetic BMAD files constructed from carrier data from the two states contained 112,442 records, whereas the summary file included 1,848 records. Part of this reduction is possible because many possible cells are empty. If all possible cells were present in the summary procedure file, the two-state sample would include 5,600 cells. We estimate that a summary file constructed on the national BMAD data base, in which all geographic regions would be represented, would include about 8,500 observations.
Because each of the procedure clusters includes procedures that require varying levels of resource intensity, however, a simple aggregation of the number of services delivered would be misleading. Therefore, we adopt a numeraire procedure for each cluster, and measure the number of services provided as the number of numeraire equivalent procedures. This requires that we establish a weight for each procedure in a cluster that reflects the number of numeraire equivalents that one unit of the procedure represents. Equivalently, this requires establishing an RVS for all procedures. Given the RVS, the number of numeraire equivalent procedures for procedure $a$ is given by:

$$RVS(a)/RVS(a'),$$

where $a'$ denotes the numeraire procedure for the cluster. The adjusted frequency of procedures in any cluster is then:

$$\sum_{a \in \text{cell}} [RVS(a)/RVS(a')] \times f(a)$$

where $f(a)$ is the frequency of procedure $a$. A similar calculation is made to determine the adjusted frequency for which assignment was accepted. The RVS for the numeraire procedure for each cluster constitutes the baseline RVS file used by the simulation model.

Before turning to a discussion of the construction of the RVS, however, we note one constraint imposed by our approach of creating summary procedure clusters as input data. Relative values of procedures within each cluster are fixed by the initial weights and are immutable in the simulation model. The simulation model does allow the user to investigate changes in the relative fees allowed across procedure clusters and the level of fees allowed for all procedures within a cluster; but the relative fees within a cluster are maintained at the initial weights assigned. Therefore, procedure clusters need to be developed to allow the adjustment of relative values believed distorted by the current system. Thus, for example, we define different procedure clusters for time-intensive (visit) categories and technology-intensive diagnostic procedures, and different clusters for inpatient visits and
outpatient visits. We also treat as separate clusters certain procedures which many believe are currently reimbursed on the basis of fee screens that are too high—such as cataract removal. If, for some reason, the chosen clusters prove inadequate, or if the original weights within a cluster are not appropriate for assessing a particular fee schedule proposal, then the model has the capability to reweight or regroup these clusters.

**Baseline Relative Value Scale**

Ideally, the weights or relative values assigned to each procedure would reflect the efficient marginal cost of producing an additional unit of the procedure. There are several possible approaches to establishing efficient cost weights.

One is to convene a panel of clinicians and develop the weights on the basis of expert opinion. Such an approach is being tried by the Boston University Health Policy Institute (see Egdahl and Manuel, 1985). However, this approach poses important practical difficulties in achieving a consensus among practitioners as to its validity.

A second approach is illustrated in the work of Hsiao and Stason (1979). They developed an RVS based on direct measurement of the resource costs required to produce a unit of a procedure including time spent by the physician, the complexity of the procedure, investment in professional training, and overhead expenses. However, complexity is difficult to measure and many clinicians believe that time, which is the major determinant of the Hsiao-Stason scale, does not adequately determine professional resources. In 1983, the Massachusetts Rate Setting Commission introduced a fee schedule for Medicaid that was based on the Hsiao-Stason model. However, objections from the physician community quickly forced Massachusetts to abandon the new schedule (Egdahl and Manuel, 1985).

A third approach is to develop relative values based on charges. This approach has been often used in developing existing RVSs, the most widely known of which is the California Relative Value Scale. In a competitive market, the market price for a good is set at the marginal cost of production. Thus, if we could assume that the market for medical care is characterized by strong price competition, then charges
would provide appropriate weights or relative values. This assumption is questionable, however, because it is believed that competition has been eroded by widespread insurance coverage (Newhouse, 1981) and that the current CPR system has produced distortions in the relative payment for different procedures.

Nonetheless, some advocates of Medicare reimbursement reform suggest incorporating current charge practices into a fee schedule. Therefore, to illustrate the prototype simulation model, we have used baseline relative values that are based on current national allowed charges. However, even if charges reflect, or are at least proportional to, marginal cost, the average allowed charges nationally for different procedures may vary for reasons unrelated to the relative cost of production. Charges for procedures may vary by geographic area because of differences in factor input prices. Because of differences by physician specialty in human capital investment and the opportunity cost of time, costs and charges for a specific procedure may vary depending on the specialty type of the provider delivering the service. If there is also variation by geographic area or specialty type in the frequency with which different procedures are performed, then the relative weights based on average allowed charges would be distorted. Therefore, in establishing the baseline RVS, we first adjust allowed charges for geographic and specialty price variation, then assign each procedure a weight equal to the adjusted average allowed charge for the procedure.

The baseline relative value for procedure \( a \), \( RV(a) \), we defined as:

\[
RV(a) = \sum_g \sum_s [A(a,g,s) \times 1/p(g) \times 1/p(s)]/f(a,\cdot,\cdot) \tag{1}
\]

where \( A(a,g,s) \) is the aggregate allowed charge for procedure \( a \) performed by physicians of specialty type \( s \) in geographic area \( g \),

\( p(g) \) is the price adjustment for geographic area \( g \),

\( p(s) \) is the price adjustment for specialty \( s \), and

\footnote{We have data from only two carriers for purposes of illustrating the use of the model; for our application, therefore, "national" averages are the averages over the two carriers.}
f(a, *, *) is the number of times procedure a is delivered across all geographic areas and specialties.

**Locality Price Index**

The geographic area used in computing the adjusted allowed charge given in Eq. (1) is the Medicare pricing locality. For each pricing locality, we calculate an adjustment factor or price index that is defined as the aggregate allowed charges that would accrue in the locality for a specified market basket of services relative to the national allowed charges for the same market basket. (The methods used to select the market basket are described later in this section.) The price index for locality (g) is given by:

\[ p(g) = \sum_a \left( \sum_s \left( \frac{A(a,g,s)}{f(a,g,s)} \times f(a,*,s) \right) / A(*,*,*) \right), \]  

where the a refers to procedures in the market basket, g indexes localities, and s indexes specialties.

The standard market basket specifies not only the number of times a specific procedure is performed but also the number of times the procedure is performed by different physician specialists. The market basket distinguishes among specialty types only for medical procedures and surgical procedures, not for radiology, pathology, and anesthesiology, because many of the latter procedures are performed by only one specialty type. Furthermore, Medicare carriers typically do not distinguish among specialty types in establishing fee screens for these procedures. The specialty type distinctions used in defining the market basket are more aggregated than the classification cells in the summary file, because some physician specialists bill very infrequently for medical or surgical procedures, and some procedures are performed primarily by a single specialty type. The specialty classifications used in the market basket are given in Fig. 4.

The market basket used in calculating the price indices is based on a subset of all procedures provided to Medicare beneficiaries. Because the market basket does not include all procedures, the sum of the allowed charges in each locality multiplied by the resultant locality
Medical Procedures

General Practice, Family Practice
General Surgery
Internal Surgery
Ophthalmology
Cardiology
Other Medical
Other Surgical
All Other

Surgical Procedures

General Surgery
Other Surgical Specialty
All Other

Fig. 4 -- Provider specialty types used in developing the market basket

price index may deviate slightly from national allowed charges. We have, therefore, proportionally adjusted all locality indices as computed using Eq. (2), so that the two quantities are equal.

Specialty Adjustment Factors

The specialty adjustment factors are defined in a manner analogous to the locality price indices. The price index or adjustment factor is defined as the aggregate allowed charges that would accrue to the specialty type for a fixed set of procedures relative to the national allowed charges for the same procedure set across all specialty types. The index for specialty type s, p(s), is given by:

\[ p(s) = \Sigma_a [\Sigma_g A(a,g,s) * 1/p(g)] * 1/f(a,*,s) * f(a,*,*)/A(\*,\*,\*) \] (3)

where a designates procedures in the market basket.

Two sets of specialty adjustments were calculated: one the specialty adjustments for medical procedures, the other the specialty adjustments for surgical procedures. Index values were calculated for the specialty types shown in Fig. 4. The index values calculated using Eq. (3) were proportionally adjusted so that the product of allowed
medical or surgical charges for each specialty type times the appropriate index equaled aggregate national allowed charges for medical or surgical care.

Processing of the BMAD Data

An overview of the steps involved in constructing the input data files is shown in Fig. 5. Because of the size of the BMAD procedure file, and because the computation of the baseline RVS, locality price indices, and specialty price indices, requires several passes through the data base, our first step was to reduce the number of records in the BMAD data files by eliminating procedure-specific information about procedures that account for a small fraction of total Medicare allowed charges.

We first identified those procedures in each pricing locality/procedure cluster/specialty type cell that, when ranked in order of allowed charges, accounted for at least 50 percent of total allowed charges in the cell. Taking the union of those procedures across all pricing localities and specialty types, for each pricing locality/procedure cluster/specialty type/place of service classification, we output records containing the specific information about the procedures in the union and one record containing aggregate information about all other procedures. The specific procedures identified in this manner accounted for 81 percent of total Medicare allowed charges. The resultant data base, however, contained only 26 percent as many records as the BMAD data files.

To construct the market basket of procedures used in calculating the locality price index, we identified the procedure and specialty combinations that occurred in all pricing localities. Prices of these combinations for a locality are weighted by the national frequency for each combination, summed, and then divided by national expenditures for all combinations in the market basket. The specialty price indices were calculated using the medical or surgical procedures that were performed by all of the designated specialty types.

Given the locality and specialty price indices, we then compute the baseline RVS. The most frequent procedure in each cluster is the numeraire for the cluster. For each procedure cluster/specialty
Fig. 5 -- Overview of the input data file construction
type/place of service cell, we then aggregate data about the procedures belonging to the cell over all localities in a census region to construct the micromodel summary file, weighting the frequency of a procedure by the ratio of its RVS value to the RVS for the numeraire procedure.

However, we do not have an RVS for the residual categories for each pricing locality/procedure cluster/specialty type/place of service cell. An RVS calculated across all residual categories would be misleading because each residual includes a different mix of services. Therefore, we approximate the number of numeraire equivalents for the residual belonging to a cell in the micromodel summary file as

\[ \sum_g (\text{Allowed charge in residual for locality } g)/(p(g)^s p(s)^R \text{V}(a')) \]

where \( a' \) is the numeraire for the cell. The approximation holds exactly if the average allowed charge for each procedure, deflated by the locality and specialty price index, in the residual set is identical across all pricing localities and specialties. While this is unlikely to hold exactly, the procedures in the residual set are performed infrequently and the approximation will not have much effect on the accuracy of the results. The slight loss in accuracy is far outweighed by the cost savings we can achieve by doing the initial aggregation over infrequent procedures and hence reducing the volume of data to be processed.

Finally, we also constructed a file that includes information about the specific procedures and residual category for each procedure cluster/specialty/type place of service cell aggregated over localities to the geographic region. We have written programs to allow the user to construct revised versions of the procedure cluster summary files on a microcomputer using the regional procedure-specific data. These programs are described next.
Revising Summary Procedure File on the Microcomputer

The microcomputer programs to revise the summary procedure file are user-interactive programs that allow the user to specify new definitions of the procedure cluster, or to revise the RVS used in establishing the number of numeraire equivalent procedures. The programs then construct the new aggregate procedure cluster file and a file including the user established RVS for the numeraire, which is the baseline RVS file used in the simulation model.

Summary Provider File

Records in the summary provider file contain data about the procedures in a procedure cluster provided by a specific provider of care. The variables in the file include information about the provider (specialty, region) and information about the providers' aggregate billed and allowed charges for procedures in the procedure cluster, the number of services for which assignment was accepted, and the number of services delivered. The number of services is measured in numeraire equivalent units using the baseline RVS described above. The summary provider file is constructed using the BMAD provider file.

THE SIMULATION MODEL

An overview of the simulation model is given in Fig. 6. The model is a user-interactive system of programs that prompts the user with a series of menus to describe the basic elements of the reimbursement policy to be tested.

When the user initiates a session, the first menu is a series of processing options: the core model option prompts for characteristics of the reimbursement policy and calculates Medicare reimbursements, beneficiary out-of-pocket liability, and physician revenue given the reimbursement policy; the physician distribution model option calculates the distribution of physicians by the change in physician revenue using the last specified reimbursement policy; the additional reports option generates new reports using the last specified reimbursement policy.
Fig. 6 -- Overview of the simulation model
Fig. 6--continued
CHEKA.PRG
manages search for necessary files and programs

SEEK.PRG
searches for necessary programs and files

PROCBUILD.PRG
when possible, builds missing files at user's request

Fig. 6--continued
During the initial run of each session, the model also checks to ensure that all necessary data files are present (CHKA.PRG); if not, the model calls a subroutine that will construct missing files at the user's request.

**Core Model**

The core model presents the user with a series of options to define the components of the fee schedule (ADJUST.PRG), including the RVS, the specialty adjustments, and the geographic adjustments. The system retains two values for each of these factors: the baseline factors and the factors used in the most recent session. The user is presented with a series of menus allowing him or her to use the baseline factors (described earlier), the most recent factors (the baseline factors in the first session, the factors used most recently in subsequent sessions), or to input new factors. The user is also given the option of eliminating the specialty and geographic area adjustments.

The input baseline geographic adjustments are for each Medicare pricing locality. The geographic unit in the summary procedure file, however, is a census region. The system of programs calculates regional price indices as the weighted average of the indices for all localities in the region where the weights are the ratio of total allowed charges in the locality to total allowed charges in the region. The user options to modify the geographic adjustment factors include: new index values for each locality; new index values for each region and with proportionate adjustment of the indices for all localities; new regional indices and elimination of locality differentials; or eliminating geographic adjustment factors.

Once the RVS and adjustment factors have been defined, the core model calls another subprogram to establish the conversion factor (TARGET.PRG). The user can specify a fixed conversion factor (for example, to test the effects of a set list of prices), or can request that the conversion factor be calculated to achieve a specified level of Medicare physician payments (expressed in percent changes from the expenditures in the input data files). This module also prompts the user for the elasticity of the assignment rate with respect to allowed
charges. Thus, the model enables the user to simulate the effects of reimbursement policy under varying assumptions about how physicians' decisions about whether to accept assignment will be affected by changes in policy.\footnote{In Sec. V, we briefly review the literature suggesting the magnitude of this response.}

The RVS, adjustment factors, and conversion factor define the fee schedule for each cell in the summary procedure file. The model then calculates the Medicare expenditures, beneficiary out-of-pocket liability, and physician revenue for each cell in the summary procedure file based on the user defined fee-schedule (GROSS.PRG). If the user specifies a level of Medicare physician expenditures, the model initially processes all records using a conversion factor of one, then calculates the correct conversion factor given the specified expenditures and adjusts the estimates using the correct conversion factor (NETTER.PRG). If the elasticity of the assignment rate with respect to allowed charges has been set at a positive value, the model calls another subprogram to determine the new assignment rate in each cell given the estimated allowed charges for the cell under the reimbursement policy, and recalculates beneficiary liability and physician revenue (ELAST.PRG).

The formulas used in the computations are given in Fig. 7. Several assumptions underly the computations. As we noted in Sec. II, the BMAD data files do not allow us to determine the amount of allowed charges that count toward beneficiaries' deductible. As a result, the calculation of the Medicare reimbursement amount shown in Fig. 6 overstates the actual reimbursement because it does not subtract out the beneficiaries' deductible. Similarly, the beneficiary liability calculation understates the true liability since it fails to account for the deductible. Consequently, the reports from the model present all results in terms of changes in Medicare expenditures and beneficiary burden from the current levels (in the input data base), assuming that the aggregate amount of allowed charges applied toward the deductible is unchanged by reimbursement policy. The reports from the model, however, also include the percent change in program expenditures and in
Price (Fee Schedule) For Each Cell = RVS (Numeraire) * Locality Adjustment * Specialty Adjustment * Conversion Factor

Allowed Charge For Cell = Price * Number of Numeraire Equivalent Procedures

Medicare Reimbursement = Allowed Charge * Reimbursement Rate

Beneficiary Liability = % Services Assignment Accepted * (1-Reimbursement Rate) * Allowed Charge + (1- % Services Assignment Accepted) * (Billed Charges - Reimbursement Rate * Allowed Charge)

Physician Revenue = % Services Assignment Accepted * Allowed Charge + (1- % Services Assignment Accepted) * Billed Charges

Fig. 7 -- Calculating effects of new reimbursement policy
beneficiary liability. Because the denominators in these calculations do not account for the deductible, estimates of the percent change in program expenditures are too small (in absolute value) and estimates of the percent change in beneficiary liability are too high (in absolute value). Based on published data concerning Medicare allowed charges and reimbursements, we estimate the bias to be about 10 percent (Sawyer et al., 1983).

Our estimates of changes in physician revenue assume that the current average level of allowed charges for physicians who accept assignment is the same as the average level for physicians who do not. If the current level of allowed charges for physicians who accept assignment is lower than for those who do not, there is a negative bias in the estimated change in both physician revenue and beneficiary liability. In other words, we assume that physicians accepting assignment are now paid, on average, the mean allowed charge for all physicians. If they are in fact now paid less, a few schedule that pays them this mean amount will increase their overall revenues by more than the model predicts. If a positive elasticity of the assignment rate is assumed, then our estimates also assume that the average current level of billed charges is the same for physicians who do and do not accept assignment. If physicians who do not accept assignment currently bill at higher rates than those who accept assignment, then there is a positive bias in the estimates of charges in physician revenue and beneficiary liability. In other words, if physicians not now accepting assignment (who might be drawn into accepting assignment if allowed charges increase) bill at higher rates than the average physician, then physician revenues increase by less than the model predicts as these physicians are induced to accept assignment. Similarly, predicted decreases in physician revenue are too small. Beneficiary burden also falls by more or increases by less than the model predicts. While these biases are a potential distortion in the model, the best available evidence indicates that physicians accepting assignment do in fact

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6 If the elasticity is zero, billed charges do not affect the change in physician revenue or beneficiary liability.
bill at almost exactly the same rate that those not accepting
assignment. Consequently, these potential biases are of negligible
importance.

Finally, we assume that billed charges in any cell will rise to the
level of allowed charges; however, we do not assume a reduction in the
level of billed charges if the fee schedule reduces allowed charges for
a cell. This assumption, coupled with the assumption that physicians'
practice styles do not respond to changes in the fee schedule, means
that physicians' revenues and beneficiaries' liability can be
substantially increased if the new fee schedule radically modifies
existing relative values. This effect is illustrated in the next
section.

The final module of the core model prompts the user for the types
of reports to be generated and calls subroutines that format and print
the reports. Results can be summarized and reported for geographic
regions, by specialty type of physician, by the place in which services
were delivered, or by procedure cluster. Illustrative examples of the
output are given in the next section.

Physician Distribution Model

The physician distribution model uses the fee schedule components
calculated in the most recent run of the core model to examine the
distribution of physicians by changes in physician revenue. For each
record in the summary physician file, the model calculates physician
revenue given the previously specified RVS, adjustment factors,
conversion factor, and assignment rate elasticity (DOCTOR.PRG). For
each physician in the file, the revenue derived from each procedure
cluster is aggregated to obtain total revenue for the physician.
Physician specific assignment rates are used in this calculation. The
model then calls a module that prompts the user for the desired output,
generates the formatted reports, and prints the results. Results may be
requested giving the distribution of physicians by the percent change in
revenue in each geographic region or for each specialty type.

As we noted, in Sec. II, the BMAD physician file, and consequently
the micromodel summary physician file, may not include complete history
data for physicians who have multiple practice locations; the BMAD file is a sample of physician/practice locations. The results from the simulation model assume that a practice location provides a representative sample of a physician's total practice.
IV. SIMULATION RESULTS

In this section, we illustrate the application of the model and its outputs by simulating the effects of two prototype fee-schedules. The input data are constructed from the synthetic BMAD files for the states of South Carolina and Washington. One fee schedule that we examine uses the baseline relative values, which are based on average allowed charges. The other is an adaptation of the Hsiao-Stason (1979) schedule. In both examples, we use the baseline locality and specialty price differentials and fix the fee schedules so that Medicare expenditures are unchanged.

AVERAGE ALLOWED CHARGE FEE SCHEDULE

Changes in Medicare expenditures for each of the procedure clusters using the average allowed charge fee-schedule are shown in Table 1. As we would expect, there are only modest adjustments in amounts paid for various procedures when the fee-schedule is based on current charge practices. The small variations that do occur reflect the fact that geographic and specialty differentials in charges allowed for various procedures are not constant under the CPR system, and the revised fee schedule uses the average locality and specialty differentials across all procedures.

Changes in Medicare expenditures by specialty type of provider are somewhat more pronounced (Table 2), again because the revised fee schedule uses a constant specialty adjustment based on the average differential in allowed charges among specialists. For example, in the two states for which we have data, internists receive a premium over other specialties for performing the same procedure, but this premium is lower for visits than for other types of procedures. The specialty indices are computed using a market basket that reflects the frequency with which procedures are performed across all specialty types. The ratio of visits to other medical procedures in this market basket is lower than the ratio of visits to other medical procedures performed by internists. The specialty price differential for internists, therefore,
is weighted toward those procedures for which they receive higher relative prices, but bill for less frequently, than visits. Consequently, the high differential results in increased payments to internists for office visits. Because changes in Medicare allowed charges do not affect revenues of physicians who bill patients directly, variation in revenue changes among specialty types is smaller than variation in Medicare payments.

The new fee-schedule results in a small decrease in beneficiary liability (Table 3). This is attributable to small effects on the distribution of benefits by state and differences in the rate of assignment between the states.

The outputs from the physician distribution component of the model are illustrated in Tables 4 and 5, which give the distribution of physicians by the percent of change in revenue. Table 4 shows results by geographic area, Table 5 by specialty type of provider. The results we have presented are obtained using data based on a random sample of physicians in each state; the sample includes 581 physicians, about 10 percent of physicians submitting bills to Medicare in the two states.¹

**COST-BASED FEE SCHEDULE**

The cost-based fee schedule is an adaptation of the RVS developed by Hsiao and Stason (1979), which established relative values based on estimates of resource intensity. For surgical procedure clusters, the relative values we use are those given by Hsiao-Stason for the numeraire procedure of the cluster; the relative value for inguinal hernia repair (the numeraire for procedure cluster 44) is standardized to 100. If the numeraire procedure was not included in the Hsiao-Stason Scale, we selected another procedure in the cluster, and used the Hsiao-Stason relative value divided by the cluster weight for the procedure. If the Hsiao-Stason Scale did not include any procedures contained in a

¹ Because we demonstrated the model on a sample, we used imputed assignment rates, rather than actual assignment rates, that are consistent with assignment rates for region, specialty, and procedure in the main summary procedure file. However, because the physician summary file is a sample file, the aggregate change in physician revenue, and the percent change in physician revenue, will not correspond with the main procedure file results.
Table 1

CHANGES IN MEDICARE EXPENDITURES BY PROCEDURE CLUSTER:
AVERAGE ALLOWED CHARGE FEE SCHEDULE

<table>
<thead>
<tr>
<th>cluster code</th>
<th>description..................</th>
<th>numerator description.............</th>
<th>relative value</th>
<th>change Medicare expenditures $</th>
<th>percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Office Vsts, non-ment</td>
<td>Limited visit, established pt.</td>
<td>17.362</td>
<td>9,531</td>
<td>0.021</td>
</tr>
<tr>
<td>02</td>
<td>ER Visits</td>
<td>Intermediate service, new pt.</td>
<td>34.368</td>
<td>-11,528</td>
<td>-0.507</td>
</tr>
<tr>
<td>03</td>
<td>Ambulatory Mental</td>
<td>Psychotherapy, 45-50 min.</td>
<td>36.124</td>
<td>-2,385</td>
<td>-0.547</td>
</tr>
<tr>
<td>04</td>
<td>Hospital Visits</td>
<td>Limited service follow-up vst.</td>
<td>19.476</td>
<td>431,914</td>
<td>0.986</td>
</tr>
<tr>
<td>05</td>
<td>SNF Visits</td>
<td>M094000</td>
<td>16.210</td>
<td>35,962</td>
<td>1.068</td>
</tr>
<tr>
<td>07</td>
<td>Dialysis</td>
<td>M094000</td>
<td>252.844</td>
<td>5,515</td>
<td>0.352</td>
</tr>
<tr>
<td>08</td>
<td>EKG</td>
<td>CPT 93000</td>
<td>29.606</td>
<td>103,778</td>
<td>3.365</td>
</tr>
<tr>
<td>09</td>
<td>Other Cardiovascular</td>
<td>CPT 93947</td>
<td>949.881</td>
<td>92,817</td>
<td>2.377</td>
</tr>
<tr>
<td>11</td>
<td>Other Diagnostic</td>
<td>Critical care diagnostic serv</td>
<td>71.392</td>
<td>6,414</td>
<td>0.192</td>
</tr>
<tr>
<td>12</td>
<td>Therapeutic Services</td>
<td>Therapeutic injection</td>
<td>27.011</td>
<td>29,955</td>
<td>1.831</td>
</tr>
<tr>
<td>20</td>
<td>Chest X-rays</td>
<td>CPT 71020</td>
<td>33.216</td>
<td>-32,016</td>
<td>-0.551</td>
</tr>
<tr>
<td>21</td>
<td>Other X-rays</td>
<td>CPT 71240</td>
<td>73.551</td>
<td>-113,826</td>
<td>-0.703</td>
</tr>
<tr>
<td>22</td>
<td>Other Radiology</td>
<td>CPT 77410</td>
<td>63.549</td>
<td>-64,952</td>
<td>-0.741</td>
</tr>
<tr>
<td>30</td>
<td>Uralysis</td>
<td>CPT 81000</td>
<td>9.546</td>
<td>-10,100</td>
<td>-0.606</td>
</tr>
<tr>
<td>31</td>
<td>Blood Chemistry</td>
<td>Multichannel, 19+ tests</td>
<td>15.501</td>
<td>-39,941</td>
<td>-0.612</td>
</tr>
<tr>
<td>32</td>
<td>Cell Counts</td>
<td>Hemogram, complete CBC</td>
<td>9.500</td>
<td>-14,055</td>
<td>-0.572</td>
</tr>
<tr>
<td>33</td>
<td>Other Hematology</td>
<td>Prothrombin time</td>
<td>7.424</td>
<td>-6,885</td>
<td>-0.559</td>
</tr>
<tr>
<td>34</td>
<td>Pap Smears</td>
<td>CPT 88150</td>
<td>7.971</td>
<td>-150</td>
<td>-0.109</td>
</tr>
<tr>
<td>35</td>
<td>Collection</td>
<td>CPT 99000</td>
<td>2.305</td>
<td>-3,809</td>
<td>-0.718</td>
</tr>
<tr>
<td>36</td>
<td>Organ/Disease Panels</td>
<td>Antibody Panel</td>
<td>17.530</td>
<td>12,327</td>
<td>1.039</td>
</tr>
<tr>
<td>37</td>
<td>Other Pathology</td>
<td>Surgical Pathology CPT 88304</td>
<td>32.226</td>
<td>-36,950</td>
<td>-0.814</td>
</tr>
<tr>
<td>40</td>
<td>Coronary Artery By-P</td>
<td>CPT 33512</td>
<td>387.197</td>
<td>32,325</td>
<td>0.472</td>
</tr>
<tr>
<td>41</td>
<td>UGI Endoscopy</td>
<td>CPT 43255</td>
<td>294.695</td>
<td>-9,580</td>
<td>-0.403</td>
</tr>
<tr>
<td>42</td>
<td>TUR</td>
<td>CPT 52601</td>
<td>947.858</td>
<td>-55,036</td>
<td>-1.102</td>
</tr>
<tr>
<td>43</td>
<td>Cataract Removal</td>
<td>CPT 66920</td>
<td>865.287</td>
<td>-6,022</td>
<td>-0.058</td>
</tr>
<tr>
<td>44</td>
<td>Other ASC Procedures</td>
<td>Inguinal hernia repair</td>
<td>463.300</td>
<td>-30,447</td>
<td>-0.241</td>
</tr>
<tr>
<td>45</td>
<td>Musculoskeletal</td>
<td>Total Hip Replacement</td>
<td>1891.927</td>
<td>-50,040</td>
<td>-0.256</td>
</tr>
<tr>
<td>46</td>
<td>Cardiovascular</td>
<td>Thromboendarterectomy</td>
<td>1437.318</td>
<td>-29,362</td>
<td>-0.255</td>
</tr>
<tr>
<td>47</td>
<td>Digestive</td>
<td>Colectomy</td>
<td>1073.210</td>
<td>-51,658</td>
<td>-0.387</td>
</tr>
<tr>
<td>48</td>
<td>Urinary System</td>
<td>CPT 52100</td>
<td>108.956</td>
<td>-13,390</td>
<td>-0.394</td>
</tr>
<tr>
<td>49</td>
<td>Other Eye</td>
<td>Lens Implantation</td>
<td>1385.006</td>
<td>-49,940</td>
<td>-0.261</td>
</tr>
<tr>
<td>50</td>
<td>Other Surgery</td>
<td>Mastectomy</td>
<td>824.201</td>
<td>-26,690</td>
<td>-0.198</td>
</tr>
<tr>
<td>60</td>
<td>Anesthesiology ASC</td>
<td>Repair inguinal hernia</td>
<td>153.140</td>
<td>-13,835</td>
<td>-0.632</td>
</tr>
<tr>
<td>61</td>
<td>Other Anesthesiology</td>
<td>Lens Implantation</td>
<td>202.375</td>
<td>-79,941</td>
<td>-0.870</td>
</tr>
</tbody>
</table>

Total 0 0.000

* Percent changes are too low (in absolute value) because deductibles are not considered in making these computations.
Table 2

CHANGE IN MEDICARE EXPENDITURES AND PHYSICIAN REVENUE BY SPECIALTY:
AVERAGE ALLOWED CHARGE FEE SCHEDULE

<table>
<thead>
<tr>
<th>Specialty code</th>
<th>Description</th>
<th>Change Medicare expenditures $</th>
<th>Change*</th>
<th>Change physician revenue $</th>
<th>Change revenue %</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>GPs and FPS</td>
<td>-1,458,760</td>
<td>-4.289</td>
<td>-528,680</td>
<td>-1.004</td>
</tr>
<tr>
<td>02</td>
<td>General Surgery</td>
<td>-650,572</td>
<td>-1.570</td>
<td>-408,690</td>
<td>-1.114</td>
</tr>
<tr>
<td>03</td>
<td>Internal Medicine</td>
<td>5,120,025</td>
<td>11.204</td>
<td>2,257,157</td>
<td>3.323</td>
</tr>
<tr>
<td>04</td>
<td>Orthopedic Surgery</td>
<td>-113,975</td>
<td>-0.627</td>
<td>-92,613</td>
<td>-0.352</td>
</tr>
<tr>
<td>05</td>
<td>Ophthalmology</td>
<td>-11,293</td>
<td>-0.043</td>
<td>-92,091</td>
<td>-0.245</td>
</tr>
<tr>
<td>06</td>
<td>Radiology</td>
<td>-314,992</td>
<td>-1.567</td>
<td>-86,090</td>
<td>-0.302</td>
</tr>
<tr>
<td>07</td>
<td>Pathology</td>
<td>-24,022</td>
<td>-0.824</td>
<td>-15,864</td>
<td>-0.397</td>
</tr>
<tr>
<td>08</td>
<td>Anesthesiology</td>
<td>30,670</td>
<td>0.221</td>
<td>16,862</td>
<td>0.100</td>
</tr>
<tr>
<td>09</td>
<td>Laboratory</td>
<td>-199,390</td>
<td>-4.244</td>
<td>-69,565</td>
<td>-1.068</td>
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<td>11</td>
<td>Cardiology</td>
<td>-831,141</td>
<td>-7.536</td>
<td>-416,805</td>
<td>-2.592</td>
</tr>
<tr>
<td>12</td>
<td>Thoracic Surgery</td>
<td>143,107</td>
<td>2.131</td>
<td>-87,585</td>
<td>-0.947</td>
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<tr>
<td>13</td>
<td>Urology</td>
<td>23,492</td>
<td>0.187</td>
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<td>0.355</td>
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<tr>
<td>14</td>
<td>Chiropractor</td>
<td>499</td>
<td>13.851</td>
<td>462</td>
<td>9.179</td>
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<tr>
<td>15</td>
<td>Podiatry</td>
<td>-42,861</td>
<td>-1.420</td>
<td>-23,278</td>
<td>-0.546</td>
</tr>
<tr>
<td>16</td>
<td>Other Surgical</td>
<td>10,941</td>
<td>0.161</td>
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<td>-0.278</td>
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<tr>
<td>17</td>
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<td>-1,845,727</td>
<td>-3.855</td>
<td>-754,853</td>
<td>-1.067</td>
</tr>
<tr>
<td>Totals...</td>
<td></td>
<td>0</td>
<td>0.000</td>
<td>-304,572</td>
<td>-0.074</td>
</tr>
</tbody>
</table>

* Percent changes are too low (in absolute value) because deductibles are not considered in making these computations.
Table 3

CHANGE IN MEDICARE EXPENDITURES, PHYSICIAN REVENUE, AND BENEFICIARY LIABILITY: AVERAGE ALLOWED CHARGE FEE SCHEDULE

<table>
<thead>
<tr>
<th>region code</th>
<th>description</th>
<th>change Medicare expenditures $</th>
<th>change expend %</th>
<th>change beneficiary burden $</th>
<th>change burden %</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>South Carolina</td>
<td>-459,118</td>
<td>-0.613</td>
<td>-425,853</td>
<td>-1.403</td>
</tr>
<tr>
<td>10</td>
<td>Washington</td>
<td>459,118</td>
<td>0.220</td>
<td>121,281</td>
<td>0.127</td>
</tr>
<tr>
<td>Totals...</td>
<td></td>
<td>0</td>
<td>0.000</td>
<td>-304,572</td>
<td>-0.242</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>region code</th>
<th>description</th>
<th>change physician revenue $</th>
<th>change revenue %</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>South Carolina</td>
<td>-884,971</td>
<td>-0.841</td>
</tr>
<tr>
<td>10</td>
<td>Washington</td>
<td>580,399</td>
<td>0.191</td>
</tr>
<tr>
<td>Totals...</td>
<td></td>
<td>-304,572</td>
<td>-0.074</td>
</tr>
</tbody>
</table>

* Percent changes are too low (in absolute value) because deductibles are not considered in making these computations.

** Percent changes are too high (in absolute value) because deductibles are not considered in making these computations.
Table 4
PERCENT OF PHYSICIANS BY CHANGE IN REVENUE AND REGION:
AVERAGE ALLOWED CHARGE FEE SCHEDULE

<table>
<thead>
<tr>
<th>region code</th>
<th>description</th>
<th>-10.0% or more</th>
<th>-9.9% to -4.9%</th>
<th>-4.9% to -0.1</th>
<th>-0.1 to +0.1</th>
<th>+0.1 to +5.0</th>
<th>+5.0 to +10.0%</th>
<th>+10.0% or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>Washington</td>
<td>0.75</td>
<td>3.01</td>
<td>46.87</td>
<td>1.25</td>
<td>35.09</td>
<td>5.51</td>
<td>7.52</td>
</tr>
<tr>
<td>Totals...</td>
<td></td>
<td>1.72</td>
<td>5.16</td>
<td>43.72</td>
<td>2.58</td>
<td>32.36</td>
<td>5.85</td>
<td>8.61</td>
</tr>
</tbody>
</table>

Table 5
PERCENT OF PHYSICIANS BY CHANGE IN REVENUE AND SPECIALTY:
AVERAGE ALLOWED CHARGE FEE SCHEDULE

<table>
<thead>
<tr>
<th>specialty code</th>
<th>description.........</th>
<th>-10.0% or more</th>
<th>-9.9% to -4.9%</th>
<th>-4.9% to -0.1</th>
<th>-0.1 to +0.1</th>
<th>+0.1 to +5.0</th>
<th>+5.0 to +10.0%</th>
<th>+10.0% or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>GPs and FPs</td>
<td>0.00</td>
<td>2.99</td>
<td>61.68</td>
<td>0.60</td>
<td>26.35</td>
<td>4.19</td>
<td>4.19</td>
</tr>
<tr>
<td>02</td>
<td>General Surgery</td>
<td>3.12</td>
<td>12.50</td>
<td>50.00</td>
<td>3.12</td>
<td>25.00</td>
<td>3.12</td>
<td>3.12</td>
</tr>
<tr>
<td>03</td>
<td>Internal Medicine</td>
<td>0.00</td>
<td>0.00</td>
<td>5.63</td>
<td>1.41</td>
<td>66.20</td>
<td>16.90</td>
<td>9.86</td>
</tr>
<tr>
<td>04</td>
<td>Orthopedic Surgery</td>
<td>0.00</td>
<td>4.00</td>
<td>68.00</td>
<td>0.00</td>
<td>28.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>05</td>
<td>Ophthalmology</td>
<td>0.00</td>
<td>0.00</td>
<td>50.00</td>
<td>0.00</td>
<td>36.36</td>
<td>4.55</td>
<td>9.09</td>
</tr>
<tr>
<td>06</td>
<td>Radiology</td>
<td>0.00</td>
<td>5.88</td>
<td>47.06</td>
<td>5.88</td>
<td>17.65</td>
<td>5.88</td>
<td>17.65</td>
</tr>
<tr>
<td>07</td>
<td>Pathology</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>25.00</td>
<td>0.00</td>
<td>25.00</td>
<td>50.00</td>
</tr>
<tr>
<td>08</td>
<td>Anesthesiology</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>09</td>
<td>Laboratory</td>
<td>0.00</td>
<td>0.00</td>
<td>55.56</td>
<td>0.00</td>
<td>44.44</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>11</td>
<td>Cardiology</td>
<td>0.00</td>
<td>0.00</td>
<td>85.71</td>
<td>0.00</td>
<td>14.29</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>12</td>
<td>Thoracic Surgery</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>100.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>13</td>
<td>Urology</td>
<td>8.33</td>
<td>0.00</td>
<td>33.33</td>
<td>0.00</td>
<td>50.00</td>
<td>0.00</td>
<td>8.33</td>
</tr>
<tr>
<td>14</td>
<td>Chiropractor</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
</tr>
<tr>
<td>15</td>
<td>Podiatry</td>
<td>7.69</td>
<td>0.00</td>
<td>38.46</td>
<td>0.00</td>
<td>30.77</td>
<td>15.38</td>
<td>7.69</td>
</tr>
<tr>
<td>16</td>
<td>Other Surgical</td>
<td>1.79</td>
<td>3.57</td>
<td>32.14</td>
<td>5.36</td>
<td>48.21</td>
<td>3.57</td>
<td>5.36</td>
</tr>
<tr>
<td>17</td>
<td>Other Medical</td>
<td>4.58</td>
<td>12.98</td>
<td>43.51</td>
<td>5.34</td>
<td>19.85</td>
<td>5.34</td>
<td>8.40</td>
</tr>
<tr>
<td>Totals...</td>
<td></td>
<td>1.72</td>
<td>5.16</td>
<td>43.72</td>
<td>2.58</td>
<td>32.36</td>
<td>5.85</td>
<td>8.61</td>
</tr>
</tbody>
</table>

NOTE: No chiropractors were in the sample of physicians.

surgical procedure cluster, we used the baseline relative value standardized to inguinal hernia repair (cluster 44). For pathology, radiology, anesthesiology and medical procedures other than the visit categories (clusters 1-5), we also used the baseline relative value, standardized to cluster 44. Cluster category 1, in which limited visit for an established patient was the numeraire procedure, was assigned Hsiao-Stason value for a routine, brief office visit. For the other
visit clusters, we used the ratio of the baseline relative value for the cluster to that of cluster category 1, multiplied by the new RVS for category 1. The actual RVS scale is shown in Table 6.

Relative to the Hsiao-Stason Scale, visits are currently undervalued relative to other procedures by a factor of almost 2.5. As a result, the cost-based fee schedule results in very large increases in Medicare expenditures for visits and corresponding reductions in expenditures for other procedures (Table 6). Payments for the services of primary care providers (internists and general practitioners) rise substantially, with corresponding decreases in payments to other providers (Table 7). Physician revenues and beneficiary liability both increase substantially (Table 8). This is because the model assumes that billed charges rise to the level of Medicare allowed charges, but that billed charges do not fall when allowed charges are decreased. This result also obtains because the model assumes no change in the service mix even though relative values have been adjusted significantly.
<table>
<thead>
<tr>
<th>Cluster Code</th>
<th>Description</th>
<th>Numeraire Description</th>
<th>Relative Value</th>
<th>Change in Medicare Expenditures $</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Office Vts., non-ment</td>
<td>Limited visit, established pt.</td>
<td>9.000</td>
<td>28,967,408</td>
<td>62.348</td>
</tr>
<tr>
<td>02</td>
<td>ER Visits</td>
<td>Intermediate service, new pt.</td>
<td>17.810</td>
<td>1,396,032</td>
<td>61.443</td>
</tr>
<tr>
<td>03</td>
<td>Ambulatory Mental</td>
<td>Psychotherapy, 45-50 min.</td>
<td>18.720</td>
<td>267,669</td>
<td>61.378</td>
</tr>
<tr>
<td>04</td>
<td>Hospital Visits</td>
<td>Limited service follow-up vst.</td>
<td>10.090</td>
<td>27,967,942</td>
<td>63.819</td>
</tr>
<tr>
<td>05</td>
<td>SNF Visits</td>
<td>M040000</td>
<td>8.390</td>
<td>2,147,630</td>
<td>63.798</td>
</tr>
<tr>
<td>07</td>
<td>Dialysis</td>
<td>M049000</td>
<td>54.580</td>
<td>-504,559</td>
<td>-32.181</td>
</tr>
<tr>
<td>08</td>
<td>EKG</td>
<td>CPT 93000</td>
<td>6.380</td>
<td>-2,403,291</td>
<td>-31.602</td>
</tr>
<tr>
<td>09</td>
<td>Other Cardiovascular</td>
<td>CPT 93547</td>
<td>118.680</td>
<td>-1,203,210</td>
<td>-30.813</td>
</tr>
<tr>
<td>11</td>
<td>Other Diagnostic</td>
<td>Critical care diagnostic serv</td>
<td>15.410</td>
<td>-1,076,598</td>
<td>-32.282</td>
</tr>
<tr>
<td>12</td>
<td>Therapeutic Services</td>
<td>Therapeutic injection</td>
<td>5.830</td>
<td>-510,129</td>
<td>-31.179</td>
</tr>
<tr>
<td>20</td>
<td>Chest X-rays</td>
<td>CPT 71020</td>
<td>7.170</td>
<td>-1,903,919</td>
<td>-32.782</td>
</tr>
<tr>
<td>21</td>
<td>Other X-rays</td>
<td>CPT 74240</td>
<td>15.870</td>
<td>-5,327,492</td>
<td>-32.913</td>
</tr>
<tr>
<td>22</td>
<td>Other Radiology</td>
<td>CPT 71410</td>
<td>13.710</td>
<td>-2,886,976</td>
<td>-32.948</td>
</tr>
<tr>
<td>30</td>
<td>Urinalysis</td>
<td>CPT 81000</td>
<td>1.200</td>
<td>-544,176</td>
<td>-32.660</td>
</tr>
<tr>
<td>31</td>
<td>Blood Chemistry</td>
<td>Multichannel, 19+ tests</td>
<td>3.350</td>
<td>-2,113,192</td>
<td>-32.744</td>
</tr>
<tr>
<td>32</td>
<td>Cell Counts</td>
<td>Hemogram, complete CBC</td>
<td>2.050</td>
<td>-805,753</td>
<td>-32.818</td>
</tr>
<tr>
<td>33</td>
<td>Other Hematology</td>
<td>Prothrombin time</td>
<td>1.600</td>
<td>-405,185</td>
<td>-32.893</td>
</tr>
<tr>
<td>34</td>
<td>Pap Smears</td>
<td>CPT 88150</td>
<td>1.720</td>
<td>-44,771</td>
<td>-32.494</td>
</tr>
<tr>
<td>35</td>
<td>Collection</td>
<td>CPT 90000</td>
<td>0.630</td>
<td>-172,824</td>
<td>-32.579</td>
</tr>
<tr>
<td>37</td>
<td>Other Pathology</td>
<td>Surgical Pathology CPT 88304</td>
<td>6.950</td>
<td>-1,499,203</td>
<td>-33.020</td>
</tr>
<tr>
<td>40</td>
<td>Coronary Artery By-P</td>
<td>CPT 33512</td>
<td>835.740</td>
<td>-2,196,984</td>
<td>-32.095</td>
</tr>
<tr>
<td>41</td>
<td>UGI Endoscopy</td>
<td>CPT H3235</td>
<td>52.810</td>
<td>-777,230</td>
<td>-32.694</td>
</tr>
<tr>
<td>42</td>
<td>TUR</td>
<td>CPT 52601</td>
<td>190.000</td>
<td>-1,894,492</td>
<td>-37.925</td>
</tr>
<tr>
<td>43</td>
<td>Cataract Removal</td>
<td>CPT 66920</td>
<td>260.000</td>
<td>-75,717</td>
<td>-6.393</td>
</tr>
<tr>
<td>44</td>
<td>Other ASC Procedures</td>
<td>Inguinal hernia repair</td>
<td>100.000</td>
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<tr>
<td>45</td>
<td>Musculoskeletal</td>
<td>Total Hip Replacement</td>
<td>408.350</td>
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<td>-32.657</td>
</tr>
<tr>
<td>46</td>
<td>Cardiovascular</td>
<td>Thromboendarterectomy</td>
<td>310.230</td>
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<td>-32.588</td>
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<tr>
<td>47</td>
<td>Digestive</td>
<td>Colectomy</td>
<td>232.360</td>
<td>-4,334,023</td>
<td>-32.468</td>
</tr>
<tr>
<td>48</td>
<td>Urinary System</td>
<td>CPT 52100</td>
<td>23.410</td>
<td>-1,270,071</td>
<td>-32.646</td>
</tr>
<tr>
<td>49</td>
<td>Other Eye</td>
<td>Lens Implantation</td>
<td>300.300</td>
<td>-6,170,512</td>
<td>-32.285</td>
</tr>
<tr>
<td>50</td>
<td>Other Surgery</td>
<td>Mastectomy</td>
<td>177.890</td>
<td>-4,386,041</td>
<td>-32.552</td>
</tr>
<tr>
<td>60</td>
<td>Anesthesiology ASC</td>
<td>Repair inguinal hernia</td>
<td>33.050</td>
<td>-718,829</td>
<td>-32.851</td>
</tr>
<tr>
<td>61</td>
<td>Other Anesthesiology</td>
<td>Lens Implantation</td>
<td>43.600</td>
<td>-3,933,807</td>
<td>-32.993</td>
</tr>
</tbody>
</table>

Total: 0 0.000

* Percent changes are too low (in absolute value) because deductibles are not considered in making these computations.
Table 7
CHANGE IN MEDICARE EXPENDITURES AND PHYSICIAN REVENUE BY SPECIALTY:
COST-BASED FEE SCHEDULE

<table>
<thead>
<tr>
<th>Specialty Code</th>
<th>Specialty Description</th>
<th>Change Medicare Expenditures $</th>
<th>Change Medicare Expend. %</th>
<th>Change Physician Revenue $</th>
<th>Change Physician Revenue %</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>GPs and FPSS</td>
<td>9,735,967</td>
<td>27.936</td>
<td>9,051,366</td>
<td>17.214</td>
</tr>
<tr>
<td>02</td>
<td>General Surgery</td>
<td>-6,876,610</td>
<td>-23.967</td>
<td>-3,229,321</td>
<td>-8.018</td>
</tr>
<tr>
<td>03</td>
<td>Internal Medicine</td>
<td>21,895,950</td>
<td>47.914</td>
<td>23,733,070</td>
<td>34.944</td>
</tr>
<tr>
<td>04</td>
<td>Orthopedic Surgery</td>
<td>-4,184,980</td>
<td>-23.010</td>
<td>-1,732,857</td>
<td>-6.582</td>
</tr>
<tr>
<td>05</td>
<td>Ophthalmology</td>
<td>-2,954,381</td>
<td>-11.269</td>
<td>906,800</td>
<td>2.411</td>
</tr>
<tr>
<td>06</td>
<td>Radiology</td>
<td>-6,275,283</td>
<td>-31.228</td>
<td>-2,839,668</td>
<td>-9.949</td>
</tr>
<tr>
<td>07</td>
<td>Pathology</td>
<td>-956,495</td>
<td>-32.795</td>
<td>-715,346</td>
<td>-17.916</td>
</tr>
<tr>
<td>08</td>
<td>Anesthesiology</td>
<td>-4,600,344</td>
<td>-31.679</td>
<td>-5,302,630</td>
<td>-31.310</td>
</tr>
<tr>
<td>09</td>
<td>Laboratory</td>
<td>-1,651,404</td>
<td>-35.151</td>
<td>-699,093</td>
<td>-10.737</td>
</tr>
<tr>
<td>10</td>
<td>Cardiology</td>
<td>-342,421</td>
<td>-3.105</td>
<td>426,018</td>
<td>2.650</td>
</tr>
<tr>
<td>11</td>
<td>Thoracic Surgery</td>
<td>-1,830,674</td>
<td>-27.258</td>
<td>-1,276,400</td>
<td>-13.804</td>
</tr>
<tr>
<td>12</td>
<td>Urology</td>
<td>-2,619,062</td>
<td>-20.892</td>
<td>-301,722</td>
<td>-1.671</td>
</tr>
<tr>
<td>14</td>
<td>Chiropractor</td>
<td>1,382</td>
<td>38.389</td>
<td>1,865</td>
<td>37.055</td>
</tr>
<tr>
<td>15</td>
<td>Podiatry</td>
<td>130,145</td>
<td>4.311</td>
<td>366,254</td>
<td>8.595</td>
</tr>
<tr>
<td>16</td>
<td>Other Surgical</td>
<td>-900,088</td>
<td>-13.247</td>
<td>-100,424</td>
<td>-1.010</td>
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<tr>
<td>17</td>
<td>Other Medical</td>
<td>1,228,296</td>
<td>2.566</td>
<td>3,469,530</td>
<td>4.903</td>
</tr>
<tr>
<td>Totals</td>
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<td>-2</td>
<td>0.000</td>
<td>21,757,442</td>
<td>5.319</td>
</tr>
</tbody>
</table>

* Percent changes are too low (in absolute value) because deductibles are not considered in making these computations.
Table 8

CHANGE IN MEDICARE EXPENDITURES, PHYSICIAN REVENUE, BENEFICIARY LIABILITY:
LIABILITY BY REGION: COST-BASED SCHEDULE

<table>
<thead>
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<th>change Medicare expenditures $</th>
<th>change * expend. %</th>
<th>change beneficiary burden $</th>
<th>change ** burden %</th>
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<td>3,879,775</td>
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<td>2,106,557</td>
<td>6.941</td>
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</table>

<table>
<thead>
<tr>
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<th>change revenue %</th>
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<tbody>
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<tr>
<td>Totals...</td>
<td></td>
<td>21,757,441</td>
<td>5.319</td>
</tr>
</tbody>
</table>

* Percent changes are too low (in absolute value) because deductibles are not considered in making these computations.
** Percent changes are too high (in absolute value) because deductibles are not considered in making these computations.
V. BEHAVIORAL RESPONSES

In this section, we briefly review some existing literature concerning the behavioral responses that might be induced by revising Medicare physician reimbursement policy. The simulation model allows the user to incorporate assumptions about how physicians' decisions to accept assignment will be altered by the fee schedule and we present here results from the literature that indicate the magnitude of the response. We also summarize available literature on the effects of fee schedule constraints and changes in relative prices on the amount and mix of procedures prescribed by physicians and on beneficiary behavior.

EFFECTS ON PHYSICIANS' DECISIONS TO ACCEPT ASSIGNMENT

The Medicare payment gives physicians a choice between two alternative reimbursement schemes. A physician may accept assignment for a bill and be paid directly by the Medicare program. Alternatively, he can refuse to accept assignment and bill the patient directly for his services, in which case, the patient is reimbursed by Medicare. In all cases, the patient is responsible for a deductible and a copayment of 20 percent of the services that he receives.

If a physician accepts assignment, and if the patient has met his deductible, then the physician receives 80 percent of his allowed charge from a Medicare carrier. He must collect the remaining 20 percent from the patient. The total that a physician accepting assignment is allowed to collect from Medicare and the patient is limited to his allowed charge. If a physician refuses to accept assignment, he can charge the patient more than his allowed charge, but he must collect the entire amount from the patient. Ordinarily, Medicare beneficiaries should prefer assignment because their out-of-pocket expenses are lower. The burden that a fee schedule imposes on patients depends in large measure on how the fee schedule affects the decision of physicians to accept assignment.
Previous research has shed some light on how physicians make this choice. A theoretical model proposed by Lynn Paringer (1980), based in turn on work by Sloan, Mitchell, and Cromwell (1978), has physicians balancing lower yet certain payment when accepting assignment against possibly higher yet risky payments when billing the patient directly. The higher the allowed charges under Medicare relative to what the doctor can collect directly, the further this balance tilts towards accepting assignment. Using California data from 1972 through 1975, Paringer found that every 1 percent increase in allowed charges led to a 1.4 percent increase in the level of assignment. This translates into a change of roughly one-half of one percent in the assignment rate. Using a national sample of three specialties (general practice, internal medicine, and general surgery), Mitchell and Cromwell (1982) found almost precisely the same results. By contrast, Rice and McCall (1983), using a sample of claims from Colorado in 1979, found a much smaller sensitivity to fee level: a 1 percent increase in allowed charges would increase assignment by 0.05 percent. Work by Rodgers and Musacchio (1983) using data from 1978, found that the elasticity of assignment with respect to allowed charge was 0.38. Because Rodgers and Musacchio were looking at the Medicare assignment rate as a share of total physician practice, their results are not directly comparable with others. Finally, Rice (1984), in a later study using 1976 and 1978 Colorado data, found large differences in assignment response across medical specialties. He found medical procedures to have comparatively large assignment responses to price changes and found surgical procedures to be comparatively unresponsive. Assignment rates for laboratory and radiology procedures were responsive to changes in prices of medical procedure prices rather than to changes in their own prices.

The weight of evidence in previous studies indicates an average change in assignment rates of about 0.4 to 0.5 percent in response to a one percent increase in Medicare allowed charges, corresponding to an elasticity of about 1.4 when assignment rates are near 33 percent. While this average rate appears consistently through past works, certain types of procedures might behave somewhat differently from this level.
EFFECTS ON PHYSICIANS' PRACTICE STYLES

There are two ways in which revised physician reimbursement policy can affect Medicare Part B expenditures. One is through the payment computation formula; the prototype computer model is designed to estimate these effects. The other way, however, is through behavioral response: changes in the number and mix of procedures that physicians perform.

The effects of changes in fee schedule levels and changes in relative fees on physician practice styles were theoretically investigated by Danzon (1982; see also Danzon, Manning and Marquis, 1984). The economic model used by Danzon assumes that physicians face a demand for visits that depends on the price consumers pay for a visit and the quality (or level of care) per visit. Physicians are assumed to produce quality by combining medical inputs or procedures and to choose the quantities of these inputs so as to maximize profits. The model does predict that decreases in the allowed fee for one medical procedure will lead providers to substitute away from that procedure towards other, relatively higher priced, procedures to produce a given level of care. However, the model also shows that changes in the fee schedule may affect the amount of health care produced; however the direction of change is ambiguous so the effects on the absolute quantities of the various procedures is also ambiguous.

Thus, changes in physician practice in response to changes in reimbursement policy might enhance the cost-containment effects of the policy if incentives to perform certain procedures are diminished or if patients are rechanneled from the hospital to less costly outpatient care. On the other hand, a new reimbursement policy might adversely affect Medicare expenditures if it results in an increase in the volume or complexity of services.

There is empirical evidence to suggest that physicians respond to controls on the level of fees by increasing both service intensity and the number of services. A study of the effects of controls on physician fees imposed during the Economic Stabilization Program on Medicare claims submitted by physicians in California revealed that the total volume of services delivered rose sharply during the control years,
leveling off or falling when the controls were lifted (Holahan and Scanlon, 1979). Increases in office and hospital visits contributed the most to the increased volume. The analysis also indicated an increase in the proportion of visits that were billed as complex or intermediate relative to those billed as simple or brief.

Rice (1983) found similar results in examining the response to a change in the Medicare reimbursement system in Colorado that resulted in increases in prevailing charge screens for some physicians and decreases for others. He found that a one percent decline in the average amount allowed for surgical care resulted in a 0.14 percent increase in the quantity of surgical services per Medicare beneficiary. The elasticity of the intensity of medical care services (measured as the average number of relative value units billed per medical service) with respect to changes in the average allowed charge for medical care was -0.61; for surgical procedures the elasticity of the intensity of service was -0.15.

While these studies suggest how changes in the average level of allowed fees affect the quantity and intensity of care delivered, they do not indicate how the mix of services would respond to adjustments in relative fees. Unfortunately, there appears to be limited empirical research in this area. Rice (1983) found that, controlling for the level of allowed surgical charges, a one percent decrease in the allowed charge rate for medical procedures increased the volume of surgical procedures per beneficiary by .27 percent. However, the results do not indicate how the volume of surgical procedures relative to the volume of medical procedures changed. Interestingly, he found that the reimbursement rate for medical procedures did not affect the volume of laboratory tests ordered. However, Rice's estimates may understate the effect of changes in fixed-fee schedules. As Danson's theoretical work demonstrates, changes in fee screens will not affect the mix or quantity of services a physician orders unless all fee screens are binding. If they are not, physicians will likely respond to changes in fee ceilings by varying prices charged for procedures that are not constrained by the ceiling.
In sum, the limited empirical evidence does suggest that, in the short run, physicians might respond to fixed fee schedules that limit the inflation in fees by changing the quantity and intensity of services provided, hence thwarting to some degree efforts to control the increase in expenditures for physicians' care. Over the longer run, however, opportunities to expand volume and complexity are likely to be limited. There is little evidence about how a fee schedule that modified relative prices incorporated in the current reimbursement system would affect the mix of services provided. An empirical investigation of how variation among Medicare pricing localities in relative fees for different procedures affects the service mix would add to understanding the consequences of changes in reimbursement policy.

EFFECTS ON BENEFICIARY BEHAVIOR

Physicians' decisions about accepting assignment and the level of allowed fees affect the out-of-pocket liability faced by beneficiaries and, in turn, may affect their decisions about the quantity of medical care to purchase and the providers from whom to seek care.

There is convincing evidence that the amount of medical care consumed falls as the share of the cost the patient must pay out-of-pocket increases (Newhouse, Manning, Morris et al., 1981). Most of this response is attributable to the patient's decision to initiate a medical care episode by contacting a doctor; patient cost-sharing is unrelated to the average costs of an episode (Keeler and Rolph, 1982). This may suggest that, once a patient has initiated an episode, he or she is unable or unwilling to constrain the amount of services the physician prescribes even if the patient is responsible for a substantial fraction of the cost of care. Therefore, it seems unlikely, even if beneficiaries had information about unit prices allowed for various procedures, that adjustments in a fee schedule would cause patients to exert pressure on their physicians to alter practice styles.

It also seems unlikely that changes in physician assignment decisions in response to changes in fee schedules will affect beneficiaries' choice of provider. Empirical research indicates that patients do not choose providers on the basis of cost (Marquis, 1985).
Furthermore, surveys of the aged have indicated that few beneficiaries understand the consequences of choosing a physician who does not accept assignment. On the other hand, the Health Care Financing Administration has made an effort to inform beneficiaries about the participating provider program and about who are the providers in the program, but the impact of this program on beneficiary choice is not yet known.
VI. APPLICATIONS AND EXTENSIONS OF THE MODEL

The prototype simulation model allows the user to investigate the effects on Medicare expenditures, on providers, and on beneficiaries of replacing the current Medicare CPR reimbursement system with a fee schedule. We have presented some illustrative results using data from two states to compare the effects of a fee schedule based on current allowed charges and one that is based on estimates of resource costs. Other applications of the model would include comparing the effects of alternative charge-based RVSs, e.g., one based on submitted rather than allowed charges, and examining the effects of eliminating or modifying specialty and locality adjustments. Furthermore, the model can be used to examine fee schedules for a bundle of services, such as inpatient services performed during a hospital admission classified by the DRG system, in addition to variations in fee schedules for specific procedures. However, this would require constructing a data file that contained diagnostic information, for example merging the BMAD beneficiary sample data with hospital claims data; the current BMAD files do not contain these data.

There are several modules, which were beyond the scope of this contract, that might be added in future model development. These would include a beneficiary distribution module and one to incorporate behavioral responses to changes in reimbursement policy.

The current model provides information on the aggregate change in beneficiary liability, but does not produce information about the distribution of beneficiaries by the amount of the increase or decrease in liability. A beneficiary distribution module, similar to the physician distribution component of the existing model, could be easily incorporated. This would require an additional input data file in which each record would contain aggregate data from the BMAD beneficiary file about the procedures in a procedure cluster provided to a specific beneficiary.
The existing model does allow the user to investigate the effects of alternative assumptions about how physicians' decisions to accept assignment respond to changes in allowed fees. A change in the assignment rate will affect both beneficiary liability and physicians' revenues, though it will not affect Medicare program expenditures.

Medicare expenditures, as well as physician revenues and beneficiary liability, might be affected if physicians respond to changes in reimbursement policy by altering the number or mix of services that they perform. However, the prototype model assumes that physician practice styles do not change. While the literature does not provide very definitive evidence about how the mix or number of procedures would change, the sensitivity of results to varying assumptions about elasticity of supply with respect to changes in its own price and the price of other procedures could be tested. The module of the prototype model that incorporates the elasticity of the assignment rate provides the framework for incorporating other behavioral responses.

The prototype model provides CRS with a capability to provide Congress with the careful analysis of physician payment options needed to guide policy formulation. Adding these enhancements would strengthen the power of the model to inform decisionmaking.
APPENDIX: DESCRIPTION OF AVAILABLE DATA

DATA COLLECTION ACTIVITIES

At the inception of the Medicare program, a variety of carrier claims reports were designed and mandated for the collection of aggregate Part B data. These are currently assembled by the Division of Reports and Analysis, now in the Bureau of Quality Control, HCFA. In addition, a variety of statistical files were initiated, most of which were oriented around beneficiary samples. Although some hospital-specific data were collected from the Medicare Hospital Insurance Program, there was no set of data specific to physician practices. As a result, most of the in-house Medicare data analysis of Part B information was beneficiary oriented.

PAYMENT RECORDS

Part B records for all Medicare beneficiaries are collected in the form of the Payment Record (see Bureau of Data Management and Strategy, 1983), but these records include information on the type of service of only that one procedure (of a possible many) that is responsible for the largest single reasonable charge for a particular claim. Further, Payment Record data are posted directly to the Health Insurance Master Files, so there is no single file of physician records. (Even if a single file had been available, the task of sorting some 100-150 million annual claims records by some 300-400 thousand provider numbers would have presented a daunting task.)

BILL SUMMARY RECORDS

In the late 1970s a beneficiary oriented sample of Part B records was initiated in the Bill Summary Record System (BSR). This system was designed to capture nearly 100 percent of the Part B records for a 5 percent sample of beneficiaries. (Part B billings from hospital-based physicians were not included.) As with payment records, the individual BSR records also were abstracts of individual claims containing information on type of service and place of service only, rather than
specific information on actual procedures billed to Medicare. Although some thought may be given to eliminating the Bill Summary Record system given the advent of the BMAD data sets (described below), these data continue to be collected from the carriers on a monthly basis. The latest complete BSR calendar year file available in HCFA is for 1983.

BMAD FILES

As a result of the early design decisions, data on a practice-specific basis were available only from outside contractors such as the Medicare carriers themselves or from analysts using carrier data. In 1982, however, an internal HCFA Task Force was convened to investigate the need for the collection of additional data on individual physician practices. The result of this effort was a decision to mandate the collection of additional data sets from the carriers, the Part B Medicare Data (BMAD) files.

The Part B data are provided in four separate files.

A. Procedure File--The Procedure file provides calendar year data organized by procedure codes. This file is an array of every procedure code used by each carrier. The array is in locality, specialty code sequence and ascending order of procedure codes. Every procedure code that was contained in the calendar-year history file is included, even if the code was used only one time.

In the 1983 BMAD Procedure File, procedures were coded using the HCFA Common Procedure Coding System (HCPCS) by only 16 carriers. The codes of carriers not using HCPCS will be identifiable in each year's file, and carriers have been directed to send translation files to HCFA central office as they convert to HCPCS. In the 1984 BMAD files, four carriers covering seven states remain on non-HCPCS systems. They are Prudential (New Jersey, Georgia, and North Carolina), Texas (Texas Group Medical), Michigan (Michigan Blue Cross Blue Shield), Iowa (Iowa Blue Shield), and Utah (Utah Blue Shield).
The procedure file provides an array of every procedure processed showing the related frequency, aggregate submitted charge and paid amounts, modifiers, place and type of service, and assignment rates by procedure. Unfortunately, there may have been some confusion in reporting of claims volumes for services that were not reimbursed, because of either denials or exclusions, and the frequency of these claims may be overcounted. As a result, estimates of adjusted frequencies will likely be biased downward.

B. *Prevailing Charge File*—This file contains the prevailing charge limits for each procedure contained in the Procedure File. It reflects the data generated during the annual update of reasonable and prevailing charges. These data allow HCFA to study and accurately project payment levels. The file also indicates both the "true" 75th percentile of the distribution of *customary* charges\(^1\) and the adjusted prevailing charge if it differs from the 75th percentile because of the application of the Medicare Economic Index or other adjustments.

C. *Provider File*—This file includes detailed information from claims histories of procedures rendered by a one percent sample of physician/suppliers. Carriers assign a provider number to each provider of Medicare Part B services. When a provider practices in more than one location, a different provider number is assigned for each location. The provider file includes all claims history dates for the physician/supplier numbers in the selected sample. However, the file does not include complete claims history dates for a physician who has been assigned multiple provider numbers; it includes only the

\(^1\) The 75th percentile of the distribution of customary charges is defined as the lowest customary charge which is not less than the 75th percentile of the distribution of customary charges weighted by volume. It is not necessarily and not likely to be equal to the 75th percentile of the distribution of charges.
data for the selected practice location. Any practice which is included in the sample will continue to be included in the sample in all future years in which that practice submits Medicare claims to the carrier. These data allow the study of the impact of actual and projected program changes on the physicians/suppliers.

D. *Beneficiary File*--This file contains line by line detail from a 100 percent claims history of services received by all ESRD (end stage renal disease) beneficiaries and a five percent sample of other beneficiaries. This file allows HCFA to link, based upon the Health Insurance Claims number, a beneficiary's Part B service utilization with beneficiary's Part A service utilization data that already exist in other HCFA central office files.

The initial BMAD files were submitted for an August 1984 deadline with data collected for calendar year 1983. The files are not entirely uniform. Some carriers did not submit adequate data, and those carriers may be missing from the files. As indicated, Medicare carriers are in the process of converting their processing of Medicare Part B data files to use HCPCS, and different carriers are in different stages of that process. Carriers were therefore instructed to use whichever procedural coding terminology they currently used in claims processing. As a result, within the available BMAD data there are a variety of procedure coding systems. Regardless of the coding procedural system used by the carrier, carriers use a consistent set of codes for type of service and place of service. And, as indicated, the carriers will be submitting translation tapes to HCFA central office when they convert to HCPCS. These tapes might be used in any analyses which require procedure-specific comparisons of data where HCPCS has not been used in both time periods being compared. Other analyses involving comparisons by place and/or type of service would not require the translations.
The expected availability of BMAD data files is as follows:

*Calendar 1983*--These data for all four files were submitted to HCFA in August 1984.

*Calendar 1984*--The deadline for submission of these data had been established as June 1, 1985 for all of the BMAD files with the exception of the prevailing charge file--where the new submission deadline was October 30, 1985. The projected date of availability within HCFA for the procedure, provider, and beneficiary files was January, 1986.²

*Calendar 1985*--The deadline for submission of 1985 and all later BMAD data will be June 1 of each calendar year for the procedure file, provider file, and beneficiary file. The prevailing charge file will be submitted 30 days following the initiation of a new fee screen year. Post-edit calendar year 1985 data can be expected to be available by the end of Fall 1986.

**CARRIER REPORTS**

There are a variety of periodic carrier reports providing aggregate information about Part B paid claims volume and expense. These are assembled on a monthly or quarterly basis for publication by the Division of Reports and Analysis in the Bureau of Quality Control. They include:

*Report on Medicare Participating Physician/Supplier Claim Workloads*--quarterly with annual national summaries. This report summarizes carrier claims workload data by participation, assignment, and physician status. These data allow one to determine participation rates and the aggregate assignment rates of physician practices which do not participate for each carrier.

*Carrier Reasonable Charge and Denial Activity Report*--quarterly with annual national summaries. This report indicates, by carrier, aggregate rates of claims reduced claims as a percentage of claims paid or applied to the deductible. In addition, it indicates the average amounts of claims reductions.

²Unfortunately, the perception within HCFA is that there was not as much improvement between 1983 and 1984 as had been expected.
Carrier Workload and Processing Time Report--monthly with annual national summaries. This report indicates, by carrier, numbers of claims received and processed by the carriers, including the percentages of those claims applied to the deductible.

SELECTED CARRIER DATA

In addition to the four regular BMAD files collected from each carrier for 1984, seven carriers provided HCFA with the equivalent of a 100 percent beneficiary file. These data represent the states of Connecticut, Maryland, Alabama, Indiana, Wisconsin, and Washington, and the carrier jurisdiction for Southern California. Analysis of these data might allow a more accurate prediction of specialty-specific effects of physician payment method reforms, because there would be no question of sampling variability among specialties.

OTHER FEDERAL DATA SETS

To examine the feasibility of procuring physician-oriented data bases, HCFA contracted with Mandex, Inc. of Vienna, Virginia in 1983 for the analysis of data from four carriers which had already converted to HCPCS. These included the carriers with jurisdictions covering South Carolina, South Dakota, North Dakota, Washington, and western Minnesota. The South Carolina and Washington data have been made available to the House Information Service for use by the Office of Technology Assessment. These data were to include all claims with dates of service in 1983, although for South Carolina they represent only claims processed in 1983. The South Carolina data, however, also include separate fields for the customary and prevailing charges used in determining the allowed charge for each claim, information which is not available on the BMAD provider files.
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