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16. Abstract (Limit: 200 words)

This report presents findings of three analyses of access to physician services by Medicare beneficiaries since the implementation of physician payment reform.

"Trends in volume and intensity of physician under the Medicare Fee Schedule: 1986-1994." shows that the growth in the volume and intensity of Medicare physician services slowed dramatically during the first three years of the Medicare Fee Schedule as compared to the preceding five-year period.

"Price controls and Medicare spending: Assessing the volume offset assumption." Estimates volume offsets in response to payment changes. This task examines price changes during the period 1986 through 1992 across the full range of Medicare physician services. The estimated average volume offset is 19 percent, although significant variation exists by both type of service and physician speciality.

"Health Care Utilization Among Beneficiaries: Demographic and Socioeconomic Differences and the Implications for Equitable Access." re-examines the question of access differentials among Medicare beneficiaries to determine what differences exist by age, urbanicity, race, income, and/or living arrangements. Utilization rates were found to be lower for African American beneficiaries, low income beneficiaries and those with lower educational attainment. Utilization rates increased with age and were higher for those living alone compared to those living with a spouse.

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ACCESS TO MEDICARE PHYSICIAN SERVICES

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assignment rates reduce the effective price of care to Medicare beneficiaries and lead to increased utilization. Thus, we focus on the beneficiary level to determine what factors are most important in explaining cross-sectional differences in use of a wide array of physician services.

In what follows we summarize the three component studies which make up this report.

Chapter 1: Trends in Volume and Intensity of Physician Services Under the Medicare Fee Schedule: 1986-1994

In January 1992, the Medicare program reformed the way it pays for physician services. Over a five year period, the customary, prevailing and reasonable (CPR) payment method was replaced with the Medicare Fee Schedule (MFS) which reflects the relative resource costs of each service. The same reform legislation placed limits on balance billing to protect beneficiaries from increased liabilities, and created the Medicare Volume Performance Standards (MVPS) in an effort to reduce the growth in Medicare Part B expenditures.

The central element of MFS is the Relative Value Scale (RVS) that increases payments for visits and consultations relative to those of procedures. Implicit in the policy is the assumption that such changes will result in an increase in the provision of E&M services relative to procedures. If volume is relatively insensitive to price changes, then the ability of the MFS to encourage the provision of E&M services relative to other services or achieve other desired policy objectives would be fairly limited. On the other hand, if volume changes significantly in response to the MFS, by either increasing or decreasing the provision of many services, unexpected access changes could develop. These improvements or reductions in access may occur for only some services or in some geographic areas. From a budgetary perspective, the

responsiveness of volume to price is relevant for assessing how realistic the assumptions were regarding the "volume offset" used in the initial conversion factors calculations.

Prior to the implementation of MFS, modifications to physician payment rates were targeted principally at reducing fees for services identified as "overpriced." In the five years preceding the MFS, prices for all services grew at an average rate 4.5 percent per year. However, due to large price reductions in non E&M services, in the first year of the MFS overall prices fell by 1.9 percent. As the MFS continued to be phased in through 1994 large national annual declines in prices were less common. In fact, payments for all services increased 2.4 between 1992 and 1993 and 5.1 percent between 1993 and 1994. Fees for evaluation and management services and procedures increased most substantially.

This study is not designed to attribute causality or isolate statistical relationships, but to provide a comprehensive picture of what happened. It represents an important step toward assessing the relationship between changes in the price and volume of Medicare services and understanding what impact, if any, the MFS has had on the utilization of Medicare physician services.

Our analysis differs from existing studies of the volume and intensity of service utilization in three ways. First, until recently researchers have been constrained to use deflated expenditures as the measure of volume and intensity of service utilization. However, with the development and implementation of the RVS, we are able to use a more direct measure of intensity (i.e., RVUs). Second, we consider volume and intensity changes within a comprehensive service classification system developed by the Urban Institute in collaboration

with staff at the Health Care Financing Administration (HCFA). Finally, we explore changes in volume and intensity across Medicare payment localities by grouping localities into three categories depending on the HCFA actuaries' *predicted* level of payment change which are likely to be more stable across time than categories based on *actual* payment changes.

Using data from BMAD and NCH Procedure Files and the Medicare Denominator Files, we examine national trends in the volume and intensity of physician services per Medicare beneficiary for the years 1986-1991,1991-1992, 1992-1993, and 1993-1994 and find that the growth in the volume and intensity of Medicare physician services slowed dramatically during the first three years of the MFS as compared to the preceding five-year period. Rates of growth as low as those observed here have not been sustained over multiple years since the mid-1980s.

This decline in growth rates was certainly not uniform across either types of service or payment localities. Some services (e.g., major general procedures and ambulatory procedures) exhibited negative growth rates over this three year period. However, some types of services (e.g., consultations and sonograms) exhibited fairly rapid growth during the 1991-1994 period. In fact, the volume and intensity of both consultations and minor procedures grew more rapidly under the MFS than they had during the base period.

Although variations in aggregate volume and intensity changes suggest no consistent evidence of either a "volume offset" or "standard supply" response, as we move below the broadest service categories, different patterns emerge. For example, for office visits, the data are consistent with the view that as fees are reduced, the volume and intensity of physician services accelerates to compensate for potentially lost revenue. On the other hand, for some procedures,

the results show that volume growth is slower among localities likely to experience large payment rate reductions, suggesting that physicians may be shifting away from providing Medicare services as payments fall. These findings could lead to the development of conflicting hypotheses regarding differences in the nature of volume responses across service groups. However, the lack of a clear link between the magnitude of the price change for specific types of services and the "average" price effect used to define the locality groups makes it difficult to characterize the price/volume relationships observed in this descriptive study.

However, these findings are more conclusive with respect to other issues. They lead us to conclude that changes in payment rules (beyond the implementation of the RVS), developments in clinical practice and coding changes play a large role in determining the observed RVU changes. Included among these payment rule changes were establishing uniform global surgery periods, redefining visit codes, eliminating and reinstating payments for certain EKG interpretations and imposing site of service differentials selectively. These factors seem to have played a role in determining trends in volume and intensity of services of both consultations and EKGs. The effects of clinical changes can be seen in the shifts away from using TURPs to treat benign prostatic hypertrophy or major breast procedures when less invasive treatments are possible. In the other direction, the data show a recent resurgence in carotid thromboendarterectomies to prevent strokes after a period of declining use prior to the MFS.

The large decline in volume and intensity growth during the first few years under the MFS relative to historical trends did not necessarily impose hardships relative to beneficiaries' need to care. Even though our locality impact group analysis is not conclusive, the trends do at

least suggest that further monitoring of both price and policy changes is warranted. The amount of care beneficiaries received grew at much slower rates during the first two years under the MFS than it had previously. Subsequently, volume and intensity growth returned to historical levels for many services. This was particularly apparent among major and endoscopic procedures in 1994 and occurred at the same time that there was a large increase in Medicare fees for these services. This suggests that the link between prices and volume growth may be important.

A strength of the way this descriptive study has been organized is that additional years of data can be easily incorporated as they become available. In particular, the stable definitions of the MFS impact groups and the use of a highly disaggregated service classification allow policy makers to focus on localities being affected similarly by the MFS and on services that may be affected by specific modifications in MFS policies. For example, anticipated modifications in the basis for establishing practice expense relative values in 1998 will continue to alter the prices Medicare pays for individual services. In all likelihood, a continuation of this type of descriptive study will be a useful first step in understanding how volume and intensity reacts to those policy changes.

Chapter 2: Price Controls and Medicare Spending: Assessing the Volume Offset Assumption

One of the major issues in Medicare physician payment policy has been the magnitude of volume changes that occur in response to changes in the fees physicians receive for services. A consensus exists around the idea that a given reduction in Medicare fee-for-service payment rate will not lead to that same reduction in program spending. Researchers, actuaries, and other policy makers assume that, in response to payment rate cuts, volume adjusts upward so as to

offset some of the reduction in rates. Theoretically, these adjustments may reflect increases in the quantity of services demanded by beneficiaries as prices (copayments) fall or decisions on the part of physicians to increase the supply of services to maintain income levels.

However, there has been disagreement about the actual size of the volume offset. HCFA actuaries have assumed that when physician fees are cut by, for example, 2 percent, service volume and intensity changes so that only a 1 percent reduction in spending occurs. This 50 percent "volume offset" would imply that fees would need to be cut by twice the reduction in spending required to keep spending within a target. This assumption has been both supported and criticized in the literature.

If prices are to be the main policy lever available for controlling Medicare spending, as some proposals suggest, then understanding how the offset may vary over time, or across services and specialties could lead to more effective and equitable policy responses. For example, if volume and intensity changes tend to offset more of a price cut for certain services (e.g., imaging) than for others (e.g., visits), policy makers may find that they achieve greater spending control by focusing price cuts on less responsive services. In addition, services with less potential for volume offsets could require smaller price reductions in order to achieve spending targets.

In this task, we examine price changes during a series of natural policy experiments covering the years 1986 through 1992 and estimate volume offsets across the full range of Medicare physician services. By analyzing price and volume changes over a seven-year period, our study draws on a broader range of policy changes than has been considered in the literature.

The breadth of these policy changes leads us away from considering the impact of any single natural experiment on the volume of a limited set of services, as is the case in much of the prior literature, and toward a framework that considers responses among all types of physician services.

In order to examine the relationship between volume growth and the fee changes embodied in the MFS, the first study, described above, grouped localities according to the HCFA actuaries' estimates of the impact of the MFS on average payments per service after it is fully phased in. However, this approach has a serious limitation. The change in average payments per service - estimated or actual - may mask variations in the change in payment rates across specific types of services. For example, under the MFS, a locality may be characterized as gaining, on average, because it had a relatively large share of E&M services (where prices increased). However, this does not mean that payments for all categories of procedures will increase. In fact, many fees for procedures in these localities will no doubt fall. If as a result of these fee reductions for procedures, procedure volume slows down, a simple descriptive analysis could suggest that procedure growth is slowing in the localities that, on average, are gaining under the MFS. This might lead to an unwarranted conclusion that for these procedures there is some evidence consistent with a volume offset. To estimate impact of price changes on volume growth, it is necessary to relate price changes to volume changes for the same services. Therefore, *procedure* volume changes should be examined relative to *procedure* fee changes, as opposed to overall average fee changes in a locality.

The primary data used in this analysis to measure price and volume and intensity changes

are derived from the 1986-1991 BMAD Procedure files and 1992 NCH Procedure files. Using the Medicare payment locality as the unit of observation, we model the annual change in the volume and intensity of services per beneficiary for each of the four groups of services and nine specialties. Volume and intensity change is measured as the change in relative value units per beneficiary within a service group and specialty.

While a simple comparison of volume growth rates and price changes does not provide evidence of volume offset, after controlling for year, type of service, specialty and market conditions, we estimate the average volume offset to be 19 percent. At a 95 percent confidence level, we can reject the hypothesis that there is no offset, but we can also reject the hypothesis that the offset is 50 percent, as is assumed by HCFA actuaries.

We also find evidence that the volume growth among one type of Medicare service increases when price changes for other types of Medicare services are reduced, suggesting that physicians may substitute among different types of services depending on relative prices. We also find evidence that consumers are price sensitive in the positive and significant relationship between the assignment rate (a proxy for low out of pocket costs) and volume growth.

Significant variations exist by type of service and by physician specialty as well, indicating that volume responses are not uniform across all services. This finding calls into question whether a single volume offset assumption is sufficient when making price adjustments to meet spending targets. We find that procedures have the highest offset effect of nearly 80 percent, compared to effects between 25 and 32 percent for the other three major types of service. Further the variation among specialties is even larger.

These results imply that the conventional wisdom regarding the need for a volume offset when setting Medicare fees or assessing the effects of a particular fee change is reasonable. However, the current assumptions about the size and uniformity of a potential volume offset warrant reconsideration. Our estimates do not support the view that there is a 50 percent volume offset overall, nor that the same volume offset should be applied to all types of services or all specialties. In general, we find that current assumptions overstate the size of the volume offset and, if applied under a policy of strict spending caps, could lead to fee cuts that are larger than would be needed to stay within the caps. Such an outcome could tend to reduce Medicare fees somewhat excessively, erode Medicare's position relative to the private market, and potentially compromise access to mainstream providers.

Chapter 3: Health Care Utilization Among Medicare Beneficiaries: Demographic and Socioeconomic Differences and their Implications for Equitable Access

In addition to concerns about reductions in access over time, there are also concerns that access to services is not equitable across subgroups of the population. Evidence from the early years of the program indicated that Medicare had improved access to care for the elderly and had begun to reduce inequities among the elderly. However, recent studies suggest that some income, race, and regional and urban-rural differences persist. Much of the research in this area has focused on race, specifically reporting that black beneficiaries have less access to care than other racial groups. Some studies suggest that, even when blacks gain access to the system, they receive less treatment and that these treatment differentials are not explained by differences in diagnosis.

The question of access differentials is important because there are still concerns about

elderly persons' access to care in general and, specifically, about vulnerable populations. Evidence of these concerns is Congress' requirement that the Secretary of Health and Human Services monitor Medicare beneficiaries' access to and utilization of health care services under the Medicare Fee Schedule implemented in 1992. More generally, achieving equitable access to care is consistent with the original objectives of the Medicare program.

This study re-examines the question of access differentials among Medicare beneficiaries. The empirical analysis specifically considers whether differences exist by: age, rural versus urban residence, race, income, and/or living arrangements. We analyzed data from the 1991 Medicare Current Beneficiary Survey matched to Medicare Part B administrative data to examine differences in the utilization of physician services along several demographic and socioeconomic dimensions. We used multivariate techniques to measure differences in the probability of receiving a wide variety of physician services and in the volume of services used, controlling for health status, physician supply and other factors thought to influence utilization.

Our findings suggest that relative to white beneficiaries, African-Americans and other non-whites have significantly lower levels of utilization for many types of physician services. This is largely a consequence of lower probabilities of service use rather than lower volume of use among those who receive services. Consistent with other findings in the literature Hispanics do not have significantly lower levels of utilization than non-Hispanics.

We also find that low income beneficiaries generally have lower utilization rates than higher income beneficiaries, with the largest differences found in the probabilities of receiving diagnostic imaging and testing and evaluation and management services from specialists. Low income beneficiaries also receive a lower volume of services in resource-intensive major

procedures.

Beneficiaries with low levels of educational attainment are significantly less likely than those with higher levels of education to receive imaging and minor procedure services. Among those with any procedure use, those with less than a high school education also receive lower volume of services in general and major orthopedic procedures in particular.

We find that beneficiaries residing in rural areas generally use significantly fewer resources than urban beneficiaries. While they are no less likely to use evaluation and management services or have procedures than urban beneficiaries, rural beneficiaries are much less likely to receive diagnostic imaging and testing services.

Relative to those who live with a spouse, beneficiaries who live alone are significantly more likely to use a wide variety of evaluation and management services other than office visits, are more likely to receive major general and cardiovascular procedures as well as minor procedures, and are more likely to use costly imaging services. In terms of volume, those who live alone use significantly more of each broad class of service except procedures and have significantly higher volume several specific services including office visits, hospital visits, consultations, standard imaging and laboratory testing.

Finally, relative to younger beneficiaries (those under 75), the very old (those 85 and over) are more likely to use nearly all types of services, except for major procedures. Among those who use any services, however, the very old use significantly fewer of them on average, most notably in procedures and imaging.

Analysis of the MCBS provides several new insights into access differences. The data allow us to examine utilization differences for a much more detailed list of physician services than has previously been studied along the sociodemographic dimensions available from survey data. However, even the MCBS does not contain a large enough sample to examine some relatively rare services (e.g., coronary artery bypass grafting). Further, researchers now have a much richer set of covariates attached to these detailed utilization measures. In particular, our analysis of differences by income, education and living arrangement would not have been possible using claims records alone. Finally, the inclusion of more controls for socioeconomic status may give us more confidence in interpreting findings on race and ethnicity.

CHAPTER 1

TRENDS IN VOLUME AND INTENSITY OF PHYSICIAN SERVICES UNDER THE MEDICARE FEE SCHEDULE: 1986-1994*

Diana Verrilli
Stephen Zuckerman

I. INTRODUCTION

The Medicare Fee Schedule (MFS) has had a direct impact on the Medicare program and may have potentially far-reaching implications for physician payment throughout the U.S. health care system. Understanding how the volume and mix of services provided to Medicare patients has changed under the MFS will be important to policymakers in evaluating the policy's effect on beneficiary access and program costs. In addition, given the strong interest in payments based on the MFS among non-Medicare payers, it is important to be able to assess what might happen if the MFS or, at least, the relative value scale (RVS) were adopted more broadly. If the effects of the MFS within Medicare were understood, it might be possible to consider the effects of broader adoption.

The dominant characteristic of the MFS is the change in relative payments for procedures and evaluation and management services that the RVS embodies. Implicit in the policy, is the

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assumption that such changes will result in an increase in the provision of E&M services relative to procedures. Over the longer run, the MFS might be expected to gradually alter the specialty choices made by medical students. This latter effect might be accentuated if non-Medicare payers were to adopt the RVS structure. However, the extent to which these outcomes occur depends, in part, on the responsiveness of service volume to price changes.

If volume is relatively insensitive to price changes, then the ability of the MFS to encourage the provision of E&M services relative to other services or achieve other desired policy objectives would be fairly limited. On the other hand, if volume changes significantly in response to the MFS, by either increasing or decreasing the provision of many services, unexpected access changes could develop. These improvements or reductions in access may occur for only some services or in some geographic areas. From a budgetary perspective, the responsiveness of volume to price is relevant for assessing how realistic the assumptions were regarding the "volume offset" used in the initial conversion factors calculations.

The widespread price changes occurring as a result of the implementation of the MFS represent the most sweeping physician payment reform in the history of the Medicare program. Prior to its implementation, modifications to physician payment rates were targeted principally at reducing fees for services identified as "overpriced."[1] As shown in Table I-1, these policies led to very slow growth in payments for procedures and imaging services in the years preceeding the MFS. Overall, national average annual price changes for all services during the five years before

1. Overpriced procedure reductions were implemented as part of the Omnibus Budget Reconciliation Act of 1987, 1988, and 1990.

Table I-1

National Average Price Changes in Medicare Physician Services

by Type of Service, 1986-1994

Type of Service	1991 Share of RVUs	1986-91	1991-92	1992-93	1993-94
ALL SERVICES	100%	4.5%	-1.9%	2.4%	5.1%
Evaluation & Management	47.2	5.0	6.0	4.0	6.7
Major Procedures	11.9	9.2	-11.6	0.2	5.2
Ambulatory, Minor, and Endoscopic Procedures	18.3	1.0	-10.2	3.5	6.5
Imaging	11.0	0.9	-7.7	-3.4	1.2
Tests	12.3	2.0	-12.0	-0.4	-0.6

the MFS were 4.5 percent. However, during the first year of the MFS prices fell by 1.9 percent.[2] With the exception of evaluation and management services, there were substantial price reductions across all of the broad types of service groups in 1991-1992. The average price change for evaluation and management services, on the other hand, did not change in 1991-92 relative to prior years of data. Services which experienced the largest price reductions under the MFS were major procedures (-11.6%), ambulatory, minor, and endoscopic procedures (-10.2%), and imaging services (-7.7%).

As the MFS continued to be phased in over the 1992 through 1994 large declines in national average annual prices were less common. In fact, payments for all services increased 2.4 and 5.1 percent for 1992-1993 and 1993-1994, respectively. Fees for evaluation and management services and procedures increased most substantially. For example, following a decline of 11.6% in 1991-1992, fees for major procedures increased by 5.2% in the 1993-94 period. Similarly, fees for ambulatory procedures increased 6.5% in 1993-94.[3]

The most widely available empirical analyses of the impacts of the MFS are those contained in the Physician Payment Review Commission (PPRC) Annual Reports. There are three important distinctions between this analysis and previous PPRC analyses. The first relates to the method used to estimate changes in the volume and intensity of medical services. PPRC uses deflated expenditures to estimate changes in volume and intensity. We use relative value

2. Price changes are measured using a Laspeyres price index of all physician services. The index values shown for the 1986-1991 period represent the product of individual annual Laspeyres indices for this period, i.e., chained Laspeyres indices.

3. In 1993 and 1994, the use of different conversion factors for three groups of services (primary care, surgical and non-surgical) played a significant role in the increase in payments for surgical payments. The conversion factor for surgical services resulted in the highest payment per RVU in 1994.

units (RVUs) per beneficiary. Historically, researchers have used deflated expenditures as the measure of volume and intensity (Zuckerman and Holahan, 1992). This was necessary because the only real way to identify volume and intensity was as the residual net of the prices of services. However, with the development and implementation of the RVS, a more direct measure of intensity (i.e., RVUs) is available and should be used.

Second, we consider volume and intensity changes within a comprehensive service classification system developed by the Urban Institute in collaboration with staff at the Health Care Financing Administration (HCFA). Finally, we explore changes in volume and intensity across Medicare payment localities by grouping localities into three categories depending on the HCFA actuaries' *predicted* level of payment change.[4]

This descriptive analysis is not designed to attribute causality or isolate statistical relationships. However, it provides a comprehensive picture of what has been happening and represents an important step toward assessing the relationship between changes in the price and volume of Medicare services and understanding what impact, if any, the MFS has had on the utilization of Medicare physician services.

The remainder of this report is divided into four sections. Section II provides a detailed background of the MFS, with particular focus on issues that can affect volume trends, including payment policy changes, the schedule for implementation and changes in the conversion factor. The next section reviews the data and methods used. Because all services represented in our data did not have RVUs assigned in the MFS, we needed to develop several approaches to filling in

4. In PPRC analyses, localities are grouped according to actual price changes, which are likely to be less stable across years.

gaps so that no services were excluded from the study. In addition, Section III also describes how Medicare payment localities are classified into three MFS impact groups according to the HCFA's estimates of the long-run impact of the MFS on payments per service. In Section IV, we present national trends in volume and intensity by broad types of services and by selected detailed types of service groups. This is followed by an analysis of volume and intensity changes across three categories of Medicare payment localities defined according to the projected impact of the MFS on payment rates. We conclude with a discussion of the results.

2. BACKGROUND

In January 1992, the Medicare program reformed the way it pays for physician services (HCFA, 1991). The customary, prevailing and reasonable (CPR) payment method was replaced with a national fee schedule that reflects the relative resource costs of each service. This reform was implemented as part of the Omnibus Budget Reconciliation Act of 1989 (OBRA89). There were two other goals of OBRA89 payment reform. First, it protected beneficiaries from increased financial liability, by limiting balance billing.[5] Second, OBRA89 aimed to reduce the growth in Medicare Part B expenditures, by creating Medicare Volume Performance Standards (MVPS).[6]

The Medicare Fee Schedule (MFS) consists of a Resource-Based Relative Value Scale (RBRVS) for physician work (Hsiao, 1990) and relative value scales reflecting the cost of

5. Beginning in 1993, balance billing was limited to 9.3% above the fee schedule payment for physicians who do not formally participate in the Medicare program.

6. The MVPS established target rates of growth for Medicare spending on physician services. If actual Medicare physician expenditures increase at a faster rate than the standard, the rate at which the Medicare program raises fees will be reduced. Alternatively, if spending grows at a rate below the standard, fee increases will be enhanced. Thus, MVPS adjust rates of increase in fees, rather than directly controlling expenditures.

physician practice expenses and malpractice expenses, which assign a relative value to each medical service, a conversion factor(s)[7], which assigns a monetary value to relative value units (RVUs) into monetary units, and a geographic adjustment factor, which adjusts payments to reflect area differences in the costs of providing medical services (Zuckerman, Welch, and Pope, 1989).

In addition to the RVS, the MFS included a number of payment policy changes such as a standardized definition of the surgical global package. At the time of this analysis, the fee schedule was being implemented over a 5-year transition period and, therefore, Medicare payments during this time are an increasing blend of the MFS and previously existing fees. By 1996, payments fully reflect the MFS.

The MFS represents a significant departure from the way physicians were reimbursed under the Medicare program. Under CPR methods of reimbursement, Medicare payments varied substantially across individual physicians, across medical specialties, and by geographic area. Under the MFS, payments for a given service only vary by geographic differences in the cost of providing services. The central element of MFS is the RVS that increases payments for visits and consultations relative to those of procedures. The financial impacts of the fee schedule on individual physicians will vary depending on the mix of service they provide, the geographic location of their practice and their specialty. The expected result is to raise Medicare payments per service to primary care specialties such as general practice, family practice, and general

7. OBRA89 allowed for separate conversion factor updates for surgical and non-surgical categories of services. Multiple conversion factors were not adopted, however, until 1993. In 1994, as a result of OBRA93, a third category for primary care services was established and a third conversion factor was adopted. Therefore, the 1992 MFS used a single conversion factor, the 1993 MFS used two conversion factors, and the 1994 MFS used three conversion factors.

internal medicine and lower payments per service for most surgical specialties and specialists (Levy, 1991).

There is a great deal of uncertainty surrounding the expected short and long run implications of these changes in Medicare payment policy. The impacts of the MFS, in terms of both beneficiary access and program costs, are largely contingent on how the physician service market responds. The effect of price changes could lead to reductions, increases, or no change in the quantity or mix of services. More specifically, the volume of services experiencing price increases, such as office visits, may increase because physicians would have a greater financial incentive to provide such services. Alternatively, the volume of these services may decrease in response to higher payment rates if physicians are on a backward-bending portion of their supply curve or if higher fees (and co-payments) curtail demand. How the changes in relative fees affect the volume of services provided is the central issue that analyses of the MFS must ultimately address.

MFS Payment Policy Changes

The MFS represents numerous other payment policy changes in addition to those embodied in the relative value scales. In order to fully understand these changes in volume and intensity per beneficiary under the MFS, we need to be consider the effect these other aspects of Medicare payment policy may have had. Preliminary evidence of wide variations in payment policies for carriers in the pre-MFS period (PPRC, 1989) suggests that moving to a uniform set of payment policies may have substantial impacts across carriers. Uniform payment policies that we would expect to have an impact on changes in service volume during the first year of the Fee Schedule include the following:

- the definition of the surgical global package;
- the establishment of a site of service payment differential for selected services performed in an outpatient setting (OPD);
- the establishment of RVUs for the technical and professional component of imaging and diagnostic tests; and
- elimination of separate payments for the interpretation and report of EKGs during a visit or consultation.

Although uniform payment policies for modified services (e.g., multiple procedures and assistants at surgery) were also established under the MFS, it is difficult to assess the possible impacts of these changes because less is known about how carriers previously determined payments for modified services. With the exception of the professional component only and technical component only payment modifiers, we do not specifically investigate in the analysis the impacts of other payment policies related to payments for modified services.

The analysis of payment policy changes is therefore focused on selected payment policies likely to have a quantifiable impact on changes in RVUs during the first three years of the MFS. For example, the implementation of a uniform global surgical package definition might change how physicians bill for services typically associated with a surgical procedure. For example, if the initial consultation in which the need for surgery is determined was usually bundled into the pre-MFS surgical payment, then a revision in this policy which permits separate payments for this service could cause the number of consultations to rise in 1991-1994. Given the volume of major surgical procedures performed on beneficiaries in any year, this increase could be substantial. In addition, other policy changes such as the site of service differential could also

influence RVU changes by possibly providing an incentive to provide services subject to this rule in settings other then the OPD.

Payment policy changes such as these are likely to provide some partial explanations for the RVU changes occurring in 1991-1994. The uniform payment rules included in the analysis and their potential impact on changes in RVUs per beneficiary in 1991-1994 are discussed in detail below. The information we have obtained on pre-MFS payment policies is drawn largely from the Federal Register (vol. 56 No. 227, 59593-59605).

Surgical Global Package. The global fee is a single fee that includes services provided by a physician before, during and after the surgical procedure. The global period for major procedures begins on the day before surgery, but does not include the initial surgical consultation in which the decision to undergo surgery was made. The MFS global surgery policy differs depending on the type of procedure. For major and ambulatory procedures, post-operative services related to the surgery cannot be billed separately by a physician for 90 days after the surgery itself. The length of the post-operative payment period for minor procedures is 10 days and for endoscopic procedures, physicians are permitted to bill separately for services immediately after the procedure is completed.

The concept of paying surgeons a single fee for surgical procedures was widely practiced among Medicare carriers before the MFS. The global surgical fee traditionally included not only the operation but also certain pre- and postoperative services. However, prior to the MFS, Medicare did not have a uniform policy specifying which services should be included in the

global fee and which services should be reimbursed separately. Carriers, therefore, had considerable discretion in defining the global surgical package.[8]

The multiplicity of prior global surgical packages suggests that the adoption of a uniform global fee policy could result in considerable changes in the way physician services are reported. More specifically, since separate payments for consultations (in which the decision to undergo surgery is made) are permitted under the MFS, it is likely that the volume of consultations will increase during the first several years of the MFS. In addition, there could be a reduction in the aggregate RVUs for minor procedures (e.g., removal of sutures) under the MFS if these types of services were not typically bundled into pre-MFS surgical global fees. Finally, because the pre-MFS payment policies for ambulatory and minor procedures are not documented, it is not clear what kind of an impact, if any, the global payment policy will have on service typically associated with these services.

Site of Service Differential. Payments for services primarily performed in an office setting are subject to payment limits when performed in an outpatient department under the 1992 and 1993 MFS. For these services, the practice expense component of the RVS is reduced by 50 percent. The site of service differential reduces the approved payment amount by an average of 21 percent. The limit was extended to inpatient services effective January 1, 1994. In the 1992 MFS there are over 380 procedures subject to the site of service limitation and in 1994, 333 procedures were affected by this rule.

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8. PPRC conducted a study in 1989 analyzing Medicare global surgery policies and Medicare payment for four commonly performed major procedures including total hip replacement, pacemaker insertion, transurethral resection of the prostate (TURP) and coronary artery bypass graft (CABG). Their findings suggest that within a carrier, there was some consistency in the way global services are defined. However, across carriers, they found substantial variation in the way a global service is defined for any given surgical service.

Prior to the implementation of the MFS, HCFA had a policy for determining a site of service payment differential. Under this policy, payments for services performed in outpatient departments were to be reduced by 40 percent relative to the payment when provided in a physician's office. However, anecdotal evidence suggests that it might not have been applied uniformly across carriers.

The MFS site of service differential may provide an incentive to provide services subject to this rule in another location and therefore circumvent the lower payment rates associated with the provision of the service in an OPD. If physicians do not shift these services to another site, then RVU changes in 1991-1994 might decline as a result of a reduction in service-specific practice expense RVUs. On the other hand, this policy could provide an incentive to report comparable or substitute services instead of the service subject to this rule. For example, office visits are included in the list of services subject to an OPD limit in 1992, but consultations are not. If physicians provide a visit in an OPD, they could avoid the reduced office visit payment if the nature of the service allows for it to be billed as a consultation. In 1994, policymakers responded to these incentives by making consultations subject to an outpatient site of service differential.

Professional and Technical Component Modifiers. The MFS established separate RVUs for the professional component, technical component and the global service of specific tests and imaging services. These service distinctions are relevant for services such as diagnostic tests involving a physician's interpretation, diagnostic and therapeutic radiology services and physician pathology services. The professional component includes the physician work and associated overhead and professional liability costs, while the technical component includes the

cost of equipment, supplies and technicians salaries. The global service is simply the sum of these two components. By establishing distinct components of the service, HCFA reduces the chance that the resource costs associated with the provision of the service are reimbursed twice--once to a facility and once to a physician who simply reports the service without a modifier (i.e., in a way that the carrier interprets it as a global service).

The impact of these changes depends on how well these modifiers were being reflected in the pre-MFS payment methods applied by carriers. Experience with these data suggest that modifiers were often missing. For example, analysts have been required to assume a professional component modifier for radiology services provided in hospitals, because BMAD and NCH data often report these as unmodified. In addition, the use of local modifiers (presumably terminated under the MFS) has made corrections to be modifier field imperfect. If there were more professional or technical component services in the pre-MFS period than analysts could detect and if the structure of RVUs leads to more accurate and complete use of modifiers, then the volume of RVUs in these service groups could appear to fall when, in fact, the number of services was at or above historical levels.

Electrocardiogram Interpretations. Separate payments for the interpretation and report of EKGs when ordered or performed in conjunction with a physician visit or consultation were prohibited under OBRA90.[9] Under the first two years of the MFS, RVUs for these services are bundled into payments for visits and consultations. This provision applied to 4 Current Procedural Terminology (CPT) codes which define the interpretation and report of routine and

9. This provision was reversed by the enactment of OBRA93 and effective, January, 1994 separate payments are permitted for these services.

rhythm EKGs (CPT 93005 and 93042) or the global EKG service (including the tracing and the interpretation and report, CPT 93000 and 93040).

Since physicians typically provide EKGs in their office, the global EKG service or the interpretation and report only are the most commonly reported EKG codes in the 1986-1991 period. Payments for EKGs reflected the resource costs of the equipment and technician work to create the tracing as well as the physician work associated with the interpretation and report. Claims for only the tracing component of the EKG were not commonly reported. However, under the MFS, since separate payments for the interpretation and report are no longer permitted, it is likely that the volume of global EKG services and the interpretation and report of EKGs will drop substantially during the first two years of the MFS. On the other hand, payments for the technical component or EKG tracing (CPT 93010 and 93041) may increase.

In 1994, this payment policy rule was reversed. OBRA93 amended section 1848(b)(3) of the Act and required Medicare to make separate payments for EKGs and the exclude the RVUs from visits and consultations. Therefore, for services provided after December 31, 1993, Medicare made separate payments for EKG interpretations performed or ordered in conjunction with visits and consultations. RVUs for visits and consultations were reduced by the number that was originally added to account for EKG interpretations. This policy change is likely to lead to an increase in the RVUs related to EKG interpretations in 1994.

3. DATA AND METHODS

Data

We measure changes in the volume and intensity of Medicare physician services based on changes in relative value units (RVUs) per beneficiary. These RVU changes can be derived from the BMAD and NCH Procedure Files that contain summary information on 100 percent of all claims submitted by physicians to Medicare Part B carriers. These summary data include the Part B carrier and payment locality, the HCPCS code and modifier, the place of service, the specialty of the physician, the number of times the service was provided and the total Medicare allowed and submitted charges. These data are aggregated so there is one record showing charges and volume for each unique HCPCS/modifier/locality/specialty/place of service combination. The analytic files are constructed so that volume and intensity trends and price changes can be investigated at a national level as well by Medicare carrier payment locality. All physician and clinical laboratory services are included in the analysis, with the exception of anesthesia, dialysis and oncology services. However, due to the widespread impacts of excluding *separate* payments for the interpretation and report of EKG services under the MFS, EKGs are not included in the overall analysis. Changes in the volume and intensity of EKG services are presented and discussed separately.

Information on Medicare enrollees is drawn from the corresponding Medicare Denominator Files. These files provide a source of data on Medicare Part B beneficiary counts so that volume and intensity can be expressed on a "per beneficiary" basis. Counts of Medicare enrollees would be summarized at the Medicare payment locality level. We omit beneficiaries

enrolled in health maintenance organizations (HMOs) at any time during the year since the physician services received by HMO enrollees are not included in the Procedure files.

As a baseline for analyzing changes in volume and intensity that may occur during the first year after the introduction of the MFS we use BMAD data for 1986-1990 and NCH data for 1991. We have analyzed the comparability of carrier-generated BMAD data and NCH data in our current work to determine whether serious discontinuities in time-series exist. In particular, we examined the distribution of charges and allowed services across carriers, localities, and types of services in the 1990 BMAD and 1991 NCH data sets. National distributions across service types and carriers were similar in both 1990 and 1991. This suggests that, at these fairly aggregate levels, the two sources of data are comparable and these data can be used as part of a time series analysis. For further details regarding this comparison, see Appendix A.

Methods

Assigning RVUs. In order to be able to measure changes in the volume and intensity of physician services, we must be able to attach an RVU (work, malpractice and practice expense) to each service. For most services this means assigning the RVU that appears in the 1993 MFS (the most recent available when this study began). Although we rely primarily on the 1993 MFS to assign RVUs to services reported in these data, we use all of the published RVU data to capture numerous additions and deletions to CPT codes over the 1990 through 1994 period. Specifically, we combine elements of the Model Fee Schedule, and the 1992-1994 Fee Schedules to form a single scale of RVUs.

However, there are a number of services for which RVUs were not developed including clinical laboratory services and services performed relatively infrequently on Medicare patients, e.g., elective plastic surgery procedures. In addition, because we use data based on claims reported during 1986-1994, there were numerous codes listed in the data files which had been deleted sometime before 1993. In cases where there are no RVUs provided for a particular service, we estimate RVUs using one of three approaches depending on the type of service requiring the RVU.

We imputed RVUs for about 12 percent of the services reported in each year. Because there are no RVUs in the MFS for clinical laboratory services, this group represents the largest proportion of the imputed values. We did not include dialysis and oncology services in the analysis because it was not possible to estimate RVUs for these services due to extensive CPT coding changes over the base period. In addition, we did not include anesthesia services in the analysis because they are paid using a different payment methodology.

Services without RVUs can be classified into 3 broad categories: evaluation and management codes deleted and replaced in 1992, services which are included in the MFS without RVUs (e.g., carrier priced services) or services which were deleted prior to the MFS, and clinical laboratory services. We describe each method briefly below. For interested readers, each of the methods is discussed in further detail in Appendix B.

We estimate RVUs for evaluation and management codes which were deleted and replaced in 1992 and reported in every year of data in the baseline period, by crosswalking the deleted code to the clinically equivalent 1992 CPT-4 code for which RVUs are available. The algorithm we use for this crosswalk was developed by HCFA and is described in the 1992

MFS.[10] HCFA used this crosswalk to project how physicians would use the new E&M codes and to estimate the budgetary impact so that a budget-neutral conversion factor could be derived. Because nearly half of all RVUs rendered to Medicare beneficiaries are for evaluation and management services (see Table I-1) the accuracy of this crosswalk has important implications for reliably measuring changes in the volume and intensity of these services in the pre-MFS years and during the first year of the MFS.

The method we use to impute RVUs to services either deleted prior to the MFS or services reported in the MFS without RVUs (e.g., carrier priced services such as rhinoplasty) relies on the relationship between charges and RVUs within a type of service group. Briefly, this approach involves assigning all services to a disaggregated type of service group (number of groups=85) and then, using Geographic Practice Cost Index (GPCI)-deflated mean allowed charges, calculating the mean RVU to mean allowed charge ratio for all services in the group which have a RVU from the MFS. We then multiply the RVU-to-charge ratio by the deflated mean allowed charge for the service without an RVU in order to derive an imputed RVU for that service. These calculations are performed separately for each type of service group.

Lastly, since Medicare does not generally use RVUs to pay for clinical laboratory services, it is not possible to impute RVUs for lab services using the process we use to estimate values for other physician services.[11] Instead, we compute charge-based RVUs for each

10. Health Care Financing Administration. Part III Department of Health and Human Services 42 CFR parts 405, 413, and 415: Medicare program; Fee Schedule for Physicians' Services; Final Rule. *Federal Register*. November 25, 1991.

11. Although there are 20 clinical laboratory services defined in the Fee Schedule as physician services and therefore assigned RVUs, there was not enough RVU data in each laboratory service group to impute RVUs using the method described above.

laboratory service. The charge data we used to estimate total RVUs for lab services are from the 1993 Diagnostic Laboratory Fee Schedule National Limits. These RVUs are derived by taking the ratio of the prevailing charge to the 1993 Medicare conversion factor for nonsurgical services ($31.249). In order to estimate RVUs for the lab services deleted prior to 1993, we impute RVUs using the same approach used to derive RVUs for deleted services and services not reported in the MFS with RVUs (described above).

Aggregating Physician and Clinical Laboratory Services. The utilization of physician services is analyzed using two types of service classification schemes developed at the Urban Institute in collaboration with HCFA staff.[12] All physician services recognized by CPT or HCPCS are classified into either a broad or detailed type of service group. In addition, these systems classify over 2,000 local codes into these clinically meaningful and analytically useful groups (Berenson and Holahan 1990). The type of service classification scheme we use includes both the broad and detailed versions. The broad version consists of 23 types of physician service groups while the detailed version consists of 85 types of physician service groups. Table I-2 and Appendix I-C provide a list of these type of service classification schemes.

We examine national trends in the volume and intensity of physician services per Medicare beneficiary for the years 1986-1991, 1991-1992, 1992-1993, and 1993-1994 using this RVU-based approach by type of physician services. While the detailed type of service classification scheme is useful for many specific analyses, most of the analyses we present in this

12. The original version of this type of service classification system was developed by Berenson and Holahan (Berenson and Holahan 1990). This classification system includes 25 types of broadly defined procedure groups (see Table 2). In collaboration with HCFA, this system was later disaggregated into 100 types of service groups. This system includes detailed physician service groups, nonphysician service groups, medical supply groups, and drugs. As part of a current HCFA funded study, this detailed type of service classification system was recently refined by Verrilli to correct for misclassified services and supplies.

report utilize the less-detailed version. The major drawback with the detailed type of service approach is that it is so disaggregated that it makes detection of general patterns of service use difficult. Where appropriate, we use the detailed type of service scheme to focus on more narrowly defined issues, such as trends in cataract extractions under the MFS.

Aggregating Localities. In order to examine the relationship between volume growth and the MFS, we group localities according to the HCFA actuaries' estimates of the impact of the MFS on average payments per service after it is fully phased in.[13] This is analogous to the approach taken by PPRC in their Annual Reports. However, in their annual reports they group localities according to the actual change in average payments per service in that year. This approach is likley to lead some localities to change classification as the MFS is phased in. However, using either the PPRC approach or the one we use here has a serious limitation. The change in average payments per service - estimated or actual - may mask variations in the change in payment rates across specific types of services. For example, under the MFS, a locality that may be characterized as gaining, on average, because it had a relatively large share of E&M services. However, this does not mean that payments for all categories of procedures will increase. In fact, many fees for procedures in these localities will no doubt fall. If as a result of these fee reductions for procedures, procedure volume slows down, a simple descriptive analysis could suggest that procedure growth is slowing in the localities that, on average, are gaining under the MFS. This might lead to a conclusion that for these procedures there is some evidence consistent with a volume offset. However, this would not necessarily be valid. Therefore,

13. Because there were 230 Medicare payment localities in 1992, it is not feasible to assess volume and intensity changes for each area.

although we present a limited set of results based on a anlysis of locality groups, we urge caution in drawing conclusions about the price/volume relationship from this section of the study.[14]

The three MFS impact groups used here are defined as: (1) localities in which average payments per service will increase ("gainers"); (2) those in which average payments per service will fall by between zero and ten percent ("small losers"); and (3) those in which average payments per service will fall by more than ten percent ("large losers"). All of these effects on payments per service were measured relative to what payments per service would have been under the CPR methodology. We use the actuaries' estimates of long-run impacts to characterize localities, as opposed to measuring the actual change in payments per service between 1991 and 1994, because these groupings will be stable over time as the transition takes place. Moreover, we computed actual changes in average payments per service at the locality level for the 1991-1994 period and found a high correlation between the rankings based on this measure and the actuaries' estimates.

However, in moving to this locality-level analysis, there is a need to exclude data from the state of Texas. Prior to the MFS, Texas had a locality structure which was a function of both location and provider specialty. Despite having over 30 localities, most specialists' fees were determined within one of three "regional" localities. For example, a gastroenterologist providing a service in Midland, Texas would have had his/her fee established based on a charge profile relevant for all of the West Rural Texas locality. Analysis of the 1992 data conducted for this study suggests that this gastroenterologist's fees and service volume under the MFS are being

14. To estimate impact of price changes on volume growth, it is necessary to relate price changes to volume changes for the same services. Therefore, procedure volume changes should be examined relative to procedure fee changes, as opposed to overall average fee changes in a locality. This is precisely the approach taken in the following chapter of this report (Zuckerman, Norton and Verrilli, 1996).

captured in the Midland locality. This patterns results in very large changes in service volumes at the locality level throughout Texas. As a result, using the Texas data on locality-level changes between 1991 and 1994 distorts the estimates for each of the MFS impact groups defined above. Although we eliminated Texas in this phase of the study, national level estimates are not affected by this problem and we include Texas in all of those analysis.

In the tables that follow, we present aggregate RVU growth estimates by type of service for the 1986-1991 and 1991-1994 periods for each of the MFS impact groups. These RVU growth estimates may differ across groups, but whether or not these differences are statistically significant need to be explored. The issue of the significance of the volume and intensity growth differences is important because of the inherent volatility in Medicare volume data both across localities and time that has been observed. A simple statistical test of the null hypothesis of no RVU growth differences can be performed, using the locality as the unit of observation, by regressing the 1991-1994 RVU growth on categorical variables defined for each of the MFS impact groups. In this case, we omit the variable for gaining localities. The coefficients estimates for the other groups test for the significance of differences between these groups and the gaining localities. To allow for the possibility that growth during the 1986-1991 base period affects 1991-1994 growth the relationships across MFS impact groups, these models are run both with and without the 1986-1991 RVU growth as an explanatory variable. This had no qualitative impact on the significance of the estimated MFS impact group differentials. The test results reported are from the model that does not include the 1986-1991 RVU growth variable.

National-Level Analyses

Tables I-2 and I-3 include annual rates of change in RVUs per beneficiary for the base period (1986-1991) and the first three years of the MFS (1991-1994). Average annual changes are presented by broad type of service groups (Table I-2) and for selected narrowly defined service groups (Tables I-3 and I-4). The percentage share of total RVUs for each type of service group in 1991 is included to provide the reader with some sense of the importance of each group. Information on the annual RVU changes for *all* of the narrowly defined service groups is included in Appendix C.

As shown in Table I-2, RVU growth per beneficiary slowed substantially across all services during the first three years of the MFS. The rate of RVU change for all services dropped from 6.9 percent in the baseline period to 3.4 percent in 1991-1994. This large slowdown in 1991-1994 represents a significant departure from the base period. In 1986-1991, all but 5 of the broad service groups, had average annual growth rates above 5 percent and some were as high as 18.4 percent (advanced imaging, which includes MRIs and CAT scans). However, in the first year under the MFS, 6 of the 19 broad type of service groups shown in Table I-2 actually had *negative* growth rates and all but three had growth rates less than 10 percent annually.

Consultations and sonograms had the largest RVU growth during the first three years of the Fee Schedule. The average annual change in RVUs per beneficiary for consultations and sonograms was 5.2 and 17.1 percent in the base period, respectively. During 1991-1994, consultations increased significantly to 11.0 percent. The rise in consultations was most

Table I-2

Average Annual Change in Volume and Intensity of Medicare Physician Service per Beneficiary (as Measured by RVUs per Beneficiary)

1986-1994

	Percentage Share of Total 1991 RVUs	Average Annual Growth 1986-1991	Average Annual Growth 1991-1994
ALL SERVICES	**100.0%**	**6.9%**	**3.4%**
IMAGING	**11.2**	**10.0**	**5.8**
I1 Standard Imaging	4.7	5.6	1.1
I2 Advanced Imaging	2.4	18.4	6.3
I3 Sonograms	2.5	17.1	12.6
I4 Imaging/Procedure	1.6	5.8	6.7
EVALUATION AND MANAGEMENT	**47.3**	**5.2**	**3.1**
M1 Office Visits	17.0	5.4	2.6
M2 Hospital Visits	14.7	2.9	0.3
M3 Emergency Room Visits	2.6	9.2	2.9
M4 Home and Nursing Home Visits	2.4	3.0	0.7
M5 Specialist Evaluation and Management	6.3	10.9	5.5
M6 Consultations	4.2	5.2	11.0
MAJOR PROCEDURES	**12.2**	**4.0**	**2.0**
P1 Major General Procedures	4.9	1.1	-0.4
P2 Major Cardiac Procedures	4.5	7.4	3.6
P3 Major Orthopedic Procedures	2.9	4.5	3.7
OTHER PROCEDURES	**18.4**	**8.3**	**4.4**
P4 Eye Procedures	6.1	8.7	0.9
P5 Ambulatory Procedures	3.7	4.4	-1.1
P6 Minor Procedures	4.8	10.6	11.9
P8 Endoscopies	3.8	9.4	4.9
TESTS (EXCLUDES ELECTROCARDIOGRAMS)	**10.8**	**14.0**	**1.8**
T1 Clinical Lab Tests	8.3	15.8	2.1
T2 Physician Tests	2.5	8.8	0.8

significant in the first year of the fee schedule (26.1 percent). Though the rate of increase for sonograms in 1991-1994 was lower than its baseline growth rate, it still had the largest annual change in volume and intensity under the MFS (12.6 percent). At the other extreme to consultations and sonograms was ambulatory procedures, whose volume and intensity actually fell under the MFS.

The increase in consultations during the first three years of the MFS is plausable given the incentives created by a number of payment policy changes. First, establishing a uniform definition of the surgical global package that permits separate payments for the initial surgical consultation may increase the number of consultations that may have been otherwise included in some carriers' pre-MFS global package. Second, the growth in consultations (especially in 1991-1992) could also be related to the explicit site of service policy implemented under the MFS. Under this payment policy the practice expense portion of the service was reduced by half if the service was provided in an outpatient department (OPD). While office visits were included in the list of 380 procedures affected by this rule, consultations were not until 1993. This policy may have created incentives for physicians to bill Medicare for a consultation as opposed to a visit in circumstances where the nature of the OPD service provided was not clear.

The sharp decline in RVUs per beneficiary for Physician Tests in 1991-1994 from an average annual growth rate of 8.8 percent in 1986-1991 to 0.8 percent in 1991-1994, is not the result of a payment rule which prohibited separate payment for interpreting EKGs. Since EKGs are excluded from this category, this service group primarily includes cardiac stress tests, continuous EKG monitoring, and other tests that require direct physician involvement. The data presented in Table I-3 C show that the observed reduction, which primarily occurs during the

Table I-3

Average Annual Change in Volume and Intensity of Evaluation and Management (E/M) Services per Beneficiary (as Measured by RVUs per Beneficiary) 1986-1994

Type of Service	Percentage Share of Total 1991 RVUs	Average Annual Growth 1986-91	Average Annual Growth 1991-92	Average Annual Growth 1992-93	Average Annual Growth 1993-94
M1 OFFICE VISITS	**17.0**	**5.4**	**1.7**	**1.2**	**5.0**
New Patient	2.2	4.5	-3.1	-2.9	2.3
Established Patient	14.8	5.6	2.5	1.8	5.4
M2 HOSPITAL VISITS	**14.7**	**2.9**	**-0.8**	**0.0**	**1.7**
Initial	2.8	-0.4	-3.9	3.6	3.5
Subsequent	9.9	2.9	10.1	-0.3	1.2
Critical Care	2.1	7.9	-47.6	-5.1	2.3
M3 EMERGENCY ROOM VISITS	**2.6**	**9.2**	**-8.7**	**10.1**	**8.3**
M4 HOME AND NURSING HOME VISITS	**2.4**	**3.0**	**-9.4**	**4.0**	**8.5**
Home Visits	0.3	-4.0	-24.6	0.3	6.0
Nursing Home Visits	2.1	4.2	-7.4	4.4	8.7
M5 SPECIALIST E/M SERVICES	**6.3**	**10.9**	**7.5**	**2.3**	**6.8**
Pathology Services	1.3	7.1	33.0	2.6	8.6
Psychiatry Services	1.6	11.6	17.7	5.0	7.6
Ophthalmology Services	3.1	11.7	-10.8	2.2	7.5
Other Specialist E/M	0.3	19.6	24.2	-10.0	-10.6
M6 CONSULTATIONS	**4.2**	**5.2**	**26.1**	**1.0**	**7.5**

Note: E/M = Evaluation and Management

Table I-3 (continued)
Average Annual Change in Volume and Intensity of Major Procedures
per Beneficiary (as Measured by RVUs per Beneficiary)
1986-1994

Type of Service	Percentage Share of Total 1991 RVUs	Average Annual Growth 1986-91	Average Annual Growth 1991-92	Average Annual Growth 1992-93	Average Annual Growth 1993-94
P1 MAJOR GENERAL PROCEDURES	**4.9**	**1.1**	**-0.8**	**-4.2**	**3.9**
Breast	0.2	0.6	-4.9	-6.7	2.1
Colectomy	0.5	-1.2	-3.8	-4.5	1.1
Cholecystectomy (including laparoscopic)	0.5	1.7	1.9	-4.9	1.7
Transurethral Resection of Prostate (TURP)	0.6	-2.1	-13.3	-14.4	-13.6
Hysterectomy	0.2	-2.9	6.2	-6.2	2.5
Laminectomy	0.4	10.7	8.1	0.7	8.6
Other	2.6	1.4	0.4	-2.6	6.9
P2 MAJOR CARDIAC PROCEDURES	**4.5**	**7.4**	**3.3**	**0.4**	**7.3**
Coronary Artery Bypass Graft	1.3	8.6	0.7	-2.0	5.6
Aortic Aneurysm Repair	0.2	-0.6	-5.0	-2.7	-1.1
Thromboendarterectomy	0.2	-0.9	6.4	-3.0	14.7
Percutaneous Transluminal Coronary Angioplasty	0.4	20.5	15.3	0.2	5.6
Pacemaker Insertion	0.3	2.7	1.1	1.4	5.9
Other	2.0	7.6	3.4	2.6	8.7
P3 MAJOR ORTHOPEDIC PROCEDURES	**2.9**	**4.5**	**3.7**	**0.8**	**6.6**
Femoral Fracture Repair	0.7	1.4	-0.9	1.1	4.9
Total Hip Replacement	0.6	0.6	-1.0	-4.3	3.2
Total Knee Replacement	0.7	10.1	6.7	0.2	7.4
Other	0.8	6.4	8.3	4.7	9.4

Table I-3(continued)
Average Annual Change in Volume and Intensity of Ambulatory and Minor Procedures
per Beneficiary (as Measured by RVUs per Beneficiary)
1986-1994

Type of Service	Percentage Share of Total 1991 RVUs	Average Annual Growth 1986-91	Average Annual Growth 1991-92	Average Annual Growth 1992-93	Average Annual Growth 1993-94
P4 EYE PROCEDURES	**6.1**	**8.7**	**3.8**	**-6.1**	**5.5**
Corneal Transplants	0.1	1.2	-1.9	-4.9	-0.9
Cataract Extractions	3.7	6.6	6.4	-9.1	6.6
Retinal Detachment	0.2	2.9	-1.8	-2.5	1.3
Treatment of Retinal Lesions	0.5	14.5	-4.0	2.9	6.1
Other	1.6	14.1	1.3	-2.2	3.5
P5 AMBULATORY PROCEDURES	**3.7**	**4.4**	**-3.1**	**-2.7**	**2.7**
Skin	1.3	4.6	-2.8	-5.0	5.5
Musculoskeletal	0.8	1.9	-2.4	-2.9	3.8
Hernia Repair	0.2	1.0	-3.5	-2.7	-8.0
Lithotripsy	0.8	19.7	-0.2	4.1	10.0
Other	1.4	5.9	-3.7	-0.5	0.8
P6 MINOR PROCEDURES	**4.8**	**10.6**	**-0.8**	**44.9**	**-2.5**
Skin	2.4	10.8	6.2	4.5	4.9
Musculoskeletal	0.7	6.3	-2.1	2.7	6.9
Other	1.7	12.3	-10.3	133.8	-11.1
P8 ENDOSCOPY	**3.8**	**9.4**	**5.5**	**1.4**	**7.8**
Arthroscopy	0.2	14.6	11.7	4.8	11.8
Upper GI Endoscopy	1.0	10.0	6.2	2.2	10.1
Sigmoidoscopy	0.3	-1.6	-6.7	-9.5	-4.7
Colonoscopy	1.2	15.8	8.5	2.9	7.7
Cystoscopy	0.7	5.2	1.0	0.2	2.4
Bronchoscopy	0.2	3.6	0.2	-3.7	1.6
Laryngoscopy	0.1	8.4	5.6	0.4	7.6
Other	0.1	15.4	20.9	10.5	34.0

Table I-3(continued)
Average Annual Change in Volume and Intensity of Physician Tests
per Beneficiary (as Measured by RVUs per Beneficiary)
1986-1994

Type of Service	Percentage Share of Total 1991 RVUs	Average Annual Growth 1986-91	Average Annual Growth 1991-92	Average Annual Growth 1992-93	Average Annual Growth 1993-94
T2 PHYSICIAN TESTS (EXCLUDES EKGS)	**2.5**	**8.8**	**-8.4**	**3.92**	**7.6**
Cardiovascular Stress Tests	0.4	10.7	12.4	20.3	6.1
EKG Monitoring	0.4	6.7	-5.8	-6.9	-4.6
Other	1.7	9.0	-13.9	2.1	11.4

first year of the MFS, is not due to cardiac stress tests, which grew slightly above their base period trends (12.8 percent versus 10.8 percent). Instead, the decline in RVUs per beneficiary among Physician Tests is largely related to a decline in the use of continuous EKG monitoring and other Tests. Analysis of CPT coding indicates that, to some extent, a change in the coding of some non-invasive arterial studies of the upper and lower extremities may be responsible for the RVU change in Other Tests. Through 1991, all methods of performing these non-invasive arterial studies were covered by CPT codes that are classified as Physician Tests. However, in 1992 new codes were created to define services in which these studies were conducted using a duplex scan in which an image of the blood flow is created. These new codes are captured in a sonographic imaging category. The data in Appendix C reflects this shift; RVUs per beneficiary for Other Sonography increase by almost 60 percent between 1991 and 1992, while RVUs per beneficiary for Other Physician Tests fall by almost 15 percent.[15] This type of shift, and the somewhat distorted view it can create for an individual service category, highlights a limitation of analyses carried out entirely at the level of the detailed type of service groups.

Rates of growth for imaging services also slowed considerably during the first several years of the MFS. As shown in Table I-2, although this decline occurs across all imaging groups, it is largest for advanced imaging and sonograms. Both of these service groups experienced rapid growth throughout most of the 1980s. Therefore, the decline in RVU growth during 1991-1994 may simply reflect a natural slowdown that might be expected as dissemination of these high tech services becomes more widespread, causing a general leveling-off of service utilization. In addition, RVU declines in these imaging groups could also reflect

15. CPT-level analysis of these two service groups suggests that the aggregate number of non-invasive arterial studies provided to Medicare patients may have fallen between 1991 and 1992.

changes in the reporting of the professional component, technical component, and global service. Across many of the services classified in these groups, the number of claims for the technical component and global services dropped in 1991-1992 and continued to decline in the 1992-1994. For example, 1992 data for the standard imaging category reveal that the number of claims for the global two view chest x-ray (CPT 71020) decreased by nearly 130,000 records, while claims for the professional component increased by nearly 200,000 claims. Because the total RVUs (work, practice expense and malpractice expense) for the professional component are about one-third of the global service RVUs, changes in the how physicians report imaging services has a fairly substantial impact on overall growth rates.

Declines in breast imaging in 1992-1993 (as shown in Appendix C) reflect coding changes. Medicare began to cover screening mammographies in 1993. Prior to this policy change, providers typically submitted claims for a more highly paid mammography code (i.e., RVUs for this code are greater than RVUs for the mammography screening code). Thus, as providers modified their billing practices in response to this payment policy change, reductions in the RVUs in 1993 resulted as the service volume for the more intense mammography code declined.

Most of the evaluation and management service groups also experienced reductions in RVU growth under the first year of the MFS, yet during 1993 and 1994, growth rates tended to increase. Consultations were the exception to the first year trend. The extent of slowdown in RVU growth during the first year of the MFS varied across the E&M groups and was most pronounced for emergency room and home and nursing home visits. For example, the average annual RVU growth rate for nursing home visits dropped from 3.0 percent in the base period to -

9.3 percent during the first year under the MFS. As shown in Table I-3, the rate of RVU growth for home visits and nursing home visits were markedly different during 1991-1992. More specifically, RVUs per beneficiary for home visits fell by 24.6 percent, but by only 7.3 percent for nursing home visits. These first year trends were not evident during the 1992-1994 period. In fact, in 1993 and 1994, home visits increased slightly by 0.3 percent in 1992-1993 and increased further to 6.0 percent in 1993-1994. The upward trend in nursing home visits was even more significant, increasing 4.4 percent in 1992-1993 and 8.7 percent in 1993-1994.

Different types of hospital visits also varied substantially in RVU changes in the first year of the Fee Schedule (see Table I-3) and then tended to increase during 1992-1994. In the first year of the Fee Schedule, RVUs for initial hospital visits fell slightly (-3.4%) and critical care visit RVUs decreased dramatically (-46.8%). On the other hand, RVU growth for subsequent hospital visits was positive (9.8%) and much larger than that of other service groups. The large declines in critical care visits in 1991-1992 may be due to CPT coding changes which eliminated codes specifying subsequent critical care services. This coding change may have caused a shift in billing that accounts for some of the growth in subsequent hospital visits.

While the volume and intensity changes for hospital visits fell during the first year of the MFS, it increased during 1992-1994. For instance, following a 0.4 percent decline in the baseline and an even larger decline in 1991-1992 (3.9 percent), initial hospital visits grew substantially in 1993 and 1994 (3.6 and 3.5 percent in 1992-1993 and 1993-1994, respectively). Further, after two years of declines in RVU growth, the volume and intensity for critical care visits increased to 2.3 percent in 1993-1994.

Inevitably, however, analysis of E&M changes must consider the potential impact of the

HCFA crosswalk which was used estimate total RVUs (work, malpractice, and practice expense RVUs) for deleted and replaced CPT codes. This crosswalk links the deleted CPT code to a clinically-equivalent 1992 code or set of codes. As described in the Methods section, this crosswalk was used to estimate how physicians would use the new visit codes during the first year of the MFS. From a budgetary perspective, this crosswalk was used to estimate the financial implications of the new codes and to calculate a budget neutral conversion factor. However, if the crosswalk did not reflect the actual changes in coding practices that took place, it could have underestimated 1991 RVUs (causing RVU growth between 1991 and 1992 to be overstated) or overestimated 1991 RVUs (causing RVU growth between 1991 and 1992 to be understated).

A comparison of changes in service volume changes in RVUs provides a means of investigating the extent to which the crosswalk might be misleading in the analysis of changes in the RVUs per beneficiary. For example, if service volume increases faster than RVUs, the crosswalk may have *overstated* the RVUs in the base period and understated growth. Conversely, if service volume growth is less than RVU growth, the crosswalk may have *understated* the RVUs in the base period and overstated growth. To illustrate this point, consider for example, the decline in nursing home visits. In 1991-1992, the RVUs for nursing home visits declined by 7.4 percent but service volume increased 5.8 percent. If the crosswalk had resulted in approximately the same number of RVUs per service in 1991 as occurred in 1992, an increase in service volume would generally result in an increase in RVUs. In this example, the RVUs per service for nursing home visits were probably overstated in the base period. Similarly, RVUs for initial office visits might have been overstated in the base period, because RVUs dropped -3.9 percent while service volume increased 2.7 percent. The potential impact of the crosswalk shows

up in office, hospital, emergency room, and home and nursing home visits, although the effects are smaller for initial hospital visits (in which both RVUs and services fell) and established patient office visits (in which RVUs and services both rose slightly). Services assigned to the specialist E&M group, however, are not impacted by the crosswalk because visit codes (e.g., ophthalmology and psychiatry) were not deleted in 1992. The slowdown in RVU growth for services in this group are therefore likely reflect real declines in the volume and intensity of services.

In the major procedure group, RVU growth in 1991-1992 and 1992-1993 is about a third of the growth in the baseline period. However, in 1993-1994, growth rates surpass the baseline rates. As shown in Table 3, there is a considerable degree of variation in the rates of RVU growth in the major general procedure group during the first three years of the MFS. For example, while the rate of RVU growth for cholecystectomy is fairly constant in the baseline compared to 1991-1992, the rate of RVU change for TURPS drops substantially. In the baseline period, RVU growth for TURPs was -2.0 percent while in 1991-1992, 1992-1993 and 1993-1994, the rate declines even further to -13.3, -14.4 and -13.6 percent, respectively. There may be clinical explanations for these patterns. Alternative therapy (e.g., pharmacological management) for benign prostatic hypertrophy, the primary reason for performing a TURP, is one possible reason for this accelerated decline. The decline in the growth of RVUs for major breast procedures which include radical and modified mastectomy could also reflect changes in treatment protocols. The movement toward less disfiguring surgical procedures such as partial

mastectomies (CPT 19160 - classified in the ambulatory procedure group) may have contributed to the decline in this subset of major procedures[16].

As shown in Table I-3, RVUs per beneficiary decline across all of the types of services groups classified in the Ambulatory Procedures group. Relative to the base period, some of these declines are fairly substantial. For example, the average annual growth in lithotripsy services in the baseline was 19.7 percent, but dropped to -0.9 percent in 1991-1992, increased slightly to 4.1 percent in 1992-1993 and then increased substantially to 10.0 percent in 1993-1994. Similar to some imaging services, these services also experienced large rates of RVU growth in the 1980s. The modest increases in RVU growth during the first three years of the MFS relative to their baseline trends may reflect a leveling off of these growth rates.

Finally, in the minor procedure group, the decline in RVUs in 1991-1992 seems to be largely driven by the "other" service group. However, in the second year of the MFS service volume and intensity increase substantially to 133 percent. This increase can largely be explained by a significant rise in the reporting of influenza vaccines.

We investigated the possible impacts of changes in the global surgical payment policy to determine whether the bundling of certain minor and ambulatory procedures resulted in declines in the number of minor procedures reported during the first year of the MFS. Examples of services which were bundled into the global package included insertion and removal of urinary catheters, routine peripheral intravenous lines, nasogastric and rectal tubes, changing and removal of tracheostomy tubes, removal of cutaneous sutures, etc. A comparison of 1991-1994 service volume growth rates for individual CPT codes revealed that the volume of these types of

16. The number of partial mastectomies increased from about 19,000 in 1991 to 69,000 in 1992.

services did not fall substantially under the first three years of the MFS. Therefore, it appears that the MFS global surgical payment policy had little impact on reducing RVUs growth in these service groups.

Electrocardiograms. The effect of banning payment for certain electrocardiogram services when they are provided during or as a result of a visit or consultation is explored in Table I-4. Specifically, in 1992 and 1993, physicians could no longer bill for the interpretation and report of either a routine or rhythm EKG when they also billed for a visit or consultation. Apparently before this rule was imposed this billing practice was quite widespread. In 1991, there were approximately 29 million bills for routine EKGs that included the interpretation and report (CPT 93000 or 93010). The new MFS rule reduced this number to about 650,000. Physician billings for only the tracing of the routine EKG increased from 288,000 in 1991 to 9.5 million in 1992. Essentially, this policy change caused bills for the interpretation and report of either the routine or the rhythm EKG to almost vanish, while creating dramatic growth in the previously-infrequent "tracing only" service.

In 1994, when this payment policy was reversed, service volume increased substantially to levels consistent with service volume prior to the MFS. For example, the volume of EKG interpretation and report (CPT 93000) increased from 421,000 services in 1993 to 8,935,000 in 1994 -- over a 2,000 percent increase. These data show quite clearly that physicians understood the rule changes and modified their billing practices accordingly or were required to do so by Medicare carriers.

Table I-4
EKG Service Volume and Annual Change in Services per
Beneficiary by HCPCS Code, 1986-1994

	Total Services (000s)					Average Annual Percentage Change in Services per Beneficiary		
	1986	1991	1992	1993	1994	1986-1991	1991-1992	1993-1994
Routine EKGs								
93000 Tracing and interpretation and report	9,098	10,676	603	421	8,935	1.8	-94.4	2,014
93005 Tracing only	500	288	9,521	9,879	2,087	-11.7	3162.5	-79
93010 Interpretation and report only	13,437	18,243	42	12	18,175	4.8	-99.8	150,949
Rhythm EKGs								
93040 Tracing and interpretation and report	405	443	36	35	300	0.4	-92.1	755
93041 Tracing only	19	25	355	383	165	4.4	1277.8	-57
93042 Interpretation and report only	389	1,001	5	3	1,512	19.1	-99.6	59,546

MFS Impact Group Analysis

Table I-5 presents volume and intensity trends during the 1986-1991 and 1991-1994 periods for each of the three MFS impact groups defined above. Before considering what these results might imply about the impact of the MFS on changes in RVUs per beneficiary between 1991 and 1994, the reader should note the similarity of the volume trends during the base period. With few exceptions, RVU growth varies less among the MFS impact groups in the 1986-1991 period than during the first several years under the MFS. One reason for this is that the base period trends are averaged over five years and this tends to reduce the impact of annual fluctuations. For example, among Eye Procedures base period RVU growth varied significantly but from only 8.3 to 9.7 percent across the three impact groups. Under the first year of the MFS, however, RVU growth varied from an 3.3 percent increase to a 1.7 percent decrease. One possible conclusion, other than this simply being due to the effect of averaging across years, is that prior to the MFS annual RVU growth was similar across these groups of areas, but that after implementation volume and intensity trends began to diverge. Whether or not this divergence in trends is consistently related to the size of the projected impact of the MFS is the focus of the remainder of this section.

The conclusions one draws about the potential impact of the MFS across these three impact groups vary considerably by type of service. Across all services (top line of Table I-5), there are no significant differences in the *reduction* in volume and intensity growth across the three groups. This might lead one to conclude that RVU changes are not related to the impact of the MFS. However, a different pattern begins to emerge by examining the data at the level of the five largest type of service groups (the boldface lines). Examining these service groups, we find

Table I-5

Average Annual Change in RVUs per Beneficiary,
by MFS Impact Group and Type of Service,
1986-1994

Type of Service	Large Losers		Small Losers		Gainers	
	Average Annual Growth 1986-1991	Average Annual Growth 1991-1994	Average Annual Growth 1986-1991	Average Annual Growth 1991-1994	Average Annual Growth 1986-1991	Average Annual Growth 1991-1994
ALL SERVICES	**7.5**	**3.1**	**6.5**	**3.7**	**7.1**	**3.2**
IMAGING	**11.0**	**5.0**	**9.7**	**5.9**	**9.6**	**6.7**
I1 Standard Imaging	5.8	-0.5**	5.6	1.3	5.5	2.6
I2 Advanced Imaging	20.8	3.9**	17.6	7.2	17.0	8.2
I3 Sonograms	18.1	14.7**	16.8	11.5	16.9	12.6
I4 Imaging/Procedure	6.8	5.3	4.9	7.2	6.5	7.5
EVALUATION AND MANAGEMENT (E/M)	**5.8**	**3.5**	**4.8**	**3.2**	**5.6**	**2.6**
M1 Office Visits	5.5	3.9**	5.2	2.5**	5.9	1.8
M2 Hospital Visits	5.0	0.1**	2.1	0.3	2.7	0.6
M3 Emergency Room Visits	10.0	0.6	8.8	2.9	9.3	4.6
M4 Nursing Home Visits	4.2	2.0**	3.1	1.1**	2.1	-0.7
M5 Specialist (E/M)	9.4	5.3**	11.0	6.5**	13.0	4.4
M6 Consultations	3.1	10.3**	6.0	11.4	6.6	11.3
MAJOR PROCEDURES	**4.8**	**1.9**	**3.8**	**1.9**	**3.5**	**2.6**
P1 Major General Procedures	2.5	-0.7**	0.9	-0.5	0.5	0.1
P2 Major Cardiac Procedures	7.4	3.3	7.2	3.7	7.9	4.1
P3 Major Orthopedic Procedures	5.1	3.8**	4.3	3.1	4.4	4.6
OTHER PROCEDURES	**8.8**	**3.1**	**7.9**	**4.6**	**8.8**	**5.8**
P4 Eye Procedures	9.7	-1.7**	8.3	1.3*	8.4	3.3
P5 Ambulatory Procedures	5.1	-2.2	4.1	-0.8	4.3	-0.1
P6 Minor Procedures	10.0	11.8	9.9	12.0	12.5	12.1
P8 Endoscopies	10.0	3.7	8.8	4.9**	9.9	6.1
TESTS (EXCLUDES EKGS)	**14.0**	**0.3**	**13.4**	**4.5**	**15.1**	**-1.2**
T1 Clinical Lab Tests	14.8	-1.1**	15.6	6.3**	17.3	-1.7
T2 Physician Tests	6.9	0.5	4.8	-1.3	4.9	0.2

Note: a) Statistical tests compare each of the groups of losing localities to the gaining group. There are 198 localities included in this analysis: 73 gainers, 81 small losers and 44 large losers.

b) * $p \leq .10$

** $p \leq .05$

c) EKG = electrocardiogram

significantly greater RVU growth in the first three years under the MFS for Evaluation and Management (E&M) services (3.5 percent) and Major Procedures (1.9 percent) among areas projected to have the largest payment rate reductions than among gaining areas (2.6 and 2.6 percent, respectively). On the other hand, we find slower RVU growth for Imaging Services (actually an increase of 5.0 percent) in the largest losers as compared to the gaining localities (6.7 percent). These findings suggest that patterns consistent with both the notions of "volume offsets" and "standard supply responses" are evident.

Further evidence of these inconsistencies are reflected in many of the other service groups in Table I-5. Among E&M services, the higher RVU growth among the largest losing localities is predominantly due to Office Visits (3.9 percent growth in the largest losers versus 1.8 percent in the projected gainers). Although a similar pattern in relative volume changes occurs for Nursing Home and Home Visits, this is a relatively minor service group. Moreover, the changes in this latter group would be more than offset by the lower volume growth among emergency room services (0.6 percent growth in the largest losers versus 4.6 percent in the projected winners). Similarly, within the Imaging service groups, we observe Standard Imaging in which the prospects of greater fee reductions seem to slow Medicare RVU growth, while in the Sonogram service group the reverse relationship exists.

Even among Other Procedures, in which volume actually falls in areas where fees are reduced, there are differences across the component service groups. The overall volume reduction in Other Procedures among the largest losers is due to the changes occurring among Eye Procedures (1.7 percent reduction) and Ambulatory Procedures (2.2 percent reduction). Although Endoscopies continue to increase in 1991-1994, they contribute to the difference across

MFS impact groups because their growth is significantly slower in the largest losers than in the projected winners (3.7 percent versus 6.1 percent). However, for Minor Procedures, volume actually seems to be grow equally fast among the largest losers relative to the winners. In this service group, volume grows at 11.8 percent and 12.1 percent among the larger losers and projected gainers, respectively.

Finally, within the three Major Procedure groups, Cardiac Procedures exhibit similar volume growth in the largest losers as compared to the projected gainers. Despite similar volume trends during the 1986-1991 period, volume growth slows to 4.1 percent among projected gainers and slows to 3.3 percent among the largest losers in 1991-1994.

5. DISCUSSION

The descriptive analysis presented in this paper shows that the growth in the volume and intensity of Medicare physician services slowed dramatically during the first three years of the MFS as compared to the preceding five-year period. Rates of growth as low as those observed here have not been sustained over multiple years since the mid-1980s. This slowdown does not necessarily imply that beneficiaries were receiving less care under the MFS, only that the rate of increase in the quantity of care was lower. Although studies of volume and intensity growth can make comparisons across time, areas and service types, they cannot compare observed trends to "appropriate" growth rates. This is analogous to the problems that research on utilization variation confronts in trying to assess whether some observed levels of use are "too high" or "too low."

In fact, there is no way to determine an appropriate volume and intensity growth rate. From the beneficiaries' perspective, this will depend on changes in health care needs as well as the availability and cost services. Providers will see the appropriate Medicare volume and

intensity growth from the beneficiaries' perspective, but may also consider this in the context of changes in medical technology and the policies of other payers. The Medicare policymaker's viewpoint will also include the budgetary effects of various volume and intensity trends.

Despite the magnitude of the volume and intensity slowdown, these descriptive results suggest that it was certainly not uniform across either types of service or payment localities. There were some types of services (e.g., consultations and sonograms) that exhibited fairly rapid growth during the 1991-1994 period. At the other extreme, some services (e.g., major general procedures and ambulatory procedures) actually exhibited negative growth rates over this three year period. In fact, the volume and intensity of both consultations and minor procedures grew more rapidly under the MFS than they had during the base period.

In terms of variation in the slowdown in RVU growth across payment localities, we find no significant differences at the level of All Services or for the broadest types of services. At this fairly aggregate level, the results do not provide consistent evidence of either "volume offset" or "standard supply response" effects. However, as we move below these broadest categories, different patterns emerge. For example, among Office Visits, the data are consistent with the view that as fees are reduced, the volume and intensity of physician services accelerates to compensate for potentially lost revenue. On the other hand, among all categories of Other Procedures, the results show that volume growth is slower among localities likely to experience large payment rate reductions, suggesting that physicians may be shifting away from provididng Medicare services as payments fall. These findings could lead to the development of conflicting hypotheses regarding differences in the nature of volume responses across service groups. However, this is not likely to be fruitful. As we stated earlier, the lack of a clear link between the magnitude of the price change for specific types of services and the "average" price effect used to

define the locality group makes it difficult to characterize the price volume realtionships observed in this descriptive study.

On the other hand, these findings lead us to conclude more definitively that changes in payment rules (beyond those reflected in the RVS), developments in clinical pratice and coding changes play a large role in determining the observed RVU changes. Included among these payment rules were establishing uniform global surgery periods, redefining visit codes, eliminating and reinstating payments for certain EKG interpretations and imposing site of service differentials selectively. These factors seem to have played a role in determining trends in volume and intensity of services of both consultations and EKGs. The effects of clinical changes can be seen in the shifts away from using TURPs to treat benign prostatic hypertrophy or major breast procedures when less invasive treatments are possible. In the other direction, the data show a recent resurgence in carotid thromboendarterectomies to prevent strokes after a period of decling use prior to the MFS.

The large decline in volume and intensity growth during the first few years under the MFS relative to historical trends did not necessarily impose hardships relative to beneficiaries' need to care. Even though it is difficult to establish precisely when hardships will develop, however, the trends uncovered here suggest that further monitoring is warranted. The amount of care beneficiaries received grew at much slower rates during the first two years under the MFS than it had previously. Subsequently, volume and intensity growth returned to historical levels for many services. This was particularly apparent among major and endoscopic procedures in 1994 and occurred at the same time that there was a large increase in Medicare fees for these services. This could suggests that the link between prices and volume growth may be important, even though our locality impact group analysis is not conclusive.

At this point, given what is known about variation in volume and intensity trends over time and the continuing changes likely to occur to the MFS over time, subsequent years could produce different findings. A strength of the way this descriptive study has been organized is that additional years of data can be easily incorporated as they become available. In particular, the stable definitions of the MFS impact groups (based on projected MFS impacts) and the use of a highly disaggregated service classification, allows policymakers to focus on localities being affected by the MFS in similar ways and on services that may be affected by specific modifications in MFS policies. For example, anticipated modifications in the basis for establishing practice expense relative values in 1998, will continue to alter the prices Medicare pay for individual services. In all likelihood, a continuation of this type of descriptive study will be a useful first step in understanding how volume and intensity reacts to those policy changes.

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APPENDIX A

Comparison of BMAD and NCH Data

APPENDIX I-A
COMPARISON OF BMAD AND NCH DATA

We reviewed the comparability of the 1991 and 1992 National Claims History Procedure Files to prior years of BMAD data in order to assess whether the new data files for 1991 and 1992 are reasonably comparable to earlier BMAD files. We pursued this analysis following discussions with BDMS staff at HCFA who suggested that few internal analyses of the comparability of BMAD and NCH data have been completed. In particular, we were concerned that differences in decisions used in the carrier generated BMAD files and those used by HCFA would be large enough to create a discontinuity in the time series. Therefore, before we used the NCH data in conjunction with BMAD, we performed some assessment of their comparability.

We compared utilization and charge data from 1985-1990 BMAD files to similar data from the NCH files. In addition, we went beyond simple aggregate comparisons of total charges and service counts and explored distributions across types of service groups, specialties, carriers and localities. In some cases, we examined individual HCPCS codes representing large shares of Medicare physician spending within selected type of service groups (TOS). We focused the comparison on the distribution of total allowed charges and total allowed services for the 1985-1990 period and compared these values to NCH data for 1991 and 1992.

Overall, we found the NCH data generally comparable to the BMAD data. Our comparison of the 1991 NCH data to earlier years of BMAD revealed comparable distributions of allowed services and allowed charges across type of service groups and Medicare carriers. There were, however, significant differences in the use of the carrierwide locality '00'. While the use of locality '00' diminished in the 1992 data, we found increased variation in the distribution of charges and services. The implementation of the Medicare Fee Schedule in 1992 may be partially responsible for the changes in the distribution of these data across types of services. A detailed discussion of these analyses is provided below.

Use of Locality '00'

As part of our initial work with the 1991 data, we identified large increases in the number of dollars reported in carrierwide locality '00'.[17] As a result of our discussions with HCFA, we understand that this carrierwide locality code is generally used to report DME and medical supplies. Because we exclude records with invalid physician specialty codes, DME and supply claims are typically not included in our analytic files. Therefore, we expected there to be few dollars in locality '00'. This is generally the case with BMAD data; with the exception of a few

17. The use of the carrierwide locality '00' in the 1991 NCH Procedure File was extensively described in a June 16, 1993 memo to Jesse Levy.

carriers, most carriers did not use the carrierwide locality. Throughout the period 1986-1990, North Carolina consistently has the highest proportion of dollars (approximately 40%) in this locality. This may be a result of the assignment of national claims for Roche Labs to this locality. Other carriers such as Iowa, New Jersey, and Texas also use this locality.

In the 1991 NCH file, we found considerable changes in the use of locality '00' in eight carriers. These carriers are listed in Table A1. As shown in the table, with the exception of North Carolina and Idaho, all of these carriers previously never used locality '00'. (Although 1990 data is presented for comparative purposes, any year of data would have been sufficient for comparison since the use of locality '00' is consistent across most years of BMAD.)

Following the detection of this problem, we ran several diagnostic runs which aimed to explain the dollars in locality '00'. We specifically investigated the distribution of allowed charges across HCPCS codes reported in locality '00' to determine whether certain types of services were concentrated in this locality. And second, we assessed the distribution of total allowed charges across all localities in the carrier to determine if all of the dollars in locality '00' were being shifted from other localities. These runs produced the following results:

- Allowed charges are distributed across ranges of HCPCS codes in a manner similar to the national distribution of charges; and

- relative to the distribution of dollars across localities in the BMAD data, allowed charges seem to be proportionately shifted from other localities in the carrier to locality '00' eg, there were no marked increases in total allowed charges in the carrier nor were particular localities contributing disproportionately more dollars compared to other localities.

These findings were discussed with both Janice Siebert and Leo Porter in BDMS and they pursued similar analyses and confirmed our results. Because the use of the carrier wide locality '00' was confined to selected carriers, we decided to include these carriers in our data and allocate the charges in locality '00' across all localities in the carrier. The allocation was done using the same algorithm we used in the earlier BMAD files which allocated dollars reported in miscoded localities to valid localities in the carrier. Briefly, this is accomplished by allocating the allowed charges, services, and allowed assigned services in the locality '00' to each recipient locality based on the ratio of total allowed charges for the carrier (i.e. across all HCPCS). Allocation is done for each HCPCS + modifier + specialty + place of service combination. After the allocation, the donor records are dropped from the file. Although this allocation process is generally reliable for redistributing small percentages of total dollars in a carrier, the large redistribution of charges across the carriers listed in Table A1, suggest that locality level analyses should proceed cautiously.

Distribution of Charges and Services by Types of Services

We examined the distribution of allowed charges and allowed services across types of services. We specifically compared the 1989 and 1990 BMAD data to the 1991 and 1992 NCH data. Tables A2 and A3 summarize shares of allowed charges and allowed services at the type of service level. As shown in these tables, the distribution of allowed charges and allowed services is generally constant across types of service groups for all years of data. This suggests a reasonable degree of comparability between the BMAD and NCH data. However, because the aggregated type of service classification scheme may conceal important variations in the distribution of charges and services across different types of services, we investigated the distribution of total allowed services and total allowed charges using a more disaggregated type of service classification.

Further analysis of the 1992 data at a more disaggregated type of service level (data not shown), suggest that variations in the distribution of both total allowed charges and total allowed services across types of service groups are likely to be more of a reflection of payment policy changes incorporated in the 1992 Medicare Fee Schedule than to differences in the reporting of BMAD and NCH data. For example, in 1992, we observe a decline in the percentage of total allowed charges in the procedure groups and an increase in the percentage of total allowed charges in the evaluation and management service groups- reflecting a redistribution of dollars away from surgical procedures toward evaluation and management services.

Further, in the EKG test group, reductions in both allowed services and charges reflect changes in EKG payment policy which prevented physicians from billing separately for EKG interpretations if they were provided during an office visit. Lastly, there was a large reduction in hospital services and a substantial increase in consultation services in 1992. The decline in the hospital visit category is partially due to a decrease in the number of critical care services reported. This decline in critical care visits may reflect changes in CPT-4 coding which resulted in elimination of subsequent critical care CPT-4 codes in 1992. The large increase in consultation services may reflect changes in the definition of global surgical policies which permit separate billing for the consultation in which the decision to perform surgery was made.

Thus, changes in the distribution of these data in 1992 may partly be explained by the implementation of the Medicare Fee Schedule. This suggests that the 1991 NCH data is perhaps the more relevant year of data to use in assessing whether BMAD and NCH data are comparable. As discussed above, the analysis of 1991 data suggest comparability to the BMAD data; i.e. any differences in the distribution of charges and services between the 1990 and 1991 periods reflect trends in the distribution already underway in the BMAD years.

Distribution of Charges and Services by Medicare Carrier

Following the analysis of these data at the type of service level, we investigated the distribution of total allowed charges and services at the carrier level. Tables A4 and A5 display the distribution of total allowed charges and total allowed services across Medicare carriers. As shown in these tables, the distribution of total charges and services across carriers is similar across all years. This finding suggests there were no substantial increases or decreases in either the relative volume of services reported or the allowed charges for any carriers in the NCH data. This finding is consistent in both the 1991 and 1992 periods.

Conclusion

This assessment of the comparability of NCH and BMAD data suggests that they are reasonably similar. The distribution of total allowed charges and total allowed services at both the type of service and carrier level reveal similar patterns across all years of data. These results confirm that any time series analysis using both BMAD and NCH data is generally reliable at the national and carrier level.

Table I-A1

Changes in the Use of the Carrierwide Locality '00'
for Selected Carriers, 1990-1991

Carrier #	State	1990 Percent of Total Allowed Charges Assigned to Locality '00'	1991 Percent of Total Allowed Charges Assigned to Locality '00'
00510	Alabama	0.0	24.7
00660	Kentucky	0.0	24.3
00700	Massachusetts	0.0	30.8
00710	Michigan	0.0	22.9
00740	Missouri	0.0	25.2
05130	Idaho	5.1	25.1
05535	North Carolina	39.1	56.0
21200	Maine	0.0	27.6

Source: 1990 BMAD Procedure File and the 1991 NCH Procedure File

APPENDIX B

1985-1992 HCPCS-to-RVU Crosswalk

APPENDIX I-B
1985-1992 HCPCS-TO-RVU CROSSWALK

In order to be able to measure changes in the volume and intensity of physician services, we must be able to attach an RVU (work, malpractice and practice expense) to each service. For most services this means assigning the RVU that appears in the MFS. However, there are a number of services for which RVUs were not developed including clinical laboratory services and services performed relatively infrequently on Medicare patients, eg, elected plastic surgery procedures. In addition, because we use data based on claims reported during 1986-1994, there were numerous codes listed in the data files which had been deleted sometime before 1994. In cases where there are no RVUs provided for a particular service, we developed several approaches to estimate RVUs for services where no RVUs are provided in the MFS.

Although we rely primarily on the 1993 MFS to assign RVUs to services reported in these data, we use all of the published RVU data to capture numerous additions and deletions to CPT codes over the 1990 through 1994 period. Specifically, we combine elements of the Model Fee Schedule, and the 1992 - 1994 Fee Schedules to form a single scale of RVUs. For the remaining services which do have reported RVUs we estimate RVUs using one of three approaches depending on the type of service requiring the RVU. Particular services without RVUs can be classified into 3 groups: evaluation and management codes deleted in 1992, services which are included in the MFS without RVUs (eg, carrier priced services) or services which were deleted prior to the MFS, and clinical laboratory services. We describe each method briefly below.

Overall, RVUs were assigned to most of the physician services reported in the 1985-1994 datasets. We imputed RVUs for about 12% of total Medicare expenditures for physician services in each year. Services which we could not accurately classify into a type of service group were eliminated from the analysis. Further, due to extensive CPT-4 coding changes it was not possible to estimate RVUs for dialysis and radiation oncology services. Finally, because anesthesia services are paid using a different fee schedule, these services were also excluded from the analysis.

This appendix describes the process we used to develop total RVU values for most codes reported in the 1985-1990 BMAD and 1991-1994 NCH Procedure Files that did not have reported RVUs in the 1992-1994 Medicare Fee Schedule (MFS). Total RVUs are defined as the sum of the work RVUs, practice expense RVUs, and malpractice RVUs. Our approach also addresses adjustments that are made for selected modifiers and for payment reductions imposed on some pre-1992 services provided in outpatient departments. Specifically, we assign RVUs for services modified by the professional and technical components (CPT modifiers 26 and TC), bilateral surgery (CPT modifier 50), two surgeons (CPT modifier 62), and assistant at surgery (CPT modifiers 80, 81, and 82) modifiers. Finally, we discuss the limitations of the methods we used to estimate RVUs.

Part A: A Description of the Process Used to Assign RVUs to Physician Services

STEP 1: Combine the 1992 and 1993 Medicare RBRVS

We used both the 1992 and 1993 Medicare Fee Schedules to assign RVUs to services reported in the 1985-1992 Procedure Files. With the exception of codes deleted in 1993, all of the RVU data we used was from the 1993 MFS. If a service was deleted in 1993 and had a reported RVU in the 1992 MFS, we used the 1992 RVU. However, when RVUs from the 1992 RBRVS were used, their RVUs were reduced by 2.783 percent in order to maintain the RVU budget neutrality adjustment incorporated in the 1993 RBRVS. This adjustment put all 1992 RVUs onto the 1993 scale.

STEP 2: Assign RVUs to Deleted Codes Using CPT Reporting Guidelines and HCFA Crosswalk

CPT guidelines for reporting deleted services were used to crosswalk deleted codes to active CPT codes. Where appropriate, we mapped deleted codes to the new CPT code and assigned the new code's RVUs to the deleted code. For example, in 1990, CPT-4 code 21001, a bilateral arthrotomy, was deleted and physicians were instructed to report this service using the unilateral arthrotomy code (21010) plus the modifier 50. The modifier 50 defines a service performed bilaterally. Thus in our assignment of RVUs to this deleted code, we used the guidelines for bilateral service payments specified in the 1992 MFS, and adjusted the total RVUs of the unilateral arthrotomy to capture the additional resources required to perform the service bilaterally (eg, we multiplied the total RVUs of 21010 by 1.5).

For evaluation and management codes which were deleted and replaced in 1992 and still reported in the 1993 data sources, we total RVUs by crosswalking the deleted code to a clinically equivalent 1992 CPT code. The algorithm we use for this crosswalk was developed by HCFA and is described in the 1992 MFS (pp. 59580-59581).[18] HCFA used this crosswalk to project how physicians would use the new E&M codes. By determining service-specific RVUs for all of the deleted and replaced E&M codes, a budget-neutral conversion factor could be calculated.

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18. Health Care Financing Administration. Part III Department of Health and Human Services 42 CFR parts 405, 413, and 415: Medicare program; Fee Schedule for Physicians' Services; Final Rule. *Federal Register*. November 25, 1991.

STEP 3: Compute RVUs

Imputing Total RVUs for Physician Services

We computed RVUs for the remaining physician services which were not reported in the 1992, 1993 or 1994 RBRVS because they had been either deleted or redefined prior to the 1992 RBRVS or were reported in the Fee Schedules with zero RVUs (these included, for example, services HCFA designated as carrier-priced). The process we used relies on relative charges among services with and without RVUs to impute or gap fill services not included in the RBRVS. The gap filling process is based on the available RVUs within a type of service group.

The first step in this process was to assign services to type of service groups. This permitted us to define reasonably homogenous groups of services. The disaggregated type of service classification scheme (TOS) for 84 groups was used to narrowly define groups of similar services. In order to maintain an even greater level of homogeneity within imaging type of service groups, we defined separate groups for the professional, technical, and global components of these services.

By using charges and RVUs at the type of service level, we have tried to minimize the possibility of introducing into the computed RVUs distortions due to a single RVU or charge anomaly. Within these small homogenous groups of services, we assumed the information about the average total RVUs for the service category could be used to provide information about the RVUs for other, related services. Therefore, we used the relationship between average allowed charges and RVUs at the type of service level to impute the RVUs for services in the group without RVUs. In effect, we assumed that the same ratio of RVUs to charges that applies to those services within the group that have RVUs also applies to those that do not have RVUs. In summary, the following formula was used to impute RVUs:

$$\text{Imputed RVU} = \frac{\text{Mean RVU for all services in the TOS with reported RVUs}}{\text{Mean allowed charge for services in the TOS with reported RVUs}} \times \text{Mean allowed charge for service in the TOS without a reported RVU}$$

We know that charge data vary across Medicare localities because of, in part, differences in physicians' costs of providing services. In order to capture relative price differentials across services, therefore, prior to computing the mean allowed charges locality-level charges were deflated by the relevant GPCI.

In addition, we must derive a single imputed RVU for each service that applies to all years of data. Therefore, it is important to insure that annual variations in relative charges are taken into account. Selection of a base year from which to compute RVUs would problematic, no matter what year is chosen. This is especially true since many of the codes requiring computed RVUs do not

exist in each year. In order to estimate mean allowed charges in a way that captures relative price differences over time as well as across types of services, RVUs were computed for each year using year-specific charge data and then averaged over all the years in which the code appears in the data.

For some codes year-specific RVUs may have been averaged over 6 years, while for other codes, year-specific RVUs may have been averaged over only 2 years. For example, code 58265 was deleted in 1991 and was reported in BMAD for years 1985-1990. An RVU equivalent would be computed for each year (1985, 1986, 1987, 1988, 1989, and 1990) and then averaged over the six years in order to calculate a single RVU for the code.

Estimating RVUs for Clinical Laboratory Services

Clinical laboratory services are not paid under the MFS and are therefore not assigned RVUs. Because Medicare does not generally use RVUs to pay for these services, it is not possible to impute RVUs for lab services using the process we use to estimate values for physician services.[19] Instead, we compute charge-based total RVUs for each laboratory service and do not separately estimate malpractice and practice expense RVUs for these services. Further, since there is no physician work associated with these services, work RVUs are also not derived.

The charge data we used to estimate total RVUs for lab services are from the 1993 Diagnostic Laboratory Fee Schedule National Limits. These data include a list of 1993 laboratory codes and their respective national prevailing charge screens. The national prevailing charge screens define separate payment rates according to where the service is provided, e.g., a physician office or a hospital outpatient lab. In 1993, services provided in a physician's office were reimbursed at 60 percent of the median prevailing charge while services provided in a hospital outpatient lab were reimbursed at 62 percent of the median prevailing charge.

We use the payment rates for office-based lab services to impute charge-based RVUs. These RVUs are derived by taking the ratio of the prevailing charge to the 1993 Medicare conversion factor for nonsurgical services ($31.249). Using this approach, we imputed total RVUs for all 1993 laboratory codes listed in the national lab fee schedule. Because we are only able to estimate RVUs for 1993 CPT-4 codes, these imputed values serve as the basis for deriving total RVUs for all other laboratory services reported in these data (e.g., those laboratory codes deleted from the 1993 version of CPT).

19. Although there are 20 clinical laboratory services defined in the Fee Schedule as physician services and therefore assigned RVUs, there was not enough RVU data in each laboratory service group to impute RVUs using the method described above.

STEP 4: Compute RVUs for Selected Modified Services

Following the estimation of RVUs for most services in these data, we computed RVUs for selected modified services. In addition to the professional and technical components of some services, we maintained modifiers which define bilateral services, services performed using an assistant-at-surgery, and services performed by two surgeons. These modifiers were maintained because their RVUs could be RVUs could be estimated using HCFA's current payment policy guidelines defined in the 1992 MFS. The computation of RVUs for these modified codes was performed as follows:

Modifier	RVU Adjustment, if applicable
bilateral: (modifier 50)	modified service has 150% of the RVUs for the unmodified service
assistants at surgery: (modifiers: 80, 81, and 82)	the modified service has 16% of the RVUs for the unmodified service
two surgeons: (modifier -62)	the modified service has 125% of the RVUs for the unmodified code divided by 2 (assumes each surgeon submits a separate bill)

STEP 5: Incorporate the Site-of-Service Practice Expense Limitation

Finally, for services affected by the site-of-service practice expense reductions defined in the 1992 MFS, we reduced the practice expense portion of their total RVUs by half. The total RVUs assigned to each service consistently reflects the assumption of lower practice costs being incurred when the service is performed in an outpatient department (see Federal Register 1993 p. 55989 and Addendum D, p. 56163 for a list of services subject to this rule). This did not affect any codes that were deleted prior to 1992 and required RVU imputation. The only deleted codes that this rule applied to were visit codes, whose RVU were derived using the HCFA crosswalk.

Part B: Limitations

We reviewed the computed RVUs at the type of service level to determine the face validity of the estimated values by comparing their RVUs to similar services in the group. In general, we found the computed values to be consistent with the RVUs for comparable services. However, there were cases where the computed value was different from RVUs for other services. Services with potentially questionable RVU values include infrequently performed services, services classified in less homogenous type of service groups, and services which underwent substantial definitional changes in CPT.

Certain local codes, obstetrical services, and advanced procedures such as heart transplants are examples of codes that are performed infrequently. Because the charge data for these services tend to be based on small numbers of claims, the determinants of the imputed RVU tend to be estimated imprecisely. As such, the imputed RVUs for these services are often inconsistent with other services classified in the type of service group. Similarly, in less homogenous type of service groups such as Other Major Procedures (which includes all major surgical services not classified in more narrowly defined surgical groups, eg, hysterectomy or colectomy) there is a greater degree of variation in both allowed charges and reported RVUs across services. Because the computed RVU to charge ratio for the group reflects the mean RVU and the mean allowed charge for all services in the group, if the mean allowed charge for the service (requiring an imputed RVU) does not accurately reflect the work of the service, the imputed value is likely to over- or underestimate the imputed RVU.

In addition, the imputed RVUs for services in a type of service group that were deleted and split into more than one CPT code were also assessed. For example, a code defining any type of arthroplasty revision (code 27135) was deleted and split into one code defining the revision of the acetabular component (code 27137) and another code defining the revision of the femoral component (27138). Because the deleted code originally reflected both types of revisions, one would expect its imputed RVU value to be in between the RVUs for codes 27137 and 27138. The imputed RVU, however, is approximately 15 percent less than the RVUs for either code. This underestimation of the imputed RVU may be a explained, in part, by the fact that its mean allowed charge did not fully capture the work involved in the performance of the service. Similarly, in other cases imputed RVUs may be overstated.

We reviewed deleted procedure codes to determine the extent to which a single code was split into many codes. In this review process, it became clear there were several ways of defining a split code. For our purposes, we defined a "truly" split code as one which originally described a rather broad type of procedure and was split into codes that more specifically defined the various services being performed under the original code. In general, many "apparently" split codes appear as if they were split, but, also underwent substantial redefinitional changes instead. In cases of definitional modifications, it is difficult to ascertain how closely the new codes are related to the deleted code they replaced. Thus, our review of split codes focused on the codes we defined as "truly" split. Over the 1985-1992 period, we found very few examples of procedure codes which fit this definition and therefore do not plan to pursue alternative approaches for estimating RVUs for deleted services which were split into more than one code.

APPENDIX I-C

Average Annual Change in Volume and Intensity of Medicare Physician Services per Beneficiary (as measured by RVUs per beneficiary), by Detailed Type-of-Service Groups, 1986-1996

APPENDIX C: AVERAGE ANNUAL CHANGE IN VOLUME AND INTENSITY OF
MEDICARE PHYSICIAN SERVICES PER BENE (AS MEASURED BY RVUS PER BENE),
BY DETAILED TYPE OF SERVICE GROUPS
(EXCLUDING TEXAS)
1986-1994

14:32 TUESDAY, DECEMBER 17, 1996

LABEL	PERCENT SHARE OF TOTAL 1991 RVUS	AVERAGE ANNUAL GROWTH 1986-91	AVERAGE ANNUAL GROWTH 1991-92	AVERAGE ANNUAL GROWTH 1992-93	AVERAGE ANNUAL GROWTH 1993-94
ALL SERVICES	100.0%	6.9%	2.7%	2.7%	4.8%
I - , IMAGING	11.2%	10.0%	.7%	2.8%	8.0%
I1 - STANDARD IMAGING	4.7%	5.6%	1.6%	-0.4%	2.2%
I1A - CHEST IMAGING	1.4%	4.3%	-1.0%	-0.4%	0.1%
I1B - MUSCULOSKELETAL IMAGING	1.1%	4.9%	1.6%	0.3%	6.2%
I1C - BREAST IMAGING	0.5%	25.6%	0.7%	-4.2%	3.6%
I1D - G.I. TRACT IMAGING	0.5%	-4.1%	-5.7%	-10.4%	-5.6%
I1E - NUCLEAR MEDICINE IMAGING	0.8%	12.7%	14.0%	6.4%	6.5%
I1F - OTHER IMAGING	0.4%	0.3%	-3.1%	2.2%	-6.1%
I2 - ADVANCED IMAGING	2.4%	18.4%	9.3%	0.7%	9.3%
I2A - CT SCANS-HEAD	0.5%	4.3%	-2.1%	-3.6%	3.8%
I2B - CT SCANS-OTHER	1.1%	16.8%	5.3%	-1.6%	7.0%
I2C - MRI-BRAIN	0.4%	35.5%	26.8%	5.0%	15.7%
I2D - MRI-OTHER	0.5%	52.3%	16.9%	5.5%	12.8%
I3 - SONOGRAPHY	2.5%	17.1%	12.7%	10.5%	14.8%
I3A - OPHTHALMIC ULTRASOUND	0.3%	6.1%	6.3%	-8.4%	3.3%
I3B - ECHOGRAPHY-ABDOMEN	0.5%	11.9%	5.4%	2.5%	7.8%
I3C - ECHO-CARDIOGRAPHY	1.3%	21.7%	13.2%	19.1%	18.2%
I3D - CAROTID ARTERIES	0.3%	17.4%	3.5%	0.7%	11.0%
I3E - PROSTATE ECHOGRAPHY	0.0%	379.6%	55.2%	2.2%	-0.4%

(CONTINUED)

	PERCENT SHARE OF TOTAL 1991 RVUS	AVERAGE ANNUAL GROWTH 1986-91	AVERAGE ANNUAL GROWTH 1991-92	AVERAGE ANNUAL GROWTH 1992-93	AVERAGE ANNUAL GROWTH 1993-94
LABEL					
I3F - OTHER SONOGRAPHY	0.1	29.1	56.7	16.8	29.0
I4 - IMAGING PROCEDURE	1.6	5.8	8.3	2.7	9.2
I4A - CARDIAC CATHETERIZATION	1.1	7.8	14.9	1.0	11.9
I4B - OTHER IMAGING/PROCEDURE	0.5	2.1	-5.6	7.1	2.7
M - ALL EVALUATION AND MANAGEMENT	47.3	5.2	2.8	1.5	4.9
M1 - OFFICE VISITS	17.0	5.4	1.7	1.2	5.0
M1A - OFFICE VISITS - NEW	2.2	4.5	-3.1	-2.9	2.3
M1B - OFFICE VISITS - ESTABLISHED	14.8	5.6	2.5	1.8	5.4
M2 - HOSPITAL VISITS	14.7	2.9	-0.8	0.0	1.7
M2A - HOSPITAL VISITS - INITIAL	2.8	-0.4	-3.9	3.6	3.5
M2B - HOSPITAL VISITS - SUBSEQUENT	9.9	2.9	10.1	-0.3	1.2
M2C - HOSPITAL VISITS - CRITICAL CARE	2.1	7.9	-47.6	-5.1	2.3
M3 - EMERGENCY ROOM	5.1	18.4	-17.4	20.2	16.7
M4 - HOME/NURSING HOME	2.4	3.0	-9.4	4.0	8.5
M4A- HOME	0.3	-4.0	-24.6	0.3	6.0
M4B- NURSING HOME	2.1	4.2	-7.4	4.4	8.7
M5 - SPECIALIST E&M	6.3	10.9	7.5	2.3	6.8
M5A- PATHOLOGY	1.3	7.1	33.0	2.6	8.6
M5B- PSYCHIATRY	1.6	11.6	17.7	5.0	7.6
M5C- OPTHALMOLOGY	3.1	11.7	-10.8	2.2	7.5

(CONTINUED)

LABEL	PERCENT SHARE OF TOTAL 1991 RVUS	AVERAGE ANNUAL GROWTH 1986-91	AVERAGE ANNUAL GROWTH 1991-92	AVERAGE ANNUAL GROWTH 1992-93	AVERAGE ANNUAL GROWTH 1993-94
M5D- OTHER SPECIALIST E&M	0.3%	19.6%	24.2%	-10.0%	-10.6%
M6 - CONSULTATIONS	8.5%	10.4%	52.2%	2.0%	14.9%
PROCEDURES P1 TO P3	12.2%	4.0%	1.7%	-1.3%	5.8%
PROCEDURES P4 TO P6, P8	18.4%	8.3%	1.6%	9.1%	2.8%
P1 - MAJOR PROCEDURES-GENERAL	4.9%	1.1%	-0.8%	-4.2%	3.9%
P1A- MAJOR PROC-BREAST	0.2%	0.6%	-4.9%	-6.7%	2.1%
P1B- MAJOR PROC-COLECTOMY	0.5%	-1.2%	-3.8%	-4.5%	1.1%
P1C- MAJOR PROC-CHOLECYSTECTOMY	0.5%	1.7%	1.9%	-4.9%	1.7%
P1D- MAJOR PROC-TURP	0.6%	-2.1%	-13.3%	-14.4%	-13.6%
P1E- MAJOR PROC-HYSTERECTOMY	0.2%	-2.9%	6.2%	-6.2%	2.5%
P1F- MAJOR PROC-LAMINECTOMY	0.4%	10.7%	8.1%	0.7%	8.6%
P1G- MAJOR PROC-OTHER	2.6%	1.4%	0.4%	-2.6%	6.9%
P2 - MAJOR PROCEDURES-CARDIOVASCULAR	4.5%	7.4%	3.3%	0.4%	7.3%
P2A- CABG	1.3%	8.6%	0.7%	-2.0%	5.6%
P2B- ABDOMINAL AORTIC ANEURYSM	0.2%	-0.6%	-5.0%	-2.7%	-1.1%
P2C- THROMBOENDARTERECTOMY	0.2%	-0.9%	6.4%	-3.0%	14.7%
P2D- CORONARY ANGIOPLASTY	0.4%	20.5%	15.4%	0.2%	5.6%
P2E- PACEMAKER INSERTION	0.3%	2.7%	1.1%	1.4%	5.9%
P2F- MAJOR CARDIO PROC-OTHER	2.0%	7.6%	3.4%	2.6%	8.7%
P3 - MAJOR PROCEDURES-OPTHOPEDIC	2.9%	4.5%	3.7%	0.8%	6.6%

(CONTINUED)

LABEL	PERCENT SHARE OF TOTAL 1991 RVUS	AVERAGE ANNUAL GROWTH 1986-91	AVERAGE ANNUAL GROWTH 1991-92	AVERAGE ANNUAL GROWTH 1992-93	AVERAGE ANNUAL GROWTH 1993-94
P3A- FEMORAL FRACTURE REPAIR	0.7	1.4	-0.9	1.1	4.9
P3B- HIP REPLACEMENT	0.6	0.6	-1.0	-4.3	3.2
P3C- KNEE REPLACEMENT	0.7	10.1	6.7	0.2	7.4
P3D- MAJOR ORTHOPEDIC PROC-OTHER	0.8	6.4	8.3	4.7	9.4
P4 - AMBULATORY PROCEDURES-EYE	6.1	8.7	3.8	-6.1	5.5
P4A- AMB. EYE PROC-CORNEAL TRANSPLANT	0.1	1.2	-1.9	-4.9	-0.9
P4B- AMB. EYE PROC-CATARACT EXTRACTION	3.7	6.6	6.4	-9.1	6.6
P4C- AMB. EYE PROC-RETINAL DETACHMENT	0.2	2.9	-1.8	-2.5	1.3
P4D- AMB. EYE PROC-TREATMENT OF RETINAL	0.5	14.5	4.0	2.9	6.1
P4E- AMBULATORY EYE PROC-OTHER	1.6	14.1	1.3	-2.2	3.5
P5 - AMBULATORY PROCEDURES-GENERAL	3.7	4.4	-3.1	-2.7	2.7
P5A- ABULATORY PROC-SKIN	1.3	4.6	-2.8	-5.0	5.5
P5B- ABULATORY PROC-MUSCULOSKELETAL	0.8	1.9	-2.4	2.9	3.8
P5C- ABULATORY PROC-HERNIA REPAIR	0.2	1.0	-3.5	-2.7	-8.0
P5D- ABULATORY PROC-LITHROTRIPSY	0.1	19.7	-0.9	4.1	10.0
P5E- ABULATORY PROC-OTHER	1.4	5.9	-3.7	-0.5	0.8
P6 - MINOR PROCEDURES	4.8	10.6	-0.8	44.9	-2.5
P6A- MINOR PROC-SKIN	2.4	10.8	6.2	4.5	6.7
P6B- MINOR PROC-MUSCULOSKELETAL	0.7	6.3	-2.1	2.7	6.9
P6C- MINOR PROC-OTHER	1.7	12.3	-10.1	133.8	-11.4

(CONTINUED)

LABEL	PERCENT SHARE OF TOTAL 1991 RVUS	AVERAGE ANNUAL GROWTH 1986-91	AVERAGE ANNUAL GROWTH 1991-92	AVERAGE ANNUAL GROWTH 1992-93	AVERAGE ANNUAL GROWTH 1993-94
P8 - ENDOSCOPY	3.8%	9.4%	5.5%	1.4%	7.8%
P8A- ATHROSCOPY	0.2%	17.9%	11.7%	4.8%	11.8%
P8B- UPPER G.I. ENDOSCOPY	1.0%	10.0%	6.2%	2.2%	10.1%
P8C- SIGMOIDOSCOPY	0.3%	-1.6%	-6.7%	9.5%	4.7%
P8D- COLONOSCOPY	1.2%	15.8%	8.5%	2.9%	7.7%
P8E- CYSTOSCOPY	0.7%	5.2%	1.0%	0.2%	2.4%
P8F- BRONCHOSCOPY	0.2%	3.6%	0.2%	-3.7%	1.6%
P8H- LARYNGOSCOPY	0.1%	8.4%	5.6%	0.4%	7.6%
P8I- ENDOSCOPY - OTHER	0.1%	15.4%	20.9%	10.5%	34.0%
T - ALL TESTS	10.8%	14.0%	1.4%	1.0%	3.0%
T1- ALL CLINICAL LAB TESTS	8.3%	15.8%	4.3%	0.2%	1.7%
T1A- ROUTINE VENIPUCTURE	0.4%	26.8%	4.1%	3.4%	-97.9%
T1B- AUTOMATED GENERAL PROFILES	1.4%	8.7%	-2.1%	-8.3%	15.8%
T1C- URINALYSIS	0.3%	3.0%	-3.0%	-2.1%	4.4%
T1D- BLOOD COUNTS	1.1%	14.9%	3.1%	3.0%	7.4%
T1E- BLOOD GLUCOSE	0.2%	0.0%	-6.4%	-7.3%	-5.6%
T1F- STAND BACTERIAL CULTURES	0.3%	10.0%	-0.2%	0.4%	9.1%
T1G- OTHER CLINICAL LAB TESTS	4.7%	21.3%	7.6%	2.1%	4.5%
T2 - ALL PHYSICIAN TESTS	2.5%	8.8%	-8.4%	1.9%	7.6%
T2B- CARDIOVASCULAR STRESS TESTS	0.4%	10.7%	12.4%	20.3%	6.1%

(CONTINUED)

APPENDIX C. AVERAGE ANNUAL CHANGE IN VOLUME AND INTENSITY OF
MEDICARE PHYSICIAN SERVICES PER BENE (AS MEASURED BY RVUS PER BENE).
BY DETAILED TYPE OF SERVICE GROUPS 14:12 TUESDAY, DECEMBER 17, 1996
(EXCLUDING TEXAS)
1986-1994

	PERCENT SHARE OF TOTAL 1991 RVUS	AVERAGE ANNUAL GROWTH 1986-91	AVERAGE ANNUAL GROWTH 1991-92	AVERAGE ANNUAL GROWTH 1992-93	AVERAGE ANNUAL GROWTH 1993-94
LABEL					
T2C- EKG MONITORING	0.4	6.7	-5.8	-6.9	-4.6
T2D- OTHER TESTS	1.7	9.0	-13.9	2.1	11.4

CHAPTER TWO

Price Controls and Medicare Spending: Assessing the Volume Offset Assumption*

Stephen Zuckerman
Stephen A. Norton
Diana Verrilli

1. INTRODUCTION

Recent evidence regarding the impending insolvency of the Medicare Trust Funds has focused debate on the need to control program spending growth. Although many believe that greater reliance on managed care could produce these savings, the majority of the program's enrollees receive care on a fee-for-service (FFS) basis and are likely to do so for the foreseeable future. The dilemma policy makers face is that, although fee-for-service spending is determined by both service price and volume, only prices are truly in their control. This inevitably leads policymakers to consider a myriad of price reductions and freezes to attain budgetary savings. However, if these policies do not adequately meet the goals for controlling overall program spending, caps are likely to be proposed. One such proposal was contained in the Balanced Budget Act. The act required an adjustment to fees in the FFS side of Medicare to offset spending in excess of predetermined caps (Balanced Budget Act, Section 8631).

If such actions lead to large reductions in Medicare FFS provider payments or increases in beneficiary cost-sharing then access could be compromised. How much individual fees would need

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to be reduced to achieve spending targets would depend on assumptions about the ability of fee reductions to lower spending. This has been a major issue in Medicare physician payment policy. HCFA actuaries have assumed that when physician fees are cut by, for example, 2 percent, service volume and intensity changes so that only a 1 percent reduction in spending occurs.[1] This 50 percent "volume offset" would imply that fees would need to be cut by twice the reduction in spending required to keep spending within a target. Offsets of this magnitude could result in reductions in payment rates that would make Medicare less attractive to providers and, therefore, could compromise the fee-for-service option in the Medicare program.[2]

However, there has been disagreement about the actual size of the volume offset. Results pertaining to the physician services market have ranged from being generally supportive of the 50 percent offset assumption (e.g., Christensen 1992) to refuting its validity (e.g., Escarce 1993). Most estimates have been based on analyses of one-time natural experiments and used data covering short time periods and limited sets of services. In this paper, we examine price changes during a series of natural policy experiments covering the years 1986 through 1992 and estimate volume offsets across the full range of Medicare physician services. Although it would be desirable to go beyond physician services in considering the volume offset issue, this has been the area in which the issue has surfaced most frequently. In addition, it serves as an example of the potential difficulties policy

1. This information is based on the Authors' correspondence with HCFA actuaries.

2. The volume offset issue is relevant for other services as well, because all are paid for on a fee-for-service basis. Personal communications with staff at the HCFA Office of the Actuary indicate that offsets for other services range from 10 to 50 percent. This suggests that some services are viewed as less sensitive to pricing changes than are others. For example, we were told that pricing policies that affected payments for hospitalizations were subject to only a 10 percent offset assumption.

makers could face in relying on Medicare fee-for-service as the program's "failsafe" mechanism to control spending.

Our goal is to develop and apply a consistent analytic framework that provides new estimates of the volume offset. We use data on price and volume changes that were associated with the introduction of the Medicare Fee Schedule and the policies that immediately preceded it. In addition, we explore the sensitivity of volume offset estimates to the time period of the data, the types of services and specialties being analyzed and econometric methods. Most studies of the volume offset issue have not been able to conduct this type of extensive analysis because they have focused on a single policy change and time period as the bases for estimating offset effects. In addition, comparisons of the results across studies are often difficult because of differences in the policies being considered and the data and methods employed.

If prices are to be the main policy lever available for controlling Medicare spending, as some of the spending cap proposals suggest, then understanding how the offset may vary over time, or across services and specialties could lead to more effective and equitable policy responses. For example, if volume and intensity changes tend to offset more of a price cut for certain services (e.g., imaging) than for others (e.g., visits), policymakers may find that they achieve greater spending control by focusing price cuts on less responsive services. In addition, services with less potential for volume offsets could require smaller price reductions in order to achieve spending targets.

2. BACKGROUND

A consensus exists around the idea that a given reduction in Medicare fee-for-service payment rate will not lead to that same reduction in program spending. Researchers, actuaries, and other policymakers assume that, in response to payment rate cuts, volume adjusts upward so as to affect some of the reduction in rates. Most of the research evidence related to the "volume offset" centers around the physician services market (discussed below) and is often related to behavioral responses on the part of physicians that allow them to maintain their incomes at some "target" levels. However, an apparent offset could also emerge as a result of beneficiaries' willingness to consume more services at lower prices (and copayments) without any effort on the part of physician to "induce" service volume.

Whatever the mechanism, the assumed offset has led to important policy decisions with respect to Medicare physician payment. Perhaps the most well-known effect of the volume offset was the decision to lower the conversion factor used in the Medicare Fee Schedule by 6.5 percent in anticipation of volume increases that would occur among physician practices that were to experience the largest fee cuts as a result of the implementation of a relative values scale (RVS) payment system in 1992 (Federal Register, 1992). This 6.5 percent across-the-board payment rate reduction was justified by HCFA as necessary in order to keep total Medicare payments under the Fee Schedule budget neutral relative to what they would have been under the previous payment systems.

To some extent, the controversy surrounding the volume offset and its ultimate impact was tempered by inclusion of the Medicare Volume Performance Standard (MVPS) policy in the 1992 physician payment reform initiative. The MVPS allows for rewards and penalties in physician payment rate updates when overall spending falls below or exceeds some preset target in a given year.

Under this policy, if the effect led to too low a level of payment, then the chances of spending being below the target are increased and the potential for update rewards is greater. In a sense, the offset acts as a withhold that physicians can earn back in future years, if spending is below the MVPS targets. The large updates that physician received as a result of MVPS in 1994 and 1995 suggest that a great deal of the initial reduction in the conversion factor brought about by the volume offset assumption has been restored. To the extent that this preserved Medicare's position relative to other payers, the MVPS may have played a role in preserving beneficiaries access to mainstream providers. For non-physician services, despite the application of volume offsets in establishing payment rates, policies analogous to the MVPS do not exist.

3. PREVIOUS LITERATURE

Three factors make it difficult to assess the existence and extent of a Medicare volume offset in the Medicare market from the current literature. First, estimates are derived from both the Medicare and the non-Medicare market with one study drawing on data from outside the US. Second, estimates of the volume offset have varied by specialty across studies (Cristensen, 1992; Escarce 1993; PPRC 1993) as well as among procedures (Hogan, 1991) and across years. Third, these studies vary significantly with respect to the natural experiment being evaluated, the breadth of services and specialties included in the analysis, and the unit of analysis that is employed. These factors contribute to the difficulties in making definitive inferences about the existence of a volume offset.

Results of these analyses have varied considerably. Some studies have indicated that there is little evidence of an offset (Hurley et. al 1990; Escarce 1993). Evaluating the impact of fee changes on the utilization of services in Ontario Canada, Hurley et. al (1990) found 25 out of 28 services

evaluated showed no consistent evidence of a volume offset. Further, an analysis of changes in Medicare prices found little evidence of a volume offset in a model of volume growth across all services and specialties (Escarce 1993). However, among specialties, changes in price had a significant effect on the volume of services provided by ophthalmologists.

Other studies, including both Christensen (1992) and PPRC (1993), provide evidence generally supportive of the 50 percent offset assumption. Taking advantage of the natural experiment implicit in the change in Medicare payment between 1976 and 1978 in Colorado, Cristensen (1992) modeled the change in the volume of services associated with changes in price using physician-level Medicare claims data for general practitioners and internists. The results suggested that roughly 50 percent of the reduction in expenditures was offset by a volume response. Using a number of natural experiments created by the reduction in fees for overvalued procedures legislated in OBRA 1987, 1989 and 1990 and the implementation of the MFS in 1992, analysts at PPRC conducted a number of analyses assessing the extent of a volume offset in the Medicare market (PPRC 1993). They estimate that the volume offset ranged from 17% for surgical specialists in 1990/91 to 62 percent for medical specialists in 1989/90. In their evaluation of the implementation of the MFS, they estimated a volume offset of approximately 36% across all providers and specialties. This estimate varied by specialty as well as by groups of services (PPRC, 1993).

4. ANALYTIC FRAMEWORK

In this study, we define the volume offset as the change in the volume and intensity of physician services that is associated with a one unit change in the prices paid for those services. We do not assume that this association is solely the result of behavioral responses on the part of either physicians or beneficiaries. Instead, our perspective on the volume offset is from the market-level

and, therefore, should be seen as a reduced-form effect in econometric terms.[3] This offset definition considers the impacts on both the demand and supply sides of the physician services market. We recognize that the literature on this market has had a decidedly supply-side orientation. The reason for this seems to be a consensus that the physician services market tends to be supply-constrained and, as a result, volume changes are more dependent on supply than demand behavior. Of all the theoretical models for considering the supply side of the market, the most useful framework is contained in McGuire and Pauly (1991). It is flexible in its view of the market in that it neither assumes physicians have some "target income" that they try to maintain by inducing their patients to utilize extra services or that they are unable to influence patient demand through inducement at all. The McGuire and Pauly model also suggests that responses may differ substantially across types of services and specialties and that prices of services not affected by policy changes may play a role in determining volume responses.

Demand can play a role, however, if supply constraints do not exist in all parts of the market. As fees are cut, patients will see reductions in copayments. If balance billing does not offset the reduced copayments, patients could demand more services. For services whose fees are increased, a decrease in demand should be observed. In sectors of the market where services are in excess supply, these effects can play a significant role in affecting the market outcomes.

As in earlier studies, the price changes that we rely on to estimate the volume offset represent a series of natural experiments resulting from the implementation of changes in Medicare payment

3. In fact, if the pricing policy changes are designed to lower the growth in prices by more in areas with the highest rates of volume growth, then an inverse association could be observed without there being a response on either the demand or supply sides of the market.

policies. The time period between 1986 and 1992 was a time of serious changes in Medicare payment policy. OBRA 86, 87, 89 and 90 reduced the fees for groups of procedures and diagnostic tests that had been identified as overvalued.[4] In January 1992, the Medicare program replaced the customary, prevailing and reasonable (CPR) payment method with a national fee schedule based on the relative resource cost of each service. The central element of the MFS was to increase payments for visits and consultations relative to those of procedures. At the same time, other payment policies were also altered. These included changes in the definition of a surgical global package, the establishment of a site-of-service payment differential for selected services performed in an outpatient setting, the establishment of RVUs for the technical and professional component of imaging and diagnostic tests, and the elimination of separate payments for the interpretation and report of EKGs during a visit or consultation.

5. DATA

The primary data used in this analysis to measure price and volume and intensity changes are derived from the 1986-1991 BMAD Procedure files and 1992 NCH Procedure files.[5] These files contain summary information on 100 percent of all claims submitted for physician services to Medicare Part B carriers. To measure the volume and intensity of Medicare physician services based on relative value units (RVUs), we merged information on RVUs to the Procedure

4. In addition, Medicare reduced the limits on the amount it would pay for clinical laboratory services in 1988 and, in the following year, introduced a radiology fee schedule that reduced payments for CAT scans and MRIs.

5. In other work, we reviewed the comparability of the 1991 and 1992 National Claims History Procedure Files to prior years of BMAD data to assess whether the new data files for 1991 and 1992 are comparable to earlier BMAD files. Distributions of charges and allowed services across service types, carriers and localities were similar. For a more complete discussion, see Verrilli and Zuckerman, 1995.

Files by service, using RVUs from the 1993 Medicare Fee Schedule.[6] The Medicare Denominator Files for 1986-1992 were used to provide counts of Medicare enrollees that allow us to express volume and intensity on a per beneficiary basis. HMO beneficiaries enrolled at any time during the year were omitted from the beneficiary counts since the physician services received by HMO enrollees are not included in the Procedure files. The numbers of HMO enrollees were derived from the AAPCC Master Files for 1983-1988 and 1989-1992. We also use the Procedure files to compute Medicare Assignment Rates.[7] The Area Resource File (ARF) was used as the source for all other explanatory variable used in the regression models.

These data allow us to measure the volume and intensity of individual physician services within each Medicare pricing locality by specialty and year.[8] All physician and clinical laboratory services are included in the analysis file, with the exception of anesthesia, dialysis and oncology services. Because it would be difficult to explain volume offsets at the service level, we aggregate physician services into four broad service categories - evaluation and management (E&M), procedures, imaging and tests - based on a service classification system developed jointly by the Urban Institute and the Health Care Financing Administration (Berenson and Holahan 1990).

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6. For a discussion of how we attached RVUs (work, malpractice and practice expense) to each service, see Verrilli and Zuckerman, 1995.

7. The Medicare assignment rates is computed as the percentage of total services for which the physician accepts the Medicare rate. The Procedure files do not provide information on the percentage of charges that are accepted on assignment so we were unable to compute the percentage of charges for which the physician accepted the Medicare rate.

8. Pricing localities are used as the basis for defining the geographic dimension of the unit of observation. Localities were established by Medicare carriers for the purpose of developing charge profiles for use as screens in the "customary, prevailing, and reasonable (CPR)" payment methodology that the MFS replaced. Although the carriers varied in their approaches to defining localities (they ranged from entire states to parts of individual counties), localities have been and continue to be the basis for implementing pricing policy changes.

Therefore, the unit of observation in this study for each year is the Medicare locality/specialty/service category.[9]

Not all specialties providing services to Medicare beneficiaries are included in this study. The reason for this is that most of the payment policy changes relate to a specific set of overvalued procedures that tend to be concentrated in certain specialties. After reviewing the policy changes (i.e. those related to overvalued procedure reductions in 1989 and 1990), we decided to focus on the 9 specialties most affected. These specialties were Thoracic Surgery, Orthopedic Surgery, Ophthalmology, Urology, General Surgery, Gynecology, Cardiology, Gastroenterology, and General Internal Medicine and account for about 60 percent of Medicare spending in 1992. The emphasis on surgical specialties results from the policy changes being studied, rather than an explicit emphasis on estimating offsets among surgical services.

The data were edited in two steps. First, because of the fairly disaggregated nature of the analysis file, estimates of the annual change in volume and intensity per beneficiary in some localities and specialties were based on a small number of claims and therefore exhibited volatility with extremely large annual increases in volume growth. As a result, observations with extremely large annual increases in volume and intensity were deleted. Approximately 2% of the data were deleted as a result of trimming. In addition, extremely large changes in price were also removed from the data. Any observation that exhibited an increase in price of greater than 20 percent or decrease of greater than 25 percent was set to missing. These price screens were based on the plausible limits of price

9. In addition, all data from Texas localities were excluded from the analysis. Prior to 1992, Texas had a locality structure which was a function of both location and provider specialty. With the implementation of the MFS, the locality structure changed with the links to specialty being removed. This change combined with the role of specialty in defining the locality makes it difficult to compare the Texas data with data from other states.

change given the policies that were in effect and resulted in a loss of less than one percent of the observations available to the study.

6. MODEL SPECIFICATION

By analyzing price and volume changes over a seven-year period, our study draws on a broader range of policy changes than has been considered in the literature. The breadth of these policy changes leads us away from considering the impact of any single natural experiment on the volume of a limited set of services, as is the case in much of the prior literature and toward a framework that considers responses among all types of physician services. Using the Medicare payment locality as the unit of observation, we model the annual change in the volume and intensity of services per beneficiary for each of the four groups of services and nine specialties. Volume and intensity change is measured as the change in relative value units per beneficiary within a service group and specialty. Explanatory variables are those that can both be expected to influence area-level volume of services, i.e., that affect area-level demand or supply, and change over time. If we were modeling variation in the level of service volume and intensity across areas - as opposed to annual changes, then variables such as the age, sex or racial composition, health status, practice styles, or region might all have roles in the model. However, in explaining annual volume and intensity changes, only explanatory variables that change from year to year need to be included. In this study, these include the change in Medicare prices, Medicare assignment rates, HMO enrollment, per capita income (a proxy for market demand), and the number of providers (a market supply proxy).

The key independent variable is the annual price change for the service group and specialty observation within the locality. This price is measured using a Laspeyres price index computed for each locality and year combination. The index is based on all services provided to Medicare beneficiaries. In addition, we capture other Medicare price changes by controlling for the impact of

changes in the payment rates available for alternative services that physicians could view as substitutes.[10] It is measured as a Laspeyres index of Medicare prices for services not included in the service group under consideration. For example, when considering evaluation and management services, the index of other Medicare prices would relate to Procedures, Imaging Services and Tests. Under the McGuire and Pauly model, this variable should be inversely related to the volume and intensity growth of E&M services.

The assignment rate measures the share of services for which providers accept the Medicare allowed charge as payment in full. This variable is both a determinant of market demand and market supply. As assignment rates grow, beneficiaries face lower out-of-pocket costs and, as such, should be willing to consume more services. In this sense, assignment rates should be positively related to volume growth. However, higher assignment rates also imply that providers receive lower total payments for their services. This would imply that growth in assignment rates should lead to lower volume and intensity growth.

An indicator variable for tests in 1992 captures the potential effect of EKG billing changes resulting from the rules associated with the implementation of the Fee Schedule. Separate payments for the interpretation and report of EKG services when ordered or performed in conjunction with a physician visit or consultation were prohibited under OBRA 90. Under the MFS, RVUs for these services were bundled into payments for visits and consultations. We explicitly control for the potential widespread impacts of excluding separate payments for the interpretation and report of EKG services.

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10. It would also be appropriate to include a measure of non-Medicare price changes, because these are also potential substitutes. However, such a measure of price change is not available at the level of geographic detail so as to be meaningful for this study.

Despite the fact that we defined volume growth on a per beneficiary basis, we also include the growth in the number of beneficiaries enrolling in Medicare risk HMOs within the locality. This variable plays a dual role in the models. First, it captures potential changes in the composition of the Medicare fee-for-service population (the basis of this study) that may be the result of favorable risk selection among HMOs. According to the results presented by Brown et al (1993), areas with greater HMO enrollment growth should have an increasingly ill population left in the fee-for-service sector and, as such, greater volume and intensity growth. On the other hand, if HMOs lead to a change in the area's style of medical practice toward less resource-intense treatment patterns, then areas with greater HMO enrollment growth could have lower volume growth in the fee-for-service sector.

To measure changes in the availability of service at the area level, we include the change in the number of physicians per 1,000 individuals. Because volume changes are measured for individual specialties within service groups, changes in physicians per 1,000 are also measured on a specialty-specific basis. For example, in explaining volume and intensity growth for procedures among ophthalmologists, we use changes in the number of ophthalmologists to capture service availability. It is expected that greater growth in physician availability will be associated with greater growth in service volume and intensity (Cromwell and Mitchell 1986; Escarce 1992).

Finally, we include changes in per capita income in the locality as an indicator of changes in the overall economic conditions facing the Medicare physician services market. If this serves as a proxy for the resources available to the Medicare population to pay the deductibles and copayments required when consuming services, then growth in per capita income would be associated with more rapid Medicare volume growth.[11] However, this variable could be capturing changes taking place

11. Another way to think of this is that per capite income growth is a key determinant of changes in the prevalence of Medigap insurance among the elderly population.

among the non-Medicare population. For example, per capita income growth could expand the ability to pay for non-Medicare services directly and be associated with growth in insurance coverage. Both of these events would suggest that demand was strengthening in the non-Medicare market and, again following McGuire and Pauly, might lead to a shift in service provision toward non-Medicare patients and a slowdown in Medicare volume and intensity growth.

7. ESTIMATION METHODS

Given the data structure, models of the volume response could be estimated for each type of service by specialty and year. This would be the most disaggregated form, relying solely on variations in price changes across areas to derive parameter estimates. Obviously, this would be analytically unwieldy and would not be very useful to policymakers who might be looking for a single estimate of a volume offset.[12] One solution is to pool all of the data and estimate a single "fully-pooled" model across all types of services, specialties, and years. This approach produces a single volume offset estimate based on all of the available data and is the initial model we discuss in the Results section that follows.

We also tested for the appropriateness of this type of pooling and concluded that the parameter estimates are sufficiently different across types of services, specialties, and years that the fully-pooled model is not warranted statistically. However, to keep the analysis tractable and relevant to the policy debate, some degree of pooling needs to be considered. Therefore, we specify three alternative approaches to pooling that allows us to assess variations in the model parameters across types of services, across years and, finally, across specialties. These "partially-pooled" models produce separate models for each type of service, year and specialty. To estimate separate models for

12. In addition, for some combinations of specialty and type of service in the data (e.g., internal medicine and major procedures), the models would not be clinically meaningful.

each service type, we pool data across specialties and years. Specialty-specific models are estimated by pooling observations across types of services and years. And, year-specific models pool across service types and specialties.[13]

A major strength of the approach we follow is that it allows us to examine the sensitivity of the important policy parameter - the volume offset - to the data and estimation strategy used. In addition, the single parameter estimate based on the fully-pooled model can be systematically contrasted with the estimates from models that explicitly allow the offset to vary across type of service, specialty, and year. This is an improvement over simply comparing our results to those from earlier studies because we use consistent model specifications and rules for data editing. In either type of the pooled models, both the volume offset and the effects of all other variables are constrained to be the same across all dimensions for which the data are pooled.

As has been observed by Hogan (1991), idiosyncracies in data processing and reporting at the carrier level could lead to systematic differences in the price and volume measures that could affect the volume offset estimates. To address this issue, he estimates his models using carrier- level fixed effects. We also estimated models using area-level fixed effects (defined at the locality level) to control for unmeasured area-specific factors that affect outcomes across all years and/or all specialties. These unmeasured differences may go beyond data reporting issues. For example, if Medicare price reductions were designed to be larger in areas with persistently high rates of volume growth, then the fixed effects would also capture this otherwise unmeasured policy design influence. However, using area-level fixed effects did not affect our parameters and therefore, are not presented in the results that follow.

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13. In both the fully- and partially-pooled models, we include dummy variable to control for the underlying volume and intensity growth rates associated with each type of services, year, and specialty. The fully-pooled models includes three sets of dummy variables, corresponding to the three dimensions across which the data are pooled. The partially-pooled models each include two sets of dummy variable controls.

Two variables included in these models - the supply of physicians per 1,000 individuals and the Medicare assignment rate - need to be treated as endogenous.[14] Because ordinary least squares estimation results in biased coefficient estimates when there are endogenous explanatory variables, we estimated the model using two-stage least squares. Each endogenous variable was replaced by an instrument derived by regressing the variable on a group of variables consisting of all exogenous variables in the equation and other variables likely to affect the endogenous variables but not the volume and intensity of services. Changes in the number of specialists per 1,000 individuals were regressed against the exogenous variables in the equation as well as the change in short term community hospitals, admissions and the general population. The assignment rate was regressed against the exogenous variables in the equation as well as the unemployment rate. The predicted values of the endogenous variables were then used in estimating the coefficients for the full equation.

Throughout the econometric analysis, all models are estimated using weighted least squares, where the weights for each annual change observation is equal to the base year allowed charges for that area/specialty/year/ type of service combination. This is appropriate to produce efficient estimates, given the variations in service volume across the observations and the potential this creates for heteroskedasticity in the data.

14. Although it can be argued that policy changes have reduced the benefits of refusing assignment to providers and that the changes in assignment rates we observe are, in fact, exogenous to the market outcomes. Despite the policy changes, however, it is still the case that providers' decisions affect the assignment rate and, therefore, using it as an explanatory variable requires that it be replaced by an instrumental variable in the volume growth models.

8. RESULTS

We begin by reviewing the average annual changes in price and volume during the study period (Table II-1). Overall, prices for the specialities included in the analysis declined by about 1 percent annually while volume increased by approximately 6 percent per year. The average price change is lower than the average price change in the entire Medicare market, because we are focusing on nine specialties most directly affected by the pricing policies. According to a 1994 PPRC report, 6 of the nine specialties included in our analysis experienced price growth rates that were lower than the average for all specialties (PPRC, 1994). The variations across types of services show clearly that policymakers were reducing fees for procedures, imaging and tests, while allowing fees for evaluation and management services to grow. Moreover, the data show that the largest reduction in price occurred in the last two years of the study period.

At this level of aggregation, patterns suggestive of a volume offset are not evident. For example, in the year in which prices fell the most (1992) volume growth was the slowest, while volume growth was the highest in the year prices rose most rapidly (1987). An offset might have suggested the opposite pattern. However, these descriptive data may be masking important relationships that can be identified through regression analyses of the variations in price and volume changes across areas.

The first regression analysis is based on the fully-pooled model of volume changes (Table II-2). This model produces a single estimate of the volume offset associated with changes in Medicare prices and policies between 1987 and 1992. Based on the coefficient of the own-price change, this model suggests a volume offset of roughly 19 percent, i.e., every 10% decrease in the price of services results in a 1.9% increase in the volume of services provided. The 95% confidence interval

Table II-1

Average Annual Percent Change in the Prices and

Volume and Intensity of Medicare Physician Services

by Type-of-Service and Year, 1986-1992

	Price	Volume and Intensity
All Services	-1.0%	5.8%
Type of Service		
Procedures	-3.7	5.8
Imaging	-3.0	14.8
Tests	-1.6	3.5
Evaluation and Management	3.2	4.5
Year		
86/87	4.2	8.9
87/88	0.0	4.8
88/89	0.0	6.0
89/90	.17	6.4
90/91	-3.2	8.3
91/92	-6.2	1.7

Note: These statistics are based on data for the nine specialties included in the regression analysis. These specialties are general internal medicine, cardiology, gastroenterology, orthopedic surgery, ophthalmology, thoracic surgery, urology, gynecology, and general surgery.

Table II-2
Determinants of Annual Change in
Volume and Intensity of Medicare Physician Services:
Fully-Pooled Regression Model

Variables	Means	Coefficient	Standard
Price Effects			
Change in Own Price	-.01	-.187*	.023
Change in Cross Price	-.01	-.190*	.034
Other Variables			
Change in Assignment Rate	.11	.009**	.004
Change in Physician Density	-.004	.013	.003
Change in Per Capita Income	.05	-.021	.034
Change in Medicare HMO Enrollees	.05	-.015*	-.002
Specialty			
Cardiology	.13	.044*	.003
Gastroenterology	.07	.087*	.005
General Surgery	.12	-.004*	.003
Opthamology	.21	.006***	.003
Orthopedic Surgery	.09	-.004	.003
Thoracic surgery	.05	.001	.005
Urology	.06	-.001	.003
Obstetrics and Gynecology	.01	.012	.007
Type Of Service			
Tests	.07	.015*	.003
Evaluation and Management	.36	.003	.004
Imaging	.07	.075*	.003
Year			
1987-88	.15	- .059*	.003
1988-89	.19	- .040*	.004
1989-90	.19	- .042*	.004
1990-91	.19	- .040*	.004
1991-92	.20	- .100*	.004
Interaction between Tests and 1992+	.015	-.208*	.007

Adjusted R^2: .11 * = significant at the .01 level ** = significant at the .05 level *** = significant at the .10 level

+ This is the indicator which captures the potential effect of EKG billing changes resulting from the rules associated with the implementation of the Fee Schedule in 1992

ranged from 12 percent to 26 percent, allowing us to reject the hypothesis that the volume offset was actually 50 percent, the level currently assumed by the Medicare program.

In addition to changes in own-prices, this fully-pooled model identified three other factors that had a significant impact on service volume growth: changes in the price of Medicare services, the assignment rate and Medicare risk HMO market shares. The impact of changes in prices of other Medicare services was negative and significant (Table II-2), suggesting that the other services may be substitutes. For example, we estimate that the growth in evaluation and management services would accelerate by 1.9 percent for each 10 percent decrease in the price of procedures, imaging services and tests. The model also suggests that increases in the number of Medicare HMO risk beneficiaries are associated with a decrease in the volume of services provided. This result indicaties that HMO penetration in a markey may change the area's style of medical practice toward less resource-intensive treatment patterns. The positive association between changes in the assignment rate and changes in volume suggest that the assignment rate may operater primarily on the demand side. As assignment rates grow, beneficiaries face lower out -of-pocket costs and may be willing to consume more services.

Generally, controls for time, specialty and type-of-service trends were significant. The growth in the volume of services peaked in 1986 (the omitted year) and was lower in each year throughout the time period studied, with the smallest growth occurring in 1991/92 (the first year of the MFS). We also show that, relative to internal medicine specialists, (the omitted group) the volume of services provided by cardiologists, gastroenterologists and ophthalmologists grew more quickly, while the volume of services provided by general surgeons declined more quickly. The remainder of the specialties did not experience growth rates significantly different from internal

medicine specialists. Relative to major procedures, the volume of services within tests and imaging services grew more quickly.

Volume offset estimates from the regression analyses based on the partially-pooled models are presented in Table II-3. Each row in this table is derived from a separate econometric model that, with the exception of one of the sets of dummy variables, contains all of the explanatory variables shown in Table 2. Because the volume offset is the focus of this paper and because the other parameter estimates were quite similar to those shown in the fully-pooled model, we summarize by presenting only the volume offset parameter, along with its standard error and the adjusted R-squared statistic.

The type of service models indicate that the estimated offset for evaluation and management services, imaging and tests are all significantly less than 50 percent. Every 10 percent reduction in fees is associated with a 2.5, 3.2 and 2.9 percent increase in volume for evaluation and management and imaging services and tests, respectively. However, for procedures the offset estimate was 80 percent, significantly higher than the current overall assumption regarding the volume offset.

Offset estimates varied more widely across specialties. Services provided by internal medicine specialists did not exhibit any offset and, in fact, were positively associated with changes in prices. This suggests that, for this specialty, volume actually increases as price increases. For gastroenterologists and ophthalmologists, there was also no evidence of a significant volume offset. However, for the remainder of the specialties, all of whom are surgical specialties, there was significant evidence of a volume offset ranging from 30 percent for urologists to 76 percent for thoracic surgeons. Statistical tests suggest that the 50 percent volume offset assumption cannot be rejected for specialties such as general and thoracic surgery.

Table II-3
Estimates of the Volume Offset by Type of Service, Year and Specialty:
Partially-Pooled Regression Models

	Volume Offset[15]	Standard Error	Adjusted R^2
Type of Service			
Evaluation and Management	-.253*	.040	.07
Procedures	-.795*	.076	.11
Imaging	-.322*	.053	.12
Tests	-.291*	.057	.25
Year			
86-87	-.318*	.083	.06
87-88	-.267*	.092	.06
88-89	-.297*	.081	.08
89-90	-.323*	.083	.11
90-91	-.476*	.052	.17
91-92	-.401*	.047	.20
Specialty			
Internal Medicine	.350*	.071	.10
Gastroenterology	-.082	.086	.05
Cardiology	-.381*	.081	.19
General Surgery	-.511*	.062	.09
Opthalmology	-.093***	.056	.08
Orthopedic Surgery	-.752*	.053	.12
Thoracic Surgery	-.761*	.142	.10
Urology	-.298*	.057	.16
Obstetrics/Gynecology	-.636*	.062	.10

* = significant at the .01 level
** = significant at the .05 level
*** = significant at the .10 level

The volume offset estimate is the coefficient of the variable measuring the change in the own price from the partially-pooled regression models. Results from the full models are available from the authors upon request.

The variation in offset estimates across years is somewhat smaller than for either service type or specialty. The smallest volume offsets occurred in 1987/88 and 1988/89. These were years in which there were overall increases in prices among the specialties in this study. In the remaining years the offsets varied significantly, ranging from 32 percent in 1986/87 to 48 percent in 1991-92. Of note, the 95 percent confidence interval includes 50 percent in only 2 years, 1990/91 and 1991/92.

9. DISCUSSION

These results imply that the conventional wisdom regarding the need for a volume offset when setting Medicare fees or assessing the effects of a particular fee change is reasonable. However, the current assumptions about the size and uniformity of a potential volume offset warrant reconsideration. Our estimates do not support the view that there is a 50 percent volume offset overall, nor that the same volume offset should be applied to all types of services or all specialties. In general, we find that current assumptions overstate the size of the volume offset and, if applied under a policy of strict spending caps, could lead to fee cuts that are larger than would be needed to stay within the caps. Such an outcome could tend to reduce Medicare fees somewhat excessively, erode Medicare's position relative to the private market, and potentially compromise access to mainstream providers.[16]

Admittedly, there is no historical evidence to suggest that the pricing policies established by Medicare or the ways they have been implemented have led to general access problems for the Medicare population. However, PPRC's observation regarding the first year of the MFS suggest that the offset assumptions made may have resulted in the establishment of too low a conversion factor in

16. The access risks of lower Medicare fees relative to the private market are substantially lower if private payers continue to be successful at negotiating discounts and reducing their own payment rates.

1992 (PPRC, 1993). Although this reduction in the conversion factor has been subsequently restored by the MVPS, it remains an excellent example of how the volume offset assumption may have put access at risk unnecessarily, albeit for a short period of time. This also highlights the important corrective role played by the MVPS policy in the physician services market.

Given these concerns and the evidence that a volume offset occurs, what do our results suggest as a prudent course? If policy makers decide to rely on a single assumption, then the estimated results from the fully-pooled model might offer the best guidance. This would lead to an assumed offset of between 12 and 26 percent for all services (the 95-percent confidence interval around the point estimate in this study). This would reduce the assumed offset to one-half its current level. Moreover, as we have structured our models, there is no reason not to apply this offset symmetrically. In other words, it would be equally appropriate to assume that volume growth would decelerate as fees are raised as it would be to assume that volume growth accelerates as fees are cut.[17] We realize, however, that alternative specifications could have been used to test the symmetry issue more directly and, as such, we would not conclude strongly that a symmetric offset is required (Christiansen 1992).

Our analysis was also specifically structured to examine potential variations in the offset and we found that several existed. Perhaps the key difference we found was across types of services - specifically between Procedures and other types of services. The offset estimate seems to be substantially larger for Procedures and significantly above the overall 50 percent assumption used by

17. Communications with staff at the Health Care Financing Administration indicate that when the offset was applied to derive the conversion factors used in the Medicare Fee Schedule it was assumed that only those practices losing as a result of the RVS would increase their volume. The possibility that gainers under RVS might reduce volume was not factored into the calculations.

the Medicare program.[18] We acknowledge that this result seems somewhat counterintuitive, given the perception of greater discretion among tests, imaging, and E&M and, as a result, more opportunities for offsets to occur. However, since the offset estimate is based on the underlying association between price and volume changes, it need not be the case that this large offset estimate for Procedures implies that volume is responding more to price changes for this type of service. Instead, it could be that the pricing polices have been designed to lower prices more for those services or areas in which volume growth has been the greatest. Locality-level fixed effects would have controlled for persistent area differences in volume growth, but this had no effect on the offset estimate. Moreover, we examined the possibility that pricing policies in a given year might be related to volume changes in the previous year by including lagged volume in the models presented above. However, this also had no effect on the offset findings for Procedures or other types of services. These analyses lead us to conclude that if there is interest in moving away from a uniform offset assumption, then researchers and policymakers should further investigate the potential for a higher offset among Procedures.

Related to this variation in the offset across types of services, are the differences we find across specialties. The larger offsets are estimated for those specialties that primarily perform the most Procedures. In fact, for the specialty in this study that performs the fewest Procedures - Internal Medicine - we find evidence of a "non-offset," i.e., as fees are cut, we would expect to see RVUs per Medicare beneficiary fall. Despite differences in the size of the estimated offset across specialties, the MFS does not presently allow for variation in payments by specialty. Therefore, it may be difficult to modify Medicare's current offset assumption to incorporate specialty-specific offset assumptions.

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18. This high offset was observed among both Major and Ambulatory Procedures.

In addition to the potential importance the offset assumption can have if Medicare spending caps were implemented, it may also play a role in other refinements to the Medicare Fee Schedule. There is a major research effort underway to develop the data and methods necessary to replace the current methods of paying physicians for their practice expenses (PPRC, 1996). Currently, practice expense RVUs were estimated using relative charges from a period prior to the Fee Schedule's implementation. There is interest in basing practice expense RVUs on relative resource costs, to make it consistent with the RVUs for physicians' work. To the extent that this leads to reductions in payments for some services and increases for others, there is likely to be an assumption of some type of volume offset when conversion factors are recomputed. This would be a natural opportunity to reevaluate the 50 percent offset assumption and to move in the direction of the lower offset, as suggested by this study, or toward one that varies across services.

Finally, no matter what assumptions are made regarding volume offsets for physician or other Medicare services, it seems reasonable to maintain a mechanism that can correct the assumptions in the face of actual experience. Currently, the MVPS policy serves this role in the Medicare physician services market. Some may argue that the MVPS has led to overly generous updates in some years. However, the MVPS would have been perceived as less generous if the offset assumed when computing the budget neutral conversion factors had been smaller. Given that we will never know with certainty what offset assumption will foretell actual volume responses for all services, it is important to consider extending the concept of MVPS to other services to assure that prospective assumptions do not drive fees continually below desired targets.

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CHAPTER THREE

Health Care Utilization Among Medicare Beneficiaries: Demographic and Socioeconomic Differences and Their Implications for Equitable Access*

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Martcia Wade

1. INTRODUCTION

The Medicare program was one of the pillars of President Lyndon Johnson's Great Society. Its principal objective was to ensure access to health care for the nation's elderly. According to Moon (1996), at the time the Medicare program was being implemented, persons over 64 years were significantly and disproportionately poor and lacked access to the health care system. The legislation was specifically motivated by concern that the elderly were not receiving necessary medical care and evidence of access differentials. Based on a review of documents from the period of debate on the Medicare program, Long and Settle (1984) identified four subgroups of elderly persons who were of particular concern to policy makers: the poor, residents of rural areas, the very old, and those living alone. Later, during and after the program's implementation, concerns arose about access barriers faced by racial minorities.

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The early evidence indicated that the Medicare program had improved access to care for the elderly and reduced inequities among the elderly. For example, Davis' (1975) analysis of the first few years of the program (through 1968-1969) indicated that access of the elderly had improved but that some income, race, and regional and urban-rural differentials persisted. Link, Long, and Settle (1982) reported that, by 1976, there were no significant differences in utilization across income groups and that racial differences in the utilization of physician services were essentially non-existent in Southern states where they had previously been noted by Davis (1975).[1] Similarly, Ruther and Dobson (1981) reported that racial disparities within the Medicare program were significantly reduced between 1967 and 1976.

More recent evidence also indicates that Medicare beneficiaries' access is good and improving (Gillis, Lee, and Willke, 1992). However, studies are now also reporting access differentials along several dimensions, including urban versus rural residence, income or socio-economic status, gender, and race. Much of the research in this area has focused on racial differences in access, specifically reporting that black beneficiaries have less access to care than other racial groups. Some studies suggest that, even when blacks gain access to the system, they receive less treatment and that these treatment differentials are not explained by differences in diagnoses (Council on Ethical and Judicial Affairs, 1990). Evidence also suggests that disparities exist for other minorities, though the number of studies is far fewer than the number examining black-white access differentials.

1 Link, Long, and Settle (1982) reported racial differences in hospital utilization in the South.

The question of access differentials is important because there is still concern about elderly persons' access to care and special concerns about access for vulnerable populations (Gornick 1993). Evidence of these concerns is Congress' requirement that the Secretary of Health and Human Services monitor Medicare beneficiaries' access to and utilization of health care services under the Medicare Fee Schedule implemented in 1992. More generally, achieving equitable access to care is consistent with original objectives of the Medicare program.

This report re-examines the question of access differentials among Medicare beneficiaries. The empirical analysis specifically considers whether differences exist by: age, rural versus urban residence, race, income, and/or living arrangements. The analysis uses a relatively new data source, the Medicare Current Beneficiary Survey (MCBS), which contains data on the personal characteristics and health care utilization of a sample of Medicare beneficiaries.

2. PREVIOUS LITERATURE

Much of the empirical literature on Medicare beneficiaries' access to care suggests that systematic differences are associated with beneficiaries' characteristics. The remainder of this section reviews recent, representative empirical analyses.

Race is by far the most frequently examined dimension in studies of differential access to medical services. The persistence of observed race differences in many measures of health and health services utilization goes a long way in explaining why the area receives so much attention. Several studies finding black/white differentials in the types of treatment received for heart disease (Ford, et al., 1989; Wenneker and Epstein, 1989; Goldberg, et al., 1992; Udvarhelyi, et al., 1992; Peterson, et al., 1994; Ford and Cooper, 1995) are but a few examples of such studies. Other studies, some by HCFA staff, have looked at a wide variety of procedures and have similar findings (Kjellstrand and

Logan, 1987; Eggers, 1988; Held, et al., 1988; Boutwell and Mitchell, 1993; McBean and Gornick, 1994; Kahn, 1994; Eggers, 1995; Gornick, et al., 1996). Other studies have found black/white differentials in utilization of primary care and in other measures of access(Davis and Reynolds, 1975; Blendon, et al., 1989; Mutchler and Burr, 1991). In contrast, studies of ethnicity differences, particularly studies comparing the access and utilization of Hispanics and non-Hispanics, are fewer and have conflicting findings after controlling for socioeconomic status (Andersen, Giachello and Aday, 1986).

Socioeconomic status, often summarized by income or educational attainment has received particular attention in the literature on access and utilization. The hypothesized relationships are complex. On the one hand, the level of income plays an important role in determining access through eligibility for public insurance and through the purchase of private insurance and personal health services. Similarly educational attainment influences employment opportunities and hence the likelihood of having employer-provided insurance. On the other hand, low levels of income, wealth and educational attainment are also associated with a variety of health problems (Schoenbaum and Waidmann, 1996) which may necessitate higher levels of health service utilization. Empirical studies of the Medicare population have tended to find lower levels of utilization among the poor (Davis and Reynolds, 1976; Link, Long and Settle, 1984; Wolinsky and Coe, 1984; Mutchler and Burr, 1991; Miller, 1992; Kahn, et al., 1994; Gornick, et al., 1996). Data on income and educational attainment are not available in most sources of utilization data, however, so existing studies are either based on survey self-reports of limited numbers of services or on hospital and Medicare administrative data linked to characteristics of neighborhoods rather than individuals. The MCBS will allow us to go

beyond this and directly examine the relationships between utilization, income and education at the beneficiary level.

Previous research has given mixed results on the extent to which rural residents are disadvantaged in access to health services. HCFA (1993) found that in simple bivariate comparisons, rural residents, while no less likely to have at least one primary care visit, have fewer visits than their urban counterparts. In their multivariate analysis, however, they find no significant differences between rural and urban beneficiaries. In another recent study of older adults in rural and urban North Carolina counties, Blazer et al. (1995) found no significant differences between rural and urban residents in the use of some services or in several other measures of access to care.

The elderly living alone have received very little attention in the health services literature. Long and Settle (1984) do find some evidence from the 1970s that Medicare beneficiaries living alone are less likely to use ambulatory care services than those living with relatives. Thomas and Kelman (1990) include an indicator of household size in a model of utilization designed to test for differences between types of delivery systems, but they find no difference in any ambulatory care measure between those living alone and those in households of size two or larger. Other researchers posit that good access to health and other services may enable seniors to live on their own but find minimal support for this hypothesis using MSA (metropolitan statistical area) level data (Krivo and Mutchler, 1989).

The very old are likely to have different health care needs than younger elderly, but may also face barriers to access. Studies of patients with heart disease have tended to find that the very old receive fewer high-technology interventions but suggest that the prognosis for survival of those over 85 is poor even with interventions (Goldberg, et al., 1989; Udvarhelyi, et al., 1992). Further, except

for elevated utilization in the last year of life, older beneficiaries have always tended to use fewer resources than younger beneficiaries (Lubitz and Riley, 1993).

For the most part, this literature relies either on survey data or on medical records and Medicare claims and administrative data. While analyses of medical records and Medicare claims data have several advantages in accurately measuring the use of very specific services, and in the case of Medicare, the availability of very large samples, they typically do not contain the detailed demographic information necessary to examine access differentials along the dimensions described above. Surveys, e.g., the National Health Interview Survey used by Davis and Reynolds (1975) among others, usually contain detailed demographic indicators but if they contain any health service utilization measures, they are limited in scope and rely on self-reports of past events.

Others have noted the problems associated with limited demographic and socioeconomic controls in health research. Researchers have argued that observed race differences in mortality and health status overstate the true race difference by not controlling for race differences in socioeconomic status (Navarro, 1990; Schoenbaum and Waidmann, 1996). Much of health services research, especially that which relies on medical records and administrative data, is subject to the same criticism. It is therefore unclear whether reported access differentials would persist if other determinants of utilization were appropriately taken into account.

On the other hand, most survey-based studies are limited to information on physician office visits and hospitalizations and are subject to the concerns that errors in reporting past events may not be randomly distributed across the population.

The Medicare Current Beneficiary Survey (MCBS) is unique in its combination of survey responses with Medicare administrative data, allowing researchers to fill a gap in the existing

literature. Using the MCBS, HCFA (1993) examined a variety of self-reported access measures, e.g., regular source of care, barriers to care, satisfaction with care, and utilization. Their bivariate analysis suggested racial differences in access and differences by socio-economic status. With respect to the latter, lower income beneficiaries tended to have less access and to be less satisfied than other beneficiaries. Perhaps related to income, supplemental insurance status appeared to increase access. In addition, the univariate analyses suggested some access differentials associated with urban versus rural residence. For example, beneficiaries residing in rural areas reported barriers to care more often than those residing in urban areas.

More interesting are their multivariate analyses which attempt to control for various determinants of utilization and isolate the relationships of interest. The analysis builds upon Andersen and Newman's (1973) model of utilization, which specifies predisposing, enabling, and need characteristics that may affect utilization. HCFA's dependent variables are the probability of any physician visits (and the probability of emergency room visits). The model's explanatory variables include: age, sex, race/ethnicity, education, living arrangement (i.e., alone or with others) whether the respondent has living children, income status, supplemental insurance status, self-reported health status and level of dependency, and region of residence.

They find statistically significant relationships between the dependent variables and a number of explanatory variables, for example, age, sex, supplemental coverage, income, and health status and level of dependency. However, in contrast to the study's univariate analyses of access and much of the recent literature, race was not statistically significant in one of the two models.[2]

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2 In the model of any physician visits, neither race nor income was statistically significant. In the model of emergency room use, race was statistically significant.

In sum, some of the literature suggests that race, gender, and urban versus rural residence may affect Medicare beneficiaries' access to care. Moreover, access differentials may vary or at least merit examination by type of service. However, most prior literature in this area does not consider a wide range of services and may not have adequately controlled for important determinants of utilization, such as income. Unfortunately, recent research that controlled for such determinants failed to analyze a wide range of services. The analysis which follows attempts to address these weaknesses of the existing literature.

3. ANALYTICAL FRAMEWORK

The goal of more equitable access underlies the Medicare program as well as other major social policy initiatives in modern American history. However, the measurement of access, equity of access, and improvements in access has challenged analysts and researchers. Aday and Andersen's (1981) work is one of few that attempts to develop a framework for the study of access. Andersen et al.'s (1983) conceptual framework for access measures defines two classifications: potential access and realized access. Measures of potential access include characteristics of the health care delivery system (such as the availability and distribution of medical resources) and characteristics of the population or individual of interest (e.g., age, insurance coverage, and illness level). Measures of realized access include utilization of health services and consumer satisfaction.

Although there is no single measure of access, one of the most common measures in the empirical literature and the measure used in this analysis is utilization of health care services. Andersen and Aday argue that ". . . access itself is best measured through observations of people's behavior, that is, their actual use of health services, and that the equity of that access is most appropriately judged by examining their actual utilization relative to some measure of the illness they

experience."[3] In their thinking, access is equitable if "predisposing" and illness variables (rather than enabling or social variables, e.g., income or regular source of care) explain variations in utilization. That is, if access to care is equitable and if illness level and predisposing factors are taken into account, characteristics such as race, income, age, living arrangements, and urban versus rural residence would not be statistically significantly related to utilization. The methodological challenge is to adequately control for the predisposing and illness factors that may affect utilization.

4. DATA

The primary source of data for this analysis is The Health Care Financing Administration's Medicare Current Beneficiary Survey (MCBS), a rich source of data for analyzing beneficiary issues. The MCBS collects data on an on-going basis from a representative sample of Medicare beneficiaries, a longitudinal panel. The core survey collects data on beneficiaries' health status and functioning, supplemental health insurance coverage, demographic and socio-economic characteristics, and household characteristics, among other factors. Supplements administered at various rounds of the survey collect detailed data on beneficiaries' income and assets, access and satisfaction, and other areas. Moreover, Medicare claims and administrative data have been linked to the survey data.

This analysis uses data from Round 1 of the MCBS, administered between September and December 1991, and the respondents' Medicare claims for services provided in 1991.[4] The data contain completed responses for 12,677 persons, 11,735 of whom reside in the community (rather than a facility) and are included in this analysis. In addition to institutionalized beneficiaries, this analysis also excludes those enrolled in HMOs and those who are Medicare-eligible for reasons other

3. See Andersen and Aday (1978), p. 534.

4. Public use tapes from Round 1 of the MCBS are available to the public.

than age. The analysis sample also excludes persons (1) residing in areas (such as Puerto Rico) for which supply data were not available, or (2) other data were missing. The final analysis sample consisted of 8,343 observations.

The analysis of whether beneficiary characteristics affect health care utilization uses a multivariate framework to control for other determinants of utilization. For each type of service, we estimate a logistic model of the probability of service use, and for those with any service use, we estimate a least squares regression model of level of service. Thus we estimate

$$(1) \qquad P_{ij} = F(X_{ij}\beta_{1j} + \epsilon_{1ij})$$

$$(2) \qquad R_{ij} = X_{ij}\beta_{2j} + \epsilon_{2ij} \quad if \quad R_{ij} > 0$$

where F( ) represents the logistic function.[5] P_{ij} is the probability that individual I has a Part B claim during the year for a service of type j. R_{ij} is the sum of the RVUs for all services of type j during the year.[6]

We analyze utilization by type of service as well as in aggregate because we hypothesize that utilization differentials may vary by type of service. In addition to examining differences in the use of high-technology services suggested elsewhere in the literature, we further hypothesize that utilization

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5 $F(z) = \frac{e^z}{1 + e^z}$

6 Relative Value Units (RVUs) are the units of service volume used to calculate physician reimbursement under the Medicare Fee Schedule. HCFA assigns each covered service an RVU value based on the resources used in delivering that service.

differences may be more evident for discretionary services such as office visits as opposed to non-discretionary services such as major cardiovascular procedures.

Drawing from other utilization models in health services research, our empirical model of Medicare beneficiaries' health care utilization includes factors encompassing the influences of both demand and supply as well as other factors which may affect access to physician services. Table III-1 describes the sample along the dimensions defined by the independent variables. The independent variables obtained from the MCBS include beneficiaries' demographic and socio-economic characteristics (age, sex, race/ethnicity, education and income), urban versus rural residence, living arrangements (living alone, with a spouse, or with someone else), supplemental health insurance, and health status. Health status is measured by three sets of variables: a self-rating of overall health,[7] two measures of activity limitations (activities of daily living and instrumental activities of daily living),[8] and fourteen indicators of the prevalence of chronic conditions.

Two variables related to the supply of services were obtained from the Area Resource File (ARF), the number of physicians and hospital beds in the respondent's county of residence. The assignment rates for all services and by type of service are calculated using Medicare claims records matched by carrier and locality to the beneficiaries in the MCBS. The assignment rate indicates the extent to which physicians accept Medicare reimbursement as payment in full for services provided to

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7. The 5 category rating (Poor, Fair, Good, Very Good, Excellent) was rescaled to a standard normal distribution. That is, if $F(x)$ is the cumulative standard normal density function, and if A percent answered "poor", B percent answered "fair", etc., responses would be recoded such that those responding "poor" are assigned a value h_p such that $F(h_p)=A$. Those answering "fair" would be assigned a value h_f such that $F(h_f)=A+B$, and so on.

8. The two measures, IADL limitation and ADL limitation, are essentially counts of the number of activities with which the respondent requires help in performing. Instrumental activities of daily living (IADL) include housework, cooking meals, shopping, managing money and using the phone. Activities of Daily Living (ADL) include bathing, dressing, transfer in and out of chairs, toileting and eating.

Table III-1: Sample Description

Variable	Mean
Male (ref)	0.414
Female	0.586
Age 65-74 (ref)	0.588
Age 75-84	0.330
Age 85+	0.082
Lives with spouse (ref)	0.653
Lives alone	0.312
Other living arrangement	0.035
White (ref)	0.903
Black	0.074
Other Race	0.023
Non-hispanic (ref)	0.965
Hispanic	0.035
Education < HS	0.434
Education = HS (ref)	0.311
Education > HS	0.255
Income < $5,000 (ref)	0.142
Income $5,000-$14,999	0.399
Income $15,000-$24,999	0.212
Income > $25,000	0.248
Urban (ref)	0.731
Rural	0.269
Has supplemental insurance	0.886
Has usual source of care	0.910
MD's per 1000 population	0.172
Short stay hospital beds per 1000 pop.	0.364
Assignment rate	0.747
Normalized self-reported health	0.069
ADL limitations (number)	0.195
IADL limitations (number)	0.723
Cardiovascular disease	0.652
Stroke	0.090
Cancer	0.282
Diabetes	0.146
Rheumatoid arthritis	0.097
Osteoarthritis	0.457
Mental retardation	0.003
Alzheimers	0.012
Psychiatric disorder	0.023
Osteoporosis	0.069
Broken hip	0.036
Parkinsons disease	0.014
Respiratory disease	0.124
Paralysis	0.058

(N=8343)

beneficiaries, and is calculated as the fraction of services (measured in RVU' units) in each carrier·locality·type of service combination that are reimbursed at Medicare's reasonable payment amount. The assignment rate, therefore, is included to capture variation in the prices paid by consumers for physician services.

One potential estimation issue derives from the fact that supplemental insurance and utilization may be endogenous, that is, jointly determined. Specifically, the concern is that beneficiaries who expect to incur significant cost-sharing levels (perhaps because of low health status) purchase supplemental insurance. If utilization and supplemental insurance status are jointly determined, the estimated effect of supplemental insurance on utilization in a multivariate analytical framework would be biased upward.

There are reasons to believe that supplemental insurance coverage and utilization are <u>not</u> always jointly determined. First, for many persons, supplemental insurance is a retirement benefit, independent of a given retiree's expected utilization level. Second, according to Chulis et al. (1993), the less healthy have less private supplemental insurance than the healthy even though they may need it more. On the other hand, the proportion of persons with supplemental Medicaid coverage is inversely related to health status. This relationship partly reflects beneficiaries who have depleted their financial resources because of high medical expenses (often for long-term care in a nursing facility) and thereby qualify for Medicaid as a Medically Needy.

Third, and finally, Chulis et al. (1993) argue the endogeneity of supplemental insurance coverage may not be a significant issue among the elderly. They argue that very few elderly persons can be sure that they will not have a medical problem or condition in the coming year that would incur significant costs.

In these data, there is also some reason to believe that endogeneity bias does not present a large problem. Using a Hausman (1978) test, we tested the specification of our model of overall utilization against the hypothesis that supplemental insurance is endogenously determined. Specifically we constructed an instrumental variable for private health insurance coverage using marital status and median income of the beneficiary's county of residence as instruments. While there may be some question as to whether the exclusion restrictions necessary to construct the instrumental variable are valid, we were unable to reject the hypothesis that the purchase of supplemental insurance was exogenous in the model of utilization volume.

5. RESULTS

Table III-2 summarizes the type-of-service-specific dependent variables in the models we estimated. We present the fraction who used a particular type of service, the mean RVU for those who used the service, and the mean RVU for the entire population (including those who did not use the service).[9] Table III-2 indicates that the largest portion of services covered by Medicare is accounted for by Evaluation and Management services (roughly 40% of covered RVUs. Procedures constitute the second largest share of total service volume at about 34%. Imaging and Testing services make up, respectively, about 14% and 11% of total services covered by Medicare. The most resource-intensive services, (major cardiovascular and orthopedic procedures and cardiac catheterization) are also among the least common. For the population as a whole, these services do not make up a large part of Medicare services. More costly for the program are commonplace services like office visits which account for more than 20 percent of all health care resources used by beneficiaries.

9. These finding are roughly consistent with other studies of Aged Medicare beneficiaries using RVUs as the measure of utilization (Welch, et al., 1996; Verilli and Zuckerman, 1995).

Table III-2: Mean levels of utilization by type of service

Type of Service	Fraction with any Utilization	Mean RVU among users	Mean RVU in population
All Services	**0.882**	**38.11**	**33.62**
Evaluation & Management	**0.865**	**14.79**	**12.79**
Office Visits	0.824	7.58	6.25
Hospital Visits and Critical Care	0.166	14.89	2.47
Emergency Room Visits	0.185	3.94	0.73
Consultations	0.188	6.57	1.24
Opthalmological Specialists	0.370	3.26	1.21
Other Specialists	0.206	3.64	0.75
Procedures	**0.547**	**21.76**	**11.90**
Major General Procedures	0.042	35.03	1.49
Major Cardiovascular Procedures	0.031	53.66	1.66
Major Orthopedic Procedures	0.018	52.15	0.95
Cataract Removal	0.040	51.04	2.05
Other Major Eye Procedures	0.041	25.99	1.06
Minor Skin Procedures	0.213	5.25	1.12
Other Minor Procedures	0.362	5.36	1.94
Endoscopy	0.131	9.85	1.29
Imaging Services	**0.590**	**8.68**	**5.13**
Standard Breast Imaging	0.253	1.66	0.42
Other Standard Imaging	0.506	3.04	1.54
Advanced Imaging	0.114	8.30	0.95
Sonograms	0.195	4.89	0.96
Cardiac Catheterization	0.020	60.50	1.19
Other Imaging Procedures	0.018	13.90	0.25
Testing Services	**0.668**	**5.34**	**3.57**
Laboratory testing	0.635	4.18	2.66
Physician testing	0.206	4.42	0.91

In tables III-3 through III-9, we present simple bivariate comparisons and results of multivariate analyses of physician services utilization by the beneficiary groups for which differential access concerns have been raised. Full multivariate results for all variables are included in Appendix tables A1-A10.

Race/Ethnicity

Tables III-3 and III-4 present the utilization differences among race and ethnic groups. The results suggest significant differences in utilization by race but fewer by Hispanic ethnicity. The descriptive statistics in table III-3 indicate that black beneficiaries and other non-whites are less likely than whites to use any services. Among those with any service use, black beneficiaries use fewer resources than whites, but other non-whites (comprised largely of Asian- and Native- Americans) use more resources than whites. After controlling for the effects of covariates, the probability difference between whites and blacks remains significant . The adjusted odds ratio, i.e., the odds ratio after controlling for the effects of all other covariates, is 0.67 ($p<0.001$).[10] The difference between whites and other-nonwhites, however, is not significant after controlling for other covariates. Further, the volume differences between whites and non-whites are no longer significant. Table III-4 indicates that Hispanic beneficiaries are less likely than non-Hispanic beneficiaries to receive any service, but statistics in table III-3 indicate that black beneficiaries and other non-whites are less likely than whites to use any services. Among those with any service use, black beneficiaries use fewer resources than whites, but other non-whites (comprised largely of Asian- and Native- Americans) use more resources than whites. After controlling for the effects of covariates, the probability difference between whites

10. An odds ratio is a measure of relative risk calculated as $(P_i/(1-P_i))/(P_j/(1-P_j))$ ranging from 0 to positive infinit. Values less than one indicate a lower risk in population i relative to population j, and values greater than one indicate higher risk in population i relative to population j. Adjusted odds ratios are obtained from logit regressions and are calculated as $\exp(\beta)$ where β is the estimated logit coefficient presented in the Appendix.

Table III-3: Race Differences in Utilization of Physician Services

Type of Service	Probability of Service Use					Volume of Service Use (RVU)				
	White	Black	Other	Adjusted Odds Ratio - Black	Adjusted Odds Ratio - Other	White	Black	Other	Adjusted RVU Difference - Black	Adjusted RVU Difference - Other
All Services	**0.888**	**0.821**	**0.835**	**0.67 *****	**0.75**	**38.26**	**35.61**	**39.77**	**-3.73**	**-4.13**
Evaluation & Management	**0.871**	**0.804**	**0.808**	**0.65 *****	**0.66 ***	**14.66**	**15.69**	**17.58**	**-0.37**	**-0.31**
Office Visits	0.834	0.732	0.761	0.61 ***	0.70 *	7.54	7.95	8.14	0.20	0.05
Hospital Visits and Critical Care	0.163	0.201	0.152	1.12	0.83	14.96	13.52	18.01	-2.64 *	0.33
Emergency Room Visits	0.179	0.248	0.216	1.31 ***	1.14	3.78	4.79	5.72	1.02 ***	1.64 ***
Consultations	0.190	0.166	0.183	0.90	0.80	6.38	7.02	12.81	0.26	2.91 **
Opthalmological Specialists	0.381	0.265	0.293	0.63 ***	0.75 *	3.19	4.40	3.58	0.96 ***	-0.19
Other Specialists	0.213	0.130	0.158	0.67 ***	0.71	3.67	3.22	3.30	-1.32 *	-2.22 *
Procedures	**0.562**	**0.393**	**0.439**	**0.61 *****	**0.65 *****	**21.64**	**22.00**	**27.17**	**-0.42**	**4.62**
Major General Procedures	0.043	0.033	0.035	0.95	0.93	35.50	29.77	27.73	-8.36	-7.69
Major Cardiovascular Procedures	0.032	0.029	0.010	0.89	0.32	55.06	40.30	5.79	-5.28	-11.26
Major Orthopedic Procedures	0.019	0.011	0.017	0.45 *	1.27	51.83	51.97	66.61	23.05	-2.79
Cataract Removal	0.040	0.033	0.078	0.79	1.84 **	50.26	57.90	57.19	4.10	-3.84
Other Major Eye Procedures	0.041	0.035	0.052	0.75	0.85	26.31	24.19	20.17	-5.50	-15.17
Minor Skin Procedures	0.221	0.139	0.133	0.74 **	0.61 **	5.31	4.41	4.41	-0.49	-0.67
Other Minor Procedures	0.376	0.228	0.262	0.59 ***	0.63 ***	5.29	5.82	7.93	0.73	1.80
Endoscopy	0.134	0.104	0.089	0.97	0.83	9.72	9.88	17.66	-0.82	7.37 ***
Imaging Services	**0.596**	**0.523**	**0.594**	**0.85 ***	**1.08**	**8.75**	**8.81**	**5.92**	**-0.23**	**-4.01 ****
Standard Breast Imaging	0.263	0.164	0.167	1.02	0.70	1.67	1.32	2.16	-0.29 *	0.51
Other Standard Imaging	0.511	0.446	0.511	0.80 **	0.98	3.06	2.86	2.84	-0.20	-0.67
Advanced Imaging	0.114	0.126	0.093	1.10	0.65	8.56	6.06	5.64	-0.85	-2.79
Sonograms	0.194	0.194	0.236	0.93	1.12	4.80	5.87	5.45	1.07 **	0.50
Cardiac Catheterization	0.021	0.013	0.000	0.61	-	60.53	59.92	0.00	-1.63	-
Other Imaging Procedures	0.017	0.028	0.007	1.43	0.27	13.52	17.03	8.74	6.47	-8.19
Testing Services	**0.674**	**0.615**	**0.614**	**0.90**	**0.75 ***	**5.34**	**5.27**	**5.62**	**-0.21**	**-1.15 ***
Laboratory testing	0.642	0.576	0.561	0.90	0.72 **	4.21	4.08	3.37	-0.16	-1.37 ***
Physician testing	0.208	0.187	0.207	0.89	0.84	4.32	4.75	7.51	-0.22	1.40

Significance Levels:
*** p< .01; ** p< .05; * p<.1

Table III-4: Ethnicity Differences in Utilization of Physician Services

Type of Service	Probability of Service Use			Volume of Services Used (RVU)		
	Hispanic	Non-Hispanic	Adjusted Odds Ratio	Hispanic	Non-Hispanic	Adjusted RVU difference
All Services	**0.806**	**0.885**	**0.77**	**46.86**	**37.82**	**8.88** **
Evaluation & Management	**0.800**	**0.867**	**0.88**	**18.43**	**14.67**	**2.90** **
Office Visits	0.773	0.826	1.08	8.92	7.53	1.35 ***
Hospital Visits and Critical Care	0.141	0.167	0.79	16.97	14.83	1.91
Emergency Room Visits	0.180	0.186	0.87	4.70	3.91	0.03
Consultations	0.199	0.188	1.22	9.67	6.45	1.24
Opthalmological Specialists	0.326	0.372	0.93	4.01	3.23	0.54
Other Specialists	0.166	0.207	0.93	7.11	3.54	3.32 ***
Procedures	**0.473**	**0.550**	**0.94**	**26.47**	**21.61**	**2.84**
Major General Procedures	0.038	0.043	0.92	28.42	35.24	-6.17
Major Cardiovascular Procedures	0.019	0.031	0.84	90.51	52.84	31.53
Major Orthopedic Procedures	0.006	0.019	0.32	24.96	52.49	11.01
Cataract Removal	0.052	0.040	1.18	73.04	49.99	22.92 **
Other Major Eye Procedures	0.065	0.040	1.50	28.08	25.87	4.54
Minor Skin Procedures	0.157	0.215	1.02	4.46	5.27	-1.00
Other Minor Procedures	0.326	0.364	1.00	7.20	5.30	1.20
Endoscopy	0.088	0.132	0.80	9.41	9.86	-3.46 *
Imaging Services	**0.542**	**0.592**	**1.01**	**9.38**	**8.66**	**1.07**
Standard Breast Imaging	0.247	0.253	1.39	1.89	1.65	-0.04
Other Standard Imaging	0.479	0.507	1.00	3.47	3.03	0.39
Advanced Imaging	0.103	0.114	1.09	4.50	8.43	-3.50 *
Sonograms	0.232	0.194	1.33 *	5.43	4.87	0.27
Cardiac Catheterization	0.018	0.020	1.37	69.52	60.21	20.52
Other Imaging Procedures	0.022	0.018	1.35	9.28	14.11	-11.52
Testing Services	**0.628**	**0.670**	**1.16**	**8.47**	**5.23**	**3.02** ***
Laboratory testing	0.594	0.637	1.14	4.64	4.17	0.67
Physician testing	0.241	0.205	1.39 **	10.64	4.15	5.35 ***

Significance Levels:
*** p< .01; ** p< .05; * p< .1

and blacks remains significant (odds ratio (OR)=0.67, $p<0.001$) while the difference between whites and other-nonwhites does not. Further, the volume differences between whites and non-whites are no longer significant. Table III-4 indicates that Hispanic beneficiaries are less likely than non-Hispanic beneficiaries to receive any service, but among those who receive services, Hispanic beneficiaries have a higher volume of utilization. However, after controlling for other factors, only the volume difference remains significant.

As in the overall utilization models, black beneficiaries have significantly lower probabilities of receiving services in each major category of service except testing but no significant difference in volume of services received in the category. The largest difference is seen in the probability of having a procedure (OR=0.61, $p<0.001$). Other non-whites have significantly lower probabilities than whites of receiving E&M services, procedures and testing services and have a significantly lower volume of utilization in imaging and testing services than white beneficiaries.

Looking first at evaluation and management services, the multivariate results indicate that while black beneficiaries have a higher probability than whites of being seen in emergency rooms, they have lower probabilities of being seen in a doctor's office, or by specialists. Relative to whites, blacks with any utilization receive a significantly higher volume of services in ER visits and from ophthalmologists, but a significantly lower volume of services in hospital visits and other specialties. Similar to our findings for blacks, the significant difference in E&M utilization among other non-whites stems largely from a lower probability of having an office visit, although they also have a lower probability of seeing an ophthalmologist. Like blacks, other non-whites use a larger volume of resources than whites in emergency room visits, but unlike blacks they also use a significantly larger volume of consultation services than whites.

In contrast to the findings in much of the literature, whether or not we control for the influence of other factors, black beneficiaries do not have significantly lower probabilities of receiving major cardiovascular procedures than white beneficiaries. This finding was surprising but probably results from the rarity of these procedures in the Medicare population.[11] On the other hand, we do find lower probabilities of receiving major orthopedic surgery as well as all types of ambulatory and minor procedures, which are by far the most common type of procedures performed. Like black beneficiaries, other non-whites have significantly lower probabilities of having ambulatory and minor procedures relative to whites. Other non-whites, however, have a higher probability than whites of having cataract removal surgery. While there is no significant difference in major cardiovascular procedures, among other non-whites in the sample, none had CABG surgery during the period covered by the Medicare claims records.

While at this level of aggregation there are no significant differences in procedure volume between blacks and whites, we may miss more subtle variations. For example, if we separate hip and knee replacement from other major orthopedic procedures, we find a large but insignificant negative effect of being black on the volume of joint replacements offset by a large and significant positive effect for the residual category. This finding is possibly consistent with an earlier finding by Gornick et al. (1996) that blacks have many more amputations of the lower limbs than whites. More likely, however, is that black beneficiaries are more likely to receive joint repair services since these make up the largest portion of orthepedic surgery as well as all types of ambulatory and minor procedures.

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11. In our sample, there were only 37 respondents with a CABG procedure in 1991, and 35 with a PTCA procedure. Of these 72 procedures, only one (a CABG) was performed on a black respondent. While these numbers are not large enough to draw statistical conclusions, even using a very limited set of control variables, they do hint that if we had a large number of cases, we might well find a significantly smaller probability among black respondents.

which are by far the most common type of procedures performed. Like black beneficiaries, other non-whites have significantly lower probabilities than whites of having cataract removal surgery. While there is no significant difference in major cardiovascular procedures, among other non-whites in the sample, none had CABG surgery during the period covered by the Medicare claims records.

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While there are no significant differences between whites and blacks in the utilization of costly imaging procedures like cardiac catheterization, blacks are significantly less likely than whites to receive standard imaging services. Without controlling for covariates black women are less likely to receive standard breast imaging services, but this effect disappears in the multivariate model. However, black women do receive a significantly lower volume of resources in this category than white women, even after controlling for covariates. The one imaging service category for which blacks receive a higher volume of services is in sonograms. The significantly lower volume of imaging services received by other non-whites seems to be driven largely by differences in cardiac

catheterization. No sample beneficiary in this group received this service which has the highest resource cost per person of any imaging service.

In the use of laboratory testing services, there are no significant differences between blacks and whites, but other non-whites have significantly lower utilization than whites measured both by the probability and volume of use.

Table III-4 indicates that after controlling for the effects of covariates, Hispanic beneficiaries do not differ significantly from non-Hispanics in the probability of receiving any broad class of service, but those who do receive services use a significantly larger volume of testing and E&M resources. That Hispanic beneficiaries receive higher volume of E&M resources seems to be driven by higher resource use in office visits and some specialties than non-Hispanics. Part of the overall volume difference between Hispanics and non-Hispanics may also be driven by large differences in the volume of resources used in cataract removal procedures.

Hispanic beneficiaries use significantly fewer resources in advanced imaging services but have a significantly higher probability of having a sonogram as well. Finally, the higher volume of resources used in testing services, is due in part to higher probabilities and volume of physician administered tests relative to non-Hispanics.

Income/Education

Our estimates suggest that Medicare beneficiaries' total utilization of services is positively related to socioeconomic status, measured by both income level and educational attainment, after controlling for need and market conditions. We include both income and education variables to account for different aspects of socioeconomic status. For many elderly, current income will not completely capture the economic resources available to an individual, which may have more to do with accumulated wealth. While the MCBS does not have a measure of wealth, education may be

thought of as a proxy for lifetime income opportunities which are likely to be more important to wealth than current income.

As indicated in table III-5, income differences in utilization are most striking when comparing beneficiaries in the top income category (>$25,000) with those in the bottom category (<$5,000). While the coefficients are ordered in the expected manner, the only statistically significant effect on the probability of receiving any services is found for the top category. There is not, however, a significant difference in the total volume of physician services among beneficiaries using any services.

Differences in beneficiary income are associated with differences in utilization of services in each of the four major categories. Coefficients on indicators of higher levels of income generally indicate higher levels of utilization in both logit and OLS regressions, though they are not always significant. The effect of income is not necessarily monotonic, however. Beneficiaries in the second lowest income category ($5,000-$15,000) often have lower levels of utilization than the those in the poorest category.

For specific types of E&M services, those in the top income category are significantly more likely to use the services of specialists and receive a higher volume of services from hospital physician visits. Our analyses indicate, however, that income may be negatively related to the volume of services obtained from ophthalmologists.

Income appears to be positively related to the probabilities of having minor skin procedures and endoscopic procedures. Further, the volume of resources used in major orthopedic and cardiovascular procedures also seems to be positively related to income level.

Table III-5: Income Differences in Utilization of Physician Services

Type of Service	Probability of Service Use						
	< $5,000	$5,000-$15,000	$15,000-$25,000	> $25,000	Adjusted Odds Ratio - $5K-$15K	Adjusted Odds Ratio - $15K-$25K	Adjusted Odds Ratio - >$25K
All Services	**0.869**	**0.880**	**0.885**	**0.891**	**1.09**	**1.23**	**1.38 ****
Evaluation & Management	**0.855**	**0.865**	**0.869**	**0.866**	**1.07**	**1.20**	**1.27 ***
Office Visits	0.814	0.822	0.829	0.831	1.00	1.09	1.19
Hospital Visits and Critical Care	0.170	0.185	0.159	0.138	1.07	1.08	1.15
Emergency Room Visits	0.209	0.213	0.173	0.138	0.98	0.96	0.90
Consultations	0.194	0.191	0.190	0.179	0.98	1.05	1.08
Opthalmological Specialists	0.359	0.362	0.372	0.389	1.03	1.14	1.21 **
Other Specialists	0.204	0.175	0.210	0.252	0.81 **	0.95	1.21 *
Procedures	**0.547**	**0.517**	**0.545**	**0.597**	**0.87 ****	**0.97**	**1.19 ****
Major General Procedures	0.040	0.038	0.051	0.045	0.90	1.10	1.09
Major Cardiovascular Procedures	0.034	0.030	0.034	0.027	0.79	0.92	0.89
Major Orthopedic Procedures	0.020	0.021	0.014	0.017	1.13	0.71	0.94
Cataract Removal	0.051	0.040	0.036	0.038	0.92	0.97	1.06
Other Major Eye Procedures	0.045	0.046	0.038	0.033	1.09	1.03	1.01
Minor Skin Procedures	0.217	0.191	0.205	0.253	0.88	0.96	1.19 *
Other Minor Procedures	0.350	0.341	0.370	0.397	0.89	1.00	1.11
Endoscopy	0.127	0.113	0.132	0.160	0.86	0.97	1.25 *
Imaging Services	**0.594**	**0.585**	**0.579**	**0.605**	**0.96**	**1.01**	**1.19 ****
Standard Breast Imaging	0.174	0.215	0.281	0.386	1.20	1.29 **	1.76 ***
Other Standard Imaging	0.511	0.505	0.497	0.513	0.94	1.01	1.20 **
Advanced Imaging	0.133	0.119	0.109	0.099	0.82 *	0.87	0.95
Sonograms	0.211	0.201	0.188	0.183	0.94	1.00	1.07
Cardiac Catheterization	0.016	0.016	0.026	0.023	0.84	1.28	1.26
Other Imaging Procedures	0.014	0.020	0.020	0.013	1.37	1.43	1.03
Testing Services	**0.650**	**0.654**	**0.677**	**0.696**	**0.93**	**1.14**	**1.34 *****
Laboratory testing	0.615	0.623	0.639	0.663	0.94	1.08	1.27 ***
Physician testing	0.189	0.200	0.214	0.220	1.05	1.24 **	1.39 ***

Significance Levels:
*** p< .01; ** p< .05; * p< .1

Table III-5 (cont): Income Differences in Utilization of Physician Services

Type of Service	Volume of Service Use (RVU)						
	< $5,000	$5,000-$15,000	$15,000-$25,000	>$25,000	Adjusted RVU Difference - $5K-$15K	Adjusted RVU Difference- $15K-$25K	Adjusted RVU Difference- $25K
All Services	**39.58**	**37.14**	**38.91**	**38.16**	**-1.81**	**0.66**	**3.22**
Evaluation & Management	**16.16**	**15.23**	**14.00**	**13.99**	**-0.56**	**-0.48**	**1.05**
Office Visits	7.90	7.62	7.55	7.34	-0.32	0.02	0.27
Hospital Visits and Critical Care	15.93	14.52	13.54	16.30	-1.04	-1.01	3.27 *
Emergency Room Visits	4.24	4.13	3.74	3.40	0.13	-0.04	0.04
Consultations	7.27	6.67	6.01	6.45	-0.21	-0.65	0.63
Opthalmological Specialists	3.58	3.44	3.05	2.98	0.02	-0.33 *	-0.49 **
Other Specialists	4.04	3.49	3.64	3.62	-0.61	-0.50	-0.59
Procedures	**21.16**	**21.36**	**23.90**	**20.96**	**0.45**	**1.98**	**1.12**
Major General Procedures	27.94	30.34	39.18	40.96	2.32	8.80	10.47
Major Cardiovascular Procedures	34.24	44.05	67.56	69.99	11.18	33.74 **	26.15
Major Orthopedic Procedures	39.32	49.73	57.21	62.03	10.25	19.45 *	19.15 *
Cataract Removal	48.77	54.05	51.90	47.00	5.74	0.42	-1.75
Other Major Eye Procedures	24.78	25.06	29.14	25.88	-1.97	2.67	0.10
Minor Skin Procedures	5.29	4.97	5.93	5.12	-0.82	0.18	-0.43
Other Minor Procedures	5.39	5.40	5.20	5.42	-0.12	-0.08	0.29
Endoscopy	9.88	10.17	10.45	9.05	-0.39	-0.29	-0.71
Imaging Services	**8.62**	**8.27**	**9.44**	**8.75**	**-0.88**	**0.09**	**0.36**
Standard Breast Imaging	1.84	1.59	1.65	1.69	-0.24 **	-0.21 *	-0.24 **
Other Standard Imaging	2.96	3.00	3.11	3.11	0.05	0.12	0.37 *
Advanced Imaging	9.08	7.68	8.36	8.84	-1.41	-1.41	-1.47
Sonograms	4.74	5.03	5.03	4.64	0.14	0.21	-0.08
Cardiac Catheterization	63.06	57.85	61.72	61.29	-6.11	-2.83	0.38
Other Imaging Procedures	13.95	12.78	11.86	19.24	0.04	-0.85	6.55
Testing Services	**5.80**	**5.15**	**5.24**	**5.46**	**-0.52** *	**-0.25**	**0.30**
Laboratory testing	4.57	4.01	4.04	4.36	-0.48 **	-0.34	0.24
Physician testing	5.05	4.37	4.50	4.12	-0.22	0.05	-0.10

Significance Levels:
*** p<.01; ** p<.05; * p<.1

The use of standard imaging services also appears to be positively related to income, although the volume of breast imaging services received among those who receive any is highest in the lowest income category. Finally, the probability of receiving testing services is strongly related to income.

As table III-6 indicates, educational attainment seems to play no role in determining the probability of receiving any care, but conditional on receiving some care, those with less than a high school education receive significantly fewer health care resources than those with more education.

Education has no significant effect on the use of E&M services except that those who did not graduate from high school have a lower probability of receiving consultative services, and those with at least some college have both a higher probability of receiving services and receive and a larger volume of services from ophthalmologists than those with less education.

Those not graduating from high school have significantly lower utilization of major orthopedic procedures (both probability and volume), and those with some college have a significantly higher probability of minor skin procedures and major eye procedures. However, those who did not graduate from high school also have a significantly higher probability than graduates of having major eye surgery.

The probability of using imaging services is significantly smaller among those who did not graduate from high school, due to smaller probabilities of receiving standard breast imaging and advanced imaging services although the probability of receiving advanced imaging services is also significantly higher among those with some college education.

Rural Residence

While table III-7 suggests that the probability of using any service is not significantly different for urban and rural residents, among those who receive any care rural residents use significantly fewer

Table III-6: Education Differences in Utilization of Physician Services

Type of Service	Probability of Service Use					Volume of Service Use (RVU)				
	< High School	High School	> High School	Adjusted Odds Ratio - LHS	Adjusted Odds Ratio - GHS	< High School	High School	> High School	Adjusted RVU Difference - LHS	Adjusted RVU Difference - GHS
All Services	**0.883**	**0.880**	**0.882**	**1.11**	**1.06**	**38.12**	**38.04**	**38.18**	**-3.38** **	**-0.32**
Evaluation & Management	**0.869**	**0.865**	**0.858**	**1.08**	**0.98**	**15.52**	**14.17**	**14.29**	**-0.56**	**0.26**
Office Visits	0.826	0.828	0.817	1.05	0.95	7.65	7.49	7.54	-0.29	0.00
Hospital Visits and Critical Care	0.189	0.154	0.140	0.95	0.96	15.05	14.76	14.71	0.26	-0.59
Emergency Room Visits	0.220	0.170	0.145	1.07	0.91	4.20	3.82	3.43	0.09	-0.35
Consultations	0.189	0.192	0.183	0.85 **	0.95	7.14	6.20	6.03	0.35	-0.36
Opthalmological Specialists	0.348	0.372	0.407	0.95	1.17 **	3.36	3.03	3.36	0.09	0.52 ***
Other Specialists	0.188	0.202	0.239	0.99	1.08	3.57	3.43	3.95	-0.17	0.41
Procedures	**0.525**	**0.544**	**0.587**	**0.93**	**1.09**	**21.71**	**22.59**	**20.89**	**-2.45** *	**-1.05**
Major General Procedures	0.040	0.042	0.046	0.93	1.06	31.58	36.15	38.90	0.62	1.11
Major Cardiovascular Procedures	0.032	0.031	0.029	0.88	0.89	45.89	62.92	56.34	-14.88	-17.18
Major Orthopedic Procedures	0.017	0.022	0.016	0.68 *	0.71	38.67	59.67	63.48	-22.86 ***	-7.53
Cataract Removal	0.046	0.035	0.037	1.12	1.11	51.46	52.05	48.97	-2.48	-1.98
Other Major Eye Procedures	0.049	0.031	0.039	1.29 *	1.38 **	25.41	29.42	23.83	-4.67	-6.22
Minor Skin Procedures	0.188	0.206	0.263	0.90	1.23 ***	5.58	5.28	4.83	0.42	-0.45
Other Minor Procedures	0.343	0.365	0.392	0.92	1.04	5.27	5.47	5.37	-0.32	-0.17
Endoscopy	0.117	0.137	0.146	0.90	0.99	10.73	8.82	9.82	1.05	0.86
Imaging Services	**0.574**	**0.606**	**0.598**	**0.87** **	**0.96**	**8.77**	**8.68**	**8.55**	**-0.33**	**-0.25**
Standard Breast Imaging	0.174	0.296	0.338	0.68 ***	0.99	1.63	1.67	1.67	0.00	-0.03
Other Standard Imaging	0.515	0.497	0.502	1.00	0.98	3.04	3.05	3.03	-0.13	-0.11
Advanced Imaging	0.119	0.122	0.096	0.83 **	0.76 ***	8.09	8.14	8.99	0.89	0.48
Sonograms	0.205	0.194	0.180	0.97	0.96	4.85	5.04	4.79	-0.52 *	-0.26
Cardiac Catheterization	0.017	0.021	0.022	0.85	1.07	63.83	58.45	58.42	1.66	-1.97
Other Imaging Procedures	0.018	0.017	0.018	0.85	1.24	13.12	14.15	14.90	0.61	-4.66
Testing Services	**0.664**	**0.671**	**0.674**	**0.99**	**0.97**	**5.34**	**5.17**	**5.54**	**-0.11**	**0.18**
Laboratory testing	0.628	0.638	0.644	0.98	0.98	4.11	4.11	4.39	-0.09	0.18
Physician testing	0.214	0.197	0.205	1.04	0.98	4.52	4.29	4.39	-0.30	-0.08

Significance Levels:
*** p< .01; ** p<.05; * p< .1

Table III-7: Urban/Rural Differences in Utilization of Physician Services

Type of Service	Probability of Service Use			Volume of Services Used (RVU)		
	Rural	Urban	Adjusted Odds Ratio	Rural	Urban	Adjusted RVU difference
All Services	**0.881**	**0.882**	**1.02**	**30.89**	**40.76**	**-8.68** ***
Evaluation & Management	**0.863**	**0.866**	**1.01**	**12.19**	**15.75**	**-2.61** ***
Office Visits	0.818	0.827	0.93	6.57	7.94	-1.00 ***
Hospital Visits and Critical Care	0.168	0.165	1.06	11.58	16.13	-3.46 ***
Emergency Room Visits	0.199	0.181	1.12	3.54	4.10	-0.27
Consultations	0.149	0.203	0.73 ***	5.25	6.92	-1.39 ***
Opthalmological Specialists	0.364	0.373	1.04	3.11	3.31	-0.22
Other Specialists	0.177	0.216	0.86 **	2.72	3.92	-0.90 **
Procedures	**0.521**	**0.556**	**0.94**	**19.59**	**22.50**	**-3.75** ***
Major General Procedures	0.036	0.045	0.83	30.57	36.35	-1.41
Major Cardiovascular Procedures	0.027	0.032	0.79	39.63	57.95	-22.60 *
Major Orthopedic Procedures	0.022	0.017	1.37	56.64	50.00	7.26
Cataract Removal	0.039	0.040	0.93	47.61	52.27	-9.18 **
Other Major Eye Procedures	0.044	0.040	1.03	24.50	26.60	-4.15
Minor Skin Procedures	0.172	0.228	0.84 **	4.37	5.50	-1.30 ***
Other Minor Procedures	0.352	0.366	0.95	4.69	5.59	-0.74
Endoscopy	0.112	0.137	0.86 *	10.01	9.80	0.21
Imaging Services	**0.545**	**0.607**	**0.85** **	**6.65**	**9.36**	**-3.05** ***
Standard Breast Imaging	0.208	0.269	0.73 ***	1.36	1.74	-0.43 ***
Other Standard Imaging	0.469	0.519	0.89 **	2.37	3.27	-0.89 ***
Advanced Imaging	0.096	0.121	0.80 **	6.25	8.90	-2.87 ***
Sonograms	0.169	0.205	0.84 **	4.09	5.14	-0.85 ***
Cardiac Catheterization	0.017	0.021	0.85	57.05	61.53	-7.54
Other Imaging Procedures	0.015	0.019	0.69	7.09	15.85	-14.73 ***
Testing Services	**0.640**	**0.679**	**0.89** *	**4.17**	**5.74**	**-1.38** ***
Laboratory testing	0.605	0.646	0.90	3.40	4.45	-0.95 ***
Physician testing	0.164	0.222	0.75 ***	3.72	4.61	-0.34

Significance Levels:
*** p<.01; ** p<.05; * p<.1

resources overall and use fewer resources in each of the four major categories of services. In addition, they are significantly less likely to receive imaging and testing services.

The lower volume of E&M services received by rural residents results from less frequent and less intense use of consultations and specialist services as well as a lower volume of use of visits in offices and hospital/critical care facilities.

Several factors contribute to the lower overall volume of procedure services used by rural residents. First, there is a large difference in the volume of services used in major cardiovascular procedures, as well as significant differences in resource volume for cataract removals and minor skin procedures. In addition, rural residents are significantly less likely to use the relatively common endoscopic and minor skin procedures.

Diagnostic imaging and testing services are also less intensively used by rural residents. They are less likely than urban beneficiaries to receive standard imaging, advanced imaging and sonography services. Further, rural beneficiaries receive a lower volume of services in each category, and these differences are all significant except for the difference in cardiac catheterization. Finally, rural residents are less likely to receive physician testing services and receive a lower volume of lab testing relative to urban beneficiaries.

Living Arrangement

Table III-8 reports our finding that Medicare beneficiaries who live alone do not differ from those who live with another in the probability of receiving any care, and among those who do receive care, those who live alone use significantly more services. There are no individual services for which those living alone are less likely to receive care than those living with a spouse, nor are there any services for which those living alone have significantly lower volume of service use. However, there

Table III-8: Living Arrangement Differences Utilization of Physician Services

Type of Service	Probability of Service Use			Volume of Services Used (RVU)		
	Live Alone	Live with Spouse	Adjusted Odds Ratio	Live Alone	Live with Spouse	Adjusted RVU difference
All Services	**0.893**	**0.878**	**0.97**	**38.86**	**37.75**	**5.37** ***
Evaluation & Management	**0.879**	**0.860**	**1.00**	**15.69**	**14.29**	**2.63** ***
Office Visits	0.840	0.820	0.99	8.04	7.34	0.63 ***
Hospital Visits and Critical Care	0.179	0.158	1.23 ***	14.86	14.87	2.48 **
Emergency Room Visits	0.206	0.175	1.16 **	3.92	3.96	0.12
Consultations	0.196	0.184	1.20 ***	6.49	6.57	0.67 *
Opthalmological Specialists	0.416	0.350	1.11 *	3.22	3.25	-0.09
Other Specialists	0.204	0.210	1.08	3.45	3.69	0.52
Procedures	**0.557**	**0.546**	**1.05**	**20.88**	**22.06**	**1.34**
Major General Procedures	0.043	0.042	1.39 **	31.49	37.15	-2.08
Major Cardiovascular Procedures	0.032	0.030	1.36 **	40.94	60.55	-9.35
Major Orthopedic Procedures	0.019	0.018	1.01	50.66	53.76	10.73
Cataract Removal	0.041	0.040	0.88	50.59	51.34	0.95
Other Major Eye Procedures	0.048	0.037	1.08	24.74	26.64	2.47
Minor Skin Procedures	0.236	0.203	1.20 ***	5.19	5.35	0.12
Other Minor Procedures	0.366	0.365	1.03	5.29	5.22	0.30
Endoscopy	0.128	0.134	1.07	10.25	9.57	1.08
Imaging Services	**0.615**	**0.582**	**1.01**	**8.83**	**8.68**	**1.63** ***
Standard Breast Imaging	0.232	0.278	0.92	1.62	1.69	-0.10
Other Standard Imaging	0.526	0.499	1.08	2.97	3.10	0.25 *
Advanced Imaging	0.126	0.108	1.31 ***	7.32	8.92	-1.30
Sonograms	0.216	0.187	1.21 ***	4.96	4.87	0.24
Cardiac Catheterization	0.021	0.019	1.60 **	62.23	59.93	4.50
Other Imaging Procedures	0.020	0.017	1.24	14.63	13.75	-0.57
Testing Services	**0.676**	**0.667**	**1.02**	**5.42**	**5.30**	**0.42** **
Laboratory testing	0.642	0.635	1.00	4.24	4.15	0.36 **
Physician testing	0.208	0.206	1.11	4.52	4.39	0.05

Significance Levels:
*** p<.01; ** p<.05; * p<.1

are several for which those living alone are more likely to receive care and several for which they have a significantly higher volume of use.

These findings may indicate that early concerns about access problems faced by those living alone may have been overstated, or alternatively effectively addressed. The lack of previous studies on the subject makes it difficult to determine which is the case. Alternatively, to the extent that we have not sufficiently controlled for age, these effects may reflect the fact that widows (who make up the largest portion of those living alone) are older on average, and presumably less healthy.

Age

Some of the strongest results of this analysis relate to the age of beneficiaries. Table III-9 indicates that the probability of using any physician services increases with age. Among those with any utilization, the level of use for beneficiaries between 75 and 84 does not differ significantly from that of beneficiaries under 75 years. However, controlling for other determinants, those over 84 years use fewer physician services than younger beneficiaries.

Relative to the largest group of beneficiaries, those under 75, the oldest beneficiaries have significantly higher probabilities of receiving all categories of service except imaging, but generally receive lower volume services than younger beneficiaries.

The oldest beneficiaries are more likely than the youngest to receive nearly all types of E&M services, but receive significantly fewer services in hospitals and critical care units, in consultations and from specialists.

Older beneficiaries are significantly less likely to receive resource-intensive major orthopedic procedures, but they are significantly more likely to receive major eye procedures and minor procedures. Differences in the volume of procedure services provided generally favor younger beneficiaries.

Table III-9: Age Differences in Utilization of Physician Services

Type of Service	Probability of Service Use					Volume of Service Use (RVU)				
	65-74	75-84	85+	Adjusted Odds Ratio - 75-84	Adjusted Odds Ratio - 85+	65-74	75-84	85+	Adjusted RVU Difference - 75-84	Adjusted RVU Difference- 85+
All Services	**0.854**	**0.920**	**0.932**	**1.89** ***	**2.42** ***	**37.36**	**39.69**	**36.80**	**0.03**	**-5.88** ***
Evaluation & Management	**0.834**	**0.906**	**0.923**	**1.82** ***	**2.37** ***	**13.92**	**15.80**	**16.43**	**0.66**	**-0.76**
Office Visits	0.795	0.867	0.867	1.62 ***	1.78 ***	7.33	8.02	7.41	0.48 ***	-0.10
Hospital Visits and Critical Care	0.133	0.201	0.261	1.46 ***	1.71 ***	15.91	14.23	13.25	-2.05 *	-1.11 ***
Emergency Room Visits	0.154	0.219	0.274	1.33 ***	1.49 ***	3.82	3.95	4.33	0.02	0.38
Consultations	0.168	0.213	0.234	1.22 ***	1.20 *	6.87	6.25	6.18	-0.92 **	-1.51 ***
Opthalmological Specialists	0.323	0.438	0.434	1.69 ***	1.84 ***	3.20	3.29	3.44	0.08	0.19
Other Specialists	0.202	0.218	0.183	1.08	0.87	4.06	3.08	3.02	-1.08 ***	-1.35 ***
Procedures	**0.512**	**0.594**	**0.603**	**1.38** ***	**1.46** ***	**22.35**	**21.46**	**19.38**	**-1.72**	**-5.29** ***
Major General Procedures	0.043	0.042	0.038	0.91	0.75	37.69	30.62	33.01	-10.12 **	-8.98
Major Cardiovascular Procedures	0.029	0.035	0.031	1.05	0.85	60.68	48.60	30.55	-5.48	-4.88
Major Orthopedic Procedures	0.018	0.019	0.016	0.73 *	0.38 ***	56.64	48.03	36.74	0.96	-11.73
Cataract Removal	0.030	0.052	0.061	1.87 ***	2.37 ***	53.91	50.15	43.94	-4.42	-14.45 ***
Other Major Eye Procedures	0.032	0.052	0.058	1.55 ***	1.64 ***	28.16	24.30	23.42	-5.15	-5.88
Minor Skin Procedures	0.186	0.238	0.304	1.31 ***	1.84 ***	5.00	5.42	5.84	0.56	1.09 *
Other Minor Procedures	0.348	0.389	0.362	1.17 ***	1.10	5.58	5.15	4.76	-0.70 *	-1.48 **
Endoscopy	0.128	0.139	0.115	1.09	0.90	9.73	10.04	9.87	-0.53	-1.67
Imaging Services	**0.562**	**0.638**	**0.603**	**1.28** ***	**1.09**	**9.24**	**8.42**	**6.09**	**-1.55** ***	**-3.86** ***
Standard Breast Imaging	0.318	0.197	0.082	0.56 ***	0.26 ***	1.68	1.62	1.56	0.00	-0.06
Other Standard Imaging	0.467	0.566	0.547	1.38 ***	1.21 **	3.10	3.09	2.52	-0.14	-0.89 ***
Advanced Imaging	0.099	0.137	0.130	1.24 ***	1.02	9.53	7.40	5.40	-2.07 ***	-4.12 ***
Sonograms	0.177	0.221	0.225	1.21 ***	1.21 **	4.78	5.10	4.77	0.23	0.06
Cardiac Catheterization	0.023	0.018	0.005	0.71 *	0.25 ***	61.56	58.42	57.20	-4.42	-13.99
Other Imaging Procedures	0.019	0.017	0.011	0.85	0.58	14.50	13.14	11.39	-3.57	-5.67
Testing Services	**0.638**	**0.718**	**0.689**	**1.40** ***	**1.25** ***	**5.33**	**5.37**	**5.24**	**-0.05**	**-0.33**
Laboratory testing	0.607	0.683	0.648	1.36 ***	1.21 **	4.18	4.20	4.16	-0.05	-0.35
Physician testing	0.190	0.234	0.210	1.24 ***	1.10	4.56	4.24	4.35	-0.21	0.11

Significance Levels:
*** p< .01; ** p< .05; * p< .1

Older beneficiaries are much less likely to receive standard breast imaging and costly cardiac catheterization, but somewhat more likely to receive other standard imaging and sonograms than younger beneficiaries. Among those receiving imaging services, the resources used in standard and advanced imaging are significantly less for the oldest beneficiaries. Finally, lab tests and non-cardiac tests by physicians are more common among the older beneficiaries, but there are no significant volume differences among beneficiaries receiving any testing services.

Other Results

Full results from these models are presented in Appendix tables III-A1-III-A10. In general the models perform as expected with regard to control variables including health status, chronic conditions and activity limitations, insurance coverage, usual source of care and physician supply. The coefficients on assignment rates, which measure the extent of cost-sharing are only sometimes significant, and most often of the expected sign.

While not an area of documented concern, gender appears to be a significant determinant of utilization among Medicare beneficiaries. Women have significantly higher probabilities of receiving all categories of services, except for procedures where there is a marginally significant negative effect. However, among beneficiaries who use services, women receive a significantly lower volume of services for all classes of service. These differences are fairly consistent across specific types of services. To some extent, differences by gender may be related to differences in health care needs. However, to the extent that self-reports of a wide variety of health measures captures differences in needs, our analysis indicates that elderly women may not fare well in access to physician services. An alternative explanation, beyond the scope of the current analysis is that a higher fraction of men than women in the population over 65 is in its last year of life. As others have demonstrated (Lubitz and Riley, 1993; Experton, et al., 1996) expenditures on health services increase dramatically in the

last year of life. This could potentially explain why women use fewer resources than men, but such a conclusion requires more research.

Some understanding of gender differences in volume can be found in a comparison the types of services used by men and women. Men are more likely than women to receive several high-cost services, including E&M services in hospital/critical care facilities and emergency rooms, major cardiovascular procedures, advanced imaging services and cardiac catheterization.

6. DISCUSSION

What do these results on utilization suggest about Medicare beneficiaries' access to care? According to Andersen and Aday (1978), access is equitable if dimensions of concern are not significantly related to utilization, controlling for other factors. By this criterion, if we look only at the likelihood of any service use, access to Medicare services is equitable across place of residence (urban versus rural) and living arrangements. Thus, only two of the five original groups of particular concern to the Medicare program do not appear to face access barriers. Racial minorities and the poor still appear to face barriers to access relative to whites and the economically secure. The very old, on the other hand appear to have even greater access to care than other Medicare beneficiaries.

When we focus on the type and volume of resources used the picture is more complicated. In particular, rural beneficiaries and those with low levels of education appear to have less access to costly high technology services. The very old tend to have higher probabilities of using evaluation and management services, but seem to use them less intensively than younger beneficiaries. They also seem to use fewer resources on expensive diagnostic imaging and procedures. These differences may reflect resource allocation decisions made by physicians or patients in choices about the use of high technology services. Those who live alone consistently use a wide variety of health care resources more frequently and more intensively than those who live with spouses, family or others.

While not a large effect in terms of magnitude, those who live alone have a significantly higher volume of office visit utilization than those who live with spouses, a finding consistent with the notion that patient choices over the use of time influence utilization patterns. The poor may have less access to specialists, consultations, testing and some minor procedures. While some of these differences might reflect differences in the use of elective services, they might also reflect price barriers to services in general. Black beneficiaries are more likely to use some services and less likely to use others. Perhaps underlying the findings of Gornick et al. (1996), Blacks are notably less likely to use primary care services which might prevent the onset of severe health problems requiring drastic measures. Perhaps as a result of distance from providers, rural beneficiaries receive significantly fewer diagnostic services than urban beneficiaries.

An issue that is not addressed by this study is the effect of differential utilization on health outcomes. Kahn, et al. (1994) address this issue for hospital care and find that while, conditional on type of hospital, black and poor beneficiaries receive lower quality care, there are no differences in death rates by race and income. One explanation offered is that low income and black beneficiaries are more likely than high income and white beneficiaries to receive care in higher quality, urban teaching hospitals which may offset the effects of receiving less effective care. The MCBS data seem especially well suited to future work on outcomes of differential use of physician services, since beneficiaries are followed for several years.

One concern addressed by these models, though perhaps not fully resolved, is the extent to which we can control for health needs in studies of access to medical services. While we have included a large number and a variety of types of health measures, we may still not accurately capture the extent to which services are allocated on the basis of need. For example, women are much less likely to receive services related to cardiovascular diseases (e.g., cardiac catheterization and coronary

artery bypass surgery), even after controlling for the presence of a chronic cardiovascular condition. While this may be the result of services being denied to women, it is perhaps more plausibly a result of a less severe cardiovascular condition. To the extent that we do not fully control for poor health, our estimates of utilization differentials for some groups may be biased. For example, if conditional on identical responses to the self-reported health questions black beneficiaries are less healthy than whites, then the coefficient on the race variable will be biased upward and blacks may face even higher barriers to access than we estimate.

However, while we lack detailed medical records which, for our purposes, may be a better indicator of health status than self-reports, and hence better control for the need for services, our results do suggest that there are still barriers to access faced by racial minorities and those with low socioeconomic status. Additionally, differences in the patterns of utilization by gender also point to the possibility that men receive more attention by physicians than women.

A related issue of concern is the timing of survey responses and measured utilization. The survey data are collected in December of 1991, and the utilization data are collected for the calendar year 1991. One problem is that the data may under-represent service utilization by the sickest members of the population. The weighted sample is representative of the beneficiary population alive at the end of the year, and we are able to use a full year's worth of services, but the services provided to the population in 1991 also included services to beneficiaries who died before the interviews were conducted. Alternatively, if we had used utilization data for 1992, we could capture more utilization up to the time of death for some portion of the population, but we would not have a full year's worth of data for this same population. The results most likely to be sensitive to the timing of data collection are those related to mortality risk. For example, our coefficient estimates on age may be biased downward since death rates increase quite rapidly with age late in life. Other variables that

may be susceptible to the same bias include morbidity and other self-reported health measures. On the other hand, the estimated coefficients on the health variables may also be affected by timing because respondents may know more about their health as a result of using physician services during the preceding year. In other words, the causal ordering of self-reported health and health service use may be opposite to that implied by the structure of the estimating equations. This would tend to bias the coefficients on these variables upward. The net effect of these two forces may be either an underestimate or an overestimate of the true relationship between health needs and utilization.

The value added by linking detailed survey information to detailed utilization measures is a more complete picture of access differentials than has been observed before. Our results suggest past research which has relied on a few self-reported measures of health services utilization may have missed interesting patterns of access to care. On the other hand, studies which have examined the utilization of specific procedures may have suffered from the omission of large amounts of demographic and socioeconomic information. For certain rare procedures, like CABG and PTCA, a much larger sample than is available in this survey seems necessary to make conclusions about access differentials, and since such large surveys would be quite costly, we may have to rely on studies that do not control for a large number of other factors to make those conclusions. However, for more common procedures and other services, which account for most resources used in treating the Medicare population, these data provide a valuable resource in studying access.

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APPENDIX

Appendix Table III-A1: Probability of Resource Utilization

	Total Utilization	Evaluation and Management	Procedures	Imaging	Testing
[illegible]	[illegible] ***	[illegible] ***	[illegible] **	[illegible] ***	[illegible] ***
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Black	[illegible] ***	[illegible] ***	[illegible] ***	[illegible] *	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Race	[illegible]	[illegible] *	[illegible] ***	[illegible]	[illegible] *
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hispanic	[illegible]	[illegible]	-0.06	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rural Resident	[illegible]	[illegible]	-0.07	[illegible] **	[illegible] *
	[illegible]	[illegible]	(0.06)	[illegible]	(0.06)
Lives Alone	[illegible]	[illegible]	0.05	[illegible]	0.02
	[illegible]	[illegible]	(0.05)	[illegible]	[illegible]
Other Living Arrangement	-0.23	-0.21	-0.15	-0.22 *	-0.15
	[illegible]	(0.29)	(0.13)	[illegible]	[illegible]
Age 75-84	0.65 ***	0.60 ***	0.32 ***	0.25 ***	0.34 ***
	[illegible]	(0.08)	(0.05)	(0.05)	(0.06)
Age > 84	0.88 ***	0.86 ***	0.38 ***	0.09	0.22 ***
	(0.15)	(0.14)	(0.08)	(0.08)	(0.08)
Less than High School	0.11	0.08	-0.07	-0.14 **	-0.01
	(0.10)	(0.09)	(0.06)	(0.06)	(0.06)
More than High School	0.06	-0.02	0.08	-0.04	-0.03
	(0.11)	(0.10)	(0.07)	(0.07)	(0.07)
Income $5,000-$15,000	0.09	0.07	-0.14 **	-0.05	-0.07
	(0.11)	(0.11)	(0.07)	(0.07)	(0.07)
Income $15,000 - $25,000	0.21	0.18	-0.03	0.01	0.13
	(0.13)	(0.13)	(0.08)	(0.08)	(0.09)
Income > $25,000	0.32 **	0.24 *	0.17 **	0.17 **	0.29 ***
	(0.14)	(0.13)	(0.09)	(0.09)	(0.09)
Has Supplemental Insurance	1.08 ***	1.02 ***	0.80 ***	0.68 ***	0.73 ***
	(0.10)	(0.10)	(0.08)	(0.08)	(0.08)
Has Usual Source of Care	1.50 ***	1.44 ***	0.74 ***	0.88 ***	1.12 ***
	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)
Physician Supply	0.24	0.23	0.79 ***	0.93 ***	0.85 ***
	(0.44)	(0.41)	(0.27)	(0.27)	(0.27)
Hospital Bed Supply	-0.02	-0.03	0.06	-0.06	-0.22
	(0.22)	(0.20)	(0.13)	(0.13)	(0.14)
Assignment Rate	0.30	0.41	-0.40 **	-0.07	-0.05
	(0.32)	(0.30)	(0.18)	(0.16)	(0.04)
Self Rated Health Status	-0.11 **	-0.09 **	-0.17 ***	-0.22 ***	-0.18 ***
	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)
ADL Limitation	-0.10	-0.05	-0.01	0.04	-0.01
	(0.08)	(0.07)	(0.04)	(0.04)	(0.04)
IADL Limitation	0.08 *	0.09 **	0.04 *	0.02	0.04
	(0.05)	(0.04)	(0.02)	(0.02)	(0.03)
Cardiovascular Disease	0.54 ***	0.58 ***	0.12 **	0.21 ***	0.50 ***
	(0.08)	(0.08)	(0.05)	(0.05)	(0.05)
Stroke	0.11	0.08	-0.04	0.21 **	0.11
	(0.18)	(0.16)	(0.09)	(0.09)	(0.10)
Cancer	0.36 ***	0.32 ***	0.48 ***	0.37 ***	0.42 ***
	(0.10)	(0.09)	(0.05)	(0.05)	(0.06)
Diabetes	0.99 ***	0.90 ***	0.35 ***	0.20 ***	0.83 ***
	(0.16)	(0.14)	(0.07)	(0.07)	(0.09)
Rheumatoid Arthritis	0.30 *	0.31 **	0.17 **	0.18 **	0.08
	(0.16)	(0.15)	(0.08)	(0.08)	(0.09)
Osteoarthritis	0.33 ***	0.34 ***	0.27 ***	0.27 ***	0.25 ***
	(0.08)	(0.08)	(0.05)	(0.05)	(0.05)
Mental Retardation	-0.52	-0.33	-0.48	-0.02	-0.24
	(0.67)	(0.66)	(0.41)	(0.43)	(0.45)
Alzheimers Disease	-0.10	-0.20	-0.25	-0.52 **	-0.13
	(0.38)	(0.35)	(0.20)	(0.20)	(0.22)
Psychiatric Condition	0.39	0.40	0.26	-0.11	-0.17
	(0.31)	(0.29)	(0.17)	(0.16)	(0.17)
Osteoporosis	0.34	0.24	0.45 ***	0.37 ***	0.12
	(0.22)	(0.19)	(0.10)	(0.11)	(0.11)
Broken Hip	0.29	0.21	0.21 *	0.33 ***	0.11
	(0.25)	(0.23)	(0.12)	(0.13)	(0.13)
Parkinson's Disease	0.45	0.31	-0.08	-0.17	-0.34 *
	(0.44)	(0.38)	(0.20)	(0.20)	(0.21)
Respiratory Disease	0.33 **	0.37 ***	0.18 **	0.27 ***	0.22 ***
	(0.14)	(0.13)	(0.07)	(0.08)	(0.08)
Paralysis	0.08	-0.02	0.02	0.00	0.02
	(0.21)	(0.19)	(0.11)	(0.12)	(0.13)

Significance Levels
*** p<.01 ** p<.05 * p<.1

Appendix Table III-X2: Volume of Resource Utilization

Variable	Total Utilization	Evaluation and Management	Procedures	Imaging	Testing
	-2.54 ***	-2.37 ***	-0.41 ***	-0.40 ***	-0.47 **
	(.42	(0.47	(.11	(0.56	(0.2
Black	-2.73	-1.37	-0.42	-0.23	-0.21
	(2.43	(0.85	(2.14	(0.36	(0.26
Other Race	-2.13	-2.51	-0.62	-0.91 **	-0.35 *
	(2.43	(1.91	(0.21	(0.36	(0.16
Hispanic	-0.88 **	-2.40 **	-2.84	-1.07	-0.12 ***
	(.72	(1.24	(2.85	(1.45	(0.51
Rural Resident	-0.68 ***	-2.61 ***	-0.75 ***	-0.95 ***	-0.38 ***
	(.65	(0.56	(1.44	(0.65	(0.24
Lives Alone	-5.37 ***	-2.63 ***	-1.34	-1.63 ***	-0.42 **
	(1.43	(0.49	(1.28	(0.57	(0.21
Other Living Arrangement	-1.74	-1.23	-3.87	-0.51	-0.05
	(3.46	(1.15	(3.12	(1.36	(0.51
Age 75-84	-0.03	0.66	-1.72	-1.53 ***	-0.08
	(1.42	(0.47	(1.23	(0.55	(0.20
Age 85	-5.88 ***	-0.76	-5.29 ***	-3.86 ***	-0.33
	(2.09	(0.70	(1.79	(0.83	(0.31
Less than High School	-3.38 **	-0.56	-2.45 *	-0.33	-0.11
	(1.57	(0.52	(1.36	(0.60	(0.23
More than High School	-0.32	0.26	-1.05	-0.25	0.18
	(1.79	(0.60	(1.51	(0.68	(0.26
Income $5,000-$15,000	-1.81	-0.56	0.45	-0.88	-0.52 *
	(1.89	(0.63	(1.66	(0.75	(0.28
Income $15,000 - $25,000	0.66	-0.48	1.08	0.09	-0.25
	(2.22	(0.74	(1.92	(0.85	(0.32
Income > $25,000	3.22	1.05	1.12	0.36	0.30
	(2.30	(0.77	(1.95	(0.88	(0.33
Has Supplemental Insurance	9.74 ***	2.63 ***	2.75	2.94 ***	0.39
	(2.19	(0.73	(2.14	(0.92	(0.34
Has Usual Source of Care	2.91	1.52	-1.73	-0.44	0.67
	(2.74	(0.93	(2.56	(1.16	(0.45
Physician Supply	11.64	5.70 **	-5.80	-0.42	2.68 **
	(7.50	(2.43	(6.25	(2.76	(1.05
Hospital Bed Supply	-0.07	-0.47	-0.34	1.39	0.02
	(3.64	(1.21	(3.17	(1.41	(0.53
Assignment Rate	12.34 **	7.98 ***	6.16	-0.66	-0.14
	(5.30	(1.76	(4.20	(1.60	(0.14
Self Rated Health Status	-8.31 ***	-3.25 ***	-3.02 ***	-1.97 ***	-0.74 ***
	(0.78	(0.26	(0.69	(0.30	(0.11
ADL Limitation	4.14 ***	3.02 ***	1.02	-0.07	0.19
	(1.02	(0.34	(0.86	(0.37	(0.15
IADL Limitation	2.97 ***	1.30 ***	1.56 ***	0.46 **	0.16 *
	(0.61	(0.20	(0.52	(0.23	(0.09
Cardiovascular Disease	4.49 ***	1.37 ***	0.99	2.38 ***	0.63 ***
	(1.42	(0.47	(1.24	(0.56	(0.21
Stroke	1.89	1.49 *	-1.36	1.82 **	0.12
	(2.37	(0.79	(2.01	(0.87	(0.33
Cancer	11.12 ***	3.12 ***	4.71 ***	1.71 ***	0.70 ***
	(1.39	(0.46	(1.16	(0.52	(0.20
Diabetes	9.54 ***	3.54 ***	4.44 ***	0.76	0.96 ***
	(1.79	(0.60	(1.51	(0.68	(0.25
Rheumatoid Arthritis	3.50 *	0.04	3.96 **	-0.17	0.29
	(2.09	(0.70	(1.76	(0.79	(0.30
Osteoarthritis	3.69 ***	0.73 *	1.75	0.32	0.21
	(1.30	(0.43	(1.13	(0.50	(0.19
Mental Retardation	-3.13	-0.07	-3.26	2.46	-1.51
	(11.39	(3.77	(10.30	(4.31	(1.67
Alzheimers Disease	-18.13 ***	-7.46 ***	-9.11 ***	-0.96	-1.27
	(5.38	(1.79	(4.74	(2.16	(0.78
Psychiatric Condition	0.62	3.16 **	-5.18	-0.24	1.62 **
	(4.24	(1.41	(3.52	(1.65	(0.63
Osteoporosis	4.12 *	2.73 ***	-0.07	-1.28	0.13
	(2.42	(0.81	(1.94	(0.87	(0.34
Broken Hip	6.48 **	2.50 **	5.21 **	-1.02	-0.04
	(3.02	(1.00	(2.49	(1.09	(0.43
Parkinson s Disease	-1.15	1.38	-7.29 *	2.47	1.84 **
	(5.06	(1.69	(4.29	(1.97	(0.76
Respiratory Disease	0.05	2.20 ***	-4.40 ***	-0.53	-0.11
	(1.93	(0.64	(1.62	(0.72	(0.27
Paralysis	0.76	0.05	0.32	0.19	0.45
	(2.97	(0.99	(2.49	(1.10	(0.42

Significance Levels
*** p< 01; ** p< 05; * p< 1

Appendix Table III-A3: Probability of Utilization, Evaluation and Management Services

	Office Visits	Hospital & Critical Care Visits	Emergency Room Visits	Consultations	Opthalmologic Specialist Visits	Other Specialist Visits
[illegible]	[illegible] ***	[illegible] ***	[illegible] **	[illegible] ***	[illegible] ***	[illegible] ***
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Black	[illegible] ***	[illegible]	[illegible] ***	[illegible]	[illegible] ***	[illegible] ***
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Race	[illegible] *	[illegible]	[illegible]	-0.22	[illegible] *	[illegible]
	[illegible]	(0.22)	[illegible]	[illegible]	[illegible]	(0.22)
Hispanic	[illegible]	-0.23	-0.14	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rural Resident	[illegible]	0.06	0.12	-0.31 ***	[illegible]	-0.15 **
	(0.08)	[illegible]	(0.07)	(0.08)	[illegible]	(0.07)
Lives Alone	0.01	0.21 ***	0.15 **	0.18 ***	0.11 *	0.08
	(0.08)	(0.07)	(0.07)	(0.07)	(0.05)	(0.07)
Other Living Arrangement	-0.34 **	0.04	-0.12	0.06	-0.02	-0.17
	[illegible]	[illegible]	(0.15)	(0.15)	[illegible]	(0.17)
Age 75-84	0.49 ***	0.38 ***	0.28 ***	0.20 ***	0.52 ***	0.08
	(0.07)	(0.07)	(0.07)	(0.07)	(0.05)	(0.06)
Age > 84	0.58 ***	0.54 ***	0.40 ***	0.18 *	0.61 ***	-0.14
	(0.11)	(0.10)	(0.09)	(0.09)	(0.08)	(0.10)
Less than High School	0.05	-0.05	0.07	-0.17 **	-0.05	-0.01
	(0.08)	(0.08)	(0.07)	(0.07)	(0.06)	(0.07)
More than High School	-0.06	-0.05	-0.10	-0.05	0.15 **	0.08
	(0.09)	(0.09)	(0.09)	(0.08)	(0.07)	(0.08)
Income $5 000-$15 000	0.00	0.07	-0.02	-0.02	0.03	-0.21 **
	(0.10)	(0.09)	(0.08)	(0.09)	(0.07)	(0.09)
Income $15 000 - $25 000	0.09	0.07	-0.05	0.05	0.13	-0.05
	(0.11)	(0.11)	(0.10)	(0.10)	(0.08)	(0.10)
Income > $25 000	0.17	0.14	-0.11	0.07	0.19 **	0.19 *
	(0.12)	(0.11)	(0.11)	(0.11)	(0.09)	[illegible]
Has Supplemental Insurance	0.98 ***	0.46 ***	0.27 ***	0.54 ***	0.59 ***	0.51 ***
	(0.09)	(0.11)	(0.09)	(0.11)	(0.08)	(0.11)
Has Usual Source of Care	1.48 ***	0.43 ***	0.26 **	0.52 ***	0.49 ***	0.49 ***
	(0.09)	(0.14)	(0.12)	(0.13)	(0.09)	(0.13)
Physician Supply	-0.02	0.32	0.29	1.05 ***	0.46 *	0.67 **
	(0.37)	(0.35)	(0.33)	(0.32)	(0.27)	(0.32)
Hospital Bed Supply	0.07	0.06	0.02	-0.31 *	0.03	-0.02
	(0.18)	(0.17)	(0.16)	(0.17)	(0.13)	(0.16)
Assignment Rate	-0.01	0.51 *	0.64 **	0.39 *	0.24	0.40 *
	(0.22)	(0.26)	(0.33)	(0.22)	(0.19)	(0.23)
Self Rated Health Status	-0.10 ***	-0.36 ***	-0.25 ***	-0.26 ***	-0.04	-0.13 ***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
ADL Limitation	-0.18 ***	0.20 ***	0.09 **	0.13 ***	-0.17 ***	0.03
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
IADL Limitation	0.04	0.14 ***	0.14 ***	0.11 ***	-0.02	0.04
	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
Cardiovascular Disease	0.67 ***	0.29 ***	0.22 ***	0.19 ***	0.05	0.00
	(0.07)	(0.07)	(0.07)	(0.07)	(0.05)	(0.06)
Stroke	0.01	0.24 **	0.26 ***	0.24 **	0.12	-0.10
	(0.14)	(0.10)	(0.10)	(0.10)	(0.09)	(0.11)
Cancer	0.41 ***	0.23 ***	-0.01	0.27 ***	0.04	0.76 ***
	(0.08)	(0.07)	(0.06)	(0.06)	(0.05)	(0.06)
Diabetes	0.77 ***	0.44 ***	0.29 ***	0.27 ***	0.37 ***	0.20 ***
	(0.12)	(0.08)	(0.08)	(0.08)	(0.07)	(0.08)
Rheumatoid Arthritis	0.33 ***	-0.17 *	-0.04	0.09	0.09	0.08
	(0.13)	(0.10)	(0.09)	(0.09)	(0.08)	(0.09)
Osteoarthritis	0.46 ***	0.06	-0.09	0.02	0.18 ***	0.13 **
	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)
Mental Retardation	-0.01	-0.83	0.36	-0.25	-0.17	-0.10
	(0.59)	(0.58)	(0.43)	(0.49)	(0.44)	(0.48)
Alzheimers Disease	-0.22	-0.54 **	0.05	-0.23	-0.48 **	-0.15
	(0.27)	(0.23)	(0.21)	(0.23)	(0.22)	(0.24)
Psychiatric Condition	0.07	-0.06	0.03	-0.15	0.04	0.64 ***
	(0.23)	(0.20)	(0.18)	(0.19)	(0.16)	(0.17)
Osteoporosis	0.08	0.04	0.12	0.18 *	0.31 ***	0.04
	(0.15)	(0.11)	(0.11)	(0.10)	(0.09)	(0.11)
Broken Hip	0.20	0.60 ***	0.54 ***	0.53 ***	-0.17	0.21
	(0.19)	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)
Parkinson's Disease	0.58 *	0.01	0.14	0.07	0.46 **	-0.21
	(0.35)	(0.22)	(0.21)	(0.21)	(0.19)	(0.23)
Respiratory Disease	0.33 ***	0.22 **	0.26 ***	0.17 **	0.07	0.06
	(0.11)	(0.09)	(0.08)	(0.08)	(0.07)	(0.08)
Paralysis	-0.03	0.06	0.02	0.00	0.05	0.19
	(0.16)	(0.13)	(0.12)	(0.13)	(0.11)	(0.13)

Significance Levels
*** p< .01 ** p< .05 * p< .1

Appendix Table III-A4. Volume of Utilization: Evaluation and Management Services

	Office Visits	Hospital & Critical Care Visits	Emergency Room Visits	Consultations	Opthalmologic Specialist Visits	Other Specialist Visits
Female	[illegible]	-2.55 **	-0.24	-1.41 ***	[illegible] *	[illegible] ***
	(0.17)	(1.02)	(0.12)	(0.37)	(0.12)	[illegible]
Black	[illegible]	-2.34 *	[illegible] ***	[illegible]	[illegible] ***	[illegible] *
	[illegible]	[illegible]	(0.28)	(0.63)	(0.24)	(0.70)
Other Race	[illegible]	[illegible]	[illegible] ***	2.91 **	[illegible]	-2.22 *
	[illegible]	[illegible]	(0.35)	(1.15)	(0.42)	(1.22)
Hispanic	[illegible] ***	[illegible]	[illegible]	1.24	0.54	3.32 ***
	(0.44)	[illegible]	(0.32)	(0.92)	(0.33)	(0.94)
Rural Resident	[illegible] ***	[illegible] ***	-0.27	-1.39 ***	-0.22	[illegible] **
	(0.20)	[illegible]	(0.22)	(0.45)	(0.14)	(0.39)
Lives Alone	[illegible] ***	2.48 **	0.12	0.67 *	-0.09	0.52
	(0.17)	(1.04)	(0.19)	(0.39)	(0.12)	(0.35)
Other Living Arrangement	[illegible]	2.33	-0.50	1.06	0.27	1.18
	(0.42)	(2.26)	(0.44)	(0.86)	(0.30)	(0.91)
Age 75-84	0.48 ***	-2.05 *	0.02	-0.92 **	0.08	-1.08 ***
	(0.17)	(1.05)	(0.19)	(0.37)	(0.12)	(0.33)
Age > 84	-0.10	-4.14 ***	0.38	-1.51 ***	0.19	-1.35 ***
	(0.25)	(1.38)	(0.26)	(0.51)	(0.17)	(0.50)
Less than High School	-0.29	0.26	0.09	0.35	0.09	-0.17
	(0.19)	(1.09)	(0.21)	(0.40)	(0.13)	(0.37)
More than High School	0.00	-0.59	-0.35	-0.36	0.52 ***	0.41
	(0.21)	(1.33)	(0.26)	(0.46)	(0.15)	(0.40)
Income $5,000-$15,000	-0.32	-1.04	0.13	-0.21	0.02	-0.61
	(0.22)	(1.29)	(0.24)	(0.49)	(0.16)	(0.46)
Income $15,000 - $25,000	0.02	-1.01	-0.04	-0.65	-0.33 *	-0.50
	(0.26)	(1.59)	(0.29)	(0.57)	(0.19)	(0.52)
Income > $25,000	0.27	3.27 *	0.04	0.63	-0.49 **	-0.59
	(0.27)	(1.69)	(0.32)	(0.59)	(0.19)	(0.51)
Has Supplemental Insurance	1.55 ***	-1.86	0.46 *	0.65	-0.11	-1.33 **
	(0.27)	(1.62)	(0.28)	(0.63)	(0.21)	(0.60)
Has Usual Source of Care	1.28 ***	-0.88	-0.07	0.56	-0.29	-0.83
	(0.35)	(2.24)	(0.37)	(0.80)	(0.24)	(0.70)
Physician Supply	2.09 **	4.55	2.19 **	1.57	-0.34	2.30
	(0.87)	(5.23)	(0.99)	(1.78)	(0.60)	(1.71)
Hospital Bed Supply	-1.09 **	1.43	-0.79	-0.66	-0.33	0.30
	(0.43)	(2.61)	(0.48)	(0.97)	(0.30)	(0.90)
Assignment Rate	3.71 ***	3.08	1.21	1.83	1.55 ***	-1.55
	(0.50)	(3.94)	(0.98)	(1.28)	(0.45)	(1.21)
Self Rated Health Status	-1.15 ***	-2.53 ***	-0.56 ***	-0.63 ***	-0.03	-0.32 *
	(0.09)	(0.53)	(0.10)	(0.19)	(0.07)	(0.18)
ADL Limitation	-0.33 ***	2.21 ***	0.28 ***	0.50 **	-0.02	0.55 **
	(0.12)	(0.49)	(0.10)	(0.20)	(0.10)	(0.23)
IADL Limitation	0.26 ***	0.85 **	0.11	0.48 ***	0.00	0.35 **
	(0.07)	(0.34)	(0.07)	(0.14)	(0.05)	(0.14)
Cardiovascular Disease	0.62 ***	0.40	0.54 ***	0.26	0.14	0.06
	(0.17)	(1.09)	(0.20)	(0.38)	(0.12)	(0.33)
Stroke	0.04	2.02	0.65 **	-0.23	-0.02	-1.20 **
	(0.28)	(1.37)	(0.26)	(0.52)	(0.19)	(0.53)
Cancer	1.20 ***	1.73 *	0.18	0.83 **	-0.08	0.44
	(0.16)	(0.94)	(0.19)	(0.34)	(0.12)	(0.30)
Diabetes	1.58 ***	0.41	0.55 **	0.56	0.46 ***	-0.53
	(0.21)	(1.09)	(0.22)	(0.42)	(0.15)	(0.40)
Rheumatoid Arthritis	0.73 ***	0.24	-0.02	-0.56	0.52 ***	-0.37
	(0.25)	(1.42)	(0.26)	(0.51)	(0.17)	(0.49)
Osteoarthritis	0.94 ***	-1.27	-0.23	0.24	0.16	-0.14
	(0.15)	(0.91)	(0.17)	(0.34)	(0.11)	(0.30)
Mental Retardation	-0.78	8.52	-2.16 *	12.53 ***	-0.99	-3.71
	(1.34)	(8.63)	(1.11)	(2.73)	(1.07)	(2.56)
Alzheimers Disease	-2.00 ***	-4.74	-0.37	-2.57 **	0.22	-0.39
	(0.65)	(3.15)	(0.54)	(1.17)	(0.56)	(1.24)
Psychiatric Condition	-0.30	0.71	0.25	3.20 ***	0.34	6.90 ***
	(0.51)	(2.77)	(0.51)	(1.06)	(0.37)	(0.79)
Osteoporosis	0.59 **	3.67 **	-0.54 *	0.75	0.11	0.01
	(0.28)	(1.55)	(0.29)	(0.55)	(0.19)	(0.55)
Broken Hip	-0.23	1.79	0.08	-0.14	0.20	-0.64
	(0.36)	(1.61)	(0.31)	(0.62)	(0.26)	(0.67)
Parkinson's Disease	1.40 **	-1.67	-0.24	0.45	-0.16	0.86
	(0.59)	(2.92)	(0.56)	(1.10)	(0.40)	(1.20)
Respiratory Disease	0.85 ***	-0.36	0.72 ***	0.02	-0.14	1.24 ***
	(0.23)	(1.22)	(0.23)	(0.46)	(0.16)	(0.43)
Paralysis	-0.19	-1.94	-0.30	0.11	-0.25	1.09 *
	(0.35)	(1.70)	(0.33)	(0.66)	(0.25)	(0.63)

Significance Levels
*** p<.01, ** p<.05, * p<.1

Appendix Table III-A5: Probability of Utilization, Procedures

	Major General Procedure	Major Cardiovascular Procedure	Major Orthopedic Procedure	Cataract Removal	Other Major Eye Procedure
Constant	[illegible] ***	[illegible] ***	[illegible]	[illegible] **	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Black	-0.05	[illegible]	[illegible] *	-0.24	-0.28
	[illegible]	[illegible]	[illegible]	(0.22)	(0.22)
Other Race	[illegible]	[illegible]	[illegible]	[illegible] **	-0.16
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hispanic	[illegible]	[illegible]	[illegible]	0.17	0.40
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rural Resident	0.19	-0.23	0.32	-0.07	0.13
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lives Alone	0.33 **	0.31 **	[illegible]	-0.13	0.08
	[illegible]	[illegible]	(0.20)	[illegible]	[illegible]
Other Living Arrangement	0.14	0.42	0.26	-0.24	0.18
	[illegible]	(0.31)	(0.40)	(0.31)	(0.27)
Age 75-84	-0.10	0.05	-0.32 *	0.63 ***	0.44 ***
	(0.12)	(0.14)	(0.17)	(0.13)	(0.13)
Age > 84	-0.29	-0.16	-0.97 ***	0.86 ***	0.49 ***
	(0.17)	(0.22)	(0.31)	(0.17)	(0.17)
Less than High School	-0.08	-0.12	-0.38 *	0.12	0.25 *
	(0.14)	(0.16)	(0.20)	(0.14)	(0.14)
More than High School	0.06	-0.12	-0.34	0.10	0.32 **
	(0.15)	(0.19)	(0.23)	(0.16)	(0.16)
Income $5,000-$15,000	-0.11	-0.24	0.13	-0.09	0.08
	(0.17)	(0.19)	(0.24)	(0.15)	(0.16)
Income $15,000 - $25,000	0.09	-0.08	-0.34	-0.03	0.03
	(0.20)	(0.22)	(0.31)	(0.19)	(0.19)
Income > $25,000	0.09	-0.12	-0.06	0.06	0.01
	(0.20)	(0.23)	(0.31)	(0.19)	(0.20)
Has Supplemental Insurance	0.53 **	0.60 **	0.56	0.63 ***	0.56 ***
	(0.22)	(0.25)	(0.36)	(0.22)	(0.21)
Has Usual Source of Care	0.30	0.67 *	0.03	0.19	-0.11
	(0.25)	(0.37)	(0.35)	(0.23)	(0.22)
Physician Supply	0.22	0.58	-0.03	-0.12	-0.30
	(0.64)	(0.73)	(1.00)	(0.62)	(0.64)
Hospital Bed Supply	-0.15	0.02	0.09	0.19	-0.28
	(0.33)	(0.37)	(0.47)	(0.30)	(0.32)
Assignment Rate	0.41	-0.65	0.54	0.38	1.51 ***
	(0.41)	(0.49)	(0.55)	(0.36)	(0.57)
Self Rated Health Status	-0.19 ***	-0.48 ***	0.08	-0.12 *	-0.07
	(0.07)	(0.08)	(0.10)	(0.07)	(0.07)
ADL Limitation	0.15 **	0.12	0.20 *	-0.04	-0.14 *
	(0.07)	(0.08)	(0.10)	(0.08)	(0.09)
IADL Limitation	0.09 *	0.07	0.15 **	-0.06	0.06
	(0.05)	(0.05)	(0.07)	(0.05)	(0.05)
Cardiovascular Disease	0.04	0.74 ***	-0.23	0.02	0.24 *
	(0.13)	(0.18)	(0.19)	(0.12)	(0.13)
Stroke	-0.09	0.48 **	-0.67 **	0.16	0.00
	(0.20)	(0.19)	(0.33)	(0.19)	(0.20)
Cancer	0.67 ***	0.37 ***	0.05	-0.09	0.07
	(0.11)	(0.13)	(0.18)	(0.12)	(0.12)
Diabetes	0.43 ***	0.20	0.04	0.28 *	0.43 ***
	(0.14)	(0.16)	(0.24)	(0.14)	(0.14)
Rheumatoid Arthritis	0.20	-0.09	0.54 **	0.30 *	0.26
	(0.17)	(0.21)	(0.23)	(0.16)	(0.16)
Osteoarthritis	0.06	0.05	1.06 ***	0.11	0.23 **
	(0.11)	(0.13)	(0.19)	(0.11)	(0.11)
Mental Retardation	-0.32	a	-0.39	-0.18	-0.35
	(1.04)		(1.11)	(1.04)	(1.04)
Alzheimers Disease	-1.47 **	-1.43 *	-0.10	-0.40	-0.34
	(0.73)	(0.74)	(0.58)	(0.53)	(0.53)
Psychiatric Condition	0.29	-0.11	0.58	0.07	-0.35
	(0.31)	(0.40)	(0.40)	(0.37)	(0.42)
Osteoporosis	0.08	-0.21	0.39	0.10	0.32 *
	(0.21)	(0.25)	(0.24)	(0.19)	(0.18)
Broken Hip	0.15	0.27	1.98 ***	-0.29	0.14
	(0.25)	(0.27)	(0.21)	(0.27)	(0.23)
Parkinson's Disease	0.20	-0.26	-0.97	-0.43	-0.24
	(0.37)	(0.48)	(0.75)	(0.52)	(0.47)
Respiratory Disease	-0.18	-0.43 **	-0.01	0.15	0.10
	(0.17)	(0.20)	(0.24)	(0.16)	(0.16)
Paralysis	-0.25	-0.31	-0.10	0.15	-0.21
	(0.25)	(0.26)	(0.37)	(0.24)	(0.26)

Significance Levels
*** p<.01 ** p<.05 * p<.1

Notes
a Variable dropped due to perfect prediction

Appendix Table III-A5 (cont.)

	Minor Skin Procedure	Other Minor and Ambulatory Procedure	Endoscopy
[illegible]	-0.25	-0.04 ***	-0.52 ***
	(.)	(.)	(.)
Male	-0.26 **	-0.32 ***	-0.13
	(.)	(.)	(.)
Other Race	-0.16 **	-0.17 ***	-0.18
	(.)	(.)	(.)
Hispanic	-0.12	-0.08	-0.22
	(.)	(.)	(.)
Rural Resident	-0.07 **	-0.06	-0.15 *
	(.)	(.)	(.)
HMO	-0.08 ***	-0.03	-0.06
	(.)	(.)	(.)
Lives Alone	-0.02	-0.03	-0.06
	(.)	(.)	(.)
Other Living Arrangement	-0.02	-0.22 *	-0.26
	(.)	(.)	(.)
Age 75-84	0.25 ***	0.16 ***	0.09
	(0.06)	(0.05)	(0.07)
Age 84	0.61 ***	0.10	-0.10
	(0.09)	(0.08)	(0.12)
Less than High School	-0.11	-0.08	-0.10
	(0.07)	(0.06)	(0.08)
More than High School	0.21 ***	0.04	-0.01
	(0.06)	(0.05)	(0.09)
Income $5,000-$15,000	-0.12	-0.11	-0.15
	(0.09)	(0.07)	(0.10)
Income $15,000 - $25,000	-0.04	0.00	-0.03
	(0.10)	(0.08)	(0.12)
Income > $25,000	0.17 *	0.10	0.22 *
	(0.10)	(0.09)	(0.12)
Has Supplemental Insurance	0.68 ***	0.70 ***	0.59 ***
	(0.11)	(0.09)	(0.12)
Has Usual Source of Care	0.56 ***	0.77 ***	0.75 ***
	(0.12)	(0.11)	(0.17)
Physician Supply	1.01 ***	0.66 **	0.57
	(0.31)	(0.27)	(0.37)
Hospital Bed Supply	-0.06	0.17	0.12
	(0.16)	(0.14)	(0.19)
Assignment Rate	0.57 **	0.86 ***	0.25
	(0.22)	(0.19)	(0.25)
Self Rated Health Status	-0.04	-0.19 ***	-0.25 ***
	(0.02)	(0.03)	(0.04)
ADL Limitation	0.06	-0.05	0.10 **
	(0.04)	(0.04)	(0.05)
IADL Limitation	0.04	0.03	0.02
	(0.03)	(0.02)	(0.02)
Cardiovascular Disease	0.01	0.14 ***	0.08
	(0.06)	(0.05)	(0.08)
Stroke	0.10	-0.06	-0.28 **
	(0.10)	(0.09)	(0.13)
Cancer	0.84 ***	0.21 ***	0.47 ***
	(0.06)	(0.05)	(0.07)
Diabetes	0.41 ***	0.17 **	0.00
	(0.06)	(0.07)	(0.09)
Rheumatoid Arthritis	0.13	0.32 ***	-0.02
	(0.09)	(0.08)	(0.11)
Osteoarthritis	0.12 **	0.28 ***	0.20 ***
	(0.06)	(0.05)	(0.07)
Mental Retardation	-0.70	-0.15	-0.56
	(0.57)	(0.42)	(0.73)
Alzheimers Disease	-0.09	-0.34	-0.64 *
	(0.22)	(0.21)	(0.33)
Psychiatric Condition	0.30 *	0.11	-0.18
	(0.17)	(0.16)	(0.22)
Osteoporosis	0.13	0.34 ***	0.34 ***
	(0.10)	(0.09)	(0.12)
Broken Hip	0.04	0.12	-0.14
	(0.13)	(0.11)	(0.17)
Parkinson's Disease	0.32	-0.07	-0.34
	(0.21)	(0.19)	(0.28)
Respiratory Disease	-0.01	0.24 ***	0.07
	(0.06)	(0.05)	(0.10)
Paralysis	0.10	0.02	0.03
	(0.12)	(0.11)	(0.15)

Significance Levels
*** p< .01, ** p< .05, * p< .1

Appendix Table III-A6. Volume of Utilization: Procedures

	Major General Procedure	Major Cardiovascular Procedure	Major Orthopedic Procedure	Cataract Removal	Other Major Eye Procedure
[illegible]	[illegible]	-21.65 **	-34.42 **	-8.54 **	[illegible]
	(4.46)	*(10.24)*	[illegible]	[illegible]	[illegible]
Black	-8.36	-5.28	[illegible]	[illegible]	-5.36
	(9.67)	*(8.45)*	*(4.62)*	[illegible]	*(6.09)*
Other Race	[illegible]	[illegible]	[illegible]	-3.84	[illegible]
	(16.75)	*(48.59)*	*(20.53)*	*(9.78)*	*(11.27)*
Hispanic	-6.17	31.53	[illegible]	22.02 **	4.54
	(13.68)	*(27.26)*	*(29.17)*	*(9.44)*	*(7.55)*
Rural Resident	-1.41	-22.60 *	7.26	-9.18 **	-4.15
	(5.66)	*(11.66)*	*(7.73)*	*(4.60)*	*(3.68)*
Lives Alone	-2.08	-0.35	10.73	0.95	2.47
	(4.66)	*(10.21)*	*(7.46)*	*(4.04)*	*(3.47)*
Other Living Arrangement	-6.91	16.00	-0.18	0.36	3.24
	(11.28)	*(21.01)*	*(13.87)*	*(10.06)*	*(7.36)*
Age 75-84	-10.12 **	-5.48	0.96	-4.42	-5.15
	(4.51)	*(9.60)*	*(6.84)*	*(4.13)*	*(3.48)*
Age > 84	-8.98	-4.88	-11.73	-14.45 ***	-5.88
	(7.08)	*(14.17)*	*(10.72)*	*(5.49)*	*(4.70)*
Less than High School	0.62	-14.88	-22.86 ***	-2.48	-4.67
	(5.11)	*(10.74)*	*(7.22)*	*(4.40)*	*(3.69)*
More than High School	1.11	-17.18	-7.53	-1.98	-6.22
	(5.78)	*(12.58)*	*(8.52)*	*(5.01)*	*(4.35)*
Income $5,000-$15,000	2.32	11.18	10.25	5.74	-1.97
	(6.35)	*(12.47)*	*(8.46)*	*(4.99)*	*(4.27)*
Income $15,000 - $25,000	8.80	33.74 **	19.45 *	0.42	2.67
	(7.24)	*(14.98)*	*(11.02)*	*(5.91)*	*(5.30)*
Income > $25,000	10.47	26.15	19.15 *	-1.75	0.10
	(7.53)	*(15.93)*	*(10.64)*	*(6.14)*	*(5.53)*
Has Supplemental Insurance	2.36	19.15	-9.68	-11.33	-7.70
	(9.03)	*(17.99)*	*(12.73)*	*(7.27)*	*(5.94)*
Has Usual Source of Care	-2.16	-7.61	1.71	-2.06	-4.08
	(9.51)	*(25.78)*	*(12.12)*	*(7.69)*	*(6.16)*
Physician Supply	17.53	-6.32	-47.93	-21.74	-8.13
	(24.45)	*(49.47)*	*(40.54)*	*(20.34)*	*(17.48)*
Hospital Bed Supply	-0.84	-33.80	15.45	-1.16	-1.88
	(11.94)	*(25.18)*	*(15.49)*	*(9.80)*	*(8.87)*
Assignment Rate	-0.14	0.04	29.03	0.50	-26.13
	(14.67)	*(34.38)*	*(17.88)*	*(11.00)*	*(17.75)*
Self Rated Health Status	0.95	-13.78 ***	4.08	3.84 *	-1.45
	(2.36)	*(5.32)*	*(3.81)*	*(2.16)*	*(1.85)*
ADL Limitation	-0.24	-5.80	3.04	-6.72 **	-0.89
	(2.43)	*(5.16)*	*(3.74)*	*(3.09)*	*(2.44)*
IADL Limitation	4.43 **	-3.23	-2.57	3.80 **	1.90
	(1.82)	*(3.83)*	*(2.28)*	*(1.91)*	*(1.41)*
Cardiovascular Disease	4.97	25.64 **	3.38	-0.76	-1.01
	(4.69)	*(12.96)*	*(6.39)*	*(4.03)*	*(3.61)*
Stroke	4.65	-8.24	-7.80	3.35	-2.00
	(6.99)	*(11.62)*	*(11.35)*	*(5.97)*	*(5.36)*
Cancer	10.45 **	-15.58 *	-6.22	-4.56	-0.11
	(4.25)	*(8.91)*	*(6.77)*	*(4.00)*	*(3.23)*
Diabetes	-5.26	8.22	-1.58	3.92	9.17 **
	(5.11)	*(10.74)*	*(8.27)*	*(4.69)*	*(3.96)*
Rheumatoid Arthritis	-1.79	6.35	13.13	3.67	0.57
	(6.42)	*(14.77)*	*(8.39)*	*(5.25)*	*(4.40)*
Osteoarthritis	-4.02	1.54	9.23	2.91	-1.96
	(4.24)	*(9.16)*	*(6.57)*	*(3.70)*	*(2.99)*
Mental Retardation	67.89	a	77.16	3.68	9.29
	(42.59)		*(52.92)*	*(43.29)*	*(32.77)*
Alzheimers Disease	-2.91	10.63	6.04	2.20	31.29 **
	(30.25)	*(52.52)*	*(25.19)*	*(19.82)*	*(14.79)*
Psychiatric Condition	-25.91 **	-14.33	2.44	-21.08	-15.53
	(11.46)	*(28.98)*	*(15.33)*	*(12.86)*	*(13.02)*
Osteoporosis	7.43	-16.31	1.99	-2.92	1.69
	(7.70)	*(17.21)*	*(7.77)*	*(6.24)*	*(4.77)*
Broken Hip	-7.55	24.90	-0.33	-8.56	1.11
	(9.00)	*(18.26)*	*(7.37)*	*(9.11)*	*(6.28)*
Parkinson's Disease	-8.50	-16.60	-21.40	-7.77	-4.58
	(13.00)	*(31.71)*	*(30.22)*	*(17.23)*	*(12.89)*
Respiratory Disease	-2.99	-23.57 *	-3.20	-4.57	-0.54
	(6.04)	*(14.01)*	*(8.18)*	*(5.22)*	*(4.36)*
Paralysis	-9.75	14.86	-6.92	3.89	-0.84
	(8.64)	*(16.06)*	*(12.63)*	*(7.49)*	*(6.97)*

Significance Levels
*** p< .01, ** p< .05, * p< .1

Notes
a Variable dropped due to perfect prediction

Appendix Table III-A6 (cont.)

	Minor Skin Procedure	Other Minor and Ambulatory Procedure	Endoscopy
[illegible]	[illegible] **	[illegible]	[illegible] ***
	[illegible]	[illegible]	(0.66)
[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	(1.22)
[illegible]	[illegible]	[illegible]	[illegible] ***
	[illegible]	[illegible]	(2.44)
[illegible]	[illegible]	[illegible]	-3.46 *
	(1.15)	(1.12)	(2.04)
Rural Resident	[illegible] ***	-0.74	0.21
	(0.50)	(0.49)	(0.80)
Lives Alone	[illegible]	0.30	1.08
	(0.42)	(0.43)	(0.70)
Other Living Arrangement	-0.47	3.55 ***	1.90
	(1.01)	(1.10)	(1.84)
Age 75-84	0.56	-0.70 *	-0.53
	(0.41)	(0.41)	(0.66)
Age > 84	1.09 *	-1.48 **	-1.67
	(0.56)	(0.61)	(1.02)
Less than High School	0.42	-0.32	1.05
	(0.45)	(0.45)	(0.76)
More than High School	-0.45	-0.17	0.86
	(0.48)	(0.51)	(0.80)
Income $5,000-$15,000	-0.82	-0.12	-0.39
	(0.54)	(0.56)	(0.93)
Income $15,000 - $25,000	0.18	-0.08	-0.29
	(0.63)	(0.64)	(1.04)
Income > $25,000	-0.43	0.29	-0.71
	(0.63)	(0.65)	(1.02)
Has Supplemental Insurance	0.20	0.14	0.56
	(0.75)	(0.74)	(1.24)
Has Usual Source of Care	0.47	-1.14	-1.37
	(0.82)	(0.92)	(1.57)
Physician Supply	-2.51	1.48	3.78
	(2.00)	(2.10)	(3.35)
Hospital Bed Supply	0.64	-0.65	0.32
	(1.05)	(1.06)	(1.72)
Assignment Rate	3.99 ***	0.49	1.12
	(1.44)	(1.22)	(1.95)
Self Rated Health Status	-0.26	-0.62 ***	-0.44
	(0.23)	(0.23)	(0.35)
ADL Limitation	-0.37	0.40	0.60
	(0.27)	(0.30)	(0.43)
IADL Limitation	0.05	0.38 **	0.64 **
	(0.17)	(0.17)	(0.28)
Cardiovascular Disease	-0.11	-1.27 ***	0.37
	(0.41)	(0.42)	(0.68)
Stroke	0.07	-1.12 *	-2.01 *
	(0.63)	(0.67)	(1.14)
Cancer	1.66 ***	1.11 ***	1.53 **
	(0.37)	(0.39)	(0.61)
Diabetes	0.61	-0.45	0.45
	(0.48)	(0.51)	(0.82)
Rheumatoid Arthritis	0.53	1.70 ***	-0.53
	(0.58)	(0.57)	(0.97)
Osteoarthritis	-0.58	0.86 **	1.14 *
	(0.37)	(0.38)	(0.61)
Mental Retardation	-2.70	-2.59	-2.07
	(3.85)	(3.42)	(6.84)
Alzheimers Disease	-0.71	-1.65	-1.58
	(1.45)	(1.71)	(3.06)
Psychiatric Condition	-0.20	-0.31	-2.01
	(1.07)	(1.19)	(2.05)
Osteoporosis	0.32	0.79	-0.88
	(0.62)	(0.64)	(1.01)
Broken Hip	-0.04	-0.67	-0.79
	(0.80)	(0.83)	(1.47)
Parkinson's Disease	0.90	-0.75	-2.98
	(1.25)	(1.43)	(2.43)
Respiratory Disease	-0.21	-0.78	0.68
	(0.54)	(0.52)	(0.83)
Paralysis	0.77	0.70	1.14
	(0.76)	(0.83)	(1.34)

Significance Levels:
*** $p < .01$, ** $p < .05$, * $p < .1$

Appendix Table III-A7: Probability of Utilization Imaging Services

	Standard Breast Imaging	Other Standard Imaging	Advanced Imaging	Sonograms	Cardiac Catheterization	Other Imaging Procedure
[illegible]	[illegible]	[illegible]	[illegible] ***	[illegible] **	[illegible] ***	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-0.22 **	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	-0.44	[illegible]	a	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0.28 *	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] ***	-0.12 **	-0.23 **	-0.18 **	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.08	[illegible] ***	[illegible] ***	[illegible] **	0.21
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Living Arrangement	-0.28	-0.12	0.08	-0.10	-0.20	[illegible]
	(0.20)	*(0.13)*	[illegible]	*(0.16)*	[illegible]	[illegible]
Age 75-84	-0.58 ***	0.32 ***	0.22 ***	0.19 ***	-0.34 *	-0.16
	(0.08)	*(0.05)*	*(0.08)*	*(0.06)*	*(0.18)*	[illegible]
Age > 84	-1.33 ***	0.19 **	0.02	0.19 **	-1.40 ***	-0.54
	(0.15)	*(0.08)*	*(0.12)*	*(0.09)*	*(0.44)*	[illegible]
Less than High School	-0.39 ***	0.00	-0.18 **	-0.04	-0.17	-0.17
	(0.09)	*(0.06)*	*(0.09)*	*(0.07)*	*(0.21)*	*(0.21)*
More than High School	-0.01	-0.02	-0.28 ***	-0.04	0.07	0.21
	(0.09)	*(0.07)*	*(0.10)*	*(0.08)*	*(0.22)*	*(0.24)*
Income $5 000-$15 000	0.18	-0.06	-0.19 *	-0.06	-0.17	0.32
	(0.11)	*(0.07)*	*(0.10)*	*(0.08)*	*(0.28)*	*(0.28)*
Income $15 000 - $25 000	0.26 **	0.01	-0.14	0.00	0.25	0.35
	(0.13)	*(0.08)*	*(0.12)*	*(0.10)*	*(0.30)*	*(0.32)*
Income > $25 000	0.56 ***	0.18 **	-0.05	0.06	0.23	0.03
	(0.13)	*(0.09)*	*(0.13)*	*(0.10)*	*(0.32)*	*(0.35)*
Has Supplemental Insurance	0.73 ***	0.58 ***	0.58 ***	0.60 ***	0.78 **	0.75 **
	(0.16)	*(0.08)*	*(0.13)*	*(0.11)*	*(0.38)*	*(0.36)*
Has Usual Source of Care	1.10 ***	0.71 ***	0.70 ***	0.54 ***	0.42	0.39
	(0.18)	*(0.09)*	*(0.18)*	*(0.13)*	*(0.43)*	*(0.43)*
Physician Supply	0.36	0.81 ***	0.58	0.55 *	-0.36	-0.56
	(0.41)	*(0.27)*	[illegible]	*(0.32)*	*(0.96)*	[illegible]
Hospital Bed Supply	-0.29	-0.01	0.27	0.13	0.36	0.09
	(0.22)	*(0.13)*	*(0.20)*	*(0.16)*	*(0.49)*	*(0.49)*
Assignment Rate	-0.31 *	0.01	0.09	0.52 **	0.02	0.35
	(0.18)	*(0.15)*	*(0.23)*	*(0.23)*	*(0.47)*	*(0.57)*
Self Rated Health Status	0.06	-0.26 ***	-0.31 ***	-0.25 ***	-0.53 ***	-0.45 ***
	(0.05)	*(0.03)*	*(0.04)*	*(0.04)*	*(0.11)*	*(0.11)*
ADL Limitation	-0.28 ***	0.06	0.12 ***	0.01	-0.35 *	0.15
	(0.09)	*(0.04)*	*(0.04)*	*(0.04)*	*(0.19)*	*(0.11)*
IADL Limitation	-0.10 **	0.07 ***	0.09 ***	0.05 **	0.02	-0.08
	(0.04)	*(0.02)*	*(0.03)*	*(0.03)*	*(0.08)*	*(0.08)*
Cardiovascular Disease	0.09	0.14 ***	0.09	0.44 ***	1.53 ***	0.56 **
	(0.08)	*(0.05)*	*(0.08)*	*(0.07)*	*(0.30)*	*(0.23)*
Stroke	-0.33 **	0.10	0.74 ***	0.39 ***	0.27	0.46 *
	(0.16)	*(0.09)*	*(0.11)*	*(0.10)*	*(0.28)*	*(0.27)*
Cancer	0.51 ***	0.36 ***	0.46 ***	0.05	0.12	0.04
	(0.08)	*(0.05)*	*(0.07)*	*(0.06)*	*(0.18)*	*(0.19)*
Diabetes	0.05	0.22 ***	0.14	0.18 **	0.21	0.27
	(0.11)	*(0.07)*	*(0.09)*	*(0.08)*	*(0.21)*	*(0.21)*
Rheumatoid Arthritis	-0.11	0.23 ***	0.07	0.09	-0.27	0.12
	(0.12)	*(0.08)*	*(0.11)*	*(0.09)*	*(0.30)*	*(0.27)*
Osteoarthritis	0.27 ***	0.29 ***	0.13 *	-0.01	0.11	0.32 *
	(0.07)	*(0.05)*	*(0.07)*	*(0.06)*	*(0.17)*	*(0.18)*
Mental Retardation	0.36	-0.12	0.40	-0.27	a	a
	(0.71)	*(0.42)*	*(0.50)*	*(0.52)*		
Alzheimers Disease	-0.97	-0.61 ***	0.21	-0.43 *	-0.39	-0.98
	(0.62)	*(0.20)*	*(0.24)*	*(0.25)*	*(1.04)*	*(1.04)*
Psychiatric Condition	-0.31	-0.07	0.03	-0.19	-0.03	-0.66
	(0.27)	*(0.16)*	*(0.21)*	*(0.19)*	*(0.53)*	*(0.72)*
Osteoporosis	0.27 **	0.41 ***	0.17	0.04	-0.37	-0.22
	(0.12)	*(0.10)*	*(0.12)*	*(0.11)*	*(0.38)*	*(0.34)*
Broken Hip	-0.13	0.38 ***	-0.20	0.02	-0.16	-0.08
	(0.19)	*(0.12)*	*(0.16)*	*(0.13)*	*(0.52)*	*(0.44)*
Parkinson's Disease	-0.44	-0.15	0.16	-0.04	0.15	-0.26
	(0.45)	*(0.20)*	*(0.24)*	*(0.22)*	*(0.61)*	*(0.73)*
Respiratory Disease	-0.08	0.33 ***	0.09	-0.01	-0.38	-0.05
	(0.12)	*(0.07)*	*(0.10)*	*(0.08)*	*(0.26)*	*(0.25)*
Paralysis	0.33 *	-0.11	-0.12	0.13	0.00	-0.23
	(0.18)	*(0.11)*	*(0.14)*	*(0.12)*	*(0.35)*	*(0.36)*

Significance Levels
*** p< .01 ** p< .05 * p< .1

Notes
a Variable dropped due to perfect prediction

Appendix Table III-A8 Volume of Utilization, Imaging Services

	Standard Breast Imaging	Other Standard Imaging	Advanced Imaging	Sonograms	Cardiac Catheterization	Other Imaging Procedure
Female	[illegible]	[illegible] ***	[illegible]	-0.81 ***	[illegible]	[illegible]
		(0.14)	[illegible]	(0.26)	[illegible]	[illegible]
Black	[illegible] *	[illegible]	-0.85	[illegible] **	-1.63	[illegible]
	[illegible]	(0.25)	(1.27)	(0.43)	(11.70)	[illegible]
Other Race	[illegible]	-0.67	-2.79	[illegible]	a	[illegible]
	[illegible]	(0.43)	(2.77)	(0.76)		(21.08)
Hispanic	[illegible]	[illegible]	-3.50 *	0.27	20.52	-11.52
	[illegible]	(0.37)	(2.10)	(0.64)	(14.59)	(9.44)
Rural Resident	[illegible] ***	-0.89 ***	-2.87 ***	-0.85 ***	-7.54	-14.73 ***
	[illegible]	(0.17)	(0.94)	(0.32)	(6.92)	(4.76)
Lives Alone	[illegible]	0.25 *	-1.30	0.24	4.50	[illegible]
	(0.07)	(0.13)	(0.82)	(0.26)	(6.15)	(3.95)
Other Living Arrangement	-0.16	-0.17	-1.85	-0.16	-23.25	-12.88
	(0.20)	(0.35)	(1.82)	(0.64)	(19.00)	(10.12)
Age 75-84	0.00	-0.14	-2.07 ***	0.23	-4.42	-3.57
	(0.07)	(0.14)	(0.79)	(0.26)	(5.77)	(4.18)
Age > 84	-0.06	-0.89 ***	-4.12 ***	0.06	-13.99	-5.67
	(0.16)	(0.21)	(1.14)	(0.37)	(13.99)	(7.40)
Less than High School	0.00	-0.13	0.89	-0.52 *	1.66	0.61
	(0.08)	(0.15)	(0.85)	(0.28)	(6.57)	(4.43)
More than High School	-0.03	-0.11	0.48	-0.26	-1.97	-4.66
	(0.08)	(0.18)	(1.01)	(0.33)	(6.94)	(5.02)
Income $5,000-$15,000	-0.24 **	0.05	-1.41	0.14	-6.11	0.04
	(0.11)	(0.19)	(1.00)	(0.34)	(8.63)	(6.21)
Income $15,000 - $25,000	-0.21 *	0.12	-1.41	0.21	-2.83	-0.85
	(0.12)	(0.22)	(1.20)	(0.40)	(9.10)	(7.03)
Income > $25,000	-0.24 **	0.37 *	-1.47	-0.08	0.38	6.55
	(0.12)	(0.23)	(1.23)	(0.41)	(10.40)	(7.83)
Has Supplemental Insurance	0.34 **	0.62 ***	1.50	0.71	25.83 **	3.78
	(0.17)	(0.23)	(1.37)	(0.45)	(11.56)	(8.98)
Has Usual Source of Care	0.32 *	-0.33	1.43	-0.50	-20.54	0.35
	(0.19)	(0.30)	(1.91)	(0.57)	(14.07)	(8.85)
Physician Supply	0.49	0.26	6.12	1.17	14.33	-26.20
	(0.38)	(0.71)	(3.86)	(1.29)	(31.92)	(17.85)
Hospital Bed Supply	-0.29	0.36	-1.11	-0.06	-10.59	8.86
	(0.20)	(0.36)	(2.05)	(0.68)	(18.45)	(8.91)
Assignment Rate	-0.30 *	0.12	-4.86 **	0.60	11.06	-21.99 *
	(0.16)	(0.41)	(2.21)	(0.96)	(14.47)	(11.96)
Self Rated Health Status	-0.05	-0.41 ***	0.11	-0.38 ***	-6.53 **	0.04
	(0.04)	(0.08)	(0.41)	(0.14)	(3.28)	(2.26)
ADL Limitation	-0.17 *	0.33 ***	0.05	-0.15	-2.91	-1.03
	(0.10)	(0.09)	(0.40)	(0.16)	(4.93)	(2.49)
IADL Limitation	0.03	0.18 ***	0.21	0.11	0.16	-1.78
	(0.04)	(0.06)	(0.27)	(0.10)	(2.80)	(1.72)
Cardiovascular Disease	-0.12 *	0.22	-1.79 **	0.96 ***	-3.93	8.79 *
	(0.07)	(0.14)	(0.83)	(0.28)	(9.70)	(4.97)
Stroke	-0.05	-0.43 *	-1.07	0.54	1.16	4.65
	(0.15)	(0.22)	(0.98)	(0.37)	(9.20)	(5.03)
Cancer	-0.09	0.47 ***	2.83 ***	0.24	8.66 *	3.36
	(0.07)	(0.13)	(0.73)	(0.25)	(5.18)	(4.02)
Diabetes	-0.08	0.06	-1.68 *	-0.23	-1.83	3.35
	(0.10)	(0.17)	(0.91)	(0.30)	(6.48)	(4.42)
Rheumatoid Arthritis	0.10	-0.01	0.74	0.08	-0.93	-1.99
	(0.12)	(0.20)	(1.08)	(0.36)	(9.85)	(5.91)
Osteoarthritis	-0.02	0.33 **	0.48	0.11	-1.18	-0.46
	(0.07)	(0.13)	(0.72)	(0.24)	(5.30)	(3.82)
Mental Retardation	-1.25 *	5.79 ***	3.22	-1.69	a	a
	(0.65)	(1.10)	(4.56)	(2.14)		
Alzheimers Disease	0.01	-1.28 **	-0.46	1.08	17.19	-5.90
	(0.64)	(0.55)	(2.13)	(0.99)	(36.32)	(26.03)
Psychiatric Condition	0.66 ***	0.36	-1.42	-0.25	-8.16	-1.75
	(0.25)	(0.42)	(2.04)	(0.79)	(18.92)	(14.75)
Osteoporosis	-0.02	0.23	-0.20	-1.06 **	-23.44 *	-3.88
	(0.10)	(0.22)	(1.16)	(0.42)	(12.71)	(7.29)
Broken Hip	-0.32 *	0.32	-1.83	0.20	-11.57	6.26
	(0.18)	(0.27)	(1.56)	(0.51)	(17.67)	(10.03)
Parkinson's Disease	-0.31	0.35	1.84	1.59 *	3.91	1.25
	(0.46)	(0.49)	(2.24)	(0.86)	(18.66)	(14.55)
Respiratory Disease	0.03	0.13	1.88 *	0.31	-14.18	-2.22
	(0.11)	(0.18)	(0.97)	(0.34)	(8.99)	(5.04)
Paralysis	-0.02	0.13	2.56 *	-0.55	4.16	-10.53
	(0.16)	(0.28)	(1.31)	(0.47)	(11.49)	(6.76)

Significance Levels
*** p<.01 ** p<.05 * p<.1

Notes
a Variable dropped due to perfect prediction

Appendix Table III-A9: Probability of Utilization - Testing Services

	Lab Tests	Physician Tests
[illegible]	-0.[illegible] ***	-0.[illegible] ***
	[illegible]	[illegible]
[illegible]	-0.[illegible]	[illegible]
Unemployed	-0.34 **	-0.28
	[illegible]	[illegible]
[illegible]	0.[illegible]	0.25 **
	[illegible]	[illegible]
Rural Residence	0.[illegible]0	0.29 ***
	[illegible]	[illegible]
Lives Alone	0.[illegible]1	0.[illegible]0
	[illegible]	[illegible]
Other Living Arrangement	0.19	0.04
	[illegible]	[illegible]
Age 75-84	0.31 ***	0.21 ***
	[illegible]	[illegible]
Age 84	0.19 **	0.10
	[illegible]	[illegible]
Less than High School	-0.02	0.03
	[illegible]	[illegible]
More than High School	-0.02	-0.02
	[illegible]	[illegible]
Income $5,000-$15,000	-0.06	0.05
	[illegible]	[illegible]
Income $15,000 - $25,000	0.08	0.21 **
	[illegible]	[illegible]
Income $25,000	0.24 ***	0.33 ***
	[illegible]	[illegible]
Has Supplemental Insurance	0.72 ***	0.54 ***
	[illegible]	[illegible]
Has Usual Source of Care	1.14 ***	0.52 ***
	[illegible]	[illegible]
Physician Supply	0.88 ***	0.69 **
	[illegible]	[illegible]
Hospital Bed Supply	-0.34 **	-0.05
	[illegible]	[illegible]
Assignment Rate	0.24	0.63 ***
	[illegible]	[illegible]
Self Rated Health Status	-0.15 ***	-0.23 ***
	[illegible]	[illegible]
ADL Limitation	0.02	-0.09 **
	[illegible]	[illegible]
IADL Limitation	-0.01	0.07 ***
	[illegible]	[illegible]
Cardiovascular Disease	0.46 ***	0.40 ***
	[illegible]	[illegible]
Stroke	0.06	0.23 **
	[illegible]	[illegible]
Cancer	0.42 ***	0.13 **
	[illegible]	[illegible]
Diabetes	0.80 ***	0.10
	[illegible]	[illegible]
Rheumatoid Arthritis	0.06	-0.02
	[illegible]	[illegible]
Osteoarthritis	0.25 ***	0.08
	[illegible]	[illegible]
Mental Retardation	-0.06	-0.28
	[illegible]	[illegible]
Alzheimers Disease	-0.04	-0.34
	[illegible]	[illegible]
Psychiatric Condition	-0.08	0.08
	[illegible]	[illegible]
Osteoporosis	0.14	0.10
	[illegible]	[illegible]
Broken Hip	0.13	0.06
	[illegible]	[illegible]
Parkinson's Disease	-0.16	-0.01
	[illegible]	[illegible]
Respiratory Disease	0.14 *	0.38 ***
	[illegible]	[illegible]
Paralysis	-0.04	-0.02
	[illegible]	[illegible]

Significance Levels
*** p< .01 ** p< .05 * p< .1

	Lab Tests	Physician Tests
Female	-0.37 *	-0.14
	(0.19)	(0.14)
Black	-0.16	-0.22
	(0.23)	(0.20)
Other Race	-0.37 ***	0.21
	(0.12)	(0.08)
Hispanic	-0.06	-0.23 ***
	(0.11)	(0.07)
Rural Resident	-0.08 ***	-0.04
	(0.01)	(0.01)
Lives Alone	0.36 **	0.05
	(0.17)	(0.15)
Other Living Arrangement	0.24	-0.47 *
	(0.40)	(0.26)
Age 75-84	-0.05	-0.21
	(0.16)	(0.13)
Age 84	-0.35	0.11
	(0.24)	(0.20)
Less than High School	-0.09	-0.30
	(0.18)	(0.17)
More than High School	0.18	-0.08
	(0.20)	(0.12)
Income $5,000-$15,000	-0.48 **	-0.22
	(0.22)	(0.16)
Income $15,000 - $25,000	-0.54	0.05
	(0.25)	(0.23)
Income > $25,000	0.24	-0.10
	(0.26)	(0.15)
Has Supplemental Insurance	0.26	-0.88
	(0.27)	(0.59)
Has Usual Source of Care	0.70 *	0.13
	(0.36)	(0.23)
Physician Supply	2.12 ***	0.59
	(0.32)	(1.66)
Hospital Bed Supply	-0.49	0.61
	(0.42)	(0.37)
Assignment Rate	0.46	3.69 ***
	(0.60)	(1.33)
Self Rated Health Status	-0.48 ***	-0.37 **
	(0.09)	(0.15)
ADL Limitation	0.32 ***	-0.08
	(0.11)	(0.23)
IADL Limitation	0.15 **	-0.07
	(0.07)	(0.14)
Cardiovascular Disease	0.21	0.81 **
	(0.16)	(0.36)
Stroke	0.11	-0.48
	(0.26)	(0.30)
Cancer	0.73 ***	-0.20
	(0.15)	(0.12)
Diabetes	0.92 ***	0.14
	(0.19)	(0.40)
Rheumatoid Arthritis	0.52 **	-0.35
	(0.23)	(0.49)
Osteoarthritis	-0.02	0.74 **
	(0.15)	(0.31)
Mental Retardation	-1.79	-0.19
	(1.27)	(2.79)
Alzheimers Disease	-0.84	-0.74
	(0.60)	(1.33)
Psychiatric Condition	0.71	1.43
	(0.48)	(0.93)
Osteoporosis	0.23	-0.38
	(0.27)	(0.54)
Broken Hip	-0.32	0.75
	(0.34)	(0.65)
Parkinson's Disease	0.99 *	1.33
	(0.58)	(1.13)
Respiratory Disease	-0.13	-0.72 *
	(0.21)	(0.40)
Paralysis	0.23	0.72
	(0.33)	(0.64)

Significance Levels
*** p= .01, ** p= .05, * p= .1