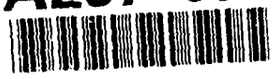

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A RAND NOTE

The Determinants of the Use of Assistants at Surgery

Sally Trude

February 1990

RAND

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Prepared for the
Health Care Financing Administration,
U.S. Department of Health and Human Services

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RAND/UCLA/HARVARD
Center for Health Care
Financing Policy Research

PREFACE

This Note was developed as part of a Health Care Financing Administration (HCFA) project aimed at studying the use of assistants at surgery. The study is intended to help health care policymakers identify areas in which regulatory controls on the use of assistants at surgery may be feasible, and to estimate potential savings in Medicare funds that such controls might generate. The research upon which this analysis is based was performed under HCFA Cooperative Research Agreement C-98489/9-06 and was supported by the RAND/UCLA/Harvard Center for Health Care Financing Policy Research.

SUMMARY

In 1986, Medicare payments for assistants at surgery were about $300 million. The Health Care Financing Administration (HCFA) estimated that Medicare will pay about $350 million for assistants at surgery in 1989. This study describes factors that influence the use of assistants at surgery. We describe general patterns of use as well as attempt to identify potentially inappropriate uses. We thereby hope to help policymakers identify potential areas for further utilization control, and estimate the potential savings from such controls.

Our study basically consisted of two parts. In the first part, we identified individual procedures for which assistants at surgery were used the most often or which received the most Medicare assistant-at-surgery dollars. In the second part of the study, we looked at the more general factors that might influence the use of assistants at surgery. We specifically considered the place of service, the specialty of the primary surgeon, characteristics of the beneficiary, region, and characteristics of the hospital.

For this study, we used two Medicare data files. Most of our analyses used the 1986 5 percent beneficiary-level Part B Medicare Data Files (BMAD)--linked to inpatient and outpatient hospital claims, and linked to administrative records. A small portion of the analysis used the 1986 procedure-level BMAD.

Our analysis of individual procedures was motivated by a study by the Office of the Inspector General, which estimated that requiring physicians to obtain prior approval for an assistant at cataract surgery might save Medicare about $30 to $40 million per year. HCFA was therefore interested in discovering if controls on other procedures could also garner significant savings.

We found that most of the assistant-at-surgery dollars are spent on a small set of procedures. Ten procedures account for 40 percent of the assistant-at-surgery dollars. The top ten procedures include cataract surgery, coronary artery bypass, hip replacement, knee replacement,

thromboendarterectomy, and colectomy. One hundred procedures account for about 78 percent of the assistant-at-surgery dollars.

We used diagnosis related groups (DRGs) to group individual procedures into larger bundles of similar surgeries. We found that 20 DRGs accounted for 79 percent of the assistant-at-surgery dollars.

In our analysis we did not find a procedure that would provide savings on the same scale as cataract surgery. Cataract procedures are unique in being both expensive and high volume. Cataract procedures are also amenable to the requirement of prior approval. In our analysis, we estimate the savings from the cataract ruling to be about $12 million. This is substantially less than the $30 million estimated by the Office of the Inspector General, but still represents significant savings.

The second part of our analysis describes the use of assistants at surgery in general. We first investigated individually those factors that we thought might influence the use of assistants at surgery. We then combined these factors in a multivariate model to understand their interactions and combined effect.

We found that surgeries performed in inpatient hospitals accounted for 88 percent of the assistant-at-surgery dollars. Thoracic and general surgeons are most likely to use an assistant at surgery. General surgeons had the greatest propensity to use a general practitioner as an assistant.

Physicians in the Mountain and Pacific regions are more than twice as likely to use a physician as an assistant at surgery as are physicians practicing in other parts of the country. We found this regional effect even after controlling for teaching hospitals, the urban/rural status of the hospital, characteristics of the beneficiary, and the specialty of the primary surgeon. This finding suggests unnecessary use of physicians as assistants at surgery. Policymakers might want to consider investigating the reasons for these differences, or reviewing the medical necessity for the use of physicians as assistants at surgery in these regions.

ACKNOWLEDGMENTS

The author would like to thank Grace M. Carter for the thoughtful guidance and insightful comments she provided throughout this study and during the writing of this Note. Daniel Byrne, as usual, did an expert job of developing the analytic data file from large and complex Medicare data files. I would also like to thank Ira Burney and Emmett B. Keeler for their helpful suggestions and comments. Their ideas substantially improved this Note. Benson Dutton deserves special thanks for his support and help as the HCFA project leader for this study. Finally, I wish to thank Nancy Elwood for her excellent secretarial assistance in preparing this Note.

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I. INTRODUCTION

Sometimes, a surgeon may require the services of another physician to actively assist in performing a surgical procedure. Such a physician is called an "assistant at surgery," and Medicare's payment to the assistant is 20 percent of the payment to the primary surgeon. In 1986, Medicare payments for assistants at surgery were about $300 million. The Health Care Financing Administration (HCFA) estimates that Medicare will pay about $350 million for assistants at surgery in 1989.

Currently there are two statutory provisions specifically governing Medicare's reimbursement of assistants at surgery. One pertains to the reimbursement of assistants at surgery in teaching hospitals, and the other to assistants at cataract surgery. Medicare does not pay for the services of an assistant at surgery in a hospital that has a training program related to the medical specialty required for the surgery. Exceptions are made for team physicians performing complex medical procedures, for cases requiring a physician of another specialty during the surgery, and for exceptional medical circumstances. Since Medicare payments to hospitals already contribute to medical education, and since residents are apt to serve or could serve as assistants at surgery in teaching hospitals, payment to assistants at surgery in teaching hospitals is considered duplicate billing. Because Medicare does not reimburse separately under Part B for assistants at surgery in teaching hospitals, claims for these assistants at surgery will not appear in the Part B claims data. Therefore, any analysis of assistants at surgery using Medicare claims data must take into consideration the under-representation of assistants at surgery in teaching hospitals.

Under the other statutory provision, Medicare no longer pays for an assistant at cataract surgery unless the primary surgeon has obtained prior approval. In 1985, the Office of the Inspector General estimated that by requiring prior approval for an assistant at cataract surgery, Medicare would save about $30 to $40 million each year. That study described large regional differences in the use of assistants at

surgery. Nine states already had prior approval or similar requirements limiting the use of assistants at routine cataract surgery. The Inspector General concluded that assistants at surgery were, therefore, unnecessary for routine cataract surgery. This conclusion and the potential savings have led to further interest in a search for inappropriate uses of assistants at surgery and additional potential savings.

This Note describes the factors that determine the use of assistants at surgery. In addition to describing general patterns of use, we also attempt to identify any potentially inappropriate uses. The actual determination of inappropriate use and medical necessity must be left to medical experts, and is beyond the scope or intent of this Note. By studying the use of assistants at surgery, we can help policymakers identify potential areas for further utilization control, and estimate the potential savings from such controls.

Because of the expected savings from the regulations on cataract surgery, HCFA was especially interested (and mandated by Congress) to find other specific procedures for which, like cataracts, restrictions on the use of assistants at surgery would garner significant savings. Because of this interest, this Note, in addition to describing general patterns of use, discusses a methodology for finding any such additional procedures.

Section II of this Note describes the data source for the analysis and the development of the analytic files. Section III describes the search for specific procedures where high use or expenses for assistants at surgery suggest a potential for additional savings. Section IV explores other circumstances under which assistants at surgery are used. We consider place of service, physician specialty, characteristics of the beneficiary, characteristics of the hospital, and geographic region. Finally, Section V discusses how the results of the analysis relate to our policy concerns.

II. DATA AND METHODOLOGY

Physicians' claims for services to Medicare beneficiaries are processed regionally by insurance companies. These insurance companies, called carriers, prepare annual data files for the HCFA. These files are the Part B Medicare Data Files, more commonly referred to as the BMAD files. One of the data files provided by the carriers takes a 5 percent random sample of beneficiaries and details every physician bill for each beneficiary. This file is called the beneficiary-level BMAD file. Information on each record also includes characteristics of the beneficiary, the physician, and the type of service provided. Each record also includes a Current Procedural Terminology (CPT) code and modifiers that identify very specifically the procedure performed by the physician. In addition to this beneficiary-level file, the carriers provide a procedure-level BMAD file that gives complete counts of the use of each procedure. These counts are provided for each different locality, physician specialty, type of service, and place of service.

Most of this Note's analysis uses the 1986 5 percent beneficiary-level BMAD file, linked to inpatient and outpatient hospital claims and to administrative records. A small portion of the analysis uses the 1986 procedure-level BMAD file.

The linked beneficiary-level BMAD file provides four types of records for the 5 percent sample of beneficiaries. The first is the administrative record, containing demographic characteristics and eligibility information about the beneficiary. Second, if the beneficiary had an inpatient acute care hospitalization during 1986, the file contains a record for each hospital stay. The inpatient hospital claim includes information on the length of the stay and the charges for the stay, as well as the diagnosis related group, or DRG; it also provides International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnostic and surgical procedure codes. The third group of records consist of all of the beneficiary's outpatient hospital claims. These records provide less detailed

information than the inpatient hospital record, but they also include ICD-9-CM diagnostic and surgical procedure codes. The fourth set of records are the beneficiary-level BMAD records, which are the claims for physician services. These records provide information on all physician services billed to Medicare whether provided in an inpatient, outpatient, or office setting. These records also include the claims made by the primary surgeon as well as claims made by the assistant at surgery.

Anesthesiologists' claims are sometimes miscoded as assistants at surgery. We omitted all claims submitted by anesthesiologists from our sample. We also omitted claims submitted to the carrier for Puerto Rico.

ANALYSIS FILE CONSTRUCTION

We used "a surgery" as the unit of analysis. We defined a surgery as all procedures performed on a Medicare beneficiary in one day in one place. An inpatient hospital record combines information for up to three procedures. If any procedures for an inpatient record occurred on different days, we counted these procedures as separate surgeries and replicated the record for each one that occurred on a different day. If all the procedures for the inpatient hospital stay occurred on the same day, we considered that record as a single surgery.

We combined all the information about a single surgery into one record. If a Medicare beneficiary's inpatient hospital record indicated that a surgery occurred on May 12, and a physician submitted a bill for an inpatient surgery on May 12 for that beneficiary, we combined this information onto one record. That is, we combined information if the surgery occurred on a given day in a given location. We were unable to link information based on the procedure code because the inpatient and outpatient hospital records use ICD-9-CM codes to identify procedures and the physician records use CPT codes; the two coding systems do not readily map into each other.

We linked information across different data sources to form surgery records in three steps. We began with each inpatient hospitalization. As mentioned before, we replicated the hospital claim for each surgery that occurred on a different day. We then linked physician claims for each inpatient surgery performed on the same day to the inpatient data. For the second step we linked all the physician bills for outpatient hospital surgeries to the outpatient hospital record for a surgery on that day. After linking physician bills to inpatient and outpatient hospital records, a pool of unlinked physician claims remained. Bills from this pool with the same place of service and the same date of service were linked together and were treated as one surgery.

After linking the physician bills to outpatient and inpatient hospital records, and to other physician bills, we found that there were still physician bills for assistants at surgery that had not been linked to a claim for the primary surgeon. For these unmatched cases, we loosened our "same day, same place" restrictions, and linked these assistant at surgery claims to physician, inpatient or outpatient records if the date of service was within 10 days regardless of the place of service.

III. INDIVIDUAL PROCEDURES IN WHICH ASSISTANTS ARE USED

The savings garnered by requiring prior approval for the use of assistants at cataract surgery have led to interest in identifying additional procedures that either show a high rate of use of assistants at surgery or represent a large fraction of the dollars that Medicare pays for assistants at surgery. After identifying such procedures, a policymaker would then ask medical experts if using an assistant at surgery for those procedures was medically necessary. However, even if an assistant is not always medically necessary for a particular procedure, requiring prior approval might have a negative health outcome for the patient. One wouldn't want to require prior approval for surgeries performed on an emergency basis; but it might be appropriate for procedures in which postponement would not cause the beneficiary any harm. In cases where prior approval is not feasible, one might require documentation of the medical necessity for the assistant at surgery after the fact.

One would want medical specialists to determine the medical appropriateness of an assistant at surgery. But one would only want to convene such a panel of experts, and have it consider the question, for procedures that use assistants at surgery frequently or that cost a substantial share of Medicare dollars.

Procedures have distinct and precise definitions, and are represented on the physician bill by a CPT code. Each CPT code identifies a very specific medical procedure. For instance, CPT code 66983 represents intracapsular cataract extraction with insertion of intraocular lens prosthesis (one stage procedure). CPT code 66984 represents extracapsular cataract extraction with insertion of intraocular lens prosthesis (one stage procedure), manual or phacoemulsification technique.

Regulations for the use of assistants at surgery would need to define surgeries more broadly than at the individual CPT level. A regulation restricting one specific procedure might lead to substitution

of a different, but similar procedure. The regulations for cataract surgery include both CPT codes 66983 and 66984, as well as others. So a procedure considered for regulation would actually include a bundle of procedures defined by CPT codes.

Therefore, one needs to identify all the CPT codes associated with a more general definition of the procedure. That is, for a particular type of surgery, one wants to identify the complete bundle of procedures that a physician might use. After the bundles are defined, one can calculate the expected savings from the proposed regulation. With such an estimate, policymakers can then determine whether it might be cost effective to convene a panel of physicians to decide on the medical appropriateness of the use of assistants at surgery for those bundles of procedures.

Unfortunately, defining such bundles of procedures *a priori* is difficult, and requires the expertise of physicians across a wide range of specialties. One would like to identify potential bundles, determine the likely cost savings from regulation, and then convene the panel of medical experts to define the bundles more carefully and determine the appropriateness of regulation. But medical expertise is also required to define the bundles.

There are two strategies for identifying the expensive or high-volume bundles of procedures without defining these bundles beforehand. The first method identifies the individual CPT codes that account for the most assistant-at-surgery dollars or that most frequently use an assistant at surgery. If substantial Medicare dollars are at stake, one might then obtain medical expertise to identify similar procedures that define the entire bundle of procedures. This method assumes that across the bundle of procedures, at least one of the procedures accounts for a large share of the assistant-at-surgery dollars relative to all of the CPT procedures billed.

Table 3.1 shows the 20 procedures (defined by CPT code) that used assistants at surgeries most frequently. These 20 procedures account for 43 percent of the use of assistants at surgery. The two cataract procedures in the top 20 procedures account for 8 percent of the use of assistants at surgery; coronary bypass surgery accounts for 5 percent.

Table 3.1

TOP 20 PROCEDURE CODES WHERE LARGEST NUMBERS OF ASSISTANTS AT SURGERY ARE USED

CPT Code	Description	Percent of Procedures Using Assistants at Surgery
66984	Extracapsular cataract extraction with insertion of intraocular lens prosthesis (one stage procedure), manual or phacoemulsification technique	6%
44140	Colectomy, partial; with anastomosis	3%
47605	Cholecystectomy; with cholangiography	3%
49505	Repair inguinal hernia, age 5 or over	3%
35301	Thromboendarterectomy, with or without patch graft; carotid, vertebral, subclavian, by neck incision	3%
27130	Arthroplasty, acetabular and proximal femoral prosthetic replacement (total hip replacement)	3%
27447	Arthroplasty, knee, condyle and plateau; medial AND lateral compartments with or without patella resurfacing (total knee replacement)	2%
47600	Cholecystectomy	2%
27244	Open treatment of closed or open intertrochanteric, pertrochanteric, or subtrochanteric femoral fracture, with internal fixation	2%
33512	Coronary artery bypass, autogenous graft (e.g., saphenous vein or internal mammary artery); three coronary grafts	2%
27236	Open treatment of closed or open femoral fracture, proximal end, neck, internal fixation or prosthetic replacement	2%
66983	Intracapsular cataract extraction with insertion of intraocular lens prosthesis (one stage procedure)	2%
19240	Mastectomy, modified radical, including axillary lymph nodes but leaving pectoral muscles	2%
33513	Coronary artery bypass, autogenous graft (e.g., saphenous vein or internal mammary artery); four coronary grafts	2%
47610	Cholecystectomy with exploration of common duct	1%
58150	Total hysterectomy (corpus and cervix), with or without removal of tube(s), with or without removal of ovary(s)	1%
49000	Exploratory laparotomy, exploratory celiotomy (separate procedure)	1%
35081	Direct repair of aneurysm or excision (partial or total) and graft insertion for aneurysm or occlusive disease, abdominal aorta	1%
33511	Coronary artery bypass, autogenous graft, (e.g., saphenous vein or internal mammary artery); two coronary grafts	1%
49560	Repair ventral (incisional) hernia (separate procedure)	1%

Source: 1986 BMAD Procedure File

Table 3.2 shows the 20 procedures (defined by CPT code) that used the most assistant-at-surgery dollars. These 20 procedures account for 53 percent of assistant-at-surgery dollars. The two cataract procedures in the top 20 procedures account for 11 percent of the assistant-at-surgery dollars; coronary bypass surgery accounts for another 15 percent.

Most of the assistant-at-surgery dollars are spent on a small set of procedures. Only ten procedures account for 40 percent of the assistant-at-surgery dollars. One hundred procedures account for about 78 percent of the assistant-at-surgery dollars. Table 3.3 shows that after about the top 300 procedures, including more procedures for review yields a small percentage return in terms of total assistant-at-surgery dollars.

Once one has identified the top-ranking procedures, one still needs to identify similar procedures that a policymaker would bundle for the purposes of regulation. From Table 3.1, we see that 66984 (extracapsular cataract removal with insertion of intraocular lens prosthesis [one stage procedure], manual or phacoemulsification technique) and 66983 (intracapsular cataract extraction with insertion of intraocular lens prosthesis [one stage procedure]) are top-ranking procedures. However, 66985 (insertion of introcular lens subsequent to cataract removal [separate procedure]) is not a top-ranking procedure. After the appropriate bundle of procedures is identified, one can determine the possible cost savings of any regulation. Even without defining the appropriate bundle, a lower bound estimate of the cost savings can be obtained from the assistant-at-surgery dollars spent on the high-ranking procedures.

The methodology for finding a procedure that uses assistants at surgery frequently or that uses a large share of assistant-at-surgery dollars assumes that for a given surgery bundle, at least one procedure will be used predominantly, and will show up in the highest rankings. However, a surgery bundle could consist of ten procedures that are each used equally often and that cost about the same. For this bundle, no single procedure would represent a large share of the assistant-at-

Table 3.2

TOP 20 PROCEDURE CODES USING MOST ASSISTANT-AT-SURGERY DOLLARS

CPT Code	Description	Percent of Assistant-at-Surgery Dollars
66984	Extracapsular cataract extraction with insertion of intraocular lens prosthesis (one stage procedure), manual or phacoemulsification technique	7%
33512	Coronary artery bypass, autogenous graft (e.g., saphenous vein or internal mammary artery); three coronary grafts	6%
33513	Coronary artery bypass, autogenous graft (e.g., saphenous vein or internal mammary artery); four coronary grafts	5%
66983	Intracapsular cataract extraction with insertion of intraocular lens prosthesis (one stage procedure)	4%
27130	Arthroplasty, acetabular and proximal femoral prosthetic replacement (total hip replacement)	4%
27447	Arthroplasty, knee, condyle and plateau; medial AND lateral compartments with or without patella resurfacing (total knee replacement)	4%
35301	Thromboendarterectomy, with or without patch graft; carotid, vertebral, subclavian, by neck incision	3%
44140	Colectomy, partial; with anastomosis	3%
33511	Coronary artery bypass, autogenous graft, (e.g., saphenous vein or internal mammary artery); two coronary grafts	2%
33514	Coronary artery bypass, autogenous graft, (e.g., saphenous vein or internal mammary artery); five coronary grafts	2%
47605	Cholecystectomy; with cholangiography	2%
27244	Open treatment of closed or open intertrochanteric, pertrochanteric, or subtrochanteric femoral fracture, with internal fixation	2%
27236	Open treatment of closed or open femoral fracture, proximal end, neck, internal fixation or prosthetic replacement	2%
35081	Direct repair of aneurysm or excision (partial or total) and graft insertion for aneurysm or occlusive disease, abdominal aorta	1%
47600	Cholecystectomy	1%
19240	Mastectomy, modified radical, including axillary lymph nodes but leaving pectoral muscles	1%
33405	Replacement, aortic valve, with cardiopulmonary bypass	1%
49505	Repair inguinal hernia, age 5 or over	1%
47610	Cholecystectomy with exploration of common duct	1%
58150	Total hysterectomy (corpus and cervix), with or without removal of tube(s), with or without removal of ovary(s)	1%

Source: 1986 BMAD Procedure File

Table 3.3

DISTRIBUTION OF CPT CODES

	Percent of Assistant-At-Surgery Dollars
Top 10 CPTs	40.0%
Top 100 CPTs	77.7%
Top 200 CPTs	86.7%
Top 300 CPTs	90.9%
Top 400 CPTs	93.2%
Top 500 CPTs	94.8%
Top 600 CPTs	95.9%

Source: 1986 BMAD Procedure File

surgery dollars. Collectively, though, the ten procedures may sum to a substantial fraction of the assistant-at-surgery dollars. To determine if such costly bundles without high-ranking procedures exist, we used a second method based on DRGs.

Because they were readily available, we used surgical DRGs to bundle procedures.[1] We then determined which DRGs used the largest share of assistant-at-surgery dollars. Table 3.4 shows the top 20 DRGs, which account for 79 percent of the assistant-at-surgery dollars.

Some DRGs are considered pairs because they are based on the same diagnoses and procedures, but one of the pair contains cases with

[1]The DRG is provided directly on the inpatient hospital claim. Information sufficient for computing the DRG is available on the outpatient hospital claim. Because the diagnostic information contained in the outpatient claim is not used for reimbursement, the quality, the order of diagnostic codes, and the detail may not be as rigorous. As a result, the DRG assignment for the outpatient surgeries may be less accurate than for the inpatient surgeries.

complications and/or comorbidities. For this analysis, we combine each "DRG pair" and treat them as a single DRG.

Having identified the DRGs using the most assistant-at-surgery dollars, we can then list all of the CPT procedures associated with a given DRG. Unfortunately, if the DRG is heterogenous, many dissimilar CPT procedures will be included in a bundle.

Of the top 20 DRGs, we found that three of them did not have a procedure ranked with the top 20 procedures. Appendix A provides tables showing the CPT codes associated with each of the top 20 DRGs, as well as the assistant-at-surgery dollars spent for each CPT within the DRG.

Table 3.4

DRGS USING MOST ASSISTANT-AT-SURGERY DOLLARS

DRG		Percent of Total Assistant-at-Surgery Dollars
209	Major Joint and Limb Reattachment Procedures	12.9%
106	Coronary Bypass with Cardiac Cath	10.6%
39	Lens Procedures with or without vitrectomy	7.9%
107	Coronary Bypass without Cardiac Cath	6.9%
110,111	Major Reconstruct Vascular Proc without Pump	6.8%
148,149	Major Small and Large Bowel Procs	6.0%
197,198	Total Cholecystectomy without C.D.E.	3.5%
5	Extracranial Vascular Procedures	3.4%
210,211	Hip and Femur Procs Except Major Joint	3.3%
214,215	Back and Neck Procedures	2.5%
105	Cardiac Valve Proc with Pump and without Cardiac Cath	1.7%
104	Cardiac Valve Proc with Pump and with Cardiac Cath	1.7%
154,155	Stomach, Esophageal, and Duodenal Procs	1.6%
161,162	Inguinal and Femoral Hernia Procs	1.6%
112	Vascular Procs Except Major Reconstruct, without Pump	1.6%
354,355	Non-radical Hysterectomy	1.6%
257,258	Total Mastectomy for Malignancy	1.4%
75	Major Chest Procedures	1.3%
195,196	Total Cholecystectomy with C.D.E.	1.2%
146,147	Rectal Resection	1.2%

Source: 1986 Part A-BMAD Linked File

IV. DETERMINANTS OF THE USE OF ASSISTANTS AT SURGERY

We were also interested in identifying other characteristics in addition to specific procedures that might be related to the use of assistants at surgery. We wished to describe the use of assistants at surgery in general as well as to identify characteristics that might highlight possible inappropriate uses.

We first investigate individually some of the possible determinants of the use of assistants at surgery. We consider the place of service, specialty of the primary surgeon and that of the assistant at surgery, characteristics of the beneficiary, and the geographic region. For inpatient and outpatient hospital surgeries, we consider characteristics of the hospital.

Some of the determinants we consider clearly impact each other. We therefore use a multivariate model to consider the combined effect of the determinants of the use of assistants at surgery.

PLACE OF SERVICE

There are two sources of information for determining the location of a surgery: the physician claim and the inpatient or outpatient hospital claim. The physician codes the place of service and submits this information as part of the physician bill. Table 4.1 shows the distribution of the use and dollars for assistants at surgery by the place of service provided on the physician bill. Eighty-six percent of the uses of assistants at surgery occur in an inpatient hospital setting. Surgeries performed in a hospital on an outpatient basis account for another 10 percent of the use of assistants at surgery.

We were also interested in knowing whether the assistants at surgery were being used for surgeries performed in an operating room. We wanted to exclude those minor surgical procedures that hospitals may code as surgeries, but for which an operating room is not used. We could identify such surgeries by the ICD-9-CM code, and by using the list of operating room procedures that define surgical DRGs. However,

Table 4.1

ASSISTANTS AT SURGERY BY PLACE OF SERVICE

Location	Percent of Instances	Percent of Dollars
Office	2%	2%
Inpatient	86%	87%
Outpatient	10%	9%
Ambulatory Surgery Center	1%	1%
Other	1%	1%
Total	100%	100%

Source: 1986 Part A-BMAD Linked File

the ICD-9-CM codes are available only on the inpatient and outpatient hospital record. As a result, to know whether or not a surgery using an assistant at surgery was performed in an operating room requires a physician bill that is successfully matched to either an inpatient or outpatient hospital record. (For example, a beneficiary eligible for Part B insurance but ineligible for Part A might have inpatient surgeries, but would not have a corresponding hospital claim.) Table 4.2 shows the use of assistants at surgery for physician claims that were successfully matched to either an inpatient or an outpatient record. For both inpatient and outpatient surgeries, almost all of the use and dollars for assistants at surgery occur for surgeries performed in an operating room.

Table 4.2

ASSISTANTS AT SURGERY BY PLACE OF SERVICE AND OPERATING ROOM PROCEDURE

Location	Percent of Instances	Percent of Dollars
Inpatient Hospital		
Operating Room	98.6%	98.8%
Not Operating Room	1.4%	1.2%
Outpatient Hospital		
Operating Room	97.4%	97.8%
Not Operating Room	2.6%	2.2%

Source: 1986 Part A-BMAD Linked File

SPECIALTY

Table 4.3 shows how often each specialty performs as an assistant at surgery. For example, general surgeons are assistants at surgery 32 percent of the time, and receive about 28 percent of the assistant-at- surgery dollars. Table 4.4 highlights the specialties that most often perform as assistants at surgery and that account for the most assistant-at-surgery dollars. General and family practitioners, and internists collectively perform as assistants at surgery 19 percent of the time, and account for 14 percent of the assistant-at-surgery dollars.

Since an assistant at surgery is supposed to be actively engaged in performance of the surgery, we wondered under what conditions general practitioners were being used as assistants at surgery. Table 4.5 shows that general surgeons are more likely to use a general practitioner for an assistant at surgery. General practitioners are also likely to use a fellow general practitioner as an assistant at surgery.

Table 4.3

PERCENTAGE OF ASSISTANT AT SURGERIES AND PERCENTAGE OF ASSISTANT AT SURGERY ALLOWED CHARGES BY SPECIALTY OF THE ASSISTANT AT SURGERY

Speciality	Specialty Code	Count of Assistants at Surgery	Allowed Charges for Assistants	Percent of Instances	Percent of Dollars
General Practice	01	3999	925883	9.1	6.5
General Surgery	02	14249	3959139	32.3	27.7
Allergy	03	2	438	0.0	0.0
Otology, etc.	04	286	78304	0.6	0.6
Cardiovascular Disease	06	789	456581	1.8	3.2
Dermatology	07	17	2788	0.0	0.0
Family Practice	08	3718	862267	8.4	6.0
Gastroenterology	10	38	6928	0.1	0.1
Internal Medicine	11	894	215279	2.0	1.5
Neurology	13	30	11834	0.1	0.1
Neurosurgery	14	536	214373	1.2	1.5
Ob-Gynecology	16	1403	285039	3.2	2.0
Ophthalmology	18	4501	1613112	10.2	11.3
Oral Surgery	19	22	6578	0.1	0.0
Orthopedic Surgery	20	4456	1720438	10.1	12.0
Pathology	22	11	3467	0.0	0.0
Plastic Surgery	24	134	37450	0.3	0.3
Physical Medicine	25	5	893	0.0	0.0
Psychiatry	26	15	4211	0.0	0.0
Proctology	28	156	39485	0.4	0.3
Pulmonary Disease	29	28	9269	0.1	0.1
Radiology	30	31	8138	0.1	0.1
Thoracic Surgery	33	3663	2416490	8.3	16.9
Urology	34	1673	426769	3.8	3.0
Pediatrics	37	46	12977	0.1	0.1
Geriatrics	38	1	655	0.0	0.0
Nephrology	39	11	2728	0.0	0.0
Hand Surgery	40	14	3799	0.0	0.0
Optometrist (aphakia)	41	1	258	0.0	0.0
Podiatry	48	569	91792	1.3	0.6
Group practice	(a)	2010	609423	4.5	4.2
Osteopathic specialties	(b)	91	26029	0.2	0.1
Other	(c)	763	265124	1.7	1.8
Total		44162	14317934	100.0	100.0

Source: 1986 Part A - BMAD Linked File.

(a) This category combines clinic or group practices (70) and other group practices (75).

(b) This category combines osteopathic gynecology (09), manual therapy (12), obstetrics (15), ophthalmology (17), peripheral vascular disease or surgery (23), roentgenology and radiology (31) and radiation therapy (32).

(c) This category combines miscellaneous (49), other medical supply (54), independent laboratories (69), unknown (99) and missing.

Table 4.4

SPECIALTIES MOST COMMONLY USED AS ASSISTANT AT SURGERY

Specialty	Percent of Instances	Percent of Dollars
General Surgery	32%	28%
Orthopedic Surgery	10%	12%
Ophthalmology	10%	11%
General Practice	9%	6%
Thoracic Surgery	8%	17%
Family Practice	8%	6%

Source: 1986 Part A-BMAD Linked File

Table 4.5

WHO USES A GENERAL PRACTITIONER AS AN ASSISTANT AT SURGERY

Speciality of Primary Surgeon	Percent of Surgeries	
	Any Assistant	GP as Assistant
Surgical Specialists	3.5%	0.2%
General Surgery	12.7%	1.7%
General Practice (GP,FP,IM)	0.3%	0.1%
Medical Specialists	0.2%	0.0%
Multi-Specialty Group	3.1%	0.2%

Source: 1986 Part A-BMAD Linked File

CHARACTERISTICS OF THE BENEFICIARY

We found that characteristics of the beneficiaries did not predict the use of assistants at surgery. The last column of Table 4.6 shows that across the range of ages, the use of assistants at surgery was relatively constant. Tables 4.7 and 4.8 show little difference across sex and race in the relative use of assistants at surgery.

REGION

Table 4.9 shows the rate of use of assistants at surgery for surgeries performed in inpatient and outpatient hospitals, as well as across all practice settings. Physicians in the Mountain and Pacific regions use a physician as an assistant at surgery for inpatient hospital surgeries about one third of the time. This rate of use is about two to three times as often as physicians in the rest of the country. Compared to the rest of the country, physicians in the

Table 4.6

PERCENTAGE OF ASSISTANTS AT SURGERY AND PERCENTAGE OF ASSISTANT AT SURGERY ALLOWED CHARGES BY AGE OF THE BENEFICIARY

Age range	Count of Assistants at Surgery	Allowed Charges for Assistants	Percent of Instances	Percent of Dollars	Percent of Surgeries Using an Assistant
0 - 44	679	184,342	1.5	1.3	3.1
45 - 49	280	89,945	.6	.6	3.4
50 - 54	394	131,732	.9	.9	3.2
55 - 59	678	242,896	1.5	1.7	3.3
60 - 64	1,312	481,745	3.0	3.4	3.6
65 - 69	10,834	3,663,160	24.5	25.6	3.6
70 - 74	11,023	3,720,352	25.0	26.0	3.4
75 - 79	9,095	2,933,886	20.6	20.5	3.4
80 - 84	5,693	1,715,121	12.9	12.0	3.1
85+	4,174	1,154,755	9.5	8.0	2.9
Total	44,162	14,317,934	100.0%	100.0%	3.3%

Source: 1986 Part A-BMAD Linked File

Table 4.7

PERCENTAGE OF ASSISTANTS AT SURGERY AND PERCENTAGE OF ASSISTANT AT SURGERY ALLOWED CHARGES BY SEX OF THE BENEFICIARY

Sex	Count of Assistants at Surgery	Allowed Charges for Assistants	Percent of Instances	Percent of Dollars	Percent of Surgeries Using an Assistant
Male	19,112	6,684,754	43.3	46.7	3.5
Female	25,050	7,633,180	56.7	53.3	3.2
Total	44,162	14,317,934	100.0%	100.0%	3.3%

Source: 1986 Part A-BMAD Linked File

Table 4.8

PERCENTAGE OF ASSISTANTS AT SURGERY AND PERCENTAGE OF ASSISTANT AT SURGERY ALLOWED CHARGES BY RACE OF THE BENEFICIARY

Race	Count of Assistants at Surgery	Allowed Charges for Assistants	Percent of Instances	Percent of Dollars	Percent of Surgeries Using an Assistant
Unknown	851	271,856	1.9	1.9	3.5
White	40,612	13,164,697	92.0	91.9	3.5
Black	2,033	640,861	4.6	4.5	3.5
Other	666	240,520	1.5	1.7	3.2
Total	44,162	14,317,934	100.0%	100.0%	3.3%

Source: 1986 Part A-BMAD Linked File

Mountain and Pacific regions are also much more likely to use a physician as an assistant for outpatient surgeries.

Table 4.10 looks at regional differences in the use of assistants at surgery in non-teaching hospitals. It separates the use of assistants at surgery for inpatient and outpatient surgeries in urban and rural areas. Even controlling for teaching status and rural areas, physicians in the Mountain and Pacific regions use assistants at surgery at least twice as often as physicians in the rest of the country.

Table 4.9

RATE OF USE OF ASSISTANTS AT SURGERY BY REGION

Census Region	Percent of Surgeries With an Assistant at Surgery		
	Inpatient Surgeries	Outpatient Surgeries	All Surgeries (a)
New England	16%	2%	3%
Mid-Atlantic	12%	5%	3%
South Atlantic	13%	2%	2%
East North Central	11%	2%	2%
East South Central	10%	1%	2%
West North Central	15%	1%	3%
West South Central	17%	2%	5%
Mountain	31%	9%	7%
Pacific	33%	11%	7%

Source: 1986 Part A-BMAD Linked File

(a) "All surgeries" includes surgeries performed in all settings including inpatient and outpatient hospitals, physicians' offices, and ambulatory surgery centers.

Hospitals in rural areas may have less ability to use substitute labor for assistants at surgery, and may therefore rely more on physicians to serve as assistants at surgery. For inpatient surgeries, physicians generally serve as an assistant at surgery as often in urban areas as in rural areas. But this result varies by region. For outpatient surgeries performed in hospitals, we find that physicians serve as assistants at surgery less often in hospitals in rural areas than in urban areas.

Table 4.10

PERCENTAGE OF SURGERIES WITH AN ASSISTANT AT SURGERY IN NON-TEACHING HOSPITALS CONTROLLING FOR URBAN/RURAL STATUS

	Inpatient Surgeries		Outpatient Surgeries	
Census Region	Urban	Rural	Urban	Rural
New England	24.6	30.9	2.4	1.6
Mid-Atlantic	19.0	20.5	7.7	1.3
South Atlantic	15.8	11.9	1.7	1.1
East North Central	17.1	21.2	1.4	1.6
East South Central	12.3	11.2	1.1	0.4
West North Central	14.6	23.9	0.7	0.7
West South Central	18.7	19.7	2.8	0.7
Mountain	33.2	36.0	9.4	7.1
Pacific	35.6	36.2	12.6	10.8
All Regions	21.1	20.1	4.9	1.9

Source: 1986 Part A-BMAD Linked File

Table B.1 in Appendix B details the use of assistants at surgery by carrier. The carriers are arranged according to census region. Even within each census region, there is still much variation across carriers in the use of and allowed charges for assistants at surgery.

CHARACTERISTICS OF THE HOSPITAL

To analyze how the type of hospital might influence the use of assistants at surgery, we linked data on hospital characteristics to inpatient and outpatient hospital records. The following tables consider rates of the use of assistants at surgery only for surgeries that were performed in a hospital setting.

Currently, Medicare does not pay for assistants at surgery for patients in hospitals with a teaching program related to the medical specialty required for the surgery. Exceptions are team physicians performing complex medical procedures, cases requiring a physician of another specialty during the surgery, and exceptional medical

circumstances. As a result, when analyzing the use of assistants at surgery, it is important to remember that teaching hospitals will have few submitted claims. Table 4.11 shows the claims submitted and dollars

Table 4.11

PERCENTAGE OF ASSISTANTS AT SURGERY AND PERCENTAGE OF ASSISTANT AT SURGERY ALLOWED CHARGES BY TEACHING STATUS OF HOSPITAL

Teaching Category	Count of Ass'ts at Surgery	Allowed Charges for Ass'ts at Surgury	Percent of Ass'ts at Surgery	Percent of Assistant-at-Surgery Dollars	Rate of Use of Ass'ts at Surgery	Percent of Total Surgery Dollars Paid to Ass'ts
Non-teach	26,470	7,917,790	73.2	66.5	14.5	5.7
Minor	9,152	3,705,450	25.3	31.1	9.1	4.3
Major	536	288,856	1.5	2.4	2.1	1.2
Total	36,158	11,912,096	100.0%	100.0%	11.7%	4.8%

Source: 1986 Part A-BMAD Linked File
Note: This table is based on surgeries performed in a hospital on either an inpatient or outpatient basis.

reimbursed for assistants at surgery by the teaching status of the hospital. Major teaching hospitals account for only 1.5 percent of the claims for assistants at surgery, and for 2.4 percent of the assistant-at-surgery dollars.

Table 4.12 shows rates at which disproportionate-share hospitals and rural hospitals use assistants at surgery. Table 4.12 also shows

the different rates of the use of assistants at surgery by region. We also differentiate the rates by the teaching status of the hospital. Whether or not a hospital has a disproportionate share of poor patients does not seem to influence the use of assistants at surgery. Except for major teaching hospitals, rural hospitals use assistants at surgery at the same rate as other hospitals. The difference in the use of assistants at surgery across regions is still large, even after controlling for the teaching status of the hospital. The Mountain and Pacific regions use assistants at surgery at least twice as much as other regions.

MULTIVARIATE ANALYSIS

In the analyses discussed up until now, we have looked at the variables individually. However, we know that many of the determinants of the use of assistants at surgery are interrelated. For instance, we know that medical schools are not evenly distributed across the United States. This means that any observed regional effect may be influenced by the geographic distribution of medical schools. It is important, therefore, to understand the collective effect of these variables and how they interact.

In this section we use a multivariate model for the use of assistants at surgery for inpatient surgeries. The dependent variable is a dummy variable for whether or not an assistant at surgery billed for the surgery. Because of the large number of cases considered here, we used an ordinary least squares model instead of a logit model.[1]

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[1]Given the size of our sample, the maximum likelihood logit model would have been too expensive.

Table 4.12

PERCENTAGE OF SURGERIES USING AN ASSISTANT AT SURGERY BY HOSPITAL CHARACTERISTIC AND CONTROLLING FOR TEACHING STATUS

Hospital Category	Type of Teaching Hospital		
	Major	Minor	Non-teaching
All	2.1	9.1	14.5
Rural	5.1	10.8	12.3
Urban	1.9	9.0	15.3
Disproportionate Share	2.0	9.7	14.7
Not Disproportionate Share	2.1	8.8	14.5
Census Region			
New England	1.6	7.7	14.3
Mid-Atlantic	2.0	8.7	14.4
South Atlantic	1.8	7.1	10.1
East North Central	1.1	4.5	11.3
East South Central	1.1	6.4	7.8
West North Central	0.4	7.9	11.8
West South Central	3.4	12.0	13.9
Mountain	3.0	21.8	25.2
Pacific	8.0	22.6	27.0

Source: 1986 Part A-BMAD Linked File
Note: This table is based on surgeries performed in a hospital on either an inpatient or outpatient basis.

The first set of variables describes the characteristics of the patient. Available patient demographic information includes age, sex, and race. In this analysis, we used the natural log of age. To capture differences between the aged and the disabled populations, we used an indicator for disabled beneficiaries under the age of 65. To capture the separate effects of aging on these two population groups, we included an interaction term (log of age multiplied by the indicator for disabled beneficiaries under the age of 65).

As a measure of the health of the beneficiary, we included variables that count the number of diseased body systems.[2] These multi-system disease variables are designed as a simple measure of case complexity using the data readily available within the hospital claim. This severity measure is similar to the one developed by Mendenhall (1984), which is based on assigning diagnoses to major diagnostic categories (MDCs) and then counting the number of distinct MDCs. Using the ICD-9-CM classification, nine distinct body systems were identified. These are listed in Table 4.13 with the associated ranges for the ICD-9-CM codes. We excluded some major categories in the ICD-9-CM classification system from the count of diseased body systems. Some categories, such as infections and parasites, or injury and poisoning, are more pervasive, and not confined to a single body system. Neoplasms are also categorized separately by the ICD-9-CM system. We excluded other categories if they did not pertain to the Medicare population, such as complications of pregnancy. As a result of these exclusions, a patient could potentially be identified as having no body system involvement. The maximum possible number of involved body systems is nine.

In each hospital claim, both the principal diagnosis and all coded secondary diagnoses are used for counting the number of diseased body systems. A patient with three respiratory conditions and one musculoskeletal disorder would be considered to have two diseased body systems.

In this analysis, we consider the additional increment in the use of assistants at surgery associated with each additional involved body system. By developing indicator variables that identify each additional involved body system, regression coefficients for each indicator variable then represent the additional increment associated with the additional involved body system. The variable DMULT1 identifies patients with involvement of more than one body system, and DMULT2 identifies patients with involvement of more than two body systems. Therefore, anyone with DMULT2=1 will also have DMULT1=1.

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[2]The methodology described here was also used to describe expensive and long-staying Medicare patients in Trude et al. (1989).

Table 4.13

RANGES OF CODES ASSOCIATED WITH BODY SYSTEM

Codes	Body System
240-279	Endocrine, nutritional, and metabolic diseases and immunity disorders
280-289	Diseases of the blood and blood-forming organs
320-389	Diseases of the nervous system and sense organs
390-459	Diseases of the circulatory system
460-519	Diseases of the respiratory system
520-579	Diseases of the digestive system
580-629	Diseases of the genitourinary system
680-709	Diseases of the skin and subcutaneous tissue
710-739	Diseases of the musculoskeletal system and connective tissue

If some of the variables in our model tend to be associated with certain illnesses or surgeries that are more likely to require an assistant at surgery, the regression coefficients for these variables may reflect an effect that is really attributable to the illness or surgery. To control for the effect of the patient's illness, we included a dummy variable for each DRG. Although the coefficients for each DRG are not particularly of interest, including a dummy for each DRG will pick up the association of specific illnesses with the use of assistants at surgery. Some DRGs are paired so that both DRGs are assigned by the same principal diagnosis and procedures. However, one of the DRGs in a "DRG pair" is assigned to patients with complications and comorbidities, or to patients 70 years or older. Since we are already including variables in our model to account for age and case complexity, we treated each DRG pair as a single DRG. That is, we assigned a single DRG dummy to each of the DRGs in a DRG pair.

We also consider characteristics of the surgery. The variable TEAM indicates surgeries with more than one primary surgeon, and in which the primary surgeons were different specialties. We also included a variable that indicates if more than one procedure was performed during the surgery.

Because teaching hospitals have fewer Medicare claims for assistants at surgery, we included two dummy variables to indicate the type of teaching hospital. Major teaching hospitals are those hospitals with an intern-to-bed ratio greater than or equal to .25. A minor teaching hospital has a nonzero intern-to-bed ratio that is less than .25.

We include dummy variables for the specialty of the primary surgeon. Medical specialties, such as geriatrics, that do not account for many surgeries, and very rarely use an assistant at surgery, are combined into the category "Other Medical." Surgical specialties with very few cases are combined into the category "Other Surgical." Group practices that include multiple specialties are identified separately by the variable GROUP. For the least squares regression, the default specialty is general surgeon.

We also include a dummy variable to identify hospitals in rural areas. We consider a hospital to be in an urban area if it is located in a Metropolitan Statistical Area. Otherwise we consider the hospital to be in a rural area.

Geographic regions of the country are grouped according to census region. For the regression, the default region is South Atlantic. Table B.1 lists the carriers and states that comprise each region.

Table 4.14 shows the results of the ordinary least squares regression of the use of an assistant at surgery on the independent variables.

The regression model includes three variables that measure age, disability status, and the interaction between age and disability status. Medicare beneficiaries under 65 years of age are all disabled, and we included a dummy variable to identify them. Instead of interpreting the three regression coefficients directly, it helps to calculate the combined contribution at given ages. The contribution of age for persons under 65 years is the sum of the coefficient for the indicator for those under 65 years, the coefficient for the indicator for those under 65 years multiplied by the log of age, and the coefficient for age multiplied by the log of age. For patients 65 years

Table 4.14

ASSISTANT AT SURGERY REGRESSION MODEL, INPATIENT SURGERIES

Variable	Coefficient	T-Statistic	Significance Level
Patient Demographics			
AGE LESS THAN 65	-0.2546	-5.18	0.0001
LOG(AGE)	-0.0503	-6.00	0.0001
AGE INTERACTION	0.0588	4.95	0.0001
MALE	-0.0012	-0.78	0.4382
BLACK	-0.0054	-2.01	0.0439
DMULT1	-0.0041	-2.44	0.0147
DMULT2	-0.0003	-0.13	0.8954
DMULT3	-0.0004	-0.10	0.9210
DMULT4	0.0107	0.89	0.3731
Hospital Characteristics			
RURAL	0.0164	7.87	0.0001
TEAM	0.0193	4.73	0.0001
MULTIPLE PROCS	0.0273	14.08	0.0001
MINOR TEACHING	-0.0811	-49.11	0.0001
MAJOR TEACHING	-0.1735	-65.59	0.0001
Specialty of Primary Surgeon			
GROUP	-0.0635	-18.66	0.0001
GENERAL PRACTICE	-0.0948	-33.69	0.0001
CARDIOVASCULAR	-0.1034	-25.09	0.0001
OSTEO	-0.1105	-6.81	0.0001
GASTRO	-0.1186	-32.70	0.0001
NEUROSURGERY	-0.0223	-3.18	0.0015
OB/GYNECOLOGY	-0.0182	-2.15	0.0316
OPHTHALMOLOGY	-0.0143	-1.31	0.1917
OTOLARYN	-0.0474	-6.25	0.0001
OTHER SURGICAL	-0.0591	-2.60	0.0093
ORTHOPEDICS	-0.0088	-2.06	0.0395
OTHER MEDICAL	-0.1379	-28.04	0.0001
PLASTIC SURGERY	-0.0441	-5.13	0.0001
PROCTOLOGY	-0.0522	-5.16	0.0001
PULMONARY	-0.1062	-18.31	0.0001
THORACIC	0.0477	13.18	0.0001
UROLOGY	-0.0908	-21.92	0.0001
PODIATRY	-0.0571	-6.76	0.0001
MISCELLANEOUS	-0.1523	-8.51	0.0001
Census Region			
NEW ENGLAND	0.0653	18.99	0.0001
MID ATLANTIC	0.0450	18.65	0.0001
EAST NORTH CENTRAL	0.0070	2.84	0.0045
EAST SOUTH CENTRAL	-0.0193	-6.22	0.0001
WEST NORTH CENTRAL	0.0272	8.97	0.0001
WEST SOUTH CENTRAL	0.0421	15.43	0.0001
MOUNTAIN	0.1616	41.65	0.0001
PACIFIC	0.1896	69.07	0.0001

Note: The sample size used in this analysis is 193,673. The R-square for this model is .29. Dummy variables for each DRG were included in this regression, but the coefficients are not shown here.

and older, the contribution of age is only the coefficient for age multiplied by the log of age. Table 4.15 shows the results of these calculations.

We found that surgeries in the disabled populations are slightly less likely than those in the aged population to have an assistant at surgery. In the aged population, increasing age at surgery is associated with a decreasing likelihood of having an assistant at surgery. In the disabled population, increasing age at surgery is associated with an increasing likelihood of having an assistant at surgery.

In the univariate analysis of race, we found no difference in the use of assistants at surgery for blacks. In the multivariate analysis we find a slight, but significant, decreased likelihood that blacks will have a surgery involving an assistant at surgery. We found no difference in the use of assistants at surgery based on sex.

We included variables measuring the number of diseased body systems to determine if the health status of the beneficiary was associated with the use of an assistant at surgery. More than one diseased body system

Table 4.15

COMBINED CONTRIBUTION OF AGE COEFFICIENTS

	Combined Coefficient
Disabled only	
40	-.2232
50	-.2213
60	-.2198
Aged and/or Disabled	
65	-.2100
70	-.2137
80	-.2204
90	-.2263

is associated with a decreased use of assistants at surgery, and variables measuring more than two diseased body systems show no significant relationship. Patients with multiple diseased body systems may be less likely to undergo surgery complex enough to require the use of an assistant at surgery.

We had initially suspected that the use of team surgery may be a substitute for the use of a primary surgeon and an assistant at surgery. That is, some assistants at surgery may be billing as primary surgeons. In that case, we would expect to find that team surgeries, as we have defined them, are less apt to use assistants at surgery. We did not find that result. Instead, team surgeries are more likely to use a physician as an assistant at surgery. The team surgeries are probably very complex and intensive, requiring more than one surgeon from different specialties as well as an assistant at surgery.

The result that an assistant at surgery is more apt to be used in a surgery involving more than one procedure provides supportive evidence that assistants at surgery are being used for more complex surgeries.

This model shows that physicians in rural areas are somewhat more likely to use a physician as an assistant at surgery than those in urban areas.

As would be expected, teaching hospitals show a marked decrease in the use of assistants at surgery. This results from teaching hospitals not submitting claims to Medicare for assistants at surgery; it is not a true reflection of their use of assistants at surgery.

General surgeons are the omitted specialty group in this regression. Only thoracic surgeons are more likely than general surgeons to use an assistant at surgery.

Even after controlling for the effect of teaching hospitals, a strong regional effect is shown. The South Atlantic region is the omitted category, and serves as the comparison region. The West (specifically the Mountain and Pacific regions) is much more apt to use assistants at surgery than other regions in the country.

We also ran individual regressions for each of the top 20 DRGs associated with the most assistant-at-surgery dollars. We wanted to determine if the effects observed with the single model varied across DRGs. The results for each of the individual regression models are provided in Appendix C. We found that some effects do vary, depending on the DRG. For example, for most of the individual DRG regressions, the coefficient for the variable identifying hospitals in rural areas is either insignificant or positive but small. However, for lens procedures (DRG 39) and coronary bypass without cardiac catheterization (DRG 107), hospitals in rural areas are less likely to use an assistant at surgery.

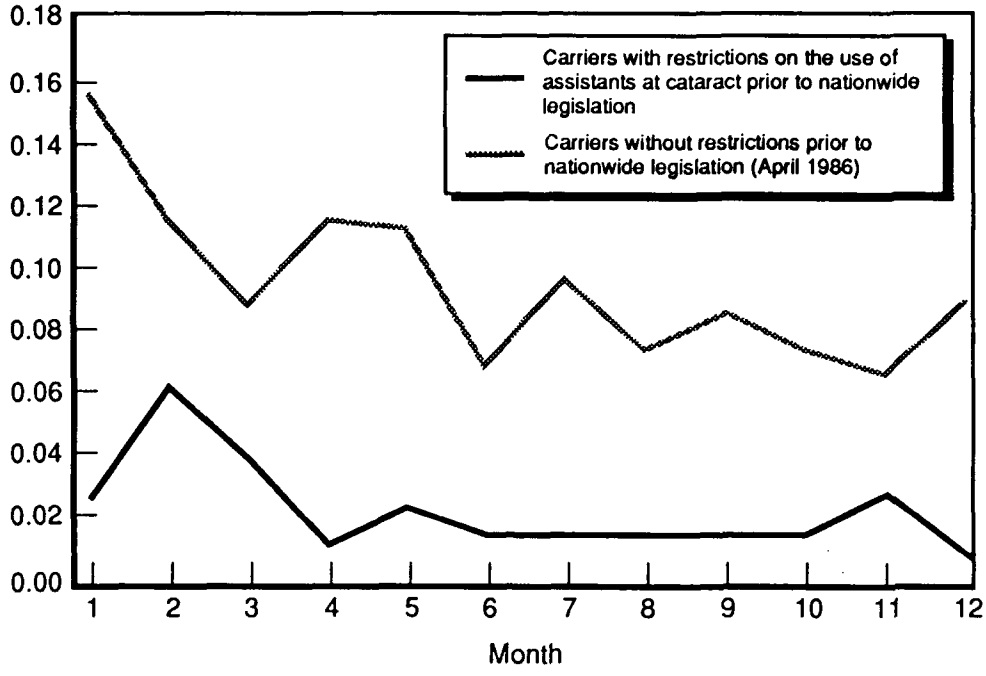
Although we did find some differences in the effects of the variables across the DRGs, two of the strongest effects in our single model also hold true for the individual DRG models. As would be expected, teaching hospitals consistently submit fewer claims for assistants at surgery. More remarkably, for each DRG model, the physicians in the Mountain and Pacific regions are associated consistently with a greater use of assistants at surgery than physicians in other regions of the country.

V. DISCUSSION

In 1985, the Office of the Inspector General conducted a review of Medicare payments to assistants at cataract surgery. It estimated that the Health Care Financing Administration could garner savings of $30 to $40 million per year by eliminating payments for assistants at surgery for routine cataract operations. The Office of the Inspector General recommended that the primary surgeon could obtain prior approval for the use of an assistant at surgery, if conditions existed that required it.

At the time of the Inspector General's report, carriers in nine states already had restrictions on the use of assistant surgeons for routine cataract operations. The states were Alabama, Florida, Hawaii, Kansas, Missouri, North Dakota, South Carolina, Tennessee, and Virginia. In these nine states, 151,000 cataract operations were performed with 1,800 uses of an assistant at surgery. (This is a rate of about 1 percent.) The Office of the Inspector General did a separate analysis using a 29-state area. That analysis found 576,000 cataract surgeries were performed, with 88,000 of them using an assistant at surgery. (This is a rate of about 15 percent.)

Figure 5.1 shows the relative use of assistants at cataract surgery for calendar year 1986. We compute the relative rate of use of assistants at surgery by taking the ratio of the number of uses of assistants at cataract surgery to the number of cataract surgeries. Because of delays, actual implementation of the prior approval legislation did not begin until April 1, 1986. We show the rates of use of assistants at cataract surgery separately for carriers that had already implemented restrictions and for carriers that had not implemented restrictions prior to the legislation. In Figure 5.1, we see declines in the use of assistants at surgery for both groups of carriers. However, not surprisingly, the decline in the use of assistants at surgery is greater for the carriers that had not already implemented restrictions on such use.



SOURCE: 1986 Part A-BMAD *linked file.*

Fig. 5.1—Rate of use of assistants at cataract surgery by month

We estimate that the total annual savings from requiring prior approval nationwide is about $11.7 million. To make this estimate from the cataract ruling, we used the rate at which assistants at surgery were used during the first four months of 1986. We then multiplied this rate times the dollars spent on cataract surgery during 1986 times the 20 percent reimbursement rate for assistants at surgery. So, without a cataract ruling, we estimate that the annual costs would be about $34 million. To determine how much would have been spent had the ruling been in place for the whole year, we multiplied the dollars spent on cataract surgery in 1986 times the 20 percent reimbursement rate times the rate of use of assistants at surgery during the last six months of 1986. (We did not use the months of April and May in our calculations

to allow for any implementation problems or delays.) We estimate that had the ruling been in place all year, Medicare would have paid $22.3 million for assistants at cataract surgery. The estimated savings from the ruling, ($11.7 million) is, therefore, the difference in the two estimates.

Although these savings are not as large as expected, the cataract ruling did garner significant savings. It therefore makes sense to look for additional procedures for which prior approval might provide similar savings. In our analysis, we did not find a procedure that would provide savings on the same scale as cataract surgery. Cataract procedures are unique in being both expensive and high volume. This assures significant savings. Cataract procedures are also more amenable to the requirement of prior approval.

This analysis identified both procedures and DRGs that use the largest share of the assistant-at-surgery dollars. Medical experts can decide on the appropriateness of requiring prior approval for these procedures. However, the expected savings would be far less than what has been achieved by requiring prior approval for the use of assistants at cataract surgery.

We also briefly looked to determine if there was much billing for assistants at surgery for procedures where an assistant would seem medically unnecessary. Two readily identifiable categories are endoscopies and "starred" procedures. Starred procedures are identified in the CPT manual by a small star, and are considered relatively small surgical services that include variable preoperative and postoperative services. Examples of starred procedures are biopsies and drainage of abscesses.

First, we identified all the endoscopies in our 5 percent sample of beneficiaries for which an assistant at surgery submitted a bill to Medicare. We found only 126 instances. We then looked at starred procedures. We found only 82 instances in which an assistant at surgery billed for a starred procedure. Such a small number of instances could represent exceptional circumstances, inappropriate coding, or some other errors in the data.

We were also interested in determining other factors that influence the use of assistants at surgery. We found that thoracic and general surgeons are most likely to use assistants at surgery. General surgeons had the greatest propensity to use a general practitioner as an assistant. Future work in this area will attempt to determine if a general practitioner is used as an assistant only occasionally by most general surgeons, or whether it is the usual practice for a small number of general surgeons. We will also consider whether general practitioners are more apt to serve as assistants at surgery in rural areas.

We found a striking regional effect. Physicians in the Mountain and Pacific regions are more than twice as likely to use an assistant at surgery as are physicians practicing in other parts of the country. Policymakers might want to consider investigating the reasons for these differences, and possibly have carriers or peer review organizations review the medical necessity for the use of assistants at surgery in these regions.

We also ran regressions individually for each of the DRGs associated with the most assistant-at-surgery dollars. We wanted to determine if the effects observed with the single model differed for each DRG. The results for each individual regression model are provided in Appendix C. There are some effects that vary depending on the DRG. For example, the use of assistants at surgery by physicians in rural areas depends on the DRG. For lens procedures (DRG 39) and coronary bypass without cardiac catheterization (DRG 107), physicians in rural areas are less likely to use an assistant at surgery. For non-radical hysterectomy (DRG 354 and 355) and extracranial vascular procedures (DRG 5), physicians in rural areas use assistants at surgery more often than physicians in urban areas.

Although there are some differences in the effects across the DRGs, two of the strongest effects in the single model also hold true for the individual models by DRG. As would be expected, teaching hospitals are consistently associated with fewer claims for assistants at surgery. More notably, for each DRG model, the physicians in the Mountain and

Pacific regions consistently use more assistants at surgery than physicians in other regions of the country.

Appendix A

CPT CODES IN THE TWENTY DRGS WITH THE HIGHEST EXPENDITURES ON ASSISTANTS

Tables A.1 to A.20 show the CPT codes associated with each of the twenty DRGs using the most assistant-at-surgery dollars. For each CPT code within each DRG, we provide the assistant-at-surgery dollars paid for that CPT code for that DRG. We also present the percent of the total dollars for the DRG that that CPT code represents. The tables are presented in DRG numerical order. Table 3.4 shows the DRGs ranked by assistant-at-surgery dollars.

Table A.1

DRG 5: EXTRACRANIAL VASCULAR PROCEDURES

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
35301	359,448	91
33570	6,791	2
35001	3,831	1
35606	3,327	1
other	22,364	5
Total	395,761	100%

Table A.2

DRG 39: LENS PROCEDURES WITH OR WITHOUT VITRECTOMY

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
66984	643,309	69
66983	189,937	20
66985	33,223	4
67036	14,945	2
67005	8,921	1
67010	7,546	1
other	31,150	3
Total	929,031	100%

Table A.3

DRG 75: MAJOR CHEST PROCEDURES

CPA Code	Assistant-at-Surgery Dollars	Percent of Dollars
32480	83,101	54
32500	15,614	10
32440	14,180	9
32100	12,379	8
other	28,977	19
Total	154,251	100%

Table A.4

DRG 104: CARDIAC VALVE PROCEDURE WITH PUMP AND WITH CARDIAC CATHETER

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
35405	58,410	30
33430	36,276	19
33511	24,487	13
33512	15,158	8
33510	9,963	5
33999	8,580	4
35483	5,761	3
33513	5,710	3
33480	3,977	2
33425	3,670	2
other	22,047	11
Total	194,039	100%

Table A.5

DRG 105: CARDIAC VALVE PROCEDURE WITH PUMP AND WITHOUT CARDIAC CATHETER

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
33405	71,900	35
33430	42,164	21
33511	20,853	10
33512	12,346	6
33510	9,943	5
other	45,784	23
Total	202,990	100%

Table A.6

DRG 106: CORONARY BYPASS WITH CARDIAC CATHETER

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
33513	392,788	32
33512	379,207	30
33514	160,470	13
33511	144,172	12
33516	48,740	4
33510	37,434	3
other	80,923	6
Total	1,243,734	100%

Table A.7

DRG 107: CORONARY BYPASS WITHOUT CARDIAC CATHETER

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
33512	311,273	39
33513	211,568	26
33514	104,708	13
33511	91,293	11
33516	31,205	4
33510	22,290	3
other	35,515	4
Total	807,852	100%

Table A.8

DRGS 110 AND 111: MAJOR RECONSTRUCTIVE VASCULAR PROCEDURES WITHOUT PUMP

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
35081	149,340	19
35556	91,190	11
35656	70,705	9
35082	51,453	6
35102	50,967	6
35566	42,553	5
35646	40,522	5
35546	22,157	3
35661	17,974	2
37799	13,081	2
35371	12,282	2
35621	12,043	2
35666	11,313	1
35549	11,108	1
35585	9,783	1
35558	9,682	1
34201	9,662	1
other	168,607	23
Total	794,422	100%

Table A.9

DRG 112: VASCULAR PROCEDURES EXCEPT MAJOR RECONSTRUCTION, WITHOUT PUMP

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
35301	18,735	10
34201	15,428	9
35371	15,235	8
92982	14,495	8
35081	11,698	7
35082	9,861	5
35141	7,801	4
33999	7,356	4
35381	7,093	4
other	74,803	41
Total	182,505	100%

Table A.10

DRGS 146 AND 147: RECTAL RESECTION

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
45110	45,569	32
44145	22,446	16
44143	21,921	15
44140	10,324	7
other	43,535	30
Total	143,795	100%

Table A.11

DRGS 148 AND 149: MAJOR SMALL AND LARGE BOWEL PROCEDURES

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
44140	281,835	40
44145	60,619	9
44120	58,977	8
44143	29,957	4
44160	29,569	4
44150	23,659	3
44320	19,632	3
44144	17,074	2
44141	16,789	2
other	169,098	25
Total	707,209	100%

Table A.12

DRGS 154 AND 155: STOMACH, ESOPHAGEAL, AND DUODENAL PROCEDURES

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
43630	25,878	14
43635	19,801	10
43640	15,431	8
43840	14,474	8
other	113,407	60
Total	188,991	100%

Table A.13

DRGS 161 AND 162: INGUINAL AND FEMORAL HERNIA PROCEDURES

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
49505	114,860	61
49520	22,121	12
49530	9,555	5
49525	8,352	5
other	32,450	17
Total	187,338	100%

Table A.14

DRGS 195 AND 196: TOTAL CHOLECYSTECTOMY WITH C.D.E.

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
47610	99,912	68
47605	9,183	6
47620	6,275	4
47760	6,087	4
other	24,978	18
Total	146,435	100%

Table A.15

DRGS 197 AND 198: TOTAL CHOLECYSTECTOMY WITHOUT C.D.E.

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
47605	215,186	53
47600	138,285	34
47610	15,601	4
other	38,588	9
Total	407,660	100%

Table A.16

DRG 209: MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
27130	521,898	34
27447	510,786	34
27236	131,828	9
27132	77,214	5
27135	44,534	3
27131	35,330	2
27125	30,289	2
27134	29,672	2
other	131,760	9
Total	1,513,311	100%

Table A.17

DRGS 210 AND 211: HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
27244	211,797	54
27236	67,087	17
27235	26,625	7
27506	21,487	6
other	62,550	16
Total	389,546	100%

Table A.18

DRGS 214 AND 215: BACK AND NECK PROCEDURES

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
63030	40,443	14
63017	40,239	14
63042	31,406	11
63031	25,591	9
63005	22,464	8
63035	17,796	6
other	109,355	38
Total	287,294	100%

Table A.19

DRGS 257 AND 258: TOTAL MASTECTOMY FOR MALIGNANCY

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
19240	137,133	83
19180	8,504	5
19200	7,969	5
other	12,055	7
Total	165,661	100%

Table A.20

DRGS 354 AND 355: NON-RADICAL HYSTERECTOMY

CPT Code	Assistant-at-Surgery Dollars	Percent of Dollars
58150	88,184	48
58265	44,711	25
58260	12,498	7
other	37,003	20
Total	182,396	100%

Appendix B

USE OF ASSISTANTS BY CARRIER AND REGION

Table B.1 shows the use of assistants at surgery by carrier and census region.

Table B.1

ASSISTANT AT SURGERY ALLOWED CHARGES BY CENSUS REGION AND CARRIER (1 of 2)

Census Region and Carrier		Count of Ass'ts at Surgery	Allowed Charges for for Ass'ts at Surgery	Percent of Ass'ts at Surgery	Percent of Assistant-at-Surgery Dollars	Rate of Use of Ass'ts at Surgery	Total Surgery Dollars Paid to Ass'ts
New England							
00700	MA	925	206409	2.1	1.4	2.7	2.2
00780	NH/VT	324	68651	0.7	0.5	4.8	4.1
00870	RI	296	77687	0.7	0.5	2.7	4.3
10230	CT	533	173657	1.2	1.2	1.6	3.2
21200	ME	318	65169	0.7	0.5	4.7	3.9
Mid-Atlantic							
00801	NY/West	1152	261058	2.6	1.8	3.3	3.7
00803	NY/Empire	1501	638066	3.4	4.5	2.6	3.1
00865	PA	1342	406322	3.0	2.8	1.3	1.8
13310	NJ	3015	1010967	6.8	7.1	5.5	5.3
14330	NY/Group	363	155434	0.8	1.1	3.4	3.1
South Atlantic							
00570	DE	27	10090	0.1	0.1	0.7	1.3
00580	WashDC	86	38773	0.2	0.3	0.5	1.0
00590	FL	2528	840576	5.7	5.9	2.6	3.1
00690	MD	447	129401	1.0	0.9	1.8	2.7
00880	SC	160	55109	0.4	0.4	1.3	2.2
10490	VA	210	67705	0.5	0.5	1.2	1.5
13110	GA	858	249986	1.9	1.7	3.5	3.2
13340	NC	1685	543467	3.8	3.8	4.9	3.5
16510	WV	206	59052	0.5	0.4	2.7	2.0
East North Central							
00621	IL	1621	472376	3.7	3.3	4.0	3.0
00630	IN	590	163241	1.3	1.1	2.8	2.4
00710	MI	954	249389	2.2	1.7	1.0	2.2
10250	MS	366	93248	0.8	0.7	3.2	2.8
16360	OH	1015	299945	2.3	2.1	1.8	1.8
East South Central							
00510	AL	403	119663	0.9	0.8	1.4	2.4
00660	KY	486	132128	1.1	0.9	2.1	3.2
05440	TN	480	147853	1.1	1.0	1.7	2.1

Table B.1

ASSISTANT AT SURGERY ALLOWED CHARGES BY CENSUS REGION AND CARRIER (2 of 2)

Census Region and Carrier		Count of Ass'ts at Surgery	Allowed Charges for for Ass'ts at Surgery	Percent of Ass'ts at Surgery	Percent of Assistant-at-Surgery Dollars	Rate of Use of Ass'ts at Surgery	Total Surgery Dollars Paid to Ass'ts
West North Central							
00640	IA	403	105077	0.9	0.7	2.4	3.3
00645	NE	293	57904	0.7	0.4	3.5	3.4
00650	KS/Blue	364	104640	0.8	0.7	2.7	4.2
00720	MN	131	23804	0.3	0.2	2.6	2.4
00740	MO/Blue	231	72644	0.5	0.5	2.6	2.3
00820	ND/SD	339	81732	0.8	0.6	4.7	3.4
10240	MN	246	71169	0.6	0.5	3.6	2.7
11260	MO/General	673	187091	1.5	1.3	2.4	2.7
West South Central							
00520	AR	248	86246	0.6	0.6	2.4	2.9
00528	LA	760	231804	1.7	1.6	5.1	4.1
00900	TX	2662	877484	6.0	6.1	4.6	3.7
01370	OK	606	166617	1.4	1.2	4.7	3.7
Mountain							
00550	CO	769	173182	1.7	1.2	7.4	6.2
00751	MT	143	39520	0.3	0.3	5.1	5.7
00910	UT	168	45594	0.4	0.3	3.3	3.7
01030	AZ	1185	387696	2.7	2.7	7.0	5.9
01290	NV	313	120529	0.7	0.8	8.4	6.8
01360	NM	388	118757	0.9	0.8	7.8	6.8
05130	ID	319	75972	0.7	0.5	5.4	6.5
05530	WY	84	20066	0.2	0.1	7.7	7.0
Pacific							
00542	CA/Blue	3243	1228889	7.3	8.6	5.8	7.0
00930	WA	1010	297596	2.3	2.1	5.5	5.1
01020	AK	47	19647	0.1	0.1	11.8	8.9
01120	HI	39	8263	0.1	0.1	1.2	0.8
01380	OR	1049	288423	2.4	2.0	8.3	6.5
02050	CA/Occid	5936	2504237	13.4	17.5	8.0	7.5
Other							
10071	Railroad	622	187928	1.4	1.3	4.2	3.6
Total		44,162	14,317,934	100.0%	100.0%	3.3%	3.8%

Source: 1986 Part A-BMAD Linked File
Note: Carrier 00951 (Wisconsin) is not in the dataset.
(a) This includes all surgeries regardless of practice setting.

Appendix C

INDIVIDUAL DRG REGRESSIONS

Tables C.1 to C.19 show the results of the regression models for each of the top 20 DRGs that account for the most assistant-at-surgery dollars. The individual models presented here are similar to the model presented in Table 4.14. However, since certain specialties are going to provide for the majority of care of patients in a particular DRG, we have only included the dummy variables for the specialties relevant to that particular DRG. For all of the individual regressions, the general surgeon is the omitted specialty.

We noted earlier that black patients are slightly less likely to have an assistant at surgery during surgery. This effect is especially strong for extracranial vascular procedures (DRG 5), major reconstructive vascular procedures (DRGs 110 and 111), total cholecystectomy (DRG 197 and 198), hip and femur procedures except major joint (DRG 210 and 211), and non-radical hysterectomy (DRG 354 and 355). This effect is not present or insignificant for the other DRG regressions.

Across all of the individual regressions by DRG, physicians in the Mountain and Pacific regions are more likely to use an assistant at surgery than are physicians in the rest of the country. Interestingly, for lens procedures (DRG 39), physicians in the Mid-Atlantic region use assistants at surgery on a par with the physicians in the Mountain and Pacific regions.

The use of assistants at surgery in rural hospitals depends on the DRG. For lens procedures (DRG 39) and coronary bypass without cardiac catheterization (DRG 107), rural hospitals are less likely to use an assistant at surgery. For non-radical hysterectomy (DRG 354 and 355) and extracranial vascular procedures (DRG 5), physicians in rural areas use assistants at surgery more often than physicians in urban areas.

Table C.1

DRG 5: EXTRACRANIAL VASCULAR PROCEDURES

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	-0.0988	-0.187	0.8517
AGE LESS THAN 65	0.0126	0.009	0.9930
LOG(AGE)	0.1531	1.245	0.2133
AGE INTERACTION	0.0030	0.008	0.9933
MALE	-0.0068	-0.389	0.6974
BLACK	-0.1370	-2.675	0.0075
DMULT1	-0.0152	-0.798	0.4250
DMULT2	-0.0045	-0.159	0.8740
NEW ENGLAND	0.0440	0.872	0.3831
MID ATLANTIC	0.0177	0.557	0.5778
EAST NORTH CENTRAL	0.0148	0.509	0.6110
EAST SOUTH CENTRAL	0.0550	1.468	0.1423
WEST NORTH CENTRAL	0.0488	1.283	0.1995
WEST SOUTH CENTRAL	0.1326	4.126	0.0001
MOUNTAIN	0.2853	5.505	0.0001
PACIFIC	0.3358	10.713	0.0001
RURAL	0.1168	4.146	0.0001
TEAM	-0.0301	-0.540	0.5890
MULTIPLE PROCS	-0.0784	-2.925	0.0035
MINOR TEACHING	-0.2348	-12.234	0.0001
MAJOR TEACHING	-0.3934	-10.749	0.0001
GROUP	-0.1034	-2.632	0.0085
GENERAL PRACTICE	-0.2818	-5.095	0.0001
CARDIOVASCULAR	-0.0903	-2.579	0.0100
NEUROSURGERY	-0.1456	-4.629	0.0001
OTHER MEDICAL	-0.5024	-12.737	0.0001
THORACIC	0.0422	1.908	0.0565
OTHER SPECIALTY	-0.3106	-5.871	0.0001

Note: The sample size for this regression is 2540 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .46.
The R-square for this regression is .26.

Table C.2

DRG 39: LENS PROCEDURES WITH OR WITHOUT VITRECTOMY

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.2951	0.704	0.4816
AGE LESS THAN 65	-0.0132	-0.015	0.9877
LOG(AGE)	-0.0740	-0.823	0.4109
AGE INTERACTION	-0.0020	-0.009	0.9925
MALE	0.0385	2.181	0.0293
BLACK	-0.0019	-0.065	0.9484
DMULT1	0.0213	1.109	0.2677
DMULT2	-0.0001	-0.006	0.9955
NEW ENGLAND	0.0191	0.465	0.6419
MID ATLANTIC	0.1644	6.370	0.0001
EAST NORTH CENTRAL	-0.0103	-0.289	0.7724
EAST SOUTH CENTRAL	-0.0469	-0.989	0.3230
WEST NORTH CENTRAL	-0.0360	-1.056	0.2913
WEST SOUTH CENTRAL	0.0555	1.225	0.2207
MOUNTAIN	0.1856	2.764	0.0058
PACIFIC	0.2451	4.662	0.0001
RURAL	-0.1022	-3.835	0.0001
TEAM	0.0763	0.413	0.6799
MULTIPLE PROCS	0.0219	0.848	0.3965
MINOR TEACHING	0.0599	3.214	0.0013
MAJOR TEACHING	-0.1080	-4.251	0.0001
OPHTHALMOLOGY	0.0911	0.649	0.5162
OTHER SPECIALTY	-0.0297	-0.207	0.8362

Note: The sample size for this regression is 2079 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .18.
The R-square for this regression is .11.

Table C.3

DRG 75: MAJOR CHEST PROCEDURES

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	1.6054	2.539	0.0112
AGE LESS THAN 65	-1.2790	-1.110	0.2673
LOG(AGE)	-0.2864	-1.936	0.0530
AGE INTERACTION	0.3053	1.087	0.2774
MALE	0.0098	0.483	0.6291
BLACK	0.0237	0.559	0.5759
DMULT1	0.0074	0.330	0.7416
DMULT2	-0.0169	-0.505	0.6136
NEW ENGLAND	0.0872	1.855	0.0638
MID ATLANTIC	-0.0120	-0.351	0.7259
EAST NORTH CENTRAL	-0.0201	-0.604	0.5460
EAST SOUTH CENTRAL	-0.0445	-0.952	0.3413
WEST NORTH CENTRAL	0.0670	1.602	0.1092
WEST SOUTH CENTRAL	0.0231	0.613	0.5397
MOUNTAIN	0.2187	4.467	0.0001
PACIFIC	0.2830	7.383	0.0001
RURAL	0.0866	2.390	0.0169
TEAM	-0.0356	-0.718	0.4727
MULTIPLE PROCS	0.0585	2.538	0.0113
MINOR TEACHING	-0.1389	-6.237	0.0001
MAJOR TEACHING	-0.3667	-9.842	0.0001
GROUP	-0.0960	-1.868	0.0619
GENERAL PRACTICE	-0.3129	-6.842	0.0001
CARDIOVASCULAR	-0.1149	-2.161	0.0308
PULMONARY	-0.3826	-9.269	0.0001
THORACIC	-0.0032	-0.123	0.9020
OTHER SPECIALTY	-0.3092	-5.662	0.0001

Note: The sample size for this regression is 1736 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .30.
The R-square for this regression is .21.

Table C.4

DRG 104 AND 105: CARDIAC VALVE PROCEDURE WITH PUMP AND WITH/WITHOUT CARDIAC CATHETER

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	-0.2635	-0.333	0.7393
AGE LESS THAN 65	-0.3229	-0.246	0.8057
LOG(AGE)	0.1572	0.854	0.3935
AGE INTERACTION	0.0691	0.217	0.8286
MALE	0.0116	0.459	0.6462
BLACK	-0.0919	-1.314	0.1891
DMULT1	0.0067	0.243	0.8081
DMULT2	-0.0361	-0.844	0.3989
NEW ENGLAND	0.0765	1.282	0.2000
MID ATLANTIC	0.0671	1.557	0.1197
EAST NORTH CENTRAL	0.0443	0.959	0.3375
EAST SOUTH CENTRAL	-0.0493	-0.715	0.4750
WEST NORTH CENTRAL	0.1286	2.470	0.0137
WEST SOUTH CENTRAL	0.0328	0.656	0.5117
MOUNTAIN	0.2126	3.526	0.0004
PACIFIC	0.2470	5.339	0.0001
RURAL	0.0425	0.461	0.6448
TEAM	0.1195	2.336	0.0197
MULTIPLE PROCS	0.1012	3.857	0.0001
MINOR TEACHING	-0.1264	-3.847	0.0001
MAJOR TEACHING	-0.4860	-12.472	0.0001
CARDIOVASCULAR	-0.1058	-2.020	0.0436
THORACIC	0.1877	3.924	0.0001
OTHER SPECIALTY	-0.1035	-1.901	0.0576

Note: The sample size for this regression is 1061 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .39.
The R-square for this regression is .34.

Table C.5

DRG 106: CORONARY BYPASS WITH CARDIAC CATHETER

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.4736	0.912	0.3617
AGE LESS THAN 65	-1.9932	-1.901	0.0574
LOG(AGE)	0.0274	0.226	0.8210
AGE INTERACTION	0.4891	1.916	0.0555
MALE	0.0059	0.371	0.7108
BLACK	0.0123	0.232	0.8168
DMULT1	0.0134	0.850	0.3952
DMULT2	-0.0108	-0.432	0.6654
NEW ENGLAND	0.0300	0.735	0.4623
MID ATLANTIC	-0.0455	-1.667	0.0957
EAST NORTH CENTRAL	-0.0638	-2.469	0.0136
EAST SOUTH CENTRAL	-0.1486	-4.645	0.0001
WEST NORTH CENTRAL	0.0063	0.213	0.8315
WEST SOUTH CENTRAL	-0.0405	-1.607	0.1081
MOUNTAIN	0.1415	3.423	0.0006
PACIFIC	0.1981	6.819	0.0001
RURAL	0.0926	1.629	0.1034
TEAM	0.0251	0.943	0.3457
MULTIPLE PROCS	0.0645	3.477	0.0005
MINOR TEACHING	-0.0735	-4.165	0.0001
MAJOR TEACHING	-0.3567	-14.640	0.0001
GROUP	-0.1604	-3.637	0.0003
GENERAL PRACTICE	-0.4427	-10.917	0.0001
CARDIOVASCULAR	-0.2982	-9.127	0.0001
THORACIC	0.1139	3.581	0.0003
OTHER SPECIALTY	-0.5018	-7.087	0.0001

Note: The sample size for this regression is 3154 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .41.
The R-square for this regression is .31.

Table C.6

DRG 107: CORONARY BYPASS WITHOUT CARDIAC CATHETER

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.9013	1.101	0.2709
AGE LESS THAN 65	-1.3201	-1.062	0.2883
LOG(AGE)	-0.0631	-0.330	0.7416
AGE INTERACTION	0.3241	1.076	0.2822
MALE	-0.0096	-0.397	0.6915
BLACK	0.0005	0.009	0.9931
DMULT1	-0.0338	-1.457	0.1453
DMULT2	-0.0254	-0.658	0.5105
NEW ENGLAND	0.0431	0.825	0.4094
MID ATLANTIC	0.0656	1.746	0.0810
EAST NORTH CENTRAL	-0.1015	-2.774	0.0056
EAST SOUTH CENTRAL	-0.2173	-4.513	0.0001
WEST NORTH CENTRAL	0.1111	2.127	0.0336
WEST SOUTH CENTRAL	0.1202	2.749	0.0060
MOUNTAIN	0.1989	3.329	0.0009
PACIFIC	0.2836	7.255	0.0001
RURAL	-0.2658	-3.767	0.0002
TEAM	0.0310	0.751	0.4526
MULTIPLE PROCS	-0.0274	-0.955	0.3396
MINOR TEACHING	-0.0741	-2.694	0.0071
MAJOR TEACHING	-0.5250	-15.621	0.0001
GROUP	-0.0040	-0.070	0.9442
CARDIOVASCULAR	0.1453	3.079	0.0021
THORACIC	0.0697	1.927	0.0541
OTHER SPECIALTY	-0.3429	-4.811	0.0001

Note: The sample size for this regression is 1542 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .54.
The R-square for this regression is .30.

Table C.7

DRGS 110 AND 111: MAJOR RECONSTRUCTIVE VASCULAR PROCEDURES WITHOUT PUMP

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.2596	0.700	0.4840
AGE LESS THAN 65	-0.7619	-1.141	0.2538
LOG(AGE)	0.0599	0.697	0.4859
AGE INTERACTION	0.1926	1.187	0.2352
MALE	-0.0030	-0.215	0.8295
BLACK	-0.0650	-2.681	0.0074
DMULT1	0.0062	0.406	0.6850
DMULT2	-0.0151	-0.875	0.3818
NEW ENGLAND	0.0416	1.372	0.1702
MID ATLANTIC	0.0327	1.427	0.1537
EAST NORTH CENTRAL	-0.0399	-1.708	0.0877
EAST SOUTH CENTRAL	-0.0163	-0.539	0.5899
WEST NORTH CENTRAL	0.0564	1.776	0.0757
WEST SOUTH CENTRAL	0.0987	3.691	0.0002
MOUNTAIN	0.2852	7.481	0.0001
PACIFIC	0.2553	10.130	0.0001
RURAL	0.0306	1.346	0.1785
TEAM	0.0471	1.619	0.1055
MULTIPLE PROCS	0.0641	4.121	0.0001
MINOR TEACHING	-0.1974	-13.182	0.0001
MAJOR TEACHING	-0.4199	-17.890	0.0001
GROUP	-0.0824	-2.895	0.0038
GENERAL PRACTICE	-0.2968	-6.920	0.0001
CARDIOVASCULAR	-0.1694	-5.966	0.0001
OTHER MEDICAL	-0.4233	-13.244	0.0001
THORACIC	0.0453	2.726	0.0064
OTHER SPECIALTY	-0.3386	-10.282	0.0001

Note: The sample size for this regression is 4289 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .41.
The R-square for this regression is .23.

Table C.8

DRG 112: VASCULAR PROCEDURES EXCEPT MAJOR RECONSTRUCTION, WITHOUT PUMP

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.6384	1.815	0.0697
AGE LESS THAN 65	-1.6566	-3.396	0.0007
LOG(AGE)	-0.0858	-1.059	0.2896
AGE INTERACTION	0.3999	3.394	0.0007
MALE	0.0213	1.607	0.1082
BLACK	-0.0088	-0.336	0.7368
DMULT1	-0.0304	-2.123	0.0339
DMULT2	-0.0145	-0.750	0.4535
NEW ENGLAND	0.0444	1.317	0.1878
MID ATLANTIC	0.0571	2.527	0.0116
EAST NORTH CENTRAL	0.0009	0.036	0.9711
EAST SOUTH CENTRAL	-0.0377	-1.225	0.2205
WEST NORTH CENTRAL	-0.0005	-0.017	0.9864
WEST SOUTH CENTRAL	0.0720	2.900	0.0038
MOUNTAIN	0.1478	4.262	0.0001
PACIFIC	0.2909	12.011	0.0001
RURAL	0.0468	1.929	0.0538
TEAM	-0.0264	-0.940	0.3475
MULTIPLE PROCS	0.0338	2.134	0.0330
MINOR TEACHING	-0.0789	-5.206	0.0001
MAJOR TEACHING	-0.1583	-7.282	0.0001
GROUP	-0.1267	-4.508	0.0001
GENERAL PRACTICE	-0.2210	-8.480	0.0001
CARDIOVASCULAR	-0.1887	-10.055	0.0001
OTHER MEDICAL	-0.2764	-9.318	0.0001
THORACIC	0.0150	0.732	0.4641
OTHER SPECIALTY	-0.1449	-4.671	0.0001

Note: The sample size for this regression is 2843 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .18.
The R-square for this regression is .20.

Table C.9

DRGS 146 AND 147: RECTAL RESECTION

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.0734	0.109	0.9134
AGE LESS THAN 65	-0.8197	-0.500	0.6175
LOG(AGE)	0.1058	0.677	0.4984
AGE INTERACTION	0.1900	0.472	0.6369
MALE	0.0201	0.737	0.4614
BLACK	0.0034	0.060	0.9524
DMULT1	-0.0205	-0.672	0.5017
DMULT2	0.0430	1.050	0.2939
NEW ENGLAND	0.0480	0.800	0.4237
MID ATLANTIC	-0.0163	-0.381	0.7036
EAST NORTH CENTRAL	-0.0716	-1.534	0.1253
EAST SOUTH CENTRAL	-0.1726	-2.346	0.0191
WEST NORTH CENTRAL	0.0730	1.188	0.2349
WEST SOUTH CENTRAL	0.1080	1.963	0.0499
MOUNTAIN	0.2519	4.005	0.0001
PACIFIC	0.2498	5.013	0.0001
RURAL	0.0442	1.120	0.2629
TEAM	0.0065	0.144	0.8854
MULTIPLE PROCS	0.0310	0.981	0.3270
MINOR TEACHING	-0.2650	-8.475	0.0001
MAJOR TEACHING	-0.4754	-9.146	0.0001
GROUP	-0.1015	-1.650	0.0992
GENERAL PRACTICE	-0.2966	-4.514	0.0001
GASTRO	-0.3396	-4.863	0.0001
PROCTOLOGY	0.0286	0.590	0.5553
OTHER SPECIALTY	-0.1804	-3.396	0.0007

Note: The sample size for this regression is 1111 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .42.
The R-square for this regression is .25.

Table C.10

DRGS 148 AND 149: MAJOR SMALL AND LARGE BOWEL PROCEDURES

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.7636	2.964	0.0030
AGE LESS THAN 65	-0.8598	-1.678	0.0935
LOG(AGE)	-0.0663	-1.115	0.2651
AGE INTERACTION	0.1976	1.561	0.1186
MALE	-0.0097	-0.902	0.3672
BLACK	-0.0383	-1.928	0.0539
DMULT1	0.0022	0.179	0.8582
DMULT2	-0.0181	-1.274	0.2026
NEW ENGLAND	0.1414	5.957	0.0001
MID ATLANTIC	0.0963	5.507	0.0001
EAST NORTH CENTRAL	-0.0013	-0.072	0.9429
EAST SOUTH CENTRAL	-0.0351	-1.452	0.1465
WEST NORTH CENTRAL	0.0921	4.114	0.0001
WEST SOUTH CENTRAL	0.0941	4.412	0.0001
MOUNTAIN	0.2583	8.818	0.0001
PACIFIC	0.3255	16.082	0.0001
RURAL	0.0400	2.735	0.0063
TEAM	0.0284	1.315	0.1886
MULTIPLE PROCS	0.0310	2.526	0.0116
MINOR TEACHING	-0.2678	-21.584	0.0001
MAJOR TEACHING	-0.4532	-20.579	0.0001
GROUP	-0.0433	-1.837	0.0663
GENERAL PRACTICE	-0.2790	-11.838	0.0001
GASTRO	-0.3911	-16.257	0.0001
PROCTOLOGY	-0.0633	-2.146	0.0319
THORACIC	-0.0684	-2.212	0.0270
UROLOGY	-0.3021	-6.424	0.0001
OTHER SPECIALTY	-0.2465	-6.467	0.0001

Note: The sample size for this regression is 6864 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .41.
The R-square for this regression is .22.

Table C.11

DRGS 154 AND 155: STOMACH, ESOPHAGEAL, AND DUODENAL PROCEDURES

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.4943	1.330	0.1838
AGE LESS THAN 65	-0.1976	-0.342	0.7326
LOG(AGE)	-0.0185	-0.216	0.8288
AGE INTERACTION	0.0422	0.298	0.7654
MALE	0.0343	2.294	0.0219
BLACK	-0.0513	-1.884	0.0596
DMULT1	-0.0122	-0.658	0.5107
DMULT2	-0.0054	-0.307	0.7589
NEW ENGLAND	0.0536	1.496	0.1347
MID ATLANTIC	0.0626	2.452	0.0143
EAST NORTH CENTRAL	-0.0164	-0.625	0.5322
EAST SOUTH CENTRAL	-0.0917	-2.702	0.0069
WEST NORTH CENTRAL	-0.0040	-0.121	0.9039
WEST SOUTH CENTRAL	0.0524	1.771	0.0767
MOUNTAIN	0.1225	3.265	0.0011
PACIFIC	0.2137	7.569	0.0001
RURAL	0.0443	2.103	0.0356
TEAM	0.0420	1.496	0.1348
MULTIPLE PROCS	0.0673	3.875	0.0001
MINOR TEACHING	-0.1861	-10.806	0.0001
MAJOR TEACHING	-0.3193	-11.748	0.0001
GROUP	-0.1367	-4.218	0.0001
GENERAL PRACTICE	-0.3305	-13.440	0.0001
GASTRO	-0.3624	-17.267	0.0001
THORACIC	-0.0425	-1.333	0.1827
OTHER SPECIALTY	-0.1835	-4.897	0.0001

Note: The sample size for this regression is 2698 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .27.
The R-square for this regression is .27.

Table C.12

DRGS 161 AND 162: INGUINAL AND FEMORAL HERNIA PROCEDURES

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.4310	1.249	0.2118
AGE LESS THAN 65	0.2551	0.451	0.6520
LOG(AGE)	-0.0515	-0.647	0.5178
AGE INTERACTION	-0.0600	-0.433	0.6647
MALE	0.0032	0.172	0.8633
BLACK	-0.0037	-0.114	0.9089
DMULT1	0.0015	0.099	0.9211
DMULT2	-0.0117	-0.673	0.5008
NEW ENGLAND	0.2852	9.658	0.0001
MID ATLANTIC	0.1835	8.301	0.0001
EAST NORTH CENTRAL	0.1334	6.015	0.0001
EAST SOUTH CENTRAL	-0.0074	-0.269	0.7881
WEST NORTH CENTRAL	0.1540	5.715	0.0001
WEST SOUTH CENTRAL	0.1162	4.749	0.0001
MOUNTAIN	0.4425	13.068	0.0001
PACIFIC	0.5236	16.358	0.0001
RURAL	0.0231	1.403	0.1606
TEAM	-0.0369	-0.892	0.3724
MULTIPLE PROCS	0.0214	1.021	0.3073
MINOR TEACHING	-0.2216	-13.990	0.0001
MAJOR TEACHING	-0.3598	-12.883	0.0001
GROUP	0.0217	0.696	0.4866
GENERAL PRACTICE	-0.0137	-0.439	0.6608
THORACIC	-0.0445	-1.190	0.2340
UROLOGY	-0.1220	-3.397	0.0007
OTHER SPECIALTY	-0.1344	-3.014	0.0026

Note: The sample size for this regression is 4060 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .28.
The R-square for this regression is .17.

Table C.13

DRGS 195 AND 196: TOTAL CHOLECYSTECTOMY WITH C.D.E.

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.7756	1.280	0.2010
AGE LESS THAN 65	0.0511	0.045	0.9640
LOG(AGE)	-0.0390	-0.278	0.7811
AGE INTERACTION	-0.0431	-0.155	0.8766
MALE	0.0185	0.698	0.4852
BLACK	-0.0486	-0.619	0.5357
DMULT1	-0.0265	-0.892	0.3726
DMULT2	0.0337	0.986	0.3244
NEW ENGLAND	0.1128	1.747	0.0809
MID ATLANTIC	0.0457	0 990	0.3226
EAST NORTH CENTRAL	-0.0085	-0.188	0.8506
EAST SOUTH CENTRAL	-0.1930	-3.391	0.0007
WEST NORTH CENTRAL	0.0810	1.440	0.1502
WEST SOUTH CENTRAL	0.0080	0.169	0.8661
MOUNTAIN	0.2116	3.365	0.0008
PACIFIC	0.2461	4.917	0.0001
RURAL	-0.0233	-0.723	0.4701
TEAM	-0.0979	-1.570	0.1167
MULTIPLE PROCS	0.0236	0.761	0.4467
MINOR TEACHING	-0.3312	-10.350	0.0001
MAJOR TEACHING	-0.5947	-9.087	0.0001
OTHER SPECIALTY	-0.0090	-0.244	0.8072

Note: The sample size for this regression is 1255 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .53.
The R-square for this regression is .18.

Table C.14

DRGS 197 AND 198: TOTAL CHOLECYSTECTOMY WITHOUT C.D.E.

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.1613	0.454	0.6496
AGE LESS THAN 65	0.2759	0.518	0.6042
LOG(AGE)	0.0782	0.945	0.3445
AGE INTERACTION	-0.0699	-0.540	0.5892
MALE	0.0244	1.755	0.0793
BLACK	-0.0665	-2.194	0.0283
DMULT1	-0.0154	-0.968	0.3331
DMULT2	0.0103	0.612	0.5406
NEW ENGLAND	0.1880	5.637	0.0001
MID ATLANTIC	0.1252	5.282	0.0001
EAST NORTH CENTRAL	0.0392	1.693	0.0904
EAST SOUTH CENTRAL	-0.0627	-2.299	0.0216
WEST NORTH CENTRAL	0.1407	4.997	0.0001
WEST SOUTH CENTRAL	0.1709	6.754	0.0001
MOUNTAIN	0.3598	9.856	0.0001
PACIFIC	0.3407	12.573	0.0001
RURAL	0.0431	2.531	0.0114
TEAM	-0.0904	-2.096	0.0362
MULTIPLE PROCS	0.0172	0.837	0.4027
MINOR TEACHING	-0.2890	-17.605	0.0001
MAJOR TEACHING	-0.5253	-15.192	0.0001
GROUP	-0.0771	-2.470	0.0136
GENERAL PRACTICE	-0.2231	-6.346	0.0001
THORACIC	-0.0410	-1.118	0.2637
OTHER SPECIALTY	-0.3672	-11.279	0.0001

Note: The sample size for this regression is 4482 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .48.
The R-square for this regression is .21.

Table C.15

DRG 209: MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	2.4890	10.419	0.0001
AGE LESS THAN 65	-2.0605	-4.100	0.0001
LOG(AGE)	-0.4782	-8.841	0.0001
AGE INTERACTION	0.4710	3.817	0.0001
MALE	0.0073	0.671	0.5025
BLACK	0.0194	0.773	0.4393
DMULT1	-0.0074	-0.648	0.5173
DMULT2	0.0036	0.265	0.7907
NEW ENGLAND	0.1687	6.843	0.0001
MID ATLANTIC	0.0294	1.623	0.1045
EAST NORTH CENTRAL	-0.0561	-3.262	0.0011
EAST SOUTH CENTRAL	-0.1325	-5.658	0.0001
WEST NORTH CENTRAL	-0.0238	-1.212	0.2257
WEST SOUTH CENTRAL	0.0081	0.417	0.6770
MOUNTAIN	0.2898	12.371	0.0001
PACIFIC	0.3535	19.147	0.0001
RURAL	0.0253	1.820	0.0688
TEAM	-0.1205	-3.036	0.0024
MULTIPLE PROCS	-0.0197	-1.105	0.2690
MINOR TEACHING	-0.2064	-18.298	0.0001
MAJOR TEACHING	-0.4794	-21.952	0.0001
GROUP	0.0343	0.849	0.3961
GENERAL PRACTICE	-0.1439	-2.997	0.0027
ORTHOPEDICS	0.0667	2.019	0.0435
OTHER SPECIALTY	-0.2843	-6.789	0.0001

Note: The sample size for this regression is 8059 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .42.
The R-square for this regression is .21.

Table C.16

DRGS 210 AND 211: HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.4033	1.658	0.0973
AGE LESS THAN 65	-0.3535	-0.750	0.4533
LOG(AGE)	-0.0287	-0.522	0.6015
AGE INTERACTION	0.0871	0.748	0.4547
MALE	-0.0197	-1.578	0.1145
BLACK	-0.0750	-2.629	0.0086
DMULT1	0.0123	1.042	0.2976
DMULT2	0.0047	0.303	0.7618
NEW ENGLAND	0.1646	6.508	0.0001
MID ATLANTIC	0.1836	10.024	0.0001
EAST NORTH CENTRAL	0.0566	3.071	0.0021
EAST SOUTH CENTRAL	0.0150	0.630	0.5286
WEST NORTH CENTRAL	0.0553	2.518	0.0118
WEST SOUTH CENTRAL	0.0688	3.407	0.0007
MOUNTAIN	0.3054	11.257	0.0001
PACIFIC	0.4368	21.868	0.0001
RURAL	0.0340	2.398	0.0165
TEAM	-0.0248	-0.652	0.5145
MULTIPLE PROCS	0.0067	0.335	0.7378
MINOR TEACHING	-0.1578	-13.027	0.0001
MAJOR TEACHING	-0.2893	-12.335	0.0001
GROUP	-0.1342	-3.880	0.0001
GENERAL PRACTICE	-0.2078	-5.414	0.0001
ORTHOPEDICS	-0.0949	-3.784	0.0002
OTHER SPECIALTY	-0.2835	-7.699	0.0001

Note: The sample size for this regression is 5843 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .25.
The R-square for this regression is .17.

Table C.17

DRGS 214 AND 215: BACK AND NECK PROCEDURES

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.3084	0.641	0.5218
AGE LESS THAN 65	-0.1237	-0.191	0.8482
LOG(AGE)	-0.0249	-0.223	0.8235
AGE INTERACTION	0.0309	0.198	0.8432
MALE	-0.0032	-0.210	0.8336
BLACK	-0.0274	-0.791	0.4288
DMULT1	0.0129	0.724	0.4690
DMULT2	0.0009	0.042	0.9666
NEW ENGLAND	0.1193	3.104	0.0019
MID ATLANTIC	0.0505	1.808	0.0708
EAST NORTH CENTRAL	0.0374	1.420	0.1556
EAST SOUTH CENTRAL	-0.0884	-2.569	0.0103
WEST NORTH CENTRAL	0.0464	1.418	0.1564
WEST SOUTH CENTRAL	0.0875	3.103	0.0019
MOUNTAIN	0.2200	6.157	0.0001
PACIFIC	0.4020	15.423	0.0001
RURAL	0.0319	1.089	0.2762
TEAM	-0.0764	-2.247	0.0247
MULTIPLE PROCS	0.0902	4.579	0.0001
MINOR TEACHING	-0.1517	-9.016	0.0001
MAJOR TEACHING	-0.2629	-8.907	0.0001
GROUP	-0.0708	-0.883	0.3771
NEUROSURGERY	0.0321	0.440	0.6596
ORTHOPEDICS	0.0937	1.271	0.2040
OTHER SPECIALTY	-0.1379	-1.827	0.0678

Note: The sample size for this regression is 2705 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .26.
The R-square for this regression is .21.

Table C.18

DRGS 257 AND 258: TOTAL MASTECTOMY FOR MALIGNANCY

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	0.4537	0.980	0.3270
AGE LESS THAN 65	-2.6304	-1.741	0.0819
LOG(AGE)	-0.0183	-0.170	0.8651
AGE INTERACTION	0.6643	1.788	0.0739
BLACK	-0.0444	-1.118	0.2635
DMULT1	0.0184	0.768	0.4428
DMULT2	0.0132	0.318	0.7508
NEW ENGLAND	0.1199	2.807	0.0051
MID ATLANTIC	0.1277	4.057	0.0001
EAST NORTH CENTRAL	0.0734	2.316	0.0207
EAST SOUTH CENTRAL	-0.0200	-0.469	0.6388
WEST NORTH CENTRAL	0.1496	3.788	0.0002
WEST SOUTH CENTRAL	0.1805	5.109	0.0001
MOUNTAIN	0.3954	7.690	0.0001
PACIFIC	0.4370	12.274	0.0001
RURAL	0.0140	0.538	0.5908
TEAM	-0.1646	-2.436	0.0149
MULTIPLE PROCS	0.0329	1.226	0.2203
MINOR TEACHING	-0.2862	-13.197	0.0001
MAJOR TEACHING	-0.4705	-11.732	0.0001
OTHER SPECIALTY	-0.0486	-1.730	0.0837

Note: The sample size for this regression is 2199 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .39.
The R-square for this regression is .20.

Table C.19

DRGS 354 AND 355: NON-RADICAL HYSTERECTOMY

Variable	Coefficient	T-Statistic	Significance Level
INTERCEPT	1.3213	2.207	0.0274
AGE LESS THAN 65	-0.6069	-0.751	0.4526
LOG(AGE)	-0.2031	-1.455	0.1459
AGE INTERACTION	0.1314	0.660	0.5091
BLACK	-0.1507	-3.127	0.0018
DMULT1	0.0140	0.567	0.5705
DMULT2	0.0053	0.139	0.8894
NEW ENGLAND	0.1828	3.663	0.0003
MID ATLANTIC	0.1012	2.630	0.0086
EAST NORTH CENTRAL	-0.0775	-2.105	0.0355
EAST SOUTH CENTRAL	-0.0342	-0.758	0.4487
WEST NORTH CENTRAL	0.0402	0.915	0.3601
WEST SOUTH CENTRAL	0.0454	1.076	0.2823
MOUNTAIN	0.3525	6.577	0.0001
PACIFIC	0.3532	9.202	0.0001
RURAL	0.0759	2.621	0.0088
TEAM	-0.0350	-0.843	0.3994
MULTIPLE PROCS	-0.0053	-0.199	0.8420
MINOR TEACHING	-0.2574	-10.105	0.0001
MAJOR TEACHING	-0.5363	-12.102	0.0001
OB/GYNECOLOGY	0.0730	2.264	0.0237
OTHER SPECIALTY	0.0210	0.483	0.6291

Note: The sample size for this regression is 1756 surgeries.
The mean of the dependent variable (indicates the use of an assistant at surgery) is .49.
The R-square for this regression is .23.

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