United States General Accounting Office

GAO

Report to the Chairman, Subcommittee on Health, Committee on Ways and Means, House of Representatives

October 1994

# MEDICARE

# Referrals to Physician-Owned Imaging Facilities Warrant HCFA's Scrutiny




GAO/HEHS-95-2

GAO

**United States**
**General Accounting Office**
**Washington, D.C. 20548**

**Health, Education, and**
**Human Services Division**

B-253835

October 20, 1994

The Honorable Fortney H. (Pete) Stark
Chairman, Subcommittee on Health
Committee on Ways and Means
House of Representatives

Dear Mr. Chairman:

Imaging services, such as magnetic resonance imaging (MRI), computed tomography (CT), ultrasound, and X rays, accounted for over $4.6 billion in Medicare Part B allowed charges in 1992. These services are frequently available outside hospitals at joint-venture imaging centers, group practices, shared-facility arrangements, and other settings. Where physicians have a financial interest in the imaging facility, concerns have been raised about the potential for excessive use and costs when physicians refer their patients to these facilities—a practice known as self-referral.

Because of the concerns associated with self-referral, you asked us to compare the Medicare imaging referral rates of physicians who invested in joint-venture imaging centers with the referral rates of other physicians. On April 20, 1993, we testified before the Subcommittee on Health on the preliminary results of our analyses.[1] Subsequent to our testimony, the Congress included new restrictions on Medicare and Medicaid self-referrals in the Omnibus Budget Reconciliation Act of 1993 (OBRA-1993).[2] These new restrictions, which will become effective January 1, 1995, cover 10 types of medical services, including diagnostic imaging. OBRA-1993 also extends Medicare restrictions on clinical laboratory self-referrals, enacted in 1989, to the Medicaid program. The Medicare and Medicaid restrictions generally exempt in-office ancillary services and referrals within group practices, but OBRA-1993 also authorizes the Secretary of Health and Human Services to establish any additional regulations needed to protect against program abuse by physicians using the exemptions to circumvent the self-referral restrictions.

Recently, we provided the Subcommittee with analyses of imaging referrals within physicians' offices, group practices, and similar settings where the ordering physician and the imaging provider had the same

[1]Medicare: Physicians Who Invest in Imaging Centers Refer More Patients for More Costly Services (GAO/T-HRD-93-14, Apr. 20, 1993).

[2]Omnibus Budget Reconciliation Act of 1993, Public Law 103-66, August 10, 1993.

Medicare physician or billing identification numbers.[3] Imaging in these settings is generally exempt from the OBRA-1993 self-referral restrictions.

The Congress is now considering legislation that would modify the OBRA-1993 exemptions for self-referral within group practices and extend the Medicare and Medicaid self-referral restrictions to all fee-for-service insurance plans. To assist the Congress as it considers this legislation, this report consolidates the final results of our two studies on physician referrals for imaging services: (1) referrals by physicians with a financial interest in joint-venture imaging centers, and (2) referrals for imaging provided within the referring physicians' practice settings.

Our analyses were based on calendar year 1990 Medicare claims for imaging services ordered by Florida physicians. We used Florida claims for our analyses because we also had access to information identifying Florida physicians with a financial interest in imaging center joint ventures—the only such statewide information then available. That information was gathered in 1990 by researchers at Florida State University for the Florida Health Care Cost Containment Board. Although Florida has a larger Medicare population and more imaging facilities than some other states, we believe that our conclusions about the relationship between physician investment in imaging facilities and their imaging referral rates are generalizable nationwide because they are based on a large-scale analyses of physician behavior rather than the characteristics of the patient population or other demographic variables.

While we did not formally assess the internal controls used by Florida Blue Cross and Blue Shield or Florida State University to ensure the accuracy of their data, we performed extensive tests to evaluate the accuracy of their data and our analyses, as described in appendix I. We performed our work between April 1993 and July 1994, in accordance with generally accepted government auditing standards. Appendix I further describes our scope, data sources, and methodology, and appendices II and III present detailed information on imaging referral patterns for each of seven types of imaging services.

## Results in Brief

Florida physicians with a financial interest in joint-venture imaging centers had higher referral rates for almost all types of imaging services than other Florida physicians. The differences in the referral rates were greatest for costly high-technology imaging services. For example, physicians with an

[3]Medicare Diagnostic Imaging Rates (GAO/HEHS-94-129R, Apr. 5, 1994).

interest in imaging centers that offered MRI services ordered twice as many MRI scans as other physicians. Medicare costs in Florida would have been about $10 million less in 1990 if physicians with a financial interest in joint-venture imaging centers ordered imaging services at the same rates as other Florida physicians practicing in the same specialties.

Florida physicians with imaging facilities in their offices, group practices, or other practice settings also had high imaging rates compared with those of other physicians. Relatively few physicians provided in-practice MRI or CT services in 1990, but physicians with access to these services within their practices ordered three times as many MRI scans and twice as many CT scans for their patients as other physicians. More significantly, in-practice rates for ultrasound and echocardiography were 5.1 and 4.8 times higher, respectively, than rates for physicians who referred patients to facilities outside their practice settings.

The Department of Health and Human Services (HHS) has not yet finalized the regulations or procedures needed to implement and enforce the OBRA-1993 self-referral restrictions as they apply to physicians with a financial interest in joint ventures. Moreover, the Health Care Financing Administration (HCFA) and the contractors that administer the Medicare program have not developed procedures to systematically monitor physician referral patterns in a way that would allow them to identify abusive overutilization of medical services through in-practice self-referrals.

## Background

As we reported in 1992,[4] high Medicare reimbursement rates supported a proliferation of diagnostic imaging facilities after Medicare began covering MRI scans in 1985. Few states regulated the establishment of facilities that provided imaging services outside of hospitals—in physicians' offices, group practices, or joint-venture imaging centers—and imaging providers were able to realize profits even in relatively low-volume settings. These two factors contributed to a rapid growth in the number of physician-owned imaging facilities. For example, in 1990, about 24 percent of Florida physicians practicing in neurological surgery had a financial interest in an MRI joint venture facility.

Since 1990, Medicare payment levels for many imaging services have declined as HCFA has phased in the congressionally mandated Medicare

[4]Medicare: Excessive Payments Support the Proliferation of Costly Technology (GAO/HRD-92-59, May 27, 1992).

Part B fee schedule. For example, the 1994 Medicare payments for some MRI and CT procedures are 31 to 32 percent lower than the payments allowed in 1990. The lower payment levels more closely reflect the costs of efficient high-volume providers, but they also create an incentive for physicians with investments in low-volume imaging facilities to maintain profitability by ordering more services.

The Congress and some state legislatures have enacted restrictions on some self-referrals. In 1989 the Congress amended Title XVIII of the Social Security Act to prohibit the referral of Medicare patients to clinical laboratories by physicians who have an investment in those laboratories. In 1992 and 1993, Florida and several other states enacted measures to more broadly restrict referrals to other diagnostic and therapeutic medical facilities by physicians with a financial interest in those facilities. Then, in August 1993, the Congress included provisions in OBRA-1993 that will extend the Medicare clinical laboratory self-referral ban to Medicare and Medicaid payments for 10 additional types of medical services, including diagnostic imaging.

The OBRA-1993 self-referral restrictions generally do not prohibit referrals for services that patients obtain within the practice settings of the referring physician. These in-practice services, such as X rays and ultrasound services, can increase physician and patient convenience and allow the ordering physician to supervise the services. However, limited studies by others[5] have raised concerns that in-practice investment in expensive imaging equipment is associated with overutilization of imaging services, similar to the higher imaging rates associated with self-referral to physician-owned joint ventures.

Recognizing the potential for using group-practice or shared-facility arrangements to circumvent the self-referral ban, the 1993 federal legislation also (1) places some restrictions on in-office ancillary services; (2) requires billings by a group practice to use the billing number assigned to the group, thereby facilitating the identification of services ordered and provided within group practices; and (3) allows the Secretary of HHS to establish additional regulations to protect against abusive use of the exemptions to the self-referral ban. Also, the ability to track physician referral patterns has been enhanced by the implementation of unique physician identification numbers (UPIN) and the requirement, effective

[5]Bruce J. Hillman, M.D., and others, "Physician Utilization and Charges for Outpatient Diagnostic Imaging in a Medicare Population," The Journal of the American Medical Association (Oct. 21, 1992), pp. 2050-2054; Stephen E. Radecki, Ph.D, and James P. Steele, M.D., "Effect of On-site Facilities on Use of Diagnostic Radiology by Non-radiologists," Investigative Radiology (Feb. 1990), pp. 190-193.

January 1, 1992, that all claims for medical services include the UPIN of the ordering or referring physician.

## Investors in Joint-Venture Imaging Centers Refer More Patients for More Costly Services

Our analyses of the imaging referral patterns of over 16,000 Florida physicians show that those physicians with a financial interest in joint-venture imaging centers ordered more imaging tests and more costly types of imaging services for their Medicare patients than other physicians practicing in the same specialty.

Using information from the Florida Health Care Cost Containment Board and Florida Blue Cross and Blue Shield, we identified 2,395 physicians who had a financial interest in joint-venture imaging centers and referred Medicare patients for imaging services. We classified these physicians as owners and compared their imaging referral rates (imaging services per thousand office visits) to 13,762 other Florida physicians whom we classified as nonowners.[6] We made separate comparisons for each of seven types of diagnostic imaging services—MRI scans, CT scans, nuclear medicine scans, echocardiography, ultrasound services, complex X rays, and simple X rays.

Because some physician specialties, such as neurology and orthopedics, make greater use of some types of imaging than other specialties, we analyzed the differences in referral rates by physician specialty and computed overall owner-to-nonowner referral ratios that are adjusted for the number of imaging services ordered by each specialty.

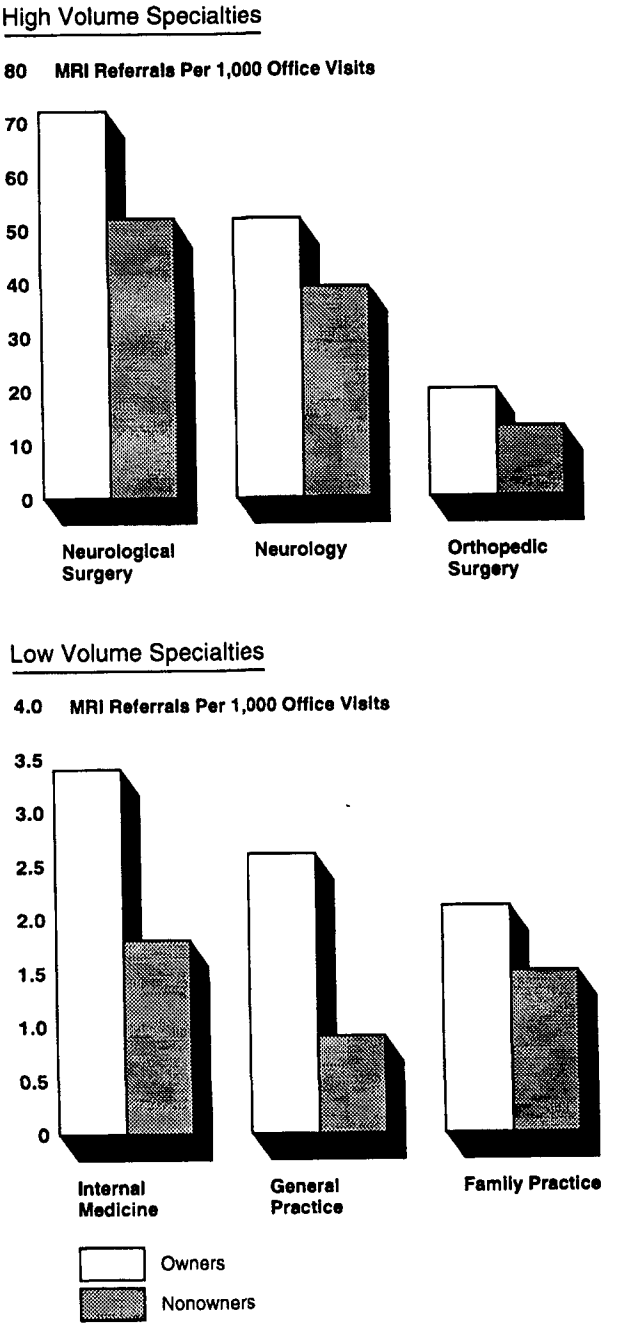
Overall, owners had higher imaging rates than nonowners for almost all types of imaging services. Owners ordered 54 percent more MRI scans; 27 percent more CT scans; 37 percent more nuclear medicine scans; 27 percent more echocardiograms; 22 percent more ultrasound services; and 22 percent more complex X rays. The referral rates for simple X rays were about the same for owners and nonowners. Summary counts of the physicians, imaging services, and office visits used in our analyses are provided in appendix II, table II.1. Detailed referral rates and owner-to-nonowner ratios by physician specialty are provided in appendix II, tables II.2 and II.3.

We further analyzed the differences in owner and nonowner referral rates for MRI and CT scans, the two most expensive types of imaging services.

[6]As discussed in appendix I, our nonowner category includes some unidentified Florida physicians known to have a financial interest in imaging center joint ventures.

Our analyses show that 952 Florida physicians had a financial interest in imaging centers that offered MRI services, and those physicians ordered twice as many MRI scans for their Medicare patients as nonowners. As shown in figure 1, among the six specialties that ranked highest in the number of MRI referrals, owners in all six specialties had higher MRI referral rates than nonowners, and owners in general practice ordered three times as many MRI scans as their nonowner counterparts. The detailed referral rates and MRI owner-to-nonowner ratios by physician specialty are provided in appendix II, table II.4.

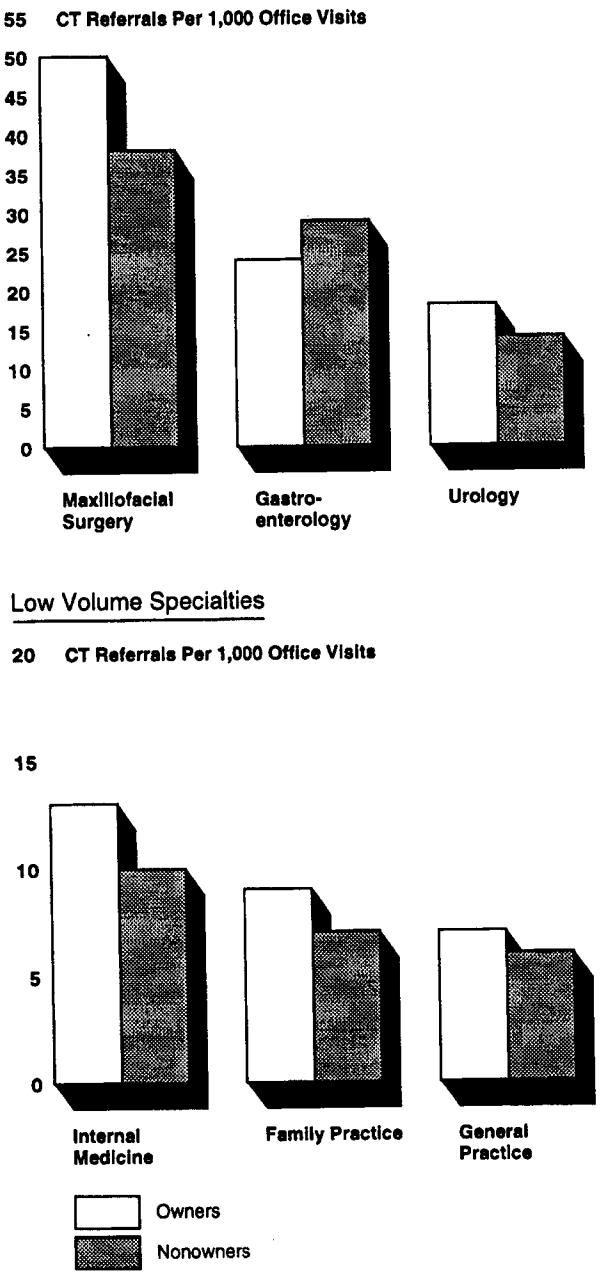
**Figure 1: MRI Referrals by MRI Owners and Nonowners**




Note: These six specialties ranked highest in the number of MRI referrals, accounting for about 80 percent of the MRI referrals in our analysis. See appendix II, table II.4.

Similarly, our analyses show that 1,369 Florida physicians had a financial interest in imaging centers that offered CT services. Overall, those physicians ordered 29 percent more CT scans for their Medicare patients than nonowners. As shown in figure 2, owners in five of the six specialties that ranked highest in the number of CT referrals had higher CT referral rates than their nonowner counterparts. The detailed referral rates and CT owner-to-nonowner ratios by physician specialty are provided in appendix II, table II.5.

**Figure 2: CT Referrals by CT Owners and Nonowners**




Note: These six specialties ranked highest in the number of CT referrals, accounting for about 65 percent of the CT referrals in our analysis. See appendix II, table II.5.

These analyses suggest that self-referral to joint-venture imaging centers is associated with significant overutilization of imaging services. We estimate that Medicare costs in Florida would have been about $10 million less in 1990 if Florida physicians with a financial interest in joint-venture imaging centers had referred their patients for imaging services at the same rates as their peers practicing the same specialties. Furthermore, the Congressional Budget Office estimated that the OBRA-1993 restrictions, which generally apply to these types of self-referrals, will save Medicare $350 million and Medicaid $37 million over 4 years.

## Physicians With In-Practice Imaging Facilities Order More Services Than Physicians Who Refer to Other Facilities

Florida physicians with imaging facilities in their offices, group practices, or other practice affiliations ordered imaging tests much more frequently than physicians who referred their patients to imaging facilities outside their practices.

Using claims for imaging services and office visits billed to Medicare in Florida in 1990, we identified physicians who ordered imaging services and provided those services themselves or through other physicians within their practice affiliations. For each type of imaging service, we classified the ordering physicians as having in-practice imaging patterns if more than 50 percent of the imaging services they ordered were provided from within their practice affiliations. Similarly, we classified physicians as having referral imaging patterns if more than 50 percent of the imaging services they ordered were performed at facilities outside their practice affiliations.

Our analyses of these two groups of physicians by practice specialty showed that physicians with in-practice imaging patterns had much higher imaging rates than physicians with referral imaging patterns. As shown in appendix III, table III.1, the in-practice imaging rates were about 3 times higher for MRI scans; about 2 times higher for CT scans; 4.5 to 5.1 times higher for ultrasound, echocardiography, and diagnostic nuclear medicine imaging; and about 2 times higher for complex and simple X rays.

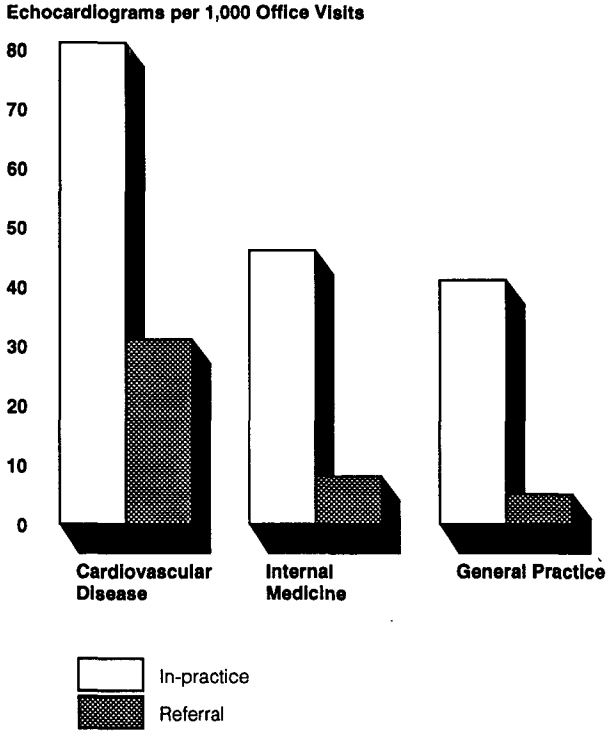
Although in-practice imaging is commonplace for some physician specialties and some types of imaging services, our analyses showed that in-practice imaging rates were higher than referral imaging rates for nearly all specialties and imaging services. For example, echocardiography is used extensively by physicians practicing in cardiovascular disease. Our analyses showed that 464 cardiovascular specialists used in-practice echocardiography and 401 referred their patients to echocardiography facilities outside their practices. As illustrated in figure 3, the in-practice

echocardiography rates were 2.6 times higher than the referral rates for cardiovascular specialists. Furthermore, the in-practice echocardiography rates for physicians in internal medicine and general practice exceeded not only the referral rates of their peers in the same specialties, but also the referral rates of cardiovascular specialists.

Echocardiography use is of particular importance nationally to the Medicare program: in terms of allowed charges in 1993, one type of echocardiogram[7] ranked higher than any other imaging procedure and ranked 10th among the top 200 Medicare procedures, accounting for almost $423 million.

[7]Echocardiography procedure code 93307, complete real time echocardiography with two dimensional image documentation, with or without M-mode recording. Over 3.4 million of these echocardiograms were paid for by Medicare in 1993.

**Figure 3: Echocardiography Utilization by Physicians With In-practice and Referral Imaging Patterns**




Note: These three specialties ranked highest in the number of echocardiograms, accounting for about 82 percent of all the echocardiography services in our analysis. See appendix III, table III.5.

## HCFA Needs to Monitor Referral Patterns to Enforce Self-Referral Restrictions and Identify Overutilization

Although HHS and HCFA have begun work on the regulations and reporting requirements needed to implement the OBRA-1993 self-referral restrictions, HCFA has not implemented a systematic way to monitor physician referral patterns to identify overutilization and potentially abusive self-referral practices. The need to systematically monitor in-practice referrals and trends is particularly important because the self-referral restrictions imposed under OBRA-1993 may provide an incentive to reorganize physician-owned joint-venture imaging centers into group practices or shared-facility arrangements exempt from those restrictions.

HCFA and the Medicare contractors are currently using focused medical review to help identify medical procedures where local utilization rates are higher than national averages and, therefore, warrant special prepayment reviews. However, as discussed in our recent report on HCFA

review of claims payments,[8] HCFA and the carriers have not implemented the type of physician profiling and trend-analysis reports that would routinely flag questionable referral practices. HCFA has required the carriers to develop the capability to perform profiling by ordering and referring physicians and is testing the use of this information at a small number of carriers.

Since Medicare regulations now require the use of UPIN identifiers, referring physician numbers, and group practice numbers on Medicare claims, HCFA and the Medicare carriers have the opportunity to more closely monitor referral patterns and in-practice imaging utilization, and to investigate potential overutilization linked to referral arrangements. High-cost imaging services such as MRI, CT, diagnostic nuclear medicine, advanced ultrasound services, and echocardiography warrant particular attention by HCFA.

## Conclusions

Physicians with a financial interest in imaging facilities—whether through investments in joint-venture imaging centers or through in-practice imaging—order more imaging services for their patients than do other physicians. The recently enacted Medicare and Medicaid ban on self-referrals for designated medical services offers the potential for reducing overutilization of imaging, especially imaging provided by physician-owned joint ventures. However, physicians who order and provide these services within their practices may still have a financial incentive to overutilize the services, especially as payment levels generally decrease under the Medicare Part B fee schedule.

The Congress has provided HHS with the tools needed to identify and restrict self-referrals and overutilization of in-practice imaging services within the Medicare and Medicaid programs. These tools include mandatory reporting of physician investment in medical facilities that provide designated health services, mandatory use of referring physician identification numbers, and the flexibility to impose additional restrictions on self-referrals where needed to prevent abusive practices.

## Recommendations to the Secretary of HHS

We recommend that the Secretary direct the Administrator of HCFA to develop the procedures and policy guidance needed for the Medicare contractors to (1) closely monitor Medicare imaging referral patterns and

[8]Medicare: Inadequate Review of Claims Payments Limits Ability to Control Spending (GAO/HEHS-94-42, Apr. 28, 1994).

utilization rates, (2) assure compliance with the provisions of the self-referral ban, and (3) identify any overutilization of imaging services ordered and provided from within physician practice settings.

We further recommend that the Secretary systematically review imaging utilization information developed by HCFA and use the authority provided under OBRA-1993 to develop any additional regulations needed to reduce overutilization through abusive self-referral practices.

## Agency Comments

HHS commented on a draft of our report and is in general agreement with our recommendations. See appendix IV for the agency's comments.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after its issue date. At that time, we will send copies of this report to other appropriate congressional committees, the Secretary of Health and Human Services, the Administrator of HCFA, and the Director of the Office of Management and Budget. We will make additional copies available to other interested parties upon request.

Please call me on (202) 512-7104 if you or your staff have any questions about this report. Major contributors are listed in appendix V.

Sincerely yours,

Leslie G. Aronovitz
Associate Director,
Health Financing Issues

# Contents

## Figures



### Abbreviations

| | |
|---|---|
| CPT | Current Procedural Terminology |
| CT | computed tomography |
| HCFA | Health Care Financing Administration |
| HHS | Department of Health and Human Services |
| MRI | magnetic resonance imaging |
| OBRA-1993 | Omnibus Budget Reconciliation Act of 1993 |
| UPIN | unique physician identification number |

# Scope, Data Sources, and Methodology

This appendix describes (1) our scope and data sources, (2) our methodology for identifying and analyzing referrals by physicians with a financial interest in joint-venture imaging centers, and (3) our methodology for identifying and analyzing referrals for imaging provided within the referring physicians' practice settings.

## Scope and Data Sources

Several studies have investigated the effect of physician ownership on the utilization and cost of health care services,[9] but those studies have based their findings on analysis of relatively small physician and patient populations. In contrast, our study is a large-scale analysis of physician referral patterns for all types of diagnostic imaging services. The study population includes all Florida physicians who referred Medicare patients for outpatient[10] imaging services in 1990, and our data sources include the full Florida Medicare Part B Beneficiary History File for calendar year 1990 and the Florida Medicare Provider File, both obtained from Florida Blue Cross and Blue Shield. By selecting Florida for our study we were also able to make use of the extensive data on physician ownership of Florida medical facilities compiled for the Florida Health Care Cost Containment Board by Florida State University.[11]

While we did not formally assess the internal controls used by Florida Blue Cross and Blue Shield or Florida State University to ensure the accuracy of their data, we met extensively with the officials who were responsible for collecting and maintaining these data and reviewed their methodology and documentation. We also performed detailed tests and edits on computerized claims and manually reviewed printouts of beneficiary history records to trace individual imaging services to imaging providers and referring physicians. To further evaluate the accuracy of our data and analyses, we reviewed medical and claims records from five diagnostic imaging centers in Florida. We also met with HCFA staff and

[9]See, for example, Bruce J. Hillman, M.D., and others, "Physicians' Utilization and Charges for Outpatient Diagnostic Imaging in a Medicare Population," Journal of the American Medical Association, Vol. 268, No.15 (Oct. 21, 1992), pp. 2050-2054; Stephen E. Radiecki and James P. Steele, "Effect of On-site Facilities on Use of Diagnostic Radiology by Non-radiologists," Investigative Radiology (Feb. 1990), pp. 190-193; Alex Swedlow and others, "Increased Costs and Rates of Use in the California Workers' Compensation System as a Result of Self Referral by Physicians," New England Journal of Medicine, Vol. 327, No. 21 (Nov. 19, 1992), pp. 1502-1524.

[10]We use "outpatient" to describe all provider settings other than hospital inpatient facilities—including freestanding imaging facilities and physicians' offices, as well as hospital outpatient departments.

[11]Joint Ventures Among Health Care Providers in Florida, State of Florida Health Care Cost Containment Board (Sept. 1991).

other researchers who have studied physician referral patterns to obtain their technical and methodological suggestions.

Given the size of our final database—almost 2.5 million imaging services ordered by about 17,900 physicians—we did not attempt to assess the medical necessity of the imaging services ordered. Because our study is based on the full range of diagnostic imaging services ordered by physicians in a wide variety of primary care and specialty practices and includes a large patient population, we believe our study design minimizes the influence of individual patient and physician characteristics on the overall analytical results. Furthermore, we structured our analyses for each type of imaging service so that they are based on comparisons between physicians practicing in the same specialty. Thus, our analytical approach reflects the variation in the use of different types of imaging by physicians practicing in different specialties.

## Analysis of Referred Imaging Services by Physician Owners and Nonowners

The first phase of our study includes only imaging services provided by facilities outside the referring physicians' practice settings, in facilities such as hospital outpatient departments and freestanding (nonhospital) imaging centers. For these analyses we grouped the referring physicians into owner and nonowner categories based on whether or not they had a financial interest in a freestanding joint-venture imaging center.

### Identifying Physicians With Ownership Interests in Freestanding Imaging Centers

We identified physician owners of Florida imaging facilities using survey information gathered by Florida State University for the Florida Health Care Cost Containment Board during 1990. Florida State researchers sent surveys to all freestanding facilities providing diagnostic imaging services, and the facilities were asked to identify their physician owners, if any. Of the 220 freestanding diagnostic imaging centers in Florida in 1990, 177—about 80 percent—responded to the survey.[12]

After meeting with the principal researchers and reviewing the survey responses, we matched ownership information from the surveys with physician data from Florida Blue Cross and Blue Shield's Medicare Provider File to identify the Medicare provider number(s) for each physician owner. We identified the Medicare provider numbers for 2,993 physician owners. Our ownership category excludes an unknown number of additional physicians with a financial interest in imaging centers

[12]Florida State University researchers provided us with 17 surveys that they received too late to include in their September 1991 report.

because (1) some medical facilities did not respond to the Florida State survey, (2) some responding facilities indicated that there were physicians with a financial interest in their facilities but declined to identify those physicians, and (3) some survey responses did not contain enough information for us to confidently match their names to a physician in the Medicare Provider File. Our nonowner category includes all Florida physicians not identified as owners. Assuming that the unidentified physician owners, included in the nonowner category, also had the higher imaging referral rates associated with owners, our analyses understate the magnitude of the higher imaging referral rates of physician owners.

After preliminary analyses of our databases and consultations with medical professionals, we excluded physicians practicing in radiology, pathology, and anesthesiology from both our owner and nonowner groups, because physicians in those specialties generally do not refer patients for imaging services.

For some of our analyses we also determined which of the physician owners had a financial interest in joint-venture imaging centers that provided MRI services, CT services, or both. We identified these physicians from information in the surveys from Florida State University, the Florida Medicare Part B Provider File, and Medicare claims submitted by imaging providers. We could not identify the types of services provided by 87 of the physician-owned imaging facilities; therefore, our analyses underestimate the numbers of physicians who invested in facilities providing MRI services, CT services, or both.

## Creating Our Data Set of Imaging Services and Office Visits

The Beneficiary History File that we obtained from Florida Blue Cross and Blue Shield included over 50 million claims with information on all Medicare Part B services provided in Florida between November 1989 and March 1991. As further described below, using this database we extracted paid claims with no obvious errors or inconsistencies for outpatient imaging services and office visits provided in 1990. We used these data to calculate physicians' imaging referral rates—the number of imaging services ordered per 1,000 office visits. This is a measure we have used in previous work on physician referrals for diagnostic services.[13]

We identified claims for imaging services and office visits using the American Medical Association's 1990 Current Procedural Terminology

[13]Medicare: Referring Physician's Ownership of Laboratories and Imaging Centers (GAO/T-HRD-89-26, June 8, 1989).

(CPT) manual, HCFA's 1990 procedure code listings, and guidance from a physician consultant. We classified all diagnostic imaging services into seven categories designed to group similar procedures together: MRI, CT, ultrasound, echocardiography, diagnostic nuclear medicine, complex X rays, and simple X rays.

In deciding which CPT codes to include as office visits, we considered all physician-patient encounters that provide physicians an opportunity to refer their patients for imaging services and an opportunity for physician-patient choice of imaging facility. Because hospital inpatients generally do not have an opportunity for physician-patient choice of imaging facility, we excluded all hospital inpatient visits and inpatient imaging services from our analysis, regardless of the CPT codes used for those services. For office visits we included all CPT and HCFA codes for outpatient medical services, consultations, preventive medicine, and case management. We also selectively included other CPT codes for services such as psychiatry, ophthalmology, and critical care.

This selection process yielded a database with about 3.5 million imaging services and 19.4 million office visits.

## Identifying the Physicians Who Ordered the Imaging Services

In 1990, providers of imaging services were not required to include the referring physicians' Medicare numbers on their claims for the imaging services. Some claims identified the referring physician but others did not. In our database of about 3.5 million imaging services (which included in-practice imaging), the Medicare claims for about 41 percent of those imaging services included the referring physician number. After analyzing a sample of the claims in our database and consulting with other researchers, we developed and tested various approaches for identifying the physician who ordered the imaging service from information in the beneficiary history file.

We did a detailed analysis of a sample of the claims that included the referring physician number, and we traced some of those claims to medical records at selected imaging providers. We found that the inclusion or exclusion of the referring physician in the claims database appeared random; that is, it did not follow any particular pattern that would bias our analytical results. We also found cases in which the referring physician was identified on a hard copy of the claim but this information was not transcribed by Florida Blue Cross and Blue Shield into the claims database.

Using claims that identified the ordering physician, we simulated various approaches for identifying the ordering physician when that physician was not identified. We determined that an imaging service for a beneficiary could be reasonably matched to the physician who ordered the service if the beneficiary had an office visit with that physician within a "referral window" occurring from 21 days before to 7 days after the imaging service.[14]

For those claims that identified the ordering physician, we included that imaging service and ordering physician in our analysis if the patient had an office visit with that physician within the referral window, regardless of the number of office visits with other physicians also within the referral window. We excluded claims where the identified ordering physician did not have any office visits with the patient within the referral window because in tracing those cases to beneficiary history records and medical files we found there was a likelihood that the claim did not correctly identify the ordering physician.

For those imaging claims where there was more than one potential ordering physician within the referral window, we further tested various approaches for identifying which physician ordered the imaging service. For example, we simulated selecting the physician with the closest office visit to the imaging service as the ordering physician, and we compared the result to information in medical files. Although the overall error rate from that approach was relatively low, we believed that there was a possibility that the approach could introduce bias by overstating in-practice imaging rates, especially in cases where there was an office visit and an imaging service on the same day. Therefore, where there was only one potential ordering physician within the referral window, we considered that physician the ordering physician and included that imaging service in our analyses. Where the imaging claim did not identify the ordering physician and there were multiple potential ordering physicians within the referral window we excluded that imaging service from our analyses.

This methodology excluded about 1 million imaging services from our database of about 3.5 million imaging referrals. Excluding those imaging services generally understates the physicians' imaging rates, but after studying the excluded imaging services we concluded that there was no evident pattern that would introduce bias into our analytical results.

[14]Physicians sometimes refer a patient for an imaging service (for example, an X ray) shortly before the physician sees the patient. Thus, an imaging service can occur before the office visit with the physician who ordered the service.

## Verifying the Accuracy of Our Referral Logic

To test the accuracy of our methodology for identifying the ordering physician, we reviewed medical and billing records for about 100 imaging services from each of five Florida imaging centers. Based on this review, we estimate that our computerized procedures correctly identified the ordering physician for 89 percent of the imaging services used in our analyses. To further confirm the accuracy of our computerized procedures and programming, we extracted over 1,300 beneficiary claim histories and provider billing records from our database and manually verified the match between the imaging service and the ordering physician.

For those cases where our referral logic may have identified an incorrect referring physician, we believe that there was little or no impact on our analytical results. The large scale of our study ensured that the incorrect attribution of a relatively small number of imaging referrals would be distributed over a large number of physicians across all our comparison groups. Also, we analyzed the claims for the services in which we discovered attribution errors, and we found no evidence of a pattern that would bias our analytical results.

## Analyzing Owner and Nonowner Imaging Referral Patterns

Of the 2.5 million imaging services for which we identified the ordering physician, we determined that about 1.2 million of those imaging services were provided within the ordering physicians' practice settings, as described below in a separate section of this appendix. The remaining 1.3 million imaging services were from referrals to facilities outside the ordering physicians' practice settings and were included in our analysis of owner and nonowner referral rates.

We arrayed and analyzed these data by type of imaging procedure and physician specialty, as shown in appendix II, tables II.2 and II.3. As specified in the notes to those tables, we used cutoff criteria for physician specialties where there was limited use of imaging. For each type of imaging service we also computed a weighted summary ratio of the referral rates of owners and nonowners, weighting by the number of imaging referrals made by each physician specialty to account for the variation in the use of imaging—by both owners and nonowners—among the various physician specialties. The overall summary of this analysis is provided in appendix II, table II.1.

To determine if physicians with a financial interest in facilities that provide costly high-technology services are more likely to refer Medicare beneficiaries for those services than owners in general, we analyzed

referral rates for two additional physician groupings: one for physicians with a financial interest in facilities providing MRI scans and another for physicians with a financial interest in facilities providing CT scans. The detailed results of those analyses are provided in appendix II, tables II.4 and II.5.

## Analysis of In-practice Imaging

The second phase of our study includes the 1.2 million in-practice imaging services provided by imaging facilities within the ordering physicians' practice settings as well as the 1.3 million imaging services provided outside the referring physicians' practice settings, in facilities such as hospital outpatient departments and freestanding imaging centers.

### Identifying In-practice Imaging Services

We classified an imaging service as in-practice if the patient received the service from either (1) the physician who ordered the service, (2) a physician in the same group practice as the ordering physician, or (3) an entity (such as an imaging center or neurology clinic) with which the ordering physician had a practice affiliation.

To identify in-practice imaging we used computerized procedures to compare the Medicare billing and performing provider numbers on the imaging claim to those on the ordering physician's office visit claim. If either of the numbers on the imaging claim matched either of the numbers on the office visit claim, we classified the imaging service as in-practice; that is, the imaging service was provided by the ordering physician or by a physician or entity (such as a clinic or group practice) with which the ordering physician had a practice affiliation.

### Classifying Physicians Based on Imaging Patterns

For each physician who ordered imaging services, we classified his or her predominant imaging pattern as either in-practice or referral separately for each of the seven types of imaging services. For example, if more than 50 percent of the ultrasound services ordered by a physician were in-practice, we classified that physician's ultrasound imaging pattern as in-practice. Similarly, if more than 50 percent of the MRI scans ordered by that same physician were referral, we classified that physician's MRI imaging pattern as referral. Thus, the same physician may be classified as having a referral imaging pattern for one type of service and an in-practice imaging pattern for another type of service.

## Analyzing Overall Imaging Utilization

Once we classified physicians based on their imaging pattern (in-practice or referral) for each type of imaging service, we arrayed and analyzed these data by type of imaging procedure and physician specialty (see app. III, tables III.2 through III.8). As specified in the notes to those tables, we used cutoff criteria for physician specialties where there was limited use of imaging. For each type of imaging service we also computed a weighted summary ratio of the in-practice and referral imaging rates, weighting by the number of imaging referrals made by each physician specialty. The overall summary of this analysis is provided in appendix III, table III.1.

## Limitations of Our In-practice Analysis

Because our data are from 1990, they predate full implementation of the unique physician identification number (UPIN) and the OBRA-1993 requirement that physicians in group practices bill under their group practice numbers rather than their individual numbers. Thus, in our database the Medicare numbers on office visit and imaging claims could have been those of the performing physician even though the service was provided in a group practice. Therefore, our analyses cannot distinguish between the various types of in-practice imaging arrangements (for example, solo practices, multi-specialty group practices, and shared-facility arrangements).

Also, because physicians may have used different Medicare numbers on their office visit and imaging claims, even though both services were provided by the same physician or group practice, our analyses probably underestimate the number of in-practice imaging services and the number of physicians with in-practice imaging patterns. Thus, the magnitude of the higher in-practice imaging rates revealed in our analyses is probably a conservative estimate, assuming that some physicians with in-practice imaging patterns are grouped with the physicians with referral imaging patterns, and that those physicians also had the higher imaging rates associated with in-practice imaging.

# Imaging Center Owner and Nonowner Imaging Rates

The tables in this appendix provide detailed comparisons between the imaging referral rates of Florida physicians with a financial interest in joint-venture imaging centers (referred to as owners) and all other Florida physicians (referred to as nonowners). As described in appendix I, we did not have sufficient information to identify some of the physician owners and the unidentified owners are included in our analyses as nonowners. This would tend to understate the higher referral rates associated with the physician owners, assuming that the unidentified owners had referral rates similar to the identified owners. Notes to the tables provide information on the cutoff criteria for the physician specialties and imaging referral rates included in the tables.

Table II.1 provides a summary of the physician, imaging service, and office visit counts for owners and nonowners, by type of imaging service. This table also provides summary ratios of the owner-to-nonowner referral rates, weighted by the number of referrals by each physician specialty to adjust for variations in imaging use among physician specialties. Tables II.2 and II.3 provide detailed information for all referrals by physician specialty.

This appendix also provides referral rates and ratios for two subsets of physician owners—those with a financial interest in imaging centers that offer MRIs, CTs, or both services. Table II.4 provides MRI referral rates by specialty for owners and nonowners of imaging centers providing MRI services. The summary ratio shows that MRI owners referred twice as often for MRI scans as nonowners. Similarly, table II.5 provides CT referral rates by specialty for owners and nonowners of imaging centers providing CT services. The summary ratio shows that CT owners referred their patients for CT scans 29 percent more often than nonowners.

**Table II.1: Summary of Physician, Imaging Service, and Office Visit Counts, by Type of Imaging Service for Referred Imaging Services**

| | Number of physicians | | |
|---|---|---|---|
| **Type of service** | **Owners** | **Nonowners** | **Total** |
| MRI | 2,122 | 11,697 | 13,819 |
| CT | 2,347 | 12,391 | 14,738 |
| Ultrasound | 2,106 | 12,332 | 14,438 |
| Echocardiography | 1,673 | 11,164 | 12,837 |
| Nuclear medicine | 2,129 | 12,091 | 14,220 |
| Complex X ray | 2,265 | 11,375 | 13,640 |
| Simple X ray | 2,285 | 12,858 | 15,143 |

| Number of imaging services | | | Number of office visits | | | Ratio of owner-to-nonowner referral rates[a] |
|---|---|---|---|---|---|---|
| Owners | Nonowners | Total | Owners | Nonowners | Total | |
| 11,650 | 22,099 | 33,749 | 2,258,613 | 9,769,738 | 12,028,351 | 1.54 |
| 30,800 | 83,315 | 114,115 | 2,302,365 | 9,816,887 | 12,119,252 | 1.27 |
| 24,204 | 75,961 | 100,165 | 2,176,944 | 10,263,263 | 12,440,207 | 1.22 |
| 13,550 | 40,831 | 54,381 | 1,982,142 | 9,932,889 | 11,915,031 | 1.27 |
| 20,060 | 48,753 | 68,813 | 2,272,806 | 10,513,993 | 12,786,799 | 1.37 |
| 29,024 | 88,273 | 117,297 | 2,190,622 | 8,189,197 | 10,379,819 | 1.22 |
| 146,359 | 600,493 | 746,852 | 2,304,395 | 10,648,918 | 12,953,313 | 1.04 |

Note: For each type of imaging service (for example, MRI or CT) this summary excludes physicians, imaging services and office visits for physician specialties where (1) the physicians in that specialty accounted for less than 0.5 percent of the total imaging services ordered for that type of imaging or (2) there were no physicians in either the owner or nonowner categories. After applying this cutoff criteria, this summary includes about 1.23 million referred imaging services, or about 96 percent of the 1.28 million referred imaging services in our database.

[a]The ratios of owner-to-nonowner referral rates are weighted by physician specialty. For each type of imaging service (for example, MRI or CT), the weighting factor for each specialty is the number of the total imaging services of that type that were ordered by the physicians in that specialty. We computed weighted ratios to adjust for differences in the use of imaging among physician specialties.

**Table II.2: Imaging Referrals Per Thousand Office Visits, by Referring Physician Specialty and Ownership Status**

| Referring physician specialty | Ownership status | Number of physicians | Number of office visits |
|---|---|---|---|
| Cardiovascular disease | Owner | 159 | 206,579 |
| | Nonowner | 706 | 554,691 |
| Endocrinology | Owner | 19 | 14,074 |
| | Nonowner | 326 | 184,882 |
| Family practice | Owner | 229 | 380,872 |
| | Nonowner | 1,681 | 1,508,811 |
| Gastroenterology | Owner | 71 | 61,301 |
| | Nonowner | 278 | 136,750 |
| General practice | Owner | 185 | 219,725 |
| | Nonowner | 1,960 | 1,629,224 |
| General surgery | Owner | 138 | 41,950 |
| | Nonowner | 921 | 304,775 |
| Geriatrics | Owner | 5 | 12,319 |
| | Nonowner | 19 | 37,367 |
| Gynecology (osteopath) | Owner | 7 | 1,564 |
| | Nonowner | 62 | 14,477 |
| Internal medicine | Owner | 476 | 640,063 |
| | Nonowner | 2,364 | 2,290,218 |
| Maxillofacial surgery | Owner | 78 | 106,359 |
| | Nonowner | 212 | 223,346 |
| Nephrology | Owner | 30 | 23,130 |
| | Nonowner | 95 | 51,949 |
| Neurological surgery | Owner | 64 | 13,943 |
| | Nonowner | 108 | 18,490 |
| Neurology | Owner | 134 | 72,604 |
| | Nonowner | 259 | 122,395 |
| Neuropsychiatry | Owner | 20 | 43,150 |
| | Nonowner | 106 | 168,941 |
| Obstetrics/gynecology | Owner | 215 | 33,213 |
| | Nonowner | 856 | 116,048 |
| Oncology/hematology | Owner | 2 | 2,982 |
| | Nonowner | 24 | 21,522 |
| Ophthalmology | Owner | 38 | 65,165 |
| | Nonowner | 775 | 1,380,109 |
| Orthopedic surgery | Owner | 238 | 127,820 |
| | Nonowner | 656 | 295,546 |

| Imaging referrals per thousand office visits | | | | | | |
|---|---|---|---|---|---|---|
| MRI scans | CT scans | Nuclear medicine | Echocardiography | Ultrasound | Complex X rays | Simple X rays |
| 1.31 | 9.46 | 14.98 | 14.12 | 11.16 | 10.54 | 49.81 |
| 0.80 | 5.79 | 12.39 | 12.80 | 7.05 | 7.37 | 48.69 |
| [a] | 8.88 | 4.69 | 1.07 | 3.98 | 4.48 | 167.83 |
| [a] | 11.81 | 2.89 | 2.44 | 3.95 | 5.38 | 206.14 |
| 1.97 | 8.54 | 4.65 | 5.32 | 9.22 | 12.63 | 67.14 |
| 1.39 | 6.56 | 3.01 | 4.32 | 8.50 | 9.61 | 66.36 |
| 1.76 | 25.90 | 8.42 | 4.98 | 25.38 | 31.16 | 60.70 |
| 0.72 | 28.98 | 6.49 | 2.12 | 21.83 | 35.96 | 49.85 |
| 1.84 | 7.70 | 3.85 | 4.52 | 8.35 | 9.73 | 78.84 |
| 0.85 | 5.80 | 2.58 | 4.88 | 7.64 | 7.72 | 75.29 |
| 4.46 | 22.05 | 10.51 | 1.53 | 18.16 | 34.28 | 127.37 |
| 0.92 | 13.09 | 5.63 | 3.47 | 11.80 | 21.00 | 94.83 |
| [a] | [a] | [a] | [a] | [a] | [a] | 108.21 |
| [a] | [a] | [a] | [a] | [a] | [a] | 107.80 |
| [a] | [a] | [a] | [a] | 9.59 | [a] | [a] |
| [a] | [a] | [a] | [a] | 36.33 | [a] | [a] |
| 2.31 | 12.05 | 8.03 | 9.38 | 11.30 | 13.29 | 70.62 |
| 1.81 | 9.47 | 5.78 | 6.01 | 9.28 | 10.70 | 67.49 |
| 6.03 | 45.86 | 20.91 | 2.59 | 5.99 | 6.07 | 82.21 |
| 4.30 | 37.49 | 16.78 | 1.39 | 4.62 | 5.87 | 74.98 |
| 4.02 | 12.54 | 15.39 | 11.59 | 24.60 | 12.58 | 96.24 |
| 1.92 | 7.51 | 10.51 | 3.41 | 14.86 | 8.93 | 69.68 |
| 66.99 | 54.36 | 18.65 | [a] | [a] | 19.22 | [a] |
| 53.22 | 42.73 | 10.76 | [a] | [a] | 19.20 | [a] |
| 47.09 | 23.86 | 4.77 | 2.26 | [a] | 3.33 | 31.00 |
| 38.18 | 23.47 | 3.64 | 2.25 | [a] | 3.19 | 37.02 |
| 5.56 | 5.28 | 5.93 | 1.67 | 3.29 | 4.17 | 26.79 |
| 4.90 | 5.01 | 5.89 | 2.39 | 4.00 | 3.10 | 57.19 |
| [a] | 6.47 | [a] | [a] | 24.75 | 7.05 | 106.68 |
| [a] | 6.26 | [a] | [a] | 22.10 | 6.21 | 102.72 |
| [a] | 107.98 | [a] | [a] | [a] | [a] | [a] |
| [a] | 22.63 | [a] | [a] | [a] | [a] | [a] |
| 1.30 | 0.60 | 0.41 | 0.34 | 2.26 | [a] | 8.73 |
| 0.36 | 0.75 | 0.38 | 0.50 | 1.03 | [a] | 9.76 |
| 16.88 | 9.75 | 12.84 | [a] | 1.24 | 4.83 | 38.09 |
| 13.01 | 7.57 | 10.35 | [a] | 1.28 | 4.44 | 41.47 |

(continued)

| Referring physician specialty | Ownership status | Number of physicians | Number of office visits |
|---|---|---|---|
| Otolaryngology | Owner | 47 | 44,092 |
| | Nonowner | 310 | 240,370 |
| Podiatry | Owner | 6 | 7,870 |
| | Nonowner | 615 | 844,265 |
| Preventive medicine | Owner | 18 | 29,445 |
| | Nonowner | 106 | 97,486 |
| Psychiatry | Owner | 18 | 7,751 |
| | Nonowner | 547 | 284,892 |
| Pulmonary disease | Owner | 54 | 62,104 |
| | Nonowner | 213 | 150,155 |
| Thoracic surgery | Owner | 12 | 1,730 |
| | Nonowner | 128 | 23,900 |
| Urology | Owner | 125 | 112,560 |
| | Nonowner | 400 | 311,590 |

| Imaging referrals per thousand office visits | | | | | | |
|---|---|---|---|---|---|---|
| MRI scans | CT scans | Nuclear medicine | Echocardiography | Ultrasound | Complex X rays | Simple X rays |
| 7.17 | 13.06 | 1.59 | [a] | [a] | [a] | 29.44 |
| 4.10 | 11.91 | 1.27 | [a] | [a] | [a] | 29.75 |
| [a] | [a] | 2.16 | 0.64 | 1.40 | [a] | 28.34 |
| [a] | [a] | 0.48 | 0.56 | 1.04 | [a] | 8.23 |
| 3.67 | 9.17 | 9.10 | 4.69 | 9.75 | 7.68 | 45.58 |
| 1.83 | 6.49 | 5.29 | 3.37 | 8.54 | 7.33 | 48.22 |
| 5.03 | [a] | [a] | 0.39 | [a] | [a] | [a] |
| 0.60 | [a] | [a] | 1.14 | [a] | [a] | [a] |
| 2.58 | 17.52 | 7.97 | 4.43 | 5.27 | 8.61 | 71.88 |
| 1.01 | 15.81 | 7.53 | 4.76 | 5.03 | 6.42 | 93.72 |
| [a] | [a] | [a] | [a] | [a] | 26.59 | [a] |
| [a] | [a] | [a] | [a] | [a] | 32.76 | [a] |
| 2.29 | 16.56 | 19.78 | [a] | 34.02 | 41.69 | 40.25 |
| 0.87 | 14.10 | 15.70 | [a] | 26.86 | 40.91 | 42.38 |

[a]For each type of imaging service (for example, MRI or CT), this analysis excludes imaging referral rates where (1) either owners or nonowners within a specialty made no referrals or (2) the referrals by physicians in the specialty for owners and nonowners combined accounted for less than 0.5 percent of all the referrals for that type of imaging service. The referrals included in this analysis account for 97 percent of the MRI scans we matched to a referring physician, 96 percent of the CT scans; 97 percent of the nuclear medicine scans; 97 percent of the echocardiography services; 97 percent of the ultrasound services; 97 percent of the complex X rays; and 96 percent of the simple X rays.

**Table II.3: Ratio of Owner-to-Nonowner Referral Rates, by Referring Physician Specialty**

| Referring physician specialty | Ownership status | Number of physicians | Number of office visits |
|---|---|---|---|
| Cardiovascular disease | Owner | 159 | 206,579 |
| | Nonowner | 706 | 554,691 |
| Endocrinology | Owner | 19 | 14,074 |
| | Nonowner | 326 | 184,882 |
| Family practice | Owner | 229 | 380,872 |
| | Nonowner | 1,681 | 1,508,811 |
| Gastroenterology | Owner | 71 | 61,301 |
| | Nonowner | 278 | 136,750 |
| General practice | Owner | 185 | 219,725 |
| | Nonowner | 1,960 | 1,629,224 |
| General surgery | Owner | 138 | 41,950 |
| | Nonowner | 921 | 304,775 |
| Geriatrics | Owner | 5 | 12,319 |
| | Nonowner | 19 | 37,367 |
| Gynecology (osteopath) | Owner | 7 | 1,564 |
| | Nonowner | 62 | 14,477 |
| Internal medicine | Owner | 476 | 640,063 |
| | Nonowner | 2,364 | 2,290,218 |
| Maxillofacial surgery | Owner | 78 | 106,359 |
| | Nonowner | 212 | 223,346 |
| Nephrology | Owner | 30 | 23,130 |
| | Nonowner | 95 | 51,949 |
| Neurological surgery | Owner | 64 | 13,943 |
| | Nonowner | 108 | 18,490 |
| Neurology | Owner | 134 | 72,604 |
| | Nonowner | 259 | 122,395 |
| Neuropsychiatry | Owner | 20 | 43,150 |
| | Nonowner | 106 | 168,941 |
| Obstetrics/gynecology | Owner | 215 | 33,213 |
| | Nonowner | 856 | 116,048 |
| Oncology/hematology | Owner | 2 | 2,982 |
| | Nonowner | 24 | 21,522 |
| Ophthalmology | Owner | 38 | 65,165 |
| | Nonowner | 775 | 1,380,109 |
| Orthopedic surgery | Owner | 238 | 127,820 |
| | Nonowner | 656 | 295,546 |

| Ratio of owner-to-nonowner referral rates | | | | | | |
|---|---|---|---|---|---|---|
| MRI scans | CT scans | Nuclear medicine | Echocardiography | Ultrasound | Complex X rays | Simple X rays |
| 1.63 | 1.63 | 1.21 | 1.10 | 1.58 | 1.43 | 1.02 |
| [a] | 0.75 | 1.62 | 0.44 | 1.01 | 0.83 | 0.81 |
| 1.42 | 1.30 | 1.54 | 1.23 | 1.08 | 1.31 | 1.01 |
| 2.46 | 0.89 | 1.30 | 2.35 | 1.16 | 0.87 | 1.22 |
| 2.17 | 1.33 | 1.49 | 0.93 | 1.09 | 1.26 | 1.05 |
| 4.87 | 1.68 | 1.87 | 0.44 | 1.54 | 1.63 | 1.34 |
| [a] | [a] | [a] | [a] | [a] | [a] | 1.00 |
| [a] | [a] | [a] | [a] | 0.26 | [a] | [a] |
| 1.27 | 1.27 | 1.39 | 1.56 | 1.22 | 1.24 | 1.05 |
| 1.40 | 1.22 | 1.25 | 1.86 | 1.30 | 1.03 | 1.10 |
| 2.09 | 1.67 | 1.46 | 3.40 | 1.66 | 1.41 | 1.38 |
| 1.26 | 1.27 | 1.73 | [a] | [a] | 1.00 | [a] |
| 1.23 | 1.02 | 1.31 | 1.01 | [a] | 1.05 | 0.84 |
| 1.13 | 1.05 | 1.01 | 0.70 | 0.82 | 1.34 | 0.47 |
| [a] | 1.03 | [a] | [a] | 1.12 | 1.13 | 1.04 |
| [a] | 4.77 | [a] | [a] | [a] | [a] | [a] |
| 3.62 | 0.80 | 1.09 | 0.67 | 2.18 | [a] | 0.89 |
| 1.30 | 1.29 | 1.24 | [a] | 0.97 | 1.09 | 0.92 |

(continued)

| Referring physician specialty | Ownership status | Number of physicians | Number of office visits |
|---|---|---|---|
| Otolaryngology | Owner | 47 | 44,092 |
| | Nonowner | 310 | 240,370 |
| Podiatry | Owner | 6 | 7,870 |
| | Nonowner | 615 | 844,265 |
| Preventive medicine | Owner | 18 | 29,445 |
| | Nonowner | 106 | 97,486 |
| Psychiatry | Owner | 18 | 7,751 |
| | Nonowner | 547 | 284,892 |
| Pulmonary disease | Owner | 54 | 62,104 |
| | Nonowner | 213 | 150,155 |
| Thoracic surgery | Owner | 12 | 1,730 |
| | Nonowner | 128 | 23,900 |
| Urology | Owner | 125 | 112,560 |
| | Nonowner | 400 | 311,590 |
| All listed specialties | Owner | 2,388 | 2,332,365 |
| | Nonowner | 13,727 | 11,012,199 |

| Ratio of owner-to-nonowner referral rates | | | | | | |
|---|---|---|---|---|---|---|
| MRI scans | CT scans | Nuclear medicine | Echocardiography | Ultrasound | Complex X rays | Simple X rays |
| 1.75 | 1.10 | 1.25 | [a] | [a] | [a] | 0.99 |
| [a] | [a] | 4.54 | 1.14 | 1.34 | [a] | 3.44 |
| 2.01 | 1.41 | 1.72 | 1.39 | 1.14 | 1.05 | 0.95 |
| 8.38 | [a] | [a] | 0.34 | [a] | [a] | [a] |
| 2.56 | 1.11 | 1.06 | 0.93 | 1.05 | 1.34 | 0.77 |
| [a] | [a] | [a] | [a] | [a] | 0.81 | [a] |
| 2.63 | 1.17 | 1.26 | [a] | 1.27 | 1.02 | 0.95 |
| 1.54[b] | 1.27[b] | 1.37[b] | 1.27[b] | 1.22[b] | 1.22[b] | 1.04[b] |

[a]For each type of imaging service (for example, MRI or CT), this analysis excludes imaging referrals where (1) either owners or nonowners within a specialty made no referrals or (2) the referrals by physicians in the specialty for owners and nonowners combined accounted for less than 0.5 percent of all the referrals for that type of imaging service.

[b]The ratios of owner-to-nonowner referrals for all specialties combined are weighted ratios, based on the number of each type of imaging service referrals by each specialty.

**Table II.4: MRI Referrals, by Referring Physician Specialty and MRI Ownership Status**

| Referring physician specialty | MRI ownership status | Number of physicians | Number of office visits | MRI referrals per 1,000 office visits | Ratio of MRI owner-to-nonowner referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | Owner | 61 | 69,952 | 1.63 | 1.98 |
| | Nonowner | 777 | 650,302 | 0.82 | |
| Family practice | Owner | 56 | 80,827 | 2.07 | 1.40 |
| | Nonowner | 1,831 | 1,766,487 | 1.48 | |
| Gastroenterology | Owner | 29 | 29,930 | 2.71 | 3.61 |
| | Nonowner | 310 | 159,988 | 0.75 | |
| General practice | Owner | 79 | 82,868 | 2.65 | 3.00 |
| | Nonowner | 2,040 | 1,728,324 | 0.89 | |
| General surgery | Owner | 57 | 18,859 | 8.32 | 9.26 |
| | Nonowner | 983 | 322,698 | 0.90 | |
| Internal medicine | Owner | 191 | 232,022 | 3.43 | 1.91 |
| | Nonowner | 2,596 | 2,630,615 | 1.79 | |
| Maxillofacial surgery | Owner | 40 | 48,087 | 7.17 | 1.61 |
| | Nonowner | 239 | 263,152 | 4.45 | |
| Nephrology | Owner | 10 | 9,988 | 6.41 | 3.27 |
| | Nonowner | 107 | 56,623 | 1.96 | |
| Neurological surgery | Owner | 49 | 8,832 | 71.78 | 1.38 |
| | Nonowner | 115 | 21,544 | 52.03 | |
| Neurology | Owner | 89 | 45,802 | 52.31 | 1.36 |
| | Nonowner | 282 | 136,066 | 38.55 | |
| Neuropsychiatry | Owner | 16 | 33,486 | 5.70 | 1.16 |
| | Nonowner | 110 | 178,605 | 4.91 | |
| Ophthalmology | Owner | 18 | 34,358 | 2.30 | 6.43 |
| | Nonowner | 787 | 1,398,387 | 0.36 | |
| Orthopedic surgery | Owner | 146 | 77,329 | 20.34 | 1.59 |
| | Nonowner | 721 | 333,603 | 12.78 | |
| Otolaryngology | Owner | 25 | 21,513 | 9.30 | 2.22 |
| | Nonowner | 329 | 258,038 | 4.19 | |
| Preventive medicine | Owner | 10 | 16,331 | 4.10 | 2.04 |
| | Nonowner | 112 | 107,171 | 2.02 | |
| Psychiatry | Owner | 12 | 4,194 | 8.11 | 13.31 |
| | Nonowner | 551 | 287,307 | 0.61 | |
| Pulmonary disease | Owner | 29 | 29,148 | 3.05 | 2.60 |
| | Nonowner | 232 | 173,906 | 1.17 | |
| Urology | Owner | 35 | 32,568 | 4.97 | 5.60 |
| | Nonowner | 474 | 378,486 | 0.89 | |

(continued)

| Referring physician specialty | MRI ownership status | Number of physicians | Number of office visits | MRI referrals per 1,000 office visits | Ratio of MRI owner-to-nonowner referral rates |
|---|---|---|---|---|---|
| All listed specialties | Owner | 952 | 876,094 | • | 2.02[a] |
| | Nonowner | 12,596 | 10,851,302 | • | |

Notes: For some physicians with an investment interest in an imaging center, we could not readily determine if the center offered MRI services. Those physicians were excluded from this analysis.

This analysis excludes physician specialties where (1) either owners or nonowners within the specialty made no MRI referrals or (2) the MRI referrals by physicians in the specialty for owners and nonowners combined accounted for less than 0.5 percent of all the MRI referrals we matched to a referring physician. The MRI referrals included in this analysis account for 93 percent of all the MRI referrals we matched to a referring physician.

[a]The ratio of MRI owner-to-nonowner referral rates for all specialties combined is a weighted ratio based on the number of MRI referrals by each specialty.

**Table II.5: CT Referrals, by Referring Physician Specialty and CT Ownership Status**

| Referring physician specialty | CT ownership status | Number of physicians | Number of office visits | CT referrals per 1,000 office visits | Ratio of CT owner-to-nonowner referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | Owner | 83 | 105,403 | 9.93 | 1.70 |
| | Nonowner | 755 | 614,851 | 5.83 | |
| Endocrinology | Owner | 17 | 13,125 | 9.37 | 0.79 |
| | Nonowner | 327 | 185,057 | 11.81 | |
| Family practice | Owner | 122 | 176,933 | 9.17 | 1.36 |
| | Nonowner | 1,765 | 1,670,381 | 6.75 | |
| Gastroenterology | Owner | 43 | 34,882 | 24.28 | 0.84 |
| | Nonowner | 296 | 155,036 | 28.77 | |
| General practice | Owner | 107 | 114,686 | 7.40 | 1.27 |
| | Nonowner | 2,012 | 1,696,506 | 5.85 | |
| General surgery | Owner | 84 | 24,352 | 19.51 | 1.41 |
| | Nonowner | 956 | 317,205 | 13.82 | |
| Internal medicine | Owner | 295 | 404,157 | 12.63 | 1.32 |
| | Nonowner | 2,492 | 2,458,480 | 9.57 | |
| Maxillofacial surgery | Owner | 58 | 76,641 | 50.21 | 1.31 |
| | Nonowner | 221 | 234,598 | 38.21 | |
| Neurological surgery | Owner | 41 | 9,489 | 57.22 | 1.36 |
| | Nonowner | 123 | 20,887 | 42.23 | |
| Neurology | Owner | 80 | 43,979 | 26.90 | 1.19 |
| | Nonowner | 291 | 137,889 | 22.67 | |
| Neuropsychiatry | Owner | 14 | 29,782 | 5.24 | 1.04 |
| | Nonowner | 112 | 182,309 | 5.04 | |
| Obstetrics/gynecology | Owner | 114 | 18,402 | 6.63 | 1.04 |
| | Nonowner | 931 | 126,587 | 6.36 | |
| Ophthalmology | Owner | 23 | 32,019 | 0.62 | 0.84 |
| | Nonowner | 782 | 1,400,726 | 0.74 | |
| Orthopedic surgery | Owner | 139 | 73,961 | 12.36 | 1.67 |
| | Nonowner | 728 | 336,971 | 7.42 | |
| Otolaryngology | Owner | 32 | 28,261 | 12.70 | 1.07 |
| | Nonowner | 322 | 251,290 | 11.89 | |
| Preventive medicine | Owner | 12 | 20,173 | 11.25 | 1.78 |
| | Nonowner | 110 | 103,329 | 6.32 | |
| Pulmonary disease | Owner | 38 | 42,574 | 19.97 | 1.26 |
| | Nonowner | 223 | 160,480 | 15.80 | |

(continued)

| Referring physician specialty | CT ownership status | Number of physicians | Number of office visits | CT referrals per 1,000 office visits | Ratio of CT owner-to-nonowner referral rates |
|---|---|---|---|---|---|
| Urology | Owner | 67 | 66,667 | 18.37 | 1.32 |
| | Nonowner | 442 | 344,387 | 13.93 | |
| All listed specialties | Owner | 1,369 | 1,315,486 | • | 1.29[a] |
| | Nonowner | 12,888 | 10,396,969 | • | |

Notes: For some physicians with an investment interest in an imaging center, we could not readily determine if the center offered CT services. Those physicians were excluded from this analysis.

This analysis excludes physician specialties where (1) either owners or nonowners within the specialty made no CT referrals, (2) the CT referrals by physicians in the specialty for owners and nonowners combined accounted for less than 0.5 percent of all the CT referrals we matched to a referring physician, or (3) there were fewer than 10 physicians in either category. The CT referrals included in this analysis account for 92 percent of all the CT referrals we matched to a referring physician.

[a]The ratio of CT owner-to-nonowner referral rates for all specialties combined is a weighted ratio based on the number of CT referrals by each specialty.

# In-practice and Referral Imaging Rates

The tables in this appendix provide detailed comparisons between in-practice and referral imaging rates for Florida physicians. As described in appendix I, we classified each physician's predominant imaging pattern as either in-practice or referral for each of seven types of imaging services.

Table III.1 provides a summary of the physician, imaging service, and office visit counts for in-practice and referring physicians by type of imaging service. This table also provides summary ratios of the in-practice and referral rates, weighted by the number of imaging services ordered by each physician specialty to adjust for variations in the use of imaging among physician specialties. The summary ratios show that in-practice imaging rates exceeded referral imaging rates for all types of imaging services. The in-practice rates were about 3 times higher for MRI scans; about 2 times higher for CT scans; 4.5 to 5 times higher for ultrasound, echocardiography, and diagnostic nuclear medicine imaging; and about 2 times higher for complex and simple X rays.

Tables III.2 through III.8 provide detailed information on imaging rates by physician specialty for each of seven types of diagnostic imaging services—MRI, CT, ultrasound, echocardiography, diagnostic nuclear medicine, complex X rays, and simple X rays.

**Table III.1: Summary of Physician, Imaging Service, and Office Visit Counts, by Type of Imaging Service for In-practice and Referred Imaging Services**

| | Number of physicians | | |
|---|---|---|---|
| Type of service | In-practice | Referral | Total |
| MRI | 169 | 13,650 | 13,819 |
| CT | 310 | 14,360 | 14,670 |
| Ultrasound | 1,646 | 10,899 | 12,545 |
| Echocardiography | 1,185 | 9,995 | 11,180 |
| Nuclear medicine | 418 | 13,677 | 14,095 |
| Complex X ray | 773 | 11,879 | 12,652 |
| Simple X ray | 4,897 | 10,222 | 15,119 |

| Number of imaging services | | | Number of office visits | | | Ratio of in-practice-to-referral imaging rates [a] |
|---|---|---|---|---|---|---|
| In-practice | Referral | Total | In-practice | Referral | Total | |
| 2,622 | 33,939 | 36,561 | 142,985 | 11,885,366 | 12,028,351 | 3.06 |
| 7,273 | 112,171 | 119,444 | 291,756 | 11,792,169 | 12,083,925 | 1.95 |
| 112,030 | 94,169 | 206,199 | 2,254,372 | 8,695,337 | 10,949,709 | 5.13 |
| 70,442 | 51,576 | 122,018 | 1,327,817 | 9,031,389 | 10,359,206 | 4.78 |
| 15,193 | 67,406 | 82,599 | 390,600 | 12,321,120 | 12,711,720 | 4.52 |
| 19,595 | 116,389 | 135,984 | 699,675 | 9,534,698 | 10,234,373 | 1.92 |
| 971,140 | 646,856 | 1,617,996 | 4,824,447 | 8,079,180 | 12,903,627 | 2.10 |

Note: For each type of imaging service (for example, MRI or CT), this summary excludes physicians, imaging services, and office visits for physician specialties where (1) the physicians in that specialty accounted for less than 0.5 percent of the total imaging services ordered for that type of imaging or (2) there were no physicians in either the in-practice or referral categories. After applying these cutoff criteria, this summary includes about 2,321,000 imaging services, or about 95 percent of the 2,441,000 imaging services in our database.

[a]The ratios of in-practice-to-referral imaging rates are weighted by physician specialty. For each type of imaging service (for example, MRI or CT), the weighting factor for each specialty is the number of the total imaging services of that type that were ordered by the physicians in that specialty. We computed a weighted ratio to adjust for differences in the use of imaging among physician specialties.

**Table III.2: MRI In-practice and Referral Rates**

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | MRI scans per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | In-practice | 9 | 3,729 | 9.65 | 10.20 |
| | Referral | 856 | 757,541 | 0.95 | |
| Family practice | In-practice | 4 | 2,987 | 2.68 | 1.77 |
| | Referral | 1,906 | 1,886,696 | 1.51 | |
| Gastroenterology | In-practice | 7 | 4,779 | 5.65 | 5.30 |
| | Referral | 342 | 193,272 | 1.07 | |
| General practice | In-practice | 5 | 4,112 | 4.38 | 4.50 |
| | Referral | 2,140 | 1,844,837 | 0.97 | |
| General surgery | In-practice | 6 | 9,353 | 12.40 | 9.00 |
| | Referral | 1,053 | 337,372 | 1.38 | |
| Internal medicine | In-practice | 50 | 47,989 | 7.73 | 3.96 |
| | Referral | 2,790 | 2,882,292 | 1.95 | |
| Maxillofacial surgery | In-practice | 7 | 5,969 | 14.91 | 3.02 |
| | Referral | 283 | 323,736 | 4.93 | |
| Nephrology | In-practice | 2 | 1,715 | 25.66 | 9.75 |
| | Referral | 123 | 73,364 | 2.63 | |
| Neurological surgery | In-practice | 7 | 1,771 | 90.91 | 1.44 |
| | Referral | 165 | 30,662 | 63.24 | |
| Neurology | In-practice | 25 | 15,558 | 81.31 | 1.77 |
| | Referral | 368 | 179,441 | 45.84 | |
| Neuropsychiatry | In-practice | 3 | 4,212 | 6.89 | 1.33 |
| | Referral | 123 | 207,879 | 5.17 | |
| Ophthalmology | In-practice | 6 | 9,844 | 3.05 | 7.49 |
| | Referral | 807 | 1,435,430 | 0.41 | |
| Orthopedic surgery | In-practice | 13 | 7,391 | 31.25 | 2.15 |
| | Referral | 881 | 415,975 | 14.51 | |
| Otolaryngology | In-practice | 7 | 6,065 | 12.04 | 2.58 |
| | Referral | 350 | 278,397 | 4.66 | |
| Preventive medicine | In-practice | 6 | 7,720 | 8.42 | 3.56 |
| | Referral | 118 | 119,211 | 2.37 | |
| Psychiatry | In-practice | 2 | 484 | 8.26 | 11.50 |
| | Referral | 563 | 292,159 | 0.72 | |
| Pulmonary disease | In-practice | 2 | 1,064 | 21.62 | 14.68 |
| | Referral | 265 | 211,195 | 1.47 | |
| Urology | In-practice | 8 | 8,243 | 3.88 | 3.02 |
| | Referral | 517 | 415,907 | 1.29 | |

(continued)

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | MRI scans per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| All listed specialties | In-practice | 169 | 142,985 | • | 3.06[b] |
| | Referral | 13,650 | 11,885,366 | • | |

[a]This table excludes specialties where (1) physicians in one or both of the comparison groups within the specialty did not order any MRI scans, (2) the number of MRI scans ordered by the physicians in the specialty accounted for less than 0.5 percent of the total MRI scans used in our analysis, or (3) fewer than 10 physicians in that specialty ordered MRI scans. The specialties included in this table accounted for over 95 percent of the MRI scans used in our analyses.

[b]The ratio for all specialties combined is weighted by the number of MRI scans ordered by physicians in each specialty.

**Table III.3: CT In-practice and Referral Rates**

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | CT scans per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | In-practice | 16 | 9,064 | 15.56 | 2.26 |
| | Referral | 849 | 752,206 | 6.89 | |
| Endocrinology | In-practice | 5 | 7,016 | 8.41 | 0.70 |
| | Referral | 340 | 191,940 | 12.02 | |
| Family practice | In-practice | 20 | 27,808 | 11.94 | 1.69 |
| | Referral | 1,890 | 1,861,875 | 7.05 | |
| Gastroenterology | In-practice | 12 | 7,509 | 40.48 | 1.39 |
| | Referral | 337 | 190,542 | 29.12 | |
| General practice | In-practice | 7 | 8,992 | 11.12 | 1.84 |
| | Referral | 2,138 | 1,839,957 | 6.06 | |
| General surgery | In-practice | 16 | 8,715 | 30.06 | 2.07 |
| | Referral | 1,043 | 338,010 | 14.51 | |
| Internal medicine | In-practice | 87 | 100,953 | 20.32 | 1.96 |
| | Referral | 2,753 | 2,829,328 | 10.36 | |
| Maxillofacial surgery | In-practice | 11 | 11,997 | 80.77 | 1.94 |
| | Referral | 279 | 317,708 | 41.58 | |
| Nephrology | In-practice | 4 | 3,194 | 28.18 | 2.97 |
| | Referral | 121 | 71,885 | 9.50 | |
| Neurological surgery | In-practice | 9 | 2,345 | 90.41 | 1.75 |
| | Referral | 163 | 30,088 | 51.75 | |
| Neurology | In-practice | 43 | 24,604 | 59.22 | 2.22 |
| | Referral | 350 | 170,395 | 26.71 | |
| Neuropsychiatry | In-practice | 5 | 9,801 | 12.75 | 2.39 |
| | Referral | 121 | 202,290 | 5.33 | |
| Obstetrics/gynecology | In-practice | 13 | 3,125 | 17.28 | 2.68 |
| | Referral | 1,058 | 146,136 | 6.45 | |
| Ophthalmology | In-practice | 12 | 19,755 | 4.96 | 6.63 |
| | Referral | 801 | 1,425,519 | 0.75 | |
| Orthopedic surgery | In-practice | 16 | 10,676 | 13.68 | 1.61 |
| | Referral | 878 | 412,690 | 8.50 | |
| Otolaryngology | In-practice | 6 | 4,990 | 28.86 | 2.34 |
| | Referral | 351 | 279,472 | 12.34 | |
| Preventive medicine | In-practice | 9 | 12,919 | 14.71 | 1.87 |
| | Referral | 115 | 114,012 | 7.85 | |
| Pulmonary disease | In-practice | 6 | 6,398 | 23.91 | 1.43 |
| | Referral | 261 | 205,861 | 16.78 | |

(continued)

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | CT scans per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Urology | In-practice | 13 | 11,895 | 32.45 | 2.14 |
| | Referral | 512 | 412,255 | 15.18 | |
| All listed specialties | In-practice | 310 | 291,756 | • | 1.95[b] |
| | Referral | 14,360 | 11,792,169 | • | |

[a]This table excludes specialties where (1) physicians in one or both of the comparison groups within the specialty did not order any CT scans, (2) the number of CT scans ordered by the physicians in the specialty accounted for less than 0.5 percent of the total CT scans used in our analyses, or (3) fewer than 10 physicians in that specialty ordered CT scans. The specialties included in this table accounted for over 95 percent of the CT scans used in our analyses.

[b]The ratio for all specialties combined is weighted by the number of CT scans ordered by physicians in each specialty.

**Table III.4: Ultrasound In-practice and Referral Rates**

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Ultrasound services per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | In-practice | 87 | 101,515 | 36.55 | 4.02 |
| | Referral | 778 | 659,755 | 9.10 | |
| Family practice | In-practice | 67 | 97,290 | 15.82 | 1.74 |
| | Referral | 1,843 | 1,792,393 | 9.07 | |
| Gastroenterology | In-practice | 20 | 15,222 | 77.72 | 3.13 |
| | Referral | 329 | 182,829 | 24.82 | |
| General practice | In-practice | 78 | 96,784 | 29.01 | 3.55 |
| | Referral | 2,067 | 1,752,165 | 8.18 | |
| General surgery | In-practice | 55 | 22,614 | 41.26 | 2.98 |
| | Referral | 1,004 | 324,111 | 13.84 | |
| Internal medicine | In-practice | 189 | 243,400 | 27.30 | 2.59 |
| | Referral | 2,651 | 2,686,881 | 10.56 | |
| Maxillofacial surgery | In-practice | 11 | 14,669 | 13.98 | 2.64 |
| | Referral | 279 | 315,036 | 5.30 | |
| Nephrology | In-practice | 3 | 2,453 | 40.77 | 2.14 |
| | Referral | 122 | 72,626 | 19.03 | |
| Neuropsychiatry | In-practice | 9 | 16,245 | 7.94 | 1.90 |
| | Referral | 117 | 195,846 | 4.18 | |
| Obstetrics/gynecology | In-practice | 111 | 17,168 | 34.42 | 1.31 |
| | Referral | 960 | 132,093 | 26.28 | |
| Ophthalmology | In-practice | 698 | 1,347,767 | 49.33 | 10.59 |
| | Referral | 115 | 97,507 | 4.66 | |
| Preventive medicine | In-practice | 13 | 18,390 | 23.16 | 2.29 |
| | Referral | 111 | 108,541 | 10.12 | |
| Pulmonary disease | In-practice | 10 | 13,197 | 22.20 | 4.17 |
| | Referral | 257 | 199,062 | 5.32 | |
| Urology | In-practice | 263 | 247,658 | 108.98 | 1.88 |
| | Referral | 262 | 176,492 | 58.04 | |
| All listed specialties | In-practice | 1,646 | 2,254,372 | • | 5.13[b] |
| | Referral | 10,899 | 8,695,337 | • | |

[a]This table excludes specialties where (1) physicians in one or both of the comparison groups within the specialty did not order any ultrasound services, (2) the number of ultrasound services ordered by the physicians in the specialty accounted for less than 0.5 percent of the total ultrasound services used in our analyses, or (3) fewer than 10 physicians in that specialty ordered ultrasound services. The specialties included in this table accounted for over 95 percent of the ultrasound services used in our analyses.

[b]The ratio for all specialties combined is weighted by the number of ultrasound services ordered by physicians in each specialty.

**Table III.5: Echocardiography In-practice and Referral Rates**

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Echocardiograms per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | In-practice | 464 | 460,045 | 80.80 | 2.63 |
| | Referral | 401 | 301,225 | 30.76 | |
| Family practice | In-practice | 78 | 93,240 | 26.36 | 5.63 |
| | Referral | 1,832 | 1,796,443 | 4.68 | |
| Gastroenterology | In-practice | 12 | 7,211 | 14.15 | 4.53 |
| | Referral | 337 | 190,840 | 3.12 | |
| General practice | In-practice | 84 | 106,783 | 40.77 | 7.90 |
| | Referral | 2,061 | 1,742,166 | 5.16 | |
| General surgery | In-practice | 31 | 15,744 | 15.43 | 4.61 |
| | Referral | 1,028 | 330,981 | 3.35 | |
| Internal medicine | In-practice | 422 | 523,060 | 46.29 | 5.68 |
| | Referral | 2,418 | 2,407,221 | 8.14 | |
| Maxillofacial surgery | In-practice | 20 | 27,258 | 6.93 | 3.51 |
| | Referral | 270 | 302,447 | 1.98 | |
| Nephrology | In-practice | 10 | 13,886 | 19.37 | 2.75 |
| | Referral | 115 | 61,193 | 7.04 | |
| Neurology | In-practice | 21 | 14,810 | 15.80 | 6.59 |
| | Referral | 372 | 180,189 | 2.40 | |
| Ophthalmology | In-practice | 15 | 27,314 | 4.58 | 9.08 |
| | Referral | 798 | 1,417,960 | 0.50 | |
| Preventive medicine | In-practice | 13 | 22,133 | 14.32 | 3.28 |
| | Referral | 111 | 104,798 | 4.37 | |
| Pulmonary disease | In-practice | 15 | 16,333 | 47.02 | 9.63 |
| | Referral | 252 | 195,926 | 4.88 | |
| All listed specialties | In-practice | 1,185 | 1,327,817 | • | 4.78[b] |
| | Referral | 9,995 | 9,031,389 | • | |

[a]This table excludes specialties where (1) physicians in one or both of the comparison groups within the specialty did not order any echocardiograms, (2) the number of echocardiograms ordered by the physicians in the specialty accounted for less than 0.5 percent of the total echocardiograms used in our analyses, or (3) fewer than 10 physicians in that specialty ordered echocardiograms. The specialties included in this table accounted for over 96 percent of the echocardiograms used in our analyses.

[b]The ratio for all specialties combined is weighted by the number of echocardiograms ordered by physicians in each specialty.

**Table III.6: Nuclear Medicine In-practice and Referral Rates**

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Nuclear scans per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | In-practice | 141 | 113,597 | 77.04 | 5.21 |
| | Referral | 724 | 647,673 | 14.79 | |
| Endocrinology | In-practice | 4 | 6,479 | 2.93 | 0.94 |
| | Referral | 341 | 192,477 | 3.12 | |
| Family practice | In-practice | 12 | 17,480 | 13.79 | 4.07 |
| | Referral | 1,898 | 1,872,203 | 3.38 | |
| Gastroenterology | In-practice | 11 | 6,575 | 11.41 | 1.55 |
| | Referral | 338 | 191,476 | 7.36 | |
| General practice | In-practice | 16 | 19,969 | 45.32 | 16.50 |
| | Referral | 2,129 | 1,828,980 | 2.75 | |
| General surgery | In-practice | 17 | 10,908 | 6.97 | 1.08 |
| | Referral | 1,042 | 335,817 | 6.42 | |
| Internal medicine | In-practice | 116 | 112,392 | 25.98 | 4.02 |
| | Referral | 2,724 | 2,817,889 | 6.46 | |
| Maxillofacial surgery | In-practice | 9 | 10,327 | 26.24 | 1.40 |
| | Referral | 281 | 319,378 | 18.73 | |
| Neurological surgery | In-practice | 6 | 1,681 | 16.06 | 1.08 |
| | Referral | 166 | 30,752 | 14.86 | |
| Neurology | In-practice | 12 | 6,799 | 7.65 | 1.80 |
| | Referral | 381 | 188,200 | 4.25 | |
| Neuropsychiatry | In-practice | 10 | 22,541 | 26.75 | 4.18 |
| | Referral | 116 | 189,550 | 6.40 | |
| Ophthalmology | In-practice | 12 | 17,368 | 2.59 | 6.67 |
| | Referral | 801 | 1,427,906 | 0.39 | |
| Orthopedic surgery | In-practice | 16 | 9,580 | 15.34 | 1.35 |
| | Referral | 878 | 413,786 | 11.39 | |
| Otolaryngology | In-practice | 5 | 3,471 | 6.63 | 4.89 |
| | Referral | 352 | 280,991 | 1.36 | |
| Podiatry | In-practice | 1 | 2,064 | 0.48 | 0.98 |
| | Referral | 620 | 850,071 | 0.49 | |
| Preventive medicine | In-practice | 11 | 12,022 | 30.94 | 4.46 |
| | Referral | 113 | 114,909 | 6.94 | |
| Pulmonary disease | In-practice | 6 | 6,731 | 25.85 | 3.27 |
| | Referral | 261 | 205,528 | 7.90 | |
| Urology | In-practice | 13 | 10,616 | 46.25 | 2.68 |
| | Referral | 512 | 413,534 | 17.29 | |

(continued)

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Nuclear scans per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| All listed specialties | In-practice | 418 | 390,600 | • | 4.52[b] |
| | Referral | 13,677 | 12,321,120 | • | |

[a]This table excludes specialties where (1) physicians in one or both of the comparison groups within the specialty did not order any nuclear medicine scans, (2) the number of nuclear medicine scans ordered by the physicians in the specialty accounted for less than 0.5 percent of the total nuclear medicine scans used in our analyses, or (3) fewer than 10 physicians in that specialty ordered nuclear medicine scans. The specialties included in this table accounted for 96 percent of the nuclear medicine scans used in our analyses.

[b]The ratio for all specialties combined is weighted by the number of nuclear medicine scans ordered by physicians in each specialty.

**Table III.7: Complex X Ray In-practice and Referral Rates**

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Complex X rays per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | In-practice | 57 | 41,585 | 16.91 | 1.90 |
| | Referral | 808 | 719,685 | 8.91 | |
| Endocrinology | In-practice | 6 | 7,939 | 10.20 | 1.85 |
| | Referral | 339 | 191,017 | 5.51 | |
| Family practice | In-practice | 73 | 96,069 | 15.89 | 1.47 |
| | Referral | 1,837 | 1,793,614 | 10.79 | |
| Gastroenterology | In-practice | 34 | 21,337 | 68.89 | 1.81 |
| | Referral | 315 | 176,714 | 38.16 | |
| General practice | In-practice | 108 | 111,972 | 16.59 | 1.96 |
| | Referral | 2,037 | 1,736,977 | 8.48 | |
| General surgery | In-practice | 29 | 18,818 | 23.06 | 0.96 |
| | Referral | 1,030 | 327,907 | 23.96 | |
| Internal medicine | In-practice | 187 | 206,001 | 21.26 | 1.76 |
| | Referral | 2,653 | 2,724,280 | 12.10 | |
| Maxillofacial surgery | In-practice | 12 | 18,033 | 15.25 | 2.42 |
| | Referral | 278 | 311,672 | 6.30 | |
| Nephrology | In-practice | 6 | 5,688 | 43.42 | 4.04 |
| | Referral | 119 | 69,391 | 10.74 | |
| Neurological surgery | In-practice | 6 | 1,335 | 40.45 | 1.91 |
| | Referral | 166 | 31,098 | 21.19 | |
| Neurology | In-practice | 15 | 7,969 | 17.82 | 5.33 |
| | Referral | 378 | 187,030 | 3.34 | |
| Neuropsychiatry | In-practice | 8 | 14,379 | 19.33 | 5.45 |
| | Referral | 118 | 197,712 | 3.55 | |
| Oral surgery | In-practice | 57 | 3,423 | 255.92 | 20.06 |
| | Referral | 26 | 392 | 12.76 | |
| Orthopedic surgery | In-practice | 50 | 29,409 | 16.12 | 3.24 |
| | Referral | 844 | 393,957 | 4.98 | |
| Preventive medicine | In-practice | 9 | 14,291 | 18.82 | 2.29 |
| | Referral | 115 | 112,640 | 8.23 | |
| Pulmonary disease | In-practice | 19 | 20,076 | 18.23 | 2.39 |
| | Referral | 248 | 192,183 | 7.63 | |
| Thoracic surgery | In-practice | 4 | 1,300 | 209.23 | 6.66 |
| | Referral | 136 | 24,330 | 31.40 | |

(continued)

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Complex X rays per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Urology | In-practice | 93 | 80,051 | 73.58 | 1.45 |
| | Referral | 432 | 344,099 | 50.76 | |
| All listed specialties | In-practice | 773 | 699,675 | • | 1.92[b] |
| | Referral | 11,879 | 9,534,698 | • | |

[a]This table excludes specialties where (1) physicians in one or both of the comparison groups within the specialty did not order any complex X rays, (2) the number of complex X rays ordered by the physicians in the specialty accounted for less than 0.5 percent of the total complex X rays used in our analyses, or (3) fewer than 10 physicians in that specialty ordered complex X rays. The specialties included in this table accounted for 97 percent of the complex X rays used in our analyses.

[b]The ratio for all specialties combined is weighted by the number of complex X rays ordered by physicians in each specialty.

**Table III.8: Simple X Ray In-practice and Referral Rates**

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Simple X rays per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Cardiovascular disease | In-practice | 311 | 355,080 | 185.90 | 2.69 |
| | Referral | 554 | 406,190 | 69.19 | |
| Endocrinology | In-practice | 29 | 19,804 | 214.25 | 0.95 |
| | Referral | 316 | 179,152 | 225.24 | |
| Family practice | In-practice | 740 | 749,314 | 158.10 | 1.59 |
| | Referral | 1,170 | 1,140,369 | 99.34 | |
| Gastroenterology | In-practice | 72 | 52,332 | 206.36 | 3.31 |
| | Referral | 277 | 145,719 | 62.31 | |
| General practice | In-practice | 643 | 588,605 | 187.69 | 1.82 |
| | Referral | 1,502 | 1,260,344 | 102.93 | |
| General surgery | In-practice | 98 | 63,028 | 165.23 | 1.39 |
| | Referral | 961 | 283,697 | 118.64 | |
| Internal medicine | In-practice | 1,053 | 1,256,899 | 192.98 | 1.97 |
| | Referral | 1,787 | 1,673,382 | 97.99 | |
| Maxillofacial surgery | In-practice | 59 | 83,714 | 175.38 | 1.77 |
| | Referral | 231 | 245,991 | 99.02 | |
| Nephrology | In-practice | 18 | 19,469 | 200.78 | 2.15 |
| | Referral | 107 | 55,610 | 93.18 | |
| Neurology | In-practice | 32 | 18,192 | 79.27 | 2.06 |
| | Referral | 361 | 176,807 | 38.44 | |
| Neuropsychiatry | In-practice | 74 | 139,340 | 255.59 | 2.23 |
| | Referral | 52 | 72,751 | 114.75 | |
| Obstetrics/gynecology | In-practice | 96 | 21,986 | 201.58 | 1.67 |
| | Referral | 975 | 127,275 | 120.46 | |
| Ophthalmology | In-practice | 19 | 30,507 | 27.93 | 2.81 |
| | Referral | 794 | 1,414,767 | 9.92 | |
| Orthopedic surgery | In-practice | 810 | 403,701 | 567.81 | 1.86 |
| | Referral | 84 | 19,665 | 305.21 | |
| Otolaryngology | In-practice | 91 | 79,145 | 102.95 | 2.88 |
| | Referral | 266 | 205,317 | 35.78 | |
| Podiatry | In-practice | 545 | 760,575 | 100.81 | 6.04 |
| | Referral | 76 | 91,560 | 16.68 | |
| Preventive medicine | In-practice | 28 | 39,881 | 187.36 | 3.08 |
| | Referral | 96 | 87,050 | 60.92 | |
| Pulmonary disease | In-practice | 121 | 98,608 | 224.02 | 1.55 |
| | Referral | 146 | 113,651 | 144.64 | |

(continued)

| Physician specialty[a] | Imaging pattern | Number of physicians | Number of office visits | Simple X rays per 1,000 office visits | Ratio of in-practice-to-referral rates |
|---|---|---|---|---|---|
| Urology | In-practice | 58 | 44,267 | 82.27 | 1.74 |
| | Referral | 467 | 379,883 | 47.39 | |
| All listed specialties | In-practice | 4,897 | 4,824,447 | • | 2.10[b] |
| | Referral | 10,222 | 8,079,180 | • | |

[a]This table excludes specialties where (1) physicians in one or both of the comparison groups within the specialty did not order any simple X rays, (2) the number of simple X rays ordered by the physicians in the specialty accounted for less than 0.5 percent of the total simple X rays used in our analyses, or (3) fewer than 10 physicians in that specialty ordered simple X rays. The specialties included in this table accounted for 96 percent of the simple X rays used in our analyses.

[b]The ratio for all specialties combined is weighted by the number of simple X rays ordered by physicians in each specialty.

# Comments From the Department of Health and Human Services

DEPARTMENT OF HEALTH & HUMAN SERVICES — Office of Inspector General

Washington, D.C. 20201

SEP 7 1994

Ms. Leslie G. Aronovitz
Associate Director,
Health Financing Issues
United States General
Accounting Office
Washington, D.C. 20548

Dear Ms. Aronovitz:

Enclosed are the Department's comments on your draft report, "Medicare: Referrals to Physician-Owned Imaging Facilities Warrant Close Scrutiny by HCFA." The comments represent the tentative position of the Department and are subject to reevaluation when the final version of this report is received.

The Department appreciates the opportunity to comment on this draft report before its publication.

Sincerely yours,

June Gibbs Brown
Inspector General

Enclosure

Comments of the Department of Health and Human Services
on the General Accounting Office (GAO) Draft Report,
"Medicare: Referrals to Physician-Owned
Imaging Facilities Warrant Close
Scrutiny by HCFA"

Overview

At the request of the Chairman of the Subcommittee on Health, House Committee on Ways and Means, GAO compared the Medicare imaging referral rates of physicians who invested in imaging center joint ventures with the referral rates of other physicians. GAO's analyses were based on calendar year 1990 Medicare claims for imaging services ordered by Florida physicians. GAO notes that, although Florida has a larger Medicare population and more imaging facilities than some other States, GAO believes its conclusions about the relationship between physician investment in imaging facilities and their imaging referral rates are generalizable nationally because they are based on large scale analyses of physician behavior rather than the characteristics of the patient population or other demographic variables.

GAO reports that Florida physicians with a financial interest in joint venture imaging centers had higher referral rates for almost all types of imaging services than other Florida physicians. In addition, GAO notes that Florida physicians with imaging facilities in their offices, group practices, or other practice applications also had high imaging rates compared with those of other physicians. Finally, GAO reports that the Department has not yet finalized the regulations or procedures needed to implement and enforce the Omnibus Budget Reconciliation Act of 1993 (OBRA 1993) self-referral restrictions as they apply to physicians with a financial interest in joint ventures.

GAO Recommendations

GAO recommends that the Secretary direct the Administrator of the Health Care Financing Administration (HCFA) to develop the procedures and policy guidance needed for the Medicare contractors to (1) closely monitor Medicare imaging referral patterns and utilization rates, (2) assure compliance with the provisions of the self-referral ban, and (3) identify any over utilization of imaging services ordered and provided from within physician practice settings.

GAO further recommends that the Secretary systematically review imaging utilization information developed by HCFA and use the authority provided under OBRA 1993 to develop any additional regulations needed to reduce over utilization through abusive self-referral practices.

Page 2

Department Comment

The Department supports the current prohibition on physicians making referrals to entities in which they have a financial interest. In the Health Security Act, the Administration proposed extending such a prohibition to all payors.

We agree with the GAO in regard to the need to develop procedures and policy guidance for the Medicare contractors.

- We are in the process of developing a final regulation to implement the physician referral requirements with regard to clinical laboratory services. Although this regulation is applicable only to clinical laboratory services, it will provide general guidance to providers of all designated health services since it will clarify the application of statutory exceptions. A notice of proposed rulemaking expanding the referral ban to the OBRA 93 list of designated health services will follow the final rule for clinical laboratory services.

- We are also in the process of developing procedures to enforce the law and regulations. In developing these procedures, however, we need to be cautious so as to not overburden the vast majority of physicians and providers who are unaffected by the prohibition either because there is no financial interest between the referring physician and entity or because their arrangement fits into one of the numerous statutory exceptions.

- In 1993, carriers were required to establish an infrastructure to implement Focused Medical Review (FMR). In 1994, as part of their FMR efforts, carriers were required to develop methods to profile physicians' ordering and referring patterns. In 1995 carriers will be required to evaluate the impact of these patterns. To implement FMR, carriers are expected to develop computer systems and methodology to analyze claims data, identify aberrant patterns of practice and decide whether patterns are appropriate, and then find the most effective course for resolving problems which result from inappropriate practice patterns.

Finally, while our priority is to implement the law, over time we agree that utilization information should be reviewed to determine whether additional regulatory measures that would further limit existing exceptions are required.

# Major Contributors to This Report

Edwin P. Stropko, Assistant Director, (202) 512-7108
William M. Reis, Evaluator-in-Charge
Mary E. Fleischman
Herman A.T. Jenich
Lyle H. Lanier, Jr.
Suzanne C. Rubins
Vanessa R. Taylor
Sibyl L. Tilson