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

The Honorable William M. Thomas
Ranking Minority Member
Subcommittee on Health
Committee on Ways and Means
House of Representatives

On April 20, 1993, we testified on the preliminary results of our study of physician self-referrals in the Medicare program.¹ Since that testimony we have further analyzed physician referrals for Medicare diagnostic imaging services, including imaging performed in physicians' offices, group practices, and other settings in which the ordering physician has a practice affiliation.

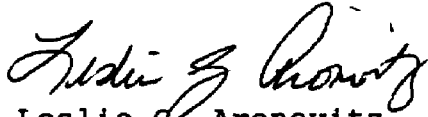
On March 11, 1994, we met with selected Subcommittee staff to discuss these additional analyses and our plans to issue a report on our further work late this spring. However, because the Congress is now considering legislation to amend the self-referral restrictions enacted under the Omnibus Budget Reconciliation Act of 1993 (OBRA 1993) (P.L. 103-66), the staff asked that we provide you with our analyses of in-practice imaging services as soon as they were finalized.

The attachments to this letter provide the information requested at our March 11 meeting. Attachment I is a description of the methodology we used, and attachment II provides comparisons of in-practice and referral imaging rates by physician specialty for each of seven types of imaging services.

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

Our analyses show that physicians with in-practice imaging patterns had much higher imaging rates for nearly all specialties and all types of imaging services. More specifically, the in-practice rates were about 3 times higher for Magnetic Resonance Imaging (MRI) scans, about 2 times higher for Computed Tomography (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.

Please call Edwin Stropko at (202) 512-7118 or me at (202) 512-7104 if you or your staff have any questions regarding this information. We will keep your staff informed about the expected availability date of our final report.



Leslie G. Aronovitz
Associate Director,
Health Financing Issues

METHODOLOGY FOR ANALYSES OF IN-PRACTICE AND REFERRAL IMAGING RATESDATA SOURCES

The data used in these analyses are from a Medicare Part B beneficiary history file containing over 50 million claims for Medicare services paid by Blue Cross and Blue Shield of Florida between November 1989 and March 1991.² From this file we extracted claims for almost 3.5 million diagnostic imaging services and over 19.4 million office visits provided in Florida during calendar year 1990.³

We identified claims for imaging services and office visits using the American Medical Association's 1990 Current Procedural Terminology (CPT) manual, the Health Care Financing Administration's (HCFA) 1990 Common Procedure Coding System, and a physician consultant. Our imaging services included all CPT and HCFA codes for diagnostic radiology, diagnostic ultrasound, nuclear medicine, and echocardiography. We grouped these services into seven imaging categories that generally use different types of imaging equipment: MRI scans, CT scans, ultrasound services, echocardiography services, diagnostic nuclear medicine scans, complex X-rays, and simple X-rays. Our office visits included CPT and HCFA codes for office visits, patient consultations and examinations in outpatient and nursing home settings, case management, and selected codes for other services such as psychiatry, ophthalmology, and critical care.

We also used information from the Florida Medicare Provider File to obtain selected information on physicians, including their practice specialty, and information on facilities that billed Medicare for imaging services.

As further described below, we used these data to (1) match diagnostic imaging services to the physicians who ordered those services, and (2) compare physicians with in-practice imaging patterns to physicians with referral imaging patterns.

²Blue Cross and Blue Shield of Florida is the Medicare Part B contractor for the entire state of Florida.

³We excluded claims for all hospital inpatient services, but included services provided in all other settings such as hospital outpatient departments, physicians offices, group practice facilities, freestanding (nonhospital) facilities such as diagnostic imaging centers, and nursing homes.

MATCHING IMAGING SERVICES TO THE
PHYSICIANS WHO ORDERED THOSE 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. Therefore, after analyzing a sample of the claims in our database and consulting with other researchers, we developed and tested a methodology to identify the physicians who ordered the imaging services from information in the beneficiary history file.

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.⁴ Using computerized procedures, we attempted to locate one or more office visits within the referral window of each imaging service for each Medicare beneficiary. Where an imaging service claim identified the ordering physician and the beneficiary had an office visit with that physician within the referral window, we used that physician as the ordering physician in our analyses. Where an imaging service claim did not identify the ordering physician but there was only one potential ordering physician within the referral window, we used that physician as the ordering physician. We excluded all other imaging services from our analyses, reducing our database from about 3.5 million imaging services to about 2.4 million imaging services.

To test the accuracy of this methodology, 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. Where there was a discrepancy between the ordering physician identified in the medical records and the physician identified through our computerized procedures, the errors appeared to be random rather than following any pattern that would bias our study results. 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.

⁴Physicians sometimes request a patient to obtain 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.

COMPARISON OF IN-PRACTICE AND REFERRAL IMAGING RATES

Our analyses compare the imaging rates of physicians with in-practice imaging patterns to physicians with referral imaging patterns. For these analyses we classified an imaging service as in-practice if the patient received the service from either (1) the physician who ordered the service, (2) another physician in a group practice arrangement with the ordering physician, or (3) an entity (such as an imaging center or neurology clinic) in which the ordering physician practiced or had a group practice affiliation. We considered all other imaging services as referral; that is, the patient obtained the imaging service outside the ordering physician's practice affiliations.

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. If neither the physician or billing numbers of the ordering physician matched those of the imaging provider, we classified the imaging service as referral; that is, the patient obtained the imaging service outside the ordering physician's practice affiliations. Of the 2.4 million imaging services included in our analyses, we classified about 47.5 percent as in-practice.

For each physician that ordered imaging services, we classified his or her predominant imaging pattern as either in-practice or referral 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.

LIMITATIONS OF OUR ANALYSES

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 practice arrangements 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 setting. Therefore, our analyses do not distinguish between the various types of in-practice imaging arrangements (for example, solo practice, multispecialty group practice, 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 in the same or affiliated practice settings, 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 high in-practice imaging rates are grouped with the physicians with referral imaging patterns.

Given the scale of our study, we did not attempt to assess the medical necessity of the imaging services ordered. We did try to minimize the impact of individual physician and patient characteristics by using a large scale database (over 2.4 million imaging services ordered by about 17,900 physicians) and by comparing physicians' imaging rates with other physicians practicing in the same specialty.

IN-PRACTICE AND REFERRAL IMAGING RATES

This attachment includes seven tables, one for each of seven types of diagnostic imaging services--MRI, CT, ultrasound, echocardiography, diagnostic nuclear medicine, complex X-rays, and simple X-rays. For each physician specialty, the tables show the imaging services ordered per thousand office visits by physicians with in-practice imaging patterns and physicians with referral imaging patterns. The tables also include the ratio of in-practice to referral imaging rates for each physician specialty and a summary ratio for all specialties, weighted by the number of imaging services by each specialty.

The data used in these tables are from our analyses of over 2.4 million imaging services, as described in attachment I. The tables exclude physician specialties and associated imaging services where the specialty had very few ordering physicians or services. Notes to the tables provide information on the cutoff criteria for the physician specialties included in the table.

The summary ratios in the last row of each table 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.

Table II.1: MRI Utilization by Ordering Physician Specialty and Imaging Pattern

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	

Table II.1: MRI Utilization by Ordering Physician Specialty and Imaging Pattern

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
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	
All listed specialties	In-practice	169	142,985	--	3.06 ^b
	Referral	13,650	11,885,366	--	

^aThis 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.

^bThe ratio for all specialties combined is weighted by the number of MRI scans ordered by physicians in each specialty.

Attachment II

Table II.2: CT Utilization by Ordering Physician Specialty and Imaging Pattern

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	

Table II.2: CT Utilization by Ordering Physician Specialty and Imaging Pattern

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
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	
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	--	

^aThis 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.

^bThe ratio for all specialties combined is weighted by the number of CT scans ordered by physicians in each specialty.

Attachment II

Table II.3: Ultrasound Utilization by Ordering Physician Specialty and Imaging Pattern

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	

Attachment II

Table II.3: Ultrasound Utilization by Ordering Physician Specialty and Imaging Pattern

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
Urology	In-practice	263	247,658	108.98	1.88
	Referral	262	176,492	58.04	
All listed specialties	In-practice	1,646	2,257,552	--	5.13 ^b
	Referral	10,899	8,698,812	--	

^aThis 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.

^bThe ratio for all specialties combined is weighted by the number of ultrasound services ordered by physicians in each specialty.

Attachment II

Table II.4: Echocardiography Utilization by Ordering Physician Specialty and Imaging Pattern

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	--	

Attachment II

Table II.4: Echocardiography Utilization by Ordering Physician Specialty and Imaging Pattern

*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.

^bThe ratio for all specialties combined is weighted by the number of echocardiograms ordered by physicians in each specialty.

Attachment II

Table II.5: Diagnostic Nuclear Medicine by Ordering Physician Specialty and Imaging Pattern

Physician specialty*	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	

Attachment II

Table II.5: Diagnostic Nuclear Medicine by Ordering Physician Specialty and Imaging Pattern

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
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	
All listed specialties	In-practice	418	390,600	--	4.52 ^b
	Referral	13,677	12,321,129	--	

^aThis 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.

^bThe ratio for all specialties combined is weighted by the number of nuclear medicine scans ordered by physicians in each specialty.

Table II.6: Complex X-ray Utilization by Ordering Physician Specialty and Imaging Pattern

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	

Attachment II

Table II.6: Complex X-ray Utilization by Ordering Physician Specialty and Imaging Pattern

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
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	
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	--	

^aThis 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.

^bThe ratio for all specialties combined is weighted by the number of complex X-rays ordered by physicians in each specialty.

Table II.7: Simple X-ray Utilization by Ordering Physician Specialty and Imaging Pattern

Physician specialty*	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	

Table II.7: Simple X-ray Utilization by Ordering Physician Specialty and Imaging Pattern

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
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	
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	--	

^aThis 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.

^bThe ratio for all specialties combined is weighted by the number of simple X-rays ordered by physicians in each specialty.