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Profiling Physician Ordering of Selected Imaging Tests for Medicare Beneficiaries

Final Report

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EXECUTIVE SUMMARY

ES.1 Study Overview

Despite the implementation of Medicare's physician fee schedule in 1992 and the associated implementation of volume growth standards, the intensity of physician services per Medicare beneficiary continued its long increase. The growth in per beneficiary use of Medicare Part B physician services increased 30 percent between 1993 and 1998 and about 22 percent between 1999 and 2003 (MedPAC, March 2005). The largest annual increases in volume per beneficiary during the period 1999 through 2003 were usually for tests and imaging (MedPAC, March 2005).

Both private industry and the federal government are concerned about increases in both public and private expenditures on health care services. CMS has been participating in public/private partnerships in addressing both the costs and quality of health care. There is great interest in the public and private sector in profiling providers in both these dimensions. This project addresses a small part of the larger objective of encouraging the efficient provision of high quality care. Within the area of cost profiling, this study looks at the ordering of particular imaging tests and develops several alternatives in computing and presenting profiles. CMS wished to explore the alternative methods of profiling, the variation in results that are associated with different methods and possibilities for presentation to providers.

Ordering of expensive imaging tests is contributing to high rates of expenditure growth and is thought to involve some clinical discretion on the part of physicians. Profiling utilization of these tests can reveal the variation in their usage and possibly can be a tool to educate and inform physicians about their referrals for these tests compared to peers. A more judicious use of these expensive tests could be a desirable outcome of disseminating the information contained in the physician profiles.

The study explored profiles of referral patterns of providers for selected high-volume and expensive imaging tests—echocardiograms (ECHOs), MRIs, and CT scans. RTI's analyses were limited to the construction of alternative profiles of referral rates and comparison of the resulting profiles. The study illustrates the range of results, and amount of data available to create the results, as the profiling algorithm is varied.

ES.2 Methods and Data

The essence of profiling is to compare the practice patterns of physicians. Distributions of five measures of physician practice were created: the number of patients; the total number of images (e.g., ECHOs) that the physicians referred for their patients; the average number of images referred per 100 patients; the percentage of patients for which the physician made at least one imaging referral; and the percentage of referred imaging tests that the physician self-referred.

To test the sensitivity of the profiles to alternative specifications, several algorithms to assign patients to physicians were tested. One purpose of the sensitivity tests was to ascertain the impact of alternative assignment algorithms on the number of patients per provider and the number of providers profiled; a small number of each can undermine the statistical reliability of profiles. One dimension of patient assignment algorithms differentiated any patient diagnosis

versus specific health conditions (e.g., congestive heart failure). A second dimension keyed on the types of medical services that patients received from the physicians to which they were assigned, for example, any Part B service versus an evaluation and management [E&M] service. A third dimension was unique versus non-unique assignment. In one alternative, Medicare FFS patients were uniquely assigned to physicians on the basis of a plurality of services provided by the physician. Patients were also non-uniquely assigned to physicians on the basis of the physician having billed Medicare for at least one Part B service.

Medicare Part B physician/supplier line items for beneficiaries residing in the Boston metropolitan statistical area (MSA) in 2002 were used in this analysis. The providers studied were limited to those practicing in the Boston area. Some Boston-area beneficiaries were treated by out-of-area providers, but these providers were excluded from our analyses.

ES.3 Results

Empirical results

Our exploratory profiling of rates of ordering selected imaging tests by Boston physicians shows that most physicians, both specialists and non-specialists, did not refer (order) many, if any, imaging tests, whereas a few physicians had very high rates per 100 patients. This was found for nearly, if not all, patient populations. Changing the patient populations affected the number of physicians available for a comparative peer group, the average number of patients per physician, and the average number of referrals per 100 patients. In particular, the most restrictive population specifications reduced the number of physicians profiled and the size of their patient panels substantially. Even the more broadly-defined patient populations often did not result in a very large number of patients per physician. This suggests that trying to specify narrowly defined patient populations to enable “apples-to-apples” comparisons will be frustrated by small numbers of providers that can be profiled or small numbers of patients used to create provider-level statistics. But without closely-matched patient populations across physicians being compared, physicians will question the validity of the profiling results, probably with good justification. One alternative approach to profiling is to use risk-adjustment to adjust for differences in patient comorbidities, severity, and casemix (diagnosis) across profiled physicians. Much more detailed casemix adjustment methods than those that were employed in this study will be necessary for physicians to find profiling reports credible.

Absent more detailed casemix adjustment and widely-accepted clinical guidelines for ordering imaging tests, the profiles we created do not identify over- or under- referral of imaging tests. Nor can the profiles be used to identify efficient practices. One reason is that some of the physicians that are profiled are in solo practice while others are in group practices. In one multi-specialty group in Boston, most of the ECHO referrals are made by just a few of the cardiologists. Consequently, some of the cardiologists in this group have very high referral rates and others have very low rates. This division of labor (or subspecialization) among the group’s cardiologists might lower the per patient cost of care for this particular group practice. However, it makes interpretation of individual physician ordering rates difficult, especially when the prevalence of such situations in group practices is not known.

The share of self-referrals was also examined. As with the number of referrals per 100 patients, most providers did not refer imaging tests to themselves. There were a number of providers that referred over 90 percent of their imaging tests to themselves. However, it was not possible to ascertain whether there was too much self referral or not. Nor was it possible to ascertain whether high self-referral rates represented abuse.

Reactions of physicians to profiles

Using the algorithms RTI developed, the Centers for Medicare & Medicaid Services (CMS) had echocardiogram physician profiling reports created by CMS Program Safeguard Contractors who have complete data for specific geographic areas. Claims were extracted from Ohio and Wisconsin for 1 year. The reports were targeted to individual physicians identified by UPIN. They presented statistics about their echocardiogram ordering patterns compared to those of their peers. Peer groups were created of physicians in the same specialty, state, and geographic setting by degree of urbanicity.

Copies of these reports were distributed to focus groups of physicians who were selected to have varied practice settings, in each of the two states, and, in a more preliminary form, to a group of academically oriented cardiologists in Boston.

The reactions of physicians was generally skepticism concerning the usefulness of the report. The focus groups of physicians did not indicate that the participants would be averse to having reports created, but did not think that under present circumstances these were very useful. There are a number of dimensions of criticism that would have to be dealt with if these physicians are representative of their peers.

- Guidelines are needed to be measured against.
- Peer groups have to be narrowly defined.
- Patients' disease stage and risk adjustment would be needed.
- Longer data collection periods might be required for some reports.

There are issues of a different nature as well.

- How does one control for retesting because of prior poor testing?
- How does one control the quality of testing?

There is also the underlying issue of the acceptability of statistical reports to physicians who tend to see their cases as individuals. The utility of such a report leading to ask why a particular physician has an apparently aberrant pattern is not always seen clearly.

ES.4 Conclusions

The results presented in this report represent an exploratory analysis of one possible way to profile physicians for several common, expensive types of imaging tests. Substantial variation

across physicians in ordering of these tests was found. The numbers of physicians who could be profiled, and patients and tests attributed to them, were documented. But before credible profiles comparing physicians can be produced, considerably more attention needs to be paid to developing guidelines for appropriate rates of testing and for adjusting for the legitimate factors that can cause variation in observed test ordering rates across physicians.

SECTION 1
STUDY OVERVIEW

This report presents the results of exploratory analyses of physician referrals (orders) for selected expensive imaging tests—echocardiograms, MRIs, and CT scans. This set of analyses was the result of a modification to a contract to identify private sector techniques for purchasing high quality and efficient physician services and the implications for Medicare.

1.1 Motivation

Despite the implementation of Medicare's physician fee schedule in 1992 and the associated implementation of volume growth standards, the intensity of physician services per Medicare beneficiary continued its long increase. MedPAC (March 2005) reported that the growth in per beneficiary use of Medicare Part B physician services increased 30 percent between 1993 and 1998 and about 22 percent between 1999 and 2003. The largest annual increases in volume per beneficiary during the period 1999 through 2003 were usually for tests and imaging (MedPAC, March 2005).

Although there is some sense that technological change and treatment expansion are among the long-term causes of increased intensity, the specific underlying causes of recent increases in physician volume are not known. And even though technological change and treatment expansion can improve health, there is controversy about the general impact of intensity increases on health (MedPAC, March 2005).

Both private industry and the federal government are concerned about increases in both public and private expenditures on health care services. Even though the underlying causes of recent increases in the intensity of physician services are not known, there is both private and public interest in identifying and rewarding efficient providers. The first step in this process is to develop methodologies to profile and compare physician treatment patterns. Ordering of expensive imaging tests is contributing to high rates of expenditure growth and is thought to involve some clinical discretion on the part of physicians. Profiling utilization of these tests can reveal the variation in their usage and possibly can be a tool to educate and inform physicians about their referrals for these tests compared to peers. A more judicious use of these expensive tests could be a desirable outcome of disseminating the information contained in the physician profiles.

1.2 Objectives

The objective of the exploratory analyses was to profile referral patterns of providers for selected high-volume and expensive imaging tests. This objective is consistent with MedPAC's (2005) "recommendation[s] that CMS set standards for providers who perform and interpret imaging tests." RTI's analyses were limited to the construction of alternative profiles of referral rates and comparison of the resulting profiles. The study illustrates the range of results, and amount of data available to create the results, as the profiling algorithm is varied.

SECTION 2
METHODOLOGICAL ISSUES

The essence of profiling is to compare the treatment patterns of physicians. One profiling methodology is the creation of distributions of various measures such as the number of diagnostic tests per patient treated by physicians. In this section, selected (general) issues in profiling physicians are discussed first, followed by discussions of assigning patients and attributing services to individual physicians, issues in counting tests, how providers were classified for profiling, and the study sample and data.

2.1 Selected Issues in Profiling Physicians

Several factors may affect the validity of physician profiles. One important issue is the statistical reliability of profiles. Statistical reliability has, at least, two important dimensions: the size of patient panels and the size of physician peer groups. The *size of patient panels* refers to the number of patients used in profiling each physician. The *size of physician peer groups* refers to the total number of physicians being compared. Two other important issues in profiling physicians are comparability of patient panels across physicians being compared, and in profiling specialists versus primary care physicians. These need to be considered in formulating and evaluating alternative approaches to profiling of physician ordering of expensive imaging tests.

Patient panel size. With regard to the size of patient panels, the number of patients in the typical panel needs to be large enough to permit comparisons of "performance" measures. Some procedures, such as X-rays, are commonly performed on many patients. In such cases, the number of patients in the panel need not be very large for comparisons in the number of X-rays per patient. On the other hand, some procedures are performed on few patients. In these cases, larger patient panels are needed to permit statistically valid comparisons. Hofer, et al. (1999) note that there is a "high degree of unreliability" or noise in single quality measures when there are few patients in the panel. They recommend, for single (instead of aggregate) quality measures, at least 100 patients. For "aggregate" quality measures, Kaplan, et al. (in review, 2005) argue that as few as 25 patients are needed in a panel to achieve statistical reliability.

Peer group size. The number of physicians in a peer group also needs to be sufficiently large to permit comparisons of performance measures. It is the behavior of other physicians to which the behavior of an individual physician is compared. As in the case of the size of patient panels, the validity of comparisons typically increases as the number of physicians in the peer group increases. However, unlike the size of patient panels, there has been little work regarding the minimum number of physicians in a peer group. Common sense dictates that the total number of physicians in the peer group needs to be greater than two. In the event that the number of physicians is too low, the number can be increased by enlarging the geographic area from which peer physicians can be selected, if the data allow. This may be important if the peer group consists of physicians from just one or two specialties that have relatively few physicians, such as cardiac surgery.

Patient comparability. All things equal, comparisons should involve patient panels that are relatively homogeneous with regard to their potential use of medical care. At one extreme, depending on the physician specialty, patients should all have the same exact condition (e.g.,

male, age 81, 3-vessel coronary arterial bypass graft, no history of cardiac heart disease, no comorbidities). Such specificity, however, typically reduces the patient panel size to well under 100 patients and can also reduce the number of physicians in the peer group. And, for primary care physicians, such specificity is impossible. Nonetheless, through suitable risk-adjustments or through specifying patient populations for selected conditions (e.g., diabetes), it is possible to "make" the patient populations more homogeneous. As discussed below, there are consequences to each of these types of adjustments.

Specialists versus primary care physicians. Although managed care physician profiling is often directed towards the primary care physicians that are charged with managing enrollee health, specialists are also profiled. Among the reasons why specialists are profiled is that they often refer and perform some of the most complex procedures. In the case of surgeons, the possibility of mistakes (e.g., accidental puncture or laceration) and post-operative problems (e.g., post-op sepsis) is relatively high. There are some procedures (e.g., diagnostic) that both specialists and primary care physicians often order. In these cases, profiling both, but in separate groups, may be a method for identifying physicians that order unusually high or low numbers of procedures.

2.2 Assigning Patients to Physicians

Profiling physicians is a two-step process. First, a patient population is assigned to a profiled physician. Then services performed for these assigned beneficiaries are attributed either to the profiled physician or to other physicians. Attributed services per assigned beneficiary provides a rate of services per patient that may be profiled and compared across physicians. In this section, we discuss several aspects of defining a physician's patient population: the types of health care services considered when assigning patients to physicians, unique versus non-unique assignment of beneficiaries to providers, and limiting assigned patients to those with a particular medical condition.

Services used to assign beneficiaries. When using services to assign patients to providers, it is necessary to decide which services to count. To determine the sensitivity of physician profiling to the types of services counted, the following four alternatives were tested:

- beneficiaries that received any Part B service from the provider;
- beneficiaries that received an evaluation and management (E&M) service (99201–99499) from the provider;
- beneficiaries that received an office or other outpatient E&M service (99201–99215) from the provider; and
- beneficiaries that received a "new patient" office or other outpatient E&M service (99201–99205) from the provider.

Use of any Part B service for assignment allows the broadest range of services to be considered in assigning a patient to a physician. Such services include E&M services, surgical procedures, and tests. Some physicians such as pathologists providing these services might not actually see the patient or supervise patient care. Depending on how services are used to assign a patient to a physician (see below), use of any Part B service could allow a patient to be assigned

to every physician that billed Medicare for services that the patient received (non-unique assignment) as well as just to only one physician (unique assignment).

Use of only E&M services reduces the number of physicians to which a patient can be assigned and, hence, the number of physicians in the peer group will typically fall. It also eliminates physicians from assignment that do not have direct contact with the patient. So, while the peer group is smaller, physicians that might be only tangentially concerned with a patient's care are also removed from the peer group.

When services used for assignment are restricted to office or other outpatient E&M services, consultants tend to be eliminated since their services are often provided when patients are hospitalized. Additionally, emphasis is placed on management services and the physicians that provide such services. Further restrictions to new patients could produce a very different imaging test profile because physicians don't have histories of new patients: physicians might be more inclined to order evaluative tests than they would for established patients. Regardless, in moving from the first to the fourth alternative, it is expected that the average size of patient panels will fall and the number of physicians in the peer groups will fall.

Unique versus non-unique assignment. To construct patient panels, RTI examined two approaches of assigning Medicare fee-for-service (FFS) beneficiaries (patients) to providers. One is *uniquely* assigning a patient to the provider that provided the largest share (plurality) office or other outpatient E&M services. The other approach, *non-unique assignment*, was to assign to a provider every patient listed on one of his Medicare bills. Non-unique assignment is suitable for profiling specialists and may be suitable when profiling FFS patients. In particular, non-unique assignment mirrors the fractionation of FFS practice. These two approaches were undertaken, in part, to examine the effects of assignment rules on the size of peer groups and the size of patient panels.

In the unique assignment approach, total allowed charges were used instead of total visits and total RVUs. Total visits were not used because it was felt that they did not give enough weight to visits that had a more complex set of E&M services provided to the patient. (When all Part B services are used instead of just E&M services, the use of allowed charges tends to assign surgical patients to surgeons because of the higher charges for surgical procedures than visits.) Although the use of allowed charges and RVUs usually result in the same assignments, allowed charges were used since there would be fewer ties between providers. In the event of a tie, total allowed charges for the larger set of Part B services was used as a tie breaker according to the hierarchy in the next section.

It might be supposed that physicians prefer unique assignment based on a plurality of services rendered over non-unique assignment. And this would certainly be the case for some types of services that are profiled. For instance, ophthalmologists that ordered just one or two echocardiograms out of the many that were ordered (by other doctors) for their patients might not want to be profiled since ophthalmologists have little if any effect on patients' cardiovascular health. Even cardiologists that order echocardiograms for their patients may not feel responsible if surgeons and other physicians are providing critical care to patients or directing the bulk of patient care. However, even if doctors do not direct overall care for patients, they may feel responsibility if they are performing the procedures that are being profiled. That is, if the doctor

is in control of patient care, then it might not matter whether the patient was uniquely or non-uniquely assigned to the doctor. The problem in profiling the care for patients, especially FFS patients, is that it can be difficult to identify the doctor that is in control for a specific procedure or set of procedures or for the overall health of patients.

Assigning using beneficiary medical condition. One way to increase patient homogeneity and clinical relevance is to limit assigned beneficiaries to those with a specific medical or health "tracer" condition. A problem with this approach, as will be seen in the empirical results, is that the size of patient panels for individual physicians declines as does the number of physicians in the peer group.

2.3 Attributing Services to Physicians

The number of a physician's assigned patients is the denominator of his or her rate of testing. The numerator is the number of tests he or she is responsible for. In managed care, profiling of primary care "gatekeeper" physicians often involves counting all of the medical services provided to a primary care physician's patients, regardless of who performed or ordered them. The reason is that two of the primary care physician's roles are to coordinate care and to control resource utilization. As such, it is the responsibility of the primary care physician to control diagnostic testing, even when other physicians actually order the tests.

In Medicare fee-for-service, there is no gatekeeper physician responsible for a beneficiary's care. Services (tests) may be attributed to either the performing physician or the ordering physician. In this study, tests are attributed to the ordering (referring) physician, including tests the physician performs himself. The rationale is that the ordering physician is the one who generates the tests by requesting them. Hence, the tests are his or her responsibility, even if another doctor performs them. We profile and compare physicians based on the rate at which they order tests for their assigned patient populations.

2.4 Counting Tests

We counted test interpretations, either through a bill for interpretation or for interpretation and performance. To avoid double counting, we did not count line items that had a technical component modifier only. Otherwise, all imaging line items were counted, including instances in which the beneficiary had multiple images on a given day.

2.5 Classification of Providers

To avoid an overwhelming amount of unnecessary detail about provider specialty/type, in the analyses of the physicians that ordered imaging, providers other than the few specialties of greatest interest were classified into one of three aggregated groups:

- Medical Doctors (other than the specialists of interest) and Doctors of Osteopathy;
- non-physician practitioners (e.g., nurse practitioners and physician assistants); and
- all other providers that have UPINs.

2.6 Study Beneficiary and Provider Sample and Data

Medicare Part B physician/supplier line items for beneficiaries residing in the Boston MSA in 2002 were used in this analysis. These data were used because they had already been developed for other analyses under the contract. Because Boston-area physicians treat some beneficiaries that live outside the MSA, using Medicare Part B physician/supplier line items for all beneficiaries treated by physicians practicing in the Boston MSA would have allowed the creation of more complete patient profiles for Boston-area physicians.

The providers studied were limited to those practicing in the Boston area. Some Boston-area beneficiaries are treated by out-of-area providers, but these providers were excluded from our analyses because we do not have claims for most of their patients. The zip code of the provider's actual office (business) address is present on physician claims and was used to identify out-of-area providers.

SECTION 3
ECHOCARDIOGRAMS

3.1 Overview

Cardiologists were identified as one of the specialties with consistently high practice variation in analyses performed by the Cave Consulting Group (MedPAC, March 2005). This same set of analyses found that variation in diagnostic testing was second highest among six classes of resource use.[1] Echocardiograms (ECHOs) are types of ultrasound tests used for the evaluation of heart function and condition, monitoring the heart during surgery, and for checking placement of artificial heart valves. Although ECHOs are a type of imaging, they are often interpreted by cardiologists rather than by radiologists. In addition, cardiologists often refer (order) ECHOs. Thus, there is potential for cardiologists to self-refer ECHOs. Large increases in self-referrals is alleged to be one of the factors accounting for the large increases in imaging tests among Medicare beneficiaries. For these reasons, ECHOs appeared to be a promising imaging test to profile variation across physicians in test ordering behavior.

The discussion of the results of RTI's analyses of ECHO referrals commences with a discussion of methods, followed by discussions of the total number of ECHOs interpreted by Boston-area providers and the results of our profiling of referrals for ECHOs.

3.2 Methods

Types of Echocardiograms Counted. ECHOs were identified by the presence of CPT codes 93303 through 93350 on physician line item bills for these tests.[2] Interpretations of ECHOs were counted either through a bill for interpretation of an ECHO or for interpretation and performance. Line items that had a technical component modifier only (indicating performance only) were not counted to avoid double counting ECHOs. Otherwise, all ECHOs were counted, including instances in which the beneficiary had multiple ECHOs on a given day.

Types of Patients. Separate profiles were developed using all beneficiaries who had an ECHO and just those beneficiaries who had congestive heart failure (CHF). Any patient with a CHF line item diagnosis was so identified. The CHF ICD-9 diagnosis codes are listed in the accompanying table, where "x" denotes any valid value in the 4th or 5th position.

Types of Providers. We identified 564 Boston-area cardiologists. A doctor needed only one claim with a cardiology specialty code to be classified as a cardiologist. We also identified

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1 The six classes were physician visits, diagnostic tests, medical/surgical procedures, inpatient facility, outpatient facility, and inpatient admissions (MedPAC, March 2005, Table 3-2).

2 This range of codes covers transthoracic, transesophageal, and doppler echocardiograms. Intracardiac echocardiography (93662) was not included since it is an add-on to a primary procedure. Fetal echocardiograms (76825-76828) were not included since there are few Medicare beneficiaries that are eligible for the procedures.

3,480 other Medical Doctors and osteopaths, 23 non-physician practitioners, and four other providers[3] that billed Medicare for at least one service provided to a Boston-area beneficiary and ordered at least one ECHO. The reason that only non-cardiologists who had ordered at least one ECHO were profiled is that there are about 20,000 doctors in the Boston area. The inclusion of these others would have resulted in distributions in which the results of 3,480 MDs ordering at least one ECHO would have been compressed into the upper 20 percent of the distribution. Therefore, only the non-cardiologist MDs and DOs who ordered ECHOs were profiled.

3.3 Total Number of ECHOs Interpreted

Table 1 shows the number of ECHOs that Boston beneficiaries received by the type of referring provider and whether the provider who interpreted the ECHO was a Boston-area cardiologist. These statistics were constructed from the bill of the provider interpreting the ECHO. No patient population or diagnostic condition restrictions were imposed in creating the table. The referring physician may or may not have seen the patient and billed Medicare for any service.

Table 1
Number of ECHOs for Boston-area beneficiaries by type of referring provider and by whether interpreted by a cardiologist

	ECHOs interpreted by		
Type of referring provider	Boston cardiologists	Other providers	Total
Boston cardiologist	59,147	4,093	63,240
Other M.D. or osteopath	123,961	36,272	160,233
Non-physician practitioners	7,134	881	8,015
Other physicians and providers	4,707	900	5,607
None[4]	114	73	187
Total	195,063	42,219	237,282

Of the 237,282 ECHOs that were interpreted for Boston-area beneficiaries by Boston-area providers in 2002, Boston cardiologists ordered 63,240 ECHOs or about one-in-four. Other MDs ordered 160,233 or two-thirds of the ECHOs. Clearly, physicians other than cardiologists are playing the major role in generating ECHO volume. Cardiologists, however, interpret most ECHOs. Boston cardiologists interpreted 195,063 (82.2 percent) of total ECHOs.

[3] These four providers could have been a dentist (DDM or DDS), a chiropractor, a podiatrist, or an optometrist.

[4] The referring UPIN field on the claims was blank on 187 claims.

3.4 Referrals by Profiled Providers

We first discuss an example physician profile of ECHO referral rates for a particular patient population and physician specialty (cardiologists). Then we present and discuss summary statistics for ECHO referral profiles using a large number of alternative patient assignment criteria and our four-way categorization of provider type. Finally, we analyze the stability of physician rankings of ECHO referral rates across different patient populations. The goal of these exploratory analyses is to gain insight into the potential methods, results, and limitations of profiling physician ECHO referral rates using Medicare claims data.

3.4.1 Example Profile

Profiles were constructed for 44 of the possible 48 combinations of patient populations assigned by types of service (four categories—see Section 2.2), types of provider (four categories—see Section 2.5), patients with any diagnosis, and, for CHF patients only, non-unique versus unique assignment. Table 2 is an example of a typical profile. Percentiles of the distribution across profiled physicians were produced for each of the following characteristics:

- Number of patients assigned to the physician
- Number of ECHOs referred by the physician for his assigned patients
- Number of ECHO referrals per 100 assigned patients
- Percentage of assigned patients for whom the physician made at least one ECHO referral
- Percentage of referred ECHOs that the physician self-referred.

Percentiles were calculated independently for each of these characteristics. Thus, the distributions shown in each column of Table 2 are independent of each other. For example, the median physician will in general be a different physician for each characteristic (i.e., for each column in Table 2).

In Table 2, statistics are shown for the 503 Boston cardiologists who billed Medicare for at least one office or other outpatient E&M visit in 2002.[5] Patients who received at least one of these services from a cardiologist are assigned to him or her. Thus, all physicians in the sample have at least one assigned patient. The same patient may be assigned to more than one cardiologist in the sample if the patient had visits with multiple cardiologists.

The sample cardiologists had an average (mean) of 166 assigned Medicare patients during 2002 (column 1). The range of assigned patients per cardiologist is large, from nine or fewer patients for cardiologists in the lowest decile (bottom 10 percent) to 381 or more patients for cardiologists in the highest decile (top 10 percent). The low number of assigned patients of some cardiologists implies that statistically reliable profiles for some physicians may not be

[5] *Group UPINs* are issued to physician group practices and should not appear on physician claims. Consequently, the few claims in the study sample that have Group UPINs were not used in constructing the profiles. We were not able to identify any cases in which the UPIN for an individual physician was used by other physicians as well as to the individual to whom it was issued.

Table 2
Echocardiogram referrals by 503 Boston cardiologists for their Medicare patients, 2002
Distributions are across providers.
Patients are beneficiaries who received an office or other outpatient.
Evaluation and management service from the cardiologist during 2002

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Share of patients with 1 or more referrals	Share of ECHOs self-referred
Mean	166	72	38.1	11.9%	29.6%
100% Maximum	798	948	412.1	100.0	100.0
99%	621	552	225.0	73.4	100.0
95%	459	301	116.9	35.5	100.0
90%	381	207	87.8	26.2	97.5
80%	300	121	62.3	18.9	81.0
70%	237	70	49.8	15.3	57.1
60%	170	39	36.8	11.8	13.3
50% Median	131	24	25.0	8.3	0.0
40%	76	13	16.5	5.6	0.0
30%	43	6	8.2	2.6	0.0
20%	24	0	0.0	0.0	0.0
10%	9	0	0.0	0.0	0.0
5%	3	0	0.0	0.0	0.0
1%	1	0	0.0	0.0	0.0
0% Minimum	1	0	0.0	0.0	0.0

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

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possible with Medicare data alone. For example, if a minimum sample size of 30 patients were imposed for profiling, more than 20 percent of sample cardiologists could not be profiled with Medicare data.

On average, Boston cardiologists in the Table 2 sample referred 72 ECHOs for their assigned patients as a group, for a total of 36,421 referred ECHOs during 2002 (column 2). At least 20 percent of the cardiologists did not order an ECHO while the top 10 percent of cardiologists that ordered the most ECHOs, referred 207 or more each, or 17,750 total (not shown in the table). This represents 48.7 percent of all ECHOs ordered by sample cardiologists. Sub-specialization by cardiologists may account for the fact that over 20 percent did not order any ECHOs while the top 10 percent accounted for close to 50 percent of the ECHO referrals. That is, some cardiologists may specialize in treating types of patients or conditions that do not require many or any ECHOs, while other cardiologists' patients may require many ECHOs.

The distribution of ECHO referrals per 100 patients by each cardiologist (column 3) also shows that at least 20 percent of cardiologists did not order any ECHOs. At the top end of the distribution, 10 percent of cardiologists ordered 88 or more ECHOs per 100 assigned patients. On average, cardiologists ordered 38 ECHOs per 100 patients. Sub-specialization also might account for such skewness in the ordering of ECHOs. The distribution of the share of patients with at least one ECHO referral (column 4) is also highly skewed.

The final column in Table 2 shows that over half of the Boston cardiologists did not self-refer any ECHOs during 2002, but at least 5 percent self-referred all ECHOs interpreted for their assigned patients. That is, they interpreted the ECHOs for each assigned patient for whom they made an ECHO referral. Twenty three of the 35 cardiologists who self-referred all of their ECHOs referred fewer than 50 ECHOs during 2002 (not shown in the table). On average, 30 percent of ECHOs on assigned patients were self-referred.

Twenty-two of the 44 profiles that were created are in Appendix A. A common characteristic of all is that the distributions are skewed. That is, the profiles show that most physicians, both specialists and non-specialists, did not refer many, if any, imaging tests while a few physicians had very high rates per 100 patients. As discussed in greater detail in the following section, however, the profiles are sensitive to changes in patient population specification. In particular, the size of the patient panels and the number of referrals are sensitive to changes in patient population specification.

3.4.2 Summary of Profiles Using Alternative Patient and Physician Populations

Table 2 is but one example from the 44 profiles that were constructed. Summary statistics for profiles of cardiologists and other Boston-area physicians were also produced. For each combination of provider type, and patient population assigned by type of service, diagnosis (any versus CHF), and non-unique versus unique assignment (CHF patients only), the following statistics are shown in Table 3: the number of providers in the peer group; the average number of patients for each provider in the peer group; and, for referrals per 100 patients, the mean number of ECHO referrals and the coefficient of variation (measured in percentage terms).

Number of providers in peer group. The number of profiled cardiologists falls as the type of services used to assign beneficiaries to providers is narrowed. For beneficiaries with any diagnosis, there is a 10 percent drop when moving from the use of any Part B service (564 cardiologists) to office or other outpatient E&M services (507 cardiologists).[6] When the services are restricted to "new patient" office or other outpatient E&M services, there is a further drop of nearly 30 percent to 364 cardiologists. This pattern is repeated for beneficiaries with a CHF diagnosis—both without unique assignment to a provider and with unique assignment to a provider. Other Boston-area MDs exhibit the same pattern as for cardiologists but with larger percentage declines. Restricting patients to those with a CHF diagnosis results in some reduction of the provider sample. But it is not dramatic except for CHF patients with new patient visits. These results indicate that the sample of cardiologists for profiling may be restricted to those

[6] Table 2 indicates that there were 503 instead of 507 cardiologists. The data for Table 3 were generated after Table 2 had been created. The main difference in the statistics presented in the individual profiles (e.g., Table 2) and Table 3 is that four additional cardiologists were identified as having billed Medicare for E&M services. Aside from the number of providers in a peer group, there were no other significant differences.

Table 3
Echocardiogram referrals by Boston physicians for their Medicare patients, 2002

Physician specialty *Patient assignment criteria*	Number of physicians[1]	Average number of patients	Referrals per 100 patients	
			Mean	Coefficient of variation (%)
Cardiologists				
Any diagnosis				
Benes who received any Pt B service from the provider	564	636.6	18.6	163.7
Benes who received any E&M service from the provider	540	264.8	30.8	124.4
Benes who received an office or other outpatient E&M service from the provider	507	166.1	38.1	122.4
Benes who received a "new patient" office or other outpatient E&M service from the provider	364	8.0	52.5	157.9
CHF diagnosis				
Benes who received any Pt B service from the provider	499	63.2	40.8	140.4
Benes who received any E&M service from the provider	471	34.9	53.5	123.6
Benes who received an office or other outpatient E&M service from the provider	401	15.1	78.3	118.6
Benes who received a "new patient" office or other outpatient E&M service from the provider	59	1.7	70.3	170.1
Unique assignment CHF patients				
Benes who received any E&M service from the provider	441	19.0	67.0	122.4
Benes who received an office or other outpatient E&M service from the provider	384	13.0	80.0	120.3
Benes who received a "new patient" office or other outpatient E&M service from the provider	56	2.0	74.0	164.3
Other Boston MDs[2]				
Any diagnosis				
Benes who received any Pt B service from the provider	3,612	263.6	15.8	174.3
Benes who received any E&M service from the provider	3,516	230.4	16.5	158.8
Benes who received an office or other outpatient E&M service from the provider	2,879	161.8	20.3	144.0
Benes who received a "new patient" office or other outpatient E&M service from the provider	851	21.9	58.2	137.9
CHF diagnosis				
Benes who received any Pt B service from the provider	1,574	17.4	106.9	85.7
Benes who received any E&M service from the provider	1,526	14.7	112.0	88.3
Benes who received an office or other outpatient E&M service from the provider	1,135	8.0	156.1	79.2
Benes who received a "new patient" office or other outpatient E&M service from the provider	38	1.6	288.6	61.8
Unique assignment CHF patients				
Benes who received any E&M service from the provider	1,223	10.0	142.0	79.4
Benes who received an office or other outpatient E&M service from the provider	1,043	7.0	170.0	78.7
Benes who received a "new patient" office or other outpatient E&M service from the provider	38	2.0	292.0	62.0

[1] Physicians providing at least one service of the specified type to the specified patient population.

[2] Limited to physicians who referred (ordered) at least one echocardiogram in 2002.

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

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providing E&M visits, or those treating CHF patients. But limiting the sample to physicians providing new patient visits, and especially new patient visits for CHF patients, will substantially reduce the number of physicians who can be profiled.

Average number of patients in provider panels. The effects of the types of services and diagnoses used to assign beneficiaries are much larger on the average number of patients in provider panels than on the number of providers in a peer group. For instance, for beneficiaries with any diagnosis, there is a 74 percent drop when moving from the use of any Part B service (637 patients) to office or other outpatient E&M services (166 patients). When the services are restricted to "new patient" office or other outpatient E&M services, there is a further drop of 95 percent to just 8 patients. This few patients is inadequate for profiling.

The impact of a CHF diagnosis criterion is generally larger on the number of patients than the number of providers, especially when moving from any Part B service to any E&M and from any E&M to office or other outpatient E&M services. For instance, the average number of patients falls 87 percent from 265 to 35 for beneficiaries assigned on the basis of any E&M service from the provider. The marginal impact of unique assignment is slightly larger for the number of patients than for the number of providers. The numbers of CHF patients per cardiologist are rather low for profiling.

The implication of these findings is that the number of patients available for profiling analysis depends greatly on the algorithm used to assign patients to physicians. The number of patients declines substantially when moving from any Part B service assignment to at least one E&M visit assignment, then again when moving to a new patient office visit assignment. However, it may be more plausible to hold physicians responsible for performance measures when patients are assigned using the narrower criteria. Thus, in profiling, there may be a tradeoff between patient sample size and degree of physician responsibility for patients.

Referrals per 100 Patients. Unlike the number of providers and the number of patients, the average (mean) number of referrals per 100 patients increases when a narrower range of services are used to assign beneficiaries and when the patient population is limited to beneficiaries diagnosed with CHF. For cardiologists, the average number of referrals per 100 patients increases from 19 to 53 for patients with any diagnosis as the service criteria become more restrictive. Application of the CHF criterion further increases the average number of referrals per 100 patients as when, for any Part B service, it increases 120 percent from 19 to 41 for cardiologists. This is presumably because cardiologists and other physicians are more likely to order diagnostic tests when they are more heavily involved in managing or initiating care for a patient with a diagnosis closely related to the test. Patient diagnosis needs to be held constant when profiling physicians.

The coefficient of variation (CV)[7] of the average number of referrals per 100 patients is also affected by the assignment criteria. For cardiologists, the CV ranges in value from 119 to 170 while for other MDs, it ranges from 62 to 174. The CV's magnitude is not as affected by

[7] The coefficient of variation (CV) is in percentage terms: $100 \times \left(\sigma_x / \bar{x}\right)$. That is, it is equal to 100 times the standard deviation divided by the mean. The CV is used as a measure of dispersion or variation instead of the standard deviation in order to eliminate the effect of the units in which performance is measured.

variations in the assignment and diagnosis criteria as are the other measures in Table 3. The CVs indicate a significant amount of variation across physicians in their mean ECHOs per assigned patient, a finding that is not surprising given the extremely skewed distributions of referrals per 100 patients displayed in Table 2. Clearly, there is substantial variation across physicians in ECHO ordering behavior. For cardiologists, alternative patient assignment and CHF diagnosis criteria do not greatly reduce the observed variation, but limiting patients to those with CHF does substantially lower ECHO ordering variation among non-cardiologists.

Conclusion. The results shown in Table 3 indicate that the number of providers in a peer group, the average number of patients in a provider's patient panel, the average number of referrals per 100 patients, and the CV for referrals per 100 patients are sensitive to the criteria used for assignment of patients to providers. While the size of provider and patient panels decrease as the service criteria used for assignment become narrower and diagnostic criteria are applied, the effects on other measures vary. In general, the profiles become less statistically robust. It would be prudent to consider all such effects when developing measures of provider performance.

The results also suggest that trying to specify narrowly defined patient populations to enable "apples-to-apples" comparisons will be frustrated by small numbers of providers that can be profiled or small numbers of patients available to create provider-level statistics. But without closely-matched patient populations across physicians being compared, physicians will question the validity of the profiling results, probably with good justification. An alternative approach to provider profiling is to use risk-adjustment to control for differences in patient casemix among a larger patient population. Or, if technology or practice standards change little over the course of several years, then the use of multiple years of data may be acceptable to increase the statistical robustness of the profiles.

3.4.3 Stability of Physicians' Relative Rankings Across Patient Populations

In addition to determining the sensitivity of the size of provider peer groups, the size of patient panels, and measures of provider performance to variation in patient population selection criteria (type of service, diagnosis, and provider assignment), the stability of providers' relative rankings (deciles) across different patient populations was also the subject of investigation. For example, are providers that are in the 9^{th} decile for a given patient population also in the 9^{th} decile for another population?

This investigation was conducted on a limited sample of cardiologists. Two cardiologists were randomly selected from each decile of referrals per 100 patients, with patients assigned who had received any Part B service from the cardiologist (the least restrictive patient population).[8] Results are shown in Table 4. Cardiologist #1 was ranked in the top decile (10 percent of cardiologists with the highest number of referrals per 100 patients) when assigned patients using the least restrictive criteria (the column labeled "Pt B" in Table 4). Cardiologist #1 fell to the next highest decile (9) when patients who received any E&M service from the

[8] By following cardiologists selected from deciles based on the least restrictive patient population specification instead of the most restrictive, it is possible to identify when physicians no longer become ranked as successively more restrictive patient population specifications are used.

Table 4
Cardiologist[1] deciles[2] for ECHO referrals per 100 beneficiaries by patient population

NOTES:
[1] To create the sample shown in the table, two cardiologists were randomly selected from each decile of referrals per 100 patients, with patients assigned who received any Part B service from the physician.
[2] 10 represents the highest decile (i.e., greater number of referrals per 100 beneficiaries). Cardiologists are sorted by decile ranking in the first assignment type, column for any Part B service, for any diagnosis, and without unique assignment to a provider.
[3] Types of Health Services:

Pt B	Benes who received any Pt B service from the provider
E&M	Benes who received any E&M service from the provider
Office	Benes who received an office or other outpatient E&M service from the provider
New	Benes who received a "new patient" office or other outpatient E&M service from the provider

A cell containing only a decimal point (period) indicates that the cardiologist does not have any patients with the selection criteria and, thus, is not ranked.
SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

cardiologist were assigned, and then back up to the top decile when patients were assigned on the basis of office and other outpatient E&M services. Cardiologist #1 did not have any patients when the other patient population selection criteria were applied. In this case, Cardiologist #1 was not ranked, as indicted by a decimal point (period) in place of decile ranking in Table 4.

Cardiologists #2, 8, and 11 are ranked for only one patient population, any Part B service, and are not ranked thereafter due to a lack of patients satisfying the patient selection criteria. Cardiologists #12 and 16 are ranked for only the two least restrictive patient populations.

Only Cardiologist #9 is ranked for all 11 patient populations. The ranking for #9 changes by patient population. It is as high as in the top decile for two of the 11 populations: CHF patients using any Part B services and all patients using any E&M services. The lowest ranking for #9 is the 2nd decile (new patients using office and other outpatient E&M visits).

Cardiologist #20 was ranked in the lowest decile for five of the six patient populations, but was in the highest decile for patients with any diagnosis and new office and other outpatient E&M visits.

Conclusions. There seems to be something of a tendency for a provider to remain in the same range of deciles in the example provided in Table 4. (See Appendix B for other examples of how rankings change by population specification.) Some large changes in the decile ranks were also found. It is not known how representative the cardiologists used in Table 4 are for the entire population. But it seems likely that there is generally good agreement in ranking physicians across similar patient populations. When criteria are imposed that significantly change the patient population—such as focusing only on new patients or patients with a particular diagnosis such as CHF—the relative rankings of physicians may show greater change. Another finding from Table 4 is that individual providers are not ranked for many of the patient populations due to not having any patients meeting the selection criteria. Hence, broad patient selection criteria may be necessary to make comparisons across large numbers of physicians.

SECTION 4
MAGNETIC RESONANCE IMAGING AND COMPUTED TOMOGRAPHY SCANS

4.1 Overview

There has been significant growth in the use of imaging procedures for Medicare beneficiaries in recent years. From 1999–2003, the volume of magnetic resonance imaging (MRI) per beneficiary had the highest cumulative growth rate at 99 percent. MRIs of the brain alone had a growth rate of 67 percent. Similarly, the volume of computed tomography (CT) scans of the head increased by 21 percent (MedPAC, 2005). We focused on MRI and CT imaging procedures in the next portion of the analysis because they appeared to be contributing significantly to the increased volume of and expenditure for imaging procedures being conducted for Medicare beneficiaries.

The remainder of this section provides detail on the types of MRI and CT imaging procedures that were analyzed, the patient populations that were considered and the providers that were profiled. Results of the referral patterns for providers are presented.

4.2 Methods

Types of Scans Counted. The analysis includes head/brain and spine MRI, magnetic resonance angiography (MRA), CT, and computed tomography angiography (CTA). These procedures were identified using CPT codes.[9] The four procedures (MRI, MRA, CT and CTA) included in this analysis were chosen because of their substitutability with each other in the clinical setting. These procedures were thought to be used as alternatives by providers and were therefore grouped and analyzed together for each of the body regions.

The analysis was limited to the head/brain and spine due to a preliminary analysis which showed that head/brain and spinal procedures were the most frequently occurring MRIs, MRAs, CTs, and CTAs performed on our sample of beneficiaries. Head/brain and spinal procedures accounted for approximately 39 percent and 37 percent of MRIs, MRAs, CTs, and CTAs performed on the beneficiaries in our sample respectively.

The analysis did not include line items with a technical component modifier only, which is consistent with the ECHO analysis. Otherwise all of the imaging procedures described above were included in the analysis.

Types of Patients. The patients included in this analysis had received at least one office or other outpatient evaluation and management (E&M) service with the provider being profiled. The analysis was restricted to this patient population based on results of the ECHO analyses, which included four different basic patient populations.

For each procedure type (i.e., head/brain or spinal) the patient population was further restricted by including only patients with specific diagnoses. Diagnoses were identified using

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[9] CPT codes used to identify procedures for the analysis are listed below.
Head or Brain MRI, MRA, CT or CTA: 70551-70553, 70544-70546, 70450, 70460, 70470 and 70496.
Spinal MRI, MRA or CT: 72141, 72142, 72146, 72148, 72149, 72156-72159 and 72125-72133.

ICD-9 codes. The diagnoses were chosen for this analysis through consultations with a clinical expert and exploratory data analysis. The diagnoses are referred to as "tracer diagnoses" and are intended to include those diagnoses where a referral for an MRI, MRA, CT, or CTA could be discretionary. For head/brain procedures these diagnoses included the following:

- General symptoms: alteration of consciousness
- General symptoms: dizziness and giddiness
- Headache
- Cerebrovascular disease
- Alzheimer's disease
- Pick's disease
- Senile degeneration of brain
- Other cerebral degeneration
- Cerebral degeneration, unspecified

For spinal procedures these diagnoses included the following:

- Ankylosing spondylitis and other inflammatory spondylopathies
- Spondylosis and allied disorder
- Intervertebral disc disorders
- Other disorders of cervical region
- Other and unspecified disorders of back
- Pathologic fracture of vertebrae

Referral rates were calculated for patients uniquely assigned to a provider as well as for those not uniquely assigned.

Types of Providers. Providers serving Medicare beneficiaries residing in the Boston area are included in this analysis. The analysis examines the referral patterns of MRIs, MRAs, CTs, and CTAs of these providers. Some provider specialties were found to refer patients for these procedures at a higher rate than others. These specialties were identified through consultations with a clinical expert, CMS, and exploratory data analysis.

Providers with these specialties were analyzed separately to see how referral patterns varied by different provider specialties. For the head/brain procedure analysis neurologists,

neurosurgeons, primary care providers (i.e., internists, family practitioners and general practitioners) and other MDs or osteopaths were examined. For the spinal procedure analysis neurosurgeons, orthopedic surgeons, primary care providers (i.e., internists, family practitioners and general practitioners) and other MDs or osteopaths were examined.

4.3 Total Number of Head, Brain or Spinal MRI, MRA, CT and CTA Referrals

Table 5 presents the total number of referrals for each of the procedures by the specialty indicated for the referring provider. There were a total of 85,893 head/brain MRI, MRA, CT and CTA referrals. Medicare beneficiaries were referred more frequently for head/brain CTs and CTAs than for head/brain MRIs and MRAs. CTs and CTAs accounted for 65 percent of all of the head/brain procedures included in the analysis. The primary care providers were found to make the greatest number of referrals for the head/brain procedures (30 percent). Neurologists and neurosurgeons did not account for as high a proportion of total referrals, as was expected. This may be because the patients had received the scanning procedure prior to being referred to a neurologist/neurosurgeon for follow-up specialty care, as well as the relatively small numbers in the specialties compared to primary care physicians.

Table 5
Number of referrals for head/brain and spinal MRI, MRA, CT and CTA procedures by referring provider specialty

	Type of procedure		
Referring provider specialty	MRI/MRA	CT/CTA	Total
Head and brain procedures			
Neurologist	7,119	2,068	9,187
Neurosurgeon	910	1,394	2,304
Family practice, general practice or internal medicine	10,536	21,289	31,825
Other MDs or osteopaths	6,166	19,191	25,357
Non-physician practitioner	31	87	118
All other	28	60	88
Surrogate UPIN listed as referring provider	5,120	11,894	17,014
Total	29,910	55,983	85,893
Spinal procedures			
Neurosurgeon	1,479	656	2,135
Orthopedic surgeon	2,702	583	3,285
Family practice, general practice or internal medicine	7,230	1,498	8,728
Other MDs or osteopaths	6,599	1,507	8,106
Non-physician practitioner	60	2	62
All other	92	11	103
Surrogate UPIN listed as referring provider	2,376	1,284	3,651
Total	20,538	5,541	26,070

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

There were a total of 26,070 spinal MRI, MRA, CT and CTA referrals. Medicare beneficiaries were referred more frequently for spinal MRIs and MRAs than for spinal CTs (spinal CTAs are not performed). MRIs and MRAs accounted for 79 percent of all of the spinal procedures included in the analysis. Among the specialties profiled, the primary care providers were found to make the greatest number of referrals for the spinal procedures (33 percent) across all patients.

For both head/brain and spinal procedures the referral patterns for the different specialties were similar for the CT and CTA procedures and the MRI and MRA procedures.

Table 5 also includes surrogate UPINs. While conducting the analysis it was discovered that a referring physician specialty could not be determined for a large proportion of MRI, MRA, CT and CTA procedures. Through further investigation it was found that these line items included surrogate UPINs for the referring provider field. Surrogate UPINs are used when the individual ordering or referring a procedure does not have a UPIN. For example, surrogate UPINs may be used for residents or interns who have not yet been assigned a UPIN. In general, surrogate UPINs are supposed to be used on a temporary basis only.

Surrogate UPINs were found on 20 percent of the head/brain procedure line items and 14 percent of the spinal procedure line items. Therefore, for approximately 18 percent of all procedures of interest, the referring provider could not be identified. This limits the accuracy of profiling referring providers using existing claims data, although revised reporting rules could possibly be formulated.

4.4 Referrals by Profiled Providers

We first discuss an example of a physician profile of CT/MRI use for a particular specialty (neurosurgery) and particular patient population (patients who had an office or other outpatient E&M visit with a physician). Then we present and discuss summary statistics for CT/MRI referral profiles using alternative physician specialties and patient assignment criteria. Finally, we analyze the stability of physician rankings of CT/MRI referral rates across different patient populations. As with the ECHO analyses, the goal of these exploratory CT/MRI analyses is to gain insight into the potential methods, results, and limitations of profiling physician imaging test referral rates using Medicare claims data.

4.4.1 Example of a Profile

Profiles were developed for each of the provider specialty, procedure and patient population combinations. Table 6 provides an example of the profiles that were created (see Appendix C for additional profiles examining different patient populations and provider specialties). Similar to the ECHO analysis, deciles were produced for each measure of provider performance or each provider characteristic. These measures and characteristics included the following:

- Number of patients for which the provider billed Medicare
- Number of patients referred for a procedure

Table 6

Head and brain MRI/MRA and CT/CTA referrals by 92 Boston neurosurgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient E&M service from a neurosurgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	49	7	12	26.9	15.7%
100% Maximum	171	72	125	400.0	100.0
99%	171	72	125	400.0	100.0
95%	148	23	47	85.0	57.1
90%	120	19	34	57.1	44.4
80%	88	11	20	41.8	25.2
70%	69	7	11	28.6	16.7
60%	51	5	8	22.5	12.7
50% Median	40	3	4	16.3	10.0
40%	23	2	3	9.5	6.0
30%	16	1	1	4.9	4.2
20%	9	0	0	0.0	0.0
10%	3	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% Minimum	1	0	0	0.0	0.0

NOTES:

[1] Procedures that had a technical component modifier only indicated were not counted.

[2] Office or other outpatient evaluation and management (E&M) codes 99201-99215.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

- Number of procedures referred by the provider
- Number of procedure referrals per 100 patients
- Percentage of patients with one or more referrals for a procedure

Table 6 shows results for the 92 neurosurgeons in the Boston area that billed Medicare for any office or other outpatient E&M service provided to a beneficiary. This sample profile presents referral rates for head or brain MRI, MRA, CT or CTAs.

The neurosurgeons included in this sample had a mean of 49 (range 1 to 171) Medicare patients during 2002. At least 20 percent of the neurosurgeons did not refer any of their patients for a head or brain MRI, MRA, CT or CTA. Some providers may treat different types of patients or conditions that do not require these imaging tests. It is also possible that these providers saw fewer patients and were less likely to make referrals for their small subset of patients or that the referrals for scanning procedures were made at the same time as their referral to the specialist. Another possibility is that given the nature of the specialty, that some of the patients were seeing the specialists for second opinions. In these situations the patient would have already had the scanning procedure completed by another provider.

The distributions for the number of referred tests, test referrals per 100 patients and percent of patients with one or more referrals are all highly skewed. Each of the profiles that were generated for this analysis showed that the five measures or characteristics for each provider sample had a large range of values. Similar to the ECHO analysis, a small proportion of providers had relatively high values for these measures, whereas a larger group of providers had relatively low values. This could be due to variations in patient casemix across physicians, subspecialization of providers, or practice style variations.

4.4.2 Summary of Head/Brain Procedure Profiles for Alternative Specialties and Patient Populations

Table 7 presents summary results by provider type for the head/brain MRI, MRA, CT and CTA analysis. In Boston in 2002, there were 378 neurologists who saw a Boston area beneficiary with any diagnosis and an office or other outpatient E&M visit. Each of the neurologists had, on average, 70 patients and made 15 referrals per 100 patients. When the patient population was restricted to those patients with one of the head/brain tracer diagnoses the mean number of patients per provider decreased substantially, however the number of physicians did not fall as greatly. Thus, limiting the analysis to the tracer diagnoses still allows profiling of a large number of physicians, however the patients per physician available for profiling is significantly reduced.

When patients were restricted to the tracer diagnoses, the mean number of referrals increased indicating that patients with the tracer diagnoses are referred for the scanning procedures at a higher rate than those with any diagnosis. A similar pattern is found with neurosurgeons, primary care providers and other MDs or osteopaths who refer for scanning procedures. Neurologists and neurosurgeons order these tests at a higher rate per patient than primary care physicians. The coefficient of variation of referrals is not very sensitive to the alternative patient populations.

Table 7
Head/brain MRI, MRA, CT, and CTA[1, 2] referrals by provider specialty for Medicare patients, 2002
Patient populations with any office or other outpatient E&M service

	Total number of providers	Mean number of patients	Referrals per 100 patients	
			Mean	Coefficient of variation (%)
Neurologists				
Any diagnosis	378	69.6	14.9	120.5
Tracer diagnoses[3]	300	20.5	29.9	130.8
Unique assignment of patients with tracer diagnoses[3]	288	18.0	31.1	133.0
Neurosurgeons				
Any diagnosis	92	49.3	26.9	174.4
Tracer diagnoses[3]	59	5.2	62.4	97.4
Unique assignment of patients with tracer diagnoses[3]	51	4.2	62.1	128.8
Internists, FPs and GPs				
Any diagnosis	3,239	126.9	2.8	148.0
Tracer diagnoses[3]	2,340	8.4	20.1	163.6
Unique assignment of patients with tracer diagnoses[3]	2,261	7.7	20.7	167.6
Other MDs or osteopaths[4]				
Any diagnosis	1,036	179.2	5.7	279.3
Tracer diagnoses[3]	266	16.0	45.5	101.7
Unique assignment of patients with tracer diagnoses[3]	239	14.1	47.5	103.0

NOTES:

[1] Head/Brain MRI, MRA, CT, and CTA procedures are defined using the following CPT codes: 70551, 70552, 70553, 70544, 70545, 70546, 70450, 70460, 70470, and 70496.

[2] MRIs, MRAs, CTs, and CTAs that had a only technical component modifier indicated were not included in the analysis.

[3] Specific head/brain diagnoses were selected as tracer diagnoses. These tracer diagnoses are defined by the following ICD-9 codes: 780.0, 780.4X, 784.0X, 43X.XX, 331.0X, 331.1X, 331.2X, 331.8X, and 331.9X.

[4] Other MDs or Osteopaths included in the analyses each referred at least one patient for a Head/Brain MRI, MRA, CT or CTA procedure in 2002. Neurologists, Neurosurgeons, Internists, FPs and GPs are included regardless of whether they referred a patient for a procedure.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

Table 7 also shows results of what happened when beneficiaries were uniquely assigned to providers based on a plurality of services. Patients with tracer diagnoses who were uniquely assigned to individual providers did not have a significantly different rate of referrals than for the non-uniquely assigned patients. The number of providers available to be profiled, and patients per physician, decreased minimally after the beneficiaries were uniquely assigned.

Neurosurgeons appear to make the most head/brain scanning referrals per 100 patients of all the specialties included in the analysis. These providers also tend to have smaller patient samples so the total number of procedures they refer patients for is not very high.

Overall, the analysis in Table 7 indicates that there appear to be enough physicians to form a peer group for profiling, but the number of patients per physician is small, especially when the patient population is restricted to those with one of the tracer diagnoses.

4.4.3 Summary of Spinal Procedure Profiles for Alternative Specialties and Patient Populations

Table 8 presents similar summary results from the spinal MRI, MRA, and CT analysis. In Boston in 2002, there were 92 neurosurgeons who saw a Boston area beneficiary with any diagnosis and an office or other outpatient E&M visit. Each of the neurosurgeons had, on average, 49 patients and made 34 referrals per 100 patients. When the patient population was restricted to those patients with at least one of the tracer diagnoses, the mean number of patients per provider decreased and the mean number of referrals increased, again, indicating that patients with the tracer diagnoses are being referred for scanning procedures at a slightly higher rate than those with just any diagnosis. A similar pattern was found for the orthopedic surgeons, the primary care providers and the other MDS or osteopaths.

Table 8 also shows results of what happened when beneficiaries were uniquely assigned to providers based on a plurality of services. The unique assignment of patients with tracer diagnoses to individual providers did not have a large impact on the number of referrals compared to the non-uniquely assigned patients. The number of providers available to be profiled after the unique assignment of beneficiaries decreased.

Neurosurgeons had, on average, the highest referral rates for spinal scanning procedures for each of the patient populations considered in the analysis. The rate of referrals was lowest for the primary care providers.

As with the head/brain procedures, the overall conclusion is that the number of assigned patients per physician would make comparative profiling of physicians problematic, especially when the patient population is restricted by diagnosis.

4.4.4 Sensitivity of Providers' Decile Ranking

As with the ECHO analysis, the MRI and CT analysis included an examination of the stability of providers' decile rankings for average number of procedures referred per 100 patients across the different patient population selection criteria. The analysis was conducted for each provider specialty and was limited to a random selection of two providers from each decile for a specific patient population.

Table 8
Mean spinal MRI, MRA, and CT[1, 2] referrals by provider specialty for Medicare patients, 2002
Patient populations with any office or other outpatient E&M service

	Total number of providers	Mean number of patients	Referrals per 100 patients	
			Mean	Coefficient of variation (%)
Neurosurgeons				
Any diagnosis	92	49.3	34.3	216.8
Tracer diagnoses[3]	80	35.5	40.1	72.1
Unique assignment of patients with tracer diagnoses[3]	75	24.0	43.2	69.9
Orthopedic surgeons				
Any diagnosis	448	131.1	4.6	189.0
Tracer diagnoses[3]	373	21.1	23.2	110.3
Unique assignment of patients with tracer diagnoses[3]	353	16.8	22.7	114.1
Internists, FPs and GPs				
Any diagnosis	3,239	126.9	1.3	182.2
Tracer diagnoses[3]	2,380	10.2	12.1	178.5
Unique assignment of patients with tracer diagnoses[3]	2,280	8.8	11.2	184.8
Other MDs or osteopaths[4]				
Any diagnosis	820	158.6	6.3	162.1
Tracer diagnoses[3]	412	22.3	37.6	102.8
Unique assignment of patients with tracer diagnoses[3]	374	16.4	39.4	95.4

NOTES:

[1] Spinal CT procedures are defined using the following CPT codes: 72141, 72142, 72146, 72147, 72148, 72149, 72156, 72157, 72158, 72159, 72125, 72126, 72127, 72128, 72129, 72130, 72131, 72132 and 72133.

[2] MRIs, MRAs, and CTs that had only a technical component modifier indicated were not included in the analysis.

[3] Specific spinal diagnoses were selected as tracer diagnoses. These tracer diagnoses are defined by the following ICD-9 codes: 720.XX, 721.XX, 722.XX, 723.XX, 724.XX and 733.13.

[4] Other MDs or Osteopaths included in the analyses each referred at least one patient for a Spinal MRI, MRA or CT procedure in 2002. Orthopedic Surgeons, Neurosurgeons, Internists, FPs and GPs are included regardless of whether they referred a patient for a procedure.

Table 9 shows an example of this sensitivity analysis (see Appendix D for other examples of how rankings change by population specification). In Table 9, two providers were randomly selected from each decile for the patient population with any diagnosis, no unique assignment and any office or other outpatient E&M service. This table shows that Neurosurgeon #1 was ranked in deciles 8 to 10 across the different patient populations. Neurosurgeon #1 was not ranked for two of the patient populations (indicated by a ".") because he/she did not have any patients when this patient population selection criterion was applied.

Other providers had greater sensitivity to changes in patient populations. Neurosurgeon #7, for example ranked in deciles 1 to 9 depending on the patient population and Neurosurgeon #17 ranked in deciles 2 to 10 depending on patient population.

In general, rankings for similarly-defined patient populations (e.g., patient populations with no unique assignment and any diagnosis) were similar. But rankings for populations where the diagnoses were restricted sometimes differed significantly from rankings for the unrestricted populations. Hence, it should not be assumed that a physician's ranking on one patient population will necessarily correlate highly with her ranking on a fairly different patient population. Careful and meaningful selection of patient populations used in profiling reports could therefore be very important to providers.

Also, as with the ECHO analysis, an important finding was that as patient populations become more restrictive several providers can no longer be profiled or ranked because they do not have any patients meeting the selection criteria.

Table 9
Neurosurgeon[1] decile rankings[2] for head or brain MRI/MRA and CT/CTA referrals per 100 patients by patient population

					Type of health services[3]				Type of health services[3]		
Provider	Pt B	E&M		New	Pt B	E&M	Office	New	E&M	Office	New
1	10	10		9	10	10	9	.	10	8	.
2	8	8		.	.	.	.	.	.	.	.
3	8	10		.	3	5	3	.	.	.	.
4	8	9		.	4	5	.	.	.	.	.
5	6	6		.	5	5	.	.	.	.	.
6	5	6		.	1	1	.	.	.	.	.
7	8	9		.	3	4	2	.	3	1	.
8	6	7		.	.	.	.	.	.	.	.
9	7	5		.	9	9	8	.	.	10	.
10	5	5		.	.	.	.	.	.	.	.
11	7	7		.	4	5	5	.	4	1	.
12	3	4		.	.	.	.	.	.	.	.
13	4	3		.	7	4	.	.	.	.	.
14	3	3		.	7	8	6	.	8	7	.
15	7	7		.	9	10	10	.	10	10	.
16	5	5		6	5	.	.	.	.	.	.
17	5	5		.	10	10	10	.	.	.	.
18	4	1		.	.	.	.	.	.	.	.
19	2	2		4	.	.	.	.	.	.	.
20	1	2		1	.	.	.	.	.	.	.

NOTES:

1 Two providers were randomly selected from each decile for this sample based on the patient population with any diagnosis, no unique assignment and any office or other outpatient E&M service (shaded column).

2 10 represents the highest decile (i.e., greater number of referrals per 100 beneficiaries). The data have been sorted by decile in the patient population with any diagnosis, no unique assignment and any office or other outpatient E&M service (shaded column).

3 Types of Health Services:

- Pt B — Beneficiaries who received any Pt B service from the provider
- E&M — Beneficiaries who received any E&M service from the provider
- Office — Beneficiaries who received an office or other outpatient E&M service from the provider
- New — Beneficiaries who received a "new patient" office or other outpatient E&M service from the provider

A cell containing only a "." indicates that the neurosurgeon does not have any patients with the selection criteria and, thus, is not ranked.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

SECTION 5
REACTION OF PHYSICIANS TO REPORTS ON USAGE OF ECHO CARDIOGRAMS

Using the algorithms RTI developed, CMS had echocardiogram physician profiling reports created by CMS Program Safeguard Contractors who have complete data for specific geographic areas. Claims were extracted from Ohio and Wisconsin for 1 year. The reports were targeted to individual physicians identified by UPIN. They presented statistics about their echocardiogram ordering patterns compared to those of their peers. Peer groups were created of physicians in the same specialty, state, and geographic setting by degree of urbanicity

Statistics included counts of patients, and patients who had a diagnosis code in a range related to the test being reported, number of echocardiograms ordered for the patients, numbers of patients for whom at least one was ordered, and for whom more than one was ordered. Tables and histograms of the per-patient frequency of testing were presented with an indicator as to where the profiled physician fell. The number of tests per patient and proportions of patients with more than one test was computed for the patient groups for the physician and the peers.

The Wisconsin cardiologist profiled in Figure 1 (obtained from CMS) billed Medicare for E&M services provided to 552 patients. For 122 of these patients, the cardiologist ordered 147 ECHOs and 282 Doppler imaging add-on services. Another 284 of the cardiologist's patients had an ECHO ordered by another provider. The cardiologist ordered 27 ECHOs per 100 patients while Wisconsin cardiologists (statewide) ordered 17 ECHOs per 100 patients and metropolitan Wisconsin cardiologists (peer group) ordered 16 ECHOs per 100 patients. The subject cardiologist ordered ECHOs at a higher rate than 81 percent of the metropolitan cardiologists in Wisconsin. The cardiologist ordered an ECHO for 22 percent of his/her patients (78^{th} percentile in peer group) while the statewide average was 15 percent and the metropolitan average was 14 percent. The cardiologist also had a higher rate of ECHOs ordered by other providers than did other cardiologists in Wisconsin.

Copies of these reports were distributed to focus groups of physicians who were selected to have varied practice settings, in each of the two states, and, in a more preliminary form, to a group of academically oriented cardiologists in Boston.

The reactions of physicians was generally skepticism concerning the usefulness of the report.

There were a number of points made, some relating to the usefulness of the report and some related to the causes of the variability.

1. When I get these types of reports from managed care plans I throw them away.

   This reaction expressed the frustration as to usefulness of a report that has no analytical depth, just counts of things and is not seen as accurate.

2. I did not get a report and yet I order these tests in my practice. These numbers do not look right.

Figure 1. Medicare physician echocardiogram resource use report - for patients with an E&M service

Physician Information

Metropolitan Sample **UPIN: XXXXXX** **Specialty: Cardiology**

Wisconsin **Location Type:** Metropolitan **Reporting Period:** 1/1/2004-12/31/2004

Report Highlights

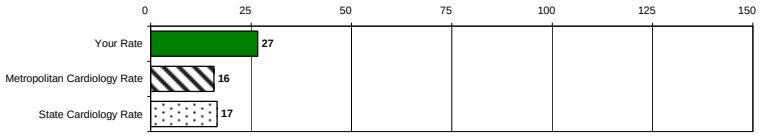
* You ordered doppler imaging add-on services for 98% of the patients for whom you ordered an echocardiogram.
* In total, 74% of your patients had an echocardiogram ordered. 51 % of your patients had an echocardiogram ordered by another provider.

Basic Statistics

Number of Patients with an E/M Service You Provided:	552
Number of Echocardiograms You Ordered for These Patients:	147
Number of Doppler Imaging Add-On Services You Ordered for These Patients:	282
Number of These Patients Who Received an Echocardiogram You Ordered:	122
Number of These Patients with an Echocardiogram Ordered only by Another Provider**:	284

Averages

Rate of Echocardiograms Ordered per 100 Patients

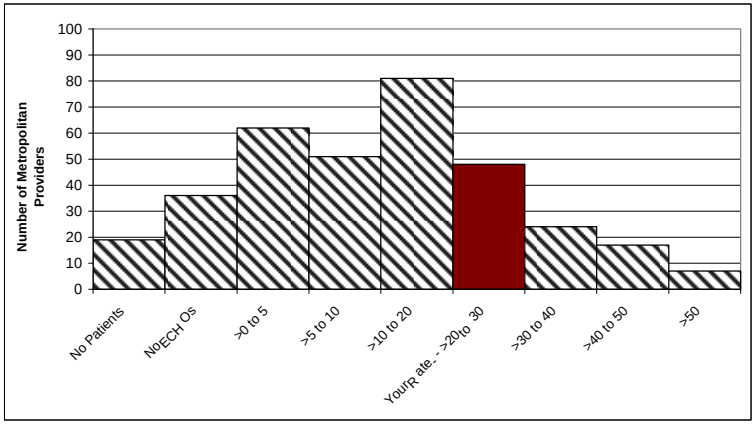


Rates and Rankings

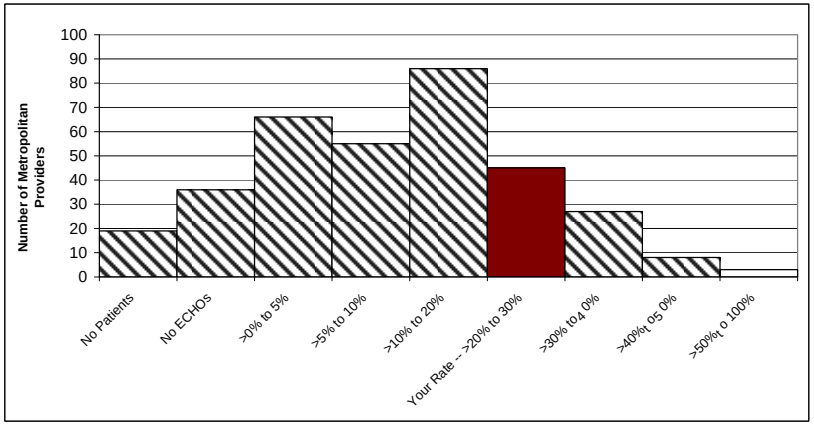
Comparisons

	Your Rate	Metropolitan Cardiology Rate	State Cardiology Rate	Your Percentile Rank to Metropolitan Peer Group
Echocardiogram Referrals per 100 Patients	27	16	17	81%
% of Patients with at Least One Echocardiogram You Ordered	22	14	15	78%
% of Patients with Echocardiograms Ordered only by Another Provider**	51	40	39	75%
% of Your Echocardiogram Recipients with a Doppler Imaging Add-On Service	98	92	92	63%

Distribution of Metropolitan Providers by Echocardiogram Referrals per 100 Patients



Distribution of Metropolitan Providers by % of Patients with at Least One Echocardiogram You Ordered



**Excludes Beneficiaries for Whom you Ordered an Echocardiogram

Note: Data Represents all your Provider Locations Summarized at the UPIN Level
Echocardiogram Code Range: 93303-93318, 93350
Echocardiogram Doppler Imaging Add-On Code Range: 93320-93325

SOURCE: Centers for Medicare and Medicaid Services

This comment likely reflects the problem of the accuracy of UPINs on the claims. With some frequency, UPINs for groups rather than individuals are on claims. This is a problem that could be dealt with if rules and mechanisms were in place to assure individual identifiers were used.

3. My practice is different. To what group are you comparing me?

   Physicians in the specialty of cardiology often felt that their practice was in a subspecialty that demanded a different rate of ordering. Physicians based in academic medical centers would have practices that differed from those not hospital based. One physician, for example, said that he had many patients approaching the need for implant of a defibrillator and these patients require frequent retesting. Coverage guidelines for these patients increase resource use. The physicians saw their peer group quite narrowly. Our presentation was done with of peer groups representing the same specialty, state and three degrees of urban-rural location. Geography was not considered as important by the physicians as practice characteristics.

4. My patients are different.

   While related to differences in practice characteristics, the emphasis is more on risk adjustment for patients. The types of test reported on were chosen because the utilization is not closely tied to patient comorbidities; this would reduce the need for risk adjustment. The physicians saw the risk adjustment issue more narrowly. The measures did not account for stages of heart failure or whether the patient was recently hospitalized. The comments of this nature emphasized that the physicians see their patients as individual cases. It is not easy to transition to a statistical point of view. The viewpoint does indicate that physicians would prefer it if a much finer risk adjustment was done on their patients. Related to this was the idea that the one-year time horizon was too short. The patients had to be followed in the data for a longer period, particularly to know whether a baseline test had been done.

5. There are no guidelines against which we are being measured.

   Physicians would point out the lack of practice guidelines generally as reasons for variability. They also cited the specific guidelines for implantation of devices and diagnosis of causes of syncope as reasons to do more testing.

6. Other types of physicians are really the cause of retesting.

   This argument relates that there are incentives for physicians to do these tests in their offices, irrespective of competence. Specialists usually attribute this to physicians in more general practice. They said that when the patient is later referred to the specialist, the test is redone because the prior results can not be trusted.

7. These test should only be done be certified cardiographers. Payment amounts should be related to the certification of those doing the tests.

This opinion was expressed by subspecialists in electrocariography. The overuse of the tests because of financial incentives to do the tests and the subsequent need to redo them properly could be avoided if only certified practitioners did the tests. Many physicians focused on overuse and fraud and abuse rather than the stated purpose of the analysis, which was to inform physicians how their test utilization in their practice compared to their peers. They suggested that cutting payments to non-specialists and the non-certified would cut down the abuse.

8. Patients pressure physicians into doing the tests.

   In this case, some physicians (other physicians), are said to give in to patient pressure to get a score card. Patients want to see a number that tells them how they are doing even though clinically there is no indication for another test.

In summary, the focus groups of physicians did not indicate that the participants would be averse to having reports created, but did not think that under present circumstances these were very useful. There are a number of dimensions of criticism that would have to be dealt with if these physicians are representative of their peers.

- Guidelines are needed to be measured against.
- Peer groups have to be narrowly defined.
- Patients' disease stage and risk adjustment would be needed.
- Longer data collection periods might be required for some reports.

There are issues of a different nature as well.

- How does one control for retesting because of prior poor testing?
- How does one control the quality of testing?

There is also the underlying issue of the acceptability of statistical reports to physicians who tend to see their cases as individuals. The utility of such a report leading to ask why a particular physician has an apparently aberrant pattern is not always seen clearly.

SECTION 6
SUMMARY

The purpose of the study was to ascertain what could be learned from an exploratory profiling of rates of ordering selected imaging tests by physicians in one area—Boston. The profiles show that most physicians, both specialists and non-specialists, did not refer many, if any, imaging tests while a few physicians had very high rates per 100 patients. This result was found for nearly, if not all, patient populations. Changing the patient populations did affect the number of physicians available for a comparative peer group, the average number of patients per physician, and the average number of referrals per 100 patients. In particular, the most restrictive population specifications reduced the number of physicians profiled and the size of their patient panels substantially. Even the more broadly-defined patient populations often did not result in a very large number of patients per physician. This result suggests that trying to specify narrowly defined patient populations to enable "apples-to-apples" comparisons will be frustrated by small numbers of providers that can be profiled or small numbers of patients used to create provider-level statistics. But without closely-matched patient populations across physicians being compared, physicians will question the validity of the profiling results, probably with good justification. An alternative approach to profiling is to use risk-adjustment to adjust for differences in patient comorbidities, severity, and casemix (diagnosis) across profiled physicians. But we can conclude that much more detailed risk adjustment methods than were employed in this study will be necessary for physicians to find profiling reports credible.

Absent more detailed casemix adjustment and widely-accepted clinical guidelines for ordering imaging tests, the profiles we created do not identify over- or under- referral of imaging tests. Nor can the profiles be used to identify efficient practices. One reason is that some of the physicians that are profiled are in solo practice while others are in group practices. In one multi-specialty group in Boston, most of the ECHO referrals are made by just a few of the cardiologists. Consequently, some of the cardiologists in this group have very high referral rates and others have very low rates. This division of labor (or subspecialization) among the group's cardiologists might lower the per-patient cost of care for this particular group practice. However, it makes interpretation of individual physician ordering rates difficult, especially when the prevalence of such situations in group practices is not known.

The share of echocardiogram self-referrals was also examined. As with the number of referrals per 100 patients, most providers did not refer imaging tests to themselves. There were a number of providers that referred over 90 percent of their imaging tests to themselves. However, it was not possible to ascertain whether there was too much self referral or not. Nor was it possible to ascertain whether high self-referral rates represented abuse.

The results presented in this report represent an exploratory analysis of one possible way to profile physicians for several common, expensive types of imaging tests. Substantial variation across physicians in ordering of these tests was documented. The numbers of physicians who could be profiled, and patients and tests attributed to them, were documented. But before credible profiles comparing physicians can be produced, considerably more attention needs to be paid to developing guidelines for appropriate rates of testing, and for adjusting for the legitimate factors that can cause variation in observed test ordering rates across physicians.

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APPENDIX A
PROFILES FOR ECHOCARDIOGRAM REFERRALS BY BOSTON PROVIDERS

Table A1

Echocardiogram referrals by 564 Boston cardiologists for their Medicare patients, 2002

Patients are beneficiaries who received a service from the cardiologist during 2002

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	637	105	18.6	5.8%	33.1%
100% MAX	3,354	1,667	269.6	66.7%	100.0%
99%	2,251	673	150.0	47.9%	100.0%
95%	1,561	421	67.6	22.2%	100.0%
90%	1,359	302	46.8	14.5%	97.2%
80%	1,097	183	28.2	8.5%	89.5%
70%	898	108	18.3	5.9%	67.8%
60%	733	72	12.6	4.1%	26.8%
50% MEDIAN	559	46	8.6	2.9%	0.0%
40%	379	24	5.3	1.9%	0.0%
30%	238	9	2.6	0.8%	0.0%
20%	95	0	0.0	0.0%	0.0%
10%	19	0	0.0	0.0%	0.0%
5%	4	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

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Table A2

Echocardiogram referrals by 537 Boston cardiologists for their Medicare patients, 2002

Patients are beneficiaries who received an evaluation and management service from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	265	88	30.8	9.5%	28.3%
100% MAX	1,009	969	412.5	97.3%	100.0%
99%	910	561	159.7	48.8%	100.0%
95%	686	384	92.7	28.4%	100.0%
90%	584	256	72.6	22.6%	95.7%
80%	475	152	50.8	15.6%	76.6%
70%	370	86	40.4	12.3%	50.0%
60%	298	52	29.6	9.6%	11.8%
50% MEDIAN	218	37	20.5	6.8%	0.0%
40%	143	19	12.6	4.3%	0.0%
30%	89	7	6.9	2.4%	0.0%
20%	47	2	0.6	0.3%	0.0%
10%	15	0	0.0	0.0%	0.0%
5%	4	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*E&M codes 99201 - 99499.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A3

Echocardiogram referrals by 503 Boston cardiologists for their Medicare patients, 2002

Patients are beneficiaries who received an office of other outpatient evaluation and management service from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	166	72	38.1	11.9%	29.6%
100% MAX	798	948	412.1	100.0%	100.0%
99%	621	552	225.0	73.4%	100.0%
95%	459	301	116.9	35.5%	100.0%
90%	381	207	87.8	26.2%	97.5%
80%	300	121	62.3	18.9%	81.0%
70%	237	70	49.8	15.3%	57.1%
60%	170	39	36.8	11.8%	13.3%
50% MEDIAN	131	24	25.0	8.3%	0.0%
40%	76	13	16.5	5.6%	0.0%
30%	43	6	8.2	2.6%	0.0%
20%	24	0	0.0	0.0%	0.0%
10%	9	0	0.0	0.0%	0.0%
5%	3	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*Office or other outpatient E&M codes 99201 - 99215.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A4

Echocardiogram referrals by 360 Boston cardiologists for their Medicare patients, 2002

Patients are beneficiaries who received a new patient visit from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	8	4	52.5	16.2%	22.6%
100% MAX	79	83	750.0	100.0%	100.0%
99%	52	42	300.0	100.0%	100.0%
95%	28	18	225.0	58.9%	100.0%
90%	20	12	150.0	50.0%	100.0%
80%	11	6	100.0	33.3%	85.7%
70%	8	4	66.7	21.4%	0.0%
60%	6	3	36.8	12.5%	0.0%
50% MEDIAN	4	0	0.0	0.0%	0.0%
40%	3	0	0.0	0.0%	0.0%
30%	2	0	0.0	0.0%	0.0%
20%	2	0	0.0	0.0%	0.0%
10%	1	0	0.0	0.0%	0.0%
5%	1	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*New office or other outpatient E&M codes 99201 - 99205.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A5

Echocardiogram referrals by 496 Boston cardiologists for their Medicare patients with CHF, 2002

Patients are beneficiaries who received a service for CHF from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	63	25	40.8	11.7%	32.4%
100% MAX	513	331	581.8	100.0%	100.0%
99%	304	198	252.6	66.7%	100.0%
95%	187	107	150.0	40.9%	100.0%
90%	158	66	108.7	30.4%	100.0%
80%	104	43	72.9	21.2%	90.0%
70%	76	25	47.7	14.3%	68.4%
60%	59	14	32.7	10.0%	29.0%
50% MEDIAN	44	9	18.7	5.9%	0.0%
40%	28	3	11.5	3.8%	0.0%
30%	19	3	2.5	0.8%	0.0%
20%	9	0	0.0	0.0%	0.0%
10%	3	0	0.0	0.0%	0.0%
5%	1	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A6
Echocardiogram referrals by 467 Boston cardiologists for their Medicare patients with CHF, 2002

Patients are beneficiaries who received an evaluation and management service for CHF** from the cardiologist during 2002.*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	35	18	53.5	15.2%	27.2%
100% MAX	196	174	580.0	100.0%	100.0%
99%	172	141	291.2	69.6%	100.0%
95%	109	76	181.8	48.0%	100.0%
90%	83	51	133.3	36.4%	100.0%
80%	57	30	100.0	29.5%	78.3%
70%	44	20	75.0	21.4%	41.5%
60%	33	12	51.0	15.4%	0.0%
50% MEDIAN	25	6	32.1	10.7%	0.0%
40%	18	3	15.0	5.0%	0.0%
30%	11	3	3.2	1.5%	0.0%
20%	6	0	0.0	0.0%	0.0%
10%	3	0	0.0	0.0%	0.0%
5%	2	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*E&M codes 99201–99499.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A7
Echocardiogram referrals by 396 Boston cardiologists for their Medicare patients with CHF, 2002

Patients are beneficiaries who received an office of other outpatient evaluation and management service for CHF** from the cardiologist during 2002.*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	15	13	78.3	22.3%	28.4%
100% MAX	127	153	600.0	100.0%	100.0%
99%	96	120	366.7	100.0%	100.0%
95%	46	58	285.7	66.7%	100.0%
90%	33	35	200.0	50.9%	100.0%
80%	24	20	136.4	40.0%	89.7%
70%	17	12	100.0	33.3%	44.0%
60%	14	6	75.0	25.0%	0.0%
50% MEDIAN	11	3	50.0	16.7%	0.0%
40%	7	3	25.0	8.3%	0.0%
30%	4	0	0.0	0.0%	0.0%
20%	3	0	0.0	0.0%	0.0%
10%	1	0	0.0	0.0%	0.0%
5%	1	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*Office or other outpatient E&M codes 99201–99215.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A8

Echocardiogram referrals by 59 Boston cardiologists for their Medicare patients with CHF, 2002

Patients are beneficiaries who received a new patient visit for CHF** from the cardiologist during 2002.*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	2	1	70.3	25.1%	13.6%
100% MAX	6	6	300.0	100.0%	100.0%
99%	6	6	300.0	100.0%	100.0%
95%	5	6	300.0	100.0%	100.0%
90%	3	3	300.0	100.0%	100.0%
80%	2	3	200.0	100.0%	0.0%
70%	2	0	0.0	0.0%	0.0%
60%	1	0	0.0	0.0%	0.0%
50% MEDIAN	1	0	0.0	0.0%	0.0%
40%	1	0	0.0	0.0%	0.0%
30%	1	0	0.0	0.0%	0.0%
20%	1	0	0.0	0.0%	0.0%
10%	1	0	0.0	0.0%	0.0%
5%	1	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% MIN	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*New office or other outpatient E&M codes 99201–99205.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A9
Echocardiogram referrals by 441 uniquely assigned Boston cardiologists for their Medicare patients, 2002

Patients are beneficiaries who received an evaluation and management service for CHF** from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	19	14	67.0	18.8%	25.3%
100% Max	161	141	577.8	100.0%	100.0%
99%	97	123	316.7	77.3%	100.0%
95%	56	61	214.3	55.0%	100.0%
90%	44	39	157.1	50.0%	100.0%
80%	31	24	124.7	34.8%	75.0%
70%	22	13	89.7	27.3%	33.3%
60%	18	8	69.2	20.0%	0.0%
50% Median	13	3	42.9	14.3%	0.0%
40%	8	3	18.8	5.6%	0.0%
30%	5	0	0.0	0.0%	0.0%
20%	3	0	0.0	0.0%	0.0%
10%	2	0	0.0	0.0%	0.0%
5%	1	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% Min	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*E&M codes 99201 - 99499.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat019 9/08/05

Table A10
Echocardiogram referrals by 384 uniquely assigned Boston cardiologists for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for CHF** from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	13	12	80.0	23.1%	25.4%
100% Max	122	150	575.0	100.0%	100.0%
99%	78	112	400.0	100.0%	100.0%
95%	39	51	300.0	80.0%	100.0%
90%	28	33	210.0	55.6%	100.0%
80%	20	19	150.0	45.0%	80.0%
70%	14	12	109.7	33.3%	28.6%
60%	11	6	80.0	25.0%	0.0%
50% Median	8	3	43.6	14.3%	0.0%
40%	6	3	15.0	6.3%	0.0%
30%	3	0	0.0	0.0%	0.0%
20%	2	0	0.0	0.0%	0.0%
10%	1	0	0.0	0.0%	0.0%
5%	1	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% Min	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*Office or other outpatient E&M codes 99201 - 99215.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat019 9/08/05

Table A11
Echocardiogram referrals by 56 uniquely assigned Boston cardiologists for their Medicare patients, 2002
Patients are beneficiaries who received a new patient visit for CHF** from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	2	1	74.1	26.5%	14.3%
100% Max	6	6	300.0	100.0%	100.0%
99%	6	6	300.0	100.0%	100.0%
95%	4	6	300.0	100.0%	100.0%
90%	3	3	300.0	100.0%	100.0%
80%	2	3	200.0	100.0%	0.0%
70%	2	1	100.0	33.3%	0.0%
60%	1	0	0.0	0.0%	0.0%
50% Median	1	0	0.0	0.0%	0.0%
40%	1	0	0.0	0.0%	0.0%
30%	1	0	0.0	0.0%	0.0%
20%	1	0	0.0	0.0%	0.0%
10%	1	0	0.0	0.0%	0.0%
5%	1	0	0.0	0.0%	0.0%
1%	1	0	0.0	0.0%	0.0%
0% Min	1	0	0.0	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*New office or other outpatient E&M codes 99201 - 99205.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat019 9/08/05

Table A12
Echocardiogram referrals by 3,480 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received a service from the MD or osteopath during 2002

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	264	33	15.8	4.8%	2.5%
100% MAX	2,285	1,286	437.5	100.0%	100.0%
99%	1,087	243	121.3	33.3%	100.0%
95%	674	123	42.9	13.0%	0.0%
90%	527	83	31.5	9.7%	0.0%
80%	397	51	22.1	7.0%	0.0%
70%	313	32	16.9	5.4%	0.0%
60%	256	21	13.0	4.2%	0.0%
50% MEDIAN	207	15	9.2	3.1%	0.0%
40%	170	9	6.4	2.1%	0.0%
30%	131	6	4.2	1.4%	0.0%
20%	95	3	2.6	0.9%	0.0%
10%	58	3	1.3	0.4%	0.0%
5%	38	3	0.8	0.3%	0.0%
1%	11	1	0.4	0.2%	0.0%
0% MIN	1	1	0.1	0.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A13
Echocardiogram referrals by 3,380 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an evaluation and management service from the MD or osteopath during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	230	32	16.5	5.0%	1.6%
100% MAX	1,273	592	566.7	100.0%	100.0%
99%	746	228	109.1	32.6%	82.6%
95%	556	119	45.4	13.8%	0.0%
90%	463	81	33.5	10.3%	0.0%
80%	353	50	24.0	7.4%	0.0%
70%	286	32	18.2	5.7%	0.0%
60%	235	21	14.1	4.5%	0.0%
50% MEDIAN	191	15	10.2	3.3%	0.0%
40%	155	9	7.1	2.3%	0.0%
30%	120	6	4.7	1.6%	0.0%
20%	89	3	2.9	1.0%	0.0%
10%	55	3	1.5	0.5%	0.0%
5%	34	3	0.9	0.3%	0.0%
1%	10	1	0.5	0.2%	0.0%
0% MIN	1	1	0.1	0.1%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*E&M codes 99201 - 99499.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A14

Echocardiogram referrals by 2,762 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an office of other outpatient evaluation and management service from the MD or osteopath during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	162	30	20.3	6.1%	1.8%
100% MAX	737	592	457.1	100.0%	100.0%
99%	534	210	137.8	33.3%	94.4%
95%	384	109	52.9	15.8%	0.0%
90%	321	75	40.5	12.2%	0.0%
80%	246	46	29.2	9.0%	0.0%
70%	200	30	22.3	7.0%	0.0%
60%	166	21	17.9	5.7%	0.0%
50% MEDIAN	137	15	13.6	4.4%	0.0%
40%	111	9	10.0	3.3%	0.0%
30%	88	6	7.0	2.3%	0.0%
20%	64	3	4.4	1.5%	0.0%
10%	40	3	2.5	0.9%	0.0%
5%	24	3	1.6	0.6%	0.0%
1%	7	1	0.8	0.3%	0.0%
0% MIN	1	1	0.3	0.1%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*Office or other outpatient E&M codes 99201 - 99215.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A15

Echocardiogram referrals by 789 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received a new patient visit from the MD or osteopath during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	22	7	58.2	17.9%	2.2%
100% MAX	369	576	1,200.0	100.0%	100.0%
99%	120	42	300.0	100.0%	100.0%
95%	73	18	200.0	55.6%	0.0%
90%	48	12	112.5	35.3%	0.0%
80%	28	9	75.0	25.0%	0.0%
70%	23	6	60.0	20.0%	0.0%
60%	18	6	42.9	14.3%	0.0%
50% MEDIAN	14	3	33.3	11.1%	0.0%
40%	11	3	27.3	9.1%	0.0%
30%	8	3	21.4	7.4%	0.0%
20%	6	3	15.8	5.7%	0.0%
10%	4	3	10.7	3.8%	0.0%
5%	3	2	5.7	2.3%	0.0%
1%	1	1	2.9	1.0%	0.0%
0% MIN	1	1	1.3	0.6%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*New office or other outpatient E&M codes 99201 - 99205.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A16

Echocardiogram referrals by 1499 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients with CHF, 2002

Patients are beneficiaries who received a service for CHF from the MD or osteopath during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	17	13	106.9	30.7%	2.4%
100% MAX	387	296	900.0	100.0%	100.0%
99%	105	77	450.0	100.0%	100.0%
95%	56	41	300.0	85.7%	0.0%
90%	36	28	210.0	57.1%	0.0%
80%	24	18	150.0	50.0%	0.0%
70%	18	14	128.6	35.7%	0.0%
60%	14	9	100.0	30.0%	0.0%
50% MEDIAN	11	7	81.1	25.0%	0.0%
40%	9	6	66.7	20.0%	0.0%
30%	6	3	51.9	16.7%	0.0%
20%	4	3	37.5	12.0%	0.0%
10%	2	3	25.0	8.0%	0.0%
5%	2	3	16.7	5.6%	0.0%
1%	1	1	6.8	2.3%	0.0%
0% MIN	1	1	1.9	0.9%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A17

Echocardiogram referrals by 1,451 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients with CHF, 2002

Patients are beneficiaries who received an evaluation and management service for CHF** from the MD or osteopath during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	15	12	112.0	31.8%	1.7%
100% MAX	123	205	1,400.0	100.0%	100.0%
99%	80	70	450.0	100.0%	90.0%
95%	43	39	300.0	100.0%	0.0%
90%	32	27	225.0	60.0%	0.0%
80%	22	18	155.6	50.0%	0.0%
70%	16	13	136.4	37.5%	0.0%
60%	13	9	100.0	33.3%	0.0%
50% MEDIAN	10	6	87.5	25.0%	0.0%
40%	8	6	70.0	21.4%	0.0%
30%	6	3	56.5	16.7%	0.0%
20%	4	3	42.9	12.5%	0.0%
10%	2	3	26.1	8.6%	0.0%
5%	2	3	18.8	6.7%	0.0%
1%	1	2	8.3	2.9%	0.0%
0% MIN	1	1	2.2	1.1%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*E&M codes 99201 - 99499.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A18

Echocardiogram referrals by 1068 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients with CHF, 2002

Patients are beneficiaries who received an office of other outpatient evaluation and management service for CHF** from the MD or osteopath during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	8	9	156.1	43.1%	2.4%
100% MAX	75	177	1,400.0	100.0%	100.0%
99%	41	57	600.0	100.0%	100.0%
95%	23	27	350.0	100.0%	0.0%
90%	17	21	300.0	100.0%	0.0%
80%	12	14	233.3	60.0%	0.0%
70%	9	10	171.4	50.0%	0.0%
60%	7	8	150.0	44.4%	0.0%
50% MEDIAN	6	6	126.7	36.4%	0.0%
40%	5	5	100.0	33.3%	0.0%
30%	3	3	85.7	25.0%	0.0%
20%	2	3	60.0	20.0%	0.0%
10%	2	3	46.2	14.3%	0.0%
5%	1	3	33.3	11.1%	0.0%
1%	1	1	17.7	6.7%	0.0%
0% MIN	1	1	5.0	1.7%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*Office or other outpatient E&M codes 99201 - 99215.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A19

Echocardiogram referrals by 35 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients with CHF, 2002

Patients are beneficiaries who received a new patient visit for CHF** from the cardiologist during 2002*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	2	4	288.6	79.0%	5.7%
100% MAX	6	9	900.0	100.0%	100.0%
99%	6	9	900.0	100.0%	100.0%
95%	3	6	600.0	100.0%	100.0%
90%	3	6	600.0	100.0%	0.0%
80%	2	3	300.0	100.0%	0.0%
70%	2	3	300.0	100.0%	0.0%
60%	1	3	300.0	100.0%	0.0%
50% MEDIAN	1	3	300.0	100.0%	0.0%
40%	1	3	250.0	100.0%	0.0%
30%	1	3	150.0	50.0%	0.0%
20%	1	3	150.0	50.0%	0.0%
10%	1	3	150.0	33.3%	0.0%
5%	1	3	100.0	33.3%	0.0%
1%	1	2	50.0	16.7%	0.0%
0% MIN	1	2	50.0	16.7%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*New office or other outpatient E&M codes 99201 - 99205.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat017 8/30/05

Table A20
Echocardiogram referrals by 1,223 uniquely assigned Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients, 2002
Patients are beneficiaries who received an evaluation and management service for CHF** from the MD or osteopath during 2002.*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	10	10	142.3	41.0%	1.8%
100% Max	102	187	1,400.0	100.0%	100.0%
99%	53	62	600.0	100.0%	92.9%
95%	31	31	300.0	100.0%	0.0%
90%	22	21	300.0	100.0%	0.0%
80%	14	15	210.0	57.7%	0.0%
70%	11	12	150.0	50.0%	0.0%
60%	8	9	148.9	40.0%	0.0%
50% Median	7	6	112.5	33.3%	0.0%
40%	5	6	100.0	28.6%	0.0%
30%	4	3	75.0	25.0%	0.0%
20%	3	3	56.3	17.9%	0.0%
10%	2	3	40.0	12.5%	0.0%
5%	1	3	27.3	9.1%	0.0%
1%	1	1	13.0	5.3%	0.0%
0% Min	1	1	5.6	2.0%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*E&M codes 99201–99499.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat019 9/08/05

Table A21
Echocardiogram referrals by 1,043 Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for CHF** from the MD or osteopath during 2002.*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	7	9	170.0	46.5%	2.2%
100% Max	74	168	1,400.0	100.0%	100.0%
99%	41	56	600.0	100.0%	100.0%
95%	22	27	385.7	100.0%	0.0%
90%	16	19	300.0	100.0%	0.0%
80%	10	14	300.0	66.7%	0.0%
70%	8	11	200.0	50.0%	0.0%
60%	6	9	150.0	50.0%	0.0%
50% Median	5	6	138.5	40.0%	0.0%
40%	4	5	109.1	33.3%	0.0%
30%	3	3	100.0	28.6%	0.0%
20%	2	3	75.0	25.0%	0.0%
10%	1	3	50.0	16.7%	0.0%
5%	1	3	37.5	12.5%	0.0%
1%	1	1	17.1	7.1%	0.0%
0% Min	1	1	5.2	1.7%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*Office or other outpatient E&M codes 99201–99215.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat019 9/08/05

Table A22

Echocardiogram referrals by 38 uniquely assigned Boston MDs (excluding cardiologists) and osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received a new patient visit for CHF** from the cardiologist during 2002.*

	Number of patients	Number of referred ECHOs	Referrals per 100 patients	Percent of patients with 1 or more referrals	Percent of ECHOs self-referred
Mean	2	4	292.1	79.0%	5.3%
100% Max	6	9	900.0	100.0%	100.0%
99%	6	9	900.0	100.0%	100.0%
95%	3	6	600.0	100.0%	100.0%
90%	3	6	600.0	100.0%	0.0%
80%	2	3	300.0	100.0%	0.0%
70%	2	3	300.0	100.0%	0.0%
60%	1	3	300.0	100.0%	0.0%
50% Median	1	3	300.0	100.0%	0.0%
40%	1	3	300.0	100.0%	0.0%
30%	1	3	150.0	50.0%	0.0%
20%	1	3	150.0	50.0%	0.0%
10%	1	3	100.0	33.3%	0.0%
5%	1	3	100.0	33.3%	0.0%
1%	1	2	50.0	16.7%	0.0%
0% Min	1	2	50.0	16.7%	0.0%

NOTE: ECHOs that had a technical component modifier only indicated were not counted.

*New office or other outpatient E&M codes 99201–99205.

**CHF Codes 402.x1, 404.x1, 404.x3, 428.xx, and 398.31.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: stat019 9/08/05

APPENDIX B
PROVIDER DECILES FOR ECHOCARDIOGRAM REFERRALS PER 100 BENEFICIARIES BY PATIENT POPULATION

Table B1

Cardiologist[1] deciles[2] for ECHO referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
c1	10	9	10	.	.	.	.	.	.	.	.
c2	10	.	.	.	.	.	.	.	.	.	.
c3	9	10	10	.	10	.	.	.	.	.	.
c4	9	9	10	7	7	6	8	.	5	8	.
c5	8	6	7	.	4	3	.	.	.	.	.
c6	8	10	10	.	.	.	.	.	.	.	.
c7	7	5	7	7	9	9	9	.	7	9	.
c8	7	.	.	.	.	.	.	.	.	.	.
c9	6	10	5	2	10	10	4	7	9	5	7
c10	6	5	7	10	5	4	4	.	6	3	.
c11	5	.	.	.	2	.	.	.	.	.	.
c12	5	5	.	.	.	.	.	.	.	.	.
c13	4	2	2	.	2	.	.	.	.	.	.
c14	4	3	3	.	3	3	.	.	1	.	.
c15	3	3	3	.	.	.	.	.	.	.	.
c16	3	2	.	.	.	.	.	.	.	.	.
c17	2	2	1	.	1	1	.	.	1	.	.
c18	2	4	3	1	4	3	2	.	3	2	.
c19	1	1	1	.	.	.	.	.	.	.	.
c20	1	1	1	10	1	1	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the least restrictive patient population (i.e., poprnk1).
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk1
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.

poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table B2

Cardiologist[1] deciles[2] for ECHO referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
c1	10	10	10	9	10	10	9	.	9	9	.
c2	10	10	10	.	9	8	6	.	.	.	.
c3	8	9	9	7	8	9	9	7	9	9	7
c4	4	9	9	.	3	9	8	.	9	7	.
c5	7	9	8	.	7	9	.	.	3	.	.
c6	7	7	8	7	7	6	10	.	6	10	.
c7	7	8	7	.	1	2	4	.	.	.	.
c8	4	4	7	.	.	.	.	.	.	.	.
c9	5	5	6	.	6	6	4	.	7	4	.
c10	5	5	6	1	5	5	7	.	3	6	.
c11	8	6	5	.	7	5	3	.	4	3	.
c12	5	5	5	2	5	7	6	2	6	6	2
c13	2	4	4	.	.	.	.	.	.	.	.
c14	2	2	4	2	.	.	.	.	.	.	.
c15	9	5	3	.	8	2	1	.	1	1	.
c16	3	3	3	.	3	2	1	.	2	1	.
c17	4	2	2	.	2	.	.	.	.	.	.
c18	2	2	2	.	1	1	1	.	1	1	.
c19	2	1	1	.	1	1	.	.	1	.	.
c20	2	2	1	.	2	2	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the poprnk3 population.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider
poprnk2. Benes who received any E&M service from the provider
poprnk3. Benes who received an office or other outpatient E&M service from the provider
poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.
poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis
poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis
poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis
poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis
poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table B3

Cardiologist[1] deciles[2] for ECHO referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
c1	10	10	9	.	9	9	10	.	5	.	.
c2	3	5	4	.	10	10	10	.	.	10	.
c3	5	8	10	6	5	7	9	.	.	10	.
c4	8	8	7	1	9	10	9	.	10	8	.
c5	6	6	8	8	1	1	8	.	3	10	.
c6	9	7	7	.	8	7	8	.	4	7	.
c7	5	9	10	8	7	7	7	.	7	8	.
c8	9	7	8	7	6	5	7	2	5	6	2
c9	7	6	5	3	7	7	6	.	6	3	.
c10	5	5	5	2	5	7	6	2	6	6	2
c11	5	7	7	3	4	5	5	.	6	5	.
c12	8	6	6	.	5	4	5	.	5	4	.
c13	6	4	4	.	6	5	4	.	4	3	.
c14	5	3	2	.	6	6	4	.	.	.	.
c15	6	5	5	2	4	5	3	.	4	3	.
c16	6	4	3	.	6	4	3	.	3	2	.
c17	4	5	4	.	3	2	2	.	2	2	.
c18	3	4	4	.	2	4	2	.	3	2	.
c19	3	3	3	.	3	2	1	.	2	1	.
c20	1	2	2	.	1	1	1	.	7	8	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the poprnk7 population.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.

poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table B4

Cardiologist[1] deciles[2] for ECHO referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
c1	8	8	10	.	8	7	10	.	6	10	.
c2	9	9	8	3	10	10	10	.	10	10	.
c3	8	9	9	3	9	10	10	7	10	9	7
c4	4	8	8	.	7	9	9	.	9	9	.
c5	9	9	9	8	9	9	8	.	9	8	.
c6	8	8	8	8	7	8	8	.	8	8	.
c7	10	9	8	4	10	8	7	.	7	7	.
c8	5	4	3	.	7	7	5	.	6	7	.
c9	2	4	4	3	4	6	6	.	7	6	.
c10	8	9	9	.	5	5	5	.	7	6	.
c11	8	7	9	5	7	4	6	.	4	5	.
c12	6	4	4	.	9	8	6	.	7	5	.
c13	7	8	8	5	5	6	4	.	5	4	.
c14	4	4	5	2	5	3	3	.	5	4	.
c15	3	4	5	.	4	3	3	.	3	3	.
c16	3	2	2	.	3	2	2	.	2	3	.
c17	3	3	3	.	3	3	2	.	2	2	.
c18	2	2	2	.	2	2	1	.	3	2	.
c19	4	4	4	2	1	1	1	.	2	1	.
c20	1	1	1	.	1	1	1	.	1	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the poprnk10 population.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.

poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table B5

Other MD[1] deciles[2] for ECHO referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
ot1	10	10	10	.	.	.	.	.	.	.	.
ot2	10	10	10	.	.	.	.	.	.	.	.
ot3	9	10	.	.	10	10	.	.	10	.	.
ot4	9	8	8	.	8	8	5	.	4	4	.
ot5	8	8	8	4	8	9	8	.	8	8	.
ot6	8	8	8	.	.	.	.	.	.	.	.
ot7	7	7	.	.	.	.	.	.	.	.	.
ot8	7	7	7	.	.	.	.	.	.	.	.
ot9	6	6	5	7	5	5	1	.	6	1	.
ot10	6	5	3	.	.	.	.	.	.	.	.
ot11	5	5	6	5	1	1	.	.	1	.	.
ot12	5	5	6	.	.	.	.	.	.	.	.
ot13	4	4	4	.	.	.	.	.	.	.	.
ot14	4	4	3	.	.	.	.	.	.	.	.
ot15	3	3	.	.	.	.	.	.	.	.	.
ot16	3	3	3	.	.	.	.	.	.	.	.
ot17	2	2	1	.	.	.	.	.	.	.	.
ot18	2	2	2	.	3	3	7	.	3	6	.
ot19	1	1	.	.	.	.	.	.	.	.	.
ot20	1	1	1	.	.	.	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the least restrictive patient population (i.e., poprnk1).
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk1.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.

poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table B6

Other MD[1] deciles[2] for ECHO referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
ot1	10	10	10	.	10	10	9	.	10	10	.
ot2	6	5	10	.	.	.	.	.	.	.	.
ot3	10	10	9	8	.	.	.	.	.	.	.
ot4	7	7	9	5	5	5	8	.	8	8	.
ot5	9	9	8	.	3	3	4	.	2	4	.
ot6	8	8	8	8	2	1	1	7	1	1	7
ot7	7	7	7	.	.	.	.	.	.	.	.
ot8	6	8	7	.	6	9	.	.	10	.	.
ot9	7	7	6	.	.	.	.	.	.	.	.
ot10	6	6	6	.	.	.	.	.	.	.	.
ot11	6	5	5	.	5	5	4	.	3	4	.
ot12	2	2	5	.	.	.	.	.	.	.	.
ot13	4	4	4	.	.	.	.	.	.	.	.
ot14	3	3	4	.	.	.	.	.	.	.	.
ot15	5	5	3	.	.	.	.	.	.	.	.
ot16	2	3	3	.	.	.	.	.	.	.	.
ot17	3	3	2	3	4	5	3	.	2	1	.
ot18	2	2	2	.	.	.	.	.	.	.	.
ot19	7	7	1	.	.	.	.	.	.	.	.
ot20	2	1	1	.	.	.	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the poprnk3 population.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.

poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table B7

Other MD[1] deciles[2] for ECHO referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
ot1	9	9	8	.	10	10	10	.	10	10	.
ot2	7	6	6	10	10	10	10	10	.	10	10
ot3	9	9	10	7	7	7	9	.	5	8	.
ot4	8	8	8	8	10	10	9	.	10	9	.
ot5	10	10	10	.	7	7	8	.	6	7	.
ot6	8	8	9	.	9	9	8	.	5	8	.
ot7	10	9	9	10	8	7	7	7	6	7	7
ot8	9	8	8	.	8	8	7	.	.	.	.
ot9	8	8	9	.	9	9	6	.	8	5	.
ot10	8	8	7	8	7	7	6	.	5	6	.
ot11	10	10	9	8	7	7	5	.	6	5	.
ot12	8	7	8	.	5	5	5	.	3	5	.
ot13	6	6	5	4	5	5	4	.	2	4	.
ot14	1	1	1	3	3	3	4	.	5	4	.
ot15	9	9	9	.	7	7	3	.	6	6	.
ot16	9	9	8	4	5	4	3	.	3	3	.
ot17	8	8	10	.	4	4	2	.	2	2	.
ot18	8	8	7	.	4	4	2	.	4	2	.
ot19	4	4	5	2	1	1	1	.	1	.	.
ot20	2	1	1	.	1	1	1	.	.	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the poprnk7 population.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.

poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table B8

Other MD[1] deciles[2] for ECHO referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
ot1	8	8	7	5	8	9	9	.	9	10	.
ot2	4	4	3	.	2	2	1	.	10	10	.
ot3	8	8	8	8	10	10	9	.	10	9	.
ot4	3	3	2	.	6	6	7	.	10	9	.
ot5	10	10	10	8	10	10	9	.	9	8	.
ot6	10	10	10	.	9	9	8	.	8	8	.
ot7	8	8	8	.	6	6	7	.	6	7	.
ot8	8	8	8	.	6	6	5	.	6	7	.
ot9	7	7	7	5	7	7	7	7	7	6	7
ot10	9	9	9	.	6	5	6	.	4	6	.
ot11	10	10	10	.	9	9	8	.	7	5	.
ot12	10	10	10	.	10	9	8	.	6	5	.
ot13	5	4	6	.	4	4	4	.	5	4	.
ot14	8	8	7	.	8	7	3	.	3	4	.
ot15	7	6	6	.	6	6	6	.	.	3	.
ot16	8	8	9	4	3	2	3	.	3	3	.
ot17	6	6	5	.	5	4	3	.	3	2	.
ot18	5	5	6	8	2	1	1	.	2	2	.
ot19	5	4	4	.	2	1	1	.	.	1	.
ot20	3	2	2	.	2	2	1	.	.	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on the poprnk10 population.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

CHF Diagnosis

poprnk5. Benes who received any Pt B service from the provider and have a CHF diagnosis.

poprnk6. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have a CHF diagnosis

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have a CHF diagnosis

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have a CHF diagnosis

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

APPENDIX C
PROFILES FOR HEAD OR BRAIN AND SPINAL MRI, MRA, CT AND CTA BY BOSTON PROVIDERS

Table C1

Head or brain MRI/MRA and CT/CTA referrals by 378 neurologists for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service from a neurologist during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	70	9	13	14.9	10.2%
100% MAX	417	100	196	125.8	100.0
99%	289	70	109	79.0	58.1
95%	226	40	54	50.0	29.8
90%	170	27	42	37.5	25.0
80%	120	16	23	26.0	17.2
70%	82	9	12	18.8	13.6
60%	64	5	7	13.6	10.2
50% MEDIAN	48	3	4	10.0	7.7
40%	33	1	2	6.5	4.7
30%	23	1	1	1.4	1.4
20%	11	0	0	0.0	0.0
10%	4	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C2

Head or brain MRI/MRA and CT/CTA referrals by 300 neurologists for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service forone of the tracer diagnoses from a neurologist during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	20	4	7	29.9	18.4%
100% MAX	129	54	86	300.0	100.0
99%	108	38	66	200.0	100.0
95%	70	20	32	100.0	55.7
90%	52	13	19	79.3	45.6
80%	34	7	11	56.6	33.3
70%	24	4	6	36.2	24.2
60%	17	2	4	25.0	18.2
50% MEDIAN	12	1	2	17.9	12.4
40%	8	1	1	10.7	7.3
30%	5	0	0	0.0	0.0
20%	3	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C3
Head or brain MRI/MRA and CT/CTA referrals by 288 uniquely assigned neurologists for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from a neurologist during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	18	4	6	31.1	19.0%
100% MAX	123	51	81	300.0	100.0
99%	96	35	64	200.0	100.0
95%	62	18	27	100.0	60.0
90%	43	11	17	80.8	50.0
80%	30	6	9	56.7	33.3
70%	21	4	5	37.5	25.0
60%	15	2	4	25.0	19.1
50% MEDIAN	11	1	2	17.6	12.5
40%	7	1	1	10.0	8.3
30%	4	0	0	0.0	0.0
20%	3	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C4

Head or brain MRI/MRA and CT/CTA referrals by 92 neurosurgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service from a neurosurgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	49	7	12	26.9	15.7%
100% MAX	171	72	125	400.0	100.0
99%	171	72	125	400.0	100.0
95%	148	23	47	85.0	57.1
90%	120	19	34	57.1	44.4
80%	88	11	20	41.8	25.2
70%	69	7	11	28.6	16.7
60%	51	5	8	22.5	12.7
50% MEDIAN	40	3	4	16.3	10.0
40%	23	2	3	9.5	6.0
30%	16	1	1	4.9	4.2
20%	9	0	0	0.0	0.0
10%	3	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C5

Head or brain MRI/MRA and CT/CTA referrals by 59 neurosurgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from a neurosurgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	5	2	4	62.4	36.9%
100% MAX	45	16	36	214.3	100.0
99%	45	16	36	214.3	100.0
95%	22	9	17	180.0	100.0
90%	11	6	13	150.0	100.0
80%	7	4	5	100.0	66.7
70%	4	2	3	100.0	50.0
60%	3	1	2	80.0	40.9
50% MEDIAN	3	1	1	50.0	33.3
40%	2	1	1	28.6	20.0
30%	1	0	0	0.0	0.0
20%	1	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C6
Head or brain MRI/MRA and CT/CTA referrals by 51 uniquely assigned neurosurgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from a neurosurgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	4	2	3	62.1	35.9%
100% MAX	38	14	33	400.0	100.0
99%	38	14	33	400.0	100.0
95%	16	6	12	225.0	100.0
90%	8	4	8	150.0	100.0
80%	5	2	4	100.0	75.0
70%	4	2	3	100.0	50.0
60%	3	1	2	75.0	50.0
50% MEDIAN	2	1	1	50.0	31.3
40%	2	0	0	0.0	0.0
30%	1	0	0	0.0	0.0
20%	1	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C7
Head or brain MRI/MRA and CT/CTA referrals by 3,239 internists, family practitioners and general practitioners for their Medicare patients, 2002
Patients are beneficiaries who received an office or other outpatient evaluation and management service from an internist, family practitioner or general practitioner during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	127	4	5	2.8	2.1%
100% MAX	800	50	78	50.0	50.0
99%	515	27	40	16.5	11.4
95%	354	15	22	10.4	7.3
90%	290	11	14	8.1	5.7
80%	215	6	8	5.4	4.0
70%	168	4	5	3.5	2.7
60%	128	2	3	2.2	1.8
50% MEDIAN	96	1	1	1.2	1.0
40%	68	0	0	0.0	0.0
30%	45	0	0	0.0	0.0
20%	23	0	0	0.0	0.0
10%	6	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C8
Head or brain MRI/MRA and CT/CTA referrals by 2,340 internists, family practitioners and general practitioners for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an internist, family practitioner or general practitioner during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	8	1	2	20.1	13.5%
100% MAX	99	20	36	400.0	100.0
99%	41	10	16	150.0	100.0
95%	24	5	8	80.0	50.0
90%	18	4	6	57.1	36.4
80%	13	2	3	36.4	25.0
70%	10	1	2	25.0	18.8
60%	8	1	1	15.0	12.4
50% MEDIAN	6	0	0	0.0	0.0
40%	4	0	0	0.0	0.0
30%	3	0	0	0.0	0.0
20%	2	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C9

Head or brain MRI/MRA and CT/CTA referrals by 2,261 uniquely assigned internists, family practitioners and general practitioners for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an internist, family practitioner or general practitioner during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	8	1	2	20.7	13.9%
100% MAX	97	17	34	400.0	100.0
99%	38	9	15	166.7	100.0
95%	22	5	8	85.7	50.0
90%	17	4	5	57.9	38.9
80%	12	2	3	38.5	26.7
70%	9	1	2	25.0	20.0
60%	7	1	1	14.3	12.5
50% MEDIAN	5	0	0	0.0	0.0
40%	4	0	0	0.0	0.0
30%	3	0	0	0.0	0.0
20%	2	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C10
Head or brain MRI/MRA and CT/CTA referrals by 1,036 other MDs or osteopaths for their Medicare patients, 2002
Patients are beneficiaries who received an office or other outpatient evaluation and management service from an other MD or osteopath during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	179	4	6	5.7	4.0%
100% MAX	761	60	68	300.0	100.0
99%	578	25	33	50.0	33.3
95%	440	15	20	16.7	11.9
90%	368	11	15	11.1	8.2
80%	286	6	8	6.5	4.9
70%	229	4	5	4.7	3.6
60%	185	3	4	3.5	2.7
50% MEDIAN	150	2	3	2.5	2.0
40%	118	1	2	1.8	1.5
30%	90	1	1	1.2	1.0
20%	60	1	1	0.8	0.7
10%	35	1	1	0.5	0.5
5%	19	1	1	0.4	0.3
1%	4	1	1	0.2	0.2
0% MIN	1	1	1	0.2	0.2

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C11
Head or brain MRI/MRA and CT/CTA referrals by 266 other MDs or osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an other MD or osteopath during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	16	3	4	45.5	30.6%
100% MAX	144	45	52	300.0	100.0
99%	108	14	24	200.0	100.0
95%	54	9	13	150.0	100.0
90%	41	6	10	100.0	66.7
80%	21	3	5	66.7	50.0
70%	16	3	4	50.0	33.3
60%	12	2	3	37.5	27.8
50% MEDIAN	9	2	2	28.6	23.3
40%	8	1	2	23.5	18.2
30%	5	1	1	18.8	12.8
20%	4	1	1	12.5	10.0
10%	2	1	1	7.3	6.3
5%	1	1	1	5.6	4.8
1%	1	1	1	2.4	2.4
0% MIN	1	1	1	1.7	1.7

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C12
Head or brain MRI/MRA and CT/CTA referrals by 239 uniquely assigned other MDs or osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an other MD or osteopath during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	14	3	4	47.5	32.2%
100% MAX	124	25	29	300.0	100.0
99%	84	13	20	225.0	100.0
95%	50	8	13	162.5	100.0
90%	34	5	9	100.0	75.0
80%	19	4	5	66.7	50.0
70%	13	2	3	50.0	33.3
60%	11	2	3	38.9	33.3
50% MEDIAN	9	1	2	33.3	25.0
40%	6	1	2	25.0	20.0
30%	4	1	1	20.0	14.3
20%	3	1	1	13.3	11.1
10%	2	1	1	7.7	7.1
5%	1	1	1	5.9	4.8
1%	1	1	1	3.2	2.6
0% MIN	1	1	1	2.0	2.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C13

Spinal MRI/MRA and CT referrals by 92 neurosurgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service from a neurosurgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	49	13	18	34.3	20.8%
100% MAX	171	56	80	700.0	100.0
99%	171	56	80	700.0	100.0
95%	148	49	70	86.8	48.7
90%	120	37	62	58.7	44.1
80%	88	22	36	46.3	34.2
70%	69	17	21	39.0	30.2
60%	51	11	13	30.4	23.6
50% MEDIAN	40	6	7	25.0	19.7
40%	23	2	3	17.4	15.4
30%	16	1	2	10.0	8.0
20%	9	0	0	0.0	0.0
10%	3	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C14

Spinal MRI/MRA and CT referrals by 80 neurosurgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from a neurosurgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	35	13	17	40.1	30.9%
100% MAX	125	53	74	112.5	100.0
99%	125	53	74	112.5	100.0
95%	103	46	61	96.3	70.9
90%	93	37	55	83.7	51.8
80%	61	24	34	62.1	46.4
70%	48	15	19	53.3	40.9
60%	35	12	15	45.4	34.2
50% MEDIAN	29	7	9	36.2	29.2
40%	15	4	5	33.0	26.5
30%	11	2	3	24.6	20.3
20%	8	1	1	14.6	13.4
10%	3	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C15
Spinal MRI/MRA and CT referrals by 75 uniquely assigned neurosurgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from a neurosurgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	24	9	12	43.2	34.0%
100% MAX	86	41	59	104.3	100.0
99%	86	41	59	104.3	100.0
95%	73	30	46	100.0	74.1
90%	66	28	35	100.0	63.0
80%	43	19	27	66.7	50.0
70%	30	11	17	57.1	44.4
60%	22	8	9	50.3	40.0
50% MEDIAN	18	4	5	41.7	33.3
40%	11	3	4	34.5	27.9
30%	6	1	1	27.3	25.0
20%	5	1	1	13.4	13.4
10%	3	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C16

Spinal MRI/MRA and CT referrals by 448 orthopedic surgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service from an orthopedic surgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	131	5	6	4.6	3.9%
100% MAX	640	82	150	67.6	50.0
99%	436	51	61	43.0	33.3
95%	334	23	26	21.5	19.4
90%	273	15	17	10.3	9.0
80%	201	8	9	6.0	5.8
70%	172	5	5	3.9	3.9
60%	143	3	3	2.6	2.6
50% MEDIAN	118	2	2	1.6	1.6
40%	94	1	1	0.9	0.9
30%	62	0	0	0.0	0.0
20%	33	0	0	0.0	0.0
10%	8	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C17

Spinal MRI/MRA and CT referrals by 373 orthopedic surgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an orthopedic surgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	21	5	6	23.2	21.2%
100% MAX	182	49	98	100.0	100.0
99%	151	45	54	100.0	100.0
95%	73	21	24	81.8	71.4
90%	56	13	16	54.3	50.0
80%	35	8	8	40.0	37.5
70%	22	4	4	33.3	28.6
60%	16	3	3	23.3	22.2
50% MEDIAN	11	2	2	16.7	15.8
40%	7	1	1	11.1	10.5
30%	4	0	0	0.0	0.0
20%	3	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C18
Spinal MRI/MRA and CT referrals by 353 uniquely assigned orthopedic surgeons for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an orthopedic surgeon during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	17	4	4	22.7	21.0%
100% MAX	136	39	52	100.0	100.0
99%	114	33	43	100.0	100.0
95%	57	16	19	80.0	71.4
90%	44	11	13	60.0	50.0
80%	28	6	7	41.2	37.5
70%	17	3	4	29.4	27.3
60%	13	2	2	21.7	20.0
50% MEDIAN	9	1	1	16.7	15.4
40%	6	1	1	9.1	9.1
30%	4	0	0	0.0	0.0
20%	2	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C19
Spinal MRI/MRA and CT referrals by 3,239 internists, family practitioners and general practitioners for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service from an internist, family practitioner or general practitioner during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	127	2	2	1.3	1.1%
100% MAX	800	55	70	33.3	33.3
99%	515	14	17	10.3	7.7
95%	354	7	9	5.2	4.3
90%	290	5	6	3.7	3.1
80%	215	3	4	2.4	2.0
70%	168	2	2	1.5	1.4
60%	128	1	1	0.9	0.8
50% MEDIAN	96	0	0	0.0	0.0
40%	68	0	0	0.0	0.0
30%	45	0	0	0.0	0.0
20%	23	0	0	0.0	0.0
10%	6	0	0	0.0	0.0
5%	2	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C20
Spinal MRI/MRA and CT referrals by 2,380 internists, family practitioners and general practitioners for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an internist, family practitioner or general practitioner during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	10	1	1	12.1	10.3%
100% MAX	172	18	22	300.0	100.0
99%	49	9	10	100.0	100.0
95%	29	5	5	50.0	38.9
90%	22	3	4	33.3	28.6
80%	16	2	2	21.4	19.8
70%	12	1	1	14.3	14.3
60%	9	1	1	9.1	8.3
50% MEDIAN	7	0	0	0.0	0.0
40%	5	0	0	0.0	0.0
30%	4	0	0	0.0	0.0
20%	3	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C21
Spinal MRI/MRA and CT referrals by 2,280 uniquely assigned internists, family practitioners and general practitioners for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an internist, family practitioner or general practitioner during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	9	1	1	11.2	9.6%
100% MAX	151	15	20	300.0	100.0
99%	44	7	8	100.0	100.0
95%	25	4	5	50.0	36.4
90%	19	3	3	33.3	28.6
80%	14	2	2	20.0	19.1
70%	10	1	1	14.3	12.5
60%	8	1	1	7.1	6.7
50% MEDIAN	6	0	0	0.0	0.0
40%	5	0	0	0.0	0.0
30%	3	0	0	0.0	0.0
20%	2	0	0	0.0	0.0
10%	1	0	0	0.0	0.0
5%	1	0	0	0.0	0.0
1%	1	0	0	0.0	0.0
0% MIN	1	0	0	0.0	0.0

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C22

Spinal MRI/MRA and CT referrals by 820 other MDs or osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service from an other MD or osteopath during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	159	5	6	6.3	4.6%
100% MAX	761	71	117	110.0	100.0
99%	553	33	39	50.0	30.1
95%	419	15	21	24.2	16.7
90%	346	11	15	14.3	10.0
80%	252	7	9	8.6	6.4
70%	198	5	6	6.1	4.6
60%	152	3	4	4.2	3.3
50% MEDIAN	123	2	3	3.1	2.5
40%	95	2	2	2.2	1.9
30%	70	1	2	1.6	1.3
20%	50	1	1	1.0	0.8
10%	31	1	1	0.6	0.6
5%	20	1	1	0.5	0.4
1%	7	1	1	0.2	0.2
0% MIN	1	1	1	0.2	0.2

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C23

Spinal MRI/MRA and CT referrals by 412 other MDs or osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an other MD or osteopath during 2002

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	22	4	5	37.6	30.5%
100% MAX	242	59	99	300.0	100.0
99%	140	30	37	200.0	100.0
95%	81	13	15	100.0	100.0
90%	55	8	10	75.0	60.0
80%	31	5	6	50.0	50.0
70%	22	4	5	43.2	34.5
60%	16	3	3	33.3	30.8
50% MEDIAN	12	2	3	26.7	25.0
40%	8	2	2	20.0	20.0
30%	6	1	1	16.7	14.3
20%	4	1	1	11.8	10.2
10%	2	1	1	6.7	6.1
5%	2	1	1	4.0	4.0
1%	1	1	1	1.9	1.9
0% MIN	1	1	1	0.8	0.8

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

Table C24
Spinal MRI/MRA and CT referrals by 374 uniquely assigned other MDs or osteopaths for their Medicare patients, 2002

Patients are beneficiaries who received an office or other outpatient evaluation and management service for one of the tracer diagnoses from an other MD or osteopath during 2002
Patients are uniquely assigned to a single provider

	Number of patients	Number of patients referred	Number of referred tests	Test referrals per 100 patients	Percent of patients with 1 or more referrals
Mean	16	3	4	39.4	32.2%
100% MAX	185	43	72	300.0	100.0
99%	88	26	31	200.0	100.0
95%	59	10	13	100.0	100.0
90%	41	7	8	86.8	60.0
80%	23	5	6	55.6	50.0
70%	17	3	4	50.0	40.0
60%	12	2	3	35.6	33.3
50% MEDIAN	10	2	2	28.2	25.0
40%	7	1	2	23.6	20.0
30%	5	1	1	18.8	16.7
20%	4	1	1	13.0	11.1
10%	2	1	1	9.1	8.3
5%	2	1	1	5.3	5.0
1%	1	1	1	2.1	2.1
0% MIN	1	1	1	1.1	1.1

NOTE: MRI/MRA/CT/CTA's that had a technical component modifier only indicated were not counted.

SOURCE: RTI analysis of 2002 Medicare claims for Boston MSA residents.

RUN: mrict09 12/08/05

APPENDIX D

PROVIDER DECILES FOR HEAD OR BRAIN AND SPINAL MRI, MRA, LT AND CTA REFERRALS PER 100 BENEFICIARIES BY PATIENT POPULATION

Table D1

Neurologist[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
n1	10	10	10	.	9	10	10	.	9	9	.
n2	8	9	10	8	9	10	9	.	10	.	.
n3	10	9	9	.	9	9	7	.	9	7	.
n4	8	9	9	.	8	8	9	.	8	9	.
n5	10	10	8	4	10	10	6	4	9	7	5
n6	10	9	8	4	9	9	8	3	9	8	3
n7	7	7	7	.	5	4	4	.	.	.	.
n8	5	6	7	.	4	4	5	.	4	2	.
n9	7	6	6	.	9	8	9	.	4	9	.
n10	4	4	6	.	3	3	3	.	3	2	.
n11	6	6	5	2	5	5	4	1	2	3	1
n12	5	5	5	.	6	6	10	.	8	10	.
n13	5	5	4	.	.	.	.	.	.	.	.
n14	2	2	4	.	3	2	4	.	2	3	.
n15	3	2	3	.	2	2	3	.	2	2	.
n16	2	2	3	8	4	4	10	9	9	10	9
n17	3	3	2	.	.	.	.	.	.	.	.
n18	2	2	2	.	.	.	.	.	.	.	.
n19	8	6	1	.	6	6	.	.	.	.	.
n20	1	1	1	.	.	.	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D2

Neurologist[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
n1	10	9	9	.	10	10	10	.	10	10	.
n2	5	5	5	.	4	4	10	.	6	10	.
n3	9	10	10	.	10	10	9	.	10	9	.
n4	8	8	9	.	8	8	9	.	8	7	.
n5	10	9	8	4	9	9	8	3	9	8	3
n6	5	5	6	.	7	7	8	.	7	8	.
n7	5	6	6	9	6	7	7	7	7	6	7
n8	9	9	5	.	6	6	7	.	8	8	.
n9	8	8	9	.	7	7	6	.	7	6	.
n10	8	6	8	.	3	2	6	.	4	7	.
n11	3	3	4	.	5	5	5	.	5	5	.
n12	3	3	4	.	3	3	5	.	3	5	.
n13	7	7	7	.	5	5	4	.	4	4	.
n14	6	6	5	2	5	5	4	1	2	3	1
n15	6	6	7	9	5	4	3	7	5	4	7
n16	3	2	3	.	2	2	3	.	2	2	.
n17	6	5	4	3	5	4	2	.	3	1	.
n18	2	1	3	.	1	1	2	.	.	.	.
n19	4	3	2	.	2	1	1	.	1	1	.
n20	4	3	1	.	3	3	1	.	2	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D3

Neurologist[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
n1	5	5	5	.	4	4	10	.	6	10	.
n2	2	2	3	8	4	4	10	9	9	10	9
n3	7	6	6	.	9	8	9	.	4	9	.
n4	6	6	4	1	9	9	8	2	10	9	2
n5	6	9	8	.	8	9	8	.	9	8	.
n6	6	6	8	.	7	7	8	.	8	8	.
n7	8	8	9	.	8	8	9	.	8	7	.
n8	6	9	8	6	7	8	7	4	6	7	4
n9	10	10	10	.	6	6	6	.	6	6	.
n10	3	3	6	.	2	2	6	.	4	6	.
n11	8	8	7	6	9	8	6	.	8	5	.
n12	6	6	4	.	7	6	5	.	5	5	.
n13	8	8	8	10	7	6	4	7	6	4	7
n14	4	4	3	.	2	2	4	.	2	4	.
n15	4	3	4	.	2	2	3	.	2	3	.
n16	4	4	4	.	4	4	3	.	4	3	.
n17	5	5	3	.	3	3	1	.	2	2	.
n18	1	1	2	.	1	1	1	.	1	2	.
n19	4	3	2	.	2	1	1	.	1	1	.
n20	3	4	2	3	1	2	1	1	1	1	1

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D4

Neurosurgeon[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ns1	10	10	10	9	10	10	9	.	10	8	.
ns2	8	8	10	.	.	.	.	.	.	.	.
ns3	8	10	9	.	3	5	3	.	.	.	.
ns4	8	9	9	.	4	5	.	.	.	.	.
ns5	6	6	8	.	5	5	.	.	.	.	.
ns6	5	6	8	.	1	1	.	.	.	.	.
ns7	8	9	7	.	3	4	2	.	3	1	.
ns8	6	7	7	.	.	.	.	.	.	.	.
ns9	7	5	6	.	9	9	8	.	.	10	.
ns10	5	5	6	.	.	.	.	.	.	.	.
ns11	7	7	5	.	4	5	5	.	4	1	.
ns12	3	4	5	.	.	.	.	.	.	.	.
ns13	4	3	4	.	7	4	.	.	.	.	.
ns14	3	3	4	.	7	8	6	.	8	7	.
ns15	7	7	3	.	9	10	10	.	10	10	.
ns16	5	5	3	6	5	.	.	.	.	.	.
ns17	5	5	2	.	10	10	10	.	.	.	.
ns18	4	1	2	.	.	.	.	.	.	.	.
ns19	2	2	1	4	.	.	.	.	.	.	.
ns20	1	2	1	1	.	.	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D5

Neurosurgeon[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ns1	9	9	8	3	8	9	10	.	8	10	.
ns2	5	5	2	.	10	10	10	.	.	.	.
ns3	10	10	10	10	9	7	9	6	7	7	6
ns4	8	8	8	9	8	9	9	.	8	9	.
ns5	9	10	10	8	8	7	8	.	5	4	.
ns6	2	2	2	.	4	4	8	.	5	9	.
ns7	3	3	4	.	7	8	6	.	8	7	.
ns8	5	2	2	6	7	4	6	.	8	7	.
ns9	8	9	7	7	7	8	5	.	10	3	.
ns10	7	7	5	.	4	5	5	.	4	1	.
ns11	7	7	7	.	3	3	4	.	4	4	.
ns12	5	6	6	.	5	6	4	.	3	4	.
ns13	6	7	7	.	6	7	3	.	4	5	.
ns14	5	5	3	.	6	5	3	.	6	3	.
ns15	9	10	9	7	2	2	2	.	.	.	.
ns16	6	7	8	.	2	3	2	.	1	.	.
ns17	6	6	6	3	3	3	1	2	3	2	2
ns18	1	1	1	.	1	1	1	.	.	3	.
ns19	.	.	.	.	.	.	.	.	.	.	.
ns20	.	.	.	.	.	.	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D6

Neurosurgeon[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ns1	7	7	3	.	9	10	10	.	10	10	.
ns2	7	5	6	.	9	9	8	.	.	10	.
ns3	8	8	8	9	8	9	9	.	8	9	.
ns4	2	2	2	.	4	4	8	.	5	9	.
ns5	10	10	10	9	10	10	9	.	10	8	.
ns6	9	9	9	.	9	10	9	.	10	8	.
ns7	10	10	10	10	9	7	9	6	7	7	6
ns8	3	3	4	10	7	8	6	6	8	7	6
ns9	9	9	9	.	6	7	4	.	7	5	.
ns10	6	7	7	.	6	7	3	.	4	5	.
ns11	9	10	10	8	8	7	8	.	5	4	.
ns12	7	7	7	.	3	3	4	.	4	4	.
ns13	7	8	7	.	7	8	6	.	4	3	.
ns14	5	5	3	.	6	5	3	.	6	3	.
ns15	6	6	6	3	3	3	1	2	3	2	2
ns16	8	9	7	.	3	4	2	.	3	1	.
ns17	10	10	10	6	1	1	1	.	1	1	.
ns18	.	.	.	.	.	.	.	.	.	.	.
ns19	.	.	.	.	.	.	.	.	.	.	.
ns20	.	.	.	.	.	.	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D7
Internal medicine, family practioners and general practitioner[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ifg1	10	10	10	6	10	10	10	9	10	10	9
ifg2	10	10	10	10	8	8	9	.	7	9	.
ifg3	10	10	9	.	10	10	10	.	10	10	.
ifg4	9	9	9	.	7	6	7	.	8	7	.
ifg5	8	8	8	.	2	2	2	.	1	1	.
ifg6	8	8	8	.	8	8	8	.	5	7	.
ifg7	9	9	7	5	10	10	10	10	.	10	10
ifg8	7	7	7	6	4	4	4	.	4	6	.
ifg9	6	6	6	.	6	6	6	.	5	9	.
ifg10	5	6	6	.	10	10	10	.	10	10	.
ifg11	7	7	5	.	4	3	.	.	4	.	.
ifg12	5	6	5	.	4	4	4	.	2	2	.
ifg13	7	7	4	4	7	7	6	.	9	6	.
ifg14	2	4	4	2	5	.	.	.	.	.	.
ifg15	4	3	3	3	4	3	3	.	4	3	.
ifg16	2	3	3	.	.	.	.	.	.	.	.
ifg17	4	3	2	.	2	2	1	.	2	2	.
ifg18	3	3	2	.	.	.	.	.	.	.	.
ifg19	2	1	1	.	.	.	.	.	.	.	.
ifg20	1	1	1	.	2	2	1	.	2	1	.

NOTES:
1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider
poprnk2. Benes who received any E&M service from the provider
poprnk3. Benes who received an office or other outpatient E&M service from the provider
poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.
poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.
poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.
poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.
poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.
poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D8

Internal medicine, family practioners and general practitioner[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ifg1	10	10	10	9	10	9	10	.	10	10	.
ifg2	7	7	9	.	10	10	10	.	10	10	.
ifg3	10	10	10	10	9	9	9	.	5	9	.
ifg4	7	10	9	8	10	10	9	9	10	9	9
ifg5	7	8	8	7	7	8	8	.	9	9	.
ifg6	2	2	2	.	7	7	8	.	8	.	.
ifg7	10	10	10	10	8	8	7	.	9	8	.
ifg8	9	9	9	.	7	7	7	.	.	.	.
ifg9	6	6	7	.	5	5	6	.	3	6	.
ifg10	5	6	2	.	8	8	6	.	6	7	.
ifg11	7	7	7	6	6	5	5	2	6	5	2
ifg12	2	2	3	.	2	2	5	.	2	5	.
ifg13	2	4	2	.	1	5	4	.	.	4	.
ifg14	7	1	1	.	3	3	4	.	.	.	.
ifg15	5	5	7	9	3	2	3	.	5	4	.
ifg16	5	5	5	.	2	3	3	.	3	3	.
ifg17	6	7	7	.	5	4	2	.	3	2	.
ifg18	3	3	2	.	3	3	2	.	4	2	.
ifg19	6	5	5	.	3	2	1	.	3	1	.
ifg20	3	3	3	.	1	1	1	.	1	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D9

Internal medicine, family practioners and general practitioner[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ifg1	8	9	8	.	10	10	10	.	.	10	.
ifg2	3	7	8	.	9	10	10	.	6	10	.
ifg3	10	10	10	.	10	10	9	.	10	9	.
ifg4	5	5	6	.	7	8	9	.	8	9	.
ifg5	8	8	6	.	7	8	7	.	5	8	.
ifg6	6	6	4	.	7	7	7	.	9	8	.
ifg7	6	6	7	5	5	5	7	9	5	7	9
ifg8	4	5	4	.	7	6	6	.	7	7	.
ifg9	6	6	6	.	4	4	6	.	5	6	.
ifg10	4	4	4	.	6	7	6	.	7	6	.
ifg11	6	6	5	.	6	6	5	.	4	5	.
ifg12	5	4	4	.	4	4	4	.	6	5	.
ifg13	8	7	7	.	6	7	4	.	8	4	.
ifg14	3	3	3	.	5	5	4	.	5	4	.
ifg15	9	10	10	.	9	10	3	.	10	3	.
ifg16	2	1	1	.	2	2	3	.	3	3	.
ifg17	6	6	6	.	7	7	6	.	8	2	.
ifg18	6	2	1	.	2	2	2	.	2	2	.
ifg19	8	8	8	.	6	6	1	.	5	1	.
ifg20	1	1	1	.	1	1	1	.	.	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D10

Other MDs and osteopath[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
oth1	10	10	10	.	6	5	6	.	.	6	.
oth2	9	9	10	.	6	7	7	.	8	7	.
oth3	9	9	9	5	.	.	.	.	.	.	.
oth4	8	8	9	7	4	3	3	.	3	3	.
oth5	7	7	8	10	.	.	.	.	.	.	.
oth6	6	7	8	.	.	.	.	.	.	.	.
oth7	6	6	7	5	4	4	6	.	2	7	.
oth8	4	6	7	.	1	.	.	.	.	.	.
oth9	6	6	6	.	.	.	.	.	.	.	.
oth10	3	6	6	.	3	2	2	.	1	2	.
oth11	5	5	5	.	.	.	.	.	.	.	.
oth12	3	5	5	.	.	.	.	.	.	.	.
oth13	5	4	4	.	.	.	.	.	.	.	.
oth14	3	3	4	.	.	.	.	.	.	.	.
oth15	4	3	3	.	.	.	.	.	.	.	.
oth16	2	2	3	.	.	.	.	.	.	.	.
oth17	2	1	2	.	.	.	.	.	.	.	.
oth18	1	3	2	.	.	.	.	.	.	.	.
oth19	4	1	1	.	.	.	.	.	.	.	.
oth20	1	1	1	.	.	.	.	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D11

Other MDs and osteopath[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
oth1	8	10	10	.	10	10	10	.	10	10	.
oth2	5	4	8	.	10	10	10	.	10	10	.
oth3	6	6	9	3	9	8	9	.	.	8	.
oth4	6	6	7	.	10	10	9	.	10	9	.
oth5	6	9	9	.	8	8	8	.	8	7	.
oth6	5	5	5	3	6	7	8	.	9	8	.
oth7	9	9	9	6	7	6	7	8	6	7	7
oth8	6	6	6	.	4	4	7	.	5	7	.
oth9	6	7	8	.	5	4	6	.	3	3	.
oth10	6	6	7	.	6	5	6	.	5	6	.
oth11	6	5	7	.	5	3	5	.	4	5	.
oth12	5	6	6	.	4	4	5	.	4	5	.
oth13	6	8	9	8	3	4	4	.	5	4	.
oth14	5	7	8	.	2	4	4	.	3	4	.
oth15	8	8	8	6	6	6	3	.	5	3	.
oth16	6	6	5	.	5	5	3	.	5	3	.
oth17	8	9	9	.	4	3	2	.	3	2	.
oth18	6	6	8	9	5	2	2	.	3	3	.
oth19	2	1	3	.	2	1	1	.	1	1	.
oth20	2	1	2	.	1	1	1	.	1	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D12

Other MDs and osteopath[1] deciles[2] for head or brain MRI/MRA and CT/CTA referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
oth1	9	10	10	.	10	10	10	.	10	10	.
oth2	4	6	7	8	3	9	9	.	10	10	.
oth3	9	9	8	.	10	9	9	.	10	9	.
oth4	2	4	7	.	3	6	9	.	8	9	.
oth5	9	9	9	9	8	8	8	.	8	8	.
oth6	5	7	9	.	7	8	8	.	8	8	.
oth7	10	10	10	.	7	7	7	.	7	7	.
oth8	5	4	4	4	5	5	6	8	7	7	7
oth9	6	7	7	.	4	6	6	.	6	6	.
oth10	5	4	4	7	5	5	6	8	7	6	7
oth11	7	7	8	6	5	5	6	.	3	5	.
oth12	6	7	5	7	6	6	5	.	7	5	.
oth13	9	9	9	8	8	7	4	.	9	4	.
oth14	5	7	8	.	2	4	4	.	3	4	.
oth15	8	8	8	.	4	3	3	.	3	3	.
oth16	3	3	6	.	1	1	3	.	2	3	.
oth17	7	7	8	.	4	4	4	.	3	2	.
oth18	3	5	5	.	3	2	2	.	2	2	.
oth19	2	1	3	.	2	1	1	.	1	1	.
oth20	2	2	1	.	1	1	1	.	.	1	.

NOTES

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D13

Neurosurgeon[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ns1	10	10	10	8	10	10	10	9	5	10	9
ns2	9	9	10	.	9	9	9	.	10	10	.
ns3	9	8	9	10	2	2	2	.	2	2	.
ns4	9	9	9	.	9	9	9	.	8	9	.
ns5	10	10	8	5	8	8	6	5	7	4	5
ns6	9	9	8	.	9	9	6	.	9	7	.
ns7	8	8	7	.	7	7	8	.	6	7	.
ns8	7	7	7	.	6	5	5	.	5	4	.
ns9	7	6	6	6	4	4	3	5	4	4	5
ns10	4	4	6	.	5	5	8	.	3	4	.
ns11	5	3	5	.	8	8	7	.	8	7	.
ns12	4	4	5	.	5	6	.	.	6	.	.
ns13	8	5	4	.	7	7	7	.	7	5	.
ns14	6	5	4	3	4	3	3	.	2	6	.
ns15	3	3	3	.	2	2	3	.	.	.	.
ns16	3	3	3	.	2	2	2	.	2	1	.
ns17	3	3	2	3	2	1	1	5	.	1	5
ns18	2	2	2	.	1	1	3	.	.	3	.
ns19	1	1	1	.	1	1	1	.	.	.	.
ns20	1	1	1	.	1	1	1	.	1	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D14

Neurosurgeon[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
ns1	10	10	10	8	10	10	10	8	10	10	9
ns2	5	4	3	.	5	5	10	.	5	.	.
ns3	8	8	9	.	9	9	9	.	9	10	.
ns4	7	7	8	.	9	9	9	.	10	10	.
ns5	8	8	7	.	7	7	8	.	6	7	.
ns6	4	4	6	.	5	5	8	.	3	4	.
ns7	8	8	8	.	7	7	7	.	7	7	.
ns8	8	5	4	.	7	7	7	.	7	5	.
ns9	10	10	8	5	8	8	6	5	7	4	5
ns10	7	6	7	.	6	6	6	.	5	6	.
ns11	7	6	5	5	6	6	5	6	7	8	6
ns12	5	5	5	4	4	4	5	4	3	3	3
ns13	3	3	8	9	2	2	4	.	2	.	.
ns14	3	3	4	.	3	3	4	.	5	6	.
ns15	7	6	6	6	4	4	3	5	4	4	5
ns16	6	6	5	1	5	5	3	1	4	3	1
ns17	9	8	9	10	2	2	2	.	2	2	.
ns18	3	3	3	.	3	3	2	.	4	4	.
ns19	1	2	2	.	1	2	1	.	1	.	.
ns20	1	2	2	1	1	1	1	3	1	2	3

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D15

Neurosurgeon[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ns1	10	10	10	9	10	10	10	10	10	10	10
ns2	2	2	2	.	3	4	4	.	10	10	.
ns3	6	7	7	7	10	10	10	8	9	9	8
ns4	10	10	10	.	10	10	9	.	9	9	.
ns5	10	10	9	9	10	10	9	10	9	8	10
ns6	4	4	4	.	6	6	6	.	6	8	.
ns7	8	8	7	.	7	7	8	.	6	7	.
ns8	7	7	6	5	7	8	6	7	10	7	7
ns9	7	6	7	.	6	6	6	.	5	6	.
ns10	6	5	4	3	4	3	3	.	2	6	.
ns11	3	2	3	.	6	3	9	.	1	5	.
ns12	2	2	2	.	3	2	3	.	5	5	.
ns13	4	4	6	.	5	5	8	.	3	4	.
ns14	10	10	8	5	8	8	6	5	7	4	5
ns15	5	5	6	.	5	5	6	.	5	3	.
ns16	5	5	5	4	4	4	5	4	3	3	3
ns17	5	4	3	2	4	4	3	3	3	2	3
ns18	1	2	2	1	1	1	1	3	1	2	3
ns19	3	3	3	.	2	2	2	.	2	1	.
ns20	3	3	2	3	2	1	1	5	.	1	5

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D16

Orthopedic surgeon[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

Provider	Patient population[3]										
	poprnk1	poprnk2	poprnk3	poprnk4	poprnk5	poprnk6	poprnk7	poprnk8	poprnk9	poprnk10	poprnk11
os1	10	10	10	9	10	10	10	9	10	9	9
os2	10	10	10	.	10	10	8	.	10	8	.
os3	9	9	9	9	9	9	8	5	8	8	5
os4	9	9	9	6	9	9	9	7	9	9	8
os5	9	9	8	7	4	4	4	3	5	4	4
os6	7	7	8	.	7	7	9	.	7	9	.
os7	8	8	7	.	3	3	3	.	2	3	.
os8	7	7	7	.	4	4	3	.	5	3	.
os9	6	7	6	4	5	9	8	8	9	8	7
os10	4	4	6	9	3	3	5	6	2	1	8
os11	5	5	5	.	2	2	2	.	1	1	.
os12	5	5	5	1	1	1	1	.	.	.	.
os13	5	5	4	3	8	8	7	9	6	5	9
os14	2	2	4	.	2	2	2	.	2	3	.
os15	4	3	3	.	10	10	10	.	.	10	.
os16	3	3	3	3	3	3	2	2	3	2	2
os17	3	3	2	.	1	1	1	.	1	1	.
os18	2	1	2	.	.	.	.	.	.	.	.
os19	2	2	1	.	5	7	8	.	5	8	.
os20	1	1	1	.	3	3	3	.	4	3	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D17

Orthopedic surgeon[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
os1	9	9	9	8	10	10	10	9	10	10	9
os2	7	7	8	.	10	10	10	.	.	.	.
os3	10	10	10	9	8	8	9	.	9	9	.
os4	10	10	9	6	9	9	9	7	9	8	6
os5	6	6	7	.	9	9	8	.	9	9	.
os6	3	3	3	.	9	9	8	.	.	.	.
os7	10	10	10	10	8	8	7	7	7	6	8
os8	7	7	7	7	7	8	7	4	7	5	4
os9	8	8	8	.	6	6	6	.	6	6	.
os10	8	8	7	.	8	8	6	.	9	8	.
os11	6	5	6	2	4	4	5	3	5	6	3
os12	5	5	5	4	6	6	5	3	6	6	4
os13	5	5	4	1	4	4	4	1	4	4	1
os14	3	3	2	.	6	6	4	.	7	4	.
os15	9	9	9	8	2	2	3	.	2	4	.
os16	2	2	2	.	2	3	3	.	4	4	.
os17	5	5	5	4	3	3	2	2	1	1	1
os18	2	2	3	.	1	1	2	.	2	2	.
os19	5	2	1	1	1	1	1	1	1	1	1
os20	2	2	1	2	1	1	1	4	1	1	4

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D18

Orthopedic surgeon[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
os1	5	4	5	.	10	10	10	.	10	10	.
os2	4	4	4	8	10	10	10	.	.	10	.
os3	8	8	8	.	9	9	9	.	8	9	.
os4	10	10	10	9	8	8	8	6	9	9	6
os5	3	3	3	.	9	9	9	.	8	8	.
os6	7	7	7	.	9	9	8	.	9	8	.
os7	10	10	10	9	8	8	8	5	8	7	4
os8	7	8	8	.	7	7	7	.	7	7	.
os9	8	8	9	7	6	6	6	7	6	6	7
os10	3	3	3	.	2	2	5	.	2	6	.
os11	7	7	8	8	6	6	5	8	7	5	8
os12	9	8	5	5	7	7	3	6	6	5	6
os13	6	6	6	2	5	5	4	1	4	4	1
os14	2	2	1	.	3	3	2	.	6	4	.
os15	4	5	5	.	6	7	4	.	7	3	.
os16	3	3	2	.	3	3	3	.	5	3	.
os17	2	2	3	.	4	4	5	.	3	2	.
os18	3	3	3	3	3	3	2	2	3	2	2
os19	4	5	3	.	1	1	1	.	2	1	.
os20	5	2	1	1	1	1	1	1	1	1	1

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D19

Internal medicine, family practioners and general practitioner[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ifg1	10	10	10	.	5	4	4	.	5	5	.
ifg2	10	10	10	.	.	.	.	.	.	.	.
ifg3	9	9	9	.	6	6	6	.	.	6	.
ifg4	9	9	9	.	10	10	10	.	10	.	.
ifg5	9	9	8	.	6	6	6	.	4	7	.
ifg6	9	9	8	.	5	5	5	.	.	6	.
ifg7	8	8	7	.	8	8	7	.	7	7	.
ifg8	7	4	7	.	9	9	8	.	.	.	.
ifg9	7	7	6	.	10	10	10	.	.	10	.
ifg10	4	6	6	.	8	8	8	.	4	6	.
ifg11	4	4	5	.	5	5	5	.	3	6	.
ifg12	3	3	5	.	.	.	.	.	.	.	.
ifg13	6	6	4	.	.	.	.	.	.	.	.
ifg14	5	5	4	.	4	3	3	.	4	3	.
ifg15	4	4	3	.	3	3	3	.	3	3	.
ifg16	3	3	3	2	.	.	.	.	.	.	.
ifg17	5	6	2	.	.	.	.	.	.	.	.
ifg18	3	3	2	.	.	.	.	.	.	.	.
ifg19	4	3	1	.	.	.	.	.	.	.	.
ifg20	1	1	1	.	2	2	2	.	3	3	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D20

Internal medicine, family practioners and general practitioner[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ifg1	9	9	9	6	10	10	10	.	.	10	.
ifg2	9	9	8	.	10	10	10	.	10	10	.
ifg3	9	9	9	6	9	9	9	.	.	10	.
ifg4	6	9	9	.	10	10	9	.	9	9	.
ifg5	10	10	10	.	5	5	8	.	2	.	.
ifg6	7	7	6	.	8	8	8	.	8	8	.
ifg7	7	8	6	.	8	7	7	.	9	8	.
ifg8	6	6	6	.	6	6	7	.	7	7	.
ifg9	6	9	9	.	5	6	6	.	6	6	.
ifg10	9	9	8	.	6	6	6	.	.	6	.
ifg11	7	7	5	.	5	5	5	.	6	6	.
ifg12	4	4	4	.	5	5	5	.	4	6	.
ifg13	8	8	8	.	7	6	4	.	6	4	.
ifg14	6	7	7	.	4	4	4	.	4	3	.
ifg15	6	6	6	.	5	5	3	.	4	2	.
ifg16	4	4	4	.	2	2	3	.	1	3	.
ifg17	8	6	5	.	2	2	2	.	.	2	.
ifg18	5	2	2	.	3	3	2	.	3	3	.
ifg19	4	3	2	.	1	1	1	.	1	1	.
ifg20	1	1	1	.	1	1	1	.	.	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D21

Internal medicine, family practioners and general practitioner[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
ifg1	9	10	10	.	10	10	10	.	10	10	.
ifg2	9	9	9	.	9	9	10	.	6	10	.
ifg3	9	9	10	.	10	10	10	.	9	9	.
ifg4	9	9	9	8	10	10	10	.	5	9	.
ifg5	10	10	10	.	9	9	9	.	9	8	.
ifg6	6	6	6	.	8	8	8	.	9	8	.
ifg7	7	8	6	.	7	7	7	.	8	7	.
ifg8	7	6	6	.	6	6	6	.	7	7	.
ifg9	8	8	8	6	7	7	7	.	6	6	.
ifg10	8	8	6	.	5	5	4	.	7	6	.
ifg11	7	7	7	6	3	3	5	.	5	5	.
ifg12	4	4	5	.	5	5	3	.	3	5	.
ifg13	6	5	3	.	5	7	7	.	.	4	.
ifg14	8	8	8	.	7	6	4	.	6	4	.
ifg15	8	8	7	7	5	5	5	.	3	3	.
ifg16	5	5	5	.	3	3	3	.	3	3	.
ifg17	8	8	7	.	6	6	6	.	2	2	.
ifg18	6	7	7	.	9	9	3	.	9	2	.
ifg19	3	4	3	5	2	2	2	4	1	1	.
ifg20	3	3	4	4	1	1	1	2	1	1	3

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D22

Other MDs and osteopath[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
oth1	10	10	10	.	.	.	.	.	.	.	.
oth2	10	10	10	9	9	9	9	.	9	8	.
oth3	10	10	9	.	4	5	4	.	5	5	.
oth4	7	9	9	.	3	7	6	.	7	8	.
oth5	10	9	8	.	9	9	9	.	9	9	.
oth6	8	8	8	.	8	8	9	.	6	7	.
oth7	10	8	7	.	.	.	.	.	.	.	.
oth8	8	8	7	6	6	6	5	.	4	4	.
oth9	7	7	6	.	4	3	3	.	3	4	.
oth10	3	2	6	6	.	.	.	.	.	.	.
oth11	4	6	5	.	6	8	5	.	.	.	.
oth12	3	6	5	.	.	.	.	.	.	.	.
oth13	7	7	4	.	4	3	3	.	3	3	.
oth14	6	6	4	.	.	.	.	.	.	.	.
oth15	5	4	3	.	.	.	.	.	.	.	.
oth16	4	4	3	.	.	.	.	.	.	.	.
oth17	4	2	2	.	.	.	.	.	.	.	.
oth18	2	3	2	.	3	3	2	.	2	2	.
oth19	2	2	1	.	.	.	.	.	.	.	.
oth20	1	1	1	.	3	3	2	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk3.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk3.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D23

Other MDs and osteopath[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
oth1	9	10	9	4	10	10	10	6	10	10	5
oth2	5	5	4	.	10	10	10	.	10	10	.
oth3	10	10	10	.	8	10	9	.	9	9	.
oth4	9	9	10	.	9	8	9	.	8	9	.
oth5	9	9	8	.	9	9	8	.	8	8	.
oth6	2	3	2	.	8	7	8	.	8	8	.
oth7	10	10	9	.	7	7	7	.	5	5	.
oth8	7	7	7	.	8	7	7	.	7	7	.
oth9	10	10	10	.	7	6	6	.	6	5	.
oth10	9	10	10	.	6	6	6	.	5	5	.
oth11	6	8	7	.	6	6	5	.	2	2	.
oth12	5	5	5	.	2	6	5	.	2	5	.
oth13	7	6	3	2	6	6	4	.	6	4	.
oth14	2	2	1	.	6	5	4	.	.	5	.
oth15	10	10	9	10	5	5	3	9	3	3	9
oth16	5	4	6	.	3	3	3	.	4	5	.
oth17	10	9	8	2	3	3	2	3	2	2	2
oth18	6	6	8	.	2	2	2	.	1	2	.
oth19	4	5	4	.	1	1	1	.	.	.	.
oth20	2	3	2	.	1	1	1	.	.	.	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk7.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk7.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.

Table D24

Other MDs and osteopath[1] deciles[2] for spinal MRI/MRA and CT referrals per 100 benes by patient population

	Patient population[3]										
Provider	**poprnk1**	**poprnk2**	**poprnk3**	**poprnk4**	**poprnk5**	**poprnk6**	**poprnk7**	**poprnk8**	**poprnk9**	**poprnk10**	**poprnk11**
oth1	10	10	9	.	9	10	10	.	10	10	.
oth2	7	6	5	.	9	9	10	.	.	10	.
oth3	10	10	10	.	10	10	10	.	10	9	.
oth4	9	9	9	10	8	9	9	10	9	9	10
oth5	9	9	8	.	9	9	8	.	7	8	.
oth6	10	10	10	.	9	9	7	.	9	8	.
oth7	10	9	9	.	8	7	7	.	7	7	.
oth8	7	7	8	.	7	7	7	.	6	7	.
oth9	10	10	10	.	7	10	7	.	10	6	.
oth10	8	8	8	.	6	5	6	.	5	6	.
oth11	9	10	10	.	6	6	6	.	5	5	.
oth12	6	5	3	.	6	5	4	.	6	5	.
oth13	10	10	9	6	6	6	5	5	4	4	5
oth14	7	6	3	2	6	6	4	.	6	4	.
oth15	6	7	5	.	5	5	4	.	4	3	.
oth16	9	9	8	.	4	3	3	.	2	3	.
oth17	6	8	8	.	2	2	2	.	2	2	.
oth18	7	7	5	.	2	2	2	.	1	2	.
oth19	6	7	5	1	1	1	1	1	1	1	1
oth20	5	4	3	.	1	1	1	.	.	1	.

NOTES:

1. Two providers were randomly selected from each decile for this sample based on poprnk10.
2. 10 represents the highest decile (i.e., greater number of referrals per 100 benes). The data have been sorted by decile in poprnk10.
3. Patient populations are defined as follows:

Any Diagnosis

poprnk1. Benes who received any Pt B service from the provider

poprnk2. Benes who received any E&M service from the provider

poprnk3. Benes who received an office or other outpatient E&M service from the provider

poprnk4. Benes who received a "new patient" office or other outpatient E&M service from the provider

Tracer Diagnoses

poprnk5. Benes who received any Pt B service from the provider and have one of the tracer diagnoses.

poprnk6. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk7. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk8. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

Unique Assignment

poprnk9. Benes who received any E&M service from the provider and have one of the tracer diagnoses.

poprnk10. Benes who received an office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

poprnk11. Benes who received a "new patient" office or other outpatient E&M service from the provider and have one of the tracer diagnoses.

SOURCE: RTI analysis of 2002 Medicare claims data for Boston MSA residents.