Focus on quality: Profiling physicians' practice patterns

This article presents a physician practice profiling system developed using Medicare data to evaluate the quality of care provided by primary care physicians. We discuss four attributes to physicians' practice profiles that make them useful for quality improvement: flexibility, user involvement in developing profiles, explicit plans for evaluation, and fairness to groups of providers. This system serves as a model for physician profiling with a focus on quality of care measurement. Key words: *physician practice profiling, primary care, quality of care*

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FEDERAL AND PRIVATE health care policy makers now recognize the potential of physicians' practice profiles as a component of a program of continuous quality improvement. In particular, claims-based profiling methods can be applied to improve the quality of care delivered to Medicare

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patients. To create such methods, we formed a multidisciplinary team of physicians, health services researchers, biostatisticians, computer programmers, and a staff of three peer review organizations (PROs). Our goal was to develop new methods that PROs could use to profile the ambulatory care provided by primary care physicians to Medicare patients in three states. The team also developed a new method to review office-based medical records using explicit criteria (Lawthers et al., 1993). This effort is among the first, and perhaps the widest in scope, ever to develop claims-based profiles focused on quality rather than on the cost of care. (Another profile development effort focused on quality is described in Leatherman, Peterson, Heinen, & Quam, 1991.)

This article is divided into two main sections:

1. In the first section, we define profiling more fully, point out some advantages and disadvantages associated with claims-based profiling, and propose a set of principles to guide the development of quality focused profiles.
2. In the second section, we describe the system we developed based on those principles.

IMPORTANCE OF PROFILING

Profiling physicians' practices has enormous potential as a component of continuous quality improvement (Findlay, 1993; Lasker, Shapiro, & Tucker, 1992; Physician Payment Review Commission, 1992; Shapiro, Lasker, Bindman, & Lee, 1993). Specifically, profiles of physicians' practices developed with a focus on quality can be used to do the following:

- Inform physicians about how closely the care they provide conforms to their peers' practice patterns.
- Track adherence to practice guidelines.
- Measure the quality of care provided by groups of physicians, including members of physician networks, staff of health maintenance organizations (HMOs), or providers who serve Medicare patients in a community.

Profiling methods that have already been developed to meet cost containment goals will not also be useful, however, for meeting quality improvement goals.

Cost containment profiles used widely

To meet cost containment goals during the 1980s, health insurance companies developed methods to "profile" physicians' practices. The insurers used claims data to identify providers with expensive practice patterns who could then be sanctioned. For example, physicians who consistently used more resources than did their peers would suffer financial penalties or would be cut from an insurer's network. In some managed care plans, efficient providers were rewarded. For instance, physicians whose patterns fell within established norms would "bypass" the requirements for detailed case-by-case review or would be selected to participate in preferred provider networks (Nathanson, et al., in press; Stephenson, 1992).

These uses of profiling as a cost containment tool have become widespread (Findlay, 1993). By 1990, insurers representing 96% of the preferred provider organization (PPO) market reported that they maintained physician profiles (Hoy, Curtis, & Rice, 1991). In 1992, 45.5% of physicians were subject to either clinical or economic profiling, although less than half were regularly provided with feedback (Emmons & Wozniak, 1993).

New quality improvement profiles needed

A simple example shows why physicians' practice profiles focusing on quality improve-

ment must differ from profiles emphasizing cost. The Medicare program now compiles comparative performance reports that are used to alert physicians whose claims submission rates for selected services are higher than the norm for their specialties (Robinson, 1990b).

One measure used is the number of colonoscopy claims a physician submits per 100 beneficiaries he or she treats (the "raw rate"). For quality improvement purposes, this rate alone is insufficient because it is subject to multiple sources of bias:

- The raw rate is not clinically meaningful because it is not adjusted to account for the specific clinical circumstances of each patient in each physician's practice.
- The denominator may be inflated by patients who are incidental to a physician's practice.
- The numerator may be artificially low for primary care physicians who refer almost all their patients to gastroenterologists for colonoscopies.
- The emphasis on individual physicians stresses the assigning of blame rather than the improvement of the performance of all physicians.
- The raw rate provides insufficient clinical information to link with educational strategies for increasing clinical knowledge or improving performance.

PHYSICIANS' PRACTICE PROFILING

Definition

Physicians' practice profiling is an epidemiological technique that focuses on patterns of care rather than on individual occurrences of care, usually using large, computerized databases (Physician Payment Review Commission, 1992). Claims data have several disadvantages as a quality improvement tool. Large datasets developed to pay bills often lack clinical specificity, test results, and information on medication, but these limitations can be overcome by linking profiling with record reviews of a sample of cases (Weiner, Powe, Steinwachs, & Dent, 1990).

Despite these shortcomings, claims profiles offer many advantages over other review methodologies. Five specific advantages are as follows:

1. *Claims data can provide a broad view of activity* even though they often lack the desired clinical depth of information. Unlike records-based tools, these profiles can readily incorporate information about all services that a beneficiary receives, linking information about episodes of care across time, providers, and settings.
2. *Claims are much less expensive to use,* given the volume of information available, because they have already been collected as part of the billing process.
3. *Claims-based profiles do not require intrusion into physicians' practices,* thus reducing the "hassle" factor. They represent an electronic audit trail of the interaction between the health care provider and patient. A far larger number of physicians' practices can be screened using this broad-based approach than by using more expensive reviews of medical records for selected individuals.
4. *Claims databases can be analyzed for varying time intervals and with varying aggregations of providers.* If small samples for a particular condition are a problem, it is possible to increase the number of observations by increasing the length of the study period.
5. *Claims profiles are flexible.* As criteria for care evolve, components of the claims-based profiles can be updated.

Principles for develop profiles

To be useful tools fo care, physician practi the following:

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- Involve the end u cians) in develop
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Principles for developing physician profiles

To be useful tools for improving quality of care, physician practice profiles need to do the following:

- Be flexible so profiles can be easily changed as medical practice changes.
- Involve the end users (practicing physicians) in developing profiles.
- Include an explicit assessment of the reliability of the profile.
- Be fair to various groups of providers.

Each of these attributes is discussed in detail in the following sections.

Flexibility

Profiles of physicians' practices must be designed to make it easy to incorporate changes in treatment for specific conditions based on new research findings, newly developed technologies, and newly published practice guidelines. Currently, if a practice guideline calls for a hemoglobin A1c test for all patients who have diabetes, then the profile can be designed to present data on the percentage of patients with the condition who receive the test. In the future, the profile can be revised if a different test is developed, a new procedure code (CPT-4) is registered, and the Health Care Financing Administration (HCFA) pays for the test.

If a profile using 1991 data shows that in one area of a state, the rate of use of the hemoglobin A1C test is very low, then educational efforts about the guideline would most efficiently be targeted to physicians in that area. Rather than show the data aggregated to the level of all physicians in the state, the profile could be revised to show data for *specific areas where the claims data or other quality measurement tools show that there* might be the need for intervention.

Profiles designed to incorporate flexibility could be used to investigate in detail how guidelines are implemented. For example, profiles could be tailored to examine whether most physicians raise their level of testing to 80% of patients with the condition, or whether some physicians remain at a very low level of testing, while others test virtually all of their eligible patients. Moreover, if a revised guideline shows a test to be unnecessary, then profiles can be used to monitor physicians' incorporation of this new information into their practices.

Profiles also should be designed to incorporate improvements in coding and data systems. For example, more specificity of procedure coding was implemented in the beginning of 1992 along with HCFA's phase-in of physician payment based on resource-based relative value scales (RBRVS). An example of improvement in data systems is the implementation of unique provider identification numbers (UPINs) by HCFA. While the profiles of physicians' practices we report in this article are based on physicians' billing numbers and not UPINs, these profiles can be easily revised to incorporate UPINs. This physician-specific identification will represent a major improvement in the profiles. Under the previous system, physicians might have used several numbers if they practiced in different locations. Furthermore, several physicians in a group might have billed under the same number. Under the new UPIN system, all of a physician's services are billed under one number that represents only one physician. This modification will allow us to include in revised profiles specific physicians who were only identified as members of a group under the old system.

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User involvement

Ideally, the development of physicians' practice profiles should be an ongoing process that involves users of profiles in all stages—initial design of profiles, interpretation of test data, improvement of earlier versions, interpretation of final versions, dissemination of profiles to practicing physicians, and design of educational interventions based on profile results. In the past, however, profiling systems often have fallen far short of this ideal because including users increased the time and expense of developing profiles. Nonetheless, theories of behavior change suggest that involving physicians in efforts to effect change should make change less threatening (Greco & Eisenberg, 1993). (Published evaluations have methodological problems, however, that make interpretation on this point difficult.)

Physician participation is crucial because physicians are the key users of the information from quality focused profiles. (In contrast, insurers are the main users of the information from profiles developed for cost containment.) Physicians use quality-related profiles to improve their own practices and the level of care in their communities. Physicians who feel ownership of the process of developing and evaluating performance profiles are more apt to feel that the resulting performance data are important. Moreover, they know best what information will be clinically meaningful and can pinpoint important issues for their patients.

An explicit assessment of reliability

The usefulness of practice profiles depends, in part, on understanding how reliable the information is. While it is not necessary that the data be completely accurate, it is necessary for users and researchers to understand the direction and extent of the errors and whether the errors are systematic or random. The concept of reliability rests upon the reproducibility of the measure, for example, whether items are measured the same way at different points in time or by different people. For Medicare claims, one component of reliability is the accuracy of coding, which can be tested by examining the correspondence of claims information with the primary physician's ambulatory medical record. (For further details, see Fowles et al., 1994.)

Yet, physicians are suspicious of claims accuracy because they are a "by-product" of the system of care rather than a deliberate clinical notation. A careful assessment of the degree of data accuracy will address these concerns and allow physicians to focus on the utility of the information.

Fairness

To be fair to providers, physicians' profiles should include only those patients for whom that provider bears the major responsibility. These profiles should compare similar groups of providers (those with the same specialty, for example), and compare similar groups of patients (by selecting patients with the same condition and controlling for case mix). However, meeting these conditions of fairness often is difficult.

Thorny issues can arise even with a test for which there is a clear and well-accepted standard of care, such as the use of annual Pap smears for women. Unless one is profiling physicians in a health system where patients are assigned to a gatekeeper physician, including all patients for each physician's profile can introduce a serious bias. Consider two primary care physicians who each care for 1,000 women and perform Pap smears on 700 of them: a rate of 70%. One physician also covers for several colleagues' vacations, however, and sees an additional 150 women over the course of the year for one or two visits. If all 1,150 women seen are used as the

denominator, this physician's rate of Pap smears is only 61% (700/1,150). Thus, a profile should exclude those patients for whom a different physician was the primary source of care.

In the case of Pap smears, it would seem fair to compare rates across internists and family practitioners because the ideal rate approaches 100% without regard to provider specialty. (If the hysterectomy rate varies by region, then the optimal Pap smear rate should also vary by region.) However, any interpretations of a higher performance rate for internists than for family practitioners should take into account differences in their patient populations. The internists in a community may serve women with a socioeconomic, educational, or ethnic status that would make them more likely to keep appointments, whereas family practitioners may serve women who may be less likely to comply with the physicians' recommendations.

When the standard of care is less clear, the issue of comparing practice patterns across physicians is even more complicated. Consider the example of the number of visits per year for a patient with chronic hypertension. The physician's practice style should be considered along with clinical factors, socioeconomic factors, benefit plan design, and financial access, which all can influence the pattern of care. Some physicians may routinely see their patients once each quarter, whereas others may see their patients less often if their blood pressure is well controlled by medication. In this example, there may be a range of patterns of care, all of which are acceptable.

DEVELOPING METHODS FOR PROFILING: FOCUS ON QUALITY

In this section, we describe the steps we took to develop new approaches to physician practice profiling, which included the following:

- Obtaining and preparing data,
- Determining which patients to include,
- Specifying the content of reports,
- Producing profiles, and
- Disseminating and evaluating profiles.

Obtaining and preparing data

Health insurance claims data are not ready to analyze immediately when the tape or cartridge of data arrives from Medicare. Rather, in order to prepare the data for analysis, several key steps are required:

- A useful unit of analysis (such as a visit to a physician) should be developed from a set of several, discrete financial transactions.
- Data elements from other databases (such as beneficiary files or provider files) should be combined with claims records.
- Superfluous claims (e.g., duplicate transactions) should be identified, removed, or modified, where possible. (For further details, see Parente et al., 1994.)

We obtained the National Claims History (NCH) file from HCFA. While the title suggests it is only one file, the NCH is actually a series of three files linked by a beneficiary identification number. These files and a provider file are described briefly below.

Beneficiary file (HISKEW)

This file contains sociodemographic information regarding the beneficiary, including the following:

- birth date,
- gender,
- type of Medicare coverage (e.g., over age 65 vs. disability or renal disease),
- place of residence (ZIP code and county), and
- death date (if applicable).

Office-based claims file

This file contains claims for services performed in an ambulatory facility and paid through Part B of Medicare (although not all Part B claims are found in this file). An ambulatory facility can be a physician's or group practice's office or a patient's home. Critical variables in this file include the following:

- date of service,
- procedure code,
- diagnosis code,
- location of service,
- type of service,
- cost of service, and
- provider code.

Institutional claims file

The file contains both Part A and Part B claims paid to institutions including hospitals (both inpatient and outpatient services), nursing homes, ambulatory surgery centers, and mental health facilities. The same key variables in the office-based claims file are also available in the institutional records, with the addition of the diagnosis related group (DRG) and patients' hospital discharge status.

Provider file

In addition, we obtained a provider file from the carrier containing information describing physicians' characteristics such as self-designated specialty, board certification status, and participation in a group practice.

Data selection

From these data files, we selected the variables and the observations (patients, claims, and providers) needed to develop profiles. For example, from the 447,145 patients on the raw beneficiary file in Maryland, we selected the 389,765 (87.2%) patients who met the following criteria:

- age 65 or older, alive the entire year, and Medicare eligible from 7/1/90 to 6/30/91;
- primary residence in the state the entire year;
- not enrolled in an HMO;
- recipient of some Part B services; and
- no nursing home claims in two consecutive quarters.

Using the Part B claims data, we eliminated data on 19.1% (1,631,466 out of 8,541,698) of records that showed the following:

- duplicates,
- nonexistent dates of services,
- services not rendered from 7/1/90 to 6/30/91,
- services that could not be linked to a beneficiary,
- nonexistent diagnosis and procedure codes, and
- services that could not be linked to a physician.

Some of these steps are now done by HCFA under the Bureau of Data Management and Strategy's (BDMS) Decision Support and Access Facility (DSAF). For the remaining beneficiaries, we constructed person-level analytic files that contained all of their claims for inpatient or outpatient services for the entire year.

Determining which patients to include

The goal of the primary care practice profile is to include those patients for whom the physician is responsible and to exclude patients who see the physician only incidentally. This relationship also is referred to as the patient's usual source of care (Franks, Nutting, & Clancy, 1993). Consider the following patient scenarios:

One goal of the primary care practice profile is to include those patients for whom the physician is responsible and to exclude patients who see the physician only incidentally.

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- Patient A gets all care from Dr. Smith, an internist.
- Patient B visits Dr. Smith only once but receives most care from a specialist.
- Patient C also visits Dr. Smith once but receives most care from a different internist.
- Patient D visits only a cardiologist.

To deal with this range of scenarios, we developed the concept of primary care source (PCS) for each patient. (In a managed care setting in which each patient is assigned to a gatekeeper physician, this step is not required.) Each patient was assigned to the primary care physician (internist, family practitioner, general practitioner) who provided more care than any other primary care physician. Using only claims for "face-to-face" visits, the primary care physician associated with the majority of services to a single patient was designated as that patient's PCS. In the case of a tie, total charges were used to assign the PCS. Of the 389,765 beneficiaries in the state of Maryland, 68% were assigned to a PCS who provided approximately 87.6% of their primary care visits. We did not include beneficiaries who could not be assigned to a PCS (i.e., they never visited an internist, family practitioner, or general practitioner) or who were assigned to a group practice.

Returning to the patient scenarios, consider the following:

- Patient A gets all care from Dr. Smith, an internist, so he is assigned to Dr. Smith.
- Patient B visits Dr. Smith only once but receives most care from a specialist, so she is assigned to Dr. Smith since a specialist cannot be a PCS.
- Patient C also visits Dr. Smith once but receives most care from a different internist, so he is assigned to the other internist.
- Patient D visits only a cardiologist, so she is not included in our profiling system since a primary care physician is not involved in her care.

Specifying content of reports

The development of profile content was an iterative process:

- *Drafting.* First, the research team developed initial draft profiles for six conditions common in the Medicare population, for office-based practice in general, and for preventive care.
- *Review.* Next, clinical experts, the states' PROs, local physicians in Maryland (and the other two states), and experts in data analysis reviewed the draft profiles for clinical logic, usefulness to providers, and clarity.
- *Revision.* Finally, the profiles were revised based on these comments.

The profiles are designed to be flexible so that they can be further revised in response to users' comments, new areas of interest, or changes in data systems or coding.

Producing profiles

We developed three types of physician *practice profiles:* (1) condition-specific profiles, (2) office practice profiles, and (3) preventive profiles. Often, measures in the profile are expressed as rates in which the denominators are the relevant patients from among those who were assigned to a PCS. The numerators are the number of patients who received services or experienced outcomes, aggregated over time (usually a year).

Condition-specific profiles

These profiles were developed for six conditions that were selected on the basis of their frequency in the Medicare population, the likelihood that poor ambulatory management would result in adverse outcomes, and the availability of relevant information in the claims data. We se-

lected patients if they had at least one face-to-face encounter with a physician for one of the conditions shown below (diagnosis codes are shown in parentheses):

- diabetes (250.xx);
- hypertension (401.00, 401.1, or 401.9 and without CHF);
- congestive heart failure (CHF) (398.91, 402.01, 401.11, 402.91, 428.xx);
- chronic obstructive pulmonary disease (COPD) (491, 491.0–491.9, 492, 492.0, 492.8, or 496);
- ischemic heart disease (IHD) (410.xx–414.xx); and
- osteoarthritis (715.xx).

For each condition, we developed a series of measures and explicit data specification forms. (Because Medicare does not cover prescription drugs, we could not develop performance measures involving drugs.) These forms facilitated discussion of which utilization or outcome measures to include in our profiles of patients with specific conditions. These forms are included in each profile presented to physicians and contain the following:

- the measure (e.g., high-density lipoprotein [HDL] cholesterol test);
- the data source (e.g., the specific procedure codes—CPT 83718);
- notes explaining the clinical rationale for inclusion, references to medical texts, recommendations of professional medical associations and practice guidelines, and caveats about the interpretation of the measure.

Table 1 presents information on the use of services that contribute to the good management of elderly patients with diabetes. It shows the percentage of patients receiving zero, one to two, three to five, and more than five services from July 1, 1990, to June 30, 1991. The services fall into two categories corresponding to those shown in Table 2 along with corresponding specifications, data sources, and notes for diabetes. (Tables 3–7 show the specifications for the other five conditions.)

- *Recommended care items* are tests or actions that should be done for all patients with a given condition, such as an annual ophthalmologic exam for diabetic patients.
- *Limited use items* are tests or actions that are appropriate for only a subset of the patients with the condition. For example, hypertensive patients receive a serum potassium if they are treated with a potassium-losing diuretic or angiotensin-converting enzyme (ACE) inhibitor. Thus, some of the performance measures need to be stratified by patient age (under and over age 85), conditions that reflect the severity or comorbidity of the patient's illness, and, ideally, patient therapy.

The data presented in this article are intended to be illustrative. A full final report is available from the Delmarva Foundation for Medical Care, Inc.

The interpretation of Table 1 is fairly straightforward. Physicians presented with this information would see data on all the 8,355 patients in their state who were treated by family practitioners and who had at least one claim in the year for a physician visit for diabetes. (The number of cases per physician is too small to permit production of a profile at the individual physician level.) The first two rows show that most patients are receiving medical visits every 6 months as recommended for monitoring patients with this chronic condition. Only about 10% of patients did not have an office visit in each 6-month period. In contrast, 47.6% of patients with diabetes did not receive an ophthalmic examination from July 1, 1990, to June 30, 1991, although the American

Table 1. Process me

Recommended care	
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Limited-use care	
Blood glucose	

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Table 1. Process measures: Distribution of services: Diabetes (N = 8,355 patients)

	Percent of patients receiving this number of services during the year				
	0	1–2	3–5	>5	Confidence interval percent with no services*
Recommended care					
General medical visits (first 6 months)	9.8	39.8	33.1	17.3	9.2–10.5
General medical visits (last 6 months)	11.7	37.4	33.5	17.5	11.0–12.4
Hemoglobin A1c tests	82.1	15.6	2.2	0.1	81.3–82.9
Urinalysis	57.7	30.2	8.8	3.3	56.7–58.8
Triglycerides	81.8	15.4	2.3	0.5	81.0–82.6
Total cholesterol	52.2	29.7	13.2	4.9	51.1–53.3
HDL cholesterol	81.3	16.4	1.9	0.4	80.4–82.1
Ophthalmology exam	47.6	38.6	10.3	3.5	46.5–48.7
Limited-use care					
Blood glucose	22.3	35.0	26.3	16.4	21.4–23.2

*These numbers reflect the 95% confidence interval around the percentage of patients who had no services. The upper and lower limits are likely to contain the true percentage, and the limits will be narrower if the data sample contains many patients. Percentages from specialty groups will not necessarily fall into the confidence intervals. However, the confidence interval around the specialty group percentage should overlap the statewide interval.

Diabetes Association (1989) recommends an annual eye exam to detect retinopathy and prevent vision loss. Another 38.6% had the test once or twice in the year, 10.3% three to five times, and 3.5% more than five times. This finding that adults in one state who are over age 65 and have diabetes are not receiving timely and recommended eye care is consistent with recently published results for all adults in the nation (Brechner et al., 1993).

Table 8 shows data for diabetic patients who were hospitalized for treatment of ketoacidosis, hyperosmolar coma, hypoglycemic coma, other coma, or lower extremity amputation—all complications that could have been a consequence of inadequate ambulatory care. (Table 9 shows specifications about the data sources and notes for each complication.) For each complication, we show the number of patients admitted, the number of admissions (some patients may be admitted more than once for the same complication), and the percentage of patients admitted.

For example, the top row of Table 8 shows that 18 patients were admitted for ketoacidosis, an acute metabolic complication of diabetes. These data show dramatically that hospital admission information of this type is useful only for groups of physicians rather than for individual physicians because the number of admissions per physician for patients with a specific condition is very small. In addition, because the complications may have an important impact, we also track how

Table 2. Specifications for process measures: Diabetes

	Data source	Notes
Recommended care		
Primary care office or home visit	CPT: 90000–90080 (90100–90170) 90600–90699 90750,90760	According to the American Board of Family Practice (ABFP), visits for diabetic patients in control should be scheduled every 3–6 months (Allerheiligen, Erwin, Galazka, & Smith, 1990, p. 36).
Hemoglobin A1c test	CPT: 83036	Since the hemoglobin A1c test gives a good indication of the level of glucose control, it is recommended every 2 to 3 months (Allerheiligen et al., 1990, p. 37) or every 6 months (American Diabetes Association, Committee on Professional Practice, 1989, p. 367).
Urinalysis	CPT: 81000,81002 81005,81099 84180,84185 84190	Annual urinalysis is recommended to check for proteinuria (Allerheiligen et al., 1990, p. 38; American Diabetes Association, Committee on Professional Practice, 1989, p. 367). Proteinuria is an early manifestation of diabetic nephropathy (Branch, 1987, p. 785). *Note:* If urinalysis is done in the physician's office, it may not be billed separately.
Triglycerides	CPT: 84478 80061–80062 80065 83705 83720	Triglycerides should be tested annually (American Diabetes Association, Committee on Professional Practice, 1989, p. 367). Hypertriglyceridemia is common in diabetics (Wilson et al., 1991, p. 1,756).
Total cholesterol	CPT: 82465,82470 83700–83720 80012–80019 80050,80053 80060–80062 80065	Total cholesterol should be tested annually (American Diabetes Association, Committee on Professional Practice, 1989, p. 367) because diabetics are prone to have arteriosclerosis and have an increased risk of myocardial infarction (Wilson et al., 1991, p. 1,753).
HDL cholesterol	CPT: 83718 80061–80062 80065	HDL cholesterol should be tested annually (American Diabetes Association, Committee on Professional Practice, 1989, p. 367). In diabetics, the ratio of HDL to LDL is altered, and the risk of arteriosclerotic disease is increased (Wilson et al., 1991, p. 1,753).
Ophthalmology visit	CPT: 92002–92019 92225–92260	A complete eye and visual examination should be performed annually (American Diabetes Association, Committee on Professional Practice, 1989, p. 367). This examination is important to detect early signs of retinopathy (Wilson et al., 1991, p. 1,753) or cataract (Branch, 1987, p. 784).
	90000–90080 90600–90699 90750,90760	These codes are acceptable if reported by an ophthalmologist. Optometry visits in an optical shop are probably not billed to Medicare.
Limited-use care		
Blood glucose	CPT: 82947–82952 80006–80019	While many physicians use blood glucose to monitor patients with diabetes, guidelines from

Table 2 *continued*

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Table 10 shows
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Office practice pro

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Table 2 *continued*

Data source	Notes
	ABFP (Allerheiligen et al., 1990, p. 37) and American Diabetes Association recommend hemoglobin A1c for diabetes monitoring. In some cases, blood glucose tests may be a valuable adjunct to the hemoglobin A1c test. The blood glucose test is listed in the limited-use category because it is sometimes appropriate for patients taking insulin. However, Medicare data do not indicate which drugs are used by a patient and may not indicate whether diabetes is type I or type II. Home blood glucose monitoring is not captured by these data.

soon patients are seen in the ambulatory setting following discharge from the hospital. As shown on Table 8, the average number of days after discharge until a visit is 8.2.

Table 10 shows the types of specialist physicians that provide care for the 8,355 patients with diabetes treated by family practitioners in this state. (Table 11 shows the data specifications.) The vast majority of care is provided by general medicine physicians. The fourth row shows that 7.58% of patients see a podiatrist. Because both the primary care physician and a podiatrist can provide foot care for diabetic patients, the percentage of patients referred to podiatrists will vary by local practice style and the supply of podiatrists.

Office practice profiles

The office practice profiles are a set of 14 tables that are intended to be presented to physicians so that they can get an overview of the characteristics and utilization of Medicare patients for whom they are the primary sources of care. These tables present data on patients to whom they provided services and also the same data for all the physicians in their specialty in their state. Often, this is the first time that physicians have seen the entire spectrum of care, both provided or ordered by themselves and by others. Using this information, they can compare their practice characteristics with others'. For example, they can tell if they treat an older set of Medicare patients, more Medicare patients, or patients with more chronic conditions than other physicians of the same specialty practicing in their state.

Tables 12 to 25 are presented for a hypothetical physician, and the following discussion tracks some of that physician's possible interpretation of the tables.

Table 12 shows that this physician saw 119 patients, of whom three quarters (89) were his primary patients (those for whom he provided more visits than other general medicine physicians). During the year, this physician provided these 89 patients with 195 visits.

Table 13 shows additional information on visits. About a third of the physician's primary patients were seen only by that physician, whereas the other two thirds had visits to other general medicine physicians, specialists, group practices, and nonphysician providers.

Table 14 shows that those 89 primary patients had an average of 4.7 visits per year, 2.2 on average to this physician and 2.5 on average to others. Among the visits to this

Table 3. Specifications for process measures: Hypertension

	Data source	Notes
Recommended care Primary care office or home visit	CPT: 90000–90080 (90100–90170) 90600–90699 90750,90760	The primary care visit for patients with hypertension is important for monitoring drug doses and side effects. For this profile, two visits per year are considered minimal care.
Limited-use care Creatinine	CPT: 80012–80019 80060,80065 80073,82546 82565	A serum creatinine test should be part of the initial evaluation for a patient with hypertension (Culik et al., 1990, p. 11). Increased serum creatinine levels indicate renal dysfunction, which may be a sequela of hypertension or its therapy (Wilson et al., 1991, pp. 1,006, 1,010–1,011, 1014).
Triglycerides	CPT: 80061–80062 80065,83705 83720,84478	Measurement of serum triglycerides is useful at initial evaluation (and later for some patients) because it aids assessment of other cardiovascular risk factors and gives guidance for therapy (Culik et al., 1990, p. 11; Goroll, May, & Mulley, 1981, pp. 100, 482).
Total cholesterol	CPT: 80012-80019 80050,80053 80060-80062 80065,82465, 82470 83700–83720	Discretionary monitoring of total cholesterol provides information on an additional risk factor and guidance for therapy (Culik et al., 1990, p. 11).
Serum potassium	CPT: 80002–80019 80060,80062 80065,84132	Close monitoring of serum potassium is necessary for patients who are receiving diuretics or ACE inhibitors (AMA, 1991, p. 488; Wilson et al., 1991, p. 1,010). A low serum potassium level may indicate primary aldosteronism (Culik et al., 1990, p. 11).

physician, about 40% of patients had one visit, just over half had two to four visits, and only a small percentage of patients had five or more visits per year.

Table 15 shows that of the office visits of this physician's primary care patients, almost half, 46.4%, were to this physician, and another 40% were to specialists. The physician might compare this information with statewide comparison tables to see if this distribution is similar to that for others in his or her specialty.

Table 16 shows that the average age of this physician's patients is 74 years and that only 5.6% are over age 85. In addition, there are more women than men (65.2% women) among this physician's 89 primary patients.

Table 17 introduces the concept of case mix. In these office practice profiles, the case mix of a particular physician may differ from the case mix of other physicians' patients. Therefore, we used ambulatory care groups (ACGs) to partially account for differences in health services use based on a person's age, gender, and patterns of morbidity over time (Weiner, 1991; Weiner, Starfield, Steinwachs, & Mumford, 1991). ACGs document the number of different comorbidities a patient

Table 4. Specifications

Recommended care Primary care office o home visit, or visit with specialist, onc in each half year
Limited-use care Total cholesterol
HDL cholesterol
Coronary catheterization
ECG without exerc
Exercise stress tes
Echocardiography
Radionuclide studi without exercise
Radionuclide stuc with exercise

Note: AMI=acute myo

Table 4. Specifications for process measures: Ischemic heart disease

	Data source	Notes
Recommended care		
Primary care office or home visit, or visit with specialist, once in each half year	CPT: 90000–90170 (90100–90170) 90600–90699 90750,90760	The regular follow-up of patients with ischemic heart disease is important to monitor for management of angina, infarction, cardiac failure, or arrhythmias. The ABFP recommends follow-up at 3- to 6-month intervals for patients with ischemic heart disease (Levine & Nong, 1990, p. 37).
Limited-use care		
Total cholesterol	CPT: 80012–80019 80050,80053 80060–80062 80065,82465 82470 83700–83720	Elevated serum cholesterol is a known risk factor for AMI (Goroll et al., 1981, p. 42). The American College of Physicians (ACP) (Hayward et al., 1991, p. 769) and the ABFP (Levine & Nong, 1990, p. 37) recommend frequent or appropriately timed cholesterol tests for patients with IHD.
HDL cholesterol	CPT: 80061–80062 80065,83718	Since risk of CAD is inversely correlated with HDL cholesterol level, periodic monitoring of HDL cholesterol is warranted for assessment of risk (Goroll et al., 1981, p. 97).
Coronary catheterization	CPT: 93547–93553	The extent of coronary disease, as revealed by coronary angiography is an important predictor of the risk of death from CAD. Coronary angiography is indicated for selected patients, including those with incapacitating angina who are already on a maximum medical program (Hutter, 1988, p. 8; Levine & Nong, 1990, p. 12).
ECG without exercise	CPT: 93000–93014	The resting ECG is a standard tool in diagnosing ischemic heart disease (Levine & Nong, 1990, p. 10). ST depression indicates ischemia.
Exercise stress test	CPT: 93015 or 93017 and 93018 (revised definition)	In the absence of an ST-segment depression on a resting ECG, an exercise stress test can help in diagnosing ischemic heart disease in patients with chest pain (Levine & Nong, 1990, p. 10) or silent ischemia.
Echocardiography	CPT: 93307–93350	A resting echocardiogram can identify myocardial involvement, provide a good measure of ventricular size and function, and help rule out other types of cardiac disease such as cardiomyopathy or valvular disease (Levine & Nong, 1990, p. 12).
Radionuclide study without exercise	CPT: 78414–78445 78460,78464 78466–78474 78481,78484	A resting radionuclide study can be useful in distinguishing the etiology of cardiac disease (e.g., a poorly functioning left ventricle versus coronary disease). Multigated studies provide data about the size, contraction pattern, and ejection fraction of a resting heart (Hutter, 1988, p. 6). Nuclear medicine studies tend to be more expensive than other studies, however, and physicians may wish to limit their use (Levine & Nong, 1990, p. 12).
Radionuclide study with exercise	CPT: 78461,78465 78475-78479 78485,78486 78487,78489	A radionuclide study with exercise can demonstrate areas of ischemia by showing defects that reperfuse after rest. Information about wall motion abnormalities and ejection fraction contribute to the diagnosis of ischemia (Wilson et al., 1991, p. 966). The caveat about the use of radionuclide studies also applies here.

Note: AMI=acute myocardial infarction; CAD=coronary artery disease

Table 5. Specifications for process measures: Congestive heart failure

	Data source	Notes
Recommended care		
Primary care office or home visit, or visit with cardiologist	CPT: 90000–90080 (90100–90170) 90600–90699 90750,90760	The primary care visit for patients with CHF is important in monitoring drug doses, drug side effects, or symptoms of heart failure. Most primary care practitioners schedule office visits 2–4 months apart (Fleg et al., 1989). For this profile, 2 visits per year are considered minimal care.
Potassium, serum	CPT: 80002–80019 80060,80062 80065,84132	Close monitoring of serum potassium is necessary for patients who are receiving diuretics, as most patients with CHF do, particularly if the patient also receives digoxin (Cohn, 1988).
Limited-use care		
Echocardiography	CPT: 93307–93350	Echocardiography (sonography) can provide accurate measurements of cardiac chambers, wall thickness, and valvular structures (Nong & Reams, 1990, p. 12). This technique should be limited to patients suspected of having cardiac valve disease.
ECG	CPT: 93000–93014	While ECGs do not confirm the presence or absence of heart failure, they provide clues to the etiology of the failure (Nong & Reams, 1990, p. 11).
Chest X-ray	CPT: 71010–71035	The chest radiograph provides an indication of underlying cardiac abnormality and information regarding the status of the failure itself (Nong & Reams, 1990, p. 11). While useful, the chest X-ray is not a very sensitive screening test for heart failure (Branch, 1987, p. 129). The history and signs detected at physical exam are more important for monitoring and managing the patient with CHF.
Contrast angiography	CPT: 93546–93553	Injection of radiographic contrast agent into coronary arteries or left ventricle permits assessment of coronary artery stenosis or ventricular ejection fraction (Wilson et al., 1991, pp. 872–874). This technique is useful only for patients known or suspected to have IHD in addition to CHF.
Exercise stress test (ECG)	CPT: 93015–93018	Stress testing provides information about ventricular function and myocardial ischemia (Wilson et al., 1991, p. 966). Exercise testing may help identify the cause of heart failure (Nong & Reams, 1990, p. 12). Exercise tolerance is an important tool to evaluate the efficacy of treatment (Cohn, 1988) and to identify a safe range for heart rate during exercise (Abrams & Berkow, 1990, pp. 280–281). However, exercise testing is contraindicated for patients with unstable angina, probable AMI, severe aortic stenosis or hypertension, or uncontrolled arrhythmias (Branch, 1987, p. 57) or for those who are asymptomatic (Branch, 1987, p. 63).

Table 6. Specifications fo

Recommended care
Primary care office or home visit
Limited-use care
Spirometry
Chest X-ray
Home oxygen therapy
Blood gases

Table 6. Specifications for process measures: Chronic obstructive pulmonary disease

	Data source	Notes
Recommended care		
Primary care office or home visit	CPT: 90000–90080 (90100–90170) 90600–90699 90750,90760	The primary care visit is important in monitoring the course of a progressive disease. A minimum of 3 visits per year is recommended by the ABFP (Johanson & Harris, 1988, p. 35). For this profile, 2 visits per year are considered minimal care.
Limited-use care		
Spirometry	CPT: 94010–94200	Spirometry provides a measure of a patient's vital capacity and lung functioning. The ABFP (Johanson & Harris, 1988, p. 35) recommends that spirometry be performed at every routine visit. Spirometry has been placed in the limited-use category to reflect that patients with mild disease may not require frequent or even yearly spirometry.
Chest X-ray	CPT: 71010–71035	A chest X-ray is important in patients with exacerbations of disease to check for pneumonia. Chest X-rays can also assist in making a diagnosis of CHF for patients with COPD. Chest X-rays also can provide information about hyperinflation and changes in vascular markings (Fanta & Ingram, 1988, p. 11). The ABFP (Johanson & Harris, 1988, p. 35) suggests that yearly chest X-rays may be warranted for some patients according to their clinical condition.
Home oxygen therapy	CPT: E0410,E0416, E0425,E0430, E1400,Q0043, Q0046	Patients with severe COPD (pO_2 < 60 mm Hg) may benefit from home O_2 therapy (Goroll et al., 1981, p. 218), but the need should be documented. Physicians with a higher proportion of patients on home oxygen therapy than the statewide average may have a patient population that is more severely ill.
Blood gases	CPT: 82790-82817 94700-94715	Blood gases are important to measure oxygenation of the blood and CO_2 retention, factors that may affect the treatment plan. Yearly measurement of blood gases is recommended by the ABFP (Johanson & Harris, 1988, p. 35). Blood gases have been placed in the limited-use category to reflect the fact that patients with mild disease may not need a yearly blood gas determination. (Note: Blood gas measurements done in the hospital are excluded.)

Table 7. Specifications for process measures: Osteoarthritis

	Data source	Notes
Recommended care		
Primary care office or home visit	CPT: 90000–90080 (90100–90170) 90600–90699 90750,90760	The primary care visit is important in monitoring the course of a progressive disease. The American College of Rheumatology (1989, p. 12) suggests a minimum of an annual visit to a primary care physician. Any patient who appears in this profile meets this minimum requirement.
Limited-use care		
Physical therapy visits	CPT: 97110–97799 97145	Physical therapy can play an important role in aiding an individual with osteoarthritis to maintain or improve flexibility and mobility. Cassel et al. (1990, p. 190) suggest that physical therapy visits are an important part of a total therapeutic plan for arthritis. Physical therapy is listed as a limited-use item because not all patients will require this specialized service.
Diathermy	CPT: 97024	Diathermy generates heat aimed at specific joints, thereby relieving the discomfort of arthritis and improving the patient's mobility. Although heat is often recommended for arthritic patients, the mechanism of benefit is unknown (Robinson, 1990a, p. 7). Goroll et al. suggest that diathermy may be an expensive alternative where simpler measures would suffice (1981, p. 698).
Ultrasound	CPT: 97128	Therapeutic ultrasound warms affected joints. As with diathermy, Goroll et al. (1981, p. 698) suggest that less expensive methods for relieving pain and discomfort exist.
Hot or cold packs	CPT: 97010	Hot or cold packs represent the inexpensive alternative to ultrasound and diathermy. As mentioned above, the mechanism of benefit for heat or cold is unknown (Robinson, 1990a, p. 7).
Exercises	CPT: 97110–97114 97260–97261 97530–97531	Passive range-of-motion exercise can sometimes aid the maintenance of joint motion (Robinson, 1990a, p. 7). Active exercise may help preserve muscle strength (Robinson, 1990a, p. 7). Isometric exercises may also help (Robinson, 1990a, p. 7). The benefit from exercise will depend on the individual patient, hence the inclusion as a limited-use item.

experiences over a year. Table 17 shows that 21.3% of this physician's patients had a single type of medical condition, about half had two to three types of medical conditions, and the rest had four or more medical conditions.

Table 18, which shows the expected service use for primary patients, is based on two concepts: (1) case mix adjustment and (2) resource units. Based on the diagnoses occurring on the claims file over a 1-year period, all patients are assigned to an ACG

Table 8. Hospital

Condition
Ketoacidosis
Hyperosmolar coma
Other coma
Hypoglycemic coma
Lower extremity amputation

*If patients have more
†Some patients were d
no follow-up ambulato
study period so no foll
readmitted.
‡The average number
up visit.
§These numbers reflect

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Table 8. Hospital admission for treatment of selected complications: Diabetes

Condition	Patients admitted*	Number of admissions	Percent admitted	Percent of discharges with no visit†	Average days until visit†	Confidence interval percent admitted§
Ketoacidosis	18	18	0.15	11.76	8.20	0.08–0.22
Hyperosmolar coma	8	9	0.07	20.00	48.50	0.02–0.11
Other coma	6	6	0.05	0.00	7.00	0.01–0.09
Hypoglycemic coma	20	21	0.16	10.00	24.06	0.10–0.24
Lower extremity amputation	64	74	0.53	21.82	26.84	0.40–0.66

*If patients have more than one hospitalized complication, they are included in each category.
†Some patients were discharged to home (i.e., did not die in the hospital or enter a skilled nursing facility) but had no follow-up ambulatory visits. There are many possible explanations: Patient was discharged near the end of the study period so no follow-up dates; patient died shortly after discharge; no follow-up visit occurred; patient was readmitted.
†The average number of days after discharge until the visit is presented only for those patients who had a follow-up visit.
§These numbers reflect the 95% confidence interval for the percentage of patients admitted.

that reflects the seriousness and number of unique conditions that affect each of them. The primary physicians' use of resources for their patient panels can be adjusted for differences in case mix by comparing actual use of resources to the resources that would be expected for patients with similar case mix.

As is shown on Table 18, if this physician's patients have an expected use index of less than 1.00, this means that, after taking case mix into account, this physician's patients can be expected to consume less than the statewide average. It indicates not the actual services delivered to this physician's patients but rather what would be expected based on statewide average for patients with similar comorbidities.

Standard resource units (showing costs of ambulatory utilization and total use of services) are applied to services to enable overall comparisons of the intensity of practice style. Standard resource units are used instead of billed charges or paid charges to avoid an inappropriate emphasis on cost. For example, we might wish to examine the use of various types of laboratory tests, each of which is priced differently depending on which laboratory performed the test, the region of the country, and the type of laboratory test. For inpatient information, we based our standardized reimbursement on the rate paid per DRG in Maryland, and for outpatient procedures, we used the HCFA resource based relative value scale (RBRVS) weights, ignoring geographic factor price differentials, multiplied by the approximate 1992 factor of $31. (When no RBRVS weight was available, we used the average reimbursement in Maryland for the procedure. For further details, see Parente et al., 1994.)

Table 19 is the first of three tables that show the number and percentage of this physician's primary patients who were hospitalized and the amount of services they used in the

Table 9. Specifications for hospital admissions for selected complications

Selected complications	Data source	Notes
Diabetes		
Ketoacidosis	ICD-9: 250.1	Ketoacidosis is an acute metabolic complication of diabetes (Wilson et al., 1991, p. 1,749).
Hyperosmolar coma	ICD-9: 250.2	Hyperosmolar nonketonic hyperglycemia can cause coma in the diabetic (Wilson et al., 1991, pp. 2,051–2,052).
Other coma	ICD-9: 250.3	Hyperglycemia with ketoacidosis is one of several conditions that can cause coma in diabetic patients (Wilson et al., 1991, pp. 2,051–2,052).
Hypoglycemic coma	ICD-9: 251.0	Hypoglycemia is a common complication of diabetes and may lead to coma (Allerheiligen et al., 1990, p. 25; Wilson et al., 1991, p. 1,747).
Lower-extremity amputation	CPT: 27590–27598 27880–27889 28800–28825	Since diabetics are prone to arteriosclerotic vascular disease and foot ulcers (Wilson et al., 1991, p. 1,753), failure to inspect the feet or to teach patients proper foot care may contribute to the need for lower-extremity amputation.
Hypertension		
Cerebrovascular accident	ICD-9: 431,434.x, 436,437,437.0 437.1,437.9 (revised definition)	Patients with hypertension have an increased risk of stroke, which may be due to ischemia or intracerebral hemorrhage (Wilson et al., 1991, p. 1,978).
Transient cerebral ischemic attack	ICD-9: 435–435.9	The cerebrovascular conditions that often accompany hypertension may lead to either TIA or CVA (Wilson et al., 1991, pp. 1,977–1,978).
Acute myocardial infarction	ICD-9: 410.xx (revised definition)	Hypertension is a risk factor for both IHD and AMI (Abrams & Berkow, 1990, p. 337).
Hyperkalemia	ICD-9: 276.7	Beta-blockers and ACE inhibitors (drugs often taken by patients with hypertension) increase the risk of hyperkalemia, particularly for patients with impaired renal function (AMA, 1990, p. 488; Wilson et al., 1991, p. 288).
Hypokalemia	ICD-9: 276.8	The risk of hypokalemia is especially high for elderly patients being treated with both digitalis and a thiazide diuretic (Culik et al., 1990, p. 24).
Congestive heart failure	ICD-9: 402.01,402.11 402.91,428.xx	Hypertension predisposes the affected patient to CHF (Abrams & Berkow, 1990, p. 337).
Ischemic heart disease		
Acute myocardial infarction	ICD-9: 410.00–410.91	A myocardial infarction can result from ischemic heart disease.
Ventricular arrhythmia	ICD-9: 427.1,427.41 427.42	Ventricular tachycardia and ventricular fibrillation may occur in patients with a myocardial infarction (Wilson et al., 1991, p. 958).
Congestive heart failure	ICD-9: 402.01,402.11 402.91 428.0–428.9 429.9	Left heart failure can result from a myocardial infarction (Wilson et al., 1991, p. 960).

Table 9 *continued*

Selected complications
Congestive heart fa
Congestive heart failure
Arrhythmias
Pulmonary embo
Volume depletion
Chronic obstructive
Pneumonia
Acute bronchitis
Influenza
Congestive heart failure
Osteoarthritis
Osteoarthritis
Hip replacement
Knee replacemen
Acute renal failure
GI bleeding or ulce

Note: GI=gastrointestina

Table 9 *continued*

Selected complications	Data source	Notes
Congestive heart failure		
Congestive heart failure	ICD-9: 402.01,402.11 402.91 428.0–428.9 429.9	Hospitalization for CHF is often due to poor patient adherence to dietary and medical regimes, inadequate physician responses to early signs of CHF decompensation, or both.
Arrhythmias	ICD-9: 427.0–427.9	Arrhythmia is both a cause and a complication of heart failure (Cohn, 1988; Wilson et al., 1991, p. 891).
Pulmonary embolism	ICD-9: 415.1	Low cardiac output, sometimes present in CHF, increases the risk of pulmonary emboli (Wilson et al., 1991, p. 890).
Volume depletion	ICD-9: 276.5	Overtreatment of the CHF patient with diuretics may lead to hypovolemia (Wilson et al., 1991, p. 895), and hospitalization may be necessary to restore fluid and electrolyte balance.
Chronic obstructive pulmonary disease (COPD)		
Pneumonia	ICD-9: 480.0–486	Pneumonia due to viruses or bacteria may exacerbate bronchitis in patients with COPD (Abrams & Berkow, 1990, p. 447).
Acute bronchitis	ICD-9: 466.0,490 491.21	An acute attack of bronchitis in an elderly person with COPD is usually due to viral infection (Cassel et al., 1990, p. 371).
Influenza	ICD-9: 487.0–487.8	Viral infections (e.g., influenza) may lead to exacerbation of bronchitis in patients with COPD (Abrams & Berkow, 1990, p. 447).
Congestive heart failure	ICD-9: 402.01,402.11 402.91 428.0–428.9 429.9	Heart failure is a common form of cardiac decompensation in elderly patients with COPD (Abrams & Berkow, 1990, p. 451).
Osteoarthritis		
Osteoarthritis	ICD-9: 715.xx	Patients with severe arthritis may occasionally require hospitalization for the management of their arthritis or its complications (American College of Rheumatology, 1989, p. 12).
Hip replacement	CPT: 27130–27138 ICD-9: 81.51–81.53 81.61–81.69	Patients with advanced hip disease may be candidates for hip replacement (Robinson, 1990a, p. 8; Wilson et al., 1991, p. 1,479).
Knee replacement	CPT: 27437–27447 ICD-9: 81.41,81.54	Patients with advanced knee disease may be candidates for knee replacement (Abrams & Berkow, 1990, p. 756; Robinson, 1990a, p. 8).
Acute renal failure	ICD-9: 584.xx 586.xx	Prolonged treatment with NSAIDs can lead to acute renal failure. Although drugs are not included in the claims database, the sequelae are included. This component includes patients with a variety of etiologies (Cassel et al., 1990, p. 191; Robinson, 1990a, p. 7).
GI bleeding or ulcer	ICD-9: 531.00–535.61 578.0–578.9	A common side effect of treatment with NSAIDs is GI bleeding or ulceration. Many patients with OA will be taking NSAIDs. This component includes patients with a variety of etiologies (Cassel et al. 1990, p. 191).

Note: GI=gastrointestinal; OA=osteoarthritis; NSAIDs=non-steriodal antiinflamatory drugs

Table 10. Measures of utilization: Diabetes

Service (visits to)	Number of services	Percent of services	Number of patients	Percent of patients
Assigned primary physician	49,660	68.24	8,347	99.90*
Other general medicine physicians	5,664	7.78	2,393	28.64
Ophthalmologists†	1,343	1.85	633	7.58
Podiatrists	1,800	2.47	802	9.60
Cardiologists	10,436	14.34	3,552	42.51
Other specialists	1,956	2.69	1,342	16.06
Emergency departments				

*This number does not equal 100% of patients assigned to a primary physician because some primary patients were seen in the emergency department only.
†Information on ophthalmologists is not shown because of data problems.

Table 11. Specifications for encounter utilization measures: Congestive heart failure, diabetes, hypertension, ischemic heart disease, osteoarthritis, chronic obstructive pulmonary disease

Specialists and emergency department use	Data source	Notes
Assigned primary physician	Self-assigned specialty	The general medicine physician who provided more visits than any other general medicine physician.
Other general medicine physicians	Self-assigned specialty	Internal medicine, family practice, and general practice physicians.
Cardiologist	Self-assigned specialty	Since congestive heart failure is often found with chronic obstructive pulmonary disease, a patient with lung disease may seek care from a cardiologist. Since arteriosclerotic heart disease is a complication of diabetes, cardiologists are an important source of nonprimary care for these patients. Cardiology specialists also represent an important source of nonprimary care for patients with congestive heart failure, ischemic heart disease, and hypertension.
Cardiac/thoracic surgeon	Self-assigned specialty	Ischemic heart disease patients requiring surgery will generally visit a cardiac or thoracic surgeon.
Ophthalmologist or optometrist	Self-assigned specialty	Patients with diabetes need regular eye examinations with dilated pupils.
Orthopedic surgeon	Self-assigned specialty	Osteoarthritis patients with severe limitation of motion may require joint replacement by an orthopedic surgeon.
Other specialists	Self-assigned specialty	Patients with any condition may require a range of other specialists' care.

Table 11 *continued*

Specialists and emergency department use
Podiatrist
Pulmonary specialist
Emergency department
X-rays
Foot
Hip
Knee
Spine

hospital. Of the 89 pat
were hospitalized; 9% w
6.7% twice, and 4.5% t
Table 20 shows that
hospitalized patients w

Table 11 *continued*

Specialists and emergency department use	Data source	Notes
Podiatrist	Self-assigned specialty	Since foot problems are common in diabetics, these patients may require podiatric services.
Pulmonary specialist	Self-assigned specialty	Pulmonary specialists represent an important source of nonprimary care for chronic obstructive pulmonary disease patients.
Emergency department	CPT: 90500–90580	Patients may seek emergency department treatment for a variety of reasons. Patients with chronic obstructive pulmonary disease, for acute exacerbations of their pulmonary disease. Patients with diabetes, for sudden worsening of their condition. Patients with hypertension, for acute complications of hypertension. Patients with congestive heart failure or ischemic heart disease, for sudden worsening of their condition. In addition, the primary care physician may refer them to the emergency department if a myocardial infarction is suspected. Emergency department use may indicate failure of control in the ambulatory care setting or failure of patient compliance with therapy.
X-rays		
Foot	CPT: 73620,73630	Patients with osteoarthritis may require various joint X-rays to monitor the course of their disease (Olsen, 1989, p. 8).
Hip	CPT: 73500,73510 73520,73525 73526,73530	
Knee	CPT: 73560,73562 73564,73580 73581	
Spine	72010,72020 72040,72050 72052,72072 72074,72080 72090,72100 72110,72114 72120,72070	

hospital. Of the 89 patients, a total of 20.1% were hospitalized; 9% were hospitalized once, 6.7% twice, and 4.5% three or more times.

Table 20 shows that most, 80.6%, of the hospitalized patients were discharged home but that 11.1% died in the hospital. During their, on average, 8.8-day stay, these patients were visited by this physician and by other physicians.

Table 21 shows the resources consumed

Table 12. Visits to your office by Medicare patients

Medicare group	Number of patients	Percent of patients	Number of visits	Percent of visits
All Medicare patients	119	100.0	247	100.0
Your primary patients	89	74.8	195	78.9
Your nonprimary patients	30	25.2	52	21.1

by the hospitalized patients translated into dollar equivalents. On average, the hospitalized patient used about $10,000 worth of resources per admission, of which the majority was for Part A, institutional charges. Recall that the same resource unit is assigned to all services of the same type regardless of what the provider's charge or payment actually was. Thus, the resource units are not influenced by provider specialty or location.

Table 22 is the first of three tables showing tests and procedures. It shows that the clinical laboratory utilization was on average almost two tests per patient per year. Of these, chemistry tests were the most frequent.

Table 23 shows X-ray and imaging services. It is understandable that the table shows all the services as performed by others since this physician is a family practitioner and not a radiologist.

Table 24 shows the distribution of other diagnostic services. This physician's patients had, on average, .91 electrocardiograms (ECGs) during the year but no sigmoidoscopies.

Table 25 provides a summary of the tables on hospitalizations and procedures by comparing the actual resource units per patient with the expected resource units after controlling for case mix. The last column shows that this physician's patients had fewer than expected visits (the ratio is 8.0) but that the resource units consumed at those visits were higher than expected (1.13). The resource units in the hospital were higher than expected but for laboratory, radiological, and diagnostic imaging lower than expected.

In sum, the office practice profile for this physician suggests that the 89 patients use more hospital resources than would be expected if the physician's practice was the same as the other physicians in his specialty in the state. While the patients have fewer than expected office visits, those visits are more resource intensive than expected given

Table 13. Patterns of care seeking by your Medicare patients

	Number of patients	Percent of patients
Primary patients		
Seen only by you	30	33.7
Seen by you and others	59	66.3
Seen by another general medicine physician	16	18.0
Seen by a specialist	46	51.7
Seen by a single- or multispecialty group	15	16.9
Seen by a nonphysician provider	9	10.1
Total	89	100.0
Nonprimary patients		
Seen by you only once	19	63.3
Seen by you more than once	11	36.7
Total	30	100.0

Table 14. Average num

Visits by primary patients	A nu
To you	
To all others	
Total	

Table 15. Percentage di

Type of visit
New patients
Established patients
Brief*
Limited
Intermediate
Extended
Comprehensive
Total

*Given the 7/1/90–6/30/91 ti

Table 16. Age and ge your primary patients

	Num of patie
65–74 years	52
75–84 years	32
85+ years	5
Female	58

Note. Total primary patients = years; range = 65–91 years.

Table 14. Average number of office visits by your primary patients

Visits by primary patients	Average number of visits	Patient distribution by their number of visits				
		0	1	2–4	5–9	10+
To you	2.2	0.0	39.3	56.2	4.5	0.0
To all others	2.5	33.7	18.0	31.5	13.5	3.4
Total	4.7					

Table 15. Percentage distribution of ambulatory visits for your primary patients

Type of visit	Total	To you	General medicine	Specialist	Other
New patients	17.6	1.7	2.6	6.7	6.7
Established patients					
Brief*	3.3	0.0	0.5	2.6	0.2
Limited	7.4	0.0	1.0	5.7	0.7
Intermediate	28.3	6.7	1.2	19.8	0.7
Extended	41.4	38.1	0.0	3.3	0.0
Comprehensive	1.9	0.0	0.0	1.9	0.0
Total	100.0	46.4	5.2	40.0	8.3

*Given the 7/1/90–6/30/91 timeframe of the data, this table uses the old CPT visit categories.

Table 16. Age and gender distribution of your primary patients

	Number of patients	Percent of patients
65–74 years	52	58.4
75–84 years	32	36.0
85+ years	5	5.6
Female	58	65.2

Note. Total primary patients = 89; mean age = 74.0 years; range = 65–91 years.

Table 17. Distribution of your primary patients by type of comorbidities

	Number of patients	Percent of patients
No type of medical condition	0	0.0
A single type of medical condition	19	21.3
2–3 types of medical conditions	43	48.3
4–5 types of medical conditions	16	18.0
6–9 types of medical conditions	10	11.2
10+ types of medical conditions	1	1.1

Table 18. Expected service use for your primary patients based on their case mix

Type of service	Expected use index (average = 1.00)
Based on total visits	0.87
Based on total ambulatory care* resource units	0.86
Based on total resource units (all settings)	0.91

*Ambulatory care is defined as services occurring outside of an inpatient setting, including outpatient services provided by a hospital.

Table 19. Distribution of inpatient admissions among your primary patients

	Total	Number of admissions 0	1	2	3+
Number of patients	89	71	8	6	4
Percent of patients	100.0	79.8	9.0	6.7	4.5

Table 20. Discharge status, length of stay, and inpatient visits to your primary patients

	Total
Percent of patients hospitalized (one or more times)	20.2
Percent of discharges:	
Percent discharged home	80.6
Percent transferred to skilled nursing facility	0.0
Percent died in hospital	11.1
Percent other	8.3
Inpatient visits per discharge	
By you	3.4
By others	4.5
Average length of stay per discharge (days)	8.8
Visit per day in the hospital	0.9

Table 21. Total hospital resource consumption of your primary patients

Average Part A resource units	
Per hospitalized patient	19,096.9
Per admission	9,548.4
Average Part B resource units (provided in hospital)	
Per hospitalized patient	1,963.0
Per admission	981.5
Average total resource units	
Per hospitalized patient	21,059.9
Per admission	10,529.9

the patients' burden of illness. Overall, the patients use 36% more resources than would be expected.

Does this mean that this physician's type of practice is inappropriately expensive? The answer is no for several reasons. First, as shown on almost all of these tables, some services are provided by other physicians over whom the physician may have no control or, in some cases, even knowledge. Second, the differences between this physician's actual and expected resource consumption may not be statistically significant. Third, there may be patient characteristics that influence the use of resources that were not accounted for by the case mix adjustment. For example, if compared with the specialty group, this physician admits fewer patients to the hospital, those who are admitted may be more severely ill, and thus their more intensive use of hospital services may be warranted. Thus, this information should be used as a tool for physicians to better understand their practice and how they

Table 22. Distribu

Chemistry
Hematology
Other lab*
Total

*Other laboratory servic
those explicitly describe

compare with their p
evaluating physician

Prevention profiles

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Table 23. Distributi

X-ray
Ultrasound
Computed tomography
Magnetic resonance imaging
Other imaging*
Total

*Other imaging services
those explicitly described

Table 22. Distribution of clinical laboratory services for your primary patients

	Total		Performed by you		Performed by other providers	
	Services per patient	Resource units per patient	Service per patient	Resource units per patient	Service per patient	Resource units per patient
Chemistry	0.94	10.13	0.15	0.44	0.80	9.70
Hematology	0.40	3.31	0.00	0.00	0.40	3.31
Other lab*	0.51	6.45	0.00	0.00	0.51	6.45
Total	1.85	19.89	0.15	0.44	1.71	19.46

*Other laboratory services are defined as those procedures listed in the CPT-4 ranges of 80000–87999 other than those explicitly described above.

compare with their peers and not as a way of evaluating physicians' practice costs.

Prevention profiles

This profile, Figure 1, was developed to demonstrate the capability of the system to measure and report preventive care patterns. Categories for items included both recommended care and limited use items. Measures include influenza immunizations, sigmoidoscopy, colonoscopy, as well as Pap smears and mammography for women. However, since Medicare did not pay for many of these

Table 23. Distribution of X-ray/imaging services for your primary patients

	Total		Performed by you		Performed by other providers	
	Services per patient	Resource units per patient	Services per patient	Resource units per patient	Services per patient	Resource units per patient
X-ray	1.46	50.98	0.00	0.00	1.46	50.98
Ultrasound	0.13	12.40	0.00	0.00	0.13	12.40
Computed tomography	0.09	15.96	0.00	0.00	0.09	15.96
Magnetic resonance imaging	0.06	17.58	0.00	0.00	0.06	17.58
Other imaging*	0.01	1.08	0.00	0.00	0.01	1.08
Total	1.75	98.00	0.00	0.00	1.75	98.00

*Other imaging services are defined as those procedures listed in the CPT-4 ranges of 70010–76999 other than those explicitly described above.

	Total		Your practice		Other providers	
	Number	Percent	Number	Percent	Number	Percent
Recommended care:						
Influenza vaccine						
Pap smear (female only)						
Mammogram (female only)						
Limited use:						
Sigmoidoscopy						
Colonoscopy						
Prostate antigen test (male only)						

Figure 1. Number and percentage of your primary patients receiving preventive care services.

Table 24. Distribution of other diagnostic services for your primary patients

	Total		Performed by you		Performed by other providers	
	Services per patient	Resource units per patient	Services per patient	Resource units per patient	Services per patient	Resource units per patient
ECG	0.91	17.22	0.24	6.13	0.67	11.09
Sigmoidoscopy	0.00	0.00	0.00	0.00	0.00	0.00
Undifferentiated upper GI visualization	0.01	2.65	0.00	0.00	0.01	2.65
Other testing*	0.47	34.36	0.00	0.00	0.47	34.36
Total	1.39	54.23	0.24	6.13	1.15	48.10

*Other testing services are defined as those procedures listed in the CPT-4 ranges of 93000–93499 and 93850–95999 other than those explicitly described above.

Table 25. Actual to ex

Type of service
Ambulatory
Visits (from Table 15
Resource units
Hospital
Part A resource units (from Table 21)
Part B resource units (from Table 21)
Ancillary
Laboratory resource units (from Table 2
X-ray/imaging resource units (from Table 23)
Diagnostic testing resource units (from Table 24)
Unspecified resource units
Total hospital resource units
Total nonhospital resource units
Overall total

items during the study perio
were not found on claims E

Disseminating and evalua

Feedback

We used a mixed strate
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Table 25. Actual to expected resource comparisons for your primary patients

Type of service	Actual resources per patient	Expected resources per patient	Actual/expected ratio
Ambulatory			
Visits (from Table 15)	4.72	5.91	0.80
Resource units	1,432.91	1,268.43	1.13
Hospital			
Part A resource units (from Table 21)	3,862.29	2,551.57	1.51
Part B resource units (from Table 21)	397.01	261.27	1.52
Ancillary			
Laboratory resource units (from Table 22)	19.90	47.55	0.42
X-ray/imaging resource units (from Table 23)	98.00	105.42	0.93
Diagnostic testing resource units (from Table 24)	53.58	69.11	0.78
Unspecified resource units	578.57	618.42	0.94
Total hospital resource units	4,259.30	2,812.84	1.51
Total nonhospital resource units	1,501.34	1,433.61	1.05
Overall total	5,760.63	4,246.45	1.36

items during the study period, these services were not found on claims before 1992.

Disseminating and evaluating profiles

Feedback

We used a mixed strategy to feed back preliminary results to physicians. First, physicians who were part of the development process were shown the results of profiling in a series of briefings in each state. Next, a special continuing medical education (CME) workshop was conducted in each state, during which participating physicians received profiles both for their specialty group and for their own patient population (for office-based profiles only). Physicians involved in the project who did not attend the workshop received their profiles through the mail.

The profiles we developed are valuable only if physicians can understand the data (i.e., locate a piece of information or derive an answer from the tables) and use these data to stimulate interpretation of the findings and their implications. During the CME workshop, we addressed both these issues. Returning to the example of annual ophthalmology examinations, 88% of physicians at the workshop read and interpreted the profile correctly. The percentage of diabetes pa-

tients with no annual exam was agreed to be informative by 84% of physicians, provocative by 63%, and believable by 61%. In terms of the office practice profile, 60% of physicians agreed with the statement that "this profile accurately represents my practice," and 89% agreed that the comparative information for their specialty was interesting. Only 30% agreed that there were too many tables in the profile (Delmarva Foundation for Medical Care, Inc., 1993).

Reliability

Information on diagnoses and procedures on claims data was compared with information contained in the medical record in order to evaluate the accuracy of the claims data. This analysis shows claims to be specific but not sensitive (Fowles et al., 1993). That is, if no claim could be found with a particular diagnosis, chances are the patient did not have the disease (high specificity). On the other hand, the record frequently showed a diagnosis for which no claim could be found (low sensitivity). We also found that claims more often indicated tests and procedures than had been documented in the primary care physician's record. (These discrepancies are partially explained by the fact that we did not also have access to specialty physicians' records and that lab test claims did not include the billing number of the ordering physician.)

If the claim is used as the gold standard for services, then the primary care record can be said to have a high false-negative rate. This implies that the claim is a better tool than the record for determining whether a patient received a service.

We concluded that the claims data are appropriate for meeting our objective, which was to develop measures of primary care by determining whether patients with a specific disease received services recommended for that disease. While the claims data underestimate the prevalence of a disease, they provide a fair picture of conformance to treatment guidelines. If there is a bias, it is in the direction of indicating more often that physicians are conforming to recommended care because there probably are more cases missing from the denominator (number of patients with the condition) than from the numerator (number of services provided; Fowles et al., 1993).

Validity

We are examining the face validity of the profiles, whether the measures appear to make sense (Abramson, 1990), by having physicians compare the interpretation of the profiling results against an interpretation they derive from the office record. For example, if the claim indicated that a patient with diabetes did receive a hemoglobin A1c test, then the physician reviews the record to see if that care was appropriate. This review suggests that the presence of a claim for recommended care items in the condition-specific profiles indicates good quality care. If the claim is not found, three categories of reasons appear to explain its absence:

1. The patient did not need the service.
2. The service may have been provided outside the Medicare system, for example, in a Veterans Administration hospital.
3. The patient may not have received a needed service.

For limited-use items, the analysis aids in the interpretation of the data.

• • •

In this article, we described the four attributes of physicians' practice profiles that make the profiles useful for quality improvement: (1) flexibility, (2) user involvement in developing profiles, (3) explicit plans for evaluation, and (4) fairness to groups of providers. Then we
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REFERENCES

Abrams, W.B., & Berkow,
Merck manual of ge
Merck & Co.
Abramson, J.H. (1990). *S*
munity medicine. Ne
Livingstone.
Allerheiligen, D.A., Erwin,
Smith, C.W. (1990). *D*
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American College of Rh

providers. Then we presented a profiling system that we developed using Medicare data. This claims dataset is well suited for profiling focused on quality of care because it includes information on the vast majority of persons age 65 and older, because people remain continuously enrolled, and because many services are covered (with the exception of many preventive services and prescription drugs).

The system presented here can also serve as a model for physician profiling in private managed care organizations if the limitations in many private health insurance claims datasets can be overcome. These datasets may be problematic because people change insurance plans, different sets of services are covered by different plans, and physicians' practices are fragmented among many payors (with the important exception of physicians who are members of PPOs or HMOs; Garnick, Hendricks, & Comstock, 1994; McNeil, Pederson, & Gatsonis, 1992).

Until now, the measurement of quality in primary care has been underdeveloped compared with the measurement of hospital-based quality (Franks et al., 1993). This discrepancy stems in part from the paucity of databases to use for studying the quality of outpatient care. However, a number of converging forces make it appropriate to begin developing methods to evaluate primary care now. First, newly available datasets such as the NCH file make it possible to track the care received in all settings by large numbers of patients and to link that care back to specific providers. Second, an explosion of activity in the development of practice guidelines gives us benchmarks developed by clinicians that can be used to compare with actual practice. Third, the interest in measuring the quality of primary care has increased (Daley, Gertman, & Delbance, 1988) as more medical care has shifted to the ambulatory setting and as more people may gain access to health care through recent reform proposals.

We believe that the physician profiling tool is a first step in developing a comprehensive system for measuring the quality of ambulatory care in the United States. The next step is to evaluate whether physicians' practice profiling can achieve its potential by conducting a systematic dissemination of profiles to groups of physicians, continuing to monitor their practice patterns, and gauging if there are improvements in the quality of care they provide following their exposure to their own specialty's practice profiles.

REFERENCES

Abrams, W.B., & Berkow, R. (Eds.). (1990). *The Merck manual of geriatrics.* Rahway, NJ: Merck & Co.

Abramson, J.H. (1990). *Survey methods in community medicine.* New York, NY: Churchill Livingstone.

Allerheiligen, D.A., Erwin, D.T., Galazka, S.S., & Smith, C.W. (1990). *Diabetes mellitus reference guide* (3rd ed.). Lexington, KY: American Board of Family Practice.

American College of Rheumatology. (1989). *Guidelines for reviewers of rheumatic disease care.* Atlanta, GA: Atlanta American College of Rheumatology.

American Diabetes Association, Committee on Professional Practice. (1989). Standards of medical care for patients with diabetes mellitus. *Diabetes Care, 12,* 365–368.

American Medical Association. (1991). *Drug evaluations.* Milwaukee, WI: Author.

Branch, W.T. (1987). *Office practice of medicine* (2nd ed.). Philadelphia, PA: W.B. Saunders.