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Measuring Physician Practice Competition Using Medicare Data

Laurence C. Baker, M. Kate Bundorf, and Anne Royalty

11.1 Introduction

Questions about the market structure of physician practices have grown increasingly prominent in contemporary health policy discussions. Market forces over the last couple of decades appear to have favored the growth of larger multispecialty groups, and more and more physicians seem to prefer the practice environment of larger groups to solo or smaller group practices, generating growth in the size of practices and horizontal merger activity (Liehaber and Grossman 2007). Growing vertical integration in health care delivery markets, such as through hospital purchase of physician practices (Kocher and Sahni 2011; O'Malley, Bond, and Berenson 2011), may in some cases effectively increase horizontal integration of practices as well as change vertical market dynamics.

These changes could have a number of important effects (Gaynor and Town 2012). Larger practices could lead to improvements in health care quality and outcomes by improving coordination—patients of organizations with a broader scope and more resources may benefit from things like better information systems, care organization activities, and investments in

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better infrastructure (Ketcham, Baker, and MacIsaac 2007). At the same time, larger practices may be more difficult to effectively manage and more challenging for patients to navigate and, if inefficient, could drive higher costs of care. Larger practices may also increase the amount of concentration in health care markets. If practices gain market power, they may drive prices higher and quality lower (Schneider et al. 2008; Berenson and Ginsburg 2010; Ginsburg 2010; Gaynor 2011; Berenson et al. 2012; Dunn and Shapiro 2014). Hospital acquisition of practices may independently affect prices paid for care (Cuellar and Gertler 2006; Gaynor 2011).

Understanding the impact of changes in physician market structure would help interpret changes in utilization and prices for health care services over recent years. It may also be important for developing policies going forward, with efforts to promote the integration of care delivery at the center of prominent policy efforts to grapple with rising costs (Crosson 2009). Antitrust authorities are increasingly faced with choices about the optimal response to changing practice structures, and recent policy positions promote use of the "rule of reason" in which potentially welfare-improving and welfare-decreasing effects of mergers must be assessed and weighed against each other (Federal Trade Commission [FTC] and Department of Justice [DOJ] 1996; Federal Trade Commission 2011).

While concentration has been well studied in the case of hospitals, and to an important though lesser degree, health insurers (Melnick et al. 1992; Pennsylvania Health Care Cost Containment Council 2007; Antwi, Gaynor, and Vogt 2009; Dafny 2009; Wu 2009; Melnick, Shen, and Wu 2011), there is less evidence about impacts of structural changes in physician markets. One of the primary reasons is a lack of broadly based data on practice market structure that is regularly collected. Some emerging efforts have used data on large samples of physicians to create measures of practice size and organization. Dunn and Shapiro used data that characterized the location and group affiliations of a large number of physicians to construct Herfindahl-Hirschman Indexes (HHIs) for cardiology and orthopedics practices for 2005–2008 (Dunn and Shapiro 2014). Their application creatively uses the physician data, with the drawback that it lacks information about the location of patients from which to identify the market areas of practices. McWilliams and colleagues have developed measures of physician practice structures that mimic Accountable Care Organizations (ACOs) based on American Medical Association (AMA) group practice data (McWilliams et al. 2013). Welch and colleagues have tracked the size of practices using data from the Centers for Medicare and Medicaid Services (CMS) (Welch et al. 2013).

In this chapter, we explore the creation of physician practice concentration measures using Medicare claims data. Medicare claims are available for large numbers of patients over time, and can be used to identify an important dimension of physician practices. We use claims data to construct measures

of practice size and HHIs for physician practices over the period 1998–2010, and explore variations in measures of size and concentration. We explore a number of issues that arise in the construction of claims-based measures that may affect their validity and interpretation.

11.2 Some Conceptual Issues in Practice Definition

Physician practices can be organized in a number of different ways. An individual physician may organize his or her business as a solo practice. Others may work in partnership arrangements or as part of a larger organization commonly called a medical group. Medical groups may have single or multiple sites. In some cases, individual physicians or groups are further integrated into larger structures. Hospitals or health systems, for example, may own physician groups or directly hire physicians. These types of arrangements involve very different sizes of organizations, but they all tend to increase the degree of integration among providers. Physicians working in all of these arrangements are typically part of a financially integrated organization that operates as a single unified business. These organizations may be clinically integrated as well, though there is no guarantee that financial and clinical integration will always be linked.

There are also more loosely integrated organizations. In some cases, physicians with practices organized as separate businesses may agree to jointly acquire office space or practice resources with other doctors, sometimes creating links between multiple doctors who each retain a separate underlying practice. Another example is independent practice associations (IPAs), in which individual physicians or groups retain their independent status but agree to work together for some business purposes.

The types of organizations of primary interest for tracking trends and measuring concentration may depend on the issues being considered. For example, physicians in the same medical group, physicians whose practices are owned by the same hospital, and physicians whose practices are owned by the same system, are generally allowed by law to negotiate jointly over payment and other contract terms with health plans (Casalino 2006). However, under current antitrust law, physicians in separate practices with looser linkages (e.g., practices that are members of IPAs) may only bargain together for risk contracts involving capitation or other withholds that put the bargaining group (e.g., the IPA) at risk for aspects of performance (Federal Trade Commission and Department of Justice 1996; Casalino 2006).[1] Thus,

1. There is some ambiguity in the law. Antitrust law does allow physicians in IPAs to negotiate jointly for nonrisk contracts if they can show that they are sufficiently clinically integrated across their member practices, though IPAs using the clinical integration enforcement safety zone to jointly negotiate nonrisk contracts appear to be uncommon (see Federal Trade Commission 2011). Another source of uncertainty comes from the legality of the so-called messenger model of physician organizations and negotiations (Casalino 2006). This model is

for studies involving prices in nonrisk contracts, it may be more appropriate to focus on financially integrated organizations, while for studies involving risk contract prices, entities such as IPAs would also be relevant.

In addition, for studies focusing on quality of care or other aspects of treatment patterns, a physician's complete set of affiliations may be important, regardless of the organizational structure, while for others (e.g., studies involving the adoption of infrastructure), measures of practice organization that capture more formal organizations may be relevant (Federal Trade Commission 2011; Casalino 2006; Pelnar 2010).

We focus here on measures relevant to financially integrated organizations, which are particularly relevant to studies of fee-for-service prices. Since these organizations constitute a large and important subset of all physician organizations, they may also be more generally useful for studies of effects on quality of care and other outcomes.

11.3 Medicare Claims Data

We use data from the 1998 to 2010 Medicare carrier claims files that include bills for services provided by physicians to a 20 percent sample of traditional (fee-for-service) Medicare enrollees, and corresponding denominator files that record information about enrolled beneficiaries. These contain, among other things, the reported ZIP Code of the patient's residence, the reported ZIP Code of the physician practice, the physician specialty, the Healthcare Common Procedure Coding System (HCPCS) code of the service provided, a physician identifier (UPIN and/or NPI), and the tax identification number (TIN) of the practice.

From these files, we selected claims with positive Medicare-allowed charges, a TIN and provider NPI or UPIN with the correct format, and valid provider and patient ZIP Codes. We restricted attention to claims where the recorded provider specialty code indicated a physician in a named specialty, and we grouped physicians according to specialty for many of the analyses. We excluded claims from pediatrics and obstetrics/gynecology, which may not be well represented in Medicare claims; pain management, which was not defined as a separate specialty in all of the years we study; and preventive medicine, hand surgery, peripheral vascular disease, addiction medicine, and osteopathic manipulative therapy, which had too few claims to effectively analyze.

intended to allow a noninterested third party to collect and convey information from multiple physician practices to payers for the purpose of facilitating contracting, though not to engage in joint negotiations. Some have argued that some messenger model arrangements, in fact, have facilitated unlawful joint contracting. The DOJ and FTC have challenged what they believe to have been abuses of the messenger model, which may limit the degree to which this is an issue, but this remains a debated area and the actual extent of the practice is uncertain.

This left us with thirty-four specialty groupings.[2] The Medicare claims allow the specialty designation "multispecialty group." In the early years of our sample, 4–6 percent of claims used this designation, but its use declined substantially over time. After 2003, 0.5 percent of claims or fewer used this code. In the most recent years of data, the code is present on less than 0.1 percent of claims. Because many of the analyses are at the specialty level, we exclude claims with this specialty designation. In total, we analyze about 150 million claims per year from the early years of the sample, rising to about 215 million claims per year in the later years.

Some of our analyses use Medicare-allowed charges as the unit of output. This is the fee-schedule-based amount that Medicare rules allow the physician to be paid for the service. The doctor may receive some of this amount from the patient by way of applicable copayments. Other analyses use work relative value units (RVUs). We obtained these data from the annual Medicare Fee Schedule files, and attached them to the claims based on reported HCPCS and modifier codes.

11.3.1 Identifying Practices

We identify physician practices using the reported TIN. Solo practice physicians normally have a unique TIN. Financially integrated entities commonly use a single TIN for the physicians in their organization. Physicians in medical group practices, perhaps the most common and most integrated form of practice organization, appear to frequently use the same TIN. Physicians in hospitals or health systems that own practices or employ physicians also appear to commonly use the same TIN, though with some exceptions. Identifying practices using TINs thus provides a means of obtaining useful information about physician organizations. Some previous studies have used tax IDs to identify physician practices as well (Pope et al. 2002; Pham et al. 2007; Welch et al. 2013).

There is some ambiguity in the precise types of organizations that will be identified. For example, a physician group that is purchased by a hospital but retains its structure as a medical group may continue to use a group TIN or could switch to the hospital TIN. Some very large medical groups have organized themselves with subsidiaries that have their own TINs. The TINs should thus be regarded as a measure of physician organizations subject to some noise. It appears likely that to the extent there is bias, this approach would tend to understate the size of organizations and thus underestimate

2. The specialties are internal medicine, family practice, allergy/immunology, cardiology, critical care, dermatology, endocrinology, gastroenterology, geriatrics, hematology, infectious disease, nephrology, neurology, oncology, pulmonary disease, radiation oncology, rheumatology, cardiac surgery, colorectal surgery, general surgery, neurosurgery, ophthalmology, orthopedics, otolaryngology, plastic/maxillofacial surgery, thoracic surgery, urology, vascular surgery, anesthesiology, emergency medicine, pathology, physical medicine/rehabilitation, psychiatry, and radiology.

the concentration of physician practices (McWilliams et al. 2013; Welch et al. 2013). We present evidence below suggesting that this may have only a small effect on overall estimates of competition in physician markets. Looser forms of organizations with little financial integration across practices, such as independent practice associations (IPAs), do not use unified TINs.

One source of information about the types of organizations identified by tax IDs in the claims data is publicly available data from IRS Form 990. A 990 must be filed annually by most tax-exempt organizations in the United States, and the 990s report the name, business type, and TIN of reporting organizations. Many health care organizations file 990s. Though this is only a subset of relevant health care organizations—most small and medium and even many large physician practices, as well as some hospitals, are structured as for-profit businesses—the 990 data provide some useful insights. We find more than 1,800 hospitals among the practice entities identified by TINs in the claims, consistent with the view that a TIN-based measure will capture cases where hospitals are serving as a vehicle for physician practice consolidation. We also find nearly 400 large nonprofit physician groups among the practices we identify. Among the large organizations that we identify in both the 990 and the claims data are many large and well-known health care systems and physicians, including, among many others, the Cleveland Clinic (1,834 physicians in the claims), the Mayo Clinic (2,199 physicians), Partners Healthcare System (558), Henry Ford Health System (1,056), and the Palo Alto Medical Foundation (880). Similar patterns are evident in other years. This suggests that the claims data can identify organizations at the large end of the spectrum, not just the individual physicians or smaller groups that may be owned by larger entities.

11.3.2 Identifying Physicians

In later years of our data, individual physicians can be identified using the National Provider Identifier (NPI) included on every claim. During 2007, the CMS began requiring the inclusion of the NPI of the physician performing the service on physician bills. The NPI fields in the claims data appear reasonably complete beginning in 2008. Prior to this, claims contain the Unique Physician Identification Number (UPIN) of the physician performing the service. Though they should generally identify individual physicians, UPINs are often thought to be less precise than NPIs as a unique physician identifier. Even after the NPI phase-in, Medicare claims continued to report UPINs where they were available.

For analytic purposes, we identify physicians in two ways. Beginning in 2007, we can identify them using NPIs alone. To obtain a longer time series, we developed a UPIN-based measure as follows. We first used UPINs where available. Some claims in later years did not report a UPIN, but did report an NPI. For these, we attempted to link a UPIN based on patterns observed

on previous claims and information reported on the National Plan and Provider Enumeration System (NPPES). When a match was found, we used the matched UPIN. If no matching UPIN was found, we identified the physician on the basis of the NPI.

The claims data will include information about practicing physicians who submit bills for patients in the 20 percent sample of fee-for-service Medicare beneficiaries. (This will not typically include residents and fellows, who do not file Medicare claims for their services.) We believe this will include the vast majority of physicians providing services to Medicare patients. We found 566,149 unique NPIs in the 2010 data. This is consistent with other calculations that, though done in a slightly different way, reported the number of physicians appearing in the 2010 100 percent sample of Medicare claims (Welch et al. 2013). As a further way of gaining information about the completeness of the 20 percent sample data, we computed the number of unique NPIs in the 2010 5 percent sample of Medicare claims. We found 532,375 unique NPIs, 94 percent of the 566,139 in the 20 percent sample. Because nearly all of the physicians identified in the 20 percent sample are also identified with only the 5 percent sample, we take it as unlikely that there would be a large number of additional physicians providing services to Medicare patients but not found in the 20 percent sample.

The set of physicians providing services to Medicare patients is likely to be a large subset of all physicians in the United States, though it will not contain all physicians. Based on results from the National Ambulatory Medical Care Survey, MedPAC recently reported that more than 90 percent of US physicians report that they accept new Medicare patients (Medicare Payment Advisory Commission [MedPAC] 2012). Some physicians in pediatrics and obstetrics/gynecology may not frequently see Medicare patients. Physicians who primarily serve managed care patients would not be expected to frequently appear in fee-for-service claims data. Other physicians may also have practices focused on non-Medicare patients. To get a better sense for the share of physicians represented in the claims data, we used data from NPPES to identify nonstudent physicians active in 2010, in specialties that we include in the analysis. We found 667,265 total NPIs. Our 2010 claims data identified 566,139, 85 percent of the NPPES total. This seems promising, particularly given that the NPPES may overstate the number of active physicians by retaining NPIs for a time after physicians retire, and including some physicians who are not actively practicing. The number of physicians we find is much lower than numbers derived from the AMA Physician Masterfile, though the Masterfile may substantially overstate the number of active physicians (Staiger, Auerbach, and Buerhaus 2009).

As described below, we also compare the claims data to data from SK&A, which provides another source of information consistent with the view that the claims data represent a large fraction of US physicians.

Table 11.1 Physicians per practice

	Physician ID based on UPIN			Physician ID based on NPI		
	N practices	*N* physicians	Mean physicians per practice	*N* practices	*N* physicians	Mean physicians per practice
1998	220,341	587,165	2.66	—	—	—
1999	211,718	581,741	2.75	—	—	—
2000	205,488	570,625	2.78	—	—	—
2001	205,179	570,667	2.78	—	—	—
2002	200,879	593,588	2.95	—	—	—
2003	204,013	605,982	2.97	—	—	—
2004	203,744	618,440	3.04	—	—	—
2005	206,139	635,734	3.08	—	—	—
2006	189,895	624,244	3.29	—	—	—
2007	184,990	634,549	3.43	171,483	601,330	3.51
2008	180,865	645,311	3.57	180,338	641,777	3.56
2009	170,683	646,879	3.79	170,682	644,901	3.78
2010	167,950	665,025	3.96	167,948	662,740	3.95

Note: Practices are defined across all specialties.

11.4 Trends in the Number and Size of Practices

For each observed practice (TIN), we counted the number of physicians billing within the practice each year. In these calculations, an individual physician can appear more than once if he or she bills with more than one practice within a year.[3] The size of practices has been increasing over time. We first computed the mean number of physicians per practice using UPINs and using NPIs (table 11.1). We observe 220,341 unique TINs in 1998, with a mean of 2.66 UPINs per practice. The number of practices declined over time to 167,950 unique TINs in 2010, and average size increased to 3.96 physicians per practice. The decline in number of practices is particularly concentrated in the 2005–2010 period. Over 2008 to 2010, estimates of the number of practices and physicians using NPIs are quite similar to the number we obtain using our approach that relies on UPINs, from which we derive some confidence that trends based on UPINs are useful to examine.

The distribution of physicians across organizations of different sizes is presented in table 11.2. The number of solo practices declined by more than 50,000 between 1998 and 2010, falling from 77 percent of practices to

3. The majority of physicians bill within one or two TINs in any given year. In 2010, for example, 80 percent of physicians billed all of their claims in a single TIN, and 96 percent billed in one or two TINs.

Table 11.2 **Distribution of practices[a] and physicians by size**

	Number of physicians per practice									
	1		2–9		10–49		50–99		≥ 100	
	N	(%)	*N*	(%)	*N*	(%)	*N*	(%)	*N*	(%)
					Practices					
1998	169,433	77	42,059	19	7,955	4	571	0.3	323	0.1
1999	161,062	76	41,753	20	7,997	4	584	0.3	322	0.2
2000	155,201	76	41,597	20	7,794	4	565	0.3	331	0.2
2001	154,533	75	41,937	20	7,811	4	565	0.3	333	0.2
2002	149,658	75	42,115	21	8,098	4	631	0.3	377	0.2
2003	151,667	74	43,062	21	8,223	4	675	0.3	386	0.2
2004	150,805	74	43,388	21	8,441	4	714	0.4	396	0.2
2005	152,855	74	43,450	21	8,642	4	744	0.4	448	0.2
2006	137,496	72	42,430	22	8,754	5	756	0.4	459	0.2
2007	132,314	72	42,450	23	8,969	5	776	0.4	482	0.3
2008	129,545	72	40,981	23	8,994	5	823	0.5	522	0.3
2009	120,334	71	39,893	23	9,046	5	852	0.5	558	0.3
2010	117,767	70	39,475	24	9,177	5	922	0.5	609	0.4
					Physicians					
1998	169,433	29	153,231	26	148,823	25	38,139	6	77,539	13
1999	161,062	28	151,882	26	149,851	26	39,051	7	79,895	14
2000	155,201	27	151,251	27	145,548	26	37,516	7	81,109	14
2001	154,533	27	151,917	27	146,421	26	37,977	7	79,819	14
2002	149,658	25	153,366	26	153,349	26	42,330	7	94,885	16
2003	151,667	25	155,917	26	154,341	25	45,220	7	98,837	16
2004	150,805	24	157,392	25	159,294	26	48,137	8	102,812	17
2005	152,855	24	158,267	25	163,143	26	50,115	8	111,354	18
2006	137,496	22	154,409	25	165,241	26	50,990	8	116,108	19
2007	132,314	21	153,855	24	170,203	27	53,030	8	125,149	20
2008	129,545	20	149,990	23	172,784	27	55,697	9	137,298	21
2009	120,334	19	146,278	23	174,642	27	58,081	9	147,544	23
2010	117,767	18	145,226	22	177,156	27	62,730	9	162,146	24

[a] Practices in this table are defined across all specialties.

70 percent. The number of practices of ten or more physicians rose. In the lower panel of table 11.2, the share of physicians in solo practice fell from 29 to 18 percent by 2010, and the share in practices of 100 or more doctors increased from 13 to 24 percent.

Much of this shift toward larger practices is driven by physicians entering and exiting practice. To explore this, we classified physicians as new entrants if they were first observed in the claims data after 1998 and still observed in 2010. We classified physicians as exiting practice if they were first observed in 1998 and last observed before 2010. Among 275,750 physicians in the entrant group, in the year in which they were first observed, about 10 percent were in a solo practice and nearly 40 percent were in practices of fifty

or more. In contrast, among 139,899 exiting physicians, 33 percent were in a solo practice in the last year they were observed, compared to 21 percent in a practice of fifty or more. There was also a transition toward larger practices among physicians who neither entered nor left during our study period. In this group, the share in solo practice fell from 27 percent to 23 percent, while the share in practices of over fifty rose from 20 percent to 27 percent.

We also characterize practices on a specialty-by-specialty basis. This approach is of particular note for development of competition measures, where relevant product markets are frequently specialty specific. To compute specialty-specific practice sizes, we separated the claims by specialty of the physician, and computed the number of practices (TINs) and physicians (UPINs or NPIs) separately within each specialty. In these calculations, the same practice will appear in more than one specialty if it contains physicians in multiple specialties. Physicians can also be included multiple times if they appear in multiple specialties or multiple practices. As in the case of the aggregated measures, the number of practices calculated by specialty decreased over time, with the decrease concentrated after 2005 (table 11.3). The share of practices that were small and the share of physicians in small practices declined over time. Larger practices became more prominent. Trends in the number of practices varied across specialties. Table 11.4 shows changes in the number of practices by specialty between 2000, 2005, and 2010. A common pattern in medical subspecialties was an increase in the number of practices before 2005 and declines after. A number of surgical specialties saw smaller declines in the number of practices in the same time period, and faster declines after 2005. Figure 11.1 plots the mean number of physicians per practice for a number of individual specialties (selected to represent a range of types of medicine and sizes of practices).

By other metrics, practices were also increasing in size. For specialty-specific practices, table 11.5 reports the number of claims per practice, work RVUs per practice, and Medicare-allowed charges per practice, all of which increased markedly over time. Some of this can be attributed to changes in the number of physicians and to the amount of activity per physician, which were both increasing. Consistent with reports of changing patterns of billing, the mean work RVUs per physician across practices increased markedly over the study period.

In addition to increases in practice size, the share of practices with multiple specialties increased over time (table 11.6). The number of practices with a single specialty fell by over 50,000, while the number with three or more specialties increased. The share of physicians in multispecialty practices grew from less than half to more than 60 percent. (The number of physicians in this analysis differs from the number in table 11.3 because physicians are counted one time per specialty per practice here.)

Table 11.3 **Practices by physician-size category, practices defined separately by specialty**

		Number of physicians per practice				
	N practices	1 (%)	2–9 (%)	10–49 (%)	50–99 (%)	≥ 100 (%)
			Practices			
1998	271,804	74	22	3	0.1	0.03
1999	261,964	74	23	3	0.1	0.03
2000	253,590	73	23	4	0.2	0.03
2001	253,027	73	23	4	0.2	0.03
2002	249,540	72	24	4	0.2	0.04
2003	256,544	72	24	4	0.2	0.04
2004	257,578	72	24	4	0.2	0.05
2005	260,278	72	24	4	0.2	0.05
2006	243,292	70	25	4	0.2	0.06
2007	239,252	69	26	5	0.2	0.07
2008	236,226	69	26	5	0.3	0.08
2009	226,871	68	26	5	0.3	0.09
2010	227,179	68	27	5	0.3	0.10
			Physicians			
1998	614,710	33	35	26	4.1	1.96
1999	605,023	32	35	26	4.2	2.21
2000	592,873	31	35	27	4.3	2.14
2001	592,605	31	36	27	4.3	2.04
2002	608,661	30	35	28	4.9	2.49
2003	625,209	30	35	28	4.9	2.57
2004	638,354	29	35	28	5.2	2.74
2005	653,215	29	34	29	5.6	2.85
2006	639,751	27	34	30	5.7	3.19
2007	650,532	26	34	31	6.2	3.58
2008	662,245	25	33	32	6.5	4.29
2009	662,161	23	33	32	7.2	4.60
2010	684,301	22	32	33	7.8	5.08

Note: Physicians or practices may appear more than one time in different specialties.

11.5 Concentration Measures

To study concentration, we computed Herfindahl-Hirschman Indexes (HHIs) for physician practices. For our purposes here, we take product markets to include all services produced by physicians in one of the specialties studied in the chapter. The extent to which relevant product markets would vary within specialty, either for subgroups of services or for subgroups of patients served, is of some interest. As a practical matter, we found it difficult to compute HHIs that distinguished subgroups of patients and services for the broad range of specialties included here. Questions about more finely defined HHIs would need to be addressed in more focused analyses. It may

Table 11.4 Changes in number of specialty-specific practices, by specialty, 2000–2010

	2000	2005	2010	Percent change 2000–2005	Percent change 2005–2010
Internal medicine	45,848	48,400	41,480	5.6	−14.3
Family practice	44,789	46,529	40,341	3.9	−13.3
Allergy/immunology	2,277	2,346	2,275	3.0	−3.0
Cardiology	10,540	10,551	9,386	0.1	−11.0
Critical care	549	920	1,174	67.6	27.6
Dermatology	6,562	6,812	6,302	3.8	−7.5
Endocrinology	1,992	2,420	2,691	21.5	11.2
Gastroenterology	5,563	5,898	5,312	6.0	−9.9
Geriatrics	728	1,003	1,245	37.8	24.1
Hematology	395	518	511	31.1	−1.4
Infectious disease	1,775	2,195	2,355	23.7	7.3
Nephrology	2,440	3,034	3,094	24.3	2.0
Neurology	6,376	6,959	6,556	9.1	−5.8
Oncology	3,391	3,970	3,590	17.1	−9.6
Pulmonary disease	4,568	5,070	4,690	11.0	−7.5
Radiation oncology	2,052	2,261	2,187	10.2	−3.3
Rheumatology	2,052	2,394	2,456	16.7	2.6
Cardiac surgery	789	1,134	1,149	43.7	1.3
Colorectal surgery	591	678	773	14.7	14.0
General surgery	15,420	13,914	11,134	−9.8	−20.0
Neurosurgery	2,301	2,308	2,074	0.3	−10.1
Ophthalmology	11,039	10,588	9,255	−4.1	−12.6
Orthopedics	10,425	10,368	8,682	−0.5	−16.3
Otolaryngology	5,666	5,394	4,630	−4.8	−14.2
Plastic/maxillofacial surgery	4,891	4,815	4,601	−1.6	−4.4
Thoracic surgery	1,862	1,640	1,463	−11.9	−10.8
Urology	5,450	5,214	4,109	−4.3	−21.2
Vascular surgery	1,443	1,683	1,819	16.6	8.1
Anesthesiology	9,285	8,883	7,406	−4.3	−16.6
Emergency med	10,448	10,433	7,092	−0.1	−32.0
Pathology	3,264	3,070	2,760	−5.9	−10.1
Physical medicine/rehab	4,142	4,827	5,139	16.5	6.5
Psychiatry	16,747	16,180	13,680	−3.4	−15.5
Radiology	7,930	7,869	5,768	−0.8	−26.7

also be worth noting that in some cases the relevant product market may span specialties that are distinguished here. For example, physicians in internal medicine and family medicine may be competitors for some primary care services.

The HHIs also require defining geographic markets. We derive geographic markets for each practice empirically, based on observed patient flows in the claims data. We compute HHIs using Medicare-allowed charges as the unit of service, following the guidance issued by the DOJ and FTC for evaluation

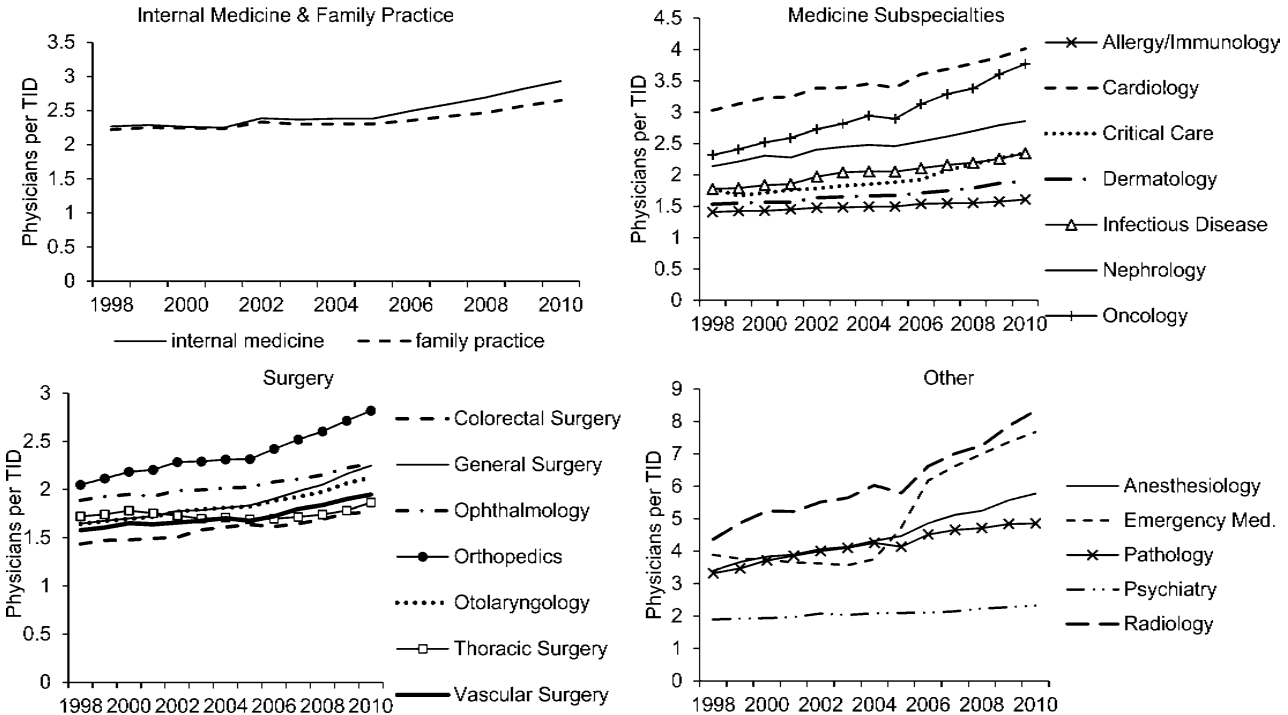

Fig. 11.1 Physicians per practice, by specialty

Table 11.5 Measures of specialty-specific practice size

	N practices	Claims/ practice	Work RVUs/ practice	Allowed charges/ practice	Physicians per practice	Claims/ physician	Work RVUs/ physician
1998	271,804	497	419	29,929	2.26	234	209
1999	261,964	527	444	32,717	2.31	244	218
2000	253,590	555	470	37,002	2.34	253	227
2001	253,027	581	494	41,007	2.34	262	237
2002	249,540	630	545	43,889	2.44	285	260
2003	256,544	693	599	50,190	2.44	302	276
2004	257,578	720	633	55,375	2.48	309	288
2005	260,278	749	649	57,522	2.51	318	289
2006	243,292	802	698	62,478	2.63	335	305
2007	239,252	803	798	63,313	2.72	328	343
2008	236,226	814	823	64,897	2.80	328	348
2009	226,871	840	868	69,889	2.92	334	361
2010	227,179	839	888	72,717	3.01	327	360

of market power when considering Accountable Care Organizations (Federal Trade Commission 2011). Other units of service, including individual claims and work RVUs, are also possible. Varying the choice of service unit will weight services in different ways, particularly in specialties that provide services of varying intensities, and could influence the HHIs, though we show below that the choice of service unit generally has a small impact on the final results.

Our analytic approach adapts the approach of Kessler and McClellan to the case of hospitals (Kessler and McClellan 2000). We derive HHIs for (specialty-specific) practices in two steps. We begin by constructing an HHI for each ZIP Code, by specialty, by year. Denote by $\text{service}_{i,j}$ the number of service units provided by physicians in practice *i* to patients who reside in ZIP Code *j*. Denoting the total number of service units provided to patients in ZIP *j* as service_j, the market share of practice *i* for ZIP *j* is $\text{share}_{i,j} = \text{service}_{i,j} / \text{service}_j$. The ZIP Code HHI is then the sum of squared market shares:

$$\text{ZIPHHI}_j = \sum_{\substack{\text{practices } i \\ \text{serving ZIP } j}} \text{share}_{i,j}^2.$$

This construction allows flexibility in the market size, basing the HHI on the set of practices actually providing services to patients in a given ZIP Code. We exclude from this calculation claims where the physician is more than 100 miles from the patient ZIP, to reduce the potential for bias from cases where a patient, perhaps while traveling, sees a distant physician who does not play a substantial role in competition for patients in the ZIP Code. (Distances were determined based on the centroid of the patient and provider ZIP Codes,

Table 11.6 Practices by number of specialties

		One specialty		Two specialties		Three or more specialties	
	N	*N*	(%)	*N*	(%)	*N*	(%)
				Practices			
1998	220,341	195,726	88.8	16,893	7.7	7,722	3.5
1999	211,718	187,672	88.6	16,519	7.8	7,527	3.6
2000	205,488	182,159	88.6	16,208	7.9	7,121	3.5
2001	205,179	182,079	88.7	16,008	7.8	7,092	3.5
2002	200,879	179,011	89.1	14,415	7.2	7,453	3.7
2003	204,013	179,267	87.9	16,856	8.3	7,890	3.9
2004	203,744	178,498	87.6	17,133	8.4	8,113	4.0
2005	206,139	181,316	88.0	16,485	8.0	8,338	4.0
2006	189,895	165,935	87.4	15,754	8.3	8,206	4.3
2007	184,991	161,112	87.1	15,604	8.4	8,275	4.5
2008	180,865	157,099	86.9	15,368	8.5	8,398	4.6
2009	170,683	147,093	86.2	15,102	8.8	8,488	5.0
2010	167,950	143,325	85.3	15,779	9.4	8,846	5.3
				Physicians			
1998	587,165	307,117	52.3	70,712	12.0	209,336	35.7
1999	581,741	299,986	51.6	71,649	12.3	210,106	36.1
2000	570,625	295,891	51.9	71,609	12.5	203,125	35.6
2001	570,667	295,008	51.7	72,188	12.6	203,471	35.7
2002	593,588	289,868	48.8	73,458	12.4	230,262	38.8
2003	605,982	288,513	47.6	78,928	13.0	238,541	39.4
2004	618,440	289,963	46.9	80,704	13.0	247,773	40.1
2005	635,734	294,132	46.3	82,356	13.0	259,246	40.8
2006	624,244	277,511	44.5	83,651	13.4	263,082	42.1
2007	634,551	275,010	43.3	84,329	13.3	275,212	43.4
2008	645,314	269,994	41.8	85,053	13.2	290,267	45.0
2009	646,879	259,156	40.1	84,459	13.1	303,264	46.9
2010	665,025	254,991	38.3	86,569	13.0	323,465	48.6

using the Haversine formula. Between 90 and 95 percent of claims meet the 100-mile criteria in any given year.)

In the second step, we identify the observed market area of each practice as the set of patient ZIP Codes with nonzero service units (i.e., the set of j for which $\text{service}_{i,j} > 0$), excluding cases where the patient ZIP is more than 100 miles from the physician ZIP. We then average the ZIPHHI values for the ZIP Codes in the market area, weighting by the number of services practice i provides in each of the patient ZIPs in its market area, to create a practice level HHI:

$$\text{PRACHHI}_i = \sum_{\substack{ZIPs\ j\ in \\ market\ area \\ of\ practice\ i}} w_{i,j}\text{ZIPHHI}_j,$$

Table 11.7 HHIs by practice, all specialties pooled

			HHI percentiles		
	N	Mean HHI	*p*10	*p*50	*p*90
1998	269,013	2,478	612	1,938	5,146
1999	259,543	2,477	610	1,932	5,157
2000	251,731	2,480	605	1,931	5,172
2001	250,930	2,479	599	1,919	5,197
2002	248,062	2,407	565	1,864	5,057
2003	254,826	2,377	563	1,835	5,008
2004	256,076	2,350	554	1,802	4,956
2005	258,775	2,369	556	1,836	4,983
2006	242,093	2,381	534	1,837	5,041
2007	238,253	2,405	543	1,866	5,069
2008	235,354	2,420	554	1,884	5,080
2009	226,035	2,448	561	1,904	5,130
2010	226,332	2,446	558	1,904	5,122

where $w_{i,j}$ is a weight with sum 1 derived from the service$_{i,j}$ values (i.e., service$_{i,j}$/service$_i$ where service$_i$ is the sum of all services provided by practice i).

This approach diverges somewhat from approaches that would simply define the market area of the practice as the set of ZIP Codes served and then compute the HHI from the market shares of all practices serving the area. Our approach allows us to weight more heavily the ZIPs from which the practice draws most of its patients. Since many practices draw patients from a large number of ZIP Codes in total, but have a much smaller set of areas from which the bulk of their patients come, this approach provides a more accurate representation of the market concentration in the areas in which the practice primarily operates.

Table 11.7 presents summary statistics for the resulting practice HHIs, pooling all specialty-specific practices. We compute an HHI for 269,013 practices in 1998 and for 226,332 practices in 2010. (These counts of practices are slightly lower than those reported earlier because we restrict analysis to claims where the patient and provider are within 100 miles of each other, and a few practices have no claims satisfying this criterion.) Mean HHIs exceed 2,350 in all years. Median HHIs exceed 1,802. The 90th percentile practices have HHIs exceeding 5,000. Though the approach we use to calculate HHIs differs from the specific analyses that might be used in an antitrust proceeding, it is interesting to note that the FTC and DOJ normally express concern about markets where HHIs are more than 1,500, considering markets between 1,500 and 2,500 to be moderately concentrated and markets above 2,500 to be highly concentrated (Federal Trade Commission and Department of Justice 2010). Between the beginning of the study period and 2004, HHIs were generally declining, indicating less

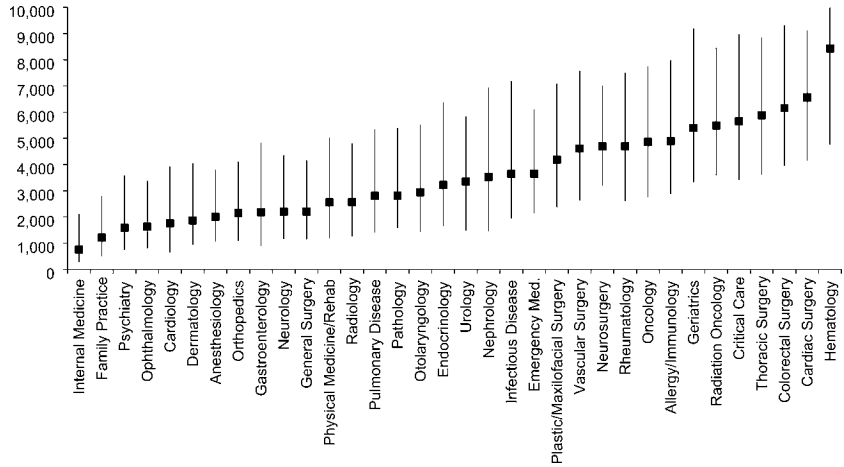

Fig. 11.2 Median (specialty-specific) practice HHI, 2010

concentration. In 2005, in contrast, HHIs began to increase, with the mean rising by about 100 points, to 2,446 in 2010. The HHIs at the 10th, 50th, and 90th percentiles also increased during the later portion of the study period. Changes of 100 points are large enough to be of interest in many antitrust contexts.

There are marked differences in HHIs across specialties. Figure 11.2 reports the median HHI by specialty in 2010, and the 10th and 90th percentiles across specialties. Internal medicine and family practice, two of the largest specialties, have the lowest median HHIs at 760 and 1,211, respectively. Cardiac surgery and hematology have the highest at 6,561 and 8,432. Twenty-three of the thirty-four specialties we studied have a median HHI of more than 2,500. Practice HHIs within each of the specialties vary considerably as well.

Changes in concentration over time vary across specialties (figure 11.3). Figure 11.4 plots 2005–2010 changes in mean HHIs by specialty against the percent change in number of practices. There are clear patterns of consolidation that vary across specialties. Thoracic surgery, emergency medicine, urology, hematology, radiation oncology, ophthalmology, and general surgery all lost significant numbers of practices and had increases of more than 200 points in the mean practice HHI. Pathology, endocrinology, critical care, and geriatrics all added practices and had declines of more than 200 in the mean practice HHI.

11.5.1 Comparisons with Alternate Approaches

To examine robustness to alternate specifications, we computed HHIs for practices in a number of different ways. Table 11.8 summarizes results. We

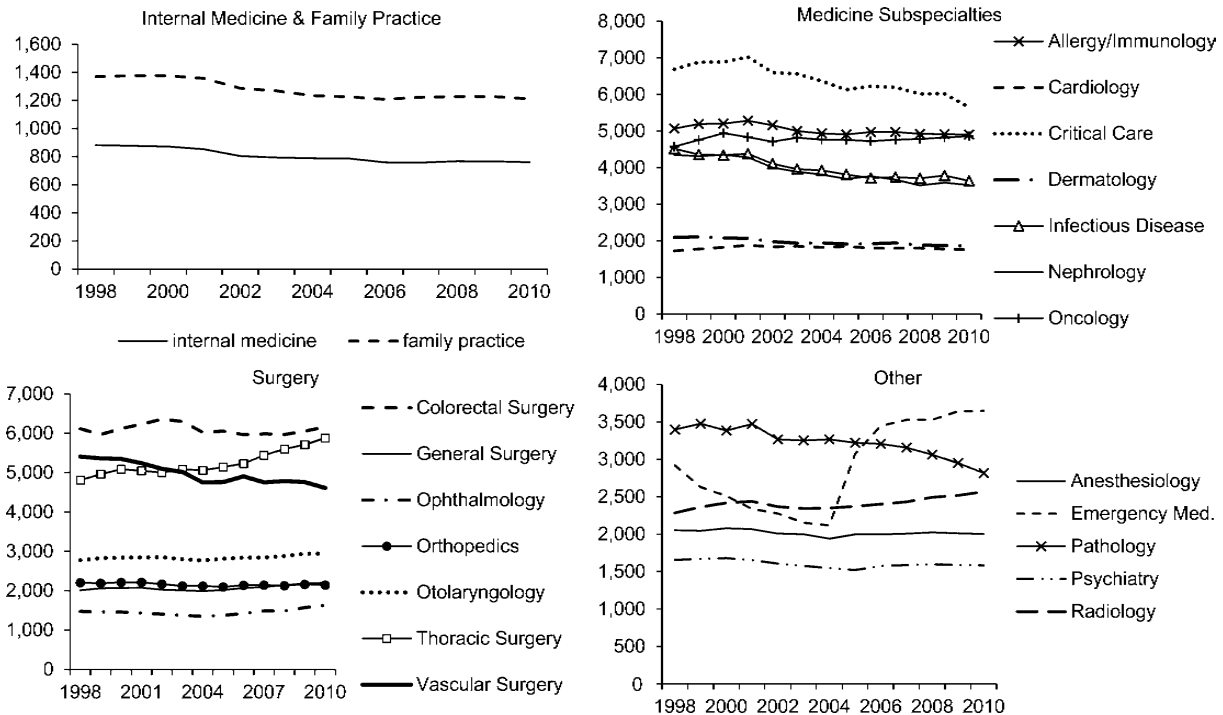

Fig. 11.3 Median practice HHIs, by specialty, by year

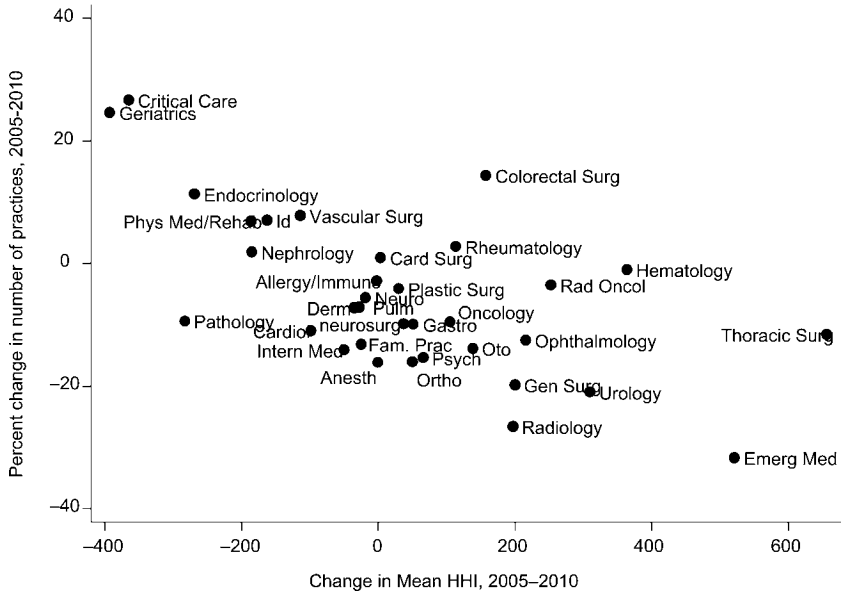

Fig. 11.4 Changes in practices and changes in mean HHI, by specialty, 2005–2010

examined the effect of using the number of claims and the number of work RVUs as the measure of output, and found results very similar to those obtained using charges. The FTC/DOJ guidance for antitrust related to Accountable Care Organizations recommends that market areas for practices be defined as the smallest number of ZIP Codes from which a practice draws 75 percent of its patients. Computing HHIs using this approach has little effect on the results, as might be expected since our approach weights ZIP HHIs by the number of claims in the practice when computing the practice HHIs, so ZIPs less important to the practice will already have less impact in the baseline approach. Finally, we examined the effect of relaxing the restriction that the physician and patient must be within 100 miles for the claim to be included, which also had little effect on the overall pattern of results. The HHIs using each alternative specification are highly correlated (≥ 0.97) with the baseline approach.

11.6 Area-Level Analyses

In many analyses, it is important to be able to summarize the degree of competition in a given geographic area. For example, one may wish to know the average HHI for providers in a given county or HRR. This can be easily computed from the practice-level measures (PRACHHI). Denoting areas by k, we take the average of PRACHHI values over the practices i with

Table 11.8 Comparison of different measurement approaches, 2010 practice-level HHIs

	N (specialty-specific) practices	Mean HHI	*p*10	*p*50	*p*90	Correlation with baseline approach
Baseline approach	226,332	2,446	558	1,904	5,122	—
Use claims as output measure	226,332	2,461	607	1,972	4,994	0.969
Use work RVUs as output measure	223,508	2,416	544	1,892	5,020	0.971
Impose 75% limit in practice market definition	226,332	2,395	517	1,819	5,106	0.995
Use all claims, not just those where physician-patient distance ≤ 100 miles	227,179	2,284	551	1,808	4,714	0.979

provider locations in area k, weighting by the services provided by the practice attributable to area k.

$$\text{GEOHHI}_k = \sum_{\substack{\text{practices } i \\ \text{with provider} \\ \text{ZIPs in area } k}} b_{i,k}\text{PRACHHI}_i,$$

where b is a weight that sums to one, capturing the distribution across practices of services attributable to area k (i.e., $b_{i,k} = \text{service}_{i,k} / \text{service}_k$). This calculation weights more heavily practices that have a prominent presence in the area, and weights less heavily practices that do not.

We have done this here for Hospital Referral Regions as defined in the Dartmouth Atlas. Paralleling the patterns seen at the practice level, there are wide variations in concentration across specialties and, within specialty, across geographic areas. Figure 11.5 shows variation across specialty and within specialty across areas for 2010. Median HHIs, calculated by specialty, at the HRR level are generally 30–60 percent higher than median practice HHIs (e.g., figure 11.2). This may reflect the fact that larger, less competitive practices naturally play a bigger role their geographic areas, and thus drive up the measure of the average HHIs by area.

Note that this calculation could also be made weighting by the location of patients, and would then give the average HHI of practices serving patients in a given geography. Results using this method are highly correlated with those weighting by the location of doctors.

11.7 Comparisons to SK&A Data

Data from the consulting firm SK&A provide an alternate way of characterizing the practice affiliations of physicians. The SK&A data is obtained by contact with physicians, and includes information about group affiliation as well as hospital or system ownership of practice. SK&A reports that the

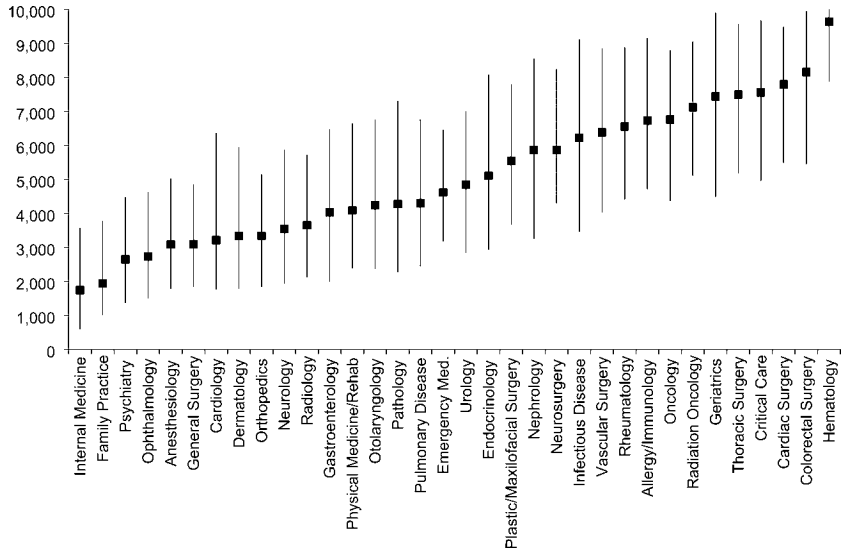

Fig. 11.5 Variation in HRR HHIs by specialty, 2010

data are updated twice per year, and contain information about nearly all physicians practicing in the United States. We used SK&A data from 2008 to 2010, selecting data for physicians in the specialties identified above. (SK&A specialty codes do not contain a code for cardiac surgery.)

Table 11.9 presents summary information. In 2010, the data contain information for 528,225 physician-specialty pairs (about 3,000 physicians appear with more than one specialty, and we include physicians in each of their indicated specialties). Of these, about 60 percent have a group, hospital, or system code indicating that the doctor is part of a larger entity. Curiously, the share of doctors with one of these codes stays approximately constant over time, despite popular reports of accelerating consolidation during this time period.

We match SK&A data to the Medicare claims data on the basis of NPI or UPIN physician identifiers. Between 83 percent and 88 percent of physicians in the SK&A data had either a UPIN or NPI with which to attempt a match (table 11.9, column [6]). Of all physician-specialty-practice (TIN) combinations in the claims data, we matched between 60 and 66 percent to information from the SK&A data. Match rates are particularly low (< 50 percent in a year) for critical care, geriatrics, anesthesiology, emergency medicine, and psychiatry. Match rates are highest for surgical specialties, near or above 80 percent for orthopedics, otolaryngology, urology, and ophthalmology. Of all doctors in the SK&A data in specialties we analyze, we find about 80 percent in the Medicare claims data, consistent with the view

Table 11.9 **Number of observations and presence of affiliations codes and NPI or UPIN, SK&A data**

	N	With group (%)	With hospital (%)	With system (%)	With group, hospital, or system (%)	With NPI or UPIN (%)
All specialties						
2008	496,339	43	18	17	58	83
2009	508,575	46	19	17	60	87
2010	528,225	46	17	18	59	88
By specialty 2010						
Internal medicine	62,915	42	16	19	52	90
Family practice	80,943	41	17	19	55	89
Allergy/immunology	4,138	42	11	12	50	85
Cardiology	21,294	61	16	18	70	89
Critical care	361	58	30	50	79	80
Dermatology	10,306	37	10	12	43	90
Endocrinology	4,300	42	23	26	59	90
Gastroenterology	11,368	53	13	14	61	91
Geriatrics	1,223	33	36	33	61	87
Hematology	364	36	40	44	71	74
Infectious disease	4,024	38	32	33	66	90
Nephrology	7,557	54	16	26	70	84
Neurology	10,137	40	20	23	57	90
Oncology	10,779	54	24	25	71	86
Pulmonary disease	4,344	46	19	18	59	85
Radiation oncology	4,186	48	34	28	74	84
Rheumatology	3,752	42	20	23	56	91
Colorectal surgery	1,064	47	12	15	57	91
General surgery	15,602	43	19	17	57	90
Neurosurgery	3,904	42	22	24	61	90
Ophthalmology	17,322	51	9	10	57	89
Orthopedics	22,567	56	13	13	65	89
Otolaryngology	8,515	46	15	15	57	91
Plastic/maxillofacial surgery	9,500	23	8	8	30	86
Thoracic surgery	2,896	44	24	25	63	90
Urology	8,835	52	14	14	62	90
Vascular surgery	2,272	43	22	23	60	86
Anesthesiology	22,423	59	14	16	70	92
Emergency med	19,865	49	22	20	67	85
Pathology	8,422	50	25	25	72	86
Physical medicine/rehab	5,358	36	15	16	49	89
Psychiatry	22,377	22	13	18	38	86
Radiology	25,005	67	12	15	75	80

Table 11.10 Median HHIs by practice, using alternate practice measures

	Tax ID (Medicare)		SK&A group		SK&A group or hospital		SK&A group or hospital or system	
	N	Med. HHI	*N*	Med. HHI	*N*	Med. HHI	*N*	Med. HHI
Internal medicine	32,996	853	40,509	750	36,942	755	34,889	786
Family practice	31,993	1,431	42,079	1,215	37,446	1,237	34,983	1,273
Allergy/immunology	2,022	5,106	2,202	4,853	2,188	4,866	2,138	4,885
Cardiology	7,953	1,914	10,085	1,577	9,165	1,576	8,694	1,587
Critical care	684	6,825	751	5,943	702	6,137	643	6,249
Dermatology	5,522	1,983	6,423	1,699	6,234	1,715	6,094	1,729
Endocrinology	2,159	3,571	2,555	3,175	2,339	3,239	2,174	3,358
Gastroenterology	4,621	2,382	6,206	1,859	5,834	1,893	5,585	1,893
Geriatrics	738	6,520	826	5,814	734	6,453	684	6,497
Hematology	388	8,862	465	8,093	424	8,520	391	8,613
Infectious disease	1,576	4,483	2,158	3,553	1,849	3,781	1,706	3,837
Nephrology	2,536	3,808	3,604	2,904	3,338	2,941	3,027	3,024
Neurology	5,204	2,473	6,295	2,162	5,602	2,224	5,231	2,280
Oncology	2,961	5,092	4,858	4,212	4,263	4,283	3,917	4,263
Pulmonary disease	3,805	3,047	4,426	2,563	4,069	2,626	3,871	2,638
Radiation oncology	1,679	6,215	2,271	5,203	1,976	5,459	1,785	5,569
Rheumatology	2,000	5,085	2,355	4,639	2,199	4,733	2,114	4,771
Cardiac surgery	877	7,143	975	6,649	929	6,812	893	6,842
Colorectal surgery	617	6,558	679	6,012	662	6,053	647	6,077
General surgery	8,579	2,516	10,376	2,216	9,555	2,291	8,938	2,310
Neurosurgery	1,682	5,112	2,280	4,740	2,049	4,829	1,890	4,901
Ophthalmology	8,280	1,703	9,692	1,554	9,331	1,564	9,109	1,567
Orthopedics	7,266	2,298	9,884	1,929	9,257	1,962	8,888	1,972
Otolaryngology	4,009	3,131	4,999	2,587	4,782	2,634	4,589	2,663
Plastic/maxillofacial surgery	3,604	4,702	3,826	4,630	3,731	4,651	3,663	4,674
Thoracic surgery	1,076	6,431	1,290	5,877	1,164	6,089	1,108	6,121
Urology	3,496	3,580	4,711	2,745	4,473	2,755	4,335	2,757
Vascular surgery	1,429	5,162	1,534	4,580	1,456	4,700	1,385	4,719
Anesthesiology	4,340	2,674	9,184	1,828	8,153	1,880	7,638	1,883
Emergency med	5,070	3,946	8,877	1,924	7,572	2,234	6,973	2,324
Pathology	1,757	3,821	3,485	2,485	2,764	2,768	2,543	2,824
Physical medicine/rehab	3,470	3,098	3,739	2,868	3,550	2,924	3,370	3,006
Psychiatry	9,352	2,090	11,618	1,820	10,897	1,870	10,047	1,908
Radiology	4,397	2,935	8,696	1,803	7,782	1,840	7,289	1,879

that a large share of all physicians in the United States are identified in the 20 percent Medicare claims sample.

Using the matched data, we computed HHIs for practices to examine the effects of characterizing practices in different ways. The first two columns of table 11.10 report the results using the method described above based on Medicare-reported TIN for specialty-specific practices. We first compare to

results that use the group code reported on the SK&A data as the indicator of practice (columns [3] and [4]). This code is intended to identify medical groups of which a doctor is part, but not hospitals or systems that might own the practice. Using this code, we find more practices than using the TIN approach, and the median HHI across practices is a bit lower—between 10 and 20 percent lower for most of the specialties reported. The correlation between the specialty median HHI based on TIN and SK&A group code is 0.98.

We next consider the effect of incorporating hospital ownership information. We assign physicians to the hospital they indicate owning their practice first. If there is no hospital indicated, we assign them to their group. This reduces the number of practices by a modest amount, and slightly increases the measured HHIs relative to measures using just the group code (columns [5] and [6]). Finally, we considered the effects of assigning physicians to the indicated system owner first, followed by hospital, followed by group. This further reduces the number of practices and increases the measured HHIs. Overall, the effect of incorporating information about hospital and system ownership from SK&A has some effect on measures of concentration, but does not substantially change the patterns observed. The patterns observed across specialties and over time are also similar in the SK&A data and the Medicare data, with somewhat higher reported HHIs based on the Medicare data.

11.8 Conclusions

We reach several conclusions based on the analyses reported. First, it appears that TINs reported in Medicare claims can provide a useful tool for measuring the size and concentration of physician practices. Medicare data appear to contain a large sample of the physicians in the United States, across a broad range of specialties. Reported TINs appear to frequently represent practice structures that are meaningful for market structure identification, generally consistent with results obtained from an alternative data source that has been used in the literature.

Second, there is a considerable degree of concentration in many physician markets. A large number of practices have HHIs of more than 2,500, in many cases well more than 2,500. In many specialties, the median HRR is served by practices with highly concentrated markets. This suggests that attention to concentration may be warranted, as the potential for inefficient market outcomes appears to be substantial.

Third, there has been consolidation over time in some areas. Surgical specialties in particular have seen significant consolidation over the past decade or so. But not all specialties have become more concentrated. Some medical specialties in particular appear to have become more competitive over time. In addition, there are variations in trends at different points in

time. Years before 2005 frequently saw declines in HHIs, while increases in HHIs are more apparent later in the sample period.

Fourth, the role of hospitals and systems is important in measuring concentration, but the overall impact is modest. When we used SK&A data to examine measures using different approaches, being able to account for hospital and system ownership raised HHIs by a nonnegligible, but overall modest amount.

It is perhaps worth noting that the Medicare data, though generally useful, will not capture market dynamics for physicians that primarily serve managed care patients and do not bill Medicare on a fee-for-service basis. They will also not capture patterns in specialties, like pediatrics, not well represented among bills from Medicare patients. As a result, these measures and conclusions may not generalize to these other settings. The analyses reported here focus on financially integrated practice arrangements, and will not capture market dynamics related to IPAs or other less integrated organizational forms.

References

Antwi, Y. A., M. S. Gaynor, and W. B. Vogt. 2009. "A Bargain at Twice the Price? California Hospital Prices in the New Millennium." *Forum for Health Economics and Policy* 12 (1). Published online. DOI: https://doi.org/10.2202/1558-9544.1144.

Berenson, R. A., and P. B. Ginsburg. 2010. "Unchecked Provider Clout in California Foreshadows Challenges to Health Reform." *Health Affairs* 29 (4): 699–705.

Berenson, R. A., P. B. Ginsburg, J. B. Christianson, and T. Yee. 2012. "The Growing Power of Some Providers to Win Steep Payment Increases from Insurers Suggests Policy Remedies may be Needed." *Health Affairs* 31 (5): 973–81.

Casalino, L. P. 2006. "The Federal Trade Commission, Clinical Integration, and the Organization of Physician Practice." *Journal of Health Politics, Policy & Law* 31 (3): 569–85.

Crosson, F. J. 2009. "21st-Century Health Care—The Case for Integrated Delivery Systems." *New England Journal of Medicine* 361 (14): 1324–25.

Cuellar, A. E., and P. J. Gertler. 2006. "Strategic Integration of Hospitals and Physicians." *Journal of Health Economics* 25 (1): 1–28.

Dafny, L. 2009. "Estimation and Identification of Merger Effects: An Application to Hospital Mergers." *Journal of Law and Economics* 52:523–50.

Dunn, A., and A. H. Shapiro. 2014. "Do Physicians Possess Market Power?" *Journal of Law and Economics* 57 (1): 159–93.

Federal Trade Commission, Antitrust Division, and Department of Justice. 2011. "Statement of Antitrust Enforcement Policy Regarding Accountable Care Organizations Participating in the Medicare Shared Savings Program." *Federal Register* 76 (209): 67026–32.

Federal Trade Commission and Department of Justice. 1996. *Statements of Antitrust Enforcement Policy in Health Care*. Washington, DC.

———. 2010. *Horizontal Merger Guidelines*. Washington, DC. https://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf.

Federal Trade Commission, Health Care Division, Bureau of Competition. 2011. Topic and Yearly Indices of Health Care Antitrust Advisory Opinions by Commission and Staff. Washington DC.

Gaynor, M. 2011. *Hearing on Health Care Industry Consolidation: Statement Before the Committee on Ways and Means Health Subcommittee*, 112th Cong., First Session. Washington, DC: US House of Representatives. https://waysandmeans.house.gov/hearing-on-health-care-industry-consolidation/.

Gaynor, M., and R. J. Town. 2012. "Competition in Health Care Markets." In *Handbook of Health Economics*, vol. 2, edited by M. V. Pauly, T. G. McGuire, and P. P. Barros, 499–627. Amsterdam: Elsevier North-Holland.

Ginsburg, P. B. 2010. *Wide Variation in Hospital and Physician Payment Rates Evidence of Provider Market Power*. Washington, DC: Center for Studying Health System Change.

Kessler, D. P., and M. B. McClellan. 2000. "Is Hospital Competition Socially Wasteful?" *Quarterly Journal of Economics* 115 (2): 577–615.

Ketcham, J. D., L. C. Baker, and D. MacIsaac. 2007. "Physician Practice Size and Variations in Treatments and Outcomes: Evidence from Medicare Patients with AMI." *Health Affairs* 26 (1): 195–205.

Kocher, R., and N. R. Sahni. 2011. "Hospitals' Race to Employ Physicians—The Logic behind a Money Losing Proposition." *New England Journal of Medicine* 364 (19): 1790–93.

Liehaber, A., and J. M. Grossman. 2007. "Physicians Moving to Mid-Sized, Single Specialty Practices." Technical Report, Tracking Report no. 18, Center for Studying Health System Change.

McWilliams, J. M., M. E. Chernew, A. M. Zaslavsky, P. Hamed, and B. E. Landon. 2013. "Delivery System Integration and Health Care Spending and Quality of Care for Medicare Beneficiaries." *JAMA Internal Medicine* 173 (15): 1447–56.

Medicare Payment Advisory Commission (MedPAC). 2012. "Report to the Congress: Medicare Payment Policy." MedPAC, Washington, DC. http://www.medpac.gov/docs/default-source/reports/march-2012-report-to-the-congress-medicare-payment-policy.pdf?sfvrsn=0.

Melnick, G. A., Y. C. Shen, and V. Y. Wu. 2011. "The Increased Concentration of Health Plan Markets Can Benefit Consumers through Lower Hospital Prices." *Health Affairs* 30 (9): 1728–33.

Melnick, G. A., J. Zwanziger, A. Bamezai, and R. Pattison. 1992. "The Effects of Market Structure and Bargaining Position on Hospital Prices." *Journal of Health Economics* 11 (3): 217–33.

O'Malley, A. S., A. M. Bond, and R. A. Berenson. 2011. *Rising Hospital Employment of Physicians: Better Quality and Costs?* Washington, DC: Center for Studying Health System Change.

Pelnar, Gregory J. 2010. "Are Clinically Integrated Physician Networks Candy-Coated Cartels?" *CPI Antitrust Chronicle* 10 (1). https://competitionpolicyinternational.com/are-clinically-integrated-physician-networks-candy-coated-cartels/.

Pennsylvania Health Care Cost Containment Council. 2007. *Cardiac Surgery in Pennsylvania 2005*. Harrisburg: Pennsylvania Health Care Cost Containment Council.

Pham, H. H., D. Schrag, A. S. O'Malley, B. Wu, and P. B. Bach. 2007. "Care Patterns in Medicare and Their Implications for Pay for Performance." *New England Journal of Medicine* 356 (11): 1130–39.

Pope, G. C., M. Trisolini, J. Kautter, and W. Adamanche. 2002. *Physician Group Practice Demonstration Design Report*. Baltimore, MD: Centers for Medicare and Medicaid Service.

Schneider, J. E., P. Li, D. G. Klepser, N. A. Peterson, T. T. Brown, and R. M. Scheffler. 2008. "The Effect of Physician and Health Plan Concentration on Prices in Commercial Health Insurance Markets." *International Journal of Health Care Finance and Economics* 8 (1): 13–26.

Staiger, D. O., D. I. Auerbach, and P. I. Buerhaus. 2009. "Comparison of Physician Workforce Estimates and Supply Projections." *Journal of the American Medical Association* 302 (15): 1674–80.

Welch, W. P., A. E. Cuellar, S. C. Stearns, and A. B. Bindman. 2013. "Proportion of Physicians in Large Group Practices Continued to Grow in 2009–2011." *Health Affairs* 32 (9): 1659–66.

Wu, V. Y. 2009. "Managed Care's Price Bargaining with Hospitals." *Journal of Health Economics* 28 (2): 350–60.