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Hospital-Physician Integration and Medicare's Site-Based Outpatient Payments

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Abstract

Objective: To determine the relationship between Medicare's site-based outpatient billing policy and hospital-physician integration.

Data sources: National Medicare claims data from 2010-2016.

Study Design: For each physician-year, we calculated the disparity between Medicare reimbursement under hospital ownership and under physician ownership. Using logistic regression analysis, we estimated the relationship between these payment differences and hospital-physician integration, adjusting for region, market concentration, and time fixed effects. We measured integration status using claims data and legal tax names.

Data Collection: The study included integrated and non-integrated physicians who billed Medicare between January 1, 2010 and December 31, 2016 (n=2,137,245 physician-year observations).

Principal Findings: Medicare reimbursement for physician services would have been \$114,000 higher per physician per year if a physician were integrated compared to being non-integrated. Primary care physicians faced a 78 percent increase, medical specialists 74 percent, and surgeons 224 percent. These payment differences exhibited a modest positive relationship to hospital-physician vertical integration. An increase in this outpatient payment differential equivalent to moving from the 25th to 75th percentile was associated with a 0.20 percentage point increase in the probability of integrating with a hospital (95% CI: .0.10 to 0.30). This effect was slightly larger among primary care physicians (0.27, 95% CI: 0.18 to 0.35) and medical specialists (0.26, 95% CI: 0.05 to 0.48), while not significantly different from zero among surgeons (-0.02; 95% CI: -0.27 to 0.22).

Conclusions: The payment differences between outpatient settings were large and grew over time. Even routine annual outpatient payment updates from Medicare may prompt some hospital-physician vertical integration, particularly among primary care physicians and medical specialists.

Keywords: hospital-physician vertical integration, physician employment, hospital workforce, Medicare Payment Advisory Commission, delivery system organization, outpatient care delivery

Key points:

Section 1: What is already known

- Vertical integration of hospitals and physicians has accelerated in the last decade, causing increases in prices and spending.
- One commonly cited reason for this acceleration is Medicare's site-based payment policy that pays providers more for the same services if billed from a hospital-owned office.

- Integration among cardiologists increased in response to 2010 changes in reimbursement for myocardial perfusion imaging (MPI), echocardiograms, and electrocardiograms.

Section 2: What this study adds

- This study quantifies the financial benefit of Medicare's outpatient payment differential associated with each physician.
- This study evaluates the cumulative effects of seven years' worth of payment updates to thousands of outpatient procedures.
- This study examines heterogeneity across specialty type, finding important differences in integration and exposure to Medicare's outpatient payment differentials.

INTRODUCTION

Over the last decade, hospitals continued to acquire physician practices in large numbers.¹⁻³ As of 2018, hospitals owned 31.2 percent of physician practices, up from 13.6 percent in 2012.² Site-based reimbursement, in which outpatient care can be billed at a higher rate if the place of service is owned by a hospital, is one potential driver of hospital-physician integration.^{4,5} In 2011, an office visit with a new patient could be billed for \$198 in a doctor's office. The same visit could be billed for \$331 if the office were designated a hospital outpatient department, thereby generating a facility fee in addition to the physician fee.⁶ The Medicare Payment Advisory Commission (MedPAC) noted that the hospital outpatient department versus office payment difference "creates a financial incentive for hospitals to purchase freestanding physicians' offices and convert them to [outpatient departments] without changing their location or patient mix."⁷ These observations, and concern about unnecessary increases in spending, have led to calls for "site-neutral payments," or equal payment for certain outpatient procedures, regardless of practice site. The Centers for Medicare and Medicaid Services (CMS) introduced site-neutral rulemaking that took effect on January 1, 2019, decreasing off-campus hospital outpatient department reimbursement to office levels for certain patient

visits. Although litigation against the rule is ongoing, CMS has pursued its site-neutral policies in 2020.⁸

Despite this move towards site-neutral payments, little is known about the extent to which site-based payment influences hospital-physician integration. While hospitals can increase reimbursement from physician services through integration, site-based payment may not be a major factor in integration decisions. Instead, hospitals may be driven more by the desire to gain leverage in price negotiations with commercial payers⁹ and influence physician referral behavior and hospital choice.^{10,11} Integration could also be driven by a shared desire across hospitals and physicians to enhance care coordination, facilitate health information exchange, or adapt to new payment models.⁴

In this paper, we examined the relationship between site-based Medicare payment differences and integration. Using 2010-2016 Medicare data, we calculated the reimbursement value of each physician's services if billed from a hospital outpatient department and compared it to the value if billed from an office. We then assessed whether hospital outpatient payment differentials were associated with greater likelihood of hospitals integrating with the physician practice, hypothesizing that larger payment differentials would lead to greater integration.

METHODS

We used several data sets. Our claims-level data included the Medicare 20 percent sample files of Part B claims and the Medicare Provider Analysis and Review files (MEDPAR). These claims files were available to us under a data use agreement with Medicare. We also used the Medicare Data on Provider Practice and Specialty (MD-PPAS) file, which is a provider-level file also available through our data use agreement. We used the Medicare Physician Fee Schedule (PFS) files and the Medicare Outpatient Prospective Payment System (OPPS) files. The level of these publicly available files is Healthcare Common Procedure Coding System (HCPCS) code, each of which specifies a procedure or service that a physician can perform and its Medicare reimbursement value.^{12,13} We also used the American Medical Association (AMA) Physician Masterfile, which is a provider-level dataset available to us under a data use agreement with the AMA. All datasets included years 2010-2016.

We extracted a number of key variables from these datasets. The claims files allowed us to characterize several aspects of a physician's practice, including whether a physician was integrated with a hospital and the market concentration of hospitals and physicians. MEDPAR contains patient claims for inpatient encounters, which we used to calculate hospital market concentration. The Medicare Part B claims contained the claims history for a 20% sample of Medicare beneficiaries, which we used to measure the set of procedures that physicians performed.¹⁴ Since we used the 20% sample (the largest sample available from Medicare), we multiplied service quantities by five to approximate the total annual quantity. The Medicare OPPS and PFS files contained the information required to calculate prices for services in the office and hospital outpatient department settings. MD-PPAS contains tax identifiers and legal names for each physician's primary place of practice. We used this to supplement our measure of integration (described below). The AMA Masterfile is a comprehensive database of nearly all U.S. physicians and lists demographic and professional characteristics associated with each physician.

Our study population included physicians in the United States who billed Medicare between 2010 and 2016. We limited our analysis to physicians with specialty codes of primary care, diagnostic radiology, obstetrics and gynecology, cardiology, surgery, psychiatry, gastroenterology, neurology, dermatology, urology, otolaryngology, and oncology. We also required each physician to have over 10 recorded line items in Medicare claims and have a matching record from the AMA Masterfile. We excluded a small number of physicians with invalid National Provider Identifiers. The resulting file was an unbalanced panel of physicians (n=2,137,245 physician-years) who met these criteria (see eTable 1 for sample flow).

Our outcome was physician integration with a hospital. We defined integration using a strategy developed by Neprash and colleagues which uses place of service codes found in Medicare claims.⁴ We supplemented this definition by identifying physicians whose legal names in MD-PPAS data were likely to correspond to hospital employment (see Appendix Section B). After applying the MD-PPAS definition, we reclassified some physicians who were originally defined as non-integrated (eTable2). Our claims-based

definition captured 79 percent of all integrated physicians; our MD-PPAS supplemental definition captured the remainder. Using the claims-only definition did not change our conclusions (eTable 3).

We appended the outpatient prospective payment system and physician fee schedule files to the Part B claims to calculate the value of each physician's services if billed from an office and if billed from a hospital outpatient department. We used this information to calculate our key exposure variable, to which we refer as the hospital-office ratio. It measures the financial benefit associated with billing from a hospital outpatient department, i.e., billing from a hospital-integrated practice. To calculate the magnitude of this financial benefit, we examined the full bundle of services for which a physician billed Medicare in 2010, using the Healthcare Common Procedure Coding System (HCPCS) codes found on each claim. Medicare specifies reimbursement levels for each HCPCS code and each place of service. We compared the dollar amount of revenue if a physician billed all their services from an office place of service code to the revenue if billed from a hospital outpatient department place of service code.

For a simplified example, take a physician who performs only three services in a year. We identified which services (i.e., which HCPCS codes) these were through the Part B claims. We then identified the reimbursement value for each of these services using the PFS and OPFS files. In this example, suppose that the PFS and OPFS indicated that Medicare reimbursed Service 1 in the office at \$50 and in the hospital outpatient department at \$75; Service 2 at \$100 and \$190; and Service 3 at \$80 and \$87. For this physician, the total value of their services if they worked in an office would have been \$230 ($50 + 100 + 80$), and the value if in an hospital outpatient department would have been \$352 ($75 + 190 + 87$). This physician's hospital-office ratio is 1.85 ($352 / 230$). Each physician thus had their own hospital-office ratio in every year, with variation in this ratio across physicians driven by differences in the bundle of services that each physician delivered to their patients. This measure exhibits variation across specialty (since physicians of different specialties perform different procedures, each of which is associated with a different hospital-office payment disparity) as well as within specialty (since each physician within a specialty performs a slightly different bundle of

procedures depending on patient need). More detail about our approach can be found in Appendix Section B.

One potential confounder in this measure is that relying on the set of services a physician performed in each year could create selection: physicians could have responded to price changes by adjusting the quantity of different services in their bundles each year. This would confound the effect of Medicare's price updates with physician behavior. To isolate the effect of price updates, we fixed each physician's bundle of services at their 2010 values. We calculated each physician's annual hospital-office ratio from 2011 through 2016 by applying Medicare's prices from each respective year to the physician's 2010 bundle of services. Each year, Medicare provides annual updates to the price for each service, leading to variation over time in the relative value of services performed in the hospital outpatient department compared to the office. Our exposure variable makes use of this year-to-year price variation.

We note that Medicare's payment system has two components: the physician fee and the facility fee. A physician fee is generated in both office and hospital outpatient department settings, while a facility fee is generated only when a service is billed from a hospital outpatient department. The physician fee, when generated from a hospital outpatient department, is smaller than the physician fee when generated from an office; however, with the addition of the facility fee, the total reimbursement for the services performed by an integrated physician is larger than an equivalent physician billing from an office. While the facility fee is paid directly to the hospital, some of this payment may be shared with physicians, as the Stark Law and Anti-Kickback Statute typically allow hospitals to pay salaries and bonuses to hospital employees. Previous research has found, for example, an increase in compensation for hospital-integrated cardiologists.¹⁵ Integration may therefore offer financial benefits to both hospitals and physicians.

We were interested in understanding the relationship between the hospital-office ratio and integration among physicians. Our first analysis examines the cross-sectional relationship between hospital-office ratios and integration levels by specialty. If the ratio plays a key role in driving hospital-physician integration, we would anticipate specialties with high hospital-office ratios (urology, for example) to be more highly integrated. We

calculated the hospital-office ratio and the integration status of each physician and summarized our findings by specialty. Furthermore, we hypothesized that physicians with large potential gains from billing from a hospital outpatient department instead of an office, i.e., those with large hospital-office ratios, would be more likely to be acquired. To test this, we estimated logistic regression models on the set of physicians who were unintegrated as of 2010. We also calculated and controlled for market competitiveness of hospitals and physicians, since the degree of market competition influences the incentive to integrate.⁹ We clustered standard errors at the physician level. We also performed stratified analysis, estimating this model within samples of primary care physicians, medical specialties, and surgeons. To improve the interpretation of our models, we report the average marginal effect of a change in the hospital-office ratio equivalent to a 25th-to-75th percentile increase within each specialty type (a unit increase of 0.42, on average) to avoid reporting unrealistically large effects from out-of-sample increases in the hospital-office ratio. To test the robustness of our results, we also specified linear probability models and found similar results. Likewise, our results were substantially similar whether using a claims-only integration measure or supplementing with the MD-PPAS definition (see eTable 3). These analyses supported our conclusions.

Our study has several limitations. First, we use Medicare prices in our analysis. We can only make inferences on the effect of Medicare prices on integration, even though commercial prices may be even more important, a subject we address further in our Discussion. Our reliance on Medicare prices could thus lead us to understate the true responsiveness of providers to outpatient price differences. Second, we use a claims-based measure of integration supplemented by a keyword search of physicians' employer names. If acquired practices do not promptly update their place of service in their Medicare claims, then a claims-based approach may introduce measurement error into our dependent variable and bias our findings toward a null result. The advantage of a claims-based measure is that it is easily understood, can be reliably reproduced using a commonly available data source, and allows us to generate a large, nationally representative physician sample. Moreover, it is the best fit with our research question, which centers on the ability of providers to receive larger payments using a different

place of service on Medicare claims. If place of service is not updated after integration, we would not measure their integration status correctly, but nor would the provider be able to receive higher reimbursement. The levels and trends of integration that we calculate are also broadly consistent – overall and across specialties – with research using alternative measures (see eTable 2). Our keyword search supplement also helps to mitigate claims-based measurement error. Third, we rely for our identification on variation that comes from Medicare’s annual updates to payment rates. Such updates may be noisy, and whether providers would be willing to change ownership structure in response to such changes is unknown. This is one of the gaps in the literature that we seek to fill.

RESULTS

We identified a total of 2,137,245 physician-years who met inclusion criteria between 2010 and 2016 (Table 1). Primary care physicians comprised about 50 percent of our sample. Integration increased between 2010 and 2016 from 23 percent of the sample to 27 percent. The average hospital-office ratio among unintegrated physicians in 2010 was 1.80. This indicates that for the average physician, the revenue they would have generated for their bundle of services if billed from a hospital outpatient department would have been 180 percent the size of revenue they would have generated for the same services if billed from an office. The average bundle of services in 2010 among unintegrated physicians was worth \$141,000 if billed from an office and \$240,000 if billed from a hospital outpatient department. This implies that integrating with a hospital would have increased total Medicare reimbursement in 2010 by a (revenue-weighted) average of \$99,000 per physician. Among physicians unintegrated in 2016, the hospital-office ratio increased to an average of 1.99 in 2016. The average bundle of their services was worth \$150,000 in the office, \$291,000 in the hospital outpatient department. This implies that integrating with a hospital would have increased total reimbursement in 2016 by about \$141,000 per physician. Across all years and specialties, the average reimbursement difference in our study period was \$114,000 per physician per year (eTable 4). The average hospital referral region (HRR) Herfindahl-

Hirschman index (HHI) for hospitals was over 1,700 and for physician specialties was over 300.

Figure 1 displays the results for our specialty-level analysis of the cross-sectional relationship between integration and hospital-office ratios. If these ratios drive vertical integration decisions, we would expect to observe a positive relationship. In this unadjusted analysis, there was little evidence of a cross-sectional relationship between the hospital-office ratio and integration. We did find considerable variation in levels of integration by specialty. Diagnostic radiologists had the highest rates of integration (64%), dermatologists the lowest (6%), and primary care physicians were in the middle (24%). For urology, other surgical specialties, and gastroenterology, the hospital-office ratio exceeded 2.0. Across all specialties, services were worth more if billed from a hospital outpatient department, with about a quarter of physicians having a ratio of 2 or more, indicating that reimbursement for their services would have been double in a hospital-owned practice compared to equivalent services delivered in an office (eFigure 1). Diagnostic radiologists were the most integrated specialty in our sample. These physicians provide a service to other doctors or hospitals and do not take care of patients directly (many radiology tests occur in the hospital inpatient or outpatient setting as opposed to the office, corresponding to the high levels of hospital employment we observed in our data). The wide range of hospital-office ratios across specialty corresponded to a wide range of differences in total Medicare revenue by specialty (Figure 2). Urology services topped this list: in 2010, a urologist's services would have been worth about \$300,000 more in the hospital outpatient department than in the office. Primary care services were worth about \$63,000 more. Obstetrics and gynecology and psychiatry exhibited the smallest differences at \$20,000 and \$16,000, respectively.

Even absent a cross-sectional relationship between integration and hospital-office ratios at the specialty level, outpatient payment differences may exert an effect at the physician level, i.e., within specialties. To test this, we turn to our logistic regression models (Figure 3). Here, we find evidence of a modest and positive relationship.

Estimates from these models showed that the hospital-office ratio was significantly associated with integration.

Across all specialties, a 25th-to-75th percentile increase in the hospital-office ratio was associated with a 0.20 percentage point increase in the probability of integrating with a hospital (95% CI: 0.10 to 0.30). The effect of the hospital-office ratio varied by specialty. A 25th-to-75th percentile increase in the hospital-office ratio among primary care physicians was associated with a 0.27 percentage point increase in integration (95% CI: 0.18 to 0.35). Medical specialties exhibited similar responsiveness (0.26 percentage points, 95% CI: 0.05 to 0.48). This effect was larger when we excluded oncologists from the analysis of medical specialties, rising to 0.61 percentage points (95% CI: 0.39 to 0.83) (eTable 4). The results among oncologists may be uniquely affected by the 340B drug pricing program (see Discussion). Cardiologists, neurologists, and otolaryngologists all showed effect sizes between 0.50 and 1.00 percentage points (eTable 4). The responsiveness of surgical specialties was not significantly different from zero (-0.02; 95% CI: -0.27 to 0.22).

We also found that high levels of hospital market concentration as well as rural geography were associated with a higher probability of a physician being integrated (eTable 5). A 10 percent increase in the hospital market concentration was associated with about a 1 percentage point increase in the probability of integrating with a hospital. Rural status was associated with a 3.4 percentage point greater probability of integrating with a hospital.

DISCUSSION

In this national, seven-year study of the relationship Medicare's annual site-specific outpatient price updates and hospital-physician integration, we report three main findings. First, hospital-office ratios were high. The average physician's workload would have produced \$114,000 in additional revenue per year if billed from a hospital-owned clinic, i.e., if the physician were vertically integrated. Second, there was considerable heterogeneity in the magnitude of this pricing disparity by specialty type: the revenue difference was \$63,000 among primary care physicians, \$178,000 among medical specialties, and \$150,000 among surgeons. Third, Medicare's annual site-specific

outpatient price updates modestly affected hospital-physician vertical integration, with implications for provider organizations and Medicare spending.

Our results expand on two studies that explore site-based payments and integration. Song and colleagues studied the effects on cardiologist integration of a Medicare pricing change to myocardial perfusion imaging (MPI), echocardiograms, and electrocardiograms. They found that the changes to these three procedures, which favored the hospital outpatient setting, increased the share of services billed from a hospital outpatient department setting.¹⁶ In our study, we add to this approach by studying the effects of seven years' worth of Medicare price updates to thousands of physician services. Although our outcomes are not directly comparable, we, like Song and colleagues, find a positive relationship between cardiologist integration and price updates that favor the hospital outpatient department. We add, first, that this positive relationship persists when we include the hundreds of distinct services that a cardiologist may perform, and, second, that the relationship is present when price changes are from routine annual payment updates rather than a single large price shock.

Second, Dranove and Ody examine, as we do, multiple physician specialties. They determined that a payment shock to Medicare prices in 2010 accounted for 20 percent of the increase in hospital employment through 2013.⁵ We add to this approach by studying the effects of payment updates that accumulate through 2016. Our results complement theirs, though our study differs in several key ways. Our exposures differ: we use annual payment updates from 2010-2016 instead of a single-year payment shock. This leads us to expect somewhat smaller effect sizes, which is what we find. Our data sources differ. We use Medicare claims data; Dranove and Ody's study does not use Medicare claims data, but rather proxies for exposure to Medicare price changes using private claims data. Lastly, and critically, our sample compositions likely differ. Their study is based on commercial insurers while ours is based on Medicare payments, which leads us to expect that their study would find larger effects. Commercial insurers often follow Medicare's lead on reimbursement structure, a core motivation of Dranove and Ody's work. A key difference, however, is that commercial

insurers regularly pay higher prices than Medicare for the same services.¹⁷ For inpatient services, they pay approximately double Medicare's rates. For outpatient services, like those under investigation in the present study, the relative prices are even larger: White and Whaley recently used 2017 data to estimate outpatient private plan prices to be 293 percent the amount of Medicare rates, while Lopez and colleagues, in a review that included data from 2010-2017, estimated outpatient prices to be an average of 264 percent of Medicare rates.^{18,19} Site-specific payment differences in Medicare are thus likely to be magnified in commercial insurance, creating an even larger incentive to integrate among physicians with large commercial volumes. Our sample, drawn from Medicare claims, does not include practices that treat only commercial patients, and also excludes practices with only a small volume of Medicare patients. We further include in our sample those physicians who practice in rural areas, which serve a disproportionate number of Medicare patients, whereas Dranove and Ody include only physicians from metro areas. Given the differences in exposure, data, and sample, we would expect to see, as we do, that our measured effects are smaller, but still positive.

The present study broadens our understanding of payment policy and vertical integration. It is the first to estimate the dollar value associated with hospitals acquiring physician practices or employing physicians by using each physician's empirically verified bundle of Medicare services. We found that the financial incentive was large – over \$114,000 per physician per year. These results cohere with recent work that has found that much of the increase in U.S. health care costs is attributable to rising prices or changes in service intensity (such as migration of services to a hospital outpatient department).²⁰ We also estimate specialty-specific differences in the relationship between integration and Medicare's site-based billing policies. Among our conclusions is that it is difficult to characterize the relationship for physicians as a uniform group, since specialty appears to exert a strong influence on this relationship. Oncology has received special attention in this literature. Like others, we find that the level of integration increased substantially from 2010 to 2016. We add that larger payment differentials between the hospital outpatient department and office seemed to be associated with a slightly reduced probability of integrating among oncologists. We caution, though, that results among oncologists may be confounded by another

important policy, the effects of which are beyond the scope of this study. Hospitals eligible for the 340B program receive large discounts from drug manufacturers. Through integration, hospitals can extend these discounts to drug-intensive physicians like oncologists, creating large incentives to integrate.²¹ Among oncology practices, the 340B program may have been a more salient factor in integration decisions, which likely influences our results among oncologists.

Finally, we show that although the routine annual updates to Medicare outpatient prices that we study here may have smaller impacts than large price shocks studied in previous work, hospital-physician vertical integration responds even to these updates. We find suggestive evidence that these effects are somewhat larger among primary care physicians and medical specialties (excepting oncology) and not significantly different from zero among surgeons. Concentrated hospital markets also appear to increase the likelihood that a physician integrates with a hospital. We also observed that rural providers were more likely to integrate than their urban counterparts. Incentives to integrate could differ across rural and urban areas for several reasons: physician labor markets are less competitive in rural areas than urban; rural critical access hospitals (CAHs) are exempt from certain value-based reforms like Medicare's Hospital Readmissions Reduction Program (HRRP); and rural hospitals are subject to different quality improvement programs and looser staffing restrictions.²² In the present study we were unable to test which factors drive the observed urban-rural difference, though we think this is an important area of further research.

The regulation of site-based payments has seen changes in recent years. In 2015, Congress passed the Bipartisan Budget Act, which grandfathered in hospital outpatient department payment rates to existing offices that billed as off-campus hospital outpatient departments on or before November 1, 2015. The 21st Century Cures Act of 2016 extended these exceptions to offices that were mid-transition at that time. However, recent rulemaking activity from CMS has begun to impose certain site-neutral payments on off-campus hospital outpatient departments – even among grandfathered hospital outpatient departments – beginning with clinic visits. The legality of this payment rule is subject to a lawsuit by the American Hospital Association, but as of

January 1, 2019, clinic visits began being paid the same reimbursement as an office. CMS projected that these changes would save the Medicare program \$380 million in 2019 and \$760 million in 2020.²³ Our results imply that this change could have a cooling effect on vertical integration.

We conclude by noting that our work warrants further inquiry into the causes of hospital-physician vertical integration. Medicare outpatient payment policies are unlikely to be the only or even the main reason for hospital-physician vertical integration. In our study, other factors, including market concentration, exerted larger effects. Moreover, disparities in payment rates between hospital outpatient departments and offices existed for many years without an acceleration in integration. This fact highlights the inadequacy of site-specific reimbursement as the main explanation for the recent increase in integration. Some have alluded to integration as a strategy to gain a leg up in negotiations with commercial payers; consistent with this, recent studies have confirmed that vertical integration is associated with rising commercial prices.^{4,24,25} Alternatively, physician preferences may play a key role: physicians today may find independent practices less commercially viable than in the past due to the costs of regulatory compliance, alternative payment models, or electronic health records.^{26,27} Some have suggested that generational differences in preference for economic security or work life balance may push more physicians to work for hospitals, and evidence from staff surveys suggests that burnout is lower among physicians working for hospitals.^{28,29} Integration appears to threaten the affordability of care with minimal gains in quality.^{10,30–36} Antitrust policy is unlikely to be a reliable remedy: many office acquisitions are not large enough to trigger antitrust scrutiny, and physicians who are directly hired to work at a hospital facility are not part of acquisitions at all.^{37,38} Many provider markets are already well beyond the “highly concentrated” thresholds set by antitrust agencies.³⁹ Further work should explore not only the implications of vertical integration for cost and access, but also the underlying strategic motivations of providers and whether these motivations are amenable to policy intervention.

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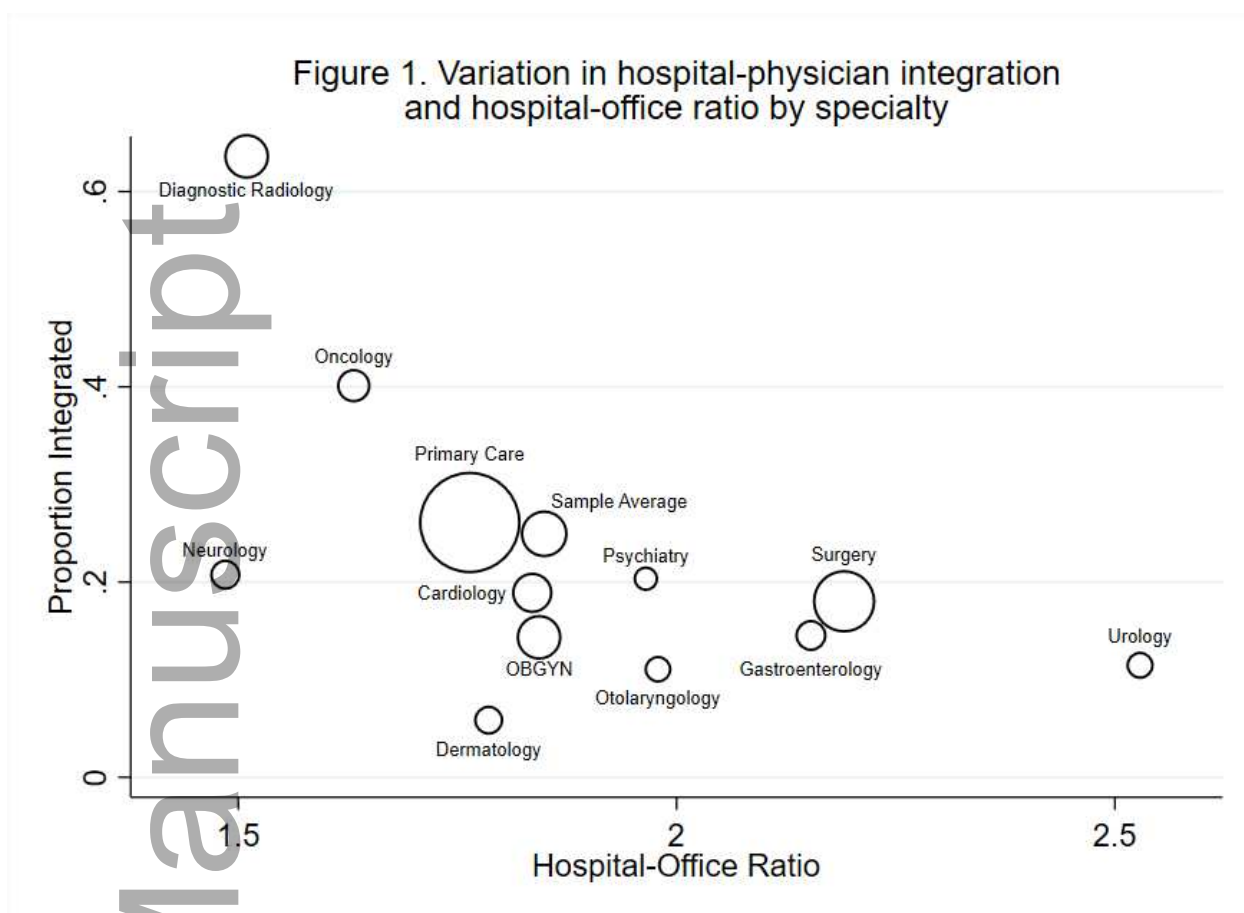
Table 1. Characteristics of physicians in the study sample

| | 2010 | 2016 |
|---------------------------------|---------|---------|
| Sample Size (unique physicians) | | |
| % of sample | | |
| Total | 330,520 | 277,417 |
| | 100% | 100% |
| Primary care | 169,517 | 139,597 |
| | 51% | 50% |

| | | |
|--|-----------|-----------|
| Medical specialties | 101,955 | 87,411 |
| | 31% | 32% |
| Surgical specialties | 59,048 | 50,409 |
| | 18% | 18% |
| Physician Characteristics | | |
| Integrated with hospital | 76,622 | 74,148 |
| | 23% | 27% |
| Not Integrated | 253,898 | 203,269 |
| | 77% | 73% |
| Hospital-Office Ratio (mean) | 1.797 | 1.995 |
| Among unintegrated | 1.800 | 1.991 |
| Office-based value of services (mean) | \$143,000 | \$147,000 |
| Among unintegrated | \$141,000 | \$150,000 |
| Hospital-based value of services (mean) | \$233,000 | \$280,000 |
| Among unintegrated | \$240,000 | \$291,000 |
| Age (mean) | 50 | 52 |
| Female (%) | 26% | 26% |
| Census Region | | |
| Midwest | 23% | 22% |
| Northeast | 23% | 22% |
| South | 34% | 35% |
| West | 21% | 21% |
| Market Concentration (Herfindahl-Hirschman Index [HHI]) | | |
| Average Hospital HHI (mean) (hospital referral region) | 1,747 | 1,873 |
| Average Physician HHI (mean) (hospital referral region) | 351 | 367 |

Note: Primary Care includes family practice, general practice, geriatric medicine, and internal medicine. Medical specialties include cardiology, dermatology, diagnostic radiology, gastroenterology, neurology, otolaryngology, psychiatry, and oncology. Surgical specialties include cardiac, colorectal, general, hand, orthopedic, plastic, thoracic, and vascular surgery, as well as neurosurgery, urology, and surgical oncology. N = 2,137,245 physician-years for full study period. The hospital-office ratio indicates the ratio of the total Medicare reimbursement value of physician services if billed from a hospital outpatient department compared to an office setting (e.g., a ratio of 2.0 indicates twice the reimbursement in a hospital outpatient department compared to an office for the same services). Reported ratio is unweighted by revenue. Numbers reported are for both unintegrated and integrated physicians unless otherwise noted. Office-based value of services provides the total Medicare reimbursement for a physician's annual bundle of all services if billed from an office, rounded to the nearest thousand. Average hospital and physician Herfindahl-Hirschman Indices (HHIs) are weighted by the number of physicians in the sample practicing in each hospital referral region.

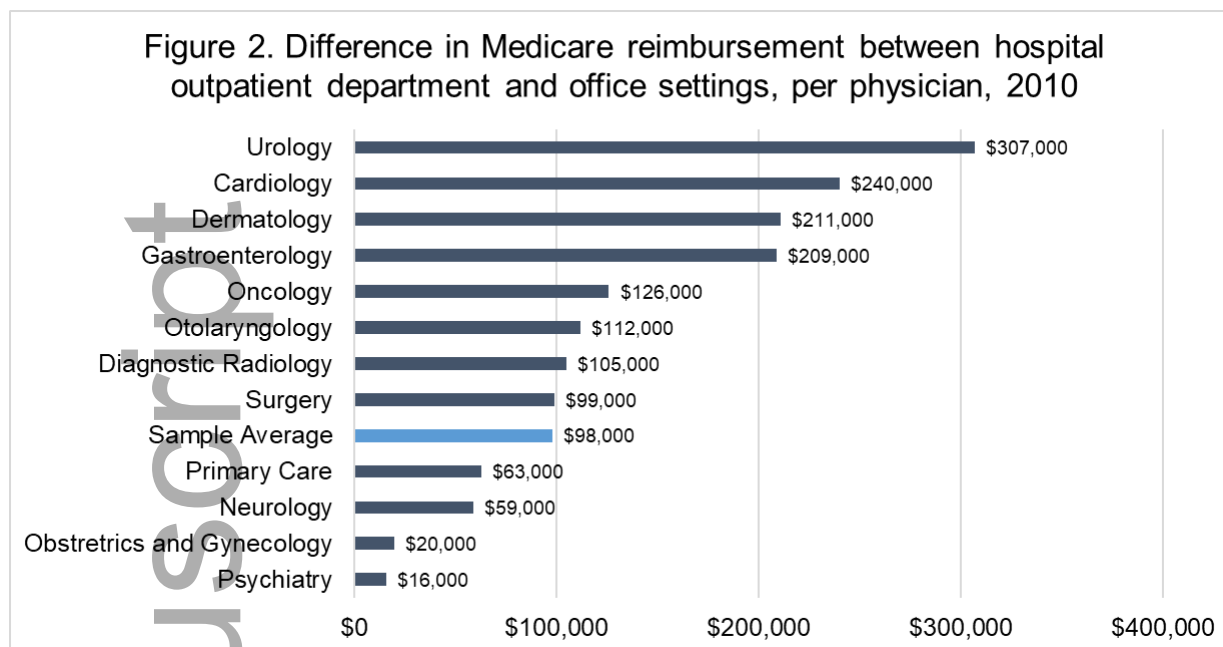
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Note: OBGYN – Obstetrics and Gynecology

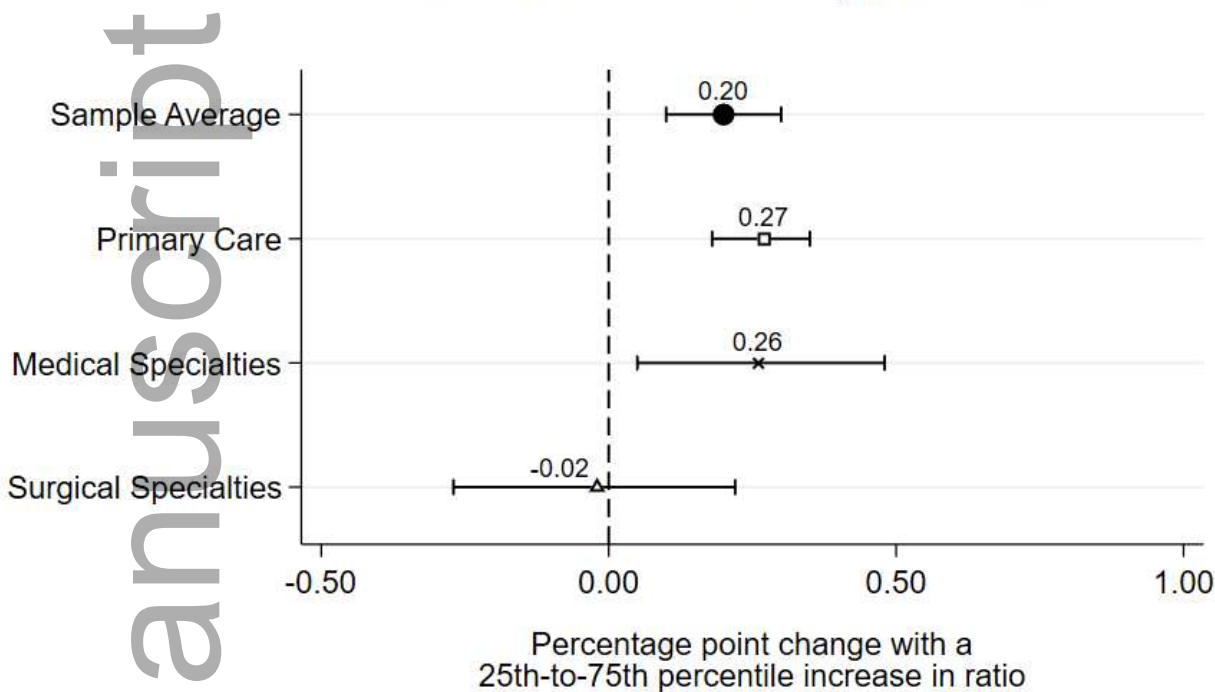
Note: Figure includes data from 2,137,245 physician-years between 2010 and 2016.

Note: The hospital-office ratio indicates the ratio of the total Medicare reimbursement value of physician services if billed from a hospital outpatient department compared to an office setting (e.g., a ratio of 2.0 indicates twice the reimbursement in a hospital outpatient department compared to an office for the same services). These measures were calculated for each physician in each year using services billed to Medicare from 2010-2016; these ratios are aggregated by specialty for display in this graph. Circle sizes are weighted by the number of physicians. Primary Care includes family practice, general practice, geriatric medicine, and internal medicine. Surgery includes cardiac, colorectal, general, hand, orthopedic, plastic, thoracic, and vascular surgery, as well as neurosurgery and surgical oncology.



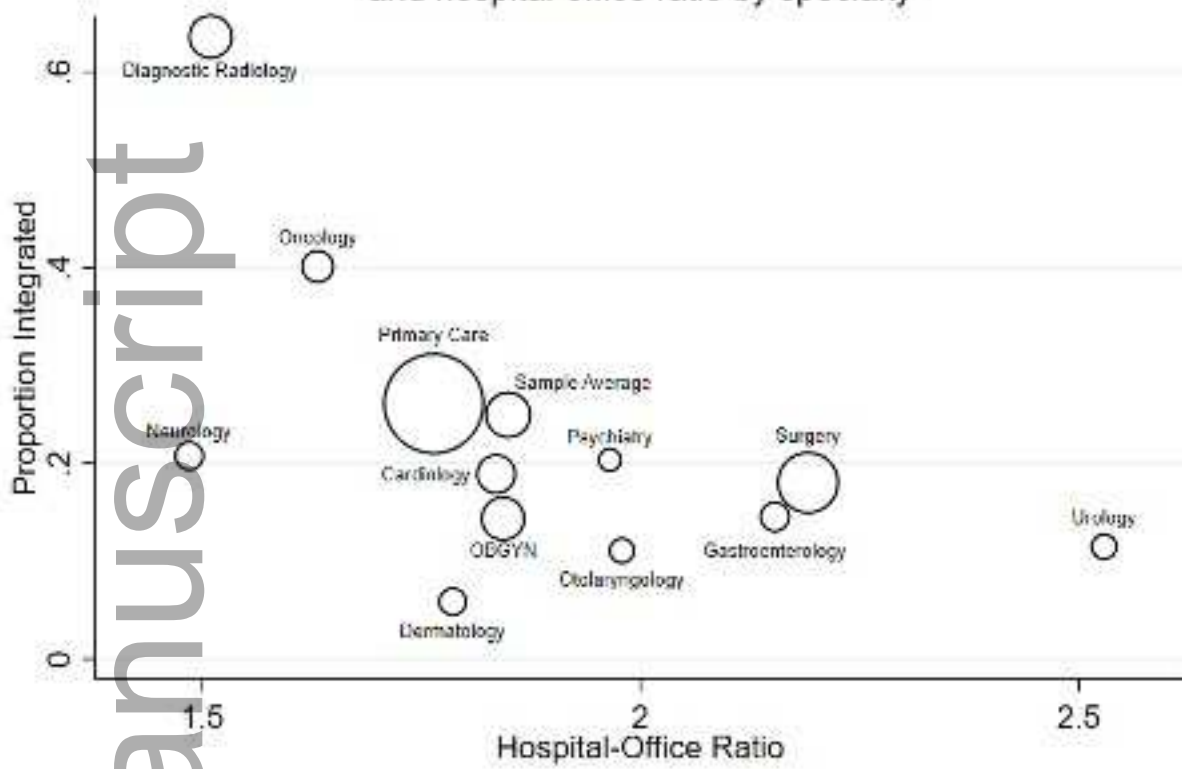
Note: Figure includes data from physicians in the sample unintegrated as of 2010. The difference in Medicare reimbursement is calculated as (total reimbursement generated for a physician's bundle of services if billed from a hospital outpatient department) – (total reimbursement generated for a physician's bundle of services if billed from an office). Numbers are rounded to the nearest thousand. Primary Care includes family practice, general practice, geriatric medicine, and internal medicine. Surgery includes cardiac, colorectal, general, hand, orthopedic, plastic, thoracic, and vascular surgery, as well as neurosurgery and surgical oncology.

Figure 3. Change in probability of integration associated with an increase in the hospital-office ratio

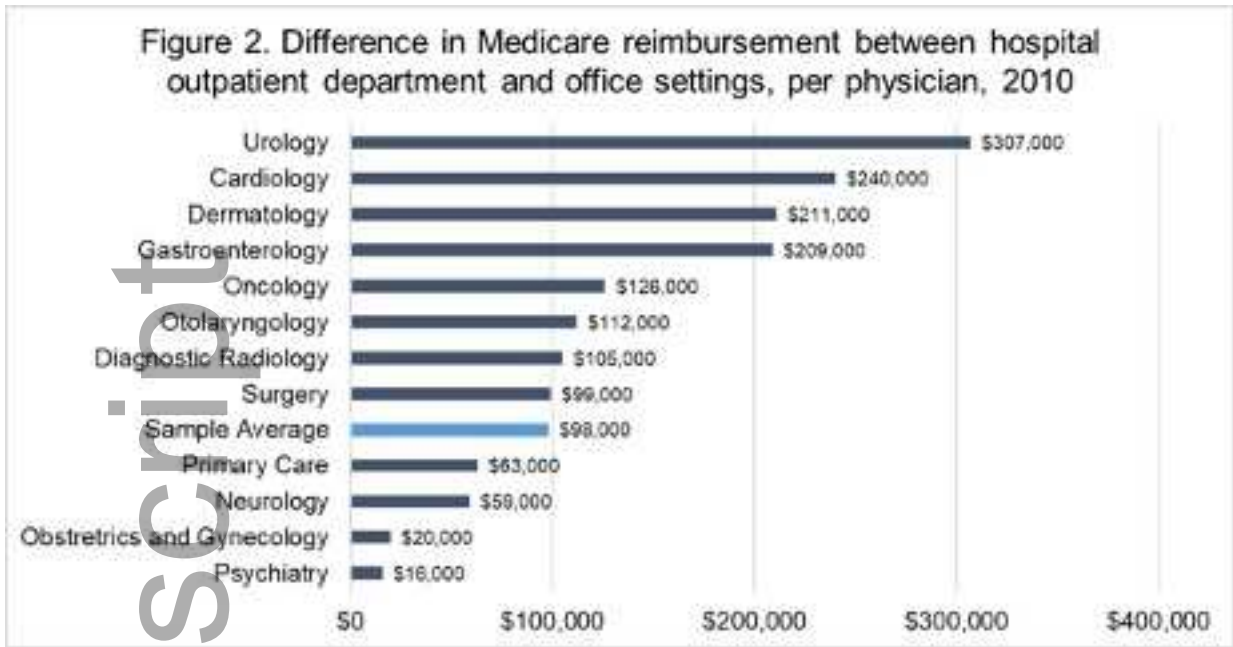


Note: The hospital-office ratio indicates the ratio of the total Medicare reimbursement value of physician services if billed from a hospital outpatient department compared to an office setting (e.g., a ratio of 2.0 indicates twice the reimbursement in a hospital outpatient department compared to an office for the same services). Percentage point changes are for the marginal effects on probability that correspond to a change in the hospital-office ratio equivalent to a 25th-to-75th percentile increase in the ratio. Estimates shown for the sample of physicians unintegrated as of 2010. Primary Care includes family practice, general practice, geriatric medicine, and internal medicine. Medical specialties include cardiology, dermatology, diagnostic radiology, gastroenterology, neurology, otolaryngology, psychiatry, and oncology. Surgical specialties include cardiac, colorectal, general, hand, orthopedic, plastic, thoracic, and vascular surgery, as well as neurosurgery, urology, and surgical oncology.

Figure 1. Variation in hospital-physician integration and hospital-office ratio by specialty



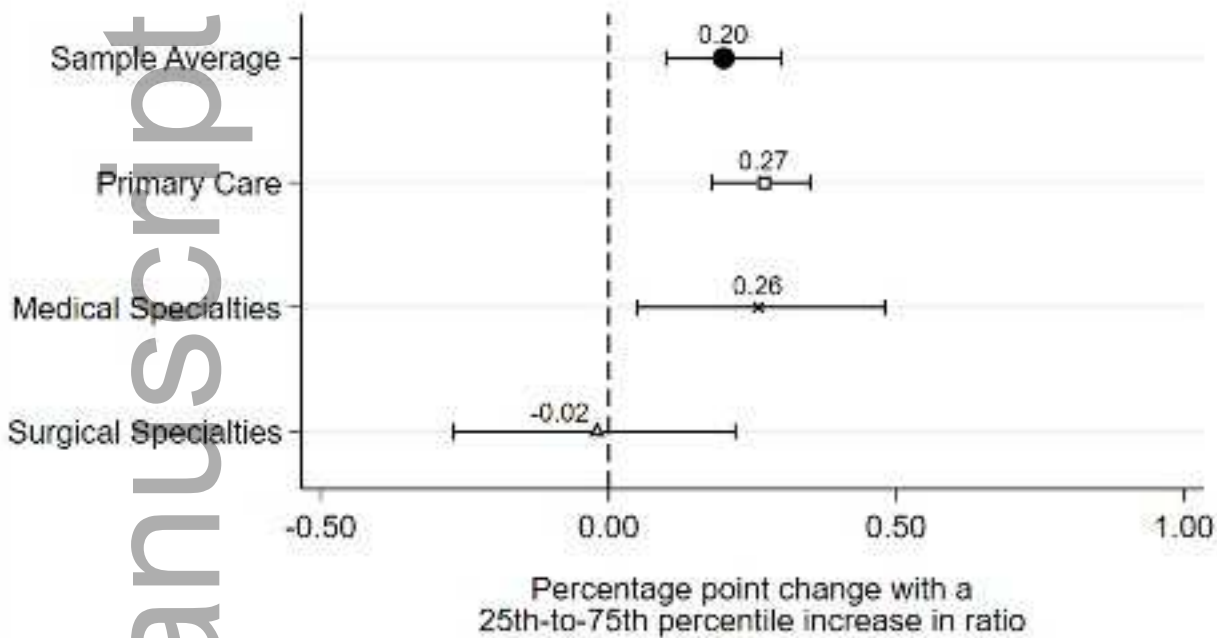
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Figure 3. Change in probability of integration associated with an increase in the hospital-office ratio



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