

The Influence of Provider Characteristics and Market Forces on Response to Financial Incentives

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Regionalization of healthcare is increasing as independent practices join hospitals and healthcare networks and larger groups and younger physicians favor employed positions.¹⁻³ Furthermore, concentration of cancer care is advocated by several studies to improve medical and surgical management of multiple disease states.⁴⁻⁶ These changes have the potential to reduce variation in care delivery and increase care coordination, resulting in reductions in unnecessary spending and ultimately improved outcomes.⁷⁻¹⁰ Yet, such benefits have been balanced by concerns surrounding potential increases in cost associated with reductions in competition.¹¹⁻¹⁴

Patterns of cancer care delivery remain heterogeneous with inconsistent reaction to market forces.^{15,16} Although observed variation in cancer care is due, in part, to differences in patient and disease characteristics, there remains considerable unexplained variation at the physician level.^{17,18} The complex relationship between physician behavior and loco-regional market forces remains poorly characterized.

Treatment of bladder cancer incurs remarkable costs and exhibits significant practice heterogeneity.^{19,20} Previous work has evaluated changes in diagnostic and treatment patterns of bladder cancer as a result of changes to physician payments in the Medicare fee schedule and demonstrated inefficient and costly alterations in practice.²¹ In brief, this work found that, despite payment incentives with strong face validity to shift bladder cancer care from high-cost facility-based locations (operating room or ambulatory surgery center) to physician offices, providers increased the total number of procedures performed as opposed to substituting site of service to optimize the value of bladder cancer care delivery. Additionally, this work demonstrated an increase in procedural redundancy and decreased diagnostic yield.

We observed considerable variation in physician response to this financial incentive. To this end, in the current analysis, we sought to determine physician characteristics and market-level factors associated with responsiveness to financial incentives. We hypothesized that readily available physician- and market-level

ABSTRACT

OBJECTIVES: Alternative payment models, such as accountable care organizations, use financial incentives as levers for change to facilitate the transition from volume to value. However, implementation raises concerns about adverse changes in market competition and the resultant physician response. We sought to identify physician characteristics and market-level factors associated with variation in response to financial incentives for cancer care that may ultimately be leveraged in risk-shared payment models.

STUDY DESIGN: Retrospective cohort study of physicians providing minimally invasive bladder cancer procedures to fee-for-service Medicare beneficiaries.

METHODS: We examined the relationship of between-group differences in market-level factors (competition [Herfindahl-Hirschman Index (HHI)] and provider density) and physician-level factors (use of unique billing codes, number of billing codes per patient, and competing financial interest) to responsiveness to financial incentives.

RESULTS: Incentive-responsive providers had increased odds (odds ratio [OR], 1.19; 95% CI, 1.04-1.35) of practicing in markets with the highest quartile of provider density but not HHI (OR, 0.96; 95% CI, 0.87-1.05). Incentive-responsive providers were more likely to bill in the highest quartile for unique codes (OR, 1.49; 95% CI, 1.32-1.69) and codes per patient (OR, 1.18; 95% CI, 1.11-1.25) and less likely to have a competing financial interest (OR, 0.76; 95% CI, 0.72-0.81).

CONCLUSIONS: Responsiveness to financial incentives in cancer care is associated with high market provider density, profit-maximizing billing behavior, and lack of competing financial ownership interests. Identifying physicians and markets responsive to financial incentives may ultimately promote the successful implementation of alternative payment models in cancer care.

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data would permit identification of a specialist physician phenotype particularly responsive to financial incentives that may ultimately be leveraged in identifying physicians and markets that may be particularly well suited to participate in early risk-bearing payment models.

TAKEAWAY POINTS

- ▶ Responsiveness to financial incentives in cancer care is associated with high market provider density, profit-maximizing billing behavior, and lack of competing financial ownership interests.
- ▶ Responsiveness to financial incentives is not associated with high levels of market competition.
- ▶ Identifying physicians and markets with this phenotype of responsiveness to financial incentives may ultimately be leveraged in identifying physicians and markets well suited to participate in and therefore optimize the successful implementation of alternative payment models.

METHODS

Data Sources

As described elsewhere, we used a 5% Medicare sample from 2001 through 2013 to identify beneficiaries enrolled in fee-for-service (FFS) Medicare Parts A and B who underwent a minor cystoscopic procedure associated with the diagnosis and/or management of bladder cancer (Current Procedural Technology [CPT] procedure codes 52204, 52214, 52224). There was a large increase in professional payment for these procedures beginning in 2005 when performed in an office-based location.²²

Performance of this group of minor cystoscopic procedures requires minimal additional equipment and expertise to perform in the office than is already established in most urology practices. Further, there are few (if any) contraindications to performing these procedures in the office rather than in dedicated operating rooms or surgical centers.

We then identified individual providers who performed 1 or more of these procedures using their National Provider Identifier (NPI). We defined 2 groups of urologists, the first being those who did not change practice pattern after implementation of the change in Medicare fee schedule and the second being the group that increased the use of office-based procedures in response to the positive change in reimbursement.

We then linked the provider-level data from our index analysis to the 2013 National Downloadable File, a dataset maintained by CMS that includes years since graduation from medical school and gender.²³ This file also contains data on firm affiliation, including number of physicians (regardless of specialty) within a given practice. Providers were excluded if their date of graduation was after 2008 to omit physicians that were highly likely to be in ongoing resident training. Provider location information was obtained from the NPI Dissemination File, which is a dataset also maintained by CMS and updated weekly with all known provider locations.²³ Proportion of effort was equally divided between each associated firm for providers listed as participating in multiple firms.

We calculated 2 measures of loco-regional markets using zip codes to assign hospital referral regions (HRRs). HRRs were defined by the Dartmouth Institute of Health Policy and Clinical Practice and represent regional healthcare markets for tertiary medical care.²⁴ Urologist density was calculated as the number

of urologists per 10,000 Medicare beneficiaries within each HRR. Herfindahl-Hirschman Index (HHI) is a widely used measure of market competition and is the sum of the squared market shares of all the firms within the market multiplied by 10,000. We used the number of urologists in each firm as a measure of market share and HRR to define a market. Values of 10,000 represent a monopoly market, with values less than 2500 considered competitive markets.¹¹

Provider billing practice data was obtained from the publically available 2012 Medicare Provider Utilization and Payment Data. Using this dataset, we calculated 2 measures of billing practice as a representation of efficient coding behavior. First, we calculated the number of unique Healthcare Common Procedure Coding System (HCPCS) codes billed to Medicare during that year by each provider. Second, we calculated the number of codes billed per beneficiary.

The structure of the data in this set does not allow for calculating the precise number of codes billed to CMS per beneficiary per visit. To estimate the number of unique codes per visit, we summed the number of times each HCPCS code was billed and divided this by the sum of the number of patients for which each HCPCS code was used. However, the denominator of this calculation contains duplicate counts for patients rather than counts of unique patients. As a result, this estimate will be conservative and should not be used as an assessment of the absolute number of codes per patient but in relative terms for between-group comparisons.

Some urologists have an ownership stake in a facility (ie, ambulatory surgery center) and may preferentially perform minor procedures in a facility that could otherwise be done in the office to capture not only the professional fee but also the facility fee associated with these procedures. Simple cystoscopy (CPT 52000) is one of the most common procedures performed by urologists and is most often conducted in the office. To account for this competing motivation for performing procedures in the facility regardless of the financial incentive associated with office-based management of bladder cancer, we identified the proportion of simple cystoscopy procedures performed by each urologist in the office compared with in the facility.

Data from the 2013 American Community Survey were used to construct additional covariates for HRR-level attributes, including median household income, race, and educational attainment.²⁵

FIGURE. Proportion of Incentive-Responsive Providers by Hospital Referral Region

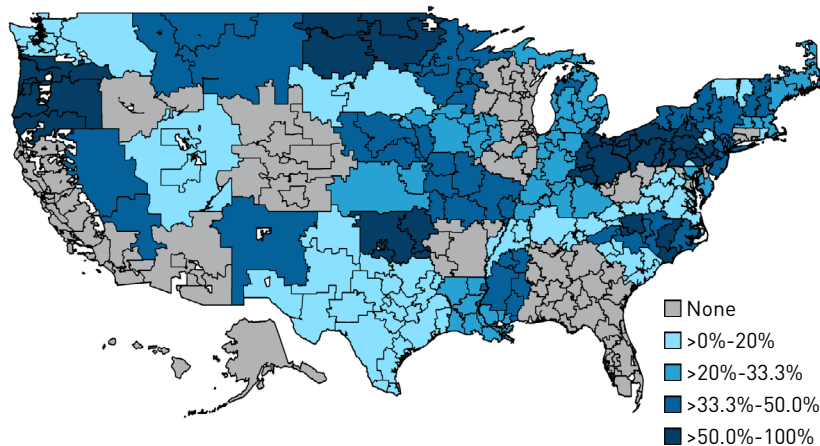


TABLE 1. Physician, Firm, and Patient Characteristics for Providers That Perform Office-Based MCP Compared With Facility-Based

	Incentive-Resistant (n = 1959)	Incentive-Responsive (n = 828)	P
Physician characteristics			
Years from graduation ^a	26 [18-35]	26 [18-34]	.67
Gender (female), n (%) ^b	93 (4.7)	37 (4.5)	.75
Firm characteristics			
Region, n (%) ^b			<.001
East	496 (25.3)	276 (33.3)	
Midwest	519 (26.5)	161 (19.4)	
South	715 (36.5)	274 (33.1)	
West	229 (11.7)	117 (14.1)	
Number of physicians ^a	32.0 [5.0-143.3]	22.0 [2.0-91.5]	<.001
Number of urologists ^a	4.0 [1.0-10.0]	3.2 [1.0-10.4]	.02
Patient characteristics^c			
Age, years ^a	75.7 [74.4-77.1]	75.8 [74.6-77.1]	.30
Number of comorbid conditions ^a	1.6 [1.2-2.0]	1.6 [1.3-2.0]	.03
Gender (female), % ^a	35.3 [25.0-46.7]	35.2 [25.0-47.9]	.43
Race (nonwhite), % ^a	5.6 [0.0-15.3]	6.2 [0.0-16.5]	.21

MCP indicates minor cystoscopic procedures.

^aMedian (interquartile range) with differences assessed by Wilcoxon test.

^bDifferences assessed by Pearson test.

^cIndividual physicians are the level of analysis, rather than individual patients, and values are averaged for each physician.

same proportion or decreased the proportion of office-based minor cystoscopic procedures compared with facility-based were considered incentive resistant. Differences in between-group provider, practice, and patient characteristics were assessed using the Wilcoxon rank sum and Pearson χ^2 tests.

The primary exposures of interest to explain provider response to the financial incentive were between-group differences in coding practice and market measures. Unadjusted comparisons were made using nonparametric statistics, and logistic regression models were used to adjust for patient (age, comorbidities, gender, and race), firm (number of physicians and number of urologists), and HRR (race, household income, and education) characteristics. Odds ratios were expressed as interquartile range values that reflect odds for the 75th percentile compared with the 25th percentile for each continuous exposure variable of interest.

Data management and statistical analyses were performed using R version 3.1.2 (The R Foundation; Vienna, Austria). *P* values below .05 were considered statistically significant. This study was approved by the institutional review board at Vanderbilt University.

RESULTS

Incentive-responsive urologists were more concentrated in the eastern United States but with other focused pockets throughout the country (Figure), and they practiced in smaller firms both in terms of number of total physicians and number of urologists (Table 1). Although incentive-resistant providers cared for patients with a slightly lower number of comorbid conditions, this observed difference may reflect between-group variation in coding practices rather than management of more complex patients. There were no observed between-group differences in provider gender, time since graduation from

medical school, or patient age, gender, and race.

Loco-regional market characteristics, differences in facility-based preference for performing procedures, and measures of billing practices are summarized in Table 2. Incentive-responsive providers used more unique billing codes and more codes per

Analysis

Providers who increased the number of office-based minor cystoscopic procedures compared with the number of facility-based minor cystoscopic procedures after 2005 were considered incentive-responsive, and those who either continued to do the

beneficiary than incentive-resistant providers. They were also less likely to have a facility-based preference for performing cystoscopy, included as a proxy for competing financial interest. Incentive-resistant providers practiced in markets with both lower urologist density and competition (indicated by higher HHI). Of note, the majority of urologists practiced in areas with higher levels of competition, with the upper quartile in each group less than 2500.

After adjusting for patient, firm, and HRR characteristics and the other exposures of interest, there was no observed relationship between HHI and incentive-responsiveness. However, urologists in HRRs at the 75th percentile of provider density had a 19% (95% CI, 4%-35%) increased odds of incentive-responsiveness compared with those practicing in HRRs in the 25th percentile of provider density (Table 3). Together, these data suggest that the impact of the market share of firms has less of an influence on individual provider response to incentives in FFS cancer care than does the density of providers in that market.

Providers who bill at the 75th percentile for number of unique codes had a 49% (CI, 32%-69%) increased odds of being incentive-responsive compared with providers at the 25th percentile. A higher number of billing codes per patient was also associated with incentive-responsive behavior. These findings suggest that providers more facile with billing practices were more likely to respond to financial incentives. Incentive-responsive providers were also less likely to prefer performing cystoscopies in a facility, suggesting that a competing interest in opposition to the studied financial incentive determined physician behavior.

DISCUSSION

This study evaluated physician- and market-level characteristics associated with adoption of a financially incentivized change in practice for the diagnosis and management of bladder cancer. Several important relationships were identified that might characterize a phenotype for incentive responsiveness: providers in smaller groups, practicing in dense markets, who are also facile with billing and without competing financial ownership interests.

The influence of firm size may reflect several possible phenomena. First, small firms are increasingly integrating with larger firms, and incentive-responsive behavior may be a resistive attempt to increase or maintain revenue in the face of consolidation pressures. Second, larger firms may be more likely to have an ownership stake in a facility that may mitigate the net benefit associated with the

TABLE 2. Physician Coding and Hospital Referral Region Characteristics for Providers That Perform Office-Based MCP Compared With Facility-Based

	Incentive-Resistant (n = 1959)	Incentive-Responsive (n = 828)	P ^a
Coding practices			
Unique codes	24 (17-33)	26 (20-35)	<.001
Codes per beneficiary ^b	1.5 (1.3-1.8)	1.6 (1.4-1.9)	<.001
Competing motivation			
Facility-based preference, n (%) ^c	445 (24.8)	44 (6.2)	<.001
Loco-regional market			
Herfindahl-Hirschman Index	1666 (926-2308)	1313 (733-2138)	<.001
Urologist density ^d	3.3 (2.8-4.5)	3.9 (2.9-4.7)	<.001

MCP indicates minor cystoscopic procedures.

^aUnless specified, numbers represent median values (interquartile range) with differences assessed by Wilcoxon test.

^bValue is a conservative estimate of the true number of codes per beneficiary; see full text for further discussion.

^cDifferences assessed by Pearson test; facility-based preference assigned to providers performing over 50% of procedure code 52000 in a facility location compared with the office.

^dNumber of urologists per 10,000 Medicare beneficiaries.

TABLE 3. Interquartile Odds Ratios From Logistic Regression Model^a

	Odds Ratio	95% CI
Coding practices		
Unique codes	1.49	1.32-1.69
Codes per beneficiary	1.18	1.11-1.25
Competing motivation		
Facility-based preference	0.76	0.72-0.81
Loco-regional market		
Herfindahl-Hirschman Index	0.96	0.87-1.05
Urologist density	1.19	1.04-1.35

^aReference group is incentive-responsive. Adjusted for patient (age, comorbidities, gender, and race), firm (number of physicians and number of urologists), and hospital referral region (race, household income, and education) characteristics. All exposure variables are continuous with odds ratios expressed as interquartile range values.

evaluated modification in the Medicare physician fee schedule. Finally, smaller organizations may be more nimble and adaptable to changes in price structure to maximize profitability.

Market forces appear to have a significant relationship with providers' responses to changes in professional payment. Markets with a higher density of providers were associated with increased likelihood of incentive-responsive behavior, suggesting that providers in these markets may face disproportionate pressures to modify practice in order to maximize profit. Alternatively, denser provider markets may lead to more physician awareness of incentives.

Although unadjusted analyses suggest a relationship between HHI and incentive responsiveness, this relationship was not maintained after adjustment for patient, practice, and market

characteristics including, most notably, provider density. This suggests that providers may more readily respond to financial incentives in highly dense markets irrespective of the structure of the firms within that market. The negotiating power of physicians in markets with higher HHI (ie, less competition) has been shown to result in leveraging increased payment from commercial insurers^{11,14}; however, the payment set by CMS is not negotiable based upon firm size or market share. As a result, CMS may be shielded from this potential unintended consequence of novel payment models that foster healthcare concentration and regionalization. At the same time, providers in highly dense markets may be better suited to respond to changes in the realignment of incentives of novel payment models. In addition, price is not the only factor driving healthcare value. It is possible that providers working closely together to coordinate care can reduce overall spending despite lower competition, even if such declines in competition contribute to higher commercial prices.^{7,8}

Incentive-responsiveness was also associated with increased provider billing efficiency, as evidenced by utilization of a higher number of unique billing codes and more codes per beneficiary. This increase in billing efficiency, whether appropriate or not, as well as responsiveness to financial incentives may be a reaction to counter the pressure of lower prices in competitive markets.

Limitations

This work has several limitations to consider. The primary data source regarding provider behavior was claims data, and we are unable to confirm important patient and disease characteristics from the medical record. Whether a given provider responded to incentives was determined by utilizing claims data spanning more than a decade (2001-2013), and data regarding loco-regional market and provider characteristics were based on data from 2011 to 2013. Therefore, we cannot determine the effects of changes in market and provider characteristics (eg, acquisition or relocation of physician firms) and assume that such events are random between groups. Finally, the Medicare claims data represents a 5% sample of patients, and the unit of analysis in this study was physicians. We cannot exclude nonrandom effects from this methodological consideration in sampling.

CONCLUSIONS

Managing bladder cancer through office-based, rather than facility-based, procedures should intuitively be in the interest of payers (more cost effective than facility-based management), physicians (more time efficient), and patients (more time efficient and cost effective), but in a FFS environment, payment incentives to adopt this practice have resulted in the delivery of low-value redundant cancer care. Our study results suggest that providers who adopt this practice may be influenced to do so by market forces and that they

may also be inclined to implement other profit-maximizing behaviors. Approaches to counter this behavior might be to enact rules to govern the appropriateness of office-based procedures, commit significant resources to investigate and enforce laws against upcoding practices, or enact policies that reduce the variation in concentration of physicians.²⁶ However, such a “whack-a-mole” approach will always face an uphill battle against the incentives in FFS medicine that reward such practices. Instead, adopting a payment model where physicians are paid for providing high-quality care rather than for the volume of billed procedures may result in better aligned incentives for all involved parties. While this is the direction cancer care is moving with the Oncology Care Model, surgeon behavior is largely excluded from such realignment of incentives.

That a large proportion of providers did not respond to this financial incentive with such strong face validity is notable. What is it about providers and firms that they did not or were not able to respond to this incentive that essentially left a large financial windfall on the table for taking care of patients with cancer? Are providers who are resistant to incentives simply unaffected due to status quo bias (ie, a preference for persisting in the current state of behavior) or are there alternative forces at play?²⁷ It may be that identifying an incentive-responsive phenotype can be leveraged to provide high-quality, rather than low-quality, care. Recent work suggests that financial incentives for providers can be used to improve cardiovascular risk.²⁸ Would similar results have been found selecting providers identified in this study as incentive-resistant? With Medicare seeking to tie payment to alternative structures instead of FFS,²⁹ identifying markets and providers that remain responsive to incentives may be a crucial step to ensure provider behavior follows intended novel payment schemes. Or perhaps institutions might look to markets, firms, or providers that promote or match this incentive-responsive phenotype for clues to remain viable in the shifting sands of payment reform. ■

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