Medicare Payment Reform and Provider Entry and Exit in the Post-Acute Care Market

Peter J. Huckfeldt, Neeraj Sood, John A. Romley, Alessandro Malchiodi, and José J. Escarce

Objective. To understand the impacts of Medicare payment reform on the entry and exit of post-acute providers.

Data Sources. Medicare Provider of Services data, Cost Reports, and Census data from 1991 through 2010.

Study Design. We examined market-level changes in entry and exit after payment reforms relative to a preexisting time trend. We also compared changes in high Medicare share markets relative to lower Medicare share markets and for freestanding relative to hospital-based facilities.

Data Extraction Methods. We calculated market-level entry, exit, and total stock of home health agencies, skilled nursing facilities, and inpatient rehabilitation facilities from Provider of Services files between 1992 and 2010. We linked these measures with demographic information from the Census and American Community Survey, information on Certificate of Need laws, and Medicare share of facilities in each market drawn from Cost Report data.

Principal Findings. Payment reforms reducing average and marginal payments reduced entries and increased exits from the market. Entry effects were larger and more persistent than exit effects. Entry and exit rates fluctuated more for home health agencies than skilled nursing facilities. Effects on number of providers were consistent with entry and exit effects.

Conclusions. Payment reform affects market entry and exit, which in turn may affect market structure, access to care, quality and cost of care, and patient outcomes. Policy makers should consider potential impacts of payment reforms on post-acute care market structure when implementing these reforms.

Provisions in the Affordable Care Act represent an important restructuring of payment for health care providers. Accountable care organizations and “bundled” payments for acute and post-acute care create incentives for coordinating and reorganizing the delivery of health care by changing provider payment for an episode of care, where care during an episode can be provided

across multiple settings. These reforms affect both the average payment received by providers for an episode of care and the “marginal” or additional payment received for the provision of additional services during the episode. These latest policies are a continuation of earlier reforms implementing prospective payment systems for acute care (1983) and post-acute care (1997–2003) that replaced prior cost-based systems of payment. As now, the earlier reforms were conceived to reduce unnecessary utilization, and considerable research has studied how these policies affected health care costs and patient outcomes (e.g., McKnight 2006; Sood, Buntin, and Escarce 2008; Grabowski, Afendulis, and McGuire 2011).

Payment reforms impact providers’ profitability and financial risks through changes in both the overall level of payment and the marginal payment for additional services. Consequently, payment reform may impact provider entry and exit, market concentration, and providers’ organizational structure (e.g., vertical integration). Such changes may have important consequences for provider competition, access to care, and patient choice. While prior research has considered the impact of specific reforms on entry and exit, there is limited evidence of how the design of payment systems more generally affects market structure. In this article, we use a series of Medicare payment reforms for post-acute care providers to investigate how payment system design affects provider entry and exit, and the implications for market structure.

BACKGROUND AND NEW CONTRIBUTION

In the Balanced Budget Act of 1997, Congress mandated separate prospective payment systems for home health agencies, skilled nursing facilities, and inpatient rehabilitation facilities after years of dramatic expansion of these services (and associated Medicare expenditures) under cost-based payment. Under prospective payment, post-acute providers receive a set payment from Medi-

Address for correspondence to Peter J. Huckfeldt, Ph.D., RAND Corporation, 1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138; e-mail: peter_huckfeldt@rand.org. Neeraj Sood, Ph.D., is with the Leonard D. Schaeffer Center, University of Southern California, Los Angeles, CA. John A. Romley, Ph.D., is with the Leonard D. Schaeffer Center, University of Southern California, Los Angeles, CA. Alessandro Malchiodi, M.Phil, M.Sc., is with the RAND Corporation, Santa Monica, CA. José J. Escarce, M.D., Ph.D., is with the Division of General Internal Medicine and Health Services Research, David Geffen School of Medicine at UCLA, and RAND Health, Los Angeles, CA.

care based on a patient's characteristics, condition, and severity. However, the prospective payment systems implemented across post-acute settings varied in their definition of an episode and in their effects on average payment levels for episodes of care.

The Home Health Interim Payment System, implemented in 1997, lowered existing limits for per visit payments and added an additional agency-specific annual payment limit per beneficiary. Thus, this reform effectively reduced both average and marginal payment for home health care services.

The Skilled Nursing Facility Prospective Payment System, implemented in 1998, shifted payment from a cost-based system with limits for routine operating costs to a per diem payment based on a patient's "resource use group" (RUG) defined by the types and amount of medical services required (e.g., therapy use) and other patient characteristics (health status and functional status). The overall level of Medicare payments to skilled nursing facilities fell after this reform (Medicare Payment Advisory Commission 2003). However, prospective payment had only a limited effect on marginal payment as per diem payments created incentives to limit resource use within a day, but not to limit the number of days of care. Moreover, resource use group assignment (and thus the level of payment) was based in part on the level of therapy intensity for patients needing rehabilitation services, producing incentives to provide more intensive therapy (Grabowski, Afendulis, and McGuire 2011).

Under the Home Health Prospective Payment System, implemented in 2000, facilities received a 60-day prospective payment based on patients' health characteristics, functional status, and service use, which reduced marginal payment.¹ In contrast to the Interim Payment System, average Medicare payments for home health patients increased after prospective payment (Huckfeldt et al. 2011).

Finally, the Inpatient Rehabilitation Facility Prospective Payment System, implemented in 2002, reimbursed inpatient rehabilitation facilities on a per discharge basis based on patients' health and functional status. This reform clearly reduced marginal payment. However, Medicare's average payments to inpatient rehabilitation facilities for episodes of care grew following the implementation of prospective payment (Sood, Buntin, and Escarce 2008). Another policy change (implemented in 2004) affecting IRFs was a revision to the "75 percent rule," mandating a higher level of severity for 75 percent of a facility's patients for classification as an inpatient rehabilitation facility, primarily by excluding less serious joint replacement patients who were commonly admitted to inpatient rehabilitation facilities (Medicare Payment Advisory Commission 2011).

Table 1: Post-Acute Payment Reforms

<i>Reform (Date)</i>	<i>Prior Payment System</i>	<i>Reform</i>	<i>Changes in Average and Marginal Reimbursement</i>	<i>Hypothesized Effect on Entry and Exit</i>
Home health interim payment system (10/1997)	Cost-based reimbursement, limits based on lower of actual costs or per visit limit	<ul style="list-style-type: none">• Per visit limits lowered, new agency-specific aggregate payment per beneficiary limit	<ul style="list-style-type: none">• Average (–)• Marginal (–)	Reductions in entry, increased exit
Home health prospective payment system (10/2000)	Interim payment system	<ul style="list-style-type: none">• Prospective payment for 60-day episode based on patient characteristics.• Increased average reimbursement	<ul style="list-style-type: none">• Average (+)• Marginal (–)	Ambiguous effect on entry and exit
Skilled nursing facility prospective payment system (7/1998)	Cost-based reimbursement, limits for operating costs	<ul style="list-style-type: none">• Per diem payments as function of Resource Use Group• Decreased average reimbursement	<ul style="list-style-type: none">• Average (–)• Marginal (–)	Reductions in entry, increased exit
Inpatient rehabilitation facility prospective payment system (1/2002)	Cost-based with facility limits	<ul style="list-style-type: none">• Per discharge payment as function of health and functional status• Intended to be budget neutral, but increased average reimbursement	<ul style="list-style-type: none">• Average (+)• Marginal (–)	Ambiguous effect on entry and exit

Table 1 summarizes the key features of the post-acute payment reforms that we examine in our study. Existing research describes the change in the number of providers after a particular reform within a specific post-acute setting and has found a range of effects.² After the Skilled Nursing Facility Prospective Payment System was implemented in 1998, for example, the number of hospital-based facilities fell while the number of freestanding facilities increased slightly (Dalton and Howard 2002; Medicare Payment Advisory Commission 2011). After the Home Health Interim Payment System in 1997, provider exits outnumbered entries by an eight-to-one ratio, with higher rates of exit for freestanding than hospital-based facilities (Porell, Liu, and Brungo 2006; Choi and Davitt 2009). In contrast, provider entries exceeded exits after the Home Health Prospective Payment System in 2000, and by 2010 the number of home health agencies exceeded their 1997 peak (Medicare Payment Advisory Commission 2011). Finally, after the implementation of prospective payment for inpatient rehabilitation facilities, the number of providers continued to grow, but at a slightly lower rate than prior to the reform (Medicare Payment Advisory Commission 2006, 2010).³

The contribution of this article is to contrast and compare the design of payment reforms occurring across post-acute settings between 1997 and 2002 to investigate how different dimensions of reform—especially the effects of the reforms on average and marginal payment—influence entry and exit and the implications for market structure. We begin by developing a conceptual framework that considers the potential impacts of average and marginal payment levels on entry and exit decisions, and how this may vary across post-acute settings. We then examine the entry, exit, and stock (i.e., total number) of providers from 1991 through 2010 to assess the effects of payment reform.

CONCEPTUAL FRAMEWORK

Bresnahan and Reiss (1991, 1994) develop a framework defining market entry and exit “thresholds”; demand must be at or above these thresholds for a provider to enter or remain in a market. In Bresnahan and Reiss (1994), the entry threshold is defined as the minimum level of demand for a given level of per patient profit such that aggregate profits cover both ongoing fixed costs of operation and the sunk costs of entry. This model has been applied in health care contexts in the past, including research investigating hospital entry (Abraham, Gaynor, and Vogt 2007) and HMO competition (Dranove, Gron, and Mazzeo 2003).

Equation (1) illustrates the profit function considered by a potential entrant at a point in time, where (*Payment* – *Variable Costs*) represents a stream of discounted per patient variable profits, *Quantity* is the expected number of patients, *Fixed Costs* represents discounted ongoing fixed costs, and *Sunk Costs* are initial sunk costs of entry.

$$\text{Profits} = (\text{Payment} - \text{Variable Costs}) \times \text{Quantity} - \text{Fixed Costs} - \text{Sunk Costs} \quad (1)$$

A potential entrant will enter the market whenever aggregate profits are greater than zero. This threshold is denoted by equation (2), that is, potential entrants will enter if the expected quantity demanded is greater than or equal to the ratio of fixed and sunk costs to per patient profit.

$$\text{Quantity} = \frac{\text{Fixed Costs} + \text{Sunk Costs}}{(\text{Payment} - \text{Variable Costs})} \quad (2)$$

If expected quantity exceeds the threshold, variable profits exceed fixed plus sunk costs, thus making entry attractive.

By contrast, for an existing provider to remain in the market, variable profits must only cover ongoing discounted fixed costs; sunk entry costs are irrelevant. Thus, an existing provider considers a profit function such as:

$$\text{Profits} = (\text{Payment} - \text{Variable Costs}) \times \text{Quantity} - \text{Fixed Costs} \quad (3)$$

and considers an “exit threshold” denoted by equation (4). Thus, an existing provider remains in the market if the quantity demanded is greater than or equal to the ratio of discounted fixed costs to per patient profits.

$$\text{Quantity} = \frac{\text{Fixed Costs}}{(\text{Payment} - \text{Variable Costs})} \quad (4)$$

Of note, the expected level of demand required for a new provider to enter the market (equation 2) is greater than the level of demand required for an existing provider to remain in the market (equation 4). Finally, if payments or costs are uncertain and providers are risk averse, then the level of demand required for a new provider to enter the market or the level of demand required for an existing provider to remain in the market will increase both with the degree of uncertainty in payments or costs and the degree of risk aversion of providers.

We use these concepts of entry and exit thresholds to motivate discussion of how the impacts of Medicare payment reforms may vary: (1) across reforms with varying impacts on average and marginal reimbursement, (2) by whether providers are prospective entrants or existing providers, and (3) across post-acute settings with differing fixed and sunk costs.

Effects of Average and Marginal Payments

In the model described above, entry and exit thresholds are inversely related to per patient variable profits. Thus, under payment reforms that increase per patient profitability, a lower demand for services will stimulate entry or dissuade exit. We examine two dimensions of payment reform that may affect profitability: the overall level of payment and marginal payment. Reforms that increase average payment also increase per patient profitability, lower the expected quantity demanded required to cover fixed and sunk costs (for potential entrants) and fixed costs (for incumbents), and thereby encourage entry and reduce exits. Marginal payment—the degree to which providers receive additional payment for the provision of additional services—is likely to affect entry and exit by changing per patient profitability and by changing providers' financial risk. Specifically, lower marginal payment will not only reduce per patient profit margins (*Payment—Variable Costs*) in some instances but might also affect the variability in profit margins.

This analysis underscores the fact that the effects of a payment reform on average and marginal payments may be reinforcing or opposing with regard to their influence on entry and exit. A reform that reduces both average and marginal payment is expected to reduce entry and increase exit. However, the expected effects on entry and exit of a payment reform that increases average payment while reducing marginal payment are ambiguous. Our hypotheses regarding the payment reforms under study on entry and exit are summarized in Table 1.

Prospective Entrants versus Existing Providers

As noted earlier, prospective entrants' thresholds for entry are likely to be higher than existing providers' thresholds for staying, and this is determined in part by the level of sunk entry costs. Indeed, Bresnahan and Reiss (1994) use rural dentists as an example and estimate that the demand required for a rural dentist to remain in the market is considerably lower than the demand required for a prospective dentist to enter a market.

This result implies that changes in per patient profitability, such as those following payment reform, will have a larger impact on prospective entrants than on existing providers. Specifically, after a payment reform that lowers per patient profitability (e.g., the Skilled Nursing Facility Prospective

Payment System), the decrease in entry is likely to be larger in magnitude than the increase in exits. Similarly, after a payment reform that increases per patient profitability, the increase in entry is expected to be larger in magnitude than the reduction in exits.

Effects of Sunk Costs

Sunk entry costs in a post-acute setting may be represented by the construction of facilities where care is provided. In settings with higher sunk entry costs, entry is costly and existing providers are better protected from competition. As a result, a payment reform that increases per patient profitability may be less likely to lead a potential entrant to enter in a setting with high sunk costs relative to a post-acute setting with low sunk costs. Similarly, existing providers may be less likely to exit the market after a payment reform decreasing per patient profitability in a post-acute setting with higher sunk entry costs, especially if the providers are cognizant of their protection from future entry and are willing to tolerate worsening market conditions (Gschwandtner and Lambson 2002). In addition, entry and exit thresholds may be closer in settings with lower sunk costs, resulting in more symmetric and entry and exit behavior after payment reforms (Bresnahan and Reiss 1994).

Sunk costs are likely to be higher in inpatient facilities such as inpatient rehabilitation and skilled nursing facilities, where care is provided in an inpatient setting, relative to home health agencies, where care is provided in a patient's home. Furthermore, sunk costs may be higher in freestanding facilities than hospital-based facilities, where floor space can be readily allocated with little cost to a post-acute unit after entry. Thus, we expect larger entry and exit effects after the home health payment reforms than after the payment reforms in inpatient post-acute settings. Similarly, we expect larger effects on hospital-based units than freestanding units. Finally, we expect more symmetric entry and exit in home health and hospital-based facilities than in freestanding inpatient facilities.

DATA AND METHODS

Data Sources

The primary sources of data are Medicare Provider of Services files between 1991 and 2010. The Provider of Services files are created from

the Center for Medicare Services Quality Improvement Evaluation System database (Centers for Medicare and Medicaid Services 2013), which includes information and characteristics for each provider participating in either the Medicare or Medicaid program. The data are updated quarterly; we use the data collected in the fourth quarter of each year. We calculate the number of home health agencies, skilled nursing facilities, and inpatient rehabilitation facilities, both at the national level and in each of 805 health service areas. Health service areas are meant to define regions that are self-contained with respect to hospital care. They are constructed by the National Center for Health Statistics by aggregating counties or equivalent administrative units based on a cluster analysis of where residents aged 65 years and older obtained routine short-term hospital care in 1988. The geographical definitions have been subsequently updated; we use the most recent version, updated in 2008 (Makuc et al. 1991; National Cancer Institute 2008).⁴ As a complement to hospital care, we expect that post-acute care geographic market patterns are similar to hospital patterns (hence the appropriateness of health service area as a definition for market). In addition, because health service areas are defined at the county level, it is straightforward to calculate market-level population characteristics from Census data.

We separately examine new entries, new exits, and stock (i.e., numbers) of facilities in each post-acute setting in each year. We also separately investigate freestanding and hospital-based facilities. Overall changes in capacity occur either through changes in the number of facilities or capacity changes within facilities. Reflecting this, we also calculate total number of beds in skilled nursing facilities and inpatient rehabilitation facilities in each year from the Provider of Service data. For skilled nursing facilities and freestanding inpatient rehabilitation facilities, we measure capacity by the number of Medicare-certified beds. For hospital-based inpatient rehabilitation facilities, we measure capacity as the number of beds in a rehabilitation unit exempt from the Medicare (Hospital) Prospective Payment system.

We augment the Provider of Service data with sociodemographic information for each health service area, including total population, per capita income, the population black or Hispanic, fraction of the population 65–74 years old, and fraction of the population 75 years old or older, obtained from the 1990 and 2000 Census and 2003–2009 American Community Survey data. (We linearly interpolated values for years in between, and extrapolated for 2010.) These measures control for changes in markets' population

composition (e.g., capturing changes in market-level demand for post-acute care).

We also supplement the data with information about Certificate of Need programs, which are meant to coordinate the construction of new hospitals, nursing homes, and home health agencies and may limit entry of new facilities. We compiled information on certificate of need programs using data from the National Conference of State Legislatures (National Conference of State Legislatures 2012) and created a binary variable indicating whether a health service area is located in a state with a certificate of need program in place in a given year.

Finally, we link Provider of Service data to Medicare Cost Report data to compute the fraction of post-acute days (or visits) for each post-acute care setting in each health service area that were covered by Medicare in 1997. We then divide health service areas into those that have above-and below-median shares of Medicare patients (by setting).

Empirical Strategy

Our empirical strategy examines changes in entry and exit trends, as well as provider stocks or the number of providers, before and after payment policy changes. We start with graphical analyses examining annual national-level entry and exit rates and counts of post-acute providers.

We augment the graphical analysis with Poisson regressions, where the expected number of entries, exits, or provider stocks in a health service area, conditional on characteristics Z , are modeled as in equation (5).

$$E(\text{Count}_{hpt}|Z) = \exp(\alpha + \beta X_{ht} + \gamma \text{Time}_t + \eta_h \text{HSA}_h + \sum_{i=1}^5 \theta_i \text{POST}_i) \quad (5)$$

To control for all unobserved time invariant market-level factors, we estimate this model as a fixed effects Poisson model with standard errors clustered at the health service area level (as described by Wooldridge 1999). The dependent variable *Count* is the number of providers of type p in health service area h in year t , and represents entries, exits, or stocks, depending on the analysis; X represents a vector of population and market characteristics for each health service area (per capita income, black and Hispanic population, log total population, proportion of the population aged 65–74, proportion of the population aged 75 or higher, the number of acute care hospitals per capita, and the certificate of need variable described above); *Time* is a linear time trend; *HSA* is a vector of health service area fixed effects; and *POST1-POST5*

are indicator variables representing years following the implementation of prospective payment. In our main specifications, the θ s are identified as deviations from a preexisting linear time trend (as the Poisson model is exponential, the time trend will thus be an exponentiated linear time trend).

For ease of interpretation, in presenting our results (see next section) we use the coefficients from the Poisson to estimate the effects of payment reforms on the stock of providers in the market and the number of providers entering or exiting the market. The underlying Poisson coefficient estimates are presented in the Appendix. In particular, we would like to estimate, $\overline{Count}_t^{POST_{t=1}} - \overline{Count}_t^{POST_{t=0}}$, or the difference in count of providers with reform (POST = 1) compared with the counterfactual of no reform (POST = 0). Equation (6) below shows the relationship between Poisson coefficients and the estimate of interest.

$$\overline{Count}_t^{POST_{t=1}} - \overline{Count}_t^{POST_{t=0}} = \overline{Count}_t^{POST_{t=1}} \left(\frac{\exp(\theta_t) - 1}{\exp(\theta_t)} \right) \quad (6)$$

Equation (6) implies that we can compute the effect of payment reform on the number of providers entering or exiting the market as long as we have valid estimates of $\overline{Count}_t^{POST_{t=1}}$ and coefficients from the Poisson model. However, it is infeasible to obtain consistent estimates of $\overline{Count}_t^{POST_{t=1}}$ from our Poisson model as it includes health service area fixed effects; these fixed effects are differenced out from the model and are not estimated directly. Therefore, we approximate $\overline{Count}_t^{POST_{t=1}}$ with the actual count of providers in the post-reform period. We verify that this is a good approximation by estimating Poisson models without health service area fixed effects. Average predicted entries, exits, and stocks (with and without controls for market characteristics) from these models are nearly identical to average actual entries, exits, and stocks in a year.

A concern about the model in equation (5) is that policy reform effects are identified off a break point in time. Thus, our estimates of the reform effects may be biased if there are unmeasured contemporaneous confounders. We use two approaches to increase our confidence that we are estimating policy effects. First, we focus on a limited time period around the break. In the case of the Home Health Interim Payment System, the pre-period extends from 1992 through 1996, and the post-period ranges from 1997 through 2001. For the Home Health Prospective Payment System, the pre-period ranges from 1997 through 1999 (i.e., the Interim Payment System post-period) and the post-period ranges from 2000 through 2004. For the Skilled Nursing Facility Prospective Payment

System, the pre-period ranges from 1993 through 1997, and the post-period extends from 1998 through 2002. For the Inpatient Rehabilitation Facility Prospective Payment System, the pre-period ranges from 1997 through 2001, and the post-period extends from 2002 through 2006. Second, we take advantage of the fact that Medicare payment reforms are expected to have larger effects on entry and exit in markets with high Medicare shares than in low Medicare share markets. Thus, in alternate regression specifications, we include interactions of the *POST* variables with indicators for being above-median Medicare share in 1997 (and we control for year fixed effects rather than a linear trend). We also estimate separate regressions for hospital-based and freestanding providers.

RESULTS

Descriptive Data

Figure 1 exhibits national-level entry and exit rates and total provider counts for home health agencies, skilled nursing facilities, and inpatient rehabilitation facilities in each calendar year. Entry rates are defined as the number of new entries for a particular post-acute provider divided by the total count in the prior year. Exit rates are defined as the total exits in a given year divided by the total providers in the prior year. Vertical lines are drawn for the year prior to the implementation of payment policy reforms.

In Figure 1a, the solid line shows that entry rates for home health agencies ranged between 13 and 16 percent in the 5 years prior to the implementation of the Home Health Interim Payment System. With the implementation of the Interim Payment System in 1997, entry rates fell to below 2 percent in 1998 through 2000. However, following the implementation of the Home Health Prospective Payment System in 2000, the entry rate again increased to a maximum of around 10 percent between 2005 and 2010. The exit rate (dashed line in Figure 1a) for home health agencies was at or below 5 percent between 1992 and 1996, with a slight positive trend. However, the exit rate spiked following the implementation of the Interim Payment System in 1997, increasing from 5 percent in 1996 to above 15 percent in 1998, before subsequently falling.

The difference between entries and exits prior to the Interim Payment System led to a positive trend in the total number of home health providers between 1991 and 1997, increasing from 6,000 to over 10,000 agencies (Figure 1b). With the increase in exits and decrease in entries while the Interim

Figure 1: Entry and Exit Rates, Provider Counts, and Total Capacity after Payment Reform. (a) Home Health Agency Entry and Exit Rates. (b) Total Numbers of Home Health Agencies. (c) Skilled Nursing Facility Entry and Exit Rates. (d) Total Number and Capacity of Skilled Nursing Facilities. (e) Inpatient Rehabilitation Facility Entry and Exit Rates. (f) Total Number and Capacity of Inpatient Rehabilitation Facilities.

Note. Figures show national-level entry and exit rates and stocks of post-acute providers. Vertical line indicates year prior to payment reform for each post-acute setting (Home health: 10/1997 and 10/2000; Skilled nursing: 7/1998; Inpatient rehab: 1/2002)

Payment System was in effect, the number of agencies fell from over 10,000 in 1997 to below 7,000 in 2001. Following the implementation of the Prospective Payment System, the renewed increase in entries and decrease in exits led to a positive trend in total agencies.

Figure 1c displays annual national entry and exit rates for skilled nursing facilities before and after the implementation of the Skilled Nursing Prospective Payment System in 1998. The entry rate fluctuated between 5 and 10 percent between 1992 and 1997, falling to between 2 and 3 percent in 1998–2000 after the reform. The exit rate prior to prospective payment was below 1 percent, but rose to 3 percent between 1998 and 2000 before slowly decreasing again. The solid line in Figure 1d shows that the reduction in entry rates and increase in exits resulted in a leveling off of skilled nursing facility counts after payment reform, compared with a steep positive prereform trend. Total skilled nursing facility capacity, as measured by the total number of Medicare-certified beds in each year, increased at a slower rate following payment reform but still increased slightly, reflecting a slightly higher number of beds per facility.

Figure 1e presents entry and exit rates for inpatient rehabilitation facilities and shows little change in either after payment reform. The total number and capacity of inpatient rehabilitation facilities followed a positive trend in the years prior to and following the implementation of the prospective payment system, leveling off and falling in the second half of the decade (Figure 1f). The later reductions were likely attributable to renewed enforcement of the 75 percent rule in 2004 (Medicare Payment Advisory Commission 2011).

Regression Results

Table 2 presents the results of the Poisson regressions (equation 5). The entries in the table represent the difference between the numbers of entries, exits, and total count of providers in each of the first 5 years following the relevant payment reform and the numbers that would have been expected in those years based on the prereform time trend, as described in the previous section. (Poisson regression coefficients are shown in Table A1). Estimates in Table 2, column 1 show that home health agency entries per health service area were on average 0.72 fewer in the first year following the Home Health Interim Payment System relative to the prereform trend; by 2001 there were 3.94 fewer entries compared with the prereform trend. The estimates in Table 2, column 2 imply that home health agency exits per health service area

Table 2: Changes in Provider Entries, Exits, and Total Counts Relative to Prereform Trend

	1. Home Health			2. Home Health			3. Skilled Nursing Facility			4. Inpatient Rehabilitation Facility		
	Interim Payment System			Prospective Payment System			Prospective Payment System			Prospective Payment System		
	Entries (1)	Exits (2)	Counts (3)	Entries (4)	Exits (5)	Counts (6)	Entries (7)	Exits (8)	Counts (9)	Entries (10)	Exits (11)	Counts (12)
Mean	1.05	0.97	10.15	0.87	1.11	9.78	0.89	0.49	17.6	0.18	0.19	2.19
POST1	-0.72***	1.17***	-0.54***	0.22***	-0.59***	0.30***	-0.62***	0.20***	-0.97***	0.04	0.01	0.05
POST2	-2.47***	1.30***	-3.49***	0.52***	-0.71***	1.05***	-0.93***	-0.09	-2.36***	-0.06	-0.04	-0.12
POST3	-2.95***	-0.40	-6.99***	0.83***	-0.43***	2.17***	-0.94***	-0.40**	-3.74***	-0.13**	0.03	0.03
POST4	-3.55***	-1.63***	-9.81***	1.07***	-0.36***	3.29***	-1.00***	-1.01***	-5.62***	-0.11	-0.00	-0.01
POST5	-3.94***	-3.06***	-12.22***	1.26***	-0.32***	4.52***	-0.96***	-1.61***	-7.45***	-0.25***	0.06	-0.17*

Notes. *** $p < .01$, ** $p < .05$, * $p < .1$.

Values represent changes in entries, exits, and counts relative to counterfactual linear trend. Estimates derived from coefficient estimates from Poisson regressions of health service area level counts of provider entries, exits, and counts on post-reform indicators 1–5, linear time trend, health service area level demographic characteristics, indicator for state certificate of need laws, and health service area fixed effects. Standard errors clustered on health service area. Significance indicated for Poisson coefficient estimates.

were approximately 1.2 and 1.3 higher in 1997 and 1998, respectively, relative to the prereform trend. Column 3 shows that decreased agency entry and increased exit translated to large reductions in home health agency counts; by 2001 there were 12.22 fewer home health agencies per health service area relative to the prereform trend.

The second panel of Table 2 displays estimates for the Home Health Prospective Payment System. Table 2, column 4 implies that home health entries increased by 0.22 agencies in the first year of reform relative to the prereform (negative) trend, and by 2004 there were 1.26 more entries per health service area relative to the prereform trend. By contrast, home health agency exits fell by 0.3–0.7 agencies in the post-reform period (Column 5). Consequently, by 2004 there were 4.52 additional home health agencies per health service area compared with the prereform trend (column 6).

The third panel of Table 2 displays results for the Skilled Nursing Facility Prospective Payment System. Table 2, column 7 implies that skilled nursing facility entries fell by 0.62 providers per health service area in the first year of reform in 1998, and there were 0.96 fewer entries by 2002 relative to the prereform trend. Column 8 shows exits spiking in the first year after payment reform, before decreasing in subsequent years. Reductions in entry translated to reduced skilled nursing facility counts. Table 2, column 9 shows that by the fifth year of the reform in 2002, there were 7.4 fewer skilled nursing facilities per health service area than expected under the prereform trend.

Finally, the fourth panel in Table 2 shows changes in inpatient rehabilitation facility numbers after the Inpatient Rehabilitation Facility Prospective Payment System in 2002. Table 2, column 10 shows that changes in entry were statistically nonsignificant, apart for reductions in the third and fifth years of reform, likely representing changes due to the 75 percent rule. There were no statistically significant changes in exits, and generally statistically nonsignificant changes in overall facility counts after this reform.

Varying Effects by Medicare Share

Figure 1 and Table 2 suggests that payment reforms had substantial impacts on provider entry, exit, and total counts for home health agencies and skilled nursing facilities (but not inpatient rehabilitation facilities, so we omit them from the following analyses). As noted earlier, however, our estimates could be driven by other contemporaneously occurring changes unrelated to payment reform. We examined this by allowing for different effects for health

Figure 2: Entry and Exit in Above- and Below-Median Medicare Share (by Post-Acute Setting) Health Service Areas. (a) Home Health Agency Entry Rates. (b) Home Health Agency Exit Rates. (c) Skilled Nursing Facility Entry Rate. (d) Skilled Nursing Facility Exit Rate.

Note. Figures show entry and exit rates separately for above and below-median Medicare share health service areas. Vertical line indicates year prior to payment reform for each post-acute setting (Home health: 10/1997 and 10/2000; Skilled nursing: 7/1998).

service areas with above- and below-median shares of Medicare patients (based on Medicare share by post-acute setting in 1997). Figure 2 shows entry and exit rates in health service areas with above-median Medicare share (solid line) and below-median Medicare share (long dashed line) for home health agencies and inpatient rehabilitation facilities.

Figure 2a shows larger decreases in home health agency entries after the Interim Payment System and greater increases in entries after the Prospective Payment System in above-median health service areas compared with below-median Medicare share health service areas. Figure 2b shows a larger spike in exit rates after the Interim Payment System in high versus low Medicare share health service areas. Figures 2c

and d exhibit entry and exit rates for skilled nursing facilities, separately by above- and below-median Medicare share health service areas. Again, decreases in entry and increases in exit appear to be larger in high Medicare share areas.

We also estimated Poisson regression models, as described in the methods section, to assess whether the effects of the payment reforms for home health care and skilled nursing facilities differed significantly between above-median and below-median Medicare share after controlling for other factors. The regression results are consistent with the findings of the graphical analyses in Figure 2 (Regression results are shown in Table A2).

Effects for Freestanding and Hospital-Based Facilities

Finally, we examine changes in the stocks of freestanding relative to hospital-based post-acute care facilities following the implementation of prospective payment. Figure 3a displays national annual counts of active freestanding and hospital-based home health agencies. The number of both hospital-based and freestanding providers grew prior to 1997, although freestanding providers grew at a greater rate. The numbers of both freestanding and hospital-based facilities fell between 1997 and 2000, after implementation of the interim payment system. By contrast, the number of freestanding facilities rose substan-

Figure 3: Entry and Exit of Standalone and Freestanding Post-Acute Facilities after Payment Reform. (a) Home Health Agencies. (b) Skilled Nursing Facilities.

Note. Figures show national-level counts of freestanding and hospital-based post-acute providers. Vertical line indicates year prior to payment reform for each post-acute setting (Home health: 10/1997 and 10/2000; Skilled nursing: 7/1998).

tially after the implementation of prospective payment, whereas the number of hospital-based facilities continued to fall.

Figure 3b shows annual national counts of freestanding and hospital-based skilled nursing facilities. The numbers of both freestanding and stand-alone facilities grew prior to prospective payment. With prospective payment for skilled nursing facilities in 1998, growth in both types of skilled nursing facilities fell relative to the preexisting trend. However, freestanding facilities continued to grow (albeit at a slower rate) while the number of hospital-based facilities fell throughout the 2000s.

Poisson regressions estimating changes in counts of hospital-based and freestanding providers following payment reform for home health agencies and skilled nursing facilities and showed results consistent with Figure 3 (see Table A3 for regression results.)

DISCUSSION

We used provider-level data from 1991 to 2010 to contrast the impacts of payment reforms for post-acute providers across reforms with varying effects on average and marginal payment, between prospective entrants and existing post-acute providers, and between freestanding and hospital-based providers. We found that the Home Health Interim Payment System and the Skilled Nursing Facility Prospective Payment System (both of which reduced average and marginal payments) led to reductions in entry and increases in exit, consistent with the predictions of our conceptual framework. The Home Health and Inpatient Rehabilitation Prospective Payment systems, by contrast, reduced marginal payment while increasing average payment, which generates ambiguous theoretical predictions. Our analysis found that, in the case of home health, entries increased and exits decreased, possibly due to the limited “prospective” aspects of the reform, such as providing additional payments for a certain number of therapy visits. The Inpatient Rehabilitation Facility Prospective Payment System had little impact on facility entries or exits, likely due to offsetting effects of average and marginal payment. Our regression results, defining a market as “health service area,” are consistent with national aggregate descriptive analyses, potentially implying that we would find similar results using other market definitions.

Our conceptual framework also suggested that changes in entry might be larger in magnitude than changes in exit, as entry decisions may account for both fixed and sunk costs while exit decisions only consider fixed costs.

Our empirical findings are consistent with this prediction for skilled nursing facilities: the reform caused a persistent decrease in entry with a smaller and temporary increase in exits, leading to a stable number of skilled nursing facilities and only slight increases in total skilled nursing facility beds in the post-payment reform period. We also found larger and more persistent entry effects than exit effects for home health agencies after both the interim and prospective payment systems, although entry and exit effects were more symmetric than for skilled nursing facilities. This finding is also consistent with our conceptual model, which suggested that entry thresholds might be more similar to exit thresholds when sunk costs are lower. We found larger entry and exit rates as well for home health agencies than skilled nursing facilities, which are also consistent with lower sunk costs in home health agencies leading to lower entry and exit thresholds, and thus more variable entry and exit. Finally, we found greater changes in entry and exit in markets with higher Medicare market share, lending support to the idea that the effects we estimated are driven by payment reform rather than other contemporaneous changes.

One result seemingly inconsistent with the predictions of our conceptual framework is the steady decline in hospital-based post-acute facilities, particularly the reductions in hospital-based home health agencies after the Home Health Prospective Payment System (in contrast with increased numbers of freestanding facilities). Hospital-based departments entered in response to inpatient prospective payment in 1983; they served as a means for inpatient facilities to shift care from a prospectively reimbursed setting to a setting that remained under cost-based payment at the time (Newhouse 2002). Once post-acute care also became prospectively reimbursed (with the associated financial risk), this strategy may have become less profitable. For example, patients in hospital-based skilled nursing facilities were more complex and costly than patients' freestanding facilities, and the prospective payment system may not have fully reflected this differential severity and costs (Liu and Black 2003). In addition, hospital-based units responded less to the financial incentives present in the prospective payment system (White 2003). White (2003) speculates that hospital-based facilities, integrated in a larger institution, may have felt less pressure to adopt more profitable rehabilitation practices.

Most studies of payment reform for post-acute care have focused on the effects of these reforms on selection of patients for admission, the treatments patients receive, and patient outcomes (e.g., McKnight 2006; Sood, Buntin, and Escarce 2008; Grabowski, Afendulis, and McGuire 2011; Huckfeldt et al. 2011). However, the findings of this study underscore that the payment

reforms have important effects on provider entry and exit and the total number and capacity of providers. Our findings further suggest that the effects of a reform on provider entry and exit can be anticipated to some degree based on the reform's design.

To the extent that the vertical integration of hospital-based facilities improves coordination of care, the balance of freestanding and hospital-based facilities may have important implications for health care quality and costs. For example, recent research shows that vertical integration of home health agencies allows for more efficient provision of care with no adverse impacts on patient outcomes (David, Rawley, and Polsky 2011). More research is needed on the broader impacts of vertical integration, but this evidence suggests that the closure of hospital-based post-acute facilities may lead to lower levels of efficiency.

Our findings have implications for anticipating and monitoring the effects of innovative payment methods that will be introduced under health care reform. Many of the payment changes envisioned in health care reform (e.g., bundled payments, accountable care organizations) reduce marginal payment. Depending on their impact on overall payment, our study suggests that such changes may reduce the number of providers through reductions in entry and increased exits, leading to greater market concentration. Moreover, such effects are likely to be intensified by vertical integration and more complex contracting arrangements between providers that may also be associated with these policies.

One of the key predictors of the choice of post-acute setting for a given patient is availability of providers, and there is evidence that similar patients have differing outcomes and incur varying costs depending on the type of post-acute facility they use (Buntin et al. 2010). As a result, policies that lead to changes in post-acute provider availability may result in changes in the type of providers patients use and the ways care is delivered, with consequences for patient outcomes and costs. In addition, Sood et al. (2011) show evidence that acute providers discharge patients with specific conditions to specific post-acute providers, implying a degree of specialization by individual post-acute providers that may benefit patients. Such specialization may decrease with reductions in the numbers of post-acute providers.

Our study has a number of limitations. While we are able to identify the direction of changes in marginal and average payment and qualitatively compare the sizes of payment changes across reforms, we are unable to quantify changes in average versus marginal payment in a cardinal sense. Second, the count of providers in a market is a simple measure of market

structure that may not capture all effects of reforms. Finally, our identification strategy comes primarily from a time series break; to the extent the payment reforms are correlated with other events our estimates would be biased. However, the larger effects in markets with high versus low Medicare shares mitigate this concern.

As policy makers consider Medicare payment reforms that transition toward capitated payment models, it is important to be mindful of potential impacts on post-acute market structure and unintended consequences for health care delivery and patient outcomes.

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NOTES

1. Home health providers originally received additional payment for providing 10 or more therapy visits, attenuating the impact on marginal payment.
2. In particular, annual Medicare Payment Advisory Commission Reports document numbers of post-acute providers.
3. Medicare also reformed payments to other providers and suppliers over the sample period, including durable medical equipment suppliers, hospice providers, and out-patient hospital departments.
4. Health service area definitions (based on county) were downloaded from SEER at <http://seer.cancer.gov/seerstat/variables/countyattribs/Health.Service.Areas.xls> (last accessed July 1, 2012).

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Table A1: Poisson Estimates of Changes in Stocks, Entries, and Exits after Prospective Payment Reforms .

Table A2: Entry and Exit in High and Low Medicare Share Health Service Areas.

Table A3: Freestanding and Hospital-Based Provider Counts after Payment Reform.

Figure A1: Vertical Integration after Reimbursement Reform: Fraction of Facilities in Hospitals after Payment Reform. (a) Home Health Agencies. (b) Skilled Nursing Facilities. *Notes:* Figures show fraction of home health and skilled nursing facilities that are hospital-based in each year. Vertical lines indicate year prior to reforms (Home health: 10/1997 and 10/2000; Skilled nursing: 7/1998)