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Neeraj Sood
Abby Alpert
Kayleigh Barnes
Peter Huckfeldt
Jose Escarce

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Effects of Payment Reform in More versus Less Competitive Markets
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ABSTRACT

Policymakers are increasingly interested in reducing healthcare costs and inefficiencies through innovative payment strategies. These strategies may have heterogeneous impacts across geographic areas, potentially reducing or exacerbating geographic variation in healthcare spending. In this paper, we exploit a major payment reform for home health care to examine whether reductions in reimbursement lead to differential changes in treatment intensity and provider costs depending on the level of competition in a market. Using Medicare claims, we find that while providers in more competitive markets had higher average costs in the pre-reform period, these markets experienced larger proportional reductions in treatment intensity and costs after the reform relative to less competitive markets. This led to a convergence in spending across geographic areas. We find that much of the reduction in provider costs is driven by greater exit of "high-cost" providers in more competitive markets.

Neeraj Sood
Schaeffer Center for Health Policy
and Economics
3335 S. Figueroa Street, Unit A
Los Angeles, CA 90089-7273
and NBER
nsood@healthpolicy.usc.edu

Abby Alpert
Paul Merage School of Business
University of California-Irvine
SB 421
Irvine, CA 92697-3125
aealpert@uci.edu

Kayleigh Barnes
Schaeffer Center for Health Policy
and Economics
3335 S. Figueroa Street, Unit A
Los Angeles, CA 90089-7273
kayleighb@nber.org

Peter Huckfeldt
Division of Health Policy and Management
School of Public Health
University of Minnesota
420 Delaware Street Southeast Mmc88
Minneapolis, MN 55455
huckfeld@umn.edu

Jose Escarce
UCLA Med-GIM-HSR
911 Broxton Avenue
Box 951736
Los Angeles, CA 90024
jescarce@mednet.ucla.edu

1. Introduction

With the passage of the Patient Protection and Affordable Care Act (ACA), policy makers are increasingly looking to reduce both health care costs and inefficiencies in care by restructuring the ways that Medicare pays health care providers. High costs and inefficiencies have long been attributed to the traditional "cost-based" reimbursement model, where health care providers are paid separately for each service provided. In addition, competition has been shown to *increase* costs under cost-based reimbursement, with health care providers competing for patients based on quality and amenities which generate higher costs (Robinson and Luft 1987, Zwanziger and Melnick 1988). In this way, competition may also drive geographic variation in costs of care since there is considerable variation in market concentration across areas.

Over the past 30 years, Medicare has progressively moved away from cost-based reimbursement towards prospective payment, where a health care provider receives a set payment for an episode of care based on the characteristics of the patient. These payment reforms occurred in 1983 for hospitals and in the late 1990s and early 2000s for providers of post-acute care (e.g., skilled nursing facilities, home health agencies, and inpatient rehabilitation facilities). Extensive evidence shows that the shift to prospective payment had varying effects on health care costs across setting, with more "prospective" reforms and those reducing marginal payments leading to larger cost reductions (Newhouse and Byrne 1988, Grabowski, Afendulis et al. 2011, Sood, Huckfeldt et al. 2013, Huckfeldt, Sood et al. 2014). In addition, there is some evidence that the relationship between competition and quality (or costs) also changed after prospective payment. For example, data from California show that costs fell more for providers in the most competitive markets after the Inpatient Prospective Payment System was implemented in 1983 (Meltzer, Chung et al. 2002). However, the implementation of the Inpatient

Prospective Payment System coincided with the implementation of selective contracting and rapid penetration of managed care in California. Thus, it is unclear the extent to which the differential effects on costs were related to implementation of prospective payment versus other contemporaneous trends.

In this paper we revisit the question of whether provider payment reforms, which reduce the marginal reimbursement to health care providers, may have a differential effect depending on the level of provider competition in a health care market. We start with the premise that differences in the level of competition across health care markets is an important source of geographic variation in health care costs, with markets with greater competition under cost-based reimbursement having higher costs or intensity of care. Prior research also suggests that greater competition in health care markets with administered prices might lead to socially wasteful spending (Gaynor 2006). We next develop a stylized model that evaluates how the impact of payment reform on costs or intensity of care might vary by the level of competition in the market. We predict that payment reform reduces costs more in more competitive markets. Thus, it is possible that payment reform can simultaneously reduce costs and reduce geographic variation in care as it will lead to convergence in costs across more and less competitive markets.

We empirically test our predictions by investigating a significant Medicare payment reform for home health agencies: the 1997 Interim Payment System (IPS). The IPS offers an interesting case study as it imposed limits on payments to home health agencies in what was a cost-based reimbursement system, dramatically reducing reimbursement to home health agencies by nearly 50 percent (US Government Accountability Office 2000). Moreover, there is evidence that post-acute care is a key driver of the still-substantial geographic variation in Medicare spending (Newhouse and Garber 2013), suggesting significant scope for payment reforms targeted at post-acute care in reducing overall geographic variation in spending. Although several studies have analyzed the effects of IPS, none have looked at how the effects of the IPS on costs or intensity of care varied by the initial level of competition in the market (McCall, Komisar et al. 2001, Liu, Long et al. 2002, McCall, Petersons et al. 2003, Murtaugh, McCall et al. 2003, Porell, Liu et al. 2006, Huckfeldt, Sood et al. 2013, Huckfeldt, Sood et al. 2014). In this paper we add to this literature by analyzing how the effects of IPS varied by the level of competition. We also analyze the pathways or mechanisms that might explain the heterogeneous impact of IPS across markets with different levels of competition.

The empirical results are consistent with the predictions from the theoretical model. We find that there was significant variation in costs by level of competition in the pre-IPS period, with more competitive markets having higher costs. After the IPS, costs declined in all markets but there were larger declines in costs in more competitive markets. The decline in costs was driven by both changes in the probability of any home health use (extensive margin) and a decline in the number of home health days among existing users (intensive margin). As a result of the heterogeneous response to the payment reform, costs and the number of home health days converged in more and less competitive markets and the significant variation in costs or intensity of care by level of competition in the pre-IPS period nearly disappeared in the post-IPS period.

In robustness tests, we show that more competitive markets are more likely to be urban with larger populations, but the heterogeneous response of IPS persists even after we flexibly control for differences in observable characteristics between less and more competitive markets. Payment limits under the IPS were partially determined by the difference between a home health agency's costs relative to the census division average, which varies systematically across regions and may be correlated with competition levels. However, we find larger cost reductions in more competitive markets even after controlling for heterogeneity in the reform's "bite" across areas. Finally, we show that the larger impact of IPS in more competitive markets is driven by two factors. First, we observe greater exit of home health agencies in more competitive markets. Second, the home health agencies that exited more competitive markets were more likely to be "high-cost" agencies. Thus, payment reform serves to eliminate some of the most inefficient providers, especially those that are operating in highly competitive markets.

Overall these findings imply that payment reform is not only an important tool for reducing health care costs but it can affect geographic variation in care and health system efficiency by changing incentives and influencing market dynamics. Under the ACA, Medicare is adopting new provider payment reforms such as bundled payment and accountable care organizations, which represent further shifts towards capitation. The extent to which these reforms can further reduce costs and improve efficiency – and potentially reduce variation in health care spending- depends in part on the differential effects of such reforms across markets with different levels of competition.

The rest of the paper proceeds as follows. Section 2 describes the IPS. Section 3 builds a conceptual framework. Section 4 describes the data. Section 5 discusses our empirical strategy and section 6 discusses the results.

2. Background

From 1989 to 1996, Medicare home health expenditures more than quintupled, rising from $3.4 billion to $19.2 billion. In addition, between 1990 and 1996 the number of beneficiaries using the home health benefit almost doubled from 1.9 million to 3.7 million and the number of visits per patient grew from 33 visits to 76 visits (United States Congress 2000).

Much of this growth was spurred by the 1988 Duggan v. Bowen court case, which drastically broadened the eligibility criteria for the Medicare home health benefit. In response to rising costs, the Balanced Budget Act of 1997 (BBA) mandated that the home health payment policy be reformed. The BBA called for a Prospective Payment System (PPS) and immediately enacted an Interim Payment System (IPS) to address the rising costs while the PPS was being developed. The IPS went into effect in October 1997 and lasted for 3 years before being replaced by the PPS in October 2000.

Before the IPS, Medicare home health payment policy was a cost based reimbursement system subject to a per-visit limit on costs. This limit was set at the lower of an agency's "reasonable costs" or 112% of the national average of per visit costs. The implementation of IPS imposed stricter per-visit cost limits (reduction in average reimbursement) and introduced a per-beneficiary total annual cost limit (reduction in marginal reimbursement). Specifically, IPS introduced per-visit limits equal to 105% of the national median cost per visit for newer home health agencies that entered the market after 1994. Older home health agencies faced a limit that was a weighted average of the agency's average per patient costs in 1994 (75%) and their census division per patient costs (25%). A home health agency received payment equal to the lower of its actual costs, its per-visit cost limit, or the per-beneficiary cost limit.

McCall et al. (2001) and McKnight (2006) found a large decrease in home health utilization and the number of visits per user following IPS. Huckfeldt et al. (2013) found that the IPS reduced average payments and that this decline in reimbursement decreased utilization of home health services with little change in readmission and mortality. The decline in use of home health care coupled with lack of changes in readmission rates and mortality suggests that the IPS increased efficiency in the home health care industry. While prior work has investigated heterogeneous effects of the IPS by geography, such work has focused on variation in the average reimbursement change after IPS across markets which stems from payment limits being based on average census division costs (McKnight 2006). One study does look at entry and exit effects by level of competition (as measured by the number of home health agencies in a market) and find that markets with more home health agencies experienced more supply changes after IPS (Porell, Liu et al. 2006). However, no studies have looked at how the impact of IPS on costs or utilization varies by level of competition, which is the focus of this paper.

Other related work has investigated trends in hospital costs in California during a period when California experienced several important cost containment measures including the introduction of Medicare inpatient prospective system, introduction of selective contracting for Medicaid patients and diffusion of managed care in private insurance markets. This literature finds that during this time reduction in costs were largest for the most competitive markets (Zwanziger and Melnick 1988, Meltzer, Chung et al. 2002). We examine whether there was a differential impact of IPS in more versus less competitive markets. The IPS provides an important case study due to the large magnitude of overall reductions in payments. Moreover, the wide variation in home health competition across markets generates an ideal context for studying how competition affects responses to payment reform. Understanding how the effects of prior Medicare payment reforms varied across more and less competitive markets provide important evidence on the potential effects of reforms underway, and how they may affect geographic variation in Medicare spending.

3. Conceptual Model

In this paper, we are interested in how agencies adjust their intensity of care (in this context intensity can be viewed as the number of visits per episode of care) in response to payment reform across markets with different levels of competition. We develop a conceptual model based on papers by Brekke, Siciliani, and Straume (2011) and Hodgkin and McGuire(1994).

Changes in an agency's intensity of care can have two effects on demand – a market stealing effect (attracting a patient from another home health agency) and a market expansion effect (attracting a patient from another post-acute care provider or a patient who was not planning on getting any post-acute care). To illustrate and isolate these effects we consider two types of patients. The first, *H* type patients have a high value of home health care. These are patients who are much more suited to home health care; they get a large amount of utility from remaining in their homes and will not switch to other post-acute options as long as home health care is provided at a baseline level of intensity. We assume this market is saturated such that increasing intensity will not draw any new *H* type patients into the market, increasing intensity will only steal them from other firms. So changes in demand by *H* type patients isolates the market stealing effect of changes in intensity of care. The second, *L* type patients have a lower value of home health care. These patients are willing to utilize other types of post-acute care, like nursing homes, or forgo post-acute care if home health intensity is not high enough. To isolate the market expansion effect we assume that the *L* type patient market is never saturated; increasing intensity will draw in new *L* type patients to the market but will not steal *L* types from other firms. We can model patient utility as:

$$U^s = \begin{cases} V - t|x - z_i| + kq_i, & H\ type \\ v - t|x - z_i| + kq_i, & L\ type \end{cases}$$

Where V or v is the value that the patient puts on home health service at a baseline intensity that we arbitrarily set as $\underline{q} \equiv 0$ for convenience. The extra utility that a patient gets from a firm providing intensity above $\underline{q}$ is kq_i. For simplicity, let $k \equiv 1$. The disutility of "mismatch costs" is $t|x - z_i|$. Firm demand is derived using a Salop circle model, classically the circle represents the physical distance between each firm, but since home health patients do not travel to the agency providing them service we think of the circle as a "firm specialization" space. The distance between firms represents the different sets of skills or attributes that firms may have. Thus the "distance" could be based on clinical condition of the patient and specialization of home health agency in treating that condition or it could more generally reflect differences in patient preferences for receiving care from a particular agency. Thus, x denotes the mix of home health agency attributes preferred by the patient, z_i indicates the mix of attributes characterizing the agency i, and $x - z_i$ represents how good of a fit a patient is for a specific home health agency, t is the marginal cost of the "distance" between the patients' preferences and an agency's attributes. The smaller the "distance" between the firm and the patient, the better the fit and lower the mismatch cost.

In our model, price is regulated and takes the form $P = \alpha + \beta * c(q_i)$, where α is average reimbursement and β is marginal reimbursement. This formulation allows Medicare's payment of home health agencies to occur on a spectrum ranging from cost based reimbursement system ($\beta = 1 \wedge \alpha = 0$) to prospective payment ($\alpha > 0 \wedge \beta = 0$). Firm costs are separable and the marginal cost of an additional patient is constant for any given level of intensity, $C = c(q_i, X_i) = c(q_i) * X(q_i, q_{-i})$ where $X(q_i, q_{-i})$ is the demand for firm i and $c(q_i)$ is the cost of intensity per patient.

We normalize patient density on the circle and the total length of the circle to one. There are n firms evenly distributed about the circle, such that their distance apart is equal to $1/n$. The patient population is split between H and L types where a fraction λ are H type and $1-\lambda$ are L

type. To find demand for each patient type, we first find their point of indifference along the circle between the first firm, *i*, and a second firm, *j*, for *H* type:

$$V - tx_i^H + q_i = V - t\left(\frac{1}{n} - x_i^H\right) + q_j$$

$$x_i^H = \frac{q_i - q_j + \frac{t}{n}}{2t} \qquad (1)$$

And for *L* type patients where agencies have a local monopoly patients are indifferent between receiving home health care and the outside option whose utility is normalized to zero:

$$v - tx_i^L + q_i = 0$$

$$x_i^L = \frac{v + q_i}{t} \qquad (2)$$

Total demand is given by multiplying (1) and (2) by two times the fraction of H or L type patients.

$$X_i = 2\lambda x_i^H + 2(1-\lambda)x_i^L = \frac{2(1-\lambda)v + (2-\lambda)q_i - \lambda q_j}{t} + \frac{\lambda}{n} \qquad (3)$$

The combination of having *H* and *L* type patients in the model separates the "market stealing" and "market expansion" effects of an agency increasing its intensity of care. When a firm increases its intensity, it "steals" *H* type patients from other agencies and "expands" the market by attracting new *L* type patients who otherwise would not receive home health. We gain greater insight from looking at how demand changes with intensity:

$$\frac{\partial X_i}{\partial q_i} = \frac{2-\lambda}{t} > 0 \qquad \frac{\partial x_i^H}{\partial q_i} = \frac{\lambda}{t} > 0 \qquad \frac{\partial x_i^L}{\partial q_i} = \frac{2(1-\lambda)}{t} > 0$$

Both the “market stealing” (the second inequality) and the “market growth” (the third inequality) components of demand contribute a positive, constant return to intensity. In addition, the market growth is usually the primary driver of the return to intensity; only at high levels of H types in the market (λ>2/3) does the “market stealing” component over power the “market growth” component. We also look at how demand changes with number of firms:

$$\frac{\partial x_i}{\partial n} = -\frac{\lambda}{n^2} < 0 \qquad \frac{\partial x_i^H}{\partial n} = -\frac{\lambda}{n^2} < 0 \qquad \frac{\partial x_i^L}{\partial n} = 0$$

As the number of firms increase, there is a decrease in demand for each firm coming from the *H* type patients switching to new agencies, but no effect from the *L* type patients.

In this model we assume that firms are profit maximizing, while in reality they may exhibit altruistic behavior. A version of our model that includes altruism can be found in the appendix. We found that our predictions are similar to the for-profit analysis presented here except when firms exhibit a high degree of altruism. However, the empirical literature suggests that the level of altruism in hospitals and post-acute care providers is not great enough to differentiate for profit from nonprofit utility maximizing actions. Pauly (1987) reviews theoretical and empirical literature and finds no significant differences in market behavior between for profit and nonprofit firms (Pauly 1987). More recently, Duggan (2000) finds that nonprofit hospitals are no more altruistic than for profit hospitals and that they respond similarly to pricing incentives.(Duggan 2000) Additionally, Sloan, Picone, Taylor, and Chou (2001) find no difference in outcomes for for-profit vs nonprofit hospitals (Sloan, Picone et al. 2001). For these reasons, we restrict our analysis to classic for-profit profit maximization and include an analysis that includes altruism in the Appendix.

Firms profit maximize, as in (4):

$$\pi_{\mathrm{i}} = \big(\alpha + \beta * c(q_i)\big)X_i(q_i, q_{-i}) - c(q_i)X_i(q_i, q_{-i}) \qquad (4)$$

With the first order condition for intensity allocation being:

$$\frac{\partial \pi}{\partial q_i} = \alpha \frac{\partial X_i}{\partial q_i} + \beta\left(\frac{\partial c}{\partial q_i}X_i + c(q_i)\frac{\partial X_i}{\partial q_i}\right) - \left(\frac{\partial c}{\partial q_i}X_i + c(q_i)\frac{\partial X_i}{\partial q_i}\right) = 0 \qquad (5)$$

We substitute equation (3) into (5) and set q_i=q_j to solve for optimum intensity q*.

Proposition 1: The intensity of care increases with number of firms.

To solve for dq/dn we take the total derivative of the first order condition:

$$dq\colon\ -\left(\left((1-\beta)\frac{\partial c}{\partial q_i}\right)\frac{2(1-\lambda)}{t} + (1-\beta)\frac{\partial c}{\partial q_i}\left(\frac{2-\lambda}{t}\right) + (1-\beta)X_i\frac{\partial^2 c}{\partial q_i^2}\right)$$

$$dn\colon\ \left((1-\beta)\frac{\partial c}{\partial q_i}\right)\frac{\lambda}{n^2}$$

$$d\alpha\colon\ \frac{2-\lambda}{t}$$

$$d\beta\colon\ c(q_i)\left(\frac{2-\lambda}{t}\right) + \left(\frac{2(1-\lambda)v + 2(1-\lambda)q_i}{t} + \frac{\lambda}{n}\right)\frac{\partial c}{\partial q_i}$$

We can see that dq is simply the second order condition of profit maximization, and is, by definition, always less than zero.

$$\frac{dq_i}{dn} = \frac{\left((1-\beta)\frac{\partial c}{\partial q_i}\right)\frac{\lambda}{n^2}}{\left((1-\beta)\frac{\partial c}{\partial q_i}\right)\frac{2(1-\lambda)}{t} + (1-\beta)\frac{\partial c}{\partial q_i}\left(\frac{2-\lambda}{t}\right) + (1-\beta)X_i\frac{\partial^2 c}{\partial q_i^2}} \geq 0$$

The denominator is the negative of the second order condition therefore is positive, so the sign is determined by the numerator. The numerator is also positive given that costs are increasing and there is a non-zero amount of *H t*ype patients in the market.

Proposition 2: A decline in marginal reimbursement has larger effect on intensity of care in more competitive markets.

To see this, consider how dq/dn changes with marginal reimbursement:

$$\frac{\partial}{\partial \beta}\left(\frac{dq_i}{dn}\right) = \frac{\frac{\partial c}{\partial q_i}\frac{\lambda}{n^2}}{\frac{\partial c}{\partial q_i}\left(\frac{\partial X_i^L}{\partial q_i} + \frac{\partial X_i}{\partial q}\right) + X_i \frac{\partial^2 c}{\partial q_i^2}} \geq 0$$

To understand why this relationship is positive, we look back to the first order condition, which simplifies to:

$$Profit\ Margin(q\ ) * \frac{\partial X_i}{\partial q_i} = \frac{\partial c}{\partial q_i}(1-\beta) * X_i$$

The right hand side (RHS) of the equation is the marginal cost of increasing intensity and the left hand side (LHS) of the equation is the marginal benefit of increasing intensity. An increase in intensity decreases profits because it increases the marginal cost of providing care for inframarginal patients (RHS). However an increase in intensity raises profits because it increases demand and firms enjoy a positive margin on the marginal patients (LHS). The marginal benefit curve slopes downwards as profit margins decline with intensity. The marginal benefit term or the LHS is independent of the number of firms as the profit margin is a function of reimbursement policies and the slope of marginal cost curve while and the responsiveness of demand to intensity is a function of patient preferences (see expression for $\frac{\partial X_i}{\partial q_i}$ derived earlier in the theory section). However, the number of firms in the market does affect the RHS as an increase in the number of firms reduces the number of inframarginal patients a firm has. Thus the marginal cost curve for intensity shifts downwards as the number of firms rises (see Figure 1) and consequently intensity is higher in more competitive markets.

An increase in marginal reimbursement pivots the marginal benefit curve for intensity upwards as increases in intensity have a smaller effect on profit margins when marginal reimbursement is higher. This has a larger effect on intensity in more competitive markets, as equilibrium intensity is higher in more competitive markets. Similarly, an increase in reimbursement also pivots the marginal cost curve for intensity downward as providing care to inframarginal patients now has a smaller effect on profits. Again this downward pivot induces a larger effect on intensity in more competitive markets, as equilibrium intensity is higher in more competitive markets. This effect is shown in Figure 1. In the figure, the points labeled A denote the level of intensity before an increase in marginal reimbursement. It is clear that intensity of care in the market with more competition leads to a higher baseline level of intensity. When marginal reimbursement increases, the marginal benefit curve pivots upwards and the marginal cost curves pivot downward as previously stated. A new equilibrium level of intensity is achieved at the points labeled B. The change in intensity for less competitive markets (low n) is less than the change in intensity for competitive markets (high n) as predicted.

Proposition 3: Reducing marginal and average reimbursement reduces intensity of care.

This proposition is fairly intuitive and can be derived easily from the total derivative of the first order condition:

$$\frac{dq_i}{d\alpha} = \frac{\frac{2-\lambda}{t}}{\left((1-\beta)\frac{\partial c}{\partial q_i}\right)\frac{2(1-\lambda)}{t} + (1-\beta)\frac{\partial c}{\partial q_i}\frac{2-\lambda}{t} + (1-\beta)X_i\frac{\partial^2 c}{\partial q_i^2}} > 0$$

$$\frac{dq_i}{d\beta} = \frac{c(q_i)\frac{2-\lambda}{t} + X_i\frac{\partial c}{\partial q_i}}{\left((1-\beta)\frac{\partial c}{\partial q_i}\right)\frac{2(1-\lambda)}{t} + (1-\beta)\frac{\partial c}{\partial q_i}\frac{2-\lambda}{t} + (1-\beta)X_i\frac{\partial^2 c}{\partial q_i^2}} > 0$$

Motivated by these propositions we expect to see the following patterns in our data:

1. Less concentrated (or more competitive markets) have higher intensity of care (and consequently, higher costs)
2. Because IPS lowered both average and marginal reimbursement we expect to see a decrease in intensity of care for all markets.
3. Because the effects of changes in marginal reimbursement are magnified in markets with more competition we expect to see a greater decrease in intensity of care (and costs) following the IPS in more competitive markets. This implies a convergence in the costs or intensity of care in more versus less competitive markets after the reform.

One caveat is that we treat the number of firms in our model as fixed for simplicity – that is we do not model firm entry or exit. In reality, the effects of IPS on firm entry and exit may vary by the level of competition. For example, reducing payment will affect firms with already slim profit margins the most. If payments are reduced such that a firm accrues a sufficient loss, they may choose to exit the market. If firms in more competitive markets are operating at higher levels of intensity their profit margins are likely to smaller and thus we might expect more exit after IPS in more competitive markets. By similar logic, firm exit might be more pronounced for "high cost" firms that are less efficient and cannot withstand a decline in reimbursement.

Although, we do not model firm exit in our theoretical model, we do explore it in our empirical models.

Another caveat is that the model is silent on the effects of competition on patient outcomes. The model predicts changes in intensity of care only and not patient outcomes. On the one hand, one can argue that if patients value intensity it must improve patient outcomes. However, on the other hand one can argue that patients might be uninformed and even though they value higher intensity care, beyond a certain level, changes in intensity of care do not improve patient outcomes and represent "wasteful" spending. Thus, in our empirical models we will evaluate both changes in intensity of care and also changes in patient outcomes.

4. Data

4.1.Home Health Payments, Costs, and Days

The primary source of data for this paper comes from a 100 percent sample of Medicare claims from the Medicare standard analytic file (SAF) for home health care. We restrict the sample to individuals who were discharged from an acute care hospital for stroke[1] between 1996 and 2000. We use the Medicare claims to obtain the total number of days that beneficiaries received home health visits and total Medicare payments for home health during the 90-day post-acute period following each individual's initial hospital discharge. Any additional acute hospital stay occurring within the 90-day follow-up period is considered a readmission.

[1] Stroke patients are defined as those with a principal diagnosis in the acute hospital stay of intracerebral hemorrhage (ICD code is 431.xx), occlusion and stenosis of precerebral arteries with infarction (433.x1), occlusion of cerebral arteries with infarction (434.x1), or acute but ill-defined cerebrovascular disease (436.xx).

Costs to home health providers are computed using data on facility costs from Medicare cost reports. To construct total costs for each 90-day post-acute episode, we multiply the number of visits from the claims data by the facility's average calendar year cost per visit.

4.2.Patient and Provider Characteristics

We use the Medicare denominator file to obtain demographic variables for each individual including gender, age (5-year age categories), race, Medicaid coverage, county of residence, and urban/rural status, as well as information about whether death occurred within 90 days of the initial hospital discharge. We use the hospital claims from the initial acute episode to measure comorbidities, as defined by Elixhauser, Steiner et al. (1998), and complications during the index hospitalization. The comorbidities and complications that are included as controls in our analysis are listed in Table 1. We also use the hospital claims to determine whether the stroke was hemorrhagic or ischemic.

Provider characteristics for the acute care hospital are derived from the CMS Medicare Provider of Services file and Acute Impact file. These provider-level databases include information about ownership status, number of beds, wage index, average daily census, acute case-mix index, DSH patient share, and Medicare patient share.

4.3.Market Competition

The empirical analysis compares changes in home health use and costs across areas with high and low levels of competition. Our primary measure of the level of competition in the market is the Herfindahl–Hirschman Index (HHI). We define markets using Hospital Service Areas (HSA) as defined by the National Center for Health Statistics (M Makuc, Haglund et al. 1991, Wennberg and Cooper 1996, National Cancer Institute 2008). An HSA is defined as a group of zip codes in which the residents receive the majority of their hospitalizations. Since home health care is typically received after a hospitalization we believe that the market definition for hospitals is a good approximation of the market for home health care. The HHI is the sum of the squared market shares for home health providers within each HSA. Each home health agency's market share is defined as the proportion of Medicare patients residing in the HSA who receive post-acute care (during the 90-days following their hospitalization for stroke) from that home health agency. We also compute the Four-Firm Concentration Ratio as the sum of the market shares for the four most dominant home health agencies within an HSA as a secondary measure of competition. We exclude small HSAs from our analysis sample that contain fewer than 28 home health claims (representing the bottom 25 percent of HSAs) where it is difficult to obtain a precise measure of competition. In some specifications, we examine firm exit and define a home health agency as exiting the Medicare market when there are no longer any Medicare claims for that provider. Figure 1 shows that HHI and the Four-Firm Concentration Ratio vary greatly across the home health industry; we will use this variation to study the differential effect of payment reform across more and less competitive markets.

4.4.Sample Restrictions

We exclude individuals who died during the initial hospital stay for stroke. We also exclude individuals under age 65, those enrolled in Medicare managed care plans, and those residing in Maryland since Maryland did not adopt prospective payment. We conduct our analysis at the discharge level and observe outcomes for a 90-day follow-up period. Our main analysis sample contains 1,178,430 post-acute episodes resulting from 1,178,430 unique stroke discharges over the study period.

5. Empirical Strategy

5.1. Primary specification

We perform OLS regression of home health outcomes on the level of competition interacted with a post-IPS indicator and controls taking the form:

$$Y_{ijt} = \gamma\left(HHI_j^{Pre} \cdot Post_t\right) + \delta_j + \mu_t + X_{ijt}\beta + \epsilon_{ijt} \quad (6)$$

where Y_{ijt} is an outcome such as the number of home health days, provider costs, or the probability of any home health care for patient *i* in market *j* discharged in quarter *t*. $Post_t$ is a binary variable indicating the time periods following the introduction of IPS. HHI_j^{Pre} is the baseline HHI in market *j* in the quarter prior to the introduction of IPS. In some specifications, we include indicators for HHI quantiles rather than a continuous measure of HHI. HHI Quantile 1 refers to the lowest quantile of HHI (i.e. highest level of competition). We also control for quarter fixed effects (μ_t), market fixed effects (δ_j) and time-varying patient level characteristics and market level characteristics (X_{ijt}). The key coefficient of interest is γ. Since the IPS has an overall negative effect on outcomes, we predict that γ will be positive since less competitive markets (high HHI) will experience smaller negative effects from IPS (Proposition 2). Standard errors are clustered at the market-level (HSA).

5.2. Robustness checks

Event study estimates

We estimate an event study version of the primary specification where we add in interactions of HHI with each quarter leading up to and following the introduction of IPS. The omitted interaction term is the quarter before IPS is introduced (quarter 3 of 1997) We expect the coefficients on the interaction terms for the quarters leading up to the IPS to be statistically insignificant, implying that pre-IPS trends in outcomes were similar in more versus less competitive markets. We expect the coefficients on the interaction terms for the quarters after IPS to be positive and significant suggesting that IPS had smaller negative effects in less competitive markets.

Urban-Rural

Prior research and our data suggest that the level of competition in a market is strongly correlated with the market's status as urban or rural. More densely populated urban markets are likely to be more competitive while rural areas have a more dispersed population and are therefore more likely to be non-competitive. An analysis of changes in health outcomes after payment reform based on levels of competition could actually be capturing the difference in responsiveness between urban and rural markets. To test for this, we run our analysis for both urban and rural areas separately.

Geographic variation in average reimbursement change

The method of payment reform instituted by the IPS imposed varying levels of reimbursement reductions for home health agencies depending on how long they had been in the market and the census averages of costs for their district. Firms that entered the market after 1994 were subject to a maximum per patient reimbursement of 105% of the national median in 1994. Agencies that had entered the market before 1994 were subject to a weighted average of the firm's average per patient costs in 1994 and the firm's census division weighted average of per patient costs. Because of this, agencies in some census regions faced a larger reduction in reimbursement limits than others, which could affect their responses to the reform. To account for this, we introduce a measure, IPS "Bite". In a similar spirit as McKnight (2006), IPS Bite is defined as the average number of home health days in a HSA less the average number of home health days in the HSA's census division. HSAs with a higher deviation from the average census region home health days are likely to be areas where IPS reduced payment the most. We plot how IPS "Bite" varies with HHI to determine whether there is a systematic relationship between the payment reduction and the level of competition in the market. We then control for the IPS "Bite" by including a triple-interaction term between post-IPS, HHI and IPS "Bite".

5.3. Mechanisms

In addition to characterizing the heterogeneous effects of payment reform by level of competition, we also want to understand the underlying mechanisms driving these differences. As discussed in the theoretical framework section, home health agencies may respond to payment reform by reducing the intensity of care or by exiting the market. We study each of these mechanisms.

First, we estimate equation 6 using the number of home health providers as the outcome variable. We also estimate models defining the outcome variable as the log number of providers. Changes in the number of home health agencies could be driven both by reductions in entry and an increased rate of exit.

Next, we compare the characteristics of exiting home health agencies (agencies that were in operation in 1996 but exited after IPS) with "stayer" home health agencies (agencies that were operating during the entire study period from 1996-2000), in order to identify changes in agency composition after the IPS that may have affected practice patterns. Specifically, we look at average home health days, Medicare payments, provider costs, and the demographic characteristics of patients seen by agencies.

In the third set of analyses, we directly investigate how much of the effect of the IPS occurred through a changing composition of home health agencies. Specifically, we estimate equation 6 for the home health days and provider costs outcomes, limiting the sample to just the agencies that stayed in the sample after IPS and compare the results to those for the full sample. Any differences in results between the two samples are driven by changes in agency composition due to exiting firms.

6. Results

6.1. Differential effects of IPS by level of competition

Figure 3 and Table 2 test a primary hypothesis generated by the conceptual model: that the IPS would have a greater impact on intensity of care (measured by the number of days of home health care) and costs in more competitive markets. Figure 3 shows reductions in average home health days, costs, and the probability of using home health across HSAs with different levels of competition during the period following the introduction of IPS but before the implementation of PPS (the introduction of IPS is indicated by a red vertical line after the third quarter of 1997). Consistent with the theoretical model and prior literature, the most competitive markets (HHI quantile 1) exhibit both the highest costs and days under cost-based reimbursement prior to the IPS and the largest reductions in costs and days after the IPS, converging towards the other HHI quartiles in the post-reform period. Figure 1 in the appendix shows the corresponding figure for two important patient outcomes: readmissions and mortality. In contrast to the results for intensity of care and costs we find little or no impact of the IPS on these outcomes and we find no differential effects by the level of competition. These results are consistent with (Huckfeldt, Sood et al. 2014) who also found large changes in costs but no change in patient outcomes after the IPS.

Table 2 displays the results from the analogous regressions for home health days (columns 1-4), provider costs (columns 5-8), and probability of any home health use (columns 9-12) on the interaction of HHI quantiles with a "post-IPS" indicator variable. The omitted quantile is the least competitive HSAs (HHI quantile 4). We show results from four specifications that progressively add controls: the first includes just HSA fixed effects, the second adds a linear time trend, the third replaces the linear time trend with quarter-year fixed effects, and the fourth specification adds time-varying patient and market-level controls. The first two specifications for each outcome include a "Post-IPS" indicator variable, which exhibits the change in outcome for the least competitive markets (the omitted interaction category). For home health days, we observe the largest reductions for the most competitive markets, where home heath days fell by about 2.4 more days than the least competitive markets, and fell 1.5 more days more than the second quantile. The reduction in home health days after the IPS for the third quantile was not statistically different from the fourth quantile. These results are robust across the four specifications. We find similar results for provider costs. All quantiles experienced a decline in costs, with home health agencies in the most competitive quantiles seeing a decline in costs of $220 more per patient than in the least competitive quantile. Home health agencies in the second quantile experienced an additional reduction of $80-$90 in costs than agencies in the least competitive quantile. In total, provider costs were reduced by approximately $320 for the first quantile of HHI and by about $200 for the second quantile of HHI (column 6). We find no significant difference between the reduction in provider costs for the third and fourth quantiles. Although there was an overall reduction in the probability of using any home health care, we do not find any statistically significant differences in the magnitude of the reduction across different levels of competition. In Appendix Table 1, we re-estimate all of these regressions to estimate proportional changes using log outcomes. The results are qualitatively similar.

6.2. Alternative specifications

Event study

In Table 3, we estimate a regression that includes leads and lags of the policy to ensure that our findings in Table 2 are not driven by differential trends in outcomes in the pre-IPS period. We find no evidence of differences in trends by level of competition in the pre-IPS period and only observe significant differences in the trends by different levels of competition immediately after the implementation of IPS.

Results stratified by urban status

Our data and prior research suggests that the level of competition might be correlated with urban/rural status, and thus the results could be related to other unobserved differences between urban and rural areas rather than competition. To investigate this, we re-estimate the main analysis separately for urban and non-urban HSAs (results shown in Table 4). To categorize our data into urban and non-urban groups we use data from NCHS. Table 4 shows that urban and non-urban areas exhibit patterns that are similar to the pooled sample in Table 2 – in both urban and non-urban areas the IPS had larger negative effects on costs and days in more competitive markets.

Heterogeneous effects by IPS "Bite"

The IPS reduced reimbursement by different amounts for home health agencies depending on how long the firm has been in the market, as well as their average costs and census division costs. To account for this difference in reimbursement changes across HSAs, we introduce a measure called IPS "bite" which is the difference between the HSA's average number of home health days and the census division's average number of home health days. This measure predicts how much of an impact IPS may have had on reimbursement. Figure 4 shows the relationship between HHI and IPS "bite". There is a slight negative correlation meaning that a larger reduction in payment is associated with more competitive HSAs. This suggests that IPS "bite" could be confounding our results.

We account for the geographic heterogeneity of IPS payment reductions in Table 5 by including an interaction between Post-IPS and IPS-bite, and a triple-interaction between HHI Quantile, Post-IPS, and IPS bite. We find that the coefficient on the interaction between Post-IPS and IPS-bite is negative and significant. This is consistent with prior research which also finds that the IPS led to larger declines in costs in areas with larger bite.(McKnight 2006, Huckfeldt, Sood et al. 2014) We find that after controlling for the IPS bite, the differential effect for the most competitive markets is reduced slightly. Home health days are reduced by approximately 1 day more for markets in the first quantile of HHI compared to the fourth quantile (columns 2 and 3) relative to the 2.5 day reduction that we estimate without controlling for IPS bite (column 1). Similarly, including the IPS "bite" interactions reduces the magnitude of the difference in reduction of provider costs between quantile 1 and quantile 4 to approximately $130 (columns 5 and 6) rather than $220 (column 4). While this does affect the magnitude of the effect of competition it does not change our overall result that competition amplifies the impact of the payment change. Finally, we find that the coefficients on the triple interaction between HHI Quantile, Post-IPS, and IPS bite are statistically insignificant suggesting that IPS bite or average reimbursement changes do not affect how competition mediates the impact of IPS on costs.

6.3. Mechanisms through which competition amplifies effect of IPS

Market exit

We find substantial evidence that the IPS response varied with the level of market competition. In our conceptual model, we exclude firm decisions regarding entry and exit for brevity and simplicity when in reality our results could be caused by both internal changes to cost and admission policies and market exit by firms who incur higher costs and more home health days. Next, we explore the extent of the role of entry and exit in our findings. Figure 5 shows the trends in the number of home health providers by level of competition. HSAs in the most competitive quantile experienced the largest reduction in the number of home health agencies after IPS while the other quantiles appear to have experienced much smaller reductions. Table 6 Panel A shows estimates from regressing the number of home health providers on the same variables and controls used in Table 2. In addition, we show results separately by urban/ non-urban status and results that control for IPS bite (columns 5-7). We find progressively greater reductions in the number of HH providers after IPS as the level of competition increases. Compared to the lowest competition markets (quantile 4), markets in the third competition quantile lost approximately 0.5 more agencies, markets in the second quantile lost 1.2 to 1.5 more agencies, and the most competitive markets lost about 5.5 to 6 additional agencies. In total, the number of agencies in the most competitive markets fell by 4.4 agencies compared to an *increase* of 1.6 agencies in the least competitive markets (based on column 2). Comparing urban and non-urban HSAs in columns 5 and 6, we find that the number of agencies in competitive markets in urban areas fell more than in non-urban competitive markets, however we find the same general pattern across competition levels for both categories. Including the IPS bite interaction terms attenuated the estimates slightly but did not change the pattern by competition levels. In Panel B we estimate log effects, regressing the log of the number of providers on the same variables in Panel A. The log effects results follow the same pattern as Panel A; we find that markets in the first quantile experience a 13.7% greater decrease in the number of providers after IPS than markets in the fourth quantile and similar results for the other specifications including IPS "bite" and urban and non-urban comparisons.

Changing composition of home health agencies in the sample

The results in Table 6 show that reductions in the number of home health agencies after the IPS were greater in more competitive markets. Table 7 displays characteristics of staying firms and exiting firms in markets with high and low competition. In non-competitive HSAs (columns 3 and 4) there is very little difference in baseline year characteristics between exiting and staying firms. In the most competitive HSAs (columns 1 and 2) we find larger differences, with exiting firms having about 8 more home health days and $500 more in Medicare payments and costs than staying firms in the baseline year (1996). Although exiting agencies provided more home health days and incurred higher costs, there is almost no difference in 90-day mortality and rehospitalization rates suggesting that exiting firms may have over-provided care intensity (as measured by days). These results suggest that payment reform is more likely to induce inefficient firms to exit the market when they are operating in high competition markets.

In Table 8 we show results from repeating our preferred specification (specification 4) from Table 2, excluding firms that exited the market after IPS was introduced. Excluding exiting firms attenuates the extra reduction in home health days in the most competitive markets, from a reduction of about 4 days receiving home health to a 2.4 day reduction (columns 1 and 2). Once we control for IPS bite, the estimates become attenuated and insignificant (column 4). This result implies that much of the difference in the reduction of home health days we found across levels of competition is likely due to home health agency exit rather than changes in internal structure. For provider costs, we also find a progressive attenuation in the estimates as the sample is limited to agencies staying in the market and when we include the IPS bite interaction terms. However, the extra reduction in the most competitive markets after IPS remains statistically significant (column 8). This result suggests that market exit plays an important role in reducing costs.

7. Conclusion

Cost-based payment of health care providers has been widely acknowledged as a driver of over-use of health care and the growth of health care costs in the US. Competition has been acknowledged to exacerbate this problem, with providers in more competitive markets attracting patients by providing more services and amenities, generating geographic variation in costs. The effects of reforms that shift provider payment away from fee-for-service towards more capitated models may also vary depending on the level of market competition. We develop a theoretical model generating predictions that reducing marginal reimbursement will have a greater effect on the intensity of care and costs in more competitive markets. Our empirical results are consistent with this prediction, with larger reductions after the IPS in the probability of receiving home health care and the intensity of care in more competitive markets, leading to convergence in costs in more and less competitive markets. We do not find a similar convergence in patient outcomes suggesting that the reduction in costs might have improved efficiency. We also find a larger reduction in the number of home health agencies in more competitive markets and that exiting providers were more likely to provide high-intensity and high-cost care. Further, much of the reduction in more competitive markets comes from the exit of such providers.

These results imply that to the extent that current health care cost variation (for example in post-acute costs) was driven by competition under cost-based reimbursement and now the separate post-acute prospective payment systems, then higher-powered payment systems such as accountable care organizations and bundled payment that further reduce marginal payments could lead to greater convergence in costs across markets.

Graphs and Figures:

Figure 1. A Decline in Marginal Reimbursement has a Larger Effect on Intensity of Care in More Competitive Markets

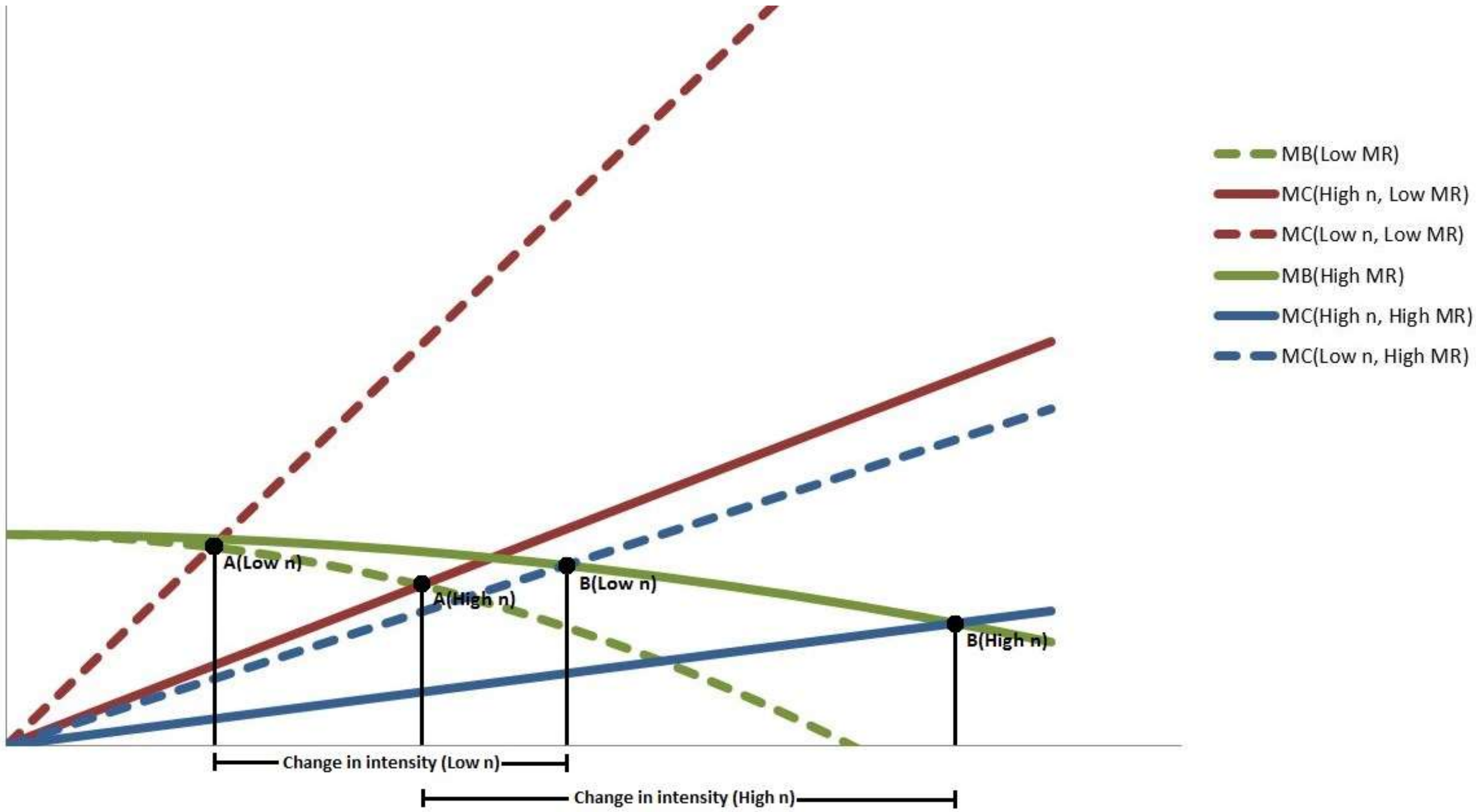
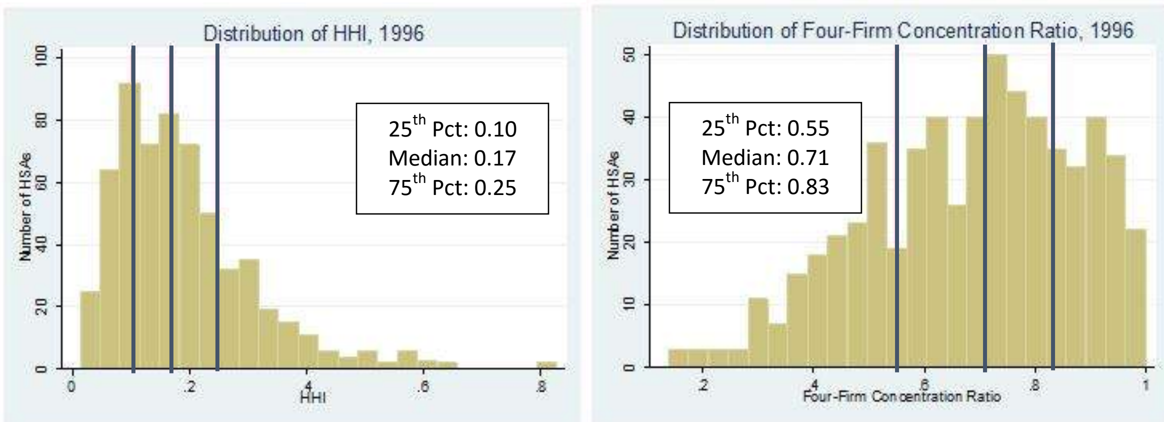


Figure 2 – Distribution of Home Health HHI and Four-Firm Concentration Ratio across HSAs, 1996

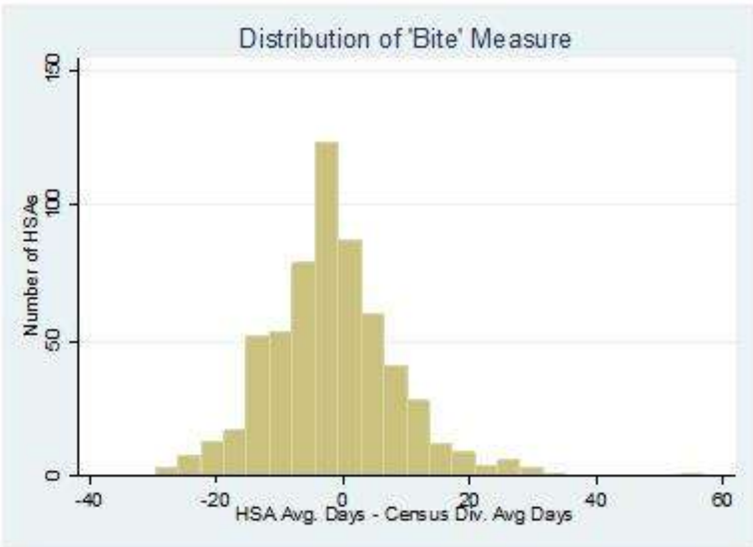


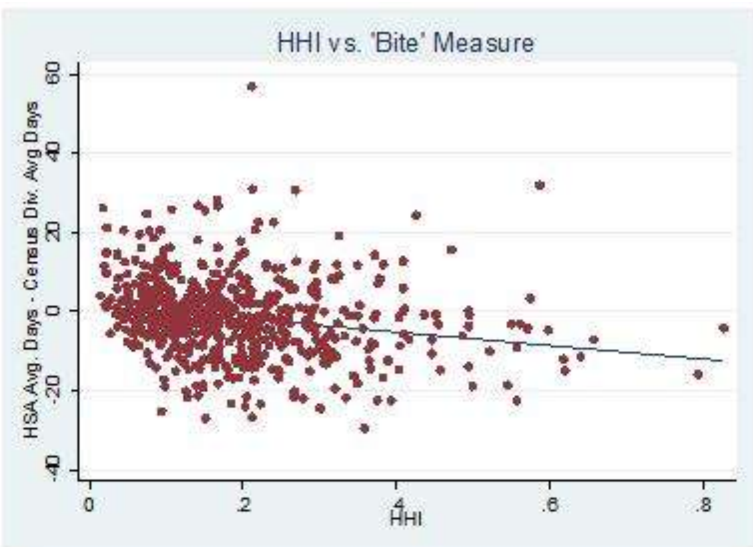
Notes: Home Health market share is defined by the patient's residence; sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Figure 3 – Trends in Home Health Outcomes by Level of Market Concentration, 1996-2000

Notes: Quantile 1 are HSAs with low HHI (low concentration), Quantile 4 are HSAs with high HHI (high concentration); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

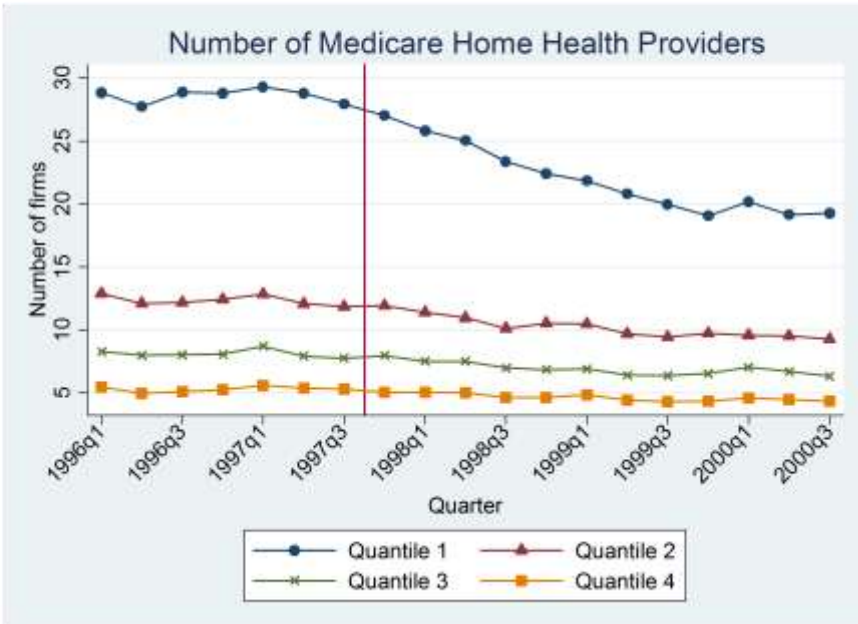
Figure 4 -- Relationship between HHI and IPS "Bite"





Notes: Observations are at the HSA-level. Sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs).

Figure 5 – Trends in Number of Home Health Providers by Level of Market Concentration, 1996-2000



Notes: Quantile 1 are HSAs with low HHI (low concentration), Quantile 4 are HSAs with high HHI (high concentration); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Table 1 – Descriptive Statistics, 1996

Sample:	Low Concentration HSAs (1)	High Concentration HSAs (2)
Competition Measures, 1996		
HHI	0.104	0.281
Four-Firm Concentration Ratio	0.533	0.835
Outcomes		
Home Health Days, 1996	19.693	16.488
Change in HH Days, 1996-1998	*-7.803*	*-5.750*
Any Home Health, 1996 (%)	0.421	0.415
Change in Any Home Health, 1996-1998	*-0.075*	*-0.070*
Home Health Medicare Payments, 1996	1264.064	1010.762
Change in HH Medicare Payments, 1996-1998	*-460.440*	*-310.973*
Home Health Provider Costs, 1996	1343.596	1106.996
Change in HH Provider Costs, 1996-1998	*-418.341*	*-268.872*
90-Day Mortality, 1996 (%)	0.150	0.146
Change in 90-Day Mortality, 1996-1998	*0.006*	*0.011*
90-Day Rehospitalization, 1996 (%)	0.269	0.260
Change in 90-Day Rehospitalization, 1996-1998	*0.004*	*0.005*
Patient Demographics, 1996		
Age	78.864	78.894
Male (%)	0.404	0.413
White (%)	0.863	0.881
Medicaid (%)	0.223	0.226
Urban (%)	0.604	0.328
Rural (%)	0.169	0.383
Adjacent to Metro Area (%)	0.227	0.289
Condition-Specific Characteristics, 1996		
Hemorrhagic or Ischemic Stroke (%)	0.073	0.072
Patient Co-Morbidities, 1996		
CHF (%)	0.146	0.142
Valvular Disease (%)	0.098	0.097
Pulmonary Circ. Disorders (%)	0.008	0.008
Peripheral Vascular Disorders (%)	0.068	0.072
Paralysis (%)	0.007	0.007
Other Neurological Disorders (%)	0.003	0.003
Diabetes- Uncomplicated (%)	0.215	0.216
Diabetes- Complicated (%)	0.039	0.036

Hypothyroidism (%)	0.068	0.069
Renal Failure (%)	0.019	0.016
Liver disease (%)	0.004	0.003
Peptic ulcer disease excl bleeding (%)	0.002	0.002
AIDS (%)	0.000	0.000
Lymphoma (%)	0.003	0.003
Metastatic cancer (%)	0.009	0.011
Solid tumor without metastasis (%)	0.016	0.016
Rheumatoid Arthritis (%)	0.016	0.017
Coagulopathy (%)	0.011	0.009
Obesity (%)	0.017	0.018
Weight Loss (%)	0.023	0.020
Fluid and electrolyte disorders (%)	0.149	0.142
Blood Loss Anemia (%)	0.006	0.005
Deficiency Anemias (%)	0.056	0.057
Alcohol Abuse (%)	0.013	0.013
Drug Abuse (%)	0.001	0.001
Psychoses (%)	0.017	0.015
Depression (%)	0.033	0.036
Patient Complications, 1996		
Post-operative Pulmonary Compromise (%)	0.013	0.011
Post-operative Gastrointestinal Hemorrhage (%)	0.011	0.010
Cellulitis or Decubitus Ulcer (%)	0.018	0.017
Septicemia (%)	0.001	0.001
Pneumonia (%)	0.055	0.056
Mechanical Complications due to a Device, Implant, or Graft	0.007	0.007
Shock or Arrest in the Hospital (%)	0.003	0.003
Post-operative Myocardial Infarction (%)	0.008	0.009
Post-operative Cardiac Abnormalities other than AMI (%)	0.002	0.002
Venous Thrombosis and Pulmonary Embolism (%)	0.004	0.004
Procedure-related Perforation or Laceration (%)	0.004	0.004
Acute Renal Failure (%)	0.004	0.004
Delirium (%)	0.014	0.013
Dementia (%)	0.097	0.095
Miscellaneous Complications (%)	0.001	0.002
Hip Replacement (%)	0.000	0.001
Acute Hospital Characteristics, 1996		
Non-Profit Ownership (%)	0.668	0.679
For-Profit Ownership (%)	0.120	0.077
Government Ownership (%)	0.212	0.245
Acute Wage Index	0.918	0.878
Daily Census	146.529	117.231

Number of Beds	242.831	200.683
Acute Case Mix Index	1.382	1.312
Resident to Avg. Daily Census Ratio	0.060	0.040
DSH Patient Percentage	0.232	0.237
Medicare Days for Prev. Year (%)	0.549	0.555
Other Descriptive Statistics, 1996		
Home Health Claims Per HSA	286.91	93.34
Stroke Claims Per HSA	664.77	231.06
Number of Home Health Medicare Providers Per HSA	39.71	13.11
Total Home Health Claims	86,074	28,003
Total Stroke Claims	199,432	69,317
Number of HSAs	300	300

Notes: Summary statistics are computed at the HSA-level. The sample is split into low concentration HSAs with below median HHI and high concentration HSAs with above median HHI; sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Table 2 – Effects of IPS on Home Health Outcomes, 1996-2000

Dependent variable:	HH Days				HH Provider Costs				Any Home Health			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
HHI Quantile1*Post	-2.437***	-2.433***	-2.443***	-2.515***	-219.663***	-219.507***	-220.140***	-220.370***	-0.003	-0.003	-0.003	-0.003
	(0.480)	(0.480)	(0.481)	(0.482)	(27.397)	(27.381)	(27.408)	(27.726)	(0.004)	(0.004)	(0.004)	(0.004)
HHI Quantile2*Post	-0.973**	-0.973**	-0.974**	-0.994**	-91.347***	-91.350***	-91.384***	-83.668***	-0.001	-0.001	-0.001	-0.003
	(0.392)	(0.391)	(0.391)	(0.401)	(24.434)	(24.380)	(24.385)	(23.613)	(0.005)	(0.005)	(0.005)	(0.004)
HHI Quantile3*Post	0.099	0.109	0.104	0.098	-1.083	-0.691	-0.985	-1.792	0.003	0.003	0.003	0.003
	(0.401)	(0.400)	(0.400)	(0.407)	(23.460)	(23.415)	(23.417)	(23.913)	(0.005)	(0.005)	(0.005)	(0.005)
Post	-5.435***	-2.041***			-245.507***	-104.583***			-0.066***	-0.045***		
	(0.283)	(0.297)			(17.163)	(19.141)			(0.003)	(0.004)		
Linear trend t	N	Y	N	N	N	Y	N	N	N	Y	N	N
Quarter-year FE	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
HSA FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	N	N	Y	N	N	N	Y	N	N	N	Y
F-test	11.65	11.70	11.72	12.06	28.30	28.36	28.38	27.19	0.49	0.50	0.50	0.71
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.688]	[0.683]	[0.683]	[0.548]
Observations	1,178,430	1,178,430	1,178,430	1,160,516	1,178,430	1,178,430	1,178,430	1,160,516	1,178,430	1,178,430	1,178,430	1,160,516

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors at the HSA-level; the F-test tests the joint significance of HHI Quantile1*Post, HHI Quantile2*Post, HHI Quantile3*Post (p-value in brackets); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Table 3 – Effects of IPS on Home Health Outcomes with Leads and Lags

Dependent variable:	HH Days		HH Provider Costs		Any Home Health	
	(1)	(2)	(3)	(4)	(5)	(6)
HHI*Post	10.041***		917.614***		0.012	
	(2.022)		(114.363)		(0.016)	
Post	-8.146***		-493.953***		-0.068***	
	(0.430)		(23.502)		(0.003)	
HHI*1996Q1		2.246		85.533		0.022
		(1.929)		(135.041)		(0.026)
HHI*1996Q2		3.379*		153.308		0.026
		(1.965)		(138.980)		(0.025)
HHI*1996Q3		-0.673		-138.96		0.022
		(1.825)		(130.714)		(0.025)
HHI*1996Q4		0.592		-7.478		0.008
		(2.021)		(151.562)		(0.028)
HHI*1997Q1		1.419		33.769		0.044*
		(1.913)		(134.776)		(0.026)
HHI*1997Q2		0.137		-74.998		0.024
		(1.644)		(121.232)		(0.028)
HHI*1997Q4		5.481***		358.717***		0.044*
		(1.698)		(122.410)		(0.027)
HHI*1998Q1		9.977***		726.035***		0.044*
		(1.989)		(138.670)		(0.026)
HHI*1998Q2		10.914***		863.341***		0.032
		(2.378)		(145.158)		(0.027)
HHI*1998Q3		11.247***		944.842***		0.031
		(2.568)		(160.389)		(0.030)
HHI*1998Q4		10.226***		888.843***		0.022
		(2.493)		(161.001)		(0.028)
HHI*1999Q1		13.664***		1,115.242***		0.042
		(2.761)		(172.913)		(0.030)
HHI*1999Q2		11.326***		923.120***		0.004
		(2.683)		(173.238)		(0.031)
HHI*1999Q3		11.425***		950.154***		0.007
		(2.682)		(167.860)		(0.031)
HHI*1999Q4		13.342***		1,135.461***		0.055*
		(2.601)		(161.717)		(0.029)
HHI*2000Q1		11.898***		976.913***		0.014
		(2.849)		(180.282)		(0.034)
HHI*2000Q2		12.562***		1,126.491***		0.075**
		(2.591)		(166.155)		(0.032)
HHI*2000Q3		14.409***		1,191.468***		0.015
		(2.770)		(168.927)		(0.032)

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors at the HSA-level; regressions include quarter-year FE, HSA FE, and full set of control variables; sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland; N=1,160,516.

Table 4 –Effects of IPS on Home Health Outcomes for Urban vs. Non-Urban HSAs

	Urban HSAs			Non-Urban HSAs		
Dependent variable:	HH Days	HH Provider Costs	Any Home Health	HH Days	HH Provider Costs	Any Home Health
	(1)	(2)	(3)	(4)	(5)	(6)
HHI Quantile1*Post	-2.794***	-241.389***	-0.003	-2.555***	-149.588***	-0.008
	(0.611)	(34.370)	(0.005)	(0.843)	(51.062)	(0.008)
HHI Quantile2*Post	-1.761***	-123.490***	-0.007	-0.245	-2.258	0.007
	(0.548)	(29.755)	(0.005)	(0.800)	(50.513)	(0.009)
HHI Quantile3*Post	-0.176	-33.451	0	-0.024	6.73	0.004
	(0.442)	(26.924)	(0.006)	(0.735)	(45.386)	(0.009)
Quarter-year FE	Y	Y	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
F-test	9.65	19.11	0.84	4.61	5.66	2.06
	[0.000]	[0.000]	[0.476]	[0.004]	[0.001]	[0.105]
Observations	927,419	927,419	927,419	181,274	181,274	181,274

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors at the HSA-level; Urban/Non-Urban definitions come from SEER-Medicare matched to NCHS HSAs; the F-test tests the joint significance of HHI Quantile1*Post, HHI Quantile2*Post, HHI Quantile3*Post (p-value in brackets); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Table 5 –Effects of IPS on Home Health Outcomes Controlling for Payment Change, 1996-2000

Dependent variable:	HH Days			HH Provider Costs			Any Home Health		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
HHI Quantile1*Post	-2.515***	-0.998**	-0.943**	-220.370***	-133.349***	-130.237***	-0.003	0.001	0.003
	(0.482)	(0.427)	(0.449)	(27.726)	(24.992)	(26.740)	(0.004)	(0.004)	(0.005)
HHI Quantile2*Post	-0.994**	-0.313	-0.257	-83.668***	-44.614**	-42.496*	-0.003	-0.001	0.001
	(0.401)	(0.337)	(0.382)	(23.613)	(19.721)	(22.260)	(0.004)	(0.004)	(0.005)
HHI Quantile3*Post	0.098	0.297	0.319	-1.792	9.594	12.919	0.003	0.004	0.005
	(0.407)	(0.290)	(0.346)	(23.913)	(19.100)	(23.700)	(0.005)	(0.005)	(0.005)
HHI Quantile1*Post*Bite			-0.068			-5.618			0.000
			(0.062)			(3.461)			(0.001)
HHI Quantile2*Post*Bite			0.045			2.65			0.001*
			(0.042)			(2.042)			(0.001)
HHI Quantile3*Post*Bite			0.008			1.123			0.000
			(0.036)			(2.385)			0.000
Post*Bite	N	Y	Y	N	Y	Y	N	Y	Y
Quarter-Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
F-test	12.06	3.49	2.86	27.19	13.63	12.33	0.71	0.36	0.43
	[0.000]	[0.016]	[0.036]	[0.000]	[0.000]	[0.000]	[0.548]	[0.780]	[0.731]
Observations	1,160,516	1,160,516	1,160,516	1,160,516	1,160,516	1,160,516	1,160,516	1,160,516	1,160,516

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors at the HSA-level; "Bite" is defined as the average days per person in the HSA minus the average days per person in the Census Division; the F-test tests the joint significance of HHI Quantile1*Post, HHI Quantile2*Post, HHI Quantile3*Post (p-value in brackets); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Table 6 –Effects of IPS on Number of Home Health Providers

Panel A: Level Effects

Dependent variable:	Number of HH Providers						
Specification:	Full Sample				Urban	Non-Urban	Controlling for Bite
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HHI Quantile1*Post	-5.969***	-5.968***	-5.968***	-5.537***	-8.476***	-1.666***	-4.938***
	(0.509)	(0.509)	(0.509)	(0.452)	(0.822)	(0.173)	(0.456)
HHI Quantile2*Post	-1.464***	-1.464***	-1.464***	-1.200***	-2.455***	-0.661***	-0.910***
	(0.142)	(0.142)	(0.142)	(0.148)	(0.269)	(0.111)	(0.147)
HHI Quantile3*Post	-0.527***	-0.526***	-0.526***	-0.430***	-0.797***	-0.278***	-0.235*
	(0.105)	(0.105)	(0.105)	(0.117)	(0.227)	(0.107)	(0.120)
Post	-0.655***	1.626***					
	(0.066)	(0.190)					
Linear trend t	N	Y	N	N	N	N	N
Year FE	N	N	Y	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y	Y	Y	Y
Controls	N	N	N	Y	Y	Y	Y
F-test	77.44	77.40	77.29	78.47	58.85	35.71	54.21
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	11,396	11,396	11,396	11,391	5,394	5,795	11,391

Panel B: Log Effects

Dependent variable:	Log (Number of Providers)			
	Full Sample	Urban	Non-Urban	Controlling for Bite
	(1)	(2)	(3)	(4)
HHI Quantile1*Post	-0.137***	-0.177***	-0.147***	-0.108***
	(0.018)	(0.023)	(0.031)	(0.020)
HHI Quantile2*Post	-0.066***	-0.100***	-0.084***	-0.049**
	(0.018)	(0.019)	(0.031)	(0.020)
HHI Quantile3*Post	-0.032*	-0.028	-0.051	-0.005
	(0.019)	(0.020)	(0.033)	(0.022)
Year FE	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
F-test	21.57	24.56	8.08	11.90
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	11,391	5,394	5,795	11,391

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors at the HSA-level; the regressions for number of HH providers are at the HSA-level; the F-test tests the joint significance of HHI Quantile1*Post, HHI Quantile2*Post, HHI Quantile3*Post (p-value in brackets); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Table 7 – Characteristics of Exiting vs. Stayer Home Health Providers, 1996

	Low Concentration HSAs		High Concentration HSAs	
	Stayer Firms	Exiting Firms	Stayer Firms	Exiting Firms
Characteristics, 1996	(1)	(2)	(3)	(4)
Home Health Days	41.361	49.292	37.959	39.609
Home Health Medicare Payments	2,881.274	3,374.920	2,385.136	2,485.309
Home Health Provider Costs	3,090.284	3,527.404	2,629.066	2,698.481
90-Day Mortality (%)	0.053	0.050	0.057	0.060
90-Day Rehospitalization (%)	0.302	0.303	0.302	0.297
Age	78.689	78.769	78.541	79.079
Male (%)	0.393	0.376	0.396	0.384
White (%)	0.821	0.803	0.854	0.881
Medicaid (%)	0.171	0.208	0.197	0.169
Urban (%)	0.827	0.803	0.502	0.464
Rural (%)	0.055	0.068	0.239	0.308
Adjacent to Metro Area (%)	0.118	0.129	0.258	0.228
Non-Profit Acute Discharging Hospital (%)	0.768	0.664	0.704	0.722
For-Profit Acute Discharging Hospital (%)	0.099	0.193	0.078	0.102
Government Acute Discharging Hospital (%)	0.133	0.143	0.218	0.176
Number of Home Health Firms	2,984	2,879	1,589	850

Notes: Means are computed at the individual-level for patients who received any home health care. The sample is split into low concentration HSAs with below median HHI and high concentration HSAs with above median HHI; sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Table 8 – Effects of IPS on Home Health Outcomes for Exiting vs. Stayer Providers

Panel A: Level Effects

Dependent variable:	Home Health Days				Home Health Provider Costs			
	Full Sample	Excl. Exiting Firms	Full Sample	Excl. Exiting Firms	Full Sample	Excl. Exiting Firms	Full Sample	Excl. Exiting Firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HHI Quantile1*Post	-3.994***	-2.392***	-1.849***	-0.597	-389.543***	-293.446***	-268.759***	-196.841***
	(0.742)	(0.684)	(0.659)	(0.579)	(46.074)	(47.330)	(42.094)	(43.992)
HHI Quantile2*Post	-2.080***	-1.821**	-1.022*	-0.856	-180.562***	-163.229***	-120.954***	-111.283**
	(0.665)	(0.705)	(0.544)	(0.566)	(47.008)	(50.943)	(39.058)	(43.218)
HHI Quantile3*Post	-0.364	-0.321	-0.026	0.022	-32.457	-20.736	-13.417	-2.245
	(0.650)	(0.709)	(0.484)	(0.542)	(44.460)	(50.013)	(39.403)	(44.516)
Post*Bite	N	N	Y	Y	N	N	Y	Y
Quarter-year FE	Y	Y	Y	Y	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y
F-test	12.36	5.77	3.82	1.24	29.95	17.95	18.00	10.53
	[0.000]	[0.001]	[0.010]	[0.293]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	421,490	347,642	421,490	347,642	421,490	347,642	421,490	347,642

Panel B: Log Effects

Dependent variable:	Log (Home Health Days)				Log (Home Health Provider Costs)			
	Full Sample	Excl. Exiting Firms	Full Sample	Excl. Exiting Firms	Full Sample	Excl. Exiting Firms	Full Sample	Excl. Exiting Firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HHI Quantile1*Post	-0.057***	-0.036**	-0.024	-0.008	-0.112***	-0.093***	-0.076***	-0.063***
	(0.016)	(0.017)	(0.015)	(0.016)	(0.016)	(0.018)	(0.015)	(0.017)
HHI Quantile2*Post	-0.029*	-0.029*	-0.013	-0.014	-0.054***	-0.055***	-0.036**	-0.039**
	(0.017)	(0.017)	(0.015)	(0.016)	(0.017)	(0.019)	(0.015)	(0.017)
HHI Quantile3*Post	0.01	0.012	0.016	0.017	-0.004	-0.002	0.002	0.004
	(0.018)	(0.020)	(0.016)	(0.018)	(0.018)	(0.021)	(0.017)	(0.019)
Post*Bite	N	N	Y	Y	N	N	Y	Y
Quarter-year FE	Y	Y	Y	Y	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y
F-test	8.23	3.71	2.98	1.45	24.91	13.68	13.85	7.44
	[0.000]	[0.012]	[0.031]	[0.226]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	421,449	347,601	421,449	347,601	421,490	347,642	421,490	347,642

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors at the HSA-level; Sample includes individuals who received any home health care; Odd columns include patients using home health providers that were in the sample from 1996 through 2000:Q3 and providers that were in the sample in 1996 but exited after IPS; Even columns exclude providers that were in the sample in 1996 but exited after IPS. "Bite" is defined as the average days per person in the HSA minus the average days per person in the Census Division; the F-test tests the joint significance of HHI Quantile1*Post, HHI Quantile2*Post, HHI Quantile3*Post (p-value in brackets); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland.

Appendix

Appendix: Altruism Model

Although there is evidence that many not-for-profit health care organizations behave as profit maximizing firms, we include a model that takes into account the altruistic behavior that may be displayed by not-for-profit home health agencies. To account for this, we include the value the firm gets from providing services to patients as a fraction of the value the consumers get, $\theta * B(q_i, q_{-i})$, where B is the total benefit patients receive from home care (the consumer surplus) and θ is a number between zero and one. To calculate the patient benefit, we integrate over the utility of patients for receiving care:

$$B_i(q_i, q_{-i}) = 2\lambda \int_0^{\frac{1}{2t}(q_i - q_j + \frac{t}{n})} (V + q_i - tx)dx + 2(1-\lambda)\int_0^{\frac{v+q_i}{t}} (v + q_i - tx)dx \quad (6)$$

Differentiating with respect to quality gives:

$$\frac{\partial B_i}{\partial q_i} = X_i(q_i, q_{-i}) + \frac{\lambda}{t}\left(V + \frac{q_i + q_j}{2} - \frac{t}{2n}\right) > 0 \quad (7)$$

There are two components that make up the change in patient benefit from a change in quality, the first part, $X_i(q_i, q_{-i})$, is the utility gained from all the existing patients experiencing increased quality, this is the inframarginal effect. The second part is a marginal effect from the new patients an increase in quality draws in. This marginal effect is dependent only upon H type customer utility, this is because the "switchers" have a strictly positive net increase in utility from treatment while the marginal L type consumers have a utility increase of zero at the margin.

We add in the altruistic value of patient benefit that the home health firm receives, (6), into the firm's utility function:

$$\pi_{\mathrm{i}} = \left(\alpha + \beta * c(q_i)\right)X_i(q_i, q_{-i}) + \theta B(q_i, q_{-i}) - c(q_i)X_i(q_i, q_{-i})$$

With the first order condition for intensity allocation being:

$$\frac{\partial \pi}{\partial q_i} = \alpha \frac{\partial X_i}{\partial q_i} + \beta\left(\frac{\partial c}{\partial q_i} X_i + c(q_i)\frac{\partial X_i}{\partial q_i}\right) + \theta \frac{\partial B}{\partial q_i} - \left(\frac{\partial c}{\partial q_i} X_i + c(q_i)\frac{\partial X_i}{\partial q_i}\right) = 0 \qquad (8)$$

We substitute equations (3) and (7) into (8) and set $q_i = q_j$ to solve for optimum intensity q*. The total differentiation of equation (8) that is used to estimate how intensity changes with the number of firms in the market and with changes to marginal and average reimbursement becomes:

$$dq\colon -\left(\left((1-\beta)\frac{\partial c}{\partial q_i} - \theta\right)\frac{2(1-\lambda)}{t} - \theta\frac{\lambda}{t} + (1-\beta)\frac{\partial c}{\partial q_i}\left(\frac{2-\lambda}{t}\right) + (1-\beta)X_i\frac{\partial^2 c}{\partial q_i^2}\right)$$

$$dn\colon \left((1-\beta)\frac{\partial c}{\partial q_i} - \frac{\theta}{2}\right)\frac{\lambda}{n^2}$$

$$d\alpha\colon \frac{2-\lambda}{t}$$

$$d\beta\colon c(q_i)\left(\frac{2-\lambda}{t}\right) + \left(\frac{2(1-\lambda)v + 2(1-\lambda)q_i}{t} + \frac{\lambda}{n}\right)\frac{\partial c}{\partial q_i}$$

$$d\theta\colon \frac{2(1-\lambda)v + 2(1-\lambda)q_i}{t} + \frac{\lambda}{n} + \frac{\lambda}{t}\left(V + q_i - \frac{t}{2n}\right)$$

We find that intensity of care increases with the number of firms only for certain θ:

$$\frac{dq_i}{dn} = \frac{\left((1-\beta)\frac{\partial c}{\partial q_i} - \frac{\theta}{2}\right)\frac{\lambda}{n^2}}{\left((1-\beta)\frac{\partial c}{\partial q_i} - \theta\right)\frac{2(1-\lambda)}{t} - \theta\frac{\lambda}{t} + (1-\beta)\frac{\partial c}{\partial q_i}\left(\frac{2-\lambda}{t}\right) + (1-\beta)X_i\frac{\partial^2 c}{\partial q_i^2}}$$

If a firm is above a certain threshold altruism level the sign is negative. Otherwise for modest levels of altruism we find the same result as for a profit maximizing firm. The threshold level of altruism is:

$$\bar{\theta} = 2(1-\beta)\frac{\partial c}{\partial q_i}$$

For a profit maximizing firm, we found that intensity of care increased as the number of firms in the market increased due to increased competition. Although this result applies to altruistic firms up to the altruistic threshold, very altruistic firms are predicted to actually decrease quality as the number of firms increases. In the profit maximizing case, we obtained the a positive relationship due to the fact that when the number of firms increased, the demand for each firm decreases, this lower demand increases marginal profits which makes it more profitable to increase intensity of care in order to attract more patients. Altruistic firms a have a second effect coming into play. Because they value the patient benefit, lower demand from an increase in firms also lowers the marginal patient benefit for high intensity of care giving the hospital less incentive to increase intensity of care. At high enough levels of altruism, this lowered patient benefit effect overshadows the increased marginal profit effect and firms actually decrease quality.

Our estimates of how intensity of care changes with the marginal and average reimbursement remain unchanged in sign, as payments increase (decrease) intensity of care increases (decreases).

Introducing the parameter, θ, lets us analyze the effect of changes in the level of altruism have on intensity:

$$\frac{dq_i}{d\theta} = \frac{X_i + \frac{\lambda}{t}\left(V + q_i - \frac{t}{2n}\right)}{\left((1-\beta)\frac{\partial c}{\partial q_i} - \theta\right)\frac{2(1-\lambda)}{t} - \theta\frac{\lambda}{t} + (1-\beta)\frac{\partial c}{\partial q_i}\frac{2-\lambda}{t} + (1-\beta)X_i\frac{\partial^2 c}{\partial q_i^2}} > 0$$

Although quality responsiveness to market competition is lowered by altruism, overall altruism leads to higher quality due to the value firms place on patient wellbeing. Altruistic firms are willing to forgo profits in order to provide higher quality and provide higher levels of equilibrium quality than do profit maximizing firms with the same level of reimbursement. Including altruism in our analysis leads to the same results as profit maximizing firms except for at high levels of altruism. Because there is evidence that not-for-profit hospitals behave similarly to for-profit hospitals, we use the simpler profit maximizing model.

Appendix Table 1 -- Effects of IPS on Home Health Outcomes, 1996-2000: Alternative Outcome Measures

Panel A: Log Effects of IPS on Days and Provider Costs

Dependent variable:	HH Days (Cond'l on Use)	Log (HH Days)	HH Provider Costs (Cond'l on Use)	Log (HH Provider Costs)
	(1)	(2)	(3)	(4)
HHI Quantile1*Post	-4.252***	-0.056***	-414.831***	-0.116***
	(0.782)	(0.017)	(47.197)	(0.016)
HHI Quantile2*Post	-1.999***	-0.027	-176.262***	-0.053***
	(0.664)	(0.017)	(46.621)	(0.017)
HHI Quantile3*Post	-0.287	0.013	-33.685	-0.003
	(0.648)	(0.018)	(43.880)	(0.018)
Linear trend t	N	N	N	N
Quarter-year FE	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
F-test	12.63	8.53	31.78	27.77
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	443,211	443,211	443,255	443,255

Panel B: Log Effects of IPS on Days and Provider Costs by Urban vs. Non-Urban

Urban HSAs

Dependent variable:	HH Days (Cond'l on Use)	Log (HH Days)	HH Provider Costs (Cond'l on Use)	Log (HH Provider Costs)
	(1)	(2)	(3)	(4)
HHI Quantile1*Post	-4.373***	-0.061***	-439.621***	-0.125***
	(0.998)	(0.020)	(56.264)	(0.018)
HHI Quantile2*Post	-2.424***	-0.033	-192.787***	-0.056***
	(0.892)	(0.021)	(51.437)	(0.019)
HHI Quantile3*Post	-0.451	-0.007	-90.485	-0.032
	(0.728)	(0.020)	(55.379)	(0.020)
Quarter-year FE	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
F-test	8.23	4.86	21.23	19.51
	[0.000]	[0.003]	[0.000]	[0.000]
Observations	360,663	360,663	360,700	360,700

<u>Non-Urban HSAs</u>

Dependent variable:	HH Days (Cond'l on Use)	Log (HH Days)	HH Provider Costs (Cond'l on Use)	Log (HH Provider Costs)
	(1)	(2)	(3)	(4)
HHI Quantile1*Post	-5.366***	-0.092***	-308.126***	-0.109***
	(1.370)	(0.032)	(91.864)	(0.036)
HHI Quantile2*Post	-1.905	-0.028	-65.56	-0.028
	(1.340)	(0.032)	(92.057)	(0.036)
HHI Quantile3*Post	-1.618	-0.041	-52.88	-0.03
	(1.190)	(0.031)	(81.489)	(0.035)
Quarter-year FE	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
F-test	5.29	3.12	4.89	4.40
	[0.001]	[0.026]	[0.003]	[0.005]
Observations	66,364	66,364	66,370	66,370

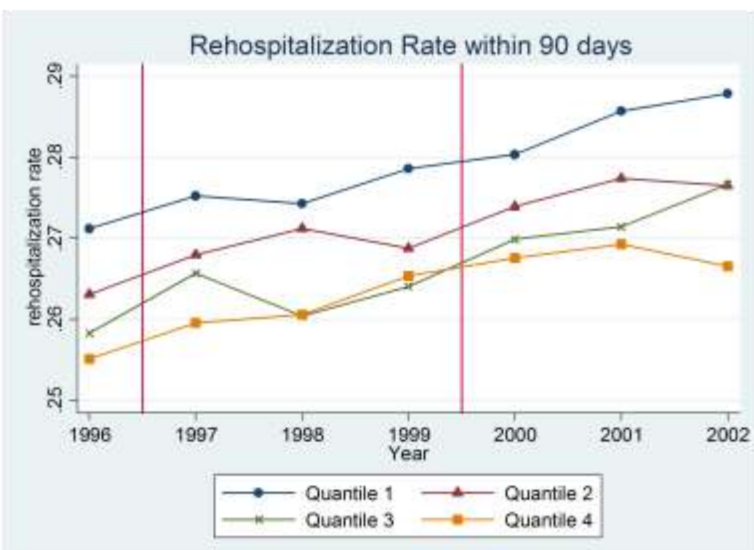
Panel C: Log Effects of IPS on Days and Provider Costs Controlling for "Bite"

Dependent variable:	HH Days (Cond'l on Use)			Log (HH Days)			HH Provider Costs (Cond'l on Use)			Log (Provider Costs)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
HHI Quantile1*Post	-4.252***	-1.967***	-1.909***	-0.056***	-0.021	-0.014	-414.831***	-284.585***	-285.116***	-0.116***	-0.078***	-0.074***
	(0.782)	(0.699)	(0.727)	(0.017)	(0.015)	(0.016)	(47.197)	(44.007)	(46.156)	(0.016)	(0.015)	(0.015)
HHI Quantile2*Post	-1.999***	-0.899*	-0.905	-0.027	-0.01	-0.003	-176.262***	-113.560***	-120.894***	-0.053***	-0.035**	-0.031**
	(0.664)	(0.540)	(0.576)	(0.017)	(0.015)	(0.016)	(46.621)	(38.860)	(42.851)	(0.017)	(0.015)	(0.016)
HHI Quantile3*Post	-0.287	0.063	0.004	0.013	0.019	0.023	-33.685	-13.715	-18.794	-0.003	0.003	0.005
	(0.648)	(0.472)	(0.555)	(0.018)	(0.016)	(0.017)	(43.880)	(39.067)	(45.025)	(0.018)	(0.016)	(0.017)
HHI Quantile1*Post*Bite						0.001						0.000
						(0.002)						(0.002)
HHI Quantile2*Post*Bite						0.003*						0.002
						(0.002)						(0.002)
HHI Quantile3*Post*Bite						0.001						0.001
						(0.002)						(0.002)
Post*Bite	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y
Quarter-Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
HSA FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
F-test	12.63	3.79	3.22	8.53	3.02	2.44	31.78	17.92	16.93	27.77	15.26	13.99
	[0.000]	[0.010]	[0.023]	[0.000]	[0.029]	[0.064]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	443,211	443,211	443,211	443,211	443,211	443,211	443,255	443,255	443,255	443,255	443,255	443,255

Appendix Figure 1 -- Effects of IPS on Health Outcomes, 1996-2000

Panel A: Mortality Rate

Panel B: Readmissions Rate



Notes: Quantile 1 are HSAs with low HHI (low concentration), Quantile 4 are HSAs with high HHI (high concentration); sample excludes HSAs with fewer than 28 HH claims (bottom 25% of HSAs); sample excludes beneficiaries<65 and residents of Maryland. Data is aggregated to annual level.

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