The Effect of Entry Regulation: the Case of Home Health

Daniel Polsky*
Guy David
Jianing Yang
Bruce Kinosian
Rachel Werner

May 25, 2011

ABSTRACT

The effect of competition, mediated by extensive entry regulation, on quality of care for patients is not well understood. We analyze the universe of hospital discharges during 2006 for publically insured beneficiaries (about 4.5 million) and a subset of 522,232 transitions from hospitals to home health agencies to determine whether there is a significant difference in home health utilization, hospital readmission rates, and health care expenditures in states with and without entry regulation. We identify these effects by looking across regulated and non-regulated states within Hospital Referral Regions, which characterize well-defined health care markets and frequently cross state boundaries. We find entry regulation in home health to result in lower resource intensity, yet similar rates of hospital readmission for patients admitted to home health. Nevertheless, entry restrictions substantially lowered the use of home health and increased overall hospital readmissions with little or no effect on overall health care expenditures.

Keywords: competition, certificate of need, quality of care, home health care
JEL Classification Codes: I1, K2, L1

Acknowledgements: We are grateful to Dennis Carlton, Richard Chesney, Liran Einav, and Mark Pauly for their valuable feedback, to Victoria Perez for her research assistance, and to Pedro L. Gozalo for the use of the HRR method to analyze state health policies. This work is supported by NIH/NHLBI grant # R01 HL088586-01.

* Corresponding Author: Daniel Polsky, Ph.D. University of Pennsylvania, Division of General Internal Medicine, Blockley Hall, Rm. 1204, 423 Guardian Drive, Philadelphia, PA 19104, w 215-573-5752, fax 215-898-0611 polsky@mail.med.upenn.edu.

Guy David, Ph.D. University of Pennsylvania, the Wharton School, 202 Colonial Penn Center, 3641 Locust Walk, Philadelphia, PA, 19104 (215) 573-5780 - Office, Philadelphia, PA 19104, gdavid2@wharton.upenn.edu.

Jianing Yang, University of Pennsylvania, Division of General Internal Medicine, Blockley Hall, Rm. 1204, 423 Guardian Drive, Philadelphia, PA 19104, w 215-898-6700 fax 215-898-0611 jianing@mail.med.upenn.edu.

Bruce Kinosian, MD. University of Pennsylvania, Division of General Internal Medicine, Ralston House, 3515 Chestnut St. 215-573-9623. brucek@mail.med.upenn.edu

Rachel Werner, MD. PhD. University of Pennsylvania, Division of General Internal Medicine, Blockley Hall, Rm. 1230, 423 Guardian Drive, Philadelphia, PA 19104, w 215-898-9278 rwerner@mail.med.upenn.edu.

1. INTRODUCTION

The effect of competition on quality in health care markets is not well understood. While the evidence generally points to a positive relationship between competition and quality, especially under regulated prices, the quality of care implications of policies aiming to slow the growth of health care costs by limiting firm entry and thus competition are unclear. One such policy tool is Certificate of Need (CON) laws designed to provide states with control over entry, expansions, and substantial capital investments by health care facilities.

CON laws exist for various types of health care providers including hospitals, nursing homes, rehabilitation centers and home health agencies. CON for hospitals and to a lesser extent for nursing homes and rehabilitation centers give state governments the authority to restrict major capital investment such as the construction of new facilities, expansions to existing ones, and the purchasing of expensive technology (MHCC, 2001). Hence, CON imposes restrictions on both incumbent hospitals and potential entrants. This is not the case in home health, a labor intensive industry with no major capital investment, where CON operates exclusively as a mechanism to restrict entry of new home health agencies. With fewer agencies in CON markets, state regulators may be more effective at having a positive influence on standardizing the care delivered by the home health agencies in their state. However, restricted entry leads to markets with fewer providers and, thus, reduced market competition among agencies. In a market with regulated prices, such as in home health, reduced competition may have a negative effect on the quality of home health care delivered.

On the other hand, CON for home health may also influence the rate of hospital discharges to home health. With evidence that effective use of home health care services can lower the rate of hospital readmissions (Sochalski, et al. 2009, Naylor, et al. 2004, Kane, et al. 2000, Penrod, et al. 1998, Penrod, Kane and Kane 2000, Hadley, et al. 2000), understanding the role of CON for home health can have broad health care implications. In particular, if there are fewer hospital discharges to home health in CON states and admissions to home health contribute to lower rates of rehospitalization, CON for home health may reduce rehospitalization rates and expenditures for all post-hospitalization care.

There are two main objectives of this paper. First, we will evaluate whether there are significant differences in the delivery of home health care between states with and without entry regulation in terms of the resource intensity of home health services and the quality of home health care among patients discharged to home health. Second, we will describe the broader implications of such regulations in terms of the rate of hospital discharge to home health care, overall hospital readmissions, and total health care expenditures.

2. BACKGROUND

Hospital expansion in the 1970s, associated with excess bed capacity (Joskow 1980) and reduced social welfare (Robinson and Luft 1985), led to the 1974 Federal Health Planning and Resources Development Act, which mandated states to develop CON to control utilization and third-party expense by controlling or reducing supply. When states universally adopted CON for hospitals in the 1970s, 38 states also applied CON regulation to the home health care sector. When the federal mandate was repealed in 1987, only 18 states continued active CON regulations for home health care (AHPA 2005, MHCC 2001).

The idea behind CON regulation was that it would prevent unnecessary duplication of services and ensure appropriate care by concentrating the location of sophisticated medical services to high-volume regional facilities with sufficient expertise and resources (Smith-Mello 2004). Proponents of CON laws view restrictions on acquisitions and expansions of hospitals as a way to achieve this goal (Ho 2004). Nevertheless, evidence on the effectiveness of CON in lowering hospital costs of care, procedure volume and mortality is mixed (Salkever 2000, Popescu, Vaughan-Sarrazin and Rosenthal 2006, Ho 2006, Ho, Ku-goto and Jollis 2009).

In home health markets, with little to no capital investment (CMS 2003) and labor as the dominating input, the potential for cost savings from major capital expansions by incumbent agencies is nonexistent. Furthermore, there is no evidence of a volume-outcome relationship which would be needed for a home health CON to enhance quality

(Kass 1987). In home health, service delivery is decentralized and provided by individuals as opposed to teams; therefore individual-nurse volume is more relevant for outcomes than agency volume. However, since nurses tend to work at full capacity even in small-scale agencies, there is little rationale for concentrating volume at a small number of agencies through entry restrictions. An alternative rationale for CON programs in home health is that they can enforce appropriate standards of care through enhanced ability to monitor agencies. However, to date there is no evidence to suggest CON in home health care is quality enhancing.

While the effect of CON on quality of home health care is not clear, the ability for CON regulations to effectively limit entry of new agencies into the market is evident. Most states with CON regulations follow specific policies and guidelines for the approval of additional home health agencies in a given market, but in practice new agencies are rarely approved. Therefore, markets in CON-regulated states are not contested, as incumbent agencies are not threatened by potential entrants.[1] Figure 1 characterizes the market for home health by CON status in 2006. CON states have almost half the number of agencies for their Medicare population (14.6 vs. 28.2 per 100,000 Medicare beneficiaries) and are therefore more concentrated as measured by an agency-specific Herfindahl-Hirschman Index (HHI) (3,964 vs. 2,745).[2]

[1] These states include: Alabama, Alaska, Arkansas, Georgia, Hawaii, Kentucky, Maryland, Mississippi, Montana, New Jersey, New York, North Carolina, South Carolina, Tennessee, Vermont, Washington, West Virginia, and District of Columbia.

[2] The Agency-HHI measures the degree of concentration for each agency in our sample. Competitive markets are defined separately for each agency based on a weighted average of the agency's market concentration in the zip-codes of the clients they serve (zip-code level HHIs are calculated by squaring the market share of each firm competing in the zip-code and then summing the resulting numbers).

The price of a home health episode is fixed by Medicare through a Prospective Payment System (PPS) for home health services.[3] Under PPS, a single payment is given for a 60-day episode of care, with payment for additional 60-day episodes if the patient is recertified for continuing home health care. The reimbursement amount is a per-episode fixed rate set at admission according to the severity of the patient's condition. To determine severity, each Medicare episode is classified into one of 80 mutually exclusive severity groups, called Home Health Resource Groups (HHRGs), which determine the payment rate. Each episode payment is adjusted for differences in labor costs across geographic areas.[4] Since prices are regulated, providers can no longer compete for patients based on price of services and instead must compete for patients on other dimensions of their services such as resource intensity or quality of care. If the regulated price is set above marginal cost for some baseline level of quality, then firms will continue to improve service delivery to try to attract more of the available pool of patients until marginal cost of delivering care equals the regulated price. Thus, economic theory suggests that market competition in the presence of regulated prices can lead to quality improvements.[5]

[3] Medicare payments to home health are $20 billion annually and represent about 80% of payments to home health for post-acute home care. Medicare beneficiaries who are determined by a doctor to have a medical need for skilled care of limited duration in the home can qualify for coverage of home health services on a part-time or "intermittent" basis. This type of home health care comprises a set of services provided in the home, most often by registered nurses, rehabilitative therapists, social workers, or home health aides (CMS, 2002).

[4] While, in general, the amount of service provided does not affect the amount of reimbursement, certain extremely high-cost episodes receive outlier payments.

[5] There is an extensive literature in this area including the following: Beitia 2003, Brekke, Nuscheler and Straume 2006, Brekke, Nuschler and Straume 2007, Calem and Rizzo 1995, Karlsson 2007, Gravelle and Masiero 2000, Gravelle 1999, Lyon 1999, Wolinsky 1997, Ma and Burgess 1993, Allen and Gertler 1991, Held and Pauly 1983, Pope 1989.

Most empirical studies of the relationship between competition and quality under regulated prices found more competition to result in higher quality (as measured by lower mortality) (Kessler and McClellan 2000, Gowrisankaran and Town 2003, Held and Pauly 1983, Kessler and Geppert 2005, Tay 2003, Sari 2002, Shen 2003, Shortell and Hughes 1988).

While the effect of market concentration on quality has been studied extensively in the hospital sector, this relationship has received no attention in the home health care industry. The case of competition in a hospital market will not necessarily apply to home health. Unlike hospitals, where location provides a degree of market power, home health agencies deliver services at the patient's residence. Without location as a natural barrier to competition, we might expect home health markets to be a highly competitive. Similarly, unlike hospitals and other facilities that require major capital investments in order to become operational, home health care is labor intensive and is expected to be highly competitive absent of entry regulation.

However, states have imposed an artificial barrier on the number of competitors in a given market by restricting the creation of new home health agencies through CON regulation. While regulation may be more effective with fewer agencies to regulate, the limited number of evidence-based standards of care in home health on which effective service regulation can be based suggests that market competition may provide a superior (self-enforcing) mechanism for promoting quality. With CON regulation creating potentially opposing effects on quality, the net effect becomes an empirical question.

Moreover, home health care is part of a larger health care system. More resource intensive home care may increase its use by hospital discharge planners, who would otherwise be sending the patient home (without home health care). If home health agencies are effective at preventing rehospitalization for the marginal patient they serve, increased use may reduce overall rehospitalization rates and thus offset Medicare's costs of increased home health expenditures. Therefore, the effect of competition for home health care on overall health care expenditures is ambiguous.

3. EMPIRICAL FRAMEWORK

Following Gaynor (2006), we base our empirical specification on the equilibrium level of quality (in a market with regulated prices). We assume that firms either maximize profit or rely on surplus to support other objectives (Lakdawalla and Philipson 2006, David 2009)). In addition, we assume that a welfare-maximizing regulator and utility-maximizing consumers imperfectly observe the quality of home health services.

The equilibrium level of firm quality becomes

$$q^* = f(\bar{p}, c(q^*), ms(q^*), demand(q^*))$$

where $\bar{p}$ is the administratively set price per home health episode, c is the cost of a home health episode at quality level q^*, and ms is the firm's market share. The right hand side

variables are a function of q^* because the quality level chosen by an agency is likely to affect its market share, cost, and willingness-to-pay for its services. That is, higher quality firms will have higher costs, but at the same time are likely to attract more customers, which in turn would lead to commanding a higher market share. To estimate quality with independent right hand side variables, we replace the endogenous variables with their exogenous determinants and estimate a reduced form equation. We replace cost with cost shifters, demand with demand shifters, and measures of competition with CON regulation for home health agencies.

Thus the econometric specification is:

$$q^* = f(\overline{p}, CS, DS, CON, \varepsilon)$$

where *CS* and *DS* are cost and demand shifters respectively. Price is the fixed Medicare price; cost shifters include market level variables that might influence factor prices such as wages, patient-to-agency distance, availability of labor, and density of customer base; demand shifters include patient-level variables that characterize patient illness severity and service needs as well as market-level variables that capture general service demand.

Of concern here are remaining omitted variables that could be correlated with CON and independently influence our quality indicators. The two most important are unobserved patient characteristics such as illness severity and unobserved area-level characteristics such as geographic variation in service use. If competition affects the severity of the

patients admitted to the home health agency, unobserved severity (i.e., severity that is not captured by the risk adjustment) may be an issue if it independently influences the resource intensity of home health service use and health outcomes. This may occur if home health agencies that face less competitive pressure are more likely to refuse complicated cases and hence, attract low-severity cases on average. Geographic variation may be an issue if those areas that are more likely to have CON are the same areas that are more likely to otherwise utilize more health care services.

We address both of these concerns with a specification that includes market-level fixed effects (υ_m).

$$q_i^* = \alpha + \beta_{CS} CS_i + \beta_{DS} DS_i + \beta_{CON} CON_s + \upsilon_m + \varepsilon_i$$

This specification is identified by the markets (*m*) that include parts of multiple states *(s)* when those multiple states vary in their CON status. We used the Dartmouth Atlas for Health Care's Hospital Referral Region (HRR) (Wennberg et al. 2004) as the market of interest because it defines a contiguous locality within which most tertiary hospital care referrals are contained and because it is the area most linked to geographic variation. Our focus on clinical outcomes for patients discharged from and readmitted to hospitals makes HRRs a natural geographic unit for defining markets. Approximately 13% of patients in our sample reside in 32 HRRs (10%) that cross state boundaries where CON rules are different. These HRRs are well spread across the U.S. in that they are in 32 of the 48 states in the analysis and 14 of the 18 CON states. Figure 2 illustrates the source of our identification for the case of Pennsylvania, a non-CON state, in which 9 of 17

HRRs cross state boundaries. Six of these HRRs cross into CON states (New Jersey, New York, and West Virginia). Our main specification essentially reduces to a comparison of patients in states under CON regulation and patients in states under no entry regulation within hospital referral regions that cross state lines. This within-HRR variation excludes fixed unobserved factors tied to competition within HRRs and differential patterns of health care service use across HRRs.

4. METHODS

4.1. Data Sources

We constructed a data set uniquely suited for this study by linking the 100% Medicare Provider Analysis and Review (MedPAR)[6] file to the Medicare Home Health Agency SAF (HHA-SAF)[7] file for 2005 and 2006. These data contain diagnoses, procedures, dates of admission and discharge, expenditures, and basic demographic information. The HHA-SAF also includes detailed home health utilization information such as the number and type of visits (skilled nursing care, home health aides, physical therapy, speech therapy, occupational therapy, and medical social services). We augmented our data with county-level market characteristics from the Area Resource File and hospital-level characteristics from the American Hospital Association (AHA) file for 2005 and 2006.

4.2. Study Sample

[6] The MedPAR file contains claims data for Medicare fee-for-service (FFS) beneficiaries admitted to Medicare-certified inpatient hospitals and skilled nursing facilities (SNF).
[7] The HHA-SAF contains claims data for Medicare home health admissions.

We define our study population as fee-for-service Medicare beneficiaries over 65.5 enrolled in Medicare between July 2005 and December 2006.[8] We define our study sample based on index hospitalizations which includes all hospitalizations except those preceded by an acute or post-acute care stay in the 90 days prior to the hospitalization. The focus on index hospitalizations in order to focus our analysis on patterns of care following relatively new health events rather than patterns of care heavily influenced by ongoing treatment in existing episodes of care. The sample includes hospitalizations in fiscal year 2006 (October 2005 – September 2006) in acute care hospitals in the 48 contiguous states.

We construct two study samples from these index hospitalizations. Our primary sample is based on home health admissions, consisting of 522,232 index hospitalizations that are followed within 3 days of the hospital discharge date by a home health admission. Our secondary sample is based on hospital discharge and is comprised of all index hospitalizations that lead to a hospital discharge. This sample excludes in-hospital deaths and the discharges to various low volume hospital types that are not substitutes for home health: hospice, long-term acute care, and inpatient rehabilitation. The final hospital discharge sample contains 4,448,479 hospital discharges.

4.3. Variables

[8] Despite the fact that the hospitalizations and home health admissions for the 15% of Medicare beneficiaries in Medicare Advantage plans are not recorded, this is a comprehensive record of hospitalizations and home health admissions for Americans over 65 given that 95% are covered by Medicare.

The key dependent variables for the sample of home health admissions include several measures of resource intensity of home health services and rehospitalization rates as an outcome measure of quality. The resource intensity measures include the total number of visits, weighted by the skill level of the provider conducting the visit,[9] the proportion of visits by skill type (skilled nursing, home health aide, and all therapists), the length of service (number of days between the first and last visit), and the frequency of visits (weighted visits divided by length of service). We measure resource utilization within the first 60-day episode of home health care as only 10% of these index episodes of care are recertified for additional episodes beyond the first 60 days on service.

We identify readmissions rates to be our key quality related outcome measure for our sample home health admissions following a hospital discharge. Given the fact that avoiding rehospitalization is a primary goal of home health care among those who enter home health from the hospital, readmission is generally viewed as the critical outcome of home health. Moreover, mortality rates are too low in this population to be measured as a reliable outcome. Shaughnessy and colleagues (2002) found hospitalization rates after home health admission to be a valid and significant indicator of quality of home health care. We measure rehospitalizations by linking home health admission claims to all hospital discharge claims. We classified the timing of rehospitalizations into 60-day intervals following a hospital discharge (0-60 days and 60 to 120 days). For

[9] There are six different home health care visit types: skilled nursing, physical therapy, occupational therapy, speech language pathology, medical social services, and home health aide. Since these represent different intensities of care and, hence different costs of resource use, we adjusted the count of all visits for the relative value of each unit type (Welch, Wennberg and Welch 1996). The relative value is based on the federally reported relative value units (RVUs) (Hsiao et al 1988). Our results are robust to using the raw number of visits.

rehospitalization measures, subjects are censored in the rare event of death and after their first rehospitalization.

For the sample of all hospital discharges, to achieve the goal of assessing the implications of home health care, we measure the rate of home health admissions, rehospitalization rates and total Medicare expenditures. Our unique dataset allows us to determine a home health admission by tracking patients admitted to home health, as indicated by a home health claim, within 3 days of hospital discharge. Rehospitalizations are estimated as above for the home health sample. Medicare expenditures were defined as the amount that Medicare actually paid for care as recorded in claims records. We included Medicare-financed care in inpatient, skilled nursing facility (SNF), and home health. Because payments for these types of care are made for care received over an interval of days, we assign the expenditure to the 60-day interval associated with the first day of that episode of care and define expenditures for the intervals 0-60 days and 60 to 120 days. All expenditures are expressed in constant 2006 dollars. For completeness, we also measure Medicare expenditures for the home health sample.

In addition to our key explanatory variable indicating which states have CON regulations, our control variables are at the patient, hospital, county, and state level. Patient level variables (demand shifters) include age, gender, race and measures of patient clinical severity, using 104 diagnoses for the hospitalization variables and 28 patient

comorbidities variables.[10] Hospital-level variables (supply shifters) include ownership status, medical school affiliation, number of licensed hospital beds, and hospital CON regulation status. County-level variables capture both demand and supply shifters. These variables include factors that capture potential variation across counties in the availability of both acute and post-acute outlets (i.e., hospital beds per 100 persons, nursing home beds per 100 persons), HMO enrollment rate, population size, density, urban status education, income, and percentage of population over age 65.

4.4. Analysis

We conducted fixed-effect multivariable regression analysis of home health resource utilization, rehospitalization, and expenditures, as a function of CON and the covariates related to use and outcomes. The model used varied by outcome. We used ordinary least squares for home health services: number of visits, length of service, frequency of visits, and percent of visits by provider type. We used a GEE logistic model for the estimation of home health admissions following hospital discharge. We estimated a fully interacted discrete time Cox model for rehospitalizations. For Medicare expenditures, because of the cluster of zero expenditures and the heavy right tail, we estimated a two-part model where the first part was a logistic GEE and the second part was a generalized linear model with a log link and gamma family. In all regressions we adjusted standard errors for clustering at the HRR level. Model results are all expressed in terms of their marginal effects.

[10] We track the 103 most frequent DRGs and code them as categorical variables while characterizing the remaining 10% into an "other" category. In addition, we have dummy variables for 28 comorbidities using the Elixhauser method (Elixhauser et al., 1998).

To better understand the contribution of adjustments for observable and unobservable factors we estimate the marginal effect of CON without any adjustment, with adjustments for observable factors without fixed effects, and with HRR fixed effects. One potential limitation of the fixed-effect model is that, while improving the internal validity of our estimates, the identification comes from those HRRs that cross state boundaries between states with different CON status. These 33 HRRs represent approximately 13% of the full sample. Nevertheless, to assess the external validity of this subset, we show the adjusted subsample marginal effects for comparison to the adjusted effects for the whole sample.

5. RESULTS

Our primary sample consists of 522,232 hospital-to-home health transitions in 2006. 29.6% of these transitions occurred in CON states. From Table 1, we see that home health admissions in CON states only differ slightly from non-CON states in terms of patient characteristics, with patients in CON states more likely to be older, female, black, and have heart failure and diabetes. There were more meaningful differences in the hospitals and market characteristics. Hospitals in CON states were more likely to be non-profit, larger, and affiliated to a medical school. Markets were similar in terms of education and income levels, but CON states were less densely populated, had more hospital beds available, were more likely to have CON for hospitals, and were more likely to hospitalize patients in their last six months of life.

The home health practice pattern differences between CON and non-CON states are shown in Table 2, highlighting a few significant differences in home health practice patterns across these states. The number of visits is essentially the same between CON and non-CON states. (Unadjusted means are 10.59 visits vs. 10.71 for a difference of -0.125 visits, p-value=0.012). This difference remains small and statistically insignificant across adjustment strategies. The length of service is slightly longer in CON states by an unadjusted 0.673 days (p-value=0.336), but this difference shrinks and becomes statistically insignificant in the adjusted models. However, the frequency of visits is significantly less in CON states across specifications. In the final HRR fixed-effects specification there are 0.011 (p-value<0.001) fewer visits per day in CON states. There are also important differences in the skill mix where the proportion of visits by skilled nursing is 0.049 less and by home health aides is 0.028 more in CON states suggesting a lower intensity of skilled human capital in CON states.

The probability of discharge from the hospital to a home health agency is 1.5 percentage points lower in CON vs. non-CON states (last column of the first row of results in Table 2). This 12.6% decline in the rate of discharge to home health is statistically significant, large, and robust to our alternative specifications. There is little difference between the overall adjusted result and the adjusted result in the subsample. The adjusted result is about twice the size of the unadjusted result, and the fixed effect result.

The effect of entry regulation on rehospitalization rates is presented in Table 3. The top panel reports results for hospitalized patients discharged to home health and the bottom

panel reports results for all hospitalized patients. Within the home health cohort, the final fixed-effects model shows no statistically significant differences in rehospitalization rates. In the first 60 days after hospital discharge rehospitalization rates are higher by only 0.51 percentage points (or 3.0%), but then are lower by 0.34 percentage points (3.9%) in the subsequent 60 days. This suggests that home health care in non-CON states may have a small influence in delaying rehospitalizations.

The other specifications in this table offer some additional suggestive evidence. The fixed-effects specification brings the marginal effects closer to zero particularly in the first 60 days suggesting observed shortcomings of home health in CON states may be an artifact of geographic variations. Adjustments for observable factors also bring the results closer to zero. We see this in the comparison between the unadjusted specification and the adjusted specification. The key driving factors here are variables adjusting for patient severity suggesting that home health in CON states attracts a more severe patient mix.

In the sample of all hospitalized patients, rehospitalization rates are slightly higher in CON states with a marginal effect of .79 percentage points (or 4.7%) (p-value=0.057) in the first 60 days. The result is stable with and without the fixed effect adjustment, however the effect may not be generalizable to the entire sample because the adjusted subsample effect is much stronger than the adjusted effect in the full sample.

Medicare expenditures are not statistically different between CON and non-CON states in the fixed-effects specification. This is true within the sample of home health admissions and among all hospital discharges. It is notable that in the unadjusted analysis, expenditure in CON states for patients discharged to home health is nearly $500 higher than in non-CON states, but is reduced close to zero after adjusting for patient mix. Costs are lower in states with CON laws in the adjusted subsample and go up slightly with fixed effects suggesting that the $123 cost difference for 120 days post discharge estimated in the adjusted specification may be a lower bound and that costs within the home health sample may be higher in CON states. For Medicare expenditures among all hospital discharges, costs are lower in the first 30 days in CON states, but this effect is not statistically significant in the most saturated fixed-effects specification. The lower costs in the first 60 days after a hospital discharge is primarily a result of the lower use of home health care services in CON states and most of these costs are offset by higher costs beyond 60 days that can be attributed to the higher rates of rehospitalization.

6. DISCUSSION

States use a one-size-fits-all regulatory approach across different segments of the health care industry. Regulation of resource utilization, such as CON laws, while used predominantly to regulate capital expansions in the hospital sector, is commonly used in labor-intensive environments such as the home health sector. Instead of regulating capital investment, home health CONs take the form of entry restrictions.[11] As a consequence, it is nearly impossible for a potential home health entrant to demonstrate

[11] This is not to say that the reasoning behind hospital CON makes practical sense. Many states dropped their hospital CONs as it created wasteful bureaucratic pressure and most importantly, failed to slow the growth in health care spending (Thorpe 1999, Salkever 2000, Field 2007).

"need", as incumbent agencies are not constrained by capacity and face few hurdles when it comes to expansion of services. Therefore, not surprisingly, CON regulation of home health leads to concentrated markets with about half the number of agencies compared with states where entry is not regulated using CON.

We find home health care in CON states to be less resource intensive (lower frequency of visits and lower skill mix), yet we did not find meaningful differences in quality based on the fact that there were no detectible differences in rehospitalization rates among patients admitted to home health from the hospital. Hence, the quality effect that we hypothesized was not confirmed, although the level of resource intensity could be viewed as the dimension of "quality" on which home health agencies compete. If this is the case, the stronger intensity of resource use in non-CON states did not translate into improved quality outcomes. On the other hand, we found no evidence that regulation in home health lowers the rate of hospital readmissions or resource intensity of home health care as suggested by the view that limiting the number of home health agencies through CON focuses monitoring efforts and results in better care. On net, it is possible that the anti-competitive and monitoring effects of CON regulation are canceling each other out.

While the delivery of home health services to those admitted does not appear to be much different in CON states, overall health service delivery is different because CON regulation is associated with 12.6% fewer home health admissions following hospital discharge. This lower rate of home health admissions is accompanied by a slightly higher rate of hospital readmission among all hospital discharges. Moreover, Medicare

expenditures overall are similar over 120 days but lower in CON states initially. This suggests that the use of more home health episodes is costly (intensive margins), but because a higher rate of use of home health lowers the likelihood of rehospitalization (extensive margins) and the associated expenditures, this home health use is not associated with a detectible overall change in Medicare expenditures.

CON laws may not reduce the performance of home health agencies among the patients seen by home health, but because home health in CON states is used less frequently following hospital admission, CON has negative implications for the broader health care system. Although there are no overall differences in total Medicare expenditures, patients are unlikely to be indifferent between the two models of care. A system with fewer hospitalizations would seem preferable, all else equal. Thus, extensive margin implications may be more important when considering the implications of entry regulation.

REFERENCES

AHPA. The Federal Trade Commission & Certificate of Need Regulation: An AHPA Critique. Association, American Health Planning, 2005.

Allen, R, and P Gertler. "Regulation and the provision of quality to heterogeneous consumers: The case of prospective pricing of medical services." Journal of Regulatory Economics 3, no. 4 (1991): 361-375.

Beitia, A. "Hospital quality choice and market structure in a regulated duopoly." Journal of Health Economics 22 (2003): 1011-1036.

Brega, Angela G., Anne K. Jordan, and Robert E. Schlenker. "Practice Variations in Home Health Care." Home Health Care Services Quarterly 22, no. 3 (2003): 41-64.

Brekke, K.R., R. Nuscheler, and O.R. Straume. "Quality and location choices under price regulation." Journal of Economics & Management Strategy 15 (2006): 207-227.

Brekke, K.R., R. Nuschler, and O.R. Straume. "Gatekeeping in health care." Journal of Health Economics 26 (2007): 149-170.

Calem, P.S., and J.A. Rizzo. "Competition and specialization in the hospital industry: an application of Hotelling's location model." Southern Economic Journal 61 (1995): 1182-1198.

CMS. "Health Care Industry Market Update: Home Health." 2003.

David, G. "The Convergence between Nonprofit and For-Profit Hospitals in the United States." International Journal of Health Care Finance and Economics, Vol. 9(4), 2009: 403-428.

Donabedian, A. "Evaluating the quality of medical care." The Milbank Memorial Fund Quarterly 44, no. 3 (1966): 166-206.

Elixhauser, A, C Steiner, DR Harris, and RM Coffey. "Comorbidity measures for use with administrative data." Medical Care 36 (1998): 8-27.

Field, R. Health Care Regulation in America: Complexity, Confrontation, and Compromise. (2007) Oxford University Press.

Gaynor, M. "What do we know about competition and quality in health care markets?" Foundations and Trends in Microeconomics 2, no. 6 (2006).

Gowrisankaran, G, and RJ Town. "Competition, payers, and hospital quality." Health Services Research 38, no. 6 Pt 1 (2003): 1403–1422.

Gravelle, H. "Capitation contracts: access and quality." Journal of Health Economics 18, no. 3 (1999): 315-340.

Gravelle, H., and G. Masiero. "Quality incentives in a regulated market with imperfect competition and switching costs: capitation in general practice." Journal of Health Economics 19 (2000): 1067-1088.

Hadley, Jack, David Rabin, Andrew Epstein, Susan Stein, and Carolyn Rimes. “Posthospitalization home health care use and changes in functional status in a Medicare population.” Medical Care 38, no. 5 (2000): 494-507.

Held, P.J., and M.V. Pauly. “Competition and efficiency in the end stage renal disease program.” Journal of Health Economics 2, no. 2 (1983): 95-118.

Ho, Vivian. “Certificate of need, volume, and percutaneous transluminal coronary angioplasty outcomes.” American Heart Journal 147, no. 3 (2004): 442-448.

Ho, Vivian, Meei-Hsiang Ku-goto, and James G. Jollis. “Certificate of Need (CON) for Cardiac Care: Controversy of the Contributions of CON.” Health Services Research, no. 44:2, Part I (2009): 483-500.

Ho, Vivien. “Does Certificate of Need Affect Cardiac Outcomes and Costs?” International Journal of Health Care, Finance, and Economics 6 (2006): 300-324.

Hsiao, WC, P Braun, D Yntema, and ER Becker. “Estimating physicians' work for a resource-based relative-value scale.” The New England Journal of Medicine 319, no. 13 (1988): 835-841.

Jencks, Stephen F., Mark V. Williams, and Eric A. Coleman. “Rehospitalizations among patients in the Medicare fee-for-service program.” The New England Journal of Medicine 360, no. 14 (2009): 1418-1428.

Joskow, Paul L. “The effects of competition and regulation on hospital bed supply and the reservation quality of the hospital.” Bell Journal of Economics 11, no. 2 (1980): 421-447.

Kane, R. L., Q. Chen, M. Finch, L. Blewett, R. Burns, and M. Moskowitz. “The optimal outcomes of post-hospital care under Medicare.” Health Services Research 35, no. 3 (2000): 612-661.

Karlsson, M. “Quality incentives for GPs in a regulated market.” Journal of Health Economics 26 (2007): 699-720.

Kass, David I. “State and Federal Regulation in the Market for Corporate Control: A Comment.” Antitrust Bull, 1987: 693-694.

Kessler, D, and J Geppert. “The effects of competition on variation in the quality and cost of medical care.” Journal of Economics & Management Strategy 14, no. 3 (2005): 575-589.

Kessler, D.P., and M.B. McClellan. “Is Hospital Competition Socially Wasteful?” Quarterly Journal of Economics 115, no. 2 (2000): 577-615.

Kruzikas, DT, HJ Jiang, and D Remus. Preventable Hospitalizations: A Window Into Primary and Preventive Care, 2000. HCUP Fact Book No. 5., Rockville, MD: Agency for Healthcare Research and Quality, 2004.

Lakdawalla, D. and T.Philipson “Nonprofit Production and Industry Performance” Journal of Public Economics, 90(8–9), 2006: 1681–1698.

Lyon, T. P. “Quality competition, insurance, and consumer choice in health care markets.” Journal of Economics & Management Strategy 8 (1999): 545-580.

Ma, C.A., and J.F. Burgess. “Quality competition, welfare, and regulation.” Jounral of Economics 58 (1993): 153-173.

MHCC. An Analysis and Evaluation of Certificate of Need Regulation in Maryland: Phase I Final Report . Baltimore, MD: Maryland Health Care Commission, 2001.

Mukamel, DB, J Zwanziger, and K J Tomaszewski. “HMO penetration, competition, and risk-adjusted hospital mortality.” Health Services 36, no. 6 Pt 1 (2001): 1019–1035.

Naylor, Mary D., Dorothy A. Brooten, Roberta L. Campbell, Greg Maislin, Kathleen M. McCauley, and J. Sanford Schwartz. “Transitional Care of Older Adults Hospitalized with Heart Failure.” Journal of the American Geriatrics Society 52, no. 5 (2004): 675-684.

Penrod, J. D., R. L. Kane, M. D. Finch, and R. A. Kane. “Effects of post-hospital Medicare home health and informal care on patient functional status.” Health Services Research 33, no. 3 Pt 1 (1998): 513-529.

Penrod, Joan D., Rosalie A. Kane, and Robert L. Kane. “Effects of Posthospital Informal Care on Nursing Home Discharge.” Research on Aging 22, no. 1 (2000): 66-82.

Pope, J.C. Journal of Health Economics 8, no. 2 (1989): 147-172.

Popescu, Ioana, Mary S. Vaughan-Sarrazin, and Gary E. Rosenthal. “Certificate of need regulations and use of coronary revascularization after acute myocardial infarction.” JAMA, 2006: 2141-2147.

Quality, Agency for Healthcare Research and. AHRQ Quality Indicators-Guide to Prevention Quality Indicators: Hospital Admission for Ambulatory Care Sensitive Conditions. Version 3.1, Rockville, MD: Agency for Healthcare Research and Quality, 2001.

Robinson, JC, and HS Luft. “The impact of hospital market structure on patient volume, average length of stay, and the cost of care.” Journal of Health Economics 4, no. 4 (1985): 333-356.

Salkever, David S. Regulation of prices and investment in hospitals in the United States. Vol. 1 Part 2, in Handbook of Health Economics, 1489-1535. 2000.

Sari, N. “Do competition and managed care improve quality?” Health Economics, 11, 2002:571–584.

Shaughnessy, Peter W, et al. “Improving Patient Outcomes of Home Health Care: Findings from Two Demonstration Trials of Outcome-Based Quality Improvement.” Journal of the American Geriatrics Society 50, no. 8 (2002): 1354-1364.

Shen, YC. “The effect of financial pressure on the quality of care in hospitals.” Journal of Health Economics 22, no. 2 (2003): 243-269.

Shortell, SM, and EFX Hughes. “The effects of regulation, competition, and ownership on mortality rates among hospital inpatients.” The New England Journal of Medicine, 1988: 1100-1107.

Smith-Mello, M. “Health Care Costs Compel Fresh Look at Old Regulatory Lever.” Foresight 10, no. 4 (2004).

Sochalski, Julie, et al. “What Works In Chronic Care Management: The Case of Heart Failure.” Health Affairs 28, no. 1 (2009): 179-189.

Swan, James H., and Carroll L. Estes. “Changes in aged populations served by home health agencies.” Journal of Aging and Health 2, no. 3 (1990): 373-394.

Tay, A. “Assessing competition in hospital care markets: the importance of accounting for quality differentiation.” RAND Journal of Economics 34, no. 4 (2003): 786-814.

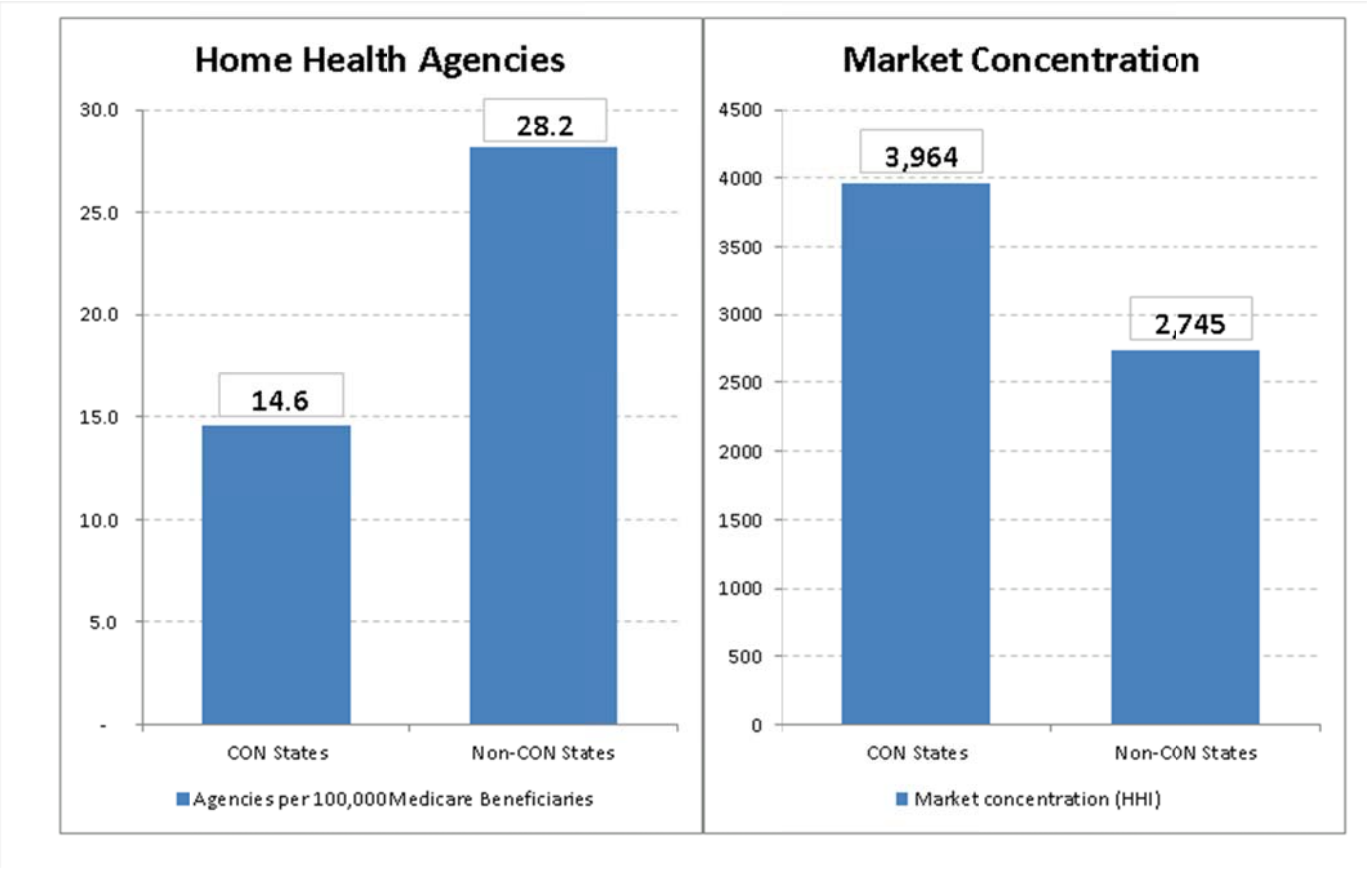
Thorpe K. E., “Health Care Cost Containment: Reflections and Future Directions,” in A. R. Kovner and S. Jones, eds., Health Care Delivery in the United States, 6th ed. (1999)

Welch, H. Gilbert, David E. Wennberg, and W. Pete Welch. “The Use of Medicare Home Health Care Services.” The New England Journal of Medicine 335, no. 5 (1996): 324-329.

Wennberg, JF, ES Fisher, TA Stukel, JS Skinner, SM Sharp, and KK Bronner. “Use of hospitals, physician visits, and hospice care during last six months of life among cohorts loyal to highly respected hospitals in the United States.” BMJ 328 (2004): 607-610.

Wolinsky, A. “Regulation of duopoly: Managed competition vs. regulated monopolies.” Journal of Economics & Management Strategy 6 (1997): 821-847.

Figure 1: Number of Home Health Agencies and Market Concentration by CON Status



Source: Authors' calcualtions from admimissions in FY 2006 in the Home Health Agencies – Standard Analityical File

Figure 2: States with CON and Hospital Referral Regions (HRRs) that cross between CON and non-CON states

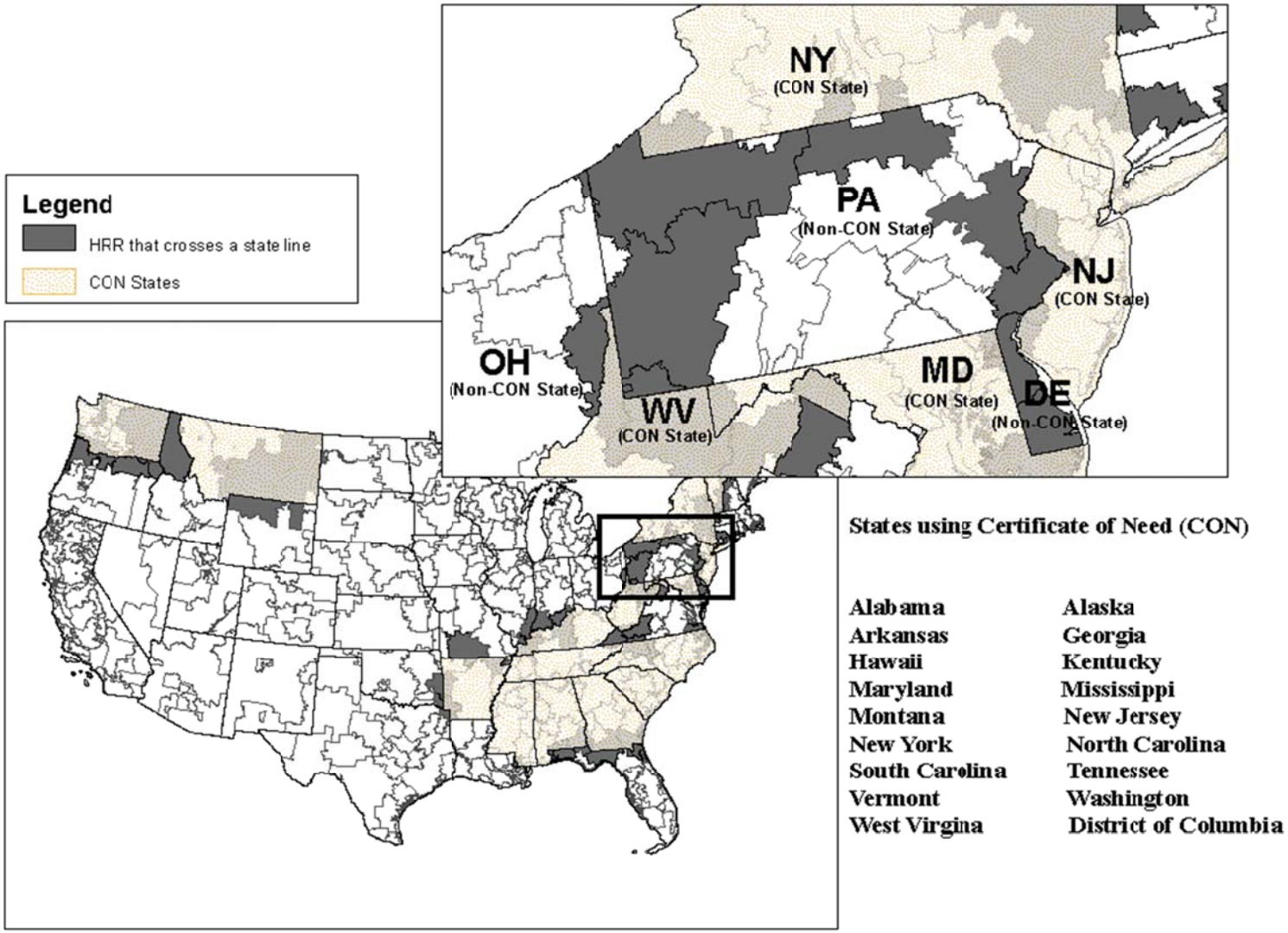


Table 1. Baseline characteristics of home health admissions following hospital discharges by CON status

	N=522,232	
	CON (n = 154501)	**non-CON** (n = 367731)
Patient characteristics		
Age, years	78.6	78.3
Male, %	36.6	39.6
Race		
White, %	84.8	89.4
Black, %	12.2	6.4
# Elixhauser comorbidities	1.5	1.5
Selected comorbidities (out of 28), %		
CHF	11.8	11.3
Chronic pulmonary disease	20.6	20.7
Diabetes w/o chronic complications	3.4	3.1
Fluid and electrolyte disorders	20.5	20.1
Deficiency Anemias	11.7	12.1
Selected DRGs (out of 103), %		
Disorders of the biliary tract	0.2	0.2
Simple pneumonia & pleurisy	4.3	4.1
Heart failure & shock	4.9	4.4
Chronic pulmonary disease	3.0	2.9
Lower extrem & humer proc	0.4	0.4
Discharging hospital characteristics		
Hospital type		
for-profit, %	9.2	14.8
government, %	15.9	9.1
Total beds	427	396
Medical school affiliation, %	26.9	22.3
Market characteristics		
College education, %	23.7	23.6
Median household income, $	47,179	47,258
Total population	525,350	982,227
Population 65+, %	13.0	13.8
Population density, /sq mile	4191	1151
Hospital beds/100 pop	0.37	0.32
SNF certified beds/100 pop	0.58	0.60
Hospital CON state, %	96.5	43.7
Medicare decedents hospitalized, %	73.2	71.4

Table 2. Home health utilization by CON status

	raw mean		unadjusted		adjusted		adjusted subsample*		adjusted with HRR fixed effects	
	CON	non-CON	marginal effect	P value	marginal effect	P value	marginal effect	P value	marginal effect	P value
Home Health Resource Intensity (N=522,232 - 29.6% CON)										
Total home health care visits	10.59	10.71	-0.125	0.225	-0.136	0.547	0.061	0.824	-0.062	0.494
Length on Service (days)	32.381	31.708	0.673	0.012	0.391	0.499	1.238	0.069	0.059	0.810
Frequency of visits (visits per day)	0.364	0.385	-0.021	<0.001	-0.010	0.159	-0.014	0.064	-0.011	0.000
Visits by provider type (proportion)										
Skilled nursing	0.470	0.517	-0.047	<0.001	-0.023	0.037	-0.007	0.674	-0.049	0.000
Home Health aide	0.122	0.091	0.031	<0.001	0.005	0.482	0.011	0.195	0.028	0.000
All therapy	0.399	0.383	0.016	0.004	0.017	0.133	-0.005	0.727	0.021	0.000
Hospital discharge location (N=4,448,479 - 31.8% CON)										
home health	0.109	0.121	-0.012	0.033	-0.026	<0.001	-0.021	0.004	-0.015	0.017

Control variables: Patient demographics are age, sex, race. Patient case-mix are 28 comorbidities and 103 DRGs. Hospital Characteristics are hospital type, bed size, and medical school affiliation. Market characteristics are percent college educated, median household income, population, % population over 65, density, hospital beds, SNF certified beds, and Hospital CON. Geographic variation is hospital stays in last 6 months of life by HRR. Agency characteristics are ownership, facility based, Medicare program tenure.

*Subsample are those HRRs that have CON in only part of the HRR because the HRR crosses state borders between states that have and don't have CON regulations. This subsample is 12.5% of the full sample and has an N of 558,081 with 50.5% in CON states. For hospital dicharges to home health the N of this subsample is 68,344 (13.1% of original sample) with 34.3% in CON states.

Regression models: Each resourc intensity outcome is analyzed with an ordinary least squares regression and the hospital discharge to home health is analyzed with a logistic GEE model. Standard errors adjusted for clustering at the HRR level

Table 3. Rehospitalization rates by CON status

	raw mean		unadjusted		adjusted		adjusted subsample*		adjusted with HRR fixed effects	
	CON	non-CON	marginal effect	P value	marginal effect	P value	marginal effect	P value	marginal effect	P value
Rehospitalization by days from hospital discharge										
Rehospitalization Rate for hospital discharges to home health (N=522,232 - 29.6% CON)										
0 - 60	0.1801	0.1684	0.0117	0.002	0.0043	0.062	0.0127	0.012	0.0051	0.436
60 - 120	0.0815	0.0867	0.0061	0.001	0.0012	0.405	-0.0087	0.016	-0.0034	0.579
0 - 120	0.2563	0.2406	0.0157	0.001	0.0049	0.086	0.0040	0.522	0.0017	0.843
Rehospitalization Rate for all hospitalizations (N=4,448,479 - 31.8% CON)										
0 - 60	0.1756	0.1688	0.0068	0.019	0.0015	0.472	0.0073	0.020	0.0079	0.057
60 - 120	0.0906	0.0874	0.0032	0.007	-0.0004	0.634	0.0005	0.799	0.0015	0.478
0 - 120	0.2502	0.2414	0.0088	0.011	0.0011	0.655	0.0071	0.087	0.0084	0.078

Control variables: Patient demographics are age, sex, race. Patient case-mix are 28 comorbidities and 103 DRGs. Hospital Characteristics are hospital type, bed size, and medical school affiliation. Market characteristics are percent college educated, median household income, population, % population over 65, density, hospital beds, SNF certified beds, and Hospital CON. Geographic variation is hospital stays in last 6 months of life by HRR. Agency characteristics are ownership, facility based, Medicare program tenure.

*Subsample are those HRRs that have CON in only part of the HRR because the HRR crosses state borders between states that have and don't have CON regulations. This subsample is 12.5% of the full sample and has an N of 558,081 with 50.5% in CON states. for hospital dicharges to home health the N of this subsample is 68,344 (13.1% of original sample) with 34.3% in CON states.

Regression models: Rehospitalizations are estimated with a linear probability model with standard errors estimated based on clustering by HRR.

Table 4. Medicare expenditure by CON status

	raw mean		unadjusted		adjusted		adjusted subsample*		adjusted with HRR fixed effects	
	CON	non-CON	marginal effect	P value	marginal effect	P value	marginal effect	P value	marginal effect	P value
Medicare expenditure ($2006) by days from hospital discharge										
Medicare expenditure ($2006) for hospital discharges to home health (N=522,232 - 29.6% CON)										
0 - 60	4845	4524	321	0.078	84	0.010	21	0.900	34	0.581
60 - 120	1573	1390	183	0.068	39	0.053	-159	0.020	-78	0.400
0 - 120	6419	5914	504	0.069	123	0.010	-138	0.030	-44	0.300
Medicare expenditure ($2006) for all hospitalizations (N=4,448,479 - 31.8% CON)										
0 - 60	4693	4737	-44	0.814	-116	0.143	-207	0.010	-92	0.278
60 - 120	1503	1425	78	0.288	-6	0.983	-10	0.700	10	0.800
0 - 120	6195	6161	34	0.895	-119	0.28	-217	0.01	-82	0.200

Control variables in adjustment: Patient demographics are age, sex, race. Patient case-mix are 28 comorbidities and 103 DRGs. Hospital Characteristics are hospital type, bed size, and medical school affiliation. Market characteristics are percent college educated, median household income, population, % population over 65, density, hospital beds, SNF certified beds, and Hospital CON. Geographic variation is hospital stays in last 6 months of life by HRR. Agency characteristics are ownership, facility based, Medicare program tenure.

*Subsample are those HRRs that have CON in only part of the HRR because the HRR crosses state borders between states that have and don't have CON regulations. This subsample is 12.5% of the full sample and has an N of 558,081 with 50.5% in CON states. for hospital dicharges to home health the N of this subsample is 68,344 (13.1% of original sample) with 34.3% in CON states.

Regression models: Medicare expenditure is estimated with a two-part model where the first part is a logistic regression and the second part is a GLM model with a log link and a gamma family.

Appendix A: List of HRRs that span more than one state, the number of patients in our sample, and the percent of population under CON

Hospital Referral Region	Non-CON State(s)	CON State	N	%CON
Albany	MA	NY	34,285	94%
Allentown	PA	NJ	27,027	5%
Billings	WY	MT	9,045	91%
Dothan	GA / FL	AL	9,860	94%
Durham	VA	NC	24,665	82%
Erie	PA	NY	14,415	11%
Evansville	IN / OH	KY	12,127	8%
Fort Smith	OK	AR	5,865	87%
Jacksonville	FL	GA	28,023	13%
Jonesboro	MO	AR	6,094	94%
Kingsport	VA	TN	8,929	53%
Lebanon	NH	VT	4,569	13%
Louisville	OH	KY	31,702	84%
Morgantown	PA	WV	9,260	97%
New Haven	CT	NY	26,509	5%
Norfolk	VA	NC	19,784	8%
Paducah	IN	KY	10,487	89%
Pensacola	FL	AL	15,533	9%
Philadelphia	PA	NJ	63,470	15%
Pittsburgh	PA	WV	45,421	9%
Portland	OR	WA	16,364	24%
Roanoke	VA	WV	15,576	17%
Salisbury	DE	MD	8,523	60%
Sayre	PA	NY	4,527	17%
Slidell	LA	MS	2,593	12%
Spokane	ID	WA	20,044	81%
Springfield	MO	AR	15,914	17%
Tallahassee	FL	GA	11,456	60%
Texarkana	OK / TX	AR	5,864	5%
Wilmington	DE	MD	15,869	13%
Winchester	VA	WV	6,135	20%
Winston-Salem	VA	NC	17,955	96%