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Public Reporting and Market Area Exit Decisions by Home Health Agencies

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Objective: To examine whether home health agencies selectively discontinue services to areas with socio-economically disadvantaged people after the introduction of Home Health Compare (HHC), a public reporting program initiated by Medicare in 2003.
Study Design /Methods: We focused on agencies' initial responses to HHC and examined selective market-area exits by agencies between 2002 and 2004. We measured HHC effects by the percentage of quality indicators reported in public HHC data in 2003. Socio-economic status was measured by per capita income and percent college-educated at the market-area level.
Data Source(s): 2002 and 2004 Outcome and Assessment Information Set (OASIS); 2000 US Census file; 2004 Area Resource File; and 2002 Provider of Service File.
Principal Findings: We found a small and weak effect of public reporting on selective exits: a 10-percent increase in reporting (reporting one more indicator) increased the probability of leaving an area with less-educated people by 0.3 percentage points, compared with leaving an area with high education.
Conclusion: The small level of market-area exits under public reporting is unlikely to be practically meaningful, suggesting that HHC did not lead to a disruption in access to home health care through selective exits during the initial year of the program.

Keywords: Public Reporting, Market-area Exits, Selection Incentives, Home Health Care, Home Health Compare
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Introduction

Public reporting of quality information is growing in the U.S. healthcare system. Most states have quality reporting programs for hospitals, and the Centers for Medicare and Medicaid Services (CMS) has initiated public reporting programs for Medicare-participating hospitals, nursing homes, and home health agencies. The rationale behind this approach is compelling. Consumers' uncertainty about quality has long been identified in healthcare (Arrow, 1963). Economic theory suggests that if consumers cannot identify quality differences in products, providers will not invest in quality improvement (Akerlof, 1970). Disclosing relevant information may help consumers choose providers based on quality, which will motivate providers to improve quality. Some also suggest that public reporting, by providing feedback on practices, directly influences providers to change their practices and improve quality (Werner & Asch, 2005). With the expectation that information disclosure is desirable, public reporting programs have been adopted in many healthcare settings.

As public reporting expands, an important concern has been raised that those programs may adversely affect access to care of vulnerable populations. The discussion began with disturbing findings that hospitals turned away high-risk patients after they were required to disclose mortality rates for cardiac procedures (Dranove, Kessler, McClellan, & Satterthwaite, 2003). In addition to incentives to select patients based on health risk, public reporting programs may give providers motives to select patients based on socio-economic status (SES). Providers who serve low-SES people usually lack resources to invest in quality, and thus, they are often categorized as "poor-quality" (Goldman, Vittinghoff, & Dudley, 2007; Werner, Goldman & Dudley, 2008). This implies that those providers may receive little financial or reputational rewards from reporting programs. To avoid this disadvantage, providers may reduce services for socio-economically disadvantaged populations or leave communities with those populations, worsening disparities in access to health care (Casalino & Elster, 2007; Chien, Chin, Davis, & Casalino, 2007).

Selection incentives related to information disclosure have been shown mainly in hospital care. However, public reporting programs are diffusing to home health care, which differs from other types of care in that services are delivered in patients' homes. This unique feature of home health care implies that home health agencies can enter or exit markets at low cost, which leads to dynamic supply changes (Scalzi, Zinn, Guilfoyle, & Perdue, 1994; General Accounting Office, 1999). Bishop, Kerwin, and Wallack (1999) viewed this fluctuation in supply as indicating that agencies do not have the technical capacity to adjust to changes in market conditions. However, Porell, Liu, and Brungo (2006) reported that agencies dropped market areas with greater financial pressure after changes in the payment system. This suggests that the potential for distorted incentives after public reporting in home health care may take the form of selective market-area choices.

We examine whether agencies selectively exited certain market areas after a nation-wide public reporting program, Home Health Compare (HHC), which was initiated by Medicare in 2003. Quality indicators in HHC focus on how well patients perform important activities of independent living in their homes, such as bathing or transferring. These activities can be improved by home health staff's efforts and thus are among the main targets of home health care. However, performance of these activities also depends on patients' use of inputs other than home health services, such as paid help or practicing self-care skills, which are not adequately captured in the current risk-adjustment model (Mor, 2005). The use of other supportive inputs has been shown to depend on patients' incomes (Brega, Jordan, & Schlenker, 2003), and education is positively related to home health outcomes (Miller & Weissert, 2000). Thus, agencies may have incentives to avoid patients who are expected to use fewer supportive services, because they are held accountable for poor outcomes that could be caused by unobserved inputs.

Our study examines whether agencies discontinued service to areas with low-SES patients under HHC. To our knowledge, this is the first study that investigates selection incentives at the market-area level. This is an important issue to address, because it may result in geographic concentration of the adverse impacts of reporting. Because public reporting programs are continuously evolving, our analysis provides information that could be used to refine those programs.

Home Health Compare (HHC)

Home health care is a growing source of post-acute care for the elderly.[1] Medicare home health care spending increased by about 10% annually between 2001 and 2009, and it reached $19.6 billion in 2011 (Medicare Payment Advisory Commission, MedPAC, 2012). The number of Medicare beneficiaries who receive home health services increased at an annual rate of 5.6% between 2002 and 2005 (MedPAC, 2008). As home health care becomes increasingly important, ensuring home health quality is a priority. CMS, thus, developed a patient assessment tool, the Outcome and Assessment Information Set (OASIS), which contains health outcome and risk measures, and has collected data since 1999.

In 2003, CMS introduced HHC, which posts a subset of agencies' risk-adjusted OASIS performance measures on the CMS-HHC Web site.[2] All Medicare-certified agencies are required to report quality scores under HHC; however, agencies with fewer than 20 cases for a specific quality indicator are not required to disclose quality scores for that indicator. Eleven indicators were included in HHC in 2003, and about half of agencies had at least one missing

[1]Medicare covers home health services used for rehabilitation or recovery during a limited time period. Another type of care includes non-medical personal and home-making services. These "home care" services requiring long-term attention are not covered by Medicare unless they are prescribed concurrently with skilled nursing services.

[2]Since July 2011, HHC has used revised risk-adjustment models based on OASIS-C, which adds data items on evidence-based processes. Additional risk factors are likely to improve the predictability of risk-adjustment models; however, the use of other health inputs by patients remains unobserved and unadjusted.

indicator in the public HHC data. We utilized this variation in the extent to which an agency was subject to HHC during the initial year to capture the HHC effect. We constructed the percentage of quality indicators reported ("percent reporting") for each agency, and used this variable to examine the impact of public reporting on selective market-area exits by agencies.

Conceptual Model

Our conceptual model of market-area exits by home health agencies is based on the theory of profit-maximizing firms, which has been used to analyze health care providers' market entry/exit decisions (Halpern, 2005; Cawley, Chernew, & McLaughlin, 2005).

Agency's Profit Function

Most agencies serve multiple market areas; thus, the agency's total profit is the sum of its profits from all market areas. Suppose an agency serves two market areas: one with all high-SES consumers (*H*-area) and another with all low-SES consumers (*L*-area). Denoting the profits in *H* and *L*-areas as π_H and π_L, respectively, the agency's total profit is:

$$\Pi = \pi_{H+}\pi_L \quad (1)$$

Profit in each area is:

$$\pi = (p - c)sN \quad (2)$$

where the Medicare payment for an episode of care (p) is the same across market areas after adjusting for cost differences across markets, c is the average cost per episode, s is the number of episodes for a patient, and N is the number of patients in the area.[3] The last three factors (c, s, and N) vary by area. Using subscripts H and L to represent corresponding areas, the agency's total profit is:

$$\Pi = (p - c_H)s_H N_H + (p - c_L)s_L N_L \quad (3)$$

Agency Quality

The quality of an agency (Q) serving H and L-areas is specified as:

$$Q = \frac{N_H q_H(s_H, X_H) + N_L q_L(s_L, X_L)}{N_H + N_L} \quad (4)$$

Each patient's health outcome (q) depends on home health services (s) and other inputs (X), such as patients' investment in health through using paid-aide services or practicing self-care skills. High-income and more-educated patients are likely to use more of other inputs than low-income/low-education patients, due to greater financial affordability and better information about the health benefits from using them. More-educated patients also may be proficient at practicing self-care skills.

[3]Medicare prospectively pays home health agencies for a 60-day episode. Agencies may have other revenue sources but we focus on Medicare patients because Medicare is the major revenue source (National Center for Health Statistics, 2007).

Agencies' Service Area Choices

Before public reporting, it is hard for patients to evaluate differences in quality across agencies, so we assume that demand for home health services (*N*) are independent of agency quality (*Q*). This implies that there is little linkage between the two areas, assuming limited economies of scale. The decision to drop an area will be based only on the change in profit from dropping that area. Thus, the change in profit from dropping an L-area before reporting is:

$$\Delta\pi^{NR} = -(p - c_L)s_L N_L \quad (5)$$

The agency will drop the L-area if this expression is positive.

After reporting, we assume that high-SES patients respond to the quality reports (N_H is a function of *Q*), an assumption supported by the literature (Abraham, Feldman, Carlin, & Christianson, 2006; Angelelli, Grabowski, & Mor, 2006; Miller & West, 2007). We assume N_L is independent of agency quality after reporting, because the same sources have shown that low-SES consumers are not as responsive to quality information.

The key change is that reporting connects the *H* and *L*-areas in a way that was not present before reporting. Specifically, agency quality depends on health outcomes for *both* types of patients. High-SES patients observe agency quality and are attracted to high quality:

$$N_H = f(Q), f'_Q > 0 \quad (6)$$

But the low scores for patients from the *L*-area drag agency quality down and agencies are held accountable for low quality that is due to unobserved inputs. Thus, *avoiding* patients from the L-area (who are not favorable to *Q*) now affects the agency's profit in an *H*-area by increasing demand in the H-area through improved quality scores. The agency will incorporate the "spillover" effect of dropping an *L*-area on its profit in the *H*-area. Formally, assuming the cost of exit is minimal, the change in profit when the agency exits the *L*-area under reporting is:

$$\Delta\pi^{R} = (p - c_H)s_H \Delta N_H - (p - c_L)s_L N_L \quad (7)$$

To examine the impact of reporting on the likelihood of dropping an *L*-area, we subtract equation (5) from equation (7),

$$\Delta\pi^{R} - \Delta\pi^{NR} = (p - c_H)s_H \Delta N_H \quad (8)$$

This difference in profit changes is positive, because leaving the *L*-area and thus improving quality scores is expected to increase demand in the *H*-area. Therefore, our hypothesis is:

> An agency is more likely to exit an area with a large share of socio-economically disadvantaged people under public reporting, when all else is equal.

Equation (8) indicates that leaving an *L*-area is more likely if the demand increase in an *H*-area (ΔN_H) is greater, when all else is equal. We will examine this differential effect on exiting an *L*-area by the size of the expected demand increase from the agency's remaining service area.

Empirical Specification

Our empirical analysis focuses on agencies' initial responses to HHC by examining market-area exits between 2002 and 2004. Some might consider comparing exit decisions during pre- and post-reporting periods (e.g., 2001–2002 versus 2004–2005), a better approach. However, a pre-post design is not appropriate for our study, because only self-selected (survived) market areas are served during the post-reporting period. Thus, we utilize variation in the degree of public reporting across agencies in 2003 to identify HHC effects. The basic empirical model is:

$$\mathrm{DROP_{ij}} = \alpha + \beta \mathrm{REPO_i} * \mathrm{SES_{ij}} + \gamma \mathrm{X_{ij}} + \mu_s + \varepsilon_{ij} \quad (9)$$

$\mathrm{DROP_{ij}}$ is an indicator that equals one, if the i^{th} agency leaves the j^{th} market area between 2002 and 2004. $\mathrm{REPO_i}$ is the extent to which the agency is subject to public reporting in 2003. $\mathrm{SES_{ij}}$ is a 2002 baseline socio-economic mix of the j^{th} area that the i^{th} agency serves. $\mathrm{X_{ij}}$ is a vector of factors that influence the agency's ability to survive demand/supply shocks between 2002 and 2004, μ_s denotes state fixed effects, and ε_{ij} is a random error term.

The demand increase from dropping a low-SES area is likely to be larger if consumers in the agency's remaining service area have larger responses to quality scores. Thus,

$$\beta = \delta_1 + \delta_2 \mathrm{RMN_{i(-j)}} \quad (10)$$

where $\mathrm{RMN_{i(-j)}}$ is the baseline socio-economic mix in the agency's *remaining* service areas. The constant term, δ_1, represents effects of any unmeasured factors affecting the demand response in the remaining service area. By substituting equation (10) into (9):

$$\mathrm{DROP_{ij}} = \alpha + \delta_1 \mathrm{REPO_i} * \mathrm{SES_{ij}} + \delta_2 \mathrm{REPO_i} * \mathrm{SES_{ij}} * \mathrm{RMN_{i(-j)}} + \gamma \mathrm{X_{ij}} + \mu_s + \varepsilon_{ij} \quad (11)$$

Estimation and Hypothesis Testing

We use a linear probability model (LPM) to estimate equation (11) and obtain bootstrapped standard errors that adjust for clustering within an agency. We chose LPM over a logit model, because LPM lets us include state fixed-effects to control for state-specific environments affecting agencies' market-area exits, which is important, because Medicaid benefits for home health care vary by state. It is also straightforward to interpret interaction terms from LPM, which are the main variables of interest in our study.

Our hypothesis is supported if the coefficients of REPO*SES and/or REPO*SES*RMN are positive. The coefficient of the two-way interaction between REPO and a low-SES area (δ_1) captures the effect of public reporting on exiting the area, when there is no difference in the expected demand gain in other areas across agencies. The coefficient of the three-way interaction among REPO, SES, and RMN (δ_2) tests differential effects of reporting on selective area exits based on characteristics of the agency's remaining service area.

Definition of Market Areas

We define market areas by ZIP Codes, which are the smallest geographic units that indicate the location of home health patients. Under HHC, agency quality is ranked among the agencies serving a ZIP Code.

HHC Effect (REPO)

We measure HHC reporting (REPO) by the percent of quality measures reported in 2003 ("percent reporting"), which reflects exogenous variation in the extent to which agencies were subject to reporting. This approach assumes that agencies with more reported indicators and those with fewer reported indicators would be similar except for the HHC effect. However, because the reporting criterion depends on the number of cases treated, larger agencies tend to report more indicators than smaller agencies. If small and large agencies have different propensities to drop an area, the assumption might not hold. We address this possibility by controlling for agency size, as well as intensity of care and case-mix of an agency, both of which may be correlated with both percent reporting and the decision to exit an area. We measure intensity of care by the number of home health visits per episode, and capture case-mix by the number of eligible HHC indicators per patient.

Moreover, we conduct a sensitivity analysis using only small agencies. If this small-agency analysis shows similar results to the full-sample analysis, it would suggest that percent reporting captures "reporting" effects and that the bias from unobserved agency attributes is small.

We also estimate the model separately by agency profit-status. We expect the HHC effect to be greater among for-profit agencies, whose main objective is financial gains, than not-for-profit agencies. If not-for-profit agencies place more value on serving the community than profits, they may not engage in selective market exits under HHC.

Socio-economic Status (SES)

We measure market-area SES by the percent of the population with a college education and per capita income. Areas are classified as low-education (low-income) if their percentage of college-educated people (per capita income) is below average. We use separate low-income and low-education indicators. While these two variables are correlated, literature suggests they have independent effects on health care use and outcomes (Robert & House, 2000), and omitting one variable will result in biased estimates.

Demand Increase in the Remaining Service Areas (RMN)

We use the socio-economic mix in the agency's remaining service areas to capture consumer responses to quality scores and potential increases in demand in those areas. We aggregate market-level income and education up to the agency level using a weighted average across all the market areas an agency serves, except the area in question. The weights are the shares of the

agency's total patients in each of its remaining service areas. We create a high-SES indicator if the agency's remaining service areas have above-average income and education.

Factors Affecting the Agency's Ability to Survive Shocks

Agencies may drop areas that become unprofitable due to demand or supply shocks. We control for agency and market-area factors that influence the agency's ability to survive shocks. We measure those factors at their 2002 baseline values. Agency-level factors are the number of patients, the number of visits per episode, the number of eligible HHC indicators per patient, the number of full-time-equivalent (FTE) registered nurses (RNs) and aides, profit status, hospital affiliation, Medicare tenure, and percent reporting. Market-level factors are the number of home health care users, nursing facility beds and long-term care (LTC) hospital beds, hospital admission rates, Medicare Part A/B payment rates, distance from the agency to the centroid of the area, market concentration, and SES indicators. To capture market concentration, we use the Herfindahl-Hirschman Index (HHI). Following Kessler and McClellan (2000), we estimate a patient choice model for all agencies within 30 miles from the patient's ZIP Code to obtain predicted probabilities of the patient choosing each agency. We then calculate predicted market shares of agencies in each ZIP Code and obtain the HHI based on those market shares.

Data

The primary data source is OASIS, which records ZIP Codes for all patients served by each agency. We identified all market areas served by each agency in 48 states (excluding Alaska and Hawaii) and DC in 2002 and areas that were no longer served in 2004. We constructed the numbers of patients per agency and home health users in a ZIP Code from the OASIS data.

We limited the sample to ZIP Codes with at least 10 home health users to obtain reliable estimates from the patient choice model. This exclusion removed 12,616 of 35,924 ZIP Codes in the original data. We considered agencies serving at least 10 patients in 2002 as active agencies. Of 6,426 agencies identified from the 2002 OASIS data, 275 agencies were excluded as inactive. We selected market areas with at least three patients from an "active" agency in 2002. This restriction, which reduced the number of agency-market areas from 237,843 to 135,434, helps mitigate a potential problem of miscoding due to sampling variation, because it is possible that an agency served one or two patients from a ZIP Code in 2002 and had no patient from that ZIP Code in 2004, by chance. We excluded 60 agencies that served only one ZIP Code in 2002.

We constructed "percent reporting" from the 2003 HHC. Twenty-seven agencies did not have HHC information. The 2000 U.S. Census file was the source of ZIP Code income and education. The Area Resource File (ARF) provided the information on health care use, cost, and facilities at the county level. We excluded 40 ZIP Codes that did not match with ARF. We obtained information about agency attributes from the 2002 Provider of Service File.

Results

The final data used for analysis comprised 125,747 agency-market area observations from 5,911 agencies that served 22,269 market areas. Exhibit 1 reports descriptive statistics for all variables used in the analysis. Market-area exit rates between 2002 and 2004 were low. On average, agencies dropped 5.3% of their market areas. The average "percent reporting" was 84.9%. About half of agencies reported all HHC measures; 15% of agencies reported less than 50%. The mean number of patients per agency was 596 (standard deviation=1,192).

Exhibit 1. Descriptive statistics for variables used in the analysis

Variables	Mean	Standard Deviation
Agency characteristics (N=5,911)		
Dropping rate (%)	5.3	(12.2)
Percent reporting (%)	84.9	(26.8)
Number of patients	595.7	(1192.2)
Number of nurse or therapy visits per episode	21.0	(7.3)
Number of eligible HHC indicators (per patient)	7.8	(0.7)
Number of RN (FTE)	15.6	(129.4)
Number of nurse aids (FTE)	7.9	(23.0)
Not-for-profit (1/0 indicator)	0.4	(0.5)
Hospital affiliation (1/0 indicator)	0.3	(0.5)
Medicare tenure (year)	14.3	(10.5)
Market-area factors (N=22,269)		
Percent college educated (%)	12.8	(8.2)
Per capita income ($)	20,270	(8,614)
Number of home health care users	155	(203)
Number of hospital admissions (per 1,000)	112.5	(85.2)
Number of LTC facility beds (per 1,000)	0.27	(1.46)
Number of nursing facility beds (per 1,000)	0.81	(2.34)
Medicare Part A/B payment ($)	548.5	(58.7)
Distance to the centroid of an area (mile)	19.5	(27.7)
Predicted Herfindahl index	3,329	(2,589)

SOURCE: Derived from 2002 and 2004 Outcome and Assessment Information System, 2000 U.S. Census file, 2004 Area Resource File, and 2002 Provider of Service file.

Exhibit 2 shows the results from the regression analysis. The two-way interaction between percent reporting and the low-education indicator had a positive effect on market-area exits, meaning that agencies with more reporting were more likely to leave an area with less-educated people, compared to agencies with fewer reported indicators. While this finding suggests that public reporting motivates agencies to exit low-SES areas, the estimated effect was weakly

significant (p=0.08) and small: a 10 percent increase in reporting increased the probability of leaving an area with less-educated people by 0.3 percentage points, compared to leaving an area with high education. This estimate implies that an agency serving 1,000 market areas and having to report one more indicator would exit three to four more low-SES than high-SES market areas. This indicates that public reporting induces only a very small level of selective exits, which is unlikely to be practically meaningful given that the average market exit rate was 5.3% and the average number of market areas served by an agency was about 40.

Exhibit 2. Regression results for the drop model (full-sample analysis)

Variables	Coefficient	Bootstrap Std. Err.	
Interactions between reporting and SES-mix of an area			
Two-way interactions			
Low-education area* percent reporting (REPO)	0.0003	(0.0002)	*
Low-income area*REPO	0.0001	(0.0002)	
Three-way interactions			
Low education*REPO* SES-mix of remaining area	0.0001	(0.0001)	
Low income*REPO* SES-mix of remaining area	0.0001	(0.0001)	
Other factors leading agencies to survive/fail shocks			
Percent reporting (REPO)	-0.0008	(0.0002)	***
Low-education area	-0.0353	(0.0174)	**
Low-income area	-0.0084	(0.0162)	
Number of patients (agency size)	-0.0003	(0.0005)	***
Number of visits per episode (intensity of care)	0.0001	(0.0004)	
Number of eligible HHC indicators (case-mix)	-0.002	(0.004)	
Number of RN (FTE)	0.0001	(0.0000)	
Number of nurse aides (FTE)	-0.0001	(0.0000)	
Not-for-profit agency	-0.016	(0.0063)	**
Hospital-based agency	-0.0125	(0.0039)	***
Medicare tenure of an agency (year)	-0.0002	(0.0002)	
Other factors leading agencies to survive/fail shocks			
Number of home health care users	-0.0037	(0.0005)	***
Number of hospital admissions	0.0001	(0.0000)	***
Number of LTC facility beds	0.0011	(0.0009)	
Number of nursing facility beds	0.0007	(0.0007)	
Medicare Part A/B payment ($)	0.0003	(0.0000)	***
Distance (mile)	0.0019	(0.0003)	***
Predicted Herfindahl index	-0.0003	(0.0001)	***
Constant	-0.0003	(0.0388)	
N	125,747		

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

[1]State fixed effects are included in the model; standard errors are adjusted for clustering within an agency.

SOURCE: Authors' estimates from 2002 and 2004 Outcome and Assessment Information System, 2000 U.S. Census file, 2004 Area Resource File, and 2002 Provider of Service file.

The coefficient of the interaction term between percent reporting and the low-income indicator was positive but insignificant. The coefficients of three-way interactions among percent reporting, low-education or low-income area, and the socio-economic mix in the agency's remaining service areas had expected signs, but were insignificant, indicating that public reporting did not have differential effects on selective exits based on agencies' expected demand increases in the remaining areas.

For the factors leading agencies to survive/fail shocks, the coefficient of "percent reporting" was negative. It remained negative when the indicators that interact with the variable were set to either zero or one, implying that agencies with more reporting were less likely to drop an area than agencies with less reporting. This may reflect that agencies with more reporting expected that disclosing their quality scores would increase demand for their services.

The low-education indicator had a negative effect on exiting, which may reflect the finding in the literature that less-educated patients were more likely than more-educated patients to use home health care, due to lack of access to private paid assistance (Solomon et al., 1993).

The results on other variables were consistent with Porell et al.'s study (2006): Large agencies and hospital-based agencies were less likely to drop areas. Agencies were less likely to leave areas with more home health users and hospital admissions, and with less competitive and closer areas.

Sensitivity Analysis

To explore whether "percent reporting" captures unmeasured characteristics of large agencies, we estimated a model using only small agencies. We identified 2,098 agencies that treated fewer than 300 episodes in 2002. The mean number of patients per small agency was 102 (standard deviation=60), far smaller than in the full sample (mean=596; standard deviation=1,192). This substantial decrease in the mean and variation of agency size suggests that the potential bias from unobserved agency attributes is likely to be small in the small-agency analysis.

The average percent reporting among small agencies was 66.8%, compared with 84.9% in the full sample. Twenty percent of small agencies reported all measures, while half reported all measures in the full sample. About 70% of small agencies reported less than 50% of the measures. The average exit rate of 6.7% was higher than in the full sample (5.3%).
The coefficients of selected variables from this analysis are shown in Exhibit 3. The two-way interaction term between low education and percent reporting had a positive and significant coefficient: a 10 percent increase in reporting increased the probability of leaving an area with less-educated people by 0.4 percentage points, compared with leaving an area with highly-educated people. This finding is similar to the full-sample analysis and confirms that public reporting created only small selection incentives based on market-area education.

Consistent with the full-sample analysis, the coefficient of the two-way interaction between low income and percent reporting was not significant. The coefficients of all three-way interaction terms were positive, but insignificant.

Exhibit 3. Selected coefficients from the regression with small agencies

Variables	Coefficient	Bootstrap Std. Err.	
Interactions between reporting and SES-mix of an area			
Two-way interactions			
Low-education area* percent reporting (REPO)	0.0004	(0.0002)	*
Low-income area*REPO	-0.0003	(0.0002)	
Three-way interactions			
Low education*REPO* SES-mix of remaining area	0.0002	(0.0001)	
Low income*REPO* SES-mix of remaining area	0.0000	(0.0001)	
Other factors leading agencies to survive/fail shocks			
Percent reporting (REPO)	-0.0005	(0.0003)	*
Low-education area	-0.0407	(0.0188)	**
Low-income area	0.0165	(0.0183)	
N	15,143		

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

[1]State fixed effects are included in the model; standard errors are adjusted for clustering within an agency.

SOURCE: Authors' estimates from 2002 and 2004 Outcome and Assessment Information System, 2000 U.S. Census file, 2004 Area Resource File, and 2002 Provider of Service file.

These findings from the analysis of small agencies suggest that percent reporting captures "reporting" effects on market-area exit decisions and that the estimated effect of percent reporting was not fully driven by unobserved agency characteristics.

Exhibit 4 reports the results on selected variables from separate analysis by agency profit-status. In the analysis of for-profit agencies, the two-way interaction between low education and percent reporting had a positive and significant coefficient, suggesting that for-profit agencies selectively exited market areas with low education after public reporting. The magnitude of the effect was small and similar to the analysis of all agencies. The same two-way interaction term was insignificant in the analysis of not-for-profit agencies, implying that public reporting did not create selection incentives for those agencies that may value serving under-served populations, regardless of financial gains.

Next, we performed a market-level analysis to incorporate market entries in the model. We estimated a model that uses changes in the number of agencies in an area between 2002 and 2004 as the dependent variable. The main independent variable is an indicator representing a market with low-SES. The result from this analysis is consistent with the finding we reported in our primary analysis: the change in the number of agencies is one less in low-SES markets than in markets with high-SES during the study period (Appendix Exhibit A1). This estimate implies one less entry into low-SES markets, because each area had 2.2 more agencies in 2004 than in

2002, on average. The overall growth of the home health industry during this period suggests that selective market-area exits did not create significant access problems in low-SES areas.

Exhibit 4. Selected coefficients from separate analysis by agency profit-status

	For-profit agencies		Not-for-profit agencies	
Variables	Coefficient	Bootstrap Std. Err.[1]	Coefficient	Bootstrap Std. Err.[1]
Reporting & area SES-mix Interactions				
Two-way interactions				
Low-education area* percent reporting (REPO)	0.0004	(0.0002) **	-0.0002	(0.0002)
Low-income area*REPO	-0.0002	(0.0002)	0.0003	(0.0002)
Three-way interactions				
Low education *REPO* SES-mix of remaining area	0.00006	(0.0001)	0.00004	(0.00001)
Low income *REPO* SES-mix of remaining area	0.00002	(0.00001)	0.00007	(0.00007)
Other factors leading agencies to survive/fail shocks				
Percent reporting (REPO)	-0.0007	(0.0002) ***	-0.0002	(0.0002)
Low-education area	-0.0487	(0.0196) **	0.0146	(0.0225)
Low-income area	0.0072	(0.0188)	-0.0329	(0.0247)
N	77,036		48,711	

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

[1]SE=Standard Errors; standard errors are adjusted for clustering within an agency; state fixed effects are included in the model.

SOURCE: Authors' estimates from 2002 and 2004 Outcome and Assessment Information System, 2000 U.S. Census file, 2004 Area Resource File, and 2002 Provider of Service file.

However, it should be noted that this estimate does not represent differential entries or exits in low-SES markets that are specifically induced by public reporting. For example, if there was a policy change (e.g., a payment increase for Medicaid home health services) that led agencies to selectively enter low-SES markets, the estimate from the change model captures the effect of that policy change as well as the effect of public reporting.

Further, we explored whether exits from low SES markets were a strategic effort by agencies to raise quality scores. We estimated a model of agencies' quality changes as a function of an indicator for an agency's leaving a low-SES market, agency attributes, and state fixed effects. We also estimated the model replacing the indicator of exiting low-SES markets with the number of low-SES markets dropped by the agency. We found that the coefficients of both variables were positive and significant (results not shown). This indicates that agencies increased quality scores by leaving low-SES markets, supporting our hypothesis.

We also checked whether agencies engaged in patient selection, instead of (or in addition to) market exits. We used different levels of service-area "reduction" as the dependent variable:

25%, 50%, and 75% decreases in the number of patients served by the agency in an area. We found very similar results to the market-exit analysis when the indicator was a 75% decrease (which is closest to market exiting): the coefficient of the interaction term between reporting and low education was 0.0004 (p=0.07). The analyses with other indicators of service reduction showed no significant coefficients of interaction terms between reporting and low education, suggesting that selective market-area exits were more likely than patient selection.

Finally, we explored the possibility that agencies serving low-SES markets simply inflate quality scores under public reporting rather than leaving the markets. Coding inflation is possible, because HHC indicators are constructed from assessment data that are coded by aides or nurses. If this were the case, it would imply that quality scores improve more among agencies serving relatively low-SES markets than agencies operating in relatively high-SES markets. We analyzed whether quality changes are a function of SES-mix of the service areas, but found no significant effect of SES-mix on the change in quality scores. This finding suggests that quality changes were not inflated according to the SES-mix of the agency's service areas (results not shown).

Discussion

Agencies with more reporting were slightly more likely than agencies with less reporting to leave low-education areas during the first year of HHC. This effect was significant among for-profit agencies. While significant, the effect was very small and it is unlikely the selective exits under public reporting resulted in disturbances in access to home health care. We found that income does not have independent effects on selective exits under HHC, once education is controlled. This may be because low-income patients are eligible for Medicaid, which covers comprehensive home health services. Brega et al. (2003) showed that Medicaid patients were more likely to receive home health services through other organizations than non-Medicaid patients. If low-income patients covered by Medicaid do not have poor outcomes, agencies should not have incentives to drop low-income areas under HHC.

We also found that public reporting did not have differential effects on selective exits based on agencies' expected demand increases in the remaining areas. This finding may be because the SES-mix variable we used was a poor measure of expected demand increases under HHC. Or, agencies had yet to learn about impacts of exiting on demand increases.

Several limitations of our study should be noted. First, our study is limited to agencies' initial responses to HHC. It is unlikely that agencies fully learned about potential impacts of HHC immediately following the introduction of the program. Long-term effects of HHC may be different. Second, the number of agencies participating in Medicare increased during the study period. The growing demand for home health care may have contributed to the small effect we found. Third, agencies may have engaged in patient selection without exiting market areas. Our sensitivity analysis indicated that market-area selection was more likely than patient selection;

however, we cannot capture changes in the composition of patients served between the two years. Fourth, the variables we used to measure public reporting or potential demand increases may not have captured those factors, contributing to the small effects.

Our primary analysis focused on market-area exits, because the concern related to public reporting is that agencies will leave low-SES areas. However, we conducted a sensitivity analysis that incorporates market entries in the model. The results from both analyses were consistent, indicating a very small level of selection based on SES-mix of the market that is unlikely to lead to access problems during the initial year of HHC.

While small, the significant effect was consistently found in several sensitivity analyses, suggesting that home health agencies respond rationally to changes in incentives, consistent with Porell et al.'s (2006) study, and that public reporting may create undesirable motives for agencies to drop areas with underserved populations. This is an important issue that should be further examined, particularly given that incentive-based payment schemes, such as pay for performance (P4P), could bring similar consequences. P4P is rapidly expanding and is planned for home health care. Future research is needed to assess whether agencies strategically choose areas to enter/exit in a long term after public reporting or incentive-based quality improvement programs.

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Appendix

Exhibit A1. Regression results from a market-level analysis

Dependent variable: Changes in the number of agencies in a market between 2002 and 2004			
Explanatory variables	Coefficient	Robust Std. Err.	
Socioeconomic status (SES)-mix of an area			
Low-SES indicator	-1.0521	(0.4994)	**
Other factors leading agencies to survive/fail shocks			
Number of home health care users	0.5579	(0.2057)	***
Number of therapy or nurse visit per episode	0.0483	(0.0633)	
Number of hospital admissions	-0.0019	(0.0013)	
Number of LTC facility beds	-0.0463	(0.0280)	
Number of nursing facility beds	-0.0921	(0.0664)	
Medicare Part A/B payment ($)	0.0339	(0.0129)	**
Distance (mile)	-0.0107	(0.0062)	*
Predicted Herfindahl index	-0.0107	(0.0124)	**
Constant	-16.163	(7.6998)	
N	22,391		

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Note: 1) State fixed effects are included in the model; 2) Standard errors are adjusted for clustering at the state level; 3) Other factors leading agencies to survive/fail shocks are measured at their 2002 baseline values.

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