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RESEARCH ARTICLE

Nursing Home Price and Quality Responses to Publicly Reported Quality Information

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Objective. To assess whether the release of Nursing Home Compare (NHC) data affected self-pay per diem prices and quality of care.

Data Sources. Primary data sources are the Annual Survey of Wisconsin Nursing Homes for 2001–2003, Online Survey and Certification Reporting System, NHC, and Area Resource File.

Study Design. We estimated fixed effects models with robust standard errors of per diem self-pay charge and quality before and after NHC.

Principal Findings. After NHC, low-quality nursing homes raised their prices by a small but significant amount and decreased their use of restraints but did not reduce pressure sores. Mid-level and high-quality nursing homes did not significantly increase self-pay prices after NHC nor consistently change quality.

Conclusions. Our findings suggest that the release of quality information affected nursing home behavior, especially pricing and quality decisions among low-quality facilities. Policy makers should continue to monitor quality and prices for self-pay residents and scrutinize low-quality homes over time to see whether they are on a pathway to improve quality. In addition, policy makers should not expect public reporting to result in quick fixes to nursing home quality problems.

Key Words. Quality, nursing homes, prices

Public quality reporting for health care providers has become widespread in the United States. The increased transparency resulting from report cards is expected to motivate providers to improve quality either to capture consumer demand or to enhance provider reputation (Berwick, James, and Coye 2003; Stevenson 2006). Report cards may also help to align provider prices with the quality of their services through value-based pricing and to facilitate value-based purchasing by consumers. However, both price and quality information must be available to purchasers in advance of receiving care for this kind of provider and consumer behavior to occur.

For most health care services in the United States, individual consumers lack relevant quality and price data. Thus, there is little incentive for providers to adjust their prices and quality to better align with each other. In particular, for many insured services, consumers only know what their copayments and deductibles will be and do not have information on provider prices net of allowable discounts. Consequently, even if some quality data are available, there is insufficient information on what consumers should expect to pay. This likely inhibits both value-based pricing and purchasing.

Conditions in the market for private (self) pay long-term care (LTC) nursing home services are different, however. Individual consumers or their family members can obtain the actual per diem nursing home price they will be billed in advance from a telephone call or meeting with an admissions staff member. Quality information for nursing homes became available in November 2002 when the Centers for Medicare and Medicaid Services (CMS) began posting six long and four short-stay quality measures (QMs) on the Nursing Home Compare (NHC) website (<http://www.medicare.gov/NHCompare>).¹ CMS introduced this effort with a media campaign to inform consumers.

We take advantage of the availability of price information and the introduction of quality data in the private nursing home market to assess whether nursing homes adjusted prices after the release of the NHC data; we also examine quality adjustments. Ours is the first research to examine both nursing home prices and quality after NHC. Although Medicaid is the dominant payer for nursing homes, there is substantial self-pay volume—33 percent of nursing home care expenditures in 2005 (Catlin et al. 2007). Since there is very little LTC insurance in the United States and the market penetration of LTC insurers is too low to negotiate prices or select providers, consumers act largely as individual purchasers in using price information (Coronel 2003). Self-pay per diem prices are available from state, but not national, databases. Consequently, we examine data for Wisconsin nursing homes for a period spanning 2 years prior and 1 year after the introduction of the NHC QMs, 2001–2003. Wisconsin nursing homes had a substantial percentage of self-pay residents (23 percent) during this period.

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PREVIOUS RESEARCH

There is little empirical research examining whether nursing home prices reflect quality either before or after the first NHC QM report. Ballou (2002) found little evidence of a relationship between quality and private pay price or markup among nursing homes in Wisconsin from 1984 to 1995. Stewart, Grabowski, and Lakdawalla (2009) report that private pay nursing home prices in the United States grew faster than both the medical care and consumer price indexes from 1977 to 2004. During the same period, the researchers describe an increase in two factors potentially related to quality—dedicated units for cognitively impaired residents and staffing. However, they were unable to conclude that nursing home price growth reflected quality improvement.

In a national survey of anticipated actions in response to poor NHC quality scores conducted in 2004, very few (4 percent) of the 724 responding nursing homes mentioned a price change, and those that did indicated a price increase (Mukamel et al. 2007). This contrasts with physician responses to the New York State Cardiac Surgery Reports in the early 1990s. Physicians with better reported coronary artery bypass graft surgery risk-adjusted mortality rates had subsequent higher rates of growth in charges (Mukamel and Mushlin 1998).

There is more empirical research about quality-related actions in response to NHC. The majority of respondents to the Mukamel et al. (2007) were aware of NHC and had investigated the basis and reasons for their NHC quality scores, but far fewer reported changes in protocols, work organization, resources, leadership, or other actions to affect their QMs. Facilities among those with the worst 20 percent of scores in the state were somewhat more likely to make changes than other nursing homes, but the difference was significant for only 4 of 22 possible actions. In a different survey of nursing home administrators in four states, the majority said they would use the NHC information to improve quality (Castle 2005).

Other research shows mixed results for the effect of NHC on QMs. Zinn et al. (2005) observed a significant downward trend (improvement) from the first to the fifth NHC quarterly reporting periods for five measures, but no clear trend for the other five QMs. However, they were unable to determine whether the changes were due to NHC or continuations of earlier trends. Mukamel et al. (2008b) compared nursing home performance on five of the QMs before and after NHC for the period 2001–2003. There were

statistically significant improvements in two of five measures (restraints and short-term pain) and worsening in one (pressure ulcers) after NHC compared to the prior period. Similarly, Werner et al. (2009) found that some, but not all, postacute QMs improved more for nursing homes subject to NHC reporting than for smaller nursing homes not subject to reporting. Finally, Castle, Engberg, and Liu (2007) found a 1-year average improvement in some NHC QMs, but almost the same number of QMs worsened.

CONCEPTUAL FRAMEWORK

Prior to NHC, limited consumer information existed on nursing home quality of care. Information related only to the most readily observable features of nursing facilities (e.g., amenities such as comfortable rooms, courteous staff, and cleanliness). Given this, the focus of competition for private pay patients likely focused on prices, for which information could be easily obtained, and those quality dimensions noted above. Nursing homes would choose prices and quality based on their perceptions of consumer valuations of price and observable quality dimensions, the costs of producing nursing home services, and the price/quality decisions of competing nursing homes in the market.

When NHC data were introduced to the market, nursing homes may have altered their price/quality decisions depending on how consumers reacted to these new data. If consumers did not value or understand the new information, or alternatively, if the NHC information simply confirmed their original expectations about quality differences across facilities, one would expect no change in the prices and quality of care offered by nursing homes. In essence, the release of NHC data would not have affected the way consumers viewed nursing homes in the market.

However, the release of the NHC data may have revealed greater quality differences present than previously believed. In this case, nursing home decisions about their product and pricing may have changed. Nursing homes identified by NHC as high quality likely experienced an increase in market power because they obtained a new way to differentiate themselves from their competitors in the market. As a result, these high-quality facilities may have decided to increase their prices. The extent to which they did so, however, would depend on the relative demand elasticities for price vis-à-vis quality among consumers. If demand elasticity for quality is high relative to price elasticity, nursing homes have greater ability to increase price without adversely affecting demand for their services. Alternatively, if consumers are

more sensitive to price differences than to quality differences, nursing homes may not have had substantial leeway to increase prices, even if it became apparent that they offered a higher quality product than others.

Nursing homes that NHC data identified as low quality also may have altered their decisions about quality and pricing. If consumers valued the NHC data and it affected their thinking about relative quality of different facilities, market pressures may have created downward pressure on the prices of nursing homes identified as low quality. However, in response, these homes may have been motivated to take short-term action to fend off potential reductions in demand and to justify maintaining or increasing their prices. They may, for example, have tried to improve more readily observable patient amenities to give consumers the impression that the NHC data may not be completely indicative of their true quality. In addition, they may also have improved staffing or processes related to those QMs that lend themselves to more rapid change so that consumers could be informed that NHC reports reflect old circumstances that have been rectified. These actions to improve consumer perceptions of their facility would add to costs of operation that would in turn affect prices. Indeed, Mukamel et al. (2010) reported that nursing home costs were affected following the implementation of NHC, especially among facilities identified as low quality. However, if consumers are highly responsive to price differences more so than to quality differences, nursing homes identified as low quality by NHC may choose to leave quality unchanged and instead lower prices.

Overall, there is substantial theoretical ambiguity about the potential effects of the release of NHC data on subsequent nursing home price and quality decision making. Effects on these decisions depend on the extent to which consumers view the information as useful to further distinguishing nursing homes based on the quality of their product. Given this theoretical ambiguity, empirical analysis is essential to assess how the release of NHC influenced nursing home pricing and quality decisions.

METHODS

Data Sources

The study data are derived from three primary sources. First, the Annual Survey of Wisconsin Nursing Homes for 2001–2003 conducted by the Wisconsin Department of Health Services provides data for price per day for LTC as well as organizational characteristics (WI 2001, 2002, 2003). Second, we use

NHC data collected prior to the first public report to determine the initial (pre-NHC) quality ranking of the nursing homes. Third, the Online Survey and Certification Reporting (OSCAR) System provides quality indicators for the pre- (2001–2002) and post- (2003) NHC periods as well as functional characteristics of the residents. To match the WI, OSCAR, and NHC data, we use a crosswalk of state license and Medicare provider numbers provided by the Wisconsin Department of Health and Family Services. To create additional market descriptors, we use data from the Area Resource File and the U. S. Census Bureau.

Dependent Variables: Price per Day and Quality of Care

Price is measured by the per diem charge for self-pay residents for long-term custodial care reported to the Wisconsin Department of Health Services. The rates for 2002–2003 are discounted to 2001 using the U.S. Bureau of Labor Statistics nursing home and adult day services annual inflation rates (BLS 2002, 2003). The variable is then transformed by the natural logarithm.

Although we do not have data with which to calculate the NHC quality indicators prior to 2002 for assessing changes pre- to post-NHC, two measures available from OSCAR are very similar to the NHC QMs, use of restraints and pressure sores (Table 1). We choose these because nursing home quality decisions would most likely focus on reported QMs. Each is transformed into natural logarithm form.²

Independent Variables

A key independent variable is nursing home quality relative to other nursing homes prior to NHC. Because they were subject to extensive testing, have been validated, and are relevant to consumers and providers, we used the six long stay measures (QMs) chosen by the CMS and the Nursing Home Quality Initiative for eventual reporting on the NHC website (Abt Associates 2003). We used data collected prior to the launch of NHC in November 2002—specifically during the second and third quarters of 2002. Although these QMs would later be published on the NHC website in November 2002 and February 2003, respectively, they reflect nursing home quality before the increased public transparency of quality information. Nursing homes with fewer than 30 residents at risk for a measure are not reported in the NHC data.

To develop the ranking, we averaged each of the six long stay NHC QMs over the two quarters in 2002 for non-hospital based nursing homes.

Table 1: Description, Data Sources, and Summary Statistics for Study Variables*

<i>Measures</i>	<i>Description</i>	<i>Data Source</i> [†]	<i>Mean (SD)</i>
Dependent			
Price	Private pay rate per day for long-term care (\$) [‡] discounted to 2001 [‡]	WI	145.38 (23.15)
Quality			
Restraints	(Residents with restraints/Total residents) × 100	OSCAR	5.93 (7.82)
Pressure sores	(Residents with pressure sores/Total residents) × 100	OSCAR	5.50 (3.26)
Independent			
High quality [§]	1, if in highest combined or individual long stay measure quality group; 0, otherwise	NHC	0.25 (0.44)
Low quality [§]	1, if in lowest combined or individual long stay measure quality group; 0, otherwise	NHC	0.25 (0.43)
High occupancy 2001	1, if in highest 25% occupancy group in 2001; 0, otherwise	OSCAR	0.25 (0.43)
Chain member	1 if chain member; 0, otherwise	WI	0.47 (0.50)
Percent Medicare	Percent Medicare residents on December 31 of year	WI	9.40 (6.34)
Percent Medicaid	Percent Medicaid residents on December 31 of year	WI	65.13 (13.71)
Acuity index	Weighted sum of activities of daily living index and special treatments index [¶]	OSCAR	9.49 (0.95)
Medicaid rate	Medicaid per diem rate	WI	111.14 (11.68)
Aged population	Number persons > 85 years of age in county/1,000	U.S. Census Bureau	3.99 (5.24)
Income	Per capita county income in county previous year/1,000	Area Resource File	27.87 (4.96)
Herfindahl index	$\sum (\text{Licensed bed share})^{2\dagger}$	WI	0.20 (0.18)
Nursing home year observations	881		

*Data for all variables are from 2001 to 2003 except for quality variables, which are for 2002 only; income, which is for 2000–2003; and high occupancy, which is for 2001. All data are for non-hospital-based nursing homes that report both price and quality information.

[†]OSCAR refers to Online Survey, Certification, and Reporting. NHC is Nursing Home Compare (<http://www.medicare.gov/NHCompare>). WI refers to Wisconsin Annual Survey of Nursing Homes.

[‡]Discounted to 2001 using the Bureau of Labor Statistics nursing home and adult day services annual December–December change (BLS 2002, 2003).

[§]Ranking created using data for nursing home average 2002 second and third quarter percentages for the six Nursing Home Compare long stay quality measures. See Abt Associates, Inc. (2003).

[¶]See Cowles (2003).

Then, we used two different approaches for determining statewide quartile rankings. First, we created an equally weighted sum of *z* scores using a statewide mean for all six long stay QMs, an approach adopted by Weech-Maldonado, Neff, and Mor (2003).³ Second, because consumers may attend to some QMs more than others, and there is disagreement on how to create good composite indicators (Nolan and Berwick 2006), we also created separate quartile rankings for the nursing homes for each short stay measure. With each approach, we created binary variables for the best and lowest performing quartiles, with the middle two quartiles serving as the referent group.

We control for chain membership, payer mix, and the nursing home's resident acuity index (Cowles 2003). In addition, the natural logarithm of the Medicaid price per day, which was suggested by Nyman (1994) and Gulley and Santere (2007) as a proxy for marginal cost, is included in the model.⁴

Market factors in the model are population aged 85 and older, per capita county income in the previous year, and competition. Competition is examined with a Herfindahl index of nursing home beds. The market is defined as the county. Despite some well-known limitations of geographic market boundaries, previous research has shown block grant funding is consistent with this market definition and that residents seldom migrate across county lines for nursing home care (Banaszak-Holl, Zinn, and Mor 1996; Grabowski 2008). Our other market measures are available at the county level as well.⁵

Study Sample

Our study group is comprised of nonfederal Wisconsin nursing homes offering LTC services. Since we examine LTC prices, facilities offering only short-term postacute or subacute care are eliminated from the sample, leaving 408 facilities in 2001 and 398 in 2003, a difference attributable to closures. For each study year, we were unable to match only one to five nursing homes in the WI database with OSCAR data and one to three matches with NHC data failed. Not included in the study are nursing homes with fewer than 30 residents at risk for a QM because NHC does not report their data.

For one of the components of the initial quality ranking variable, decline in activities of daily living (ADLs), we observed outliers in the change from the second to third quarter. Using the top and bottom first percentile for the change in this component, 10 nursing homes were eliminated. No other similarly large quarterly variations were observed.⁶ After excluding non-hospital-based nursing homes, the number of nursing homes in the study is

293 in 2001, 295 in 2002, and 293 in 2003. Excluded nursing homes tend to be smaller and more likely to be located in rural areas than the study nursing homes. They also have a lower private pay price, acuity, restraint use, pressure sore rate, and Medicare resident proportion.

Analyses

We assume that NHC was an exogenous event introducing data to the market that nursing homes could not influence or control and they did not take anticipatory action to change their quality or prices before the introduction of NHC. If nursing homes did not take anticipatory action, the base-year price and quality data reflect nursing home decision making during a period when consumers had poor-quality information.⁷ Our empirical approach exploits this fact.

As noted by Grabowski (2004) and others, endogeneity is a concern for modeling quality and price for private pay patients for nursing homes. Quality and price are determined jointly as nursing homes select production processes and inputs based on their assessment of market demand and consumer trade-offs in relation to quality and price. However, Grabowski (2004) had also noted the difficulty in identifying instruments for private pay price. Therefore, we estimate a reduced form model. For nursing home price or quality of care, it is

$$\begin{aligned}
 PQ_{it} = & \alpha_0 + \sum_{t=2001}^{2003} \alpha_1^t \text{Post\_NHC}_t + \alpha_2 \text{Post\_NHC} * \text{Highqual}_{i2002} \\
 & + \alpha_3 \text{Post\_NHC} * \text{Lowqual}_{i2002} + \alpha_4 \text{Post\_NHC} * \text{Highoccup}_{i2001} \\
 & + \alpha_5 \text{NH}_{it} + \alpha_6 \text{Market}_{it} + \theta_i + \varepsilon_{it}
 \end{aligned}$$

where t references time period and i references nursing homes, Highqual and Lowqual are indicators for high/low quality prior to the first posting of data on the NHC website, NH_{it} represents nursing home characteristics, Market_{it} represents market characteristics that affect supply and demand, α represents parameters to estimate, θ represents nursing home specific error component, and the remaining variable is the random error term. Note that the high-, mid-range, and low-quality indicators are defined at one point in time. They do not change from period to period because their values after NHC could be affected by the first release of quality information. Thus, we are examining the effects of the initial introduction of NHC on quality and price in the years

after this initial introduction. Since we estimate fixed effects models, the time invariant initial quality rankings are not entered as a separate variable in the model (Lindrooth, LoSasso, and Bazzoli 2003).

The fixed effects price and quality models are estimated for the same group of nursing homes, those reporting both price and quality, with OLS and robust standard errors. Hausman tests rejected the null hypothesis that coefficient estimates from a random effects model had no systematic differences from a fixed effects model ($p < .05$ – $p < .001$).

RESULTS

Descriptive statistics for the study variables are shown in Table 1. Table 2 shows the average price by quality ranking both before and after NHC. Overall and during both periods, the highest quality nursing homes had the highest average private pay price per day followed by the mid-level and then the low-quality nursing homes. However, the price differences were not statistically significant.

Table 3 summarizes the effect of initial quality on change in price following NHC from the estimates of the multivariable models ranking with the composite as well as each NHC long stay QM. Full results for the price and quality models are in the Supporting Information. In the top panel of Table 3, the results for the composite and two individual NHC quality ranking models

Table 2: Price by 2002 Initial Quality Ranking, All Years, and before (2001–2002) and after (2003) Nursing Home Compare Initial Data Release, Wisconsin Nursing Homes*†

Quality‡	Average Private Pay Price per Day, 2001–2003 (U.S.\$)	Average Private Pay Price per Day, 2001–2002 (U.S.\$)	Average Private Pay Price per Day, 2003 (U.S.\$)
Lowest	\$143.80	\$143.30	\$144.78
Middle	\$144.57	\$144.58	\$145.55
Highest	\$148.52	\$148.42	\$148.73

*Price is discounted to 2001 dollars using U.S. Bureau of Labor Statistics nursing home and adult day services annual inflation rates (BLS 2002, 2003).

†An ANOVA shows no significant differences in price by quality for entire study period or during either subperiod. *T* tests of pre- and postprice for each quality category show no statistically significant differences.

‡Quality rankings are determined from *z* scores using statewide averages and data collected during the second and third quarters of 2002.

Table 3: Effect of Baseline Quality Ranking on Change in Private Pay Price per Day pre- to post-Nursing Home Compare for Wisconsin Nursing Homes[†]

<i>Nursing Home Compare Quality Measure for Ranking</i>	<i>Individual Long Stay Nursing Home Compare Measures</i>				
	<i>Composite Measure[‡]</i>	<i>ADL Decline</i>	<i>Pressure Ulcer, Not Adjusted</i>	<i>Pressure Ulcer, Adjusted</i>	<i>Pain Restraints Infections</i>
Baseline relative quality [§]					
Low quality	0.013 [†] (0.008)	0.009 (0.007)	0.008 (0.008)	0.007 (0.009)	0.012 0.014 [†] 0.012 [†] (0.008) (0.008) (0.007)
Mid-level quality	0.004 (0.005)	0.007 (0.006)	0.007 (0.006)	0.006 (0.005)	0.002 0.005 0.006 (0.006) (0.005) (0.006)
High quality	0.008 (0.007)	0.006 (0.007)	0.007 (0.007)	0.009 (0.006)	0.013* 0.006 0.005 (0.006) (0.008) (0.006)
By private pay percent in 2001 ^{**}					
Low quality, >median percent	0.022* (0.011)	0.13 (0.010)	0.011 (0.010)	0.007 (0.012)	0.027* 0.019 [†] 0.019 [†] (0.011) (0.010) (0.010)
Low quality, ≤ median percent	0.005 (0.011)	0.010 (0.009)	0.007 (0.012)	0.009 (0.013)	0.003 0.009 0.013 (0.010) (0.011) (0.011)
Mid-level quality, >median percent	0.005 (0.008)	0.008 (0.007)	0.007 (0.009)	0.012 [†] (0.006)	0.004 0.009 0.006 (0.008) (0.007) (0.009)

continued

Table 3. *Continued*

Nursing Home Compare Quality Measure for Ranking	Individual Long Stay Nursing Home Compare Measures				
	Composite Measure [†]	ADL Decline	Pressure Ulcer, Not Adjusted	Pressure Ulcer, Adjusted	Pain Restraints Injections
Mid-level quality, ≤ median percent	0.006 (0.008)	0.009 (0.008)	0.009 (0.008)	0.004 (0.008)	0.003 0.001 0.005 (0.008) (0.007) (0.008)
High quality, >median percent	0.011 (0.008)	0.015 (0.009)	0.017* (0.008)	0.014 [†] (0.008)	0.011 0.005 0.012 (0.008) (0.010) (0.008)
High quality, ≤ median percent	0.007 (0.011)	-0.005 (0.009)	0.008 (0.010)	0.007 (0.010)	0.017 [†] 0.012 0.001 (0.010) (0.011) (0.009)

[†]Price models were estimated only for nursing homes for which quality data were available. Private pay price is the natural logarithm of the reported price. Data are for 2001–2003. Nursing home year observations total 871 for 2001–2003.

[‡]The baseline quality ranking is formulated using Wisconsin state data collected in the second and third quarters of 2002, prior to the implementation of Nursing Home Compare in November 2002, for the six Nursing Home Compare long stay quality measures. See Abt Associates, Inc (2003). High quality is the best performing quartile while low quality is the worst performing quartile.

^{*}The composite quality ranking is formulated with summed z scores using statewide averages, which is then divided into quartiles.

^{**}There are 436 nursing home year observations in the above median private pay percent group and 435 in the below median group.

[†] $p < .10$,

^{*} $p < .05$,

ADL, activities of daily living.

show that low-quality nursing homes increased price after NHC but the statistical significance of the coefficients is only marginal ($p < .10$).

However, it is possible that dependence on private pay residents would affect the nursing home's pricing decision. Our models do not include the percentage of private pay residents in the empirical model because it would be endogenous. Therefore, we split the sample by median private pay percentage in 2001 and estimated the price model. The second panel of Table 3 shows that low-quality nursing homes that were more reliant on private pay residents (above median percent) raised prices significantly after NHC when using the composite and three of the individual QM rankings. However, low-quality nursing homes that were less reliant on private pay residents did not significantly increase prices pre- to post-NHC.

The results presented in the top panel of Table 4 provide evidence that low-quality nursing homes increased quality (lowered rates) after NHC on one of the two measures, use of restraints, and did not significantly change the rate of pressure sores.⁸ Mid-level and high-quality nursing homes showed no improvement in the QMs post-NHC. Similar to the price models, we split the sample by the 2001 percentage of private pay residents. Unlike the top panel, the bottom half of Table 4 tells a slightly different story about changes in nursing home behavior. For low-quality nursing homes, those with an above median percentage of private pay residents improved quality as measured by use of restraints, but nursing homes with fewer private pay residents did not. Results for mid-level and high-quality nursing homes, which did not increase price significantly post-NHC, were inconsistent. High-quality nursing homes with more private pay residents both improved and lowered quality. Mid-level quality homes improved restraint use when there were more private pay residents but lowered quality when there were fewer of these residents.

DISCUSSION

This study examined nursing home self-pay prices and quality adjustments after NHC made quality information more transparent using Wisconsin nursing home data for a period before and after the introduction of the NHC QMs. The results provide some evidence that low-quality nursing homes increased prices after NHC but high-quality and mid-level quality facilities did not. The size of the effect among low-quality nursing homes is small, 2.2 percent for the nursing homes with an above median percentage of private pay residents. This translates into approximately a U.S.\$3.15 increase in

Table 4: Effect of Baseline Quality Ranking on Change in Quality Pre- to Post-Nursing Home Compare (NHC) for Wisconsin Nursing Homes[†]

NHC Quality Measure for Baseline Ranking [§]	Composite [†]		Pressure Ulcer, Not Adjusted		Restraints
	OSCAR Pressure Scores	OSCAR Restraints	OSCAR Pressure Scores	OSCAR Restraints	
Quality Measure for Outcome ^{**}					
Low	0.024 (0.112)	-0.440* (0.183)	-0.028 (0.129)	-0.360* (0.168)	
Mid-level	0.195* (0.091)	-0.163 (0.136)	0.071 (0.089)	-0.204 (0.139)	
High	0.029 (0.171)	-0.201 (0.224)	0.162 (0.166)	-0.078 (0.241)	
By private pay percent residents in 2001 ^{§§}					
Low quality, > median percent	-0.077 (0.173)	-0.527 [†] (0.279)	-0.140 (0.189)	-0.628* (0.274)	
Low quality, ≤ median percent	0.139 (0.159)	-0.325 (0.226)	0.154 (0.160)	-0.099 (0.176)	
Mid-level quality, > median percent	0.144 (0.140)	-0.384 [†] (0.198)	0.016 (0.129)	-0.468* (0.191)	
Mid-level quality, ≤ median percent	0.279* (0.131)	0.037 (0.206)	0.216 [†] (0.124)	0.039 (0.195)	
High quality, > median percent	0.183 (0.167)	-0.658* (0.308)	0.473** (0.175)	-0.338 (0.372)	
High quality, ≤ median percent	-0.135 (0.262)	0.274 (0.318)	-0.039 (0.258)	0.133 (0.336)	

[†]Quality models were estimated only for nursing homes that reported a private (self) pay price per day. The quality dependent variables are percent-ages of residents and are transformed by the natural logarithm. Data are for 2001–2003. Nursing home year observations total 871 for 2001–2003.

[§]The baseline quality ranking is formulated using Wisconsin state data collected in the second and third quarters of 2002, prior to the implementation of Nursing Home Compare in November 2002, for the six Nursing Home Compare long stay quality measures. See Abt Associates, Inc (2003). High quality is the best performing quartile while low quality is the worst performing quartile.

^{††}The composite quality ranking is formulated with summed z-scores using statewide averages, which is then divided into quartiles.

^{§§}Dependent variables transformed by natural logarithm.

^{§§§}There are 436 nursing home year observations in the above median private pay percent group and 435 in the below median group.

^{†††} $p < .10$,

^{††††} $p < .05$,

^{†††††} $p < .01$,

OSCAR, Online Survey, Certification, and Reporting.

private pay price per day. For a nursing home at the group's mean pre-NHC price per day, U.S.\$141.96, a private pay resident staying a full year would pay U.S.\$1,150 more annually. For low-quality nursing homes with a private pay percentage above the median, the pre-NHC average licensed bed size was 90.38 and the mean percent private pay percentage was 32.98. Thus, over the course of a year, the total revenue increase would be about U.S.\$34,274, perhaps enough to initiate a quality improvement effort.

To assess whether nursing homes adjusted quality in response to NHC, the study was limited to two OSCAR QMs that are similar to the reported NHC QMs. The results show that, overall, low-quality nursing homes lowered use of restraints but mid-level and high-quality nursing homes showed no consistent quality improvement. Zinn et al. (2005) and Mukamel et al. (2008b) found a decrease in use of physical restraints in a national study during this period, but they did not examine changes by initial quality level. The lack of improvement for any quality group for pressure sores in our study is consistent with national data (Mukamel et al. 2008b). Not only may pressure sores be more difficult to improve than restraint use, reducing restraints has received much attention from policy makers and nursing home advocates over the past decade or longer. It is impossible to separate fully the effects of these efforts from the effect of NHC, but it is interesting that our results suggest that the improvement was concentrated in pre-NHC low-quality nursing homes with a high percentage of private pay residents.

Both the price and quality change for low-quality nursing homes occurred primarily in nursing homes with more private pay residents. These nursing homes would be especially sensitive to the quality preferences of private pay residents and, as a result, would likely move to improve their reported quality. Increasing price to the one payer where the nursing home has some control would be a means to generate funds. Although it may seem counterintuitive to charge private pay residents more, because it could decrease demand, it is important to remember that these are long stay residents. Previous research shows few transfers to new nursing homes once someone becomes a resident (Hirth, Banazok-Hull, and McCarthy 2000).

The results suggest that the release of the NHC quality data had an important effect on nursing home behavior. The new information likely broadened the focus of competition from prices and the quality of amenities for which information could previously have been observed to include quality of care measures. In response, low-quality nursing homes did not lower price to reflect their initial quality level. Instead, the study results suggest that they may have decided to improve quality and increase price, possibly

passing on higher costs of production to consumers. Estimation of a full cost function would be necessary to examine this possibility, but that is beyond the scope of our study. However, our results are consistent with those of Mukamel et al. (2010) who showed that nursing homes increased the ratio of clinical to hotel costs following publication of the NHC report card and that the effect was stronger among low-quality nursing homes. In our study, high-quality nursing homes did not improve quality. Nor did they increase prices significantly after NHC. It is also important to note that high-quality nursing homes did not lower their quality to be consistent with that of other facilities. If nursing homes solely sought to maximize profit and if producing quality is expensive, some facilities may have reduced quality to save money and increase profits.

Like other studies, our study has limitations. First, because self-pay per diem prices are not generally available, we studied nursing homes in one state, Wisconsin, which may affect the generalizability of the results. In particular, in the second and third quarters of 2002, Wisconsin nursing homes had statistically significantly better performance on the pressure sore and restraints NHC QMs than nursing homes nationally. In contrast, compared to nursing homes across the United States, their performance on the infections QM was worse and there was no difference on the ADL decline and pain. However, like other nursing homes nationally, overall, there was improvement on the restraints QM but not for pressure sores. Thus, it is not likely that these differences affected the study results. Future research should examine price and quality in other states. In particular, for states with larger sample sizes than we obtained in Wisconsin, it would be interesting to examine how within market price differentials affect nursing home price and quality decisions.

Second, given the multidimensional nature of quality, it is difficult to rank nursing homes on quality prior to NHC and to evaluate quality afterward, a problem also confronted by consumers, policy makers, and others including pay-for-performance programs. One strength of our initial quality ranking method is that it relied upon measures that would be publicly released. However, there may have been improvement in aspects of quality not measured by the study, such as those noted by Zinn et al. (2010), or that it will take a period longer than what we studied to observe quality improvements. Price changes are not difficult to implement in the short run, whereas quality improvement efforts may take longer to show results. Third, risk adjustment of the QMs is limited (Mukamel et al. 2008a) and, although we controlled for differences in resident characteristics with the

acuity index, we cannot be certain that all differences in risk were eliminated. Fourth, there is no control group, which limits the model's ability to control for secular trends. Finally, we studied the period immediately following the release of the first set of NHC data. It is possible that price and quality adjustments may take time to materialize and may be more evident after nursing homes and consumers became more familiar with the data.

Despite these limitations, the findings from this study provide insights on nursing home price and quality decisions when new quality information is released. The higher price growth among low-quality facilities may eventually translate into higher quality on measures other than restraint use, but additional study is needed. Policy makers need to monitor price changes for self-pay residents and to scrutinize low-quality nursing homes over time to determine whether they are on a pathway to improve care. Public reporting must be combined with regulatory and other measures to address quality especially for the nursing home industry, which has long been plagued by concerns about poor quality of care, and because the market for long-term residential services is one with an important self-pay component where individual consumers are the decision makers rather than large third-party payers.

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NOTES

1. Although CMS had historically provided data to consumers on nursing home deficiencies beginning in 1998, NHC provided additional measures that could help consumers judge relative quality better across facilities. See Zinn et al. (2005) for a more complete description of launch of NHC.
2. Because the natural logarithm of zero does not exist, we added a small number to those values (0.1) before taking the logarithm.

3. Statewide performance benchmarking is consistent with how NHC presents that data for an individual nursing home.
4. The Wisconsin Medicaid payment methodology is a prospective facility specific rate based on last year's costs with a flat rate for support services (Miller et al. 2009).
5. See Grabowski (2008) for a more complete discussion of the limited research concerning LTC market definitions.
6. The percentage point change over the two contiguous quarters was so large for this QM (24–53 percentage points) that it raised concerns. Further, it was not repeated for any of the other QMs. The nursing homes were unremarkable; they were similar to the other nursing homes in the study with regard to bed size, payer mix, or market characteristics.
7. Lu (2009) examined changes in nursing home care processes for facilities participating in the NHC state pilots relative to changes in facilities in nonpilot states for the second and third quarters of 2002. Her findings suggest that nursing homes in pilot states did not make anticipatory changes in care processes prior to NHC.
8. We also tested the quality models using 2001–2004 data. The statistical significance of the coefficient is higher when using these data than that for the 2001–2003 data, suggesting that although there was a near term effect, low-quality nursing homes may have been able to achieve even better quality improvements during a longer time period.

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SUPPORTING INFORMATION

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

Appendix SA1: Author Matrix.

Table A1: Full Results for Price Models.

Table A2: Full Results for Quality Models.

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