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## Ownership and Quality in Markets with Asymmetric Information: Evidence from Nursing Homes

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# Ownership and Quality in Markets with Asymmetric Information: Evidence from Nursing Homes\*

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## Abstract

The ownership and governance of for-profit (FP), nonprofit (NP), and local government (LG) organizations are different. Therefore, the objectives of these different types of organizations and their performance may differ. We conjecture that in markets where there is substantial asymmetric information between providers and customers, FP firms, LG organizations and NP organizations provide similar levels of quality attributes that are observable to their customers and are well understood by them. However, FP firms are likely to provide lower levels of less-well observed and less-well understood desirable but costly quality attributes than their NP and LG counterparts. Using a rich dataset, we study the quality of outcomes for Minnesota nursing homes, which do not compete on prices. We find support for our theoretical conjectures: FP homes provide lower quality on a number of dimensions, especially those that are less observable by nursing home residents and their families.

**KEYWORDS:** ownership, quality, asymmetric information, nursing homes, for-profit firms, nonprofit organizations, local government organizations

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## Introduction

For-profit (FP), nonprofit (NP) and local government-owned (LG) organizations have different objectives, linked to their different ownership structures, leading to differentiation in their products (e.g., Hansmann 1996). When organizations compete in the same markets, are subject to the same regulations and draw key employees from the same labor markets, these differences may wane (see, for example, DiMaggio and Powell 1983; Brown and Slivinski 2006; and various chapters in Weisbrod 1988). Competition compels organizations to provide similar levels of observable attributes, which allows customers to judge the tradeoff between price and observable quality. However, in the presence of asymmetric information, differences in less observable attributes may remain. In particular, FP firms have a financial incentive to undersupply high quality on less observable and less-well understood but desirable attributes because they are costly to produce.

Disentangling the effect of ownership on quality attributes is complex and confounded by firms' pricing strategies. For example, FP firms may pursue a low price and low quality strategy while NP firms may pursue a high price and high quality strategy. Alternatively, FP firms may provide lower quality in unobserved dimensions in order to gain profit under the veil of asymmetric information.

In this paper, we investigate the role of ownership for quality focusing on nursing homes in Minnesota where, by law, all residents with the same medical condition must be charged the same price at all nursing homes, irrespective of the source of payment or quality of care. This unique setting allows inference about quality by excluding the possibility of price competition. Furthermore, all firms, regardless of ownership type, are part of the same political and regulatory jurisdiction. Our study design exploits differences in the degree of observability of quality attributes by consumers. We conjecture that, in the presence of asymmetric information, the three types of organizations, FP, NP and LG, provide similar levels of observable quality attributes. However, NP firms will provide higher levels of unobservable quality attributes than FP organizations, and possibly more than LG organizations.

A nursing home is a residence for individuals with physical or mental problems that prevent them from living independently. Residents receive meals, assistance with daily activities and medical care, but not the extensive or intensive care provided by a hospital. Some nursing homes specialize in different types of care or medical conditions, but the majority of homes have residents with diverse medical conditions and ages.

Asymmetric information is of particular concern in the nursing home market. Typically, nursing home residents are frail and vulnerable individuals who often enter a nursing home under the duress of a medical event that

necessitates removal from their own homes, usually after first receiving intensive care in a hospital. Therefore, for reasons of limited cognitive capacity, residents are commonly in a position of informational and power disadvantage. Their family members cannot observe the substantive aspects of most of the care their relatives will receive in nursing homes, or make sense of their quality. Thus, they are reduced to observing facilities and other factors that may have little, if any, impact on the nature and quality of care. This places family members, who generally make nursing home decisions, at a great informational disadvantage.

Nursing homes are subject to state and federal regulations that prescribe minimum practices concerning standards of care, housing, food, and more. Regulators collect information about residents, staffing, quality of care and other matters, perform scheduled and unannounced inspections, issue letters of deficiencies when regulations are not met, and, sometimes, impose fines. Most observers agree that regulation raises the standards of care beyond those which would otherwise prevail. Improvements in data collection and enforcement have dramatically changed the situation from that reported by Vladeck (1980). However, the problem of asymmetric information runs deep and it is difficult for even professionally-trained observers to detect all problems.<sup>1</sup> Thus, there is ample opportunity for providers to take advantage of the residual asymmetric information and the limited ability to comprehend what can be observed. Furthermore, one may presume that the incentives of FP firms will make them more likely to take advantage of these opportunities than NP and LG nursing home operators.

There have been several empirical comparative investigations of the quality of FP and NP (but none of LG) provision of nursing home services, but these studies generally focus on one or just a few indicators, typically regulatory deficiencies (Chou, 2002; O'Neill et al., 2003, Grabowski and Stevenson, 2008). Schlesinger and Gray (2006) review studies on nursing homes and report that most studies conclude that NP homes, in general, provide higher quality.<sup>2</sup>

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<sup>1</sup> In a report to the US Congress, the Government Accountability Office summarizes some of its findings as follows: "In the five large states we reviewed, federal surveyors concluded that the state surveyors had missed serious deficiencies in from 8 percent to 33 percent of comparative surveys ...". Moreover, enforcement is imperfect, so that homes found to violate regulations, even if they have done so repeatedly, are not always penalized (GAO 2007).

<sup>2</sup> Other studies substantiate Schlesinger and Gray's (2006) conclusions. Stevenson (2006) found that the incidence of consumer complaints in FP nursing homes is twice as high as that in NP homes, and Ballou (2005) found that Wisconsin consumers who pay their own nursing home expenses favor NP homes over FP and LG homes. Hirth, Banaszak-Holl, Fries and Turenne (2003) found that residents are more likely to transfer out of low quality than out of high quality homes, and FP residents are more likely than NP residents to transfer. Grabowski and Castle (2004) found that a higher NP market share is associated with higher quality in both FP and NP homes.

Our study makes a contribution by empirically identifying the effect of ownership on quality in the absence of confounding price competition. More importantly, we study a rich set of quality attributes and differentiate between their degrees of observability by consumers to investigate differences that are likely to be associated with the organizational objectives of FP, NP, and LG in the presence of asymmetric information.

We use data from all of the nursing homes in Minnesota that participate in Medicare and Medicaid drawn from: (1) the Online Survey, Certification, and Reporting database of the federal Centers for Medicare and Medicaid Services (OSCAR), (2) the Minnesota Department of Health (MDH), and (3) the Minnesota Department of Human Services (MDHS). For the year 2006, the datasets are linked for 367 homes: 99 FP, 219 NP, and 49 LG. We estimate seemingly unrelated regression (SUR) models that relate ownership of the nursing homes to quality outcomes.

To account for the general concern that unobserved factors may influence both the ownership type and nursing home quality, we take several approaches. First, the quality outcomes are risk-adjusted to account for residents' gender, age, length of stay and prior health condition. For outcomes that are not available in a risk-adjusted format, we control for the average case-mix index of the nursing home. Nevertheless, to the extent that selection is driven by unobserved resident severity, observed risk adjustment factors or the case-mix index may not fully account for the endogeneity bias. Second, we include a rich set of market-level factors to control for market-level demand and preferences for quality that may be correlated with both the entry/exit of NP versus FP and LG nursing homes and their quality outcomes. Third, we exploit the fact that we observe multiple nursing homes in the same county and account for county specific unobserved factors by including county-level fixed effects. Fourth, we conduct a sensitivity test excluding these characteristics and the county-level fixed effects to assess the impact of their omission on parameter estimates. While this is not a formal test of endogeneity, it allows for an examination of selection based on observed characteristics and serves as a guide to assess the extent of potential selection based on unobservable characteristics (Altonji, Elder and Taber, 2005). An ideal approach would use an exogenous variation that affects the ownership type, but not the quality outcomes. However, finding such an instrumental variable is inherently difficult as we discuss further below.

We find that compared to FP homes, NP homes provide better or at least no worse levels of quality of outcomes. The equal outcomes are concentrated amongst the more observable outcomes whereas the superior outcomes belong to the category of outcomes that we judged as being less observable, particularly to residents' family members.

## **Conceptual Framework**

An organization's broad goals depend on the identity of its principals. In FP firms, the principals are equity owners who want to maximize the returns on their investments. In NP organizations, the principals are members of the board of directors who not only have fiduciary duties towards the organization but also are not legally required to pursue specific goals. However, the goals of NP board members are typically related to the product of the organization – its quality and quantity – and its beneficiaries (Weisbrod 1998).<sup>3</sup> The principals of LG organizations are the constituents who exercise their rights through elected officials. The goals of these organizations may be similar to those of NP organizations (Warner and Hebdon 2001).

The attributes of a product may be classified by the degree of asymmetric information between sellers and customers, ranging from observable to unobservable attributes (Weisbrod and Schlesinger 1986). In a nursing home, the size of residents' rooms, the quality of food, the appearance of facilities and the ratio of nursing staff to residents are relatively observable even to a weekend visitor. In contrast, partially-incapacitated residents have limited ability to judge the details of the services they receive separately from the effects of their own condition and may be unable to communicate their needs and their perception of the quality of services they receive to members of their family; these details are not discernible by a visiting relative.

While competition compels organizations to provide similar levels of observable attributes, it does not have the same effect on unobservable or difficult to evaluate attributes. Repeat purchases, publicly-available information, such as *Consumer Reports*, news reports, and reputation can form the basis for competition on attributes that are not commonly observable at the time of purchase or that remain largely unobservable even after purchase. In the case of nursing homes, the effectiveness of such mechanisms is limited because most people have only one nursing home experience, each experience is unique, and most experiences are, by the very circumstances of how and why people end up in nursing homes, preordained to have an undesirable ending. Providers of a service may be able to provide low quality unobservable elements even if these are desired by customers because they cannot observe actual delivery. FP firms have

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<sup>3</sup> Nonprofit directors cannot be sued by donors or customers (except in a subset of membership organizations) for straying from certain goals. State Attorney Generals have standing to sue, but not with respect to the pursuit of specific goals. For example, the board of a nonprofit university can decide to expand its educational mission to other countries without any legal challenge. However, if board members of a for-profit university decided to pursue goals such as research that did not hold the promise of profits they could be sued by shareholders. For discussions of boards' duties, see Ben-Ner (1994) and Brody (2006).

a financial motive to undersupply these elements because their production is costly.

A common rationale for NP and LG organizations' existence is the protection of customers when asymmetric information is severe (Arrow 1963; Hansmann 1980; Hirth 1999), so taking advantage of customer informational disadvantages would undermine their fundamental objectives. The rationale for the existence of other NP and LG organizations is to provide public goods when FP firms do not provide them (Weisbrod 1988). In these instances, the undersupply of unobservable attributes would allow them to shift resources from quality to quantity. Nursing homes do not provide public goods, and in the specific case of Minnesota, access is provided to all in need. Hence cutting on unobservable quality cannot support a major organizational goal. We hypothesize that NP organizations provide higher levels (quality) of unobservable attributes than FP firms, and LG homes provide no more than NP homes because of their more severe agency problems.

### Empirical Specification

The services of nursing homes and their various attributes are produced directly by nursing inputs, and other factors, such as support staff and facilities. We adopt a production function framework whereby each quality outcome is produced by the inputs of the nursing staff, controlling for various organization and regional characteristics, and is augmented by organization-type-indicators.<sup>4</sup> The input of the nursing staff is the *number of hours per day* provided by RNs and LPNs (combined) and by CNAs.

We use a standard log-linear Cobb-Douglas specification of the production function:

$$\ln y = \ln \alpha_0 + \beta_0 NP + \gamma_0 LG + \alpha_1 \ln L1 + \alpha_2 \ln L2 + \eta Z + u \quad (1)$$

where  $y$  is the outcome of interest,  $L1$  is the input of RNs and LPNs and  $L2$  the input of CNAs,  $NP$  is a dummy variable that equals 1 if the organization is NP and 0 otherwise,  $LG$  is a dummy variable that equals 1 if the organization is LG and 0 otherwise (FP is the omitted dummy variable),  $Z$  is a vector of nursing home and regional characteristics that may affect outcomes, and  $u$  is the error term. The coefficient estimates  $\beta_0$  and  $\gamma_0$  reflect the percentage difference in outcome  $y$  associated with NP and LG relative to FP, respectively.

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<sup>4</sup> We do not have the inputs of non-nursing labor and capital. To understand the significance of the omission of other inputs, note that we include three types of nursing staff, RNs, LPNs and CNAs, whose combined wages account for 81% of nursing home revenue (based on 121 responses to a 2007/8 survey we administered to all the nursing homes included in this study).

In analyses such as this, there is a general concern that factors the researcher cannot observe may influence both the ownership type and nursing home quality. For example, nursing home rates (if not set exogenously by the regulators) may be correlated with FP or NP entry and exit and at the same time influence quality outcomes. Alternatively, markets with higher unobserved demand or stronger preferences for quality may have a larger number of NPs and at the same time higher levels of nursing home quality. In contrast, individuals who are sicker and need higher quality care may choose NP nursing homes, potentially making it more complex and costly to provide high quality care. Similarly, FP nursing homes may admit residents with less severe medical conditions because it is less costly to provide high quality care.

In our application nursing home rates in Minnesota are set exogenously to reflect local market conditions such as wages and cost of living and resident CMI rather than competitive pressures in the nursing home market. The absence of price competition amongst nursing homes alleviates concerns about ownership type endogeneity. However, unobserved demand for quality or admittance of residents into NP and LG versus FP nursing homes based on unobserved severity may still bias our estimates.

An ideal approach would require an exogenous variation that affects the ownership type, but not the quality outcomes. Previous studies have utilized several instruments. Chou (2002) used state-level population density (to capture demand), Medicaid reimbursement type (flat rate or not) and Medicaid reimbursement rate (to capture the level of public subsidy), and the number of nursing home beds relative to the population over 65 (to capture the competitive environment) as instrumental variables that are related to the ownership type. Similarly, Grabowski and Hirth (2003) used growth in demand for nursing home care and NP hospital market shares (to capture the environment/perception for NPs) as instruments.

However, the instrumental variables listed above each have their drawbacks. For example, the demand for nursing homes is likely to be correlated with the quality of nursing homes. The competitive structure of the nursing home market may also influence quality outcomes. Areas with more nursing homes would likely have stronger quality competition as well. In fact, Grabowski and Hirth (2003) use the county-level nursing home market Herfindahl index (HHI) as a control variable. The entry of NPs in the hospital market could also influence nursing home quality indicators because, as Grabowski and Hirth (2003) acknowledge, nursing homes and hospitals compete on certain services. The generosity of the state's Medicaid reimbursement is likely to be exogenous as no single nursing home can affect it. However, the relative generosity of Medicaid reimbursement rate and private market nursing home rates could influence both the quality outcomes and the ownership type.



To address the concerns surrounding the unobserved demand for quality and selection bias discussed above (either bias due to resident selection of nursing homes or due to nursing home selection of residents), we take several approaches. First, the quality outcomes are risk-adjusted to account for residents' gender, age, length of stay and prior health condition. For outcomes that are not available in a risk-adjusted format, we control for the average case-mix index of the nursing home. Nevertheless, to the extent that selection is driven by unobserved resident severity, observed risk adjustment factors or the case-mix index may not fully account for the endogeneity bias.

Second, we include a rich set of market-level factors to control for market-level demand and preferences for quality that may be correlated with both the entry/exit of NP versus FP and LG nursing homes and their quality outcomes. These include the nursing home rates and the five-digit zip-code level characteristics (discussed below in the Data section), including demographic and socio-economic conditions. One of the zip code characteristics is the percentage of the population over the age of 65, which captures the demand for nursing homes as in other studies. In summary, while previous literature has used some of these variables as instrumental variables, we use them as control variables because they could influence quality outcomes.

We take this strategy one step further by exploiting the fact that we observe multiple nursing homes in the same county. Only 2.5% of the nursing homes in the sample are the only nursing home in their county. Eight percent are in a county with two nursing homes, 8% with three nursing homes, and the rest are in counties with four or more nursing homes. We account for county specific unobserved factors by including county-level fixed effects.

We conduct a sensitivity test excluding these characteristics and the county-level fixed effects to assess the impact of their omission on parameter estimates. While this is not a formal test of endogeneity, it allows for an examination of selection based on observed characteristics and serves as a guide to assess the extent of potential selection based on unobservable characteristics (Altonji, Elder and Taber, 2005).

Finally, we examine quality outcomes that vary in their degree of observability and we do not expect to find an effect of ownership type on quality for outcomes that are more observable to residents and their families because NPs, LGs and FPs compete on these observable outcomes. However, if our approaches above (case-mix adjustment, inclusion of rich set of market-level factors and county fixed effects) do not sufficiently account for the potential endogeneity concerns, we would observe spurious correlation between ownership type and even the quality outcomes that are more observable. Although this is not a formal falsification test, the fact that we do not observe such correlation is reassuring that our empirical strategy addresses endogeneity concerns.

## **Data and Measures**

Data concerning all of the nursing homes in Minnesota that participate in Medicare and Medicaid were drawn from: (1) the Online Survey, Certification, and Reporting database of the federal Centers for Medicare and Medicaid Services (OSCAR), (2) the Minnesota Department of Health (MDH), and (3) the Minnesota Department of Human Services (MDHS). For the year 2006, the datasets are linked for 367 homes: 99 FP, 219 NP, and 49 LG.<sup>5</sup> Table 1 provides definitions of the variables, descriptive statistics, and data sources.

The OSCAR dataset provides information about nursing home ownership, capacity, nursing inputs, violations of regulations, the health condition of residents, and more. The data are collected in accordance with federal laws and regulations, supplemented by Minnesota laws and regulations. The MDH data includes nursing home quality indicators constructed from information reported regularly by nursing homes. There are 23 quality indicators adjusted for resident case mix (health condition and the need for care), covering diverse areas and dimensions of care (psychosocial, continence, infections, accidents, nutrition, pain, skin care, administration of antipsychotic medication, and functioning). The MDHS data include items from a survey administered to a sample of residents in every Minnesota nursing home. Residents are interviewed during a site visit and asked to respond using one of the following responses: generally yes, generally no, and don't know/not applicable/no response. All measures were adjusted by MDHS to reflect resident's medical condition, length of stay, demographic and other characteristics as well as home characteristics. The survey covers 13 areas, from food enjoyment and sense of personal safety to satisfaction with relationships in the home and overall satisfaction.

## **Outcome Variables**

We examine a series of outcomes or attributes of nursing home services that are generated principally by nursing staff's time and effort: the prevalence of falls and infections, the proportion of residents who receive antipsychotic medication without an underlying condition, the number of regulatory deficiencies, residents' rating of food quality, safety, living environment, and overall satisfaction with the home. We describe these variables below, and characterize them in terms of observability by regulators, residents and residents' families. We think of

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<sup>5</sup> The MDH home quality rating data were collected during the period between the fourth quarter of 2005 and the third quarter of 2006. The MDHS resident interview was conducted in July and August 2006. To match up the two data sources, we extracted home inspection data from OSCAR in the time frame between November 2005 and December 2006. For those homes that were inspected twice during the period, we used the information from the later inspection.

observability broadly to refer to the limited ability to comprehend information about an outcome and how that outcome contributes to the overall quality of the service.

We use the prevalence of *infections* and *falls* amongst residents as measures of the quality of relatively *observable elements*, because visiting family members may notice dramatic physical changes in their relatives during regular visits. The two variables are risk-adjusted by MDH to account for residents' gender, age, length of stay, and prior health condition.<sup>6</sup>

Three variables from the resident surveys represent elements that can be assessed, with some effort and time, by family members during regular visits: *food enjoyment* (the degree to which residents like the food), *safety* (the degree to which residents feel that they and their belongings are safe), and *adaptation to the living environment* (the extent to which residents feel that their immediate physical environment is comfortable). Family members may see and taste the food served to residents and visit their rooms to judge the safety and comfort they provide. Thus, these measures can be thought of as *partially observable* elements.

The number of *regulatory deficiencies* reported in OSCAR for the timeframe of our investigation captures 28 deficiency categories with over 150 regulatory standards that nursing homes must meet at all times. When an inspection team finds that a home does not meet a specific regulation, it issues a deficiency citation. Deficiency categories vary in the degree of direct observability by family members or inference through discussion with residents. However, government audits claim that not all deficiencies are detected, suggesting that the underreporting of deficiencies may be correlated with the degree of unobservability of the elements that are subject to inspection. Hence, differences amongst the types of organizations will tend to be underestimated. Data on individual homes drawn from regulatory inspections were made public on the internet in 2004 and will likely alleviate some of the asymmetric information and affect the decision of some customers. However, at present, the effects appear to be very small. A focus-group study conducted by the U.S. Department of Health and Human Services (Shugarman and Brown 2006) reports that patients and their family members were generally unaware of or found it difficult to use sources, such as Medicare's Nursing Home Compare website, to facilitate the home selection process in a timely fashion. We classified regulatory deficiencies into two categories: those that are more observable and those that are less observable. For example, more observable deficiencies include those related to the building, corridors, walls, doors, exits, furnishings, decorations, interior

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<sup>6</sup> Details of the case-mix adjustment for 2006 (our study year) can be found at the "Minnesota Department of Health Case Mix Review, Facility Manual for Case Mix Classification, March 21, 2003, updated July 5, 2006.

design, smoke alarms, and nutrition and dietary services. On the other hand, less observable deficiencies include those related to administrative issues, resident treatment, emergency plans, hazardous area handling, electrical issues and other less observable building deficiencies. We provide more details and examples of our categorization in Appendix Table 1.

Prescription drug use is crucial to residents' health and thus an important aspect of nursing home care quality. However, information about drug use is usually opaque to residents, many of whom receive a large number of medications at different times of the day. The incidence of *antipsychotic drug* administration without a diagnosis of psychosis is regarded with suspicion by some experts because they may be used to pacify demanding residents and free up nursing staff to care for other residents (e.g., Ray et al. 1980; Avorn and Gurwitz 1995; Briesacher et al. 2005). If antipsychotic drugs are indeed used for such purposes, then the variable measures *unobservable undesirable elements* of nursing home outcomes.<sup>7</sup> On the other hand, there is transparency with respect to use by medical authorities, especially when the prescribing physician is not on the nursing home staff, which is generally the case. This monitoring makes the administration of antipsychotic drugs more observable. Therefore, we consider *antipsychotic drugs* as a *partially observable* element.

We include two additional measures from the resident survey: *satisfaction* (the extent to which residents are satisfied with their lives in the nursing home) and *relationship* (the degree to which residents report that there is a social, emotional, and affective relationship between them and nursing staff as well as other residents). These two variables are also risk-adjusted for residents' characteristics and health condition by the MDHS. These elements are likely to be largely *unobservable* to family members. Nursing home residents who are cognitively impaired or disabled are less likely and able to disclose such information. Even if the nursing home resident reports unhappiness to family members, it may be difficult for them to determine whether this is really due to the nursing home's quality or to the resident's condition. Moreover, residents' degree of satisfaction or relationship with the staff and other residents are unlikely to be reported in a way that can be used for nursing home evaluation.

## Explanatory Variables

*Nursing Home Characteristics:* The three types of organizations are represented by indicator variables. Some nursing homes are independent while others are part of a chain. We identify, with indicator variables, to which of the 24 chains each home belongs.

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<sup>7</sup> Prescription of antipsychotics *with* medical justification (e.g., for residents with schizophrenia and delusional and mood disorder) are excluded from the calculation.

In all estimations, we control for the number of residents, affiliation with a hospital, the proportion of Medicare residents, the proportion of private rooms, and the labor inputs of nursing staff--registered nurses (RNs), licensed practical nurses (LPNs) and certified nursing assistants (CNAs). In the estimation of outcomes that are not already adjusted for case mix (regulatory deficiencies), we use the average case mix index amongst the residents of the nursing home.<sup>8</sup>

*Regional Characteristics:* We use the *Census 2000 Summary File 3* data to control for socioeconomic and demographic characteristics of the nursing home's 5-digit zip code. These characteristics include: the median household income, and the racial/ethnic and demographic distribution of the population (%white, %black, %asian, %hispanic, %elderly).

We also include the nursing home rates in our specifications. As argued earlier, nursing home rates in Minnesota (and S. Dakota) are set by the state's Department of Human Services and are based on residents' condition (which affects the cost of care) and location of homes (which affects their operating and property costs), but not on their quality or residents' sources of payment. Nevertheless, areas with high operating and property costs may attract residents with higher socio-economic status who have stronger preferences for quality. Previous studies have controlled for Medicaid reimbursement rates (Chou, 2002) and CMS area hospital wage index (Grabowski and Hirth, 2003) as exogenous controls for supply shocks. The fact that we observe actual nursing home rates for the corresponding locality of the nursing homes that are the same for Medicaid and private-pay patients provides an advantage in our study.

In Minnesota's case mix index (CMI) classification, there are 34 Resource Utilization Groups (RUGs) divided into 7 domains: Extensive Services, Rehabilitation, Special Care, Clinically Complex, Impaired Cognition, Behavior Problems, and Reduced Physical Functioning. Each domain is further divided into severity categories based on Activities of Daily Living (ADLs), and some are divided into categories that capture depression or rehabilitation services (Minnesota Department of Health, 2003). Accordingly, MDH sets 34 distinct rates for each nursing home's locality corresponding to each RUG. We include, as controls, the rates for the most severe RUG category from each of the 7 domains. For example, the clinically complex domain has 6 RUG categories. The most severe category corresponds to an ADL count of 17-18 and a diagnosis of depression.

In sensitivity analyses, we also include indicators for the county where the nursing home is located. Previous research has validated "county" as the relevant

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<sup>8</sup> The variables are used as controls in similar research; see, for example, Nyman and Bricker (1989) and O'Neill et al. (2003), who provide justification for the inclusion of most of these variables. The key estimates are not very sensitive to the inclusion or exclusion of specific variables in particular equations.

geographic market for nursing homes (Nyman, 1985; Cohen and Spector, 1996; Grabowski and Hirth, 2003).

## **Results**

The descriptive statistics in Table 1 reveal certain differences in unadjusted quality outcomes among FP, NP and LG nursing homes. The differences in means between FP, NP and LG increase with the presumed degree of unobservability. However, there is no statistically significant difference in the *prevalence of falls* and a very small one in *prevalence of infections*. NP and LG homes' quality outcomes are superior for *food, safety, and environment*. For *antipsychotics, satisfaction and relationships*, NP and LG advantage relative to FP is statistically significant. Whereas this pattern of differences is consistent with our hypotheses, this may not hold if we control for additional variables. There is no statistically significant difference in the unadjusted means of regulatory deficiencies (regardless of observability). However, it is important to note, that all quality outcomes with the exception of regulatory deficiencies are case-mix adjusted. The unadjusted means of regulatory deficiencies do not take into account the potentially different case-mix of residents in NP, LG and FP homes. Next, we report the main results of the empirical strategy described earlier.

Table 2 reports the results for the SUR estimations of the performance outcomes, which are listed in decreasing order of observability by residents' families. Compared to FP homes, NP homes provide more of the less observable but desirable outcomes (superior satisfaction, relationship with staff and other residents). Additionally, they provide at least as much of the partially observable desirable outcomes (similar food quality, superior safety and living environment), and similar or less of the partially observable undesirable outcomes (lower levels of less observable regulatory deficiencies, and fewer but not statistically different administrations of antipsychotic drugs that were not prescribed for a diagnosed condition) than FP homes. Between FP and NP homes, the more observable outcomes (falls, infections, and more observable regulatory deficiencies) are not statistically different. In additional analyses, we estimated separate models for each deficiency outcome instead of bundling them into "less observable" and "more observable" deficiency outcomes. As the summary in the Appendix Table 1 shows, the deficiency outcomes that differ between NP and FP are the less observable electrical deficiencies (weekly inspection and monthly testing of generators; properly installed electrical wiring and equipment), environmental deficiencies (programs to keep infection from spreading; keep safe, clean, and homelike surroundings; provide needed housekeeping and maintenance) and fire alarm system deficiencies (maintained smoke detectors; approved installation, maintenance, and testing program for fire alarm systems).

Table 3 reports various sensitivity analyses. The first set of analyses assesses the robustness of our findings, excluding observed market characteristics. As argued earlier, we include various zip-code level demographic and socio-economic characteristics, nursing home rates and county-level fixed effects to control for unobserved demand and preferences that may be correlated with both the ownership type and quality outcomes. In the first analysis, we exclude county-level fixed effects. In the second analysis, we exclude zip-code level characteristics in addition to county-level fixed effects. In the third analysis, we exclude nursing home rates, zip code level characteristics and county-level fixed effects. Across all three analyses, the estimated coefficients are remarkably stable and robust in terms of magnitude, direction, and statistical significance. These sensitivity analyses do not rule out the presence of unobserved factors that could still bias our results. However, they suggest that even the exclusion of important and observed economic and demographic controls do not alter our findings significantly, lessening the concern that a factor we did not control for will substantially bias the results.

In another sensitivity analysis, we controlled for the competitive nature of the nursing home market using a county-level HHI and excluded county-level fixed effects. Previous literature has argued that in more competitive markets, consumers may find it more difficult to search for and obtain information on each nursing home, and they may prefer to choose NP homes (Chou, 2002). While HHI is typically considered endogenous when studying quality outcomes (for example, as in the case for the hospital market), this concern is less relevant for the nursing home market, which has strong certificate-of-need laws (Grabowski and Hirth, 2003). The specification which included the nursing home market HHI resulted in very similar estimates to our baseline model.

In our final sensitivity analysis, we investigated the effect of the NP's religious affiliation. Many NP organizations are affiliated with a religious organization, and several studies find that religious affiliation makes a difference in some respects (e.g., Ballou and Weisbrod 2003). About a third of our sampled NP homes have religious affiliation, and we explore the possibility that the estimated differences between FP and NP are actually driven by religious affiliation rather than NP ownership. Considering observable quality outcomes, religious and secular NP homes are similar to FP homes. Considering the unobservable quality outcomes, residents of religious and secular NP homes have higher levels of satisfaction and relationship with staff and other residents than residents of FP homes. Additionally, both types of NP homes have fewer violations of the less observable regulatory items than FP homes. There is more variation between religious and secular NP on partially observable quality outcomes, but overall, they provide as much or higher levels of desirable partially

observable outcomes and lower levels of partially observable undesirable outcomes than FP homes.

## **Discussion and Conclusions**

Does quality vary with ownership in markets with asymmetric information? We hypothesized that NP and LG organizations emphasize customers' well-being. Therefore, they may be less likely than FP firms to take advantage of customers' informational vulnerabilities. In particular, they may be more likely to provide higher-quality services in areas that are difficult for customers to observe, understand and evaluate than FP homes.

We investigated empirically these hypothesized differences in a narrowly-defined and homogenous industry where all three types of organization coexist, nursing homes in Minnesota. Nursing homes provide services that have both observable and unobservable outcomes relevant to customers – residents or their families. Compared to FP homes, we found that NP homes provide better or at least no worse levels of quality of outcomes. The equal outcomes are concentrated amongst the more observable outcomes whereas the superior outcomes belong to the category of outcomes that we judged as being less observable, particularly to residents' family members. LG homes provide outcomes at levels similar to or slightly lower than NONPROFIT homes.

Our findings are consistent with those from the nursing home and hospital industries, where it appears that NP organizations produce a higher quality of care than FP firms (e.g., Rosenau and Linder 2003; Amirkhanyan et al. 2008). Horwitz (2007) finds that NP hospitals produce different services than their FP counterparts along dimensions where administrators can influence profitability, consistent with differences in objectives. Picone et al. (2002) find that hospitals converting from NP or LG status to FP status are associated with a decline in quality (mortality), but not the other way around. Amirkhanyan (2008) finds that quality declines in nursing homes converted from LG ownership to FP, but not from LG to NP. Weisbrod and Schlesinger (1986), Spector et al. (1998), Hirth (1999), Chou (2002), Grabowski and Hirth (2003) and Santerre and Vernon (2005) find that NP nursing homes provide services in a manner that exploits fewer of customers' informational disadvantages than do FP homes.

Since the price of a nursing home stay is determined by the State of Minnesota on the basis of medical diagnoses and regional cost indices, but not the quality of care or source of payment, nursing homes cannot adopt a standard price-quality pairing business strategy. Instead, FP homes have an incentive to minimize costs and maximize profit by providing as little (low quality) of certain outcomes as they can afford in terms of regulation, market competition and their own non-financial objectives. The ability to skimp on quality is obviously greater



in areas where customers and regulators have greater difficulty observing outcomes or the regulatory standards are low. Our results cannot be directly generalized to industries where firms also compete on prices. It would be useful to explore theoretically the equilibrium price, observable quality and unobservable quality in a mixed-ownership market where firms are not constrained in their price and quality choices.

Another limitation of our study is that there does not exist a systematic way to classify the degree of observability and understandability of outcomes as they likely vary across residents and their families. The publicly available report cards would ideally improve quality transparency and encourage informed decision-making. Unfortunately, there is little evidence that supports this for health care organizations such as nursing homes, hospitals, physicians and health plans (Mukamel and Mushlin, 2001). In the case of public reporting for nursing home outcomes, studies have attributed challenges of the Nursing Home Compare website to difficulties of understanding/interpreting risk adjusted quality indicators and presentation format of the quality indicators. For example, results benchmarked against three nursing homes may not be helpful for consumers. The information is difficult to interpret when there is no evident dominance of one home as compared to others (see illustrations in Appendix Table 2). Similarly, average information based on resident surveys may not be very useful as consumers probably care more for the experiences of consumers similar to them rather than some risk adjusted averages. As another example, public websites typically report total number of deficiencies benchmarked to national and state averages. Consumers may care more about specific deficiencies rather than totals (Castle and Lowe, 2005; Mukamel and Spector, 2003). Moreover, most family members do not search, but take their loved ones to the local nursing home as we discussed earlier.

Our results are consistent with the hypothesis of inherent differences in quality of unobservable outcomes associated with differences in ownership. The ownership of an organization is not chosen randomly. At some point in time, some entrepreneurs decided to form a FP nursing home because they saw an opportunity to make a profit. Others chose to establish a NP home to provide a service for the benefit of others, and members of a city council resolved to start a new LG nursing home to provide care for their constituents. Hansmann (1980), Weisbrod (1988), Ben-Ner and Van Hoomissen (1991, 1992), Glaeser and Shleifer (2001), Lakdawalla and Philipson (2006) and others advanced theories that explain the reasons for the emergence of NP alongside or instead of FP firms, emphasizing the degree of observability and publicness of various characteristics of products and communities from which customers and entrepreneurs were drawn. While we cannot completely rule out that factors we do not observe may

influence both the ownership type and nursing home quality, all of the available tests suggest that our empirical strategy have addressed this.

Clearly, any inferences about the performance associated with organization's ownership beyond nursing homes should be a matter of careful interpretation of the role played by factors that were intentionally kept out of our analysis as well as those that are central to it. For example, nursing homes, automobiles, and pharmaceuticals present substantial problems of asymmetric information between providers and consumers. However, in the United States, where there are many NP and quite a few LG nursing homes alongside a large FP sector, there are practically only FP automobile manufacturing, retail and repair establishments and pharmaceutical manufacturers.<sup>9</sup> Therefore, for our findings to be generalizable, we need to understand the key contingencies of the other industries that share a similar degree of substantial asymmetric information with nursing homes.

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<sup>9</sup> There are a few exceptions (such as the government bailout of General Motors and cooperative repair shops). The reasons for this, having to do mostly with costs of entry, are explored partially in Weisbrod (1988), Ben-Ner and Van Hoomissen (1991) and Hansmann (1996).

<b>Table 1. Variable Definitions, Sources and Descriptive Statistics</b>							
<b>Variable Name</b>	<b>Variable Definition</b>	<b>Sample Mean (S.D.)</b>	<b>Sample Range</b>	<b>NP Mean (S.D.)</b>	<b>LG Mean (S.D.)</b>	<b>FP Mean (S.D.)</b>	<b>Data source<sup>1</sup></b>
<b>Organization Ownership</b>							
NP	1- nonprofit 0-otherwise	0.60 (0.49)	0/1	-	-	-	OSCAR
LG	1- local government 0- otherwise	0.13 (0.34)	0/1	-	-	-	OSCAR
FP	1- for-profit 0- otherwise	0.26 (0.44)	0/1	-	-	-	OSCAR
<b>Organization Performance</b>							
Prevalence of new falls	Number of falls in the last 30 days (before the current assessment is conducted) to number of residents.	0.12 (0.03)	0.01-0.25	0.12 (0.03)	0.12 (0.03)	0.12 (0.04)	MDH
Prevalence of infections	Number of cases of pneumonia, respiratory infection, septicemia, viral hepatitis, wound infection, or recurrent lung aspirations since most-recent full non-admission assessment or urinary tract infection in the last 30 days (before the current assessment is conducted) to number of residents.	0.11 (0.04)	0.01-0.33	0.12 (0.04)	0.11 (0.04)	0.11 (0.04)	MDH
More observable regulatory deficiencies		4.44 (2.61)	1-13	4.47 (2.58)	4.35 (2.52)	4.42 (2.73)	OSCAR
Food enjoyment	Items: "Do you like the food here?" "Do you enjoy mealtimes here?" and "Can you get your favorite foods here?"	84.72 (5.05)	65.53-92.89	84.92** (4.87)	86.13*** (4.53)	83.57 (5.50)	MDHS
Safety	Items: "Are your belongings safe here?" "Do your clothes get lost or damaged in the laundry?" and "Do you feel safe and secure?"	86.67 (3.65)	71.85-93.8	87.00** (3.33)	86.85** (3.30)	85.84 (4.36)	MDHS
Environment	Items: "Is it easy for you to get around in your room by yourself?" "Are your belongings arranged so you can get them?" "Can you get the things you want to use in your bathroom?" and "Do you take care of your own things as much as you want?"	88.29 (3.02)	76.75-94.17	88.59** (2.83)	88.19 (3.37)	87.64 (3.20)	MDHS
Prevalence of antipsychotics	Number of residents using antipsychotic medications without diagnosis of psychosis in the last 7 days (before the current assessment is conducted) to number of residents.	0.17 (0.08)	0.02-0.81	0.16*** (0.06)	0.17 (0.08)	0.19 (0.10)	MDH
Less observable regulatory deficiencies		29.16 (12.55)	1-72	29.04 (12.65)	28.37 (13.06)	29.83 (12.14)	OSCAR
Satisfaction	Items: "Is there somebody to talk to here if you have a problem?" "Do the people who work here spend enough time	81.73 (3.40)	71.56-89.92	82.13*** (3.16)	82.27*** (3.25)	80.54 (3.74)	MDHS

	with you when giving you care?" "Do you understand the people who work here when they talk to you?" "Do the people who work here listen to what you say?" "Do the people who work here explain your care to you?" "Do you consider any of the other people who live here a friend?" "Do the people who work here knock on your door and wait to be invited in?" "Are you alone too much?" "Do the people who work here ever get angry at you?" "Would you recommend this nursing home to someone who needs care?" and "Overall, what grade would you give this nursing home, where A is best it could be and F is worst it could be?"						
Relationship	Items: "Do the people who work here ever stop by just to talk?" "Do you consider anybody who works here to be your friend?" and "Can you get help when you need it?"	81.93 (4.26)	66.32-90.14	82.25*** (4.13)	82.70** (3.94)	80.79 (4.52)	MDHS
<b>Labor Inputs</b>							
RNs and LPNs	Total number of hours of registered nurses (RNs) and licensed practical nurses (LPNs) per day	105.33 (68.51)	11.40-613.72	115.14** (73.73)	81.13 (49.85)	94.05 (59.64)	OSCAR
CNAs	Total number of hours of certified nursing assistants (CNAs) per day	191.77 (119.83)	9.76-966.38	208.95*** (124.29)	158.80 (91.43)	169.02 (115.70)	OSCAR
<b>Nursing Home Characteristics</b>							
Number of residents	Total number of residents	82.56 (49.03)	15-458	88.53* (51.68)	63.41** (36.28)	78.50 (45.81)	OSCAR
Chain status	1 if the nursing home belongs to a chain operation; 0 if independent.	0.50 (0.50)	0/1	0.55 (0.50)	0.02*** (0.15)	0.63 (0.49)	OSCAR
Hospital affiliation	1 if the facility is affiliated with a hospital; 0 otherwise	0.15 (0.36)	0/1	0.17*** (0.37)	0.37*** (0.49)	0 (0)	OSCAR
% Private Rooms	Proportion of private rooms among all rooms in each nursing home	26.95 (23.64)	0-1	31.10*** (25.29)	22.25 (17.72)	19.83 (20.10)	OSCAR
Case mix index <sup>2</sup>	Intensity of care and services provided to residents in each nursing home	1.01 (0.09)	0.60-1.30	1.01 (0.08)	1.00 (0.06)	1.01 (0.11)	MDH
Proportion of Medicare residents	Proportion of residents whose stay is paid for by Medicare	10.06 (5)	0-0.41	10.05 (4.85)	9.2 (3.59)	10.49 (5.88)	OSCAR
<b>Regional Characteristics at 5-digit zipcode</b>							
Median household income		41,052 (10,268.99)	14,360-87,648	40,678** (9,718)	37,259*** (6,991)	43,805 (12,073)	2000 Census
%White Pop		91.80 (10.99)	2.41-100	92.01 (11.04)	95.29*** (6.37)	89.60 (12.23)	2000 Census
% Black Pop		2.27 (5.02)	0-55.65	2.20 (4.95)	0.56*** (1.31)	3.28 (6.03)	2000 Census

Ben-Ner et al.: Ownership and Quality

% Asian Pop		1.86 (3.21)	0-27.98	1.77** (3.19)	0.63*** (0.73)	2.67 (3.78)	2000 Census
% Hispanic		2.92 (3.89)	0-32.62	2.96 (4.08)	1.74*** (2.74)	3.42 (3.82)	2000 Census
% Age 65 and older		16.60 (5.56)	4.57-35.86	16.70** (5.40)	19.42*** (4.79)	14.97 (5.72)	2000 Census
<b>Nursing Home Rates for Most Severe Case Mix Groups by Domain, December 2005</b>							
Extensive Services	SE3: Services count of 4-5	211.83 (27.60)	141.79-380.07	212.38 (28.61)	209.11 (22.29)	211.92 (27.82)	MDH
Rehabilitation	RAD: ADL sum of 17-18	184.51 (22.98)	125.34-306.09	184.98 (23.88)	182.51 (18.61)	184.45 (23.03)	MDH
Special Care	SSC: ADL sum: of 17-18	169.84 (20.49)	116.3-277.69	169.90 (21.33)	167.87 (16.64)	169.34 (20.45)	MDH
Clinically Complex	CC2: ADL sum of 17-18 and depression	175.63 (21.51)	120-287.95	176.07 (22.37)	173.86 (17.44)	175.52 (21.50)	MDH
Impaired Cognition	IB2: ADL sum of 6-10 and nursing rehabilitation	131.92 (14.55)	93.69-224.42	132.22 (15.23)	131.29 (12.02)	131.57 (14.24)	MDH
Behavior Problems	BB2: ADL sum of 6-10 and nursing rehabilitation	123.73 (13.34)	88.74-212.91	123.99 (13.99)	123.31 (11.11)	123.32 (12.96)	MDH
Reduced Physical Functioning	PE2: ADL sum of 16-18 and nursing rehabilitation	142.17 (16.11)	99.85-238.82	142.49 (16.84)	141.27 (13.22)	141.87 (15.88)	MDH

**Notes:**

1. OSCAR - Online Survey, Certification and Reporting data of nursing facilities (Centers for Medicare and Medicaid Services).

<http://www.cms.hhs.gov/NursingHomeQualityInits/>

MDH - Minnesota State Department of Health; details available at <http://www.health.state.mn.us/nhreportcard/>

MDHS - Minnesota State Department of Human Services; details available at <http://www.health.state.mn.us/nhreportcard/>

2. For details on the definition and calculation of case mix see [http://www.health.state.mn.us/divs/fpc/profinfo/cms/8\\_21manual.pdf](http://www.health.state.mn.us/divs/fpc/profinfo/cms/8_21manual.pdf).

3. \*, \*\* and \*\*\* indicate significance of the one-tailed t- test at the 0.10, 0.05, and 0.01 levels, respectively, for the comparison between NP and FP, and LG and FP nursing homes.

Table 2: Organization Ownership and Quality Outcomes: SUR Estimations																					
		Observable Outcomes						Partially Observable Outcomes								Unobservable Outcomes					
		Falls		Infections		More Observable Regulatory Deficiencies		Food		Safety		Environment		Antipsychotics		Less Observable Regulatory Deficiencies		Satisfaction		Relationship	
		coef	se	coef	se	coef	se	coef	se	coef	se	coef	se	Coef	Se	coef	se	coef	se	coef	se
NP		0.072	0.056	-0.061	0.062	-0.079	0.106	0.013	0.009	0.012*	0.007	0.012**	0.005	-0.108	0.074	-0.154*	0.075	0.014*	0.006	0.020*	0.008
LG		0.123	0.076	-0.168**	0.085	-0.054	0.144	0.015	0.012	0.008	0.009	0.010	0.007	-0.029	0.102	-0.102	0.101	0.008	0.008	0.032**	0.011
log (Number of residents)		0.325**	0.134	-0.219	0.150	-0.312	0.256	0.040*	0.021	-0.020	0.016	0.023*	0.013	0.296*	0.178	0.447*	0.180	-0.008	0.014	-0.020	0.019
log (RN + LPN hours)		-0.162*	0.097	0.028	0.108	0.337*	0.183	-0.013	0.015	-0.001	0.012	0.024**	0.009	0.044	0.129	-0.085	0.129	-0.014	0.010	-0.004	0.014
log (CNA hours)		-0.063	0.080	0.074	0.089	0.197	0.154	0.019	0.013	0.003	0.009	0.013*	0.008	0.249*	0.106	-0.062	0.108	-0.002	0.008	0.006	0.011
Belongs to a chain		0.023	0.051	-0.024	0.057	0.004	0.098	0.002	0.008	-0.009	0.006	0.003	0.005	0.225**	0.068	0.042	0.069	-0.004	0.005	0.007	0.007
log( % Private rooms)		-0.022	0.019	-0.000	0.022	-0.081**	0.037	0.001	0.003	0.011**	0.002	0.004**	0.002	-0.044*	0.026	-0.100**	0.026	0.010**	0.002	0.002	0.003
Affiliated with a hospital		-0.011	0.062	-0.085	0.069	0.197*	0.116	0.002	0.010	0.006	0.007	0.002	0.006	-0.091	0.082	-0.119	0.082	-0.006	0.007	0.003	0.009
log( % Medicare residents)		0.089**	0.042	0.178***	0.047	-0.023	0.000	0.009	0.007	0.001	0.005	0.004	0.004	-0.016	0.057	0.113	0.069	0.004	0.004	-0.002	0.006
note: *** p<0.01, ** p<0.05, * p<0.1																					
All specifications included chain fixed effects, county fixed effects, zip-code level regional characteristics, nursing home rates. Regulatory deficiency models included the average case mix. All outcome variables were in natural logarithm.																					
N=348 nursing homes																					

Ben-Ner et al.: Ownership and Quality

**Table 3: Sensitivity Analyses of Organization Ownership and Quality Outcomes: SUR Estimations**

	Observable Outcomes										Partially Observable Outcomes						Unobservable Outcomes				
	Falls		Infections		More Observable Regulatory Deficiencies		Food		Safety		Environment		Antipsychotics		Less Observable Regulatory Deficiencies		Satisfaction		Relationship		
	Coef	Se	Coef	Se	Coef	Se	Coef	se	Coef	Se	Coef	se	Coef	se	Coef	se	Coef	se	Coef	se	
Baseline (Table 2)																					
NP	0.07 <sub>2</sub>	0.0 <sub>56</sub>	-0.061	0.06 <sub>2</sub>	-0.079	0.1 <sub>06</sub>	0.0 <sub>13</sub>	0.0 <sub>09</sub>	0.012 <sub>*</sub>	0.0 <sub>07</sub>	0.012 <sub>*</sub>	0.00 <sub>5</sub>	-0.108	0.0 <sub>74</sub>	-0.154 <sub>**</sub>	0.0 <sub>75</sub>	0.014 <sub>**</sub>	0.0 <sub>06</sub>	0.020 <sub>*</sub>	0.0 <sub>08</sub>	
LG	0.12 <sub>3</sub>	0.0 <sub>76</sub>	0.168 <sub>*</sub>	0.08 <sub>5</sub>	-0.054	0.1 <sub>44</sub>	0.0 <sub>15</sub>	0.0 <sub>12</sub>	0.008	0.0 <sub>09</sub>	0.010	0.00 <sub>7</sub>	-0.029	0.1 <sub>02</sub>	-0.102	0.1 <sub>01</sub>	0.008	0.0 <sub>08</sub>	0.032 <sub>**</sub>	0.0 <sub>11</sub>	
Exclude county fixed effects																					
NP	0.03 <sub>3</sub>	0.0 <sub>54</sub>	-0.026	0.06 <sub>5</sub>	0.199 <sub>*</sub>	0.1 <sub>10</sub>	0.0 <sub>12</sub>	0.0 <sub>10</sub>	0.010	0.0 <sub>07</sub>	0.017 <sub>**</sub>	0.00 <sub>6</sub>	-0.110	0.0 <sub>78</sub>	0.178 <sub>**</sub>	0.0 <sub>75</sub>	0.013 <sub>**</sub>	0.0 <sub>06</sub>	0.019 <sub>*</sub>	0.0 <sub>08</sub>	
LG	0.07 <sub>2</sub>	0.0 <sub>70</sub>	-0.128	0.08 <sub>3</sub>	-0.220	0.1 <sub>41</sub>	0.0 <sub>16</sub>	0.0 <sub>12</sub>	0.005	0.0 <sub>09</sub>	0.012	0.00 <sub>7</sub>	-0.005	0.1 <sub>01</sub>	-0.121	0.0 <sub>96</sub>	0.008	0.0 <sub>08</sub>	0.022 <sub>*</sub>	0.0 <sub>11</sub>	
Exclude county fixed effects and zip-code characteristics																					
NP	0.03 <sub>1</sub>	0.0 <sub>56</sub>	-0.021	0.06 <sub>6</sub>	0.193 <sub>*</sub>	0.1 <sub>11</sub>	0.0 <sub>11</sub>	0.0 <sub>10</sub>	0.009	0.0 <sub>07</sub>	0.016 <sub>**</sub>	0.00 <sub>6</sub>	-0.108	0.0 <sub>78</sub>	0.174 <sub>**</sub>	0.0 <sub>79</sub>	0.012 <sub>*</sub>	0.0 <sub>06</sub>	0.019 <sub>*</sub>	0.0 <sub>09</sub>	
LG	0.07 <sub>3</sub>	0.0 <sub>71</sub>	-0.127	0.08 <sub>4</sub>	-0.189	0.1 <sub>42</sub>	0.0 <sub>15</sub>	0.0 <sub>12</sub>	0.005	0.0 <sub>09</sub>	0.012	0.00 <sub>7</sub>	0.005	0.1 <sub>00</sub>	-0.086	0.1 <sub>00</sub>	0.008	0.0 <sub>08</sub>	0.021 <sub>*</sub>	0.0 <sub>11</sub>	
Exclude county fixed effects, zip-code characteristics and nursing home rates																					
NP	0.03 <sub>9</sub>	0.0 <sub>54</sub>	-0.023	0.06 <sub>4</sub>	-0.166	0.1 <sub>11</sub>	0.0 <sub>11</sub>	0.0 <sub>10</sub>	0.010	0.0 <sub>07</sub>	0.017 <sub>**</sub>	0.00 <sub>6</sub>	-0.124	0.0 <sub>76</sub>	0.172 <sub>**</sub>	0.0 <sub>77</sub>	0.014 <sub>**</sub>	0.0 <sub>06</sub>	0.021 <sub>*</sub>	0.0 <sub>09</sub>	
LG	0.07 <sub>0</sub>	0.0 <sub>71</sub>	-0.123	0.08 <sub>4</sub>	-0.164	0.1 <sub>44</sub>	0.0 <sub>15</sub>	0.0 <sub>13</sub>	0.005	0.0 <sub>09</sub>	0.012	0.00 <sub>7</sub>	-0.005	0.1 <sub>00</sub>	-0.078	0.1 <sub>01</sub>	0.009	0.0 <sub>08</sub>	0.023 <sub>*</sub>	0.0 <sub>11</sub>	

Exclude county fixed effects, include county level nursing home HHI																				
NP	0.034	0.054	-0.021	0.065	0.210*	0.110	0.012	0.010	0.010	0.007	0.016**	0.006	-0.114	0.078	0.180**	0.075	0.013**	0.006	0.019**	0.008
LG	0.071	0.070	-0.131	0.083	-0.214	0.141	0.016	0.012	0.005	0.009	0.012*	0.007	-0.002	0.101	-0.120	0.096	0.008	0.008	0.023**	0.011
Differentiate NP by religious affiliation																				
Non-Religious NP	0.078	0.058	-0.061	0.065	-0.050	0.111	0.007	0.009	0.014**	0.007	0.010*	0.006	-0.082	0.078	0.146*	0.078	0.014**	0.006	0.018**	0.008
Religious NP	0.058	0.069	-0.063	0.077	-0.143	0.130	0.008	0.011	0.007	0.008	0.017**	0.007	0.168*	0.091	0.172*	0.091	0.013*	0.007	0.024**	0.010
LG	0.125	0.076	0.168**	0.085	-0.045	0.144	0.013	0.012	0.009	0.009	0.009	0.007	-0.021	0.102	-0.099	0.101	0.008	0.008	0.031**	0.011
note: *** p<0.01, ** p<0.05, * p<0.1																				
All outcome variables were in natural logarithm.																				
N=348 nursing homes																				



Appendix Table 1: Classification of Regulatory Deficiencies and Analysis of Separate Deficiencies

More Observable Deficiencies	Examples	Average number of deficiencies across all nursing homes	Adjusted Difference in the Deficiency Outcome of NP relative to FP (p-value)	Adjusted Difference in the Deficiency Outcome of LG relative to FP (p-value)
Building and Service Equipment	Properly protected cooking facilities; properly constructed linen or trash chutes; heating and ventilation systems that have been properly installed according to the manufacturer's instructions	0.22	-0.02 (0.80)	-0.08 (0.46)
Corridor Walls and Doors	corridor and hallway doors that block smoke; corridors that are separated from common areas by walls constructed to limit the passage of smoke; signs that state that exit doors are to be kept closed	0.92	-0.20 (0.26)	-0.18 (0.44)
Exits and Egress	exits that are accessible at all times; corridors or aisles that are unobstructed and are at least eight feet in width; exit stairways and towers that are smoke proof	0.45	0.02 (0.84)	-0.03 (0.84)
Furnishings and Decoration	restrictions on the use of highly flammable materials; exits that are free from obstructions and can be used at all times	0.29	-0.10 (0.33)	-0.07 (0.57)
Interior Finish	fire-resistant interior walls	0.03	-0.004 (0.91)	-0.01 (0.72)
Nutrition and Dietary	store, cook, and give out food in a safe and clean way; provide three meals daily at regular times; prepare food that is nutritional, appetizing, tasty, attractive, well-cooked and at the right temperature	1.84	-0.30 (0.24)	-0.36 (0.27)
Smoke Compartmentation and Control	walls or barriers that prevent smoke from passing through and would resist fire for at least one hour; smoke barrier doors that can resist smoke for at least 20 minutes	0.44	-0.16 (0.19)	-0.22 (0.15)
<b>Less Observable Deficiencies</b>				
Administration	follow all laws and professional standards; keep accurate and appropriate medical records; train all employees on what to do in an emergency	0.61	-0.05 (0.75)	-0.03 (0.90)
Automatic Sprinkler Systems	automatic sprinkler systems that have been maintained in working order; portable fire extinguishers; properly working alarms or sprinkler valves	0.75	-0.10 (0.57)	0.09 (0.68)
Building	a two-hour-resistant firewall in common walls; approved construction type or materials; fire resistant	0.23	-0.06	0.08

Construction	interior walls		(0.49)	(0.52)
Electrical	weekly inspection and monthly testing of generators; properly installed electrical wiring and equipment	0.33	-0.18 (0.05)	-0.19 (0.09)
Emergency Plans and Fire Drills	record of quarterly fire drills for each shift under varying conditions; did not have a written emergency evacuation plan	0.31	-0.14 (0.21)	0.003 (0.21)
Environmental	have a program to keep infection from spreading; keep safe, clean, and homelike surroundings; provide needed housekeeping and maintenance	3.77	-0.70 (0.08)	-0.73 (0.16)
Fire Alarm Systems	properly maintained smoke detectors; a approved installation, maintenance, and testing program for fire alarm systems	0.84	0.05 (0.75)	-0.13 (0.52)
Hazardous Area	construction that can resist fire for one hour or an approved fire extinguishing system	0.43	- 0.21(0.05 )	-0.19 (0.15)
Illumination and Emergency Power	proper backup exit lighting; emergency lighting that can last at least 1 1/2 hours	0.52	-0.12 (0.35)	-0.19 (0.09)
Medical Gases and Anesthetizing Areas	proper fire barriers, ventilation, and signs for the transport of oxygen; proper medical gas storage and administration areas	0.30	-0.14 (0.13)	-0.08 (0.48)
Miscellaneous	fire safety features required by current fire safety codes	0.21	-0.07 (0.37)	-0.05 (0.60)
Mistreatment	keep each resident free from physical restraints, unless needed for medical treatment; hire only people who have no legal history of abusing, neglecting, or mistreating residents; report and investigate any acts or reports of abuse, neglect, or mistreatment of residents	1.07	-0.17 (0.38)	-0.15 (0.55)
Pharmacy Service	properly mark drugs and other similar products; make sure residents are free from serious medication errors	2.27	-0.29 (0.31)	0.13 (0.72)
Quality Care	make sure that residents who cannot care for themselves receive help with eating/drinking, grooming, and hygiene; provide activities to meet the needs of each resident; give professional services that follow each resident's written care plan	8.97	-1.22 (0.11)	-0.68 (0.49)
Resident Assessment	develop a complete care plan that meets all of the resident's needs, with timetables and actions that can be measured; check and update (if needed) each resident's assessment every three months	4.06	-0.26 (0.53)	0.18 (0.73)
Resident Rights	provide services to meet the needs and preferences of each resident; listen to the resident or family groups or act on their complaints or suggestions	3.76	-0.26 (0.52)	-0.06 (0.91)
Smoking Regulations	posted "No smoking" signs in areas where smoking is not permitted or did not provide ashtrays where smoking was allowed	0.02	0.025 (0.36)	0.05 (0.13)
Vertical Openings	proper stairway enclosures and vertical shafts; protected exits that allow the resident to escape the building;	0.13	-0.02 (0.76)	0.002 (0.98)
Notes: Adjusted differences in the deficiency outcome of NP and LG relative to FP are based on models with each deficiency measure as the outcome variable. They include all explanatory variables discussed in the Data and Measures section.				

**Appendix Table 2: Illustrations of the Nursing Home Compare Website**



[Nursing Home Compare Home](#) [Nursing Home Results](#) [Compare Nursing Homes](#)

- [About Nursing Home Compare](#)
- [About the Data](#)
- [Resources](#)
- [Help](#)
- [PRINT ALL TABS](#)

## Compare Nursing Homes

[Back to Results](#)

Key: **Special Focus Facilities (SFF) [?]**


- [General Information](#)
- [Inspections and Complaints](#)
- [Staffing](#)
- [Quality Measures](#)
- [Penalties](#)

	<b>PARK HEALTH AND REHABILITATION CENTER</b> <span style="float: right;">✕</span> 4415 WEST 36 1/2 STREET SAINT LOUIS PARK, MN 55416 (952) 927-9717 Add to my Favorites Map and Directions	<b>JONES HARRISON RESIDENCE</b> <span style="float: right;">✕</span> 3700 CEDAR LAKE AVENUE MINNEAPOLIS, MN 55416 (612) 920-2030 Add to my Favorites Map and Directions	<b>TEXAS TERRACE CARE CENTER</b> <span style="float: right;">✕</span> 7900 WEST 28TH STREET SAINT LOUIS PARK, MN 55426 (952) 920-8380 Add to my Favorites Map and Directions
<b>Overall Rating [?]</b>	Average	Much Above Average	Much Below Average
Fines	0 Fines	0 Fines	0 Fines
Payment Denials	0 Payment Denials	0 Payment Denials	0 Payment Denials













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## Compare Nursing Homes

[Back to Results](#)

Key:  Special Focus Facilities (SFF) [?]

General Information | Inspections and Complaints | **Staffing** | Quality Measures | Penalties

	<b>PARK HEALTH AND REHABILITATION CENTER</b> 	<b>JONES HARRISON RESIDENCE</b> 	<b>TEXAS TERRACE CARE CENTER</b> 
	4415 WEST 36 1/2 STREET SAINT LOUIS PARK, MN 55416 (952) 927-9717 Add to my Favorites  Map and Directions 	3700 CEDAR LAKE AVENUE MINNEAPOLIS, MN 55416 (612) 920-2030 Add to my Favorites  Map and Directions 	7900 WEST 28TH STREET SAINT LOUIS PARK, MN 55426 (952) 920-8380 Add to my Favorites  Map and Directions 
<b>Overall Rating [?]</b>	 Average	 Much Above Average	 Much Below Average
<b>Staffing Rating [?]</b>	 Above Average	 Above Average	 Average
<b>RN Staff Only<sup>5</sup> [?]</b>	 Much Above Average	 Much Above Average	 Above Average
Total Number of Residents	<b>75</b>	<b>152</b>	<b>127</b>
Total Number of Licensed Nurse Staff Hours per Resident per day	<b>1 hour 41 minutes</b>	<b>1 hour 44 minutes</b>	<b>1 hour 13 minutes</b>
RN Hours per Resident per Day	<b>1 hour 17 minutes</b>	<b>1 hour</b>	<b>46 minutes</b>
LPN/LVN Hours per Resident per Day	<b>24 minutes</b>	<b>44 minutes</b>	<b>27 minutes</b>
CNA Hours per Resident per Day	<b>2 hours 2 minutes</b>	<b>2 hours 20 minutes</b>	<b>2 hours 3 minutes</b>
Physical Therapy Staff Hours per Resident per Day	<b>8 minutes</b>	<b>6 minutes</b>	<b>5 minutes</b>

## Compare Nursing Homes

[Back to Results](#) Key: Special Focus Facilities (SFF) [\[?\]](#)

General Information	Inspections and Complaints	Staffing	Quality Measures	Penalties
	<b>PARK HEALTH AND REHABILITATION CENTER</b> 4415 WEST 36 1/2 STREET SAINT LOUIS PARK, MN 55416 (952) 927-9717 Add to my Favorites Map and Directions	<b>JONES HARRISON RESIDENCE</b> 3700 CEDAR LAKE AVENUE MINNEAPOLIS, MN 55416 (612) 920-2030 Add to my Favorites Map and Directions	<b>TEXAS TERRACE CARE CENTER</b> 7900 WEST 28TH STREET SAINT LOUIS PARK, MN 55426 (952) 920-8380 Add to my Favorites Map and Directions	
<b>Overall Rating [?]</b>	★★★★★ Average	★★★★★ Much Above Average	★★★★★ Much Below Average	
<b>Quality Measures [?]</b>	★★★★★ Above Average	★★★★★ Much Above Average	★★★★★ Above Average	
<b>SHORT-STAY RESIDENTS</b> Current data collection period				
Percent of short-stay residents who self-report moderate to severe pain. <i>Lower percentages are better.</i>	17.6%	7.0%	11.7%	
Percent of short-stay residents with Pressure ulcers that are new or worsened. <i>Lower percentages are better.</i>	3.2%	1.8%	1.2%	
Percent of short-stay residents assessed and given, appropriately, the seasonal influenza vaccine. <i>Higher percentages are better.</i>	89.7%	99.8%	85.3%	
Percent of short-stay residents assessed and given, appropriately, the pneumococcal vaccine. <i>Higher percentages are better.</i>	87.1%	99.5%	77.6%	
Percent of short stay residents who newly received an antipsychotic medication. <i>Lower percentages are better.</i>	2.0%	0.4%	2.0%	
<b>LONG-STAY RESIDENTS</b> Current data collection period				
Percent of long-stay residents experiencing one or more falls with major injury. <i>Lower percentages are better.</i>	0.0%	3.3%	2.9%	
Percent of long-stay residents with a urinary tract infection. <i>Lower percentages are better.</i>	5.5%	6.5%	2.9%	
Percent of long stay residents who self-report moderate to severe pain. <i>Lower percentages are better.</i>	10.9%	12.0%	7.7%	

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