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Hospital-based Skilled Nursing Facilities: Predictors of Survival and Performance

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HOSPITAL-BASED SKILLED NURSING FACILITIES: PREDICTORS OF SURVIVAL AND PERFORMANCE

by

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HOSPITAL-BASED SKILLED NURSING FACILITIES:
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ABSTRACT

This three-paper dissertation examined the organizational and market factors predicting the response of hospital-based skilled nursing facilities (HBSNFs) to the changes in their environment such as the implementation of prospective payment system in 1998 and their role in coordination of care for patients in transition from acute care to home or a post-acute care facility.

In the first study, population ecology of organizations framework was used to evaluate the organizational and market factors associated with HBSNFs' closure after 1998. The event histories of all acute-care hospitals which had an open HBSNF in 1998 were examined across 15 years (1998-2012) to estimate their time-to-closure, adjusting for covariates. The results showed that large, not-for-profit hospitals and those located in more competitive markets had lower odds of closing their HBSNFs.

The second paper focused on the association between presence of HBSNFs and hospitals' readmission rates for congestive heart failure, acute myocardial infarction and pneumonia, using the concept of vertical integration and Resource-based view (RBV). Panel data from 2006 to 2012 was analyzed using the Ordinary Least Squares regression and a fixed effects regression with standard error correction at the hospital level. The results of the ordinary least squares regression showed a significant, negative association between the presence of HBSNFs and the overall variation in hospitals' readmission rates. However, the fixed effects regression results did not show a similar association.

The third study explored the association between HBSNFs' staffing patterns and their health inspections and quality ratings. Logistic regression with state and year fixed effects, and standard error correction at the HBSNF level was done using panel data (2008-2011). The results showed that greater staffing mix and higher staffing intensity in terms of licensed practical nurse hours per resident day were significantly associated with high health inspections ratings and high quality ratings respectively.

Given the increasing emphasis on coordination of patient care between providers, findings of this dissertation can contribute to the literature on care coordination by providing insights into the role HBSNFs could play in the patients' transition from acute to post-acute settings and assist hospitals in improving their quality outcomes.

Keywords: Hospital-based skilled nursing facility closures, time-to-event analysis, hospital-based skilled nursing facilities and readmissions, health inspection ratings, quality ratings, staffing in hospital-based skilled nursing facilities

DEDICATION

To Patrick Browning, Camille Browning, friends and family for their belief in me and consistent support, especially “when the going got tough”.

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Four years ago, when I embarked on this journey of pursing a Ph.D. - in Administration-Health Services – everything was very new to me because it was different from everything I was used to. Finding an answer to the question: How do one get research ideas and how will I do it? -- seemed very daunting. I could not have found the answer and completed this journey without the support and the guidance of the faculty who guided me in and outside class and several other people who encouraged me at the times when I needed it the most. I am very thankful to all of them for their expert guidance, knowledge and support throughout this process.

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ASSOCIATION BETWEEN STAFFING AND VARIATION IN QUALITY RATING OF HOSPITAL-BASED SKILLED NURSING FACILITIES

INTRODUCTION

Rising health care costs and lack of corresponding increase in quality of care has been an ongoing concern for policy makers. Many reimbursement reforms have been introduced over the years in an attempt to hold providers accountable for the cost and quality of care. The prospective payment system (PPS) for hospitals was introduced in 1983 (Bishop & Dubay, 1991). This implementation of the PPS in 1983 created incentives for hospitals to either purchase or convert their excess capacity into hospital-based skilled nursing facilities (HBSNFs) to reduce their patients' acute care length of stay (Manton, Stallard, & Woodbury, 1994).

HBSNF refers to a facility which is licensed by the state as a skilled nursing facility (SNF), is financially integrated with the hospital and shares its governing board (Whitman, DeAngelis, & Knapp, 1986). HBSNFs have also been referred to as "sub-acute care units" and "transitional care units" in the literature (Smith, 1996). For the purpose of this dissertation, these terms have been considered interchangeable. HBSNFs provide care to patients who "need short-term skilled nursing or rehabilitation services on an inpatient basis after a hospital stay of at least three days" (Dummit, 2011). By discharging patients to the HBSNFs, hospitals could potentially generate 2 streams of revenue from 1 patient: first, under the PPS in the form of incentives related to reductions in their length of stay; and second, by discharging the same patient to the HBSNF which

still had cost-based reimbursement. In an effort to curb this practice, PPS for SNFs was introduced in 1998. With this change in reimbursement system for SNFs in 1998, the prior monetary incentives for hospitals to own a SNF disappeared and many of them closed their HBSNFs. The number of HBSNFs dropped to less than 50 percent in 2011 from almost 2500 a decade earlier (Feng et al., 2011; Rahman, Zinn, & Mor, 2013; White & Nguyen, 2011).

Most of the research related to HBSNF closures focused primarily on the effect of HBSNF closures on access to care, use of alternative care settings, level of Medicare spending and health outcomes. Not many studies have examined the hospital characteristics associated with HBSNF closures and most of them are based in the period immediately after the implementation of PPS in 1998. (Medicare payment Advisory Commission, 2004; Rahman et al., 2013; White & Seagrave, 2005).

No research out knowledge has examined HBSNF closures over an extended period of time. The antecedents to early HBSNF closures might be different from that of the closures that occurred in the later years due factors such as organizational inertia and multi-year contractual relationships with post-acute care (PAC) providers (White & Nguyen, 2011). Moreover, the environmental factors associated with the hospitals' decision to close the HBSNFs have not been explored. Examining the organizational and market factors that could influence HBSNFs' likelihood of closure over an extended period (15 years) can allow us to understand additional factors which may influence the long-term operations of healthcare organizations.

Furthermore, HBSNFs may have a new role to play in the continuum of patient care, given the recent changes in the reimbursement of hospitals (Butcher, 2013). In

October 2012, the Centers for Medicare and Medicaid Services (CMS) embarked on the hospital readmissions reduction program, which reduced Medicare payments to hospitals with "excessive" readmission rates by 1% for heart failure, acute myocardial infarction, and pneumonia. These penalties increased to 2% and 3% in years 2014 and 2015, respectively (CMS, 2014). Several studies have suggested that better coordination of care and communication between providers across the continuum of care may exhibit the most potential to reduce the readmission rates (DeCoster, Ehlman, & Conners, 2013; Epstein, Tsaras, Amoateng-Adjepong, Greiner, & Manthous, 2009; Hansen, Young, Hinami, Leung, & Williams, 2011; King et al., 2013; Kirsebom, Wadensten, & Hedström, 2013; Minott, 2008; Stone & Hoffman, 2010). HBSNFs could offer a viable choice for hospitals to improve coordination of care and reduce their readmission rates.

Although HBSNFs could play a significant role in maintaining the continuum of care for patients, little is known about their association with hospitals' readmission rates. Few studies have shown that the free-standing SNFs, which acted as substitutes for HBSNFs upon their closure, were unable to meet the needs of high acuity patients and had higher readmissions because they were less experienced in dealing with these patients. Traditionally, these patients would have received care in HBSNFs (pre-PPS period) (Rahman et al., 2013). No study, to our knowledge, has explored the association between the presence of a HBSNF in a hospital and its readmission rates. Some of the factors which could enable HBSNFs to contribute in lowering the hospitals' readmission rates include

improved access to treating physicians, greater availability of total nursing and aide resources per patient, and immediate and timely availability of resources, such as emergency services and equipment.

Traditionally, after an acute episode, patients are discharged either to home or a post-acute care (PAC) setting (Blewett, Kane, & Finch, 1995). Post-acute care could involve a range of services, such as physical rehabilitation and skilled nursing care, as per the needs of the patient (MedPAC, 2014; Murad, 2011). Currently, there are four PAC settings that are reimbursed by Medicare and are available to patients upon discharge: skilled nursing facility (free-standing or hospital-based), home health agencies (HHA), inpatient rehabilitation facility (IRF), and long-term care hospitals (LTCHs) (MedPAC, 2014). Medicare currently reimburses upto 100% for the first twenty days and patients are responsible for the $157.50 coinsurance per day for each benefit period for 21 to 100 days. Beyond 100 days patients pay the full cost of their PAC treatment (MedPAC, 2011b).

However, post-acute care has been characterized by limited involvement of physicians and the choice of a PAC site has been based on either the hospitals' ownership of HBSNFs, contractual arrangements with other SNFs, or patient preferences such as distance from family (Dummit, 2011). Furthermore, there have been no established standards or evidence-based measures to evaluate the quality of care delivered by various PAC providers (Kolus, 2012; MedPAC, 2007). Consequently, the quality of post-acute care has also been compromised by poor communication and coordination of care among providers during and after the patients' transition from acute to PAC settings (Grabowski,

Feng, Hirth, Rahman, & Mor, 2013; Pesis-Katz, Phelps, Temkin-Greener, Spector, Veazie, & Mukamel, 2013).

Nursing Home Compare (NHC) was introduced in 2002 as part of the Nursing Home Quality Initiative (Werner et al., 2009) in an attempt to improve the availability of information on quality of post-acute care to consumers which could potentially motivate providers to improve their quality of care. However, patients may find it difficult to interpret the measures of clinical quality reported on NHC on their own (Grabowski & Norton, 2012; Pesis-Katz et al., 2013). Therefore, NHC five-star quality rating was designed and implemented to simplify the information reported on NHC for consumers (hospitals, patients and their families). The five-star rating captures the information related to three measures of a SNF's quality of care: 1) health inspections (based on number, scope and severity of deficiencies identified from state health inspections), 2) quality ratings (based on 9 quality measures from MDS resident assessments) and 3) staffing (based on staffing levels of SNFs) (CMS, 2012). NHC displays the overall quality rating of a facility as well as the individual ratings for each of the three measures.

In addition to public reporting of quality information, staffing levels have been found to be associated with quality of care in a variety of healthcare settings and the relationship between staffing and SNF quality has been studied extensively (Castle, et al., 2007; Hyer et al., 2011; Weech-Maldonado, Meret-Hanke, Neff & Mor, 2004). However, HBSNFs have mostly been excluded from the studies on the association of staffing and quality of care since their patient

population is considered to be different from that of the free-standing SNFs (Castle et al., 2007; Hyer et al., 2011). As a result, much remains unclear about the relationship between HBSNF staffing and their quality of care even though the availability of quality related information is expected to influence consumer's choice of HBSNFs as their PAC site.

Therefore, this purpose of this three-paper dissertation is to examine three research questions related to the response of HBSNFs to the change in their environment such as the implementation of PPS in 1998 and their role in coordination of care for patients in transition from hospital acute care to home or other post-acute care facilities.

1) What organizational and market factors are associated with the closure of hospital-based skilled nursing facilities? (Paper 1)
2) What is the association between the presence of hospital-based skilled nursing facilities and readmission rates of hospitals? (Paper 2)
3) What is the association between the staffing patterns of hospital-based skilled nursing facilities and their quality ratings? (Paper 3)

Paper 1: Hospital-based SNF Closures: Organizational and Market-level Predictors

The purpose of this study was to examine the organizational and market-level factors associated with the closure of HBSNFs using the population ecology of organizations framework. The event histories of all acute care hospitals which had an open HBSNF in 1998, were examined over a period of 15 years (1998-2012) and 1,062 hospitals closed their HBSNFs during the study period. The data were derived from the American Hospital Association (AHA) Annual Survey, the Area Health Resources File

(AHRF), and CMS Medicare Cost Reports. Cox regression was conducted to estimate the hazard ratios and 95% confidence interval among hospitals that closed their HBSNFs as compared to the hospitals that did not, adjusting for covariates.

Paper 2: Hospital-based SNFs and Readmission Rates

This study examined the association between the presence of HBSNFs and hospitals' readmission rates, using the concept of vertical integration and Resource-based view (RBV). The data for years 2006-2012 were derived from the American Hospital Association (AHA) Annual Survey, the Area Health Resources Files (AHRF), CMS Medicare cost reports and CMS Hospital Compare. The final analytic sample consisted of 10,484 hospital-year observations for acute myocardial infarction, 16,980 for heart failure and 17,820 hospital-year observations were pneumonia. Ordinary Least Squares regression and a fixed effects regression with standard error correction for clustering at the hospital level.

Paper 3: Staffing and Quality Rating of Hospital-Based SNFs

This study examined the association of HBSNFS' staffing patterns with their health inspection ratings and quality ratings using the resource-based view. The data on all the HBSNFs operating the U.S from 2008 to 2011 were derived from Nursing Home Compare, Online Survey Certification and Reporting (OSCAR), LTCFocus database and Area Health Resource File (AHRF). The final analytic sample consisted of 4,116 HBSNF-year observations. A multivariate logistic regression, with state and year fixed

effects, was done with standard errors correcting for clustering at facility level to analyze the association between HBSNFs' staffing patterns and their quality ratings.

Significance

Given the increasing emphasis on communication and coordination of patient care between providers, findings of this dissertation can contribute to the literature on care coordination by providing insights into the influence various organizational and market factors could have on an organization's response to environmental changes and their likelihood of closure. The findings of the first study could provide more information about the factors that could allow healthcare organizations to better position themselves to face of the changes such as the reduction in reimbursement for excessive readmissions and bundled payment system. The second study could allow providers, payers and policy makers to better understand the role HBSNFs could play as a potential means of achieving lower readmission rates and in coordinating patients' care during and after their transition from acute to post-acute care or back into the community. Finally, the findings from the third study for a better understanding of how staffing patterns could influence the quality of post-acute care and create performance differentials as indicated by the HBSNFs' quality ratings. This understanding could be translated into staffing-related initiatives by administrators and policy makers to minimize disparities in the quality of post-acute care, specifically among HBSNFs with low quality ratings.

ORGANIZATIONAL AND MARKET-LEVEL PREDICTORS OF HOSPITAL-BASED SKILLED NURSING FACILITY CLOSURES

by

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ABSTRACT

Objective: This study examines the organizational and market-level factors associated with the closure of hospital-based skilled nursing facilities (HBSNFs) using the population ecology of organizations framework.

Data Sources: The event histories of all acute care hospitals with an open HBSNF in 1998, were examined. Data for a study period of 15 years (1998-2012) was derived from three sources: the American Hospital Association (AHA) Annual Survey, the Area Health Resources File (AHRF), and CMS Medicare Cost Reports.

Study Design: Time to closure was the dependent variable and was measured in years. Event represented whether a hospital closed its HBSNF or not (1 = yes); 0 = No). The event variable (closure) was assigned a value of 1 if the hospital did not report having a HBSNF for two consecutive years in either AHA or Medicare Cost Reports and 0 if the hospital had HBSNF beds greater than 0. The primary independent variables included size, ownership, total margin, market concentration and Medicare managed care penetration. The variables controlled for in the analysis included system-affiliation, rehabilitation services, occupancy rate, length of stay, ratio of HBSNF beds to total hospital beds, percentage of Medicare patients, SNF to hospital ratio in the county, poverty, Medicare discharges per 1000 population and urban location. All independent and control variables were lagged by one year. Cox regression was done to estimate the hazard ratios and 95% confidence interval among hospitals that closed their HBSNFs as compared to the hospitals that did not, adjusting for covariates.

Principal Findings: The results showed that large and not-for-profit hospitals and those located in more concentrated markets had lower odds of closing their HBSNFs, while those located in markets with greater Medicare managed care penetration were at greater risk of closing their HBSNFs. No significant relationship was found between the hospitals' total margin and likelihood of HBSNF closures.

Conclusion: Hospitals with access to more slack resources and operating more concentrated markets were less likely to close their HBSNFs.

INTRODUCTION

Rising health care costs and consequent increase in Medicare reimbursements have been an ongoing concern for policy makers. Therefore, many payment reforms targeting Medicare reimbursements have been introduced over the years. The prospective payment system (PPS) for Medicare reimbursements for hospitals was introduced in 1983 but did not apply to skilled nursing facilities until 1998 (Rahman, Zinn, & Mor, 2013). Implementation of the PPS for hospitals in 1983 created incentives for hospitals to reduce their length of stay. Hospitals responded to these incentives by either purchasing skilled nursing facilities (SNFs) or utilizing excess capacity to establish skilled nursing units (hospital-based skilled nursing units / facilities (HBSNFs)) within the hospital (Bishop & Dubay, 1991; Manton, Stallard, & Woodbury, 1994).

HBSNFs provide care to patients who "need short-term skilled nursing or rehabilitation services on an inpatient basis after a hospital stay of at least three days" (Dummit, 2011). By discharging patients to the HBSNFs, hospitals could potentially generate 2 streams of revenue from 1 patient: first, under the PPS in the form of incentives related to reductions in acute care length of stay; and second, by discharging the same patient to the HBSNF, from cost-based reimbursement. In an effort to curb this practice, PPS for SNFs was introduced in 1998. With PPS for SNFs in 1998, prior monetary incentives for hospitals to own a SNF disappeared (Rahman et al., 2013). Between 1997 and 2001 after PPS was

implemented, the average Medicare rates per SNF day for HBSNFs fell from $463 to $350 (White & Nguyen, 2011). Many hospitals closed their HBSNFs in response to this change in reimbursement policy. The number of HBSNFs dropped to approximately 1000 in 2008 as compared to almost 2500 a decade earlier (Feng et al., 2011; Kitchener, Bostrom, & Harrington, 2004).

HBSNF closures have been studied extensively in recent years. However, these studies have focused primarily on the effect of HBSNF closures on healthcare utilization and outcomes (length of stay) among Medicare fee-for-service beneficiaries (White & Seagrave, 2005) and the effect of reduction in HBSNF beds on readmissions from other SNFs (Rahman et al., 2013). For instance, White & Seagrave (2005) found that HBSNF closures were associated with an increase in utilization of alternative post-acute care (PAC) settings such as free-standing SNFs and inpatient rehabilitation facilities, and longer hospital lengths of stay.

Few studies have examined the hospital characteristics associated with HBSNF closures and found that lower Medicare SNF per diem, fewer HBSNF beds (size), newness of HBSNF and urban and metropolitan location were associated with higher probability of HBSNF closure (Medicare payment Advisory Commission, 2004; White & Seagrave, 2005). However, this research has not been extended the environmental characteristics of the hospitals that did versus did not close their HBSNFs. Evaluation of these factors can increase our understanding of the influence market factors could have on an organization's response to adverse environmental changes and their likelihood of closure.

Furthermore, all the studies on HBSNF closures have focused on the period immediately after the implementation of PPS. It is possible that the characteristics that were antecedents of early closures might be different from that of the closures that occurred in the later years (White & Seagrave, 2005). This delayed response could be attributed to organizational inertia and multi-year contractual relationships with PAC providers (White & Nguyen, 2011). Examining the organizational and market factors that could influence HBSNFs' likelihood of closure over an extended period (15 years) can allow us to understand additional factors which may influence long-term operation of healthcare organizations.

The purpose of this paper is to examine the organizational and market factors that predict the closure of HBSNFs using a population ecology perspective. This study will allow us to better understand the various factors which steered some hospitals towards HBSNF closure versus others that continued to operate their HBSNFs after the implementation of PPS. Such insights are especially important given the current changes in the healthcare environment, such as reduction in reimbursement for excessive readmissions and bundled payment system (Butcher, 2013). The study findings will provide more information about the factors that could influence organizational response to environmental changes, and the factors that could allow healthcare organizations to better position themselves to face these changes.

LITERATURE REVIEW

This study seeks to evaluate the factors which allowed the HBSNFs to remain in operation after the changes in their environment, specifically the implementation of the PPS in 1998. The rapid increase in the number of HBSNFs in the 1980s and 1990s could be considered the hospitals' response to implementation of PPS for hospitals in 1983 (Gruca & Nath, 1994). Historically, reimbursement had been cost-based, meaning hospitals had been free to set their own charges for their services even though their reimbursement by Medicare was based on certain allowable charges. In contrast, the PPS system set these payments to fixed levels irrespective of the actual costs incurred by the individual hospitals. This change in the reimbursement for Medicare patients adversely affected the payments of over 40% of all hospitals (Gruca & Nath, 1994). In response, many hospitals opened a HBSNF which were still reimbursed on cost basis. In 1997, 7% of all acute care stays were followed by HBSNF stays (White & Seagrave, 2005). However, with the implementation of PPS for SNFs in 1998, the hospitals' environment underwent another change. Since Medicare is the largest buyer of skilled nursing services (Weech-Maldonado, Qaseem, & Mkanta, 2009), especially for short-stay Medicare beneficiaries, this change had a significant impact on HBSNFs (Zinn, Mor, Feng, & Intrator, 2009). Hospitals had reduced financial incentives to operate a SNF as a result of the 1998 PPS legislation. Consequently, hospitals started closing down their HBSNFs (Dalton & Howard, 2002; Rahman et al., 2013), and the number of HBSNFs decreased by more than 50% between 1998 and 2011 (Rahman et al., 2013).

Closure of HBSNFs gave rise to important questions, such as the effect of these closures on access to care and the quality of the care for Medicare beneficiaries. HBSNF

closures could lead to decline in beneficiaries' access to care, especially if substitute settings providing comparable quality of care, were not available (White & Seagrave, 2005). Considerable research has focused on answering this question. White and Seagrave (2005), explored the effect of HBSNF closures on length of stay, use of alternative PAC settings, level of Medicare spending and health outcomes. They found that HBSNF closures were associated with greater utilization of alternative post-acute settings (free-standing SNFs) and longer hospital length of stays. For instance, the HBSNF closure increased the probability of freestanding SNF use by 2.4 percentage points and the hospital length of stay increased on average by 0.12 days. Similarly, Rahman, Zinn and Mor (2013) found that the freestanding SNFs, which acted as substitutes for HBSNFs, were unable to meet the needs of high acuity patients and had higher readmissions because they were less experienced in dealing with these patients. Traditionally, these patients would have received care in HBSNFs (pre-PPS period).

In another study assessing the effect of changes in Medicare payment rates per SNF day, under PPS, White and Nguyen (2011) found that the decrease in reimbursement for HBSNFs was associated with decline in the volume of HBSNF care at the level of hospital service area (HSA), since many HBSNFs exited the market. However, this reimbursement change was also associated with increase in provider-level volume of services provided by HBSNFs that continued to operate. This increase in volume for existing HBSNFs could be attributed to the increase in demand for their services since the other HBSNFs had closed. These studies show that the HBSNFs that continued to operate after the implementation of PPS continued to play an important role in care provision to patients. In this paper, the

population ecology perspective is utilized to explore the organizational and market factors that allowed some HBSNFs to respond differently than others to the changes in their environment and continue to operate.

CONCEPTUAL FRAMEWORK

The population ecology of organizations framework examines organizational change from an evolutionary perspective and attributes the organizational changes to natural selection, similar to that of biological ecology (Hannan & Freeman, 1977, 1989). According to population ecology, organizations, like species in the natural world, exist in multiple forms which are expressed in their structure. An organization's structure allows it to compete with other organizations for resources, which are critical for their effective functioning, and growth. However, the resource configurations may change when the environment changes. For instance, regulation such as PPS could create misalignment between an organization and its environment. Superior ability to compete could reduce an organization's risk of closure, especially when the environment is changing and resources are limited (Alexander, Kaluzny, & Middleton, 1986).

In order to survive, the organizations could respond to the environmental change in two ways: adaptation or natural selection. Organizational adaptation refers to the changes made by the organization internally to cope with the changes in their external environment (Thompson, 1967). It is a transformation that the organizations undergo when the barriers to entry into their market and / or the sources of their competitive advantage change (Parsa, Self, Sydnor-Busso, & Yoon, 2011). Hannan and Freeman (1977), on the other hand, suggested that organizational change is shaped by natural

selection. According to this perspective, stronger organizations continue to survive and the weaker ones are selectively eliminated from the population. Cook, Shortell, Conrad, and Morrisey, (1983) consider both the perspectives (adaptation and selection) as complementary. According to them, the organizations which are able to adapt to the environmental change are more likely to survive while those that are not able to adapt are eliminated.

The ability of an organization to adapt is influenced by a variety of factors such as organizational inertia, structural configurations (plant and equipment), market concentration and organizational density (Freeman, Carroll, & Hannan, 1983; Hannan & Freeman, 1989). Consequently, the external environment determines the optimal characteristics of the population of organizations by allowing the survival of the fittest. Organizations that are able to take advantage of environmental changes and respond accordingly continue to survive while those that are ill-suited to the new conditions and do not adapt "die" or are selected out (Alexander et al., 1986). Thus the population ecology seeks to explain the survival or failure of organizations based on the environmental characteristics, characteristics of organizations operating in a given environment and the interaction between these environmental and organizational characteristics.

Population ecology has been applied in healthcare research to study issues such as success and failure of organizations, mergers & acquisitions, and diversification. For instance, Alexander, Kaluzny and Middleton (1986) developed a framework predicting the success, growth and failure of U.S.

hospitals. They identified the conditions which influence the survival of generalist versus specialist hospitals and proposed that instability in the environment resulted in mergers and greater diversification. Hurley and Kaluzny (1987), examined the role of regulation in development of various organizational forms and structures. They concluded that regulation played a significant role in natural selection. Similarly, Wholey and Sanchez (1992) used population ecology to model the entry, exit and density of HMOs into the market and evaluated how regulation could affect the rate of growth of a market. The theoretical framework is shown in figure 1.

HYPOTHESES

According to population ecology, success or failure of an organization is the result of its ability to adapt to their environment, which is based on organizational factors such as organization's age and size (Parsa et al., 2011) and on market factors such as competitive density (Freeman, Carroll, & Hannan, 1983; Hannan & Freeman, 1989). Each of these characteristics explain why some organizations can thrive, while others fail in response to environmental changes (Parsa et al., 2011).

Ownership status

For-profit organizations primarily depend on their profits to survive. Therefore, services that become unprofitable due to environmental change could threaten financial viability of these organizations. Moreover, it would be difficult for such organizations to attract and / or keep investors if they are not producing adequate returns (Johnson & Roman, 2002). On the other hand, not-for-profit hospitals have greater access to tax

exemptions, endowments and charitable contributions which could shield them from such adverse effects of the environmental change. Therefore, HBSNFs in hospitals that are operated on a for-profit basis would be more vulnerable to closure given the decrease in Medicare reimbursement. Hence, we hypothesize that:

Hypothesis 1: Not-for-profit hospitals are less likely to close their HBSNFs compared to for-profit hospitals.

Hospital Size

When the environmental resources are low or there is increased competition for resources, larger organizations may get positively selected. This may happen because they are able to better tolerate variations in resource levels as well as the periods between resource procurements (Zinn et al., 2009). In contrast, smaller hospitals may not be able to do the same due to their lack of slack resources and excess capacity (Alexander et al., 1986). For instance, small size has been found to be associated with greater risk of closure among nursing homes (Kitchener et al., 2004). Furthermore, larger hospitals may have lower production costs due to economies of scale and sharing resources and nursing personnel between the acute and the post-acute setting. They could also have greater negotiating ability in contracts with suppliers (Kazley & Ozcan, 2007; Lucas et al., 2005). Additionally, larger hospitals are often more diversified and operate in more markets which may allow them to pool risks and survive in the face of

adverse environmental conditions (Wholey, Christianson, & Sanchez, 1992; Nyhan, Ferrando, & Clare, 2002). Therefore, we hypothesize that,

Hypothesis 2: Larger hospitals are less likely to close their HBSNFs as compared to smaller hospitals.

Total Profit Margin

Reimbursement reforms tend to influence the profitability and levels of financial risks for hospitals by directly influencing the payments they receive for their services. Reduction in reimbursement may decrease the profitability of services offered by a hospital and increase the financial risk; thereby affecting the hospitals' ability to continue offering those services especially if it has already been struggling financially (Huckfeldt, Sood, Romley, Malchiodi, & Escarce, 2011).

Prior poor financial performance has been found to be a significant predictor of closure among various health care organizations (Castle, 2006; Castle, Engberg, Lave, & Fisher, 2009; Dalton & Howard, 2002; Zinn et al., 2009). It may indicate that the organization is struggling to obtain necessary resources to continue operating in its current market (Alexander, D'Aunno, & Succi, 1996; Zinn et al., 2009). Such organizations would tend to close down unprofitable services such as HBSNFs in the face of adverse financial changes in their environment. Since total profit margin has been used extensively as an indicator of overall profitability of an organization (Gapenski, 1999; Weech-Maldonado, Laberge, Pradhan, Johnson, Zhou, & Hyer, 2012) and accounts for all revenues (operating and non- operating revenues) as well as expenses (operating and non-operating expenses), we hypothesize that:

Hypothesis 3: Hospitals with higher total profit margin are less likely to close their HBSNFs.

Market Concentration

Organizational ecology posits that organizations influence each other's likelihood of success and / or failure since they compete for similar resources (Mellahi & Wilkinson, 2004). Organizational failure as well as growth could, therefore, be attributed to the number of organizations in the market (or market concentration). Market concentration has been frequently used as a measure of competition in research studies involving market factors (Everhart, Neff, Al-Amin, Nogle, & Weech-Maldonado, 2013; Starkey, Weech-Maldonado, & Mor, 2005). For instance, Gifford and Mullner (1988) found that closure rates were lower in "sparse environments" i.e. in more concentrated markets (lower levels of competition). The hospitals' decision to close their HBSNF may depend on the level of concentration in their market.

In more concentrated markets the hospitals may face less competition for the similar resources. Consequently, they may allocate additional resources to minimize the adverse effects of environmental changes. Moreover, an organization with one product (specialist) is generally more affected by changes in their environment as opposed to a multi-product organization (generalist) (Alexander et al., 1986; Gruca & Nath, 1994). The hospitals located in more concentrated markets may compete as a generalist by providing a range of better coordinated services, lower the production costs by sharing resources and nursing

personnel between the acute and the post-acute setting and respond to the environmental changes better. Therefore, we hypothesize that,

Hypothesis 4: Hospitals operating in more concentrated markets are less likely to close their HBSNFs.

Medicare Managed Care Penetration

Managed care penetration in the hospitals' markets could also significantly influence HBSNF closures. With increasing numbers of Medicare beneficiaries choosing to enroll in managed care plans, it has become an important source of referrals for hospitals. Approximately 15.4 % of Medicare beneficiaries were enrolled in managed care plans in 2011 (MCOL, 2011). Therefore, in markets with greater managed care penetration, these plans could potentially influence hospitals' behavior (Starkey et al., 2005) especially in terms of reducing length of stay and maintaining continuity of care. HBSNFs would allow hospitals to provide post-acute care in HBSNFs rather than transferring them to other facilities (Weech-Maldonado et al., 2009). Consequently, hospitals operating in markets with greater managed care penetration would seek ways to continue to operate their HBSNFs to accommodate the needs of managed care plans. Therefore, we hypothesize that

Hypothesis 5: Hospitals which are located in markets with greater managed care penetration are less likely to close their HBSNFs.

METHODS

Data

Data for this study were derived from three sources: the American Hospital Association (AHA) Annual Survey, the Area Health Resource File (AHRF), and CMS Medicare Cost Reports. The AHA survey includes information on the organizational characteristics of hospitals such as structure and inpatient utilization (American Hospital Association, 2012). The AHRF data set contains county-level information on socio-economic status, population demographics and environmental characteristics (HRSA, 2011). It is compiled from a variety of sources, including the AHA, the U.S. Bureau of Census, the Centers for Medicare and Medicaid Services (CMS), the U.S. Bureau of Labor and Statistics, and the National Center for Health Statistics. The Medicare cost reports dataset includes financial information of the hospitals (Centers for Medicare and Medicaid Statistics., 2011). The study protocol was approved by the University of Alabama at Birmingham's Institutional Review Board (IRB) (Appendix A).

Study Sample

This retrospective cohort study used the event histories of all non-federal, medical/surgical, acute-care hospitals, in the U.S, which had an open HBSNF in 1998, the year in which PPS went into effect for SNFs (n = 2,217). The organizational and market factors of this cohort were examined across a period of 15 years (1998-2012) to evaluate the predictors of HBSNFs' closure over time.

The hospitals that did not have a HBSNF in 1998 or opened one after 1998 were excluded from the analysis. The missing data in the variables market concentration, concentration, hospital to SNF ratio and the Medicare discharges per 1000 population was replaced with the mean of the observations from the years that the data was available for. However, only the hospitals-year observations with complete data were used in the final analysis. Therefore, the final analytic sample had 1062 hospitals that closed their HBSNFs between 1998 and 2012.

Measures

The list and operational definitions of the dependent, independent and control variables included in the analyses and sources of data are presented in Table 1.

Dependent variable. The dependent variable was the time to HBSNF closure. Hospitals were considered to have a HBSNF if the number of HBSNF beds reported by them in the AHA survey and Medicare Cost Reports was greater than 0. The event variable (closure) was assigned a value of 1 if the hospital did not report having a HBSNF for two consecutive years and 0 if the hospital reported having HBSNF beds greater than 0. Due to the possibility of incomplete reporting, the event was also assigned a value of 0 if the data indicating the presence or absence of HBSNF was missing for one year but the hospital had a HBSNF in the prior and the next year (n = 110). The time-to-event was measured in years.

Independent variables. The independent variables included in the analyses were the organizational and market factors which could affect the ability of the hospital to continue operating their HBSNF. Organizational factors included size (hypothesis 1),

ownership (hypothesis 2), and total margin (hypothesis 3) of the hospital operating the HBSNFs. Hospital size was categorized into small (0-99 beds), medium (100-249 beds) and large (250 or more beds) to compare its impact on HBSNFs' closure. Market factors included hospital-level market concentration (HHI) (hypothesis 4) and Medicare managed care penetration (hypothesis 5).

Control variables. The analysis controlled for the organizational and market factors that have been found to be associated with organizational survival and closure of healthcare organizations (Hsia, Kellerman, & Shen, 2011; Knudson et al., 2005; Mullner, & McNeil, 1986; White & Seagrave, 2005). The organizational control variables included system-affiliation, rehabilitation services offered by the hospital, hospitals' occupancy rate, length of stay, HBSNF size, and percentage of Medicare patients. The market-level control variables were SNF to hospital ratio in the county, poverty, Medicare discharges per 1000 population and urban location. All the independent and control variables were lagged by one year to account for the variables' effect on the hospitals' decision to close the HBNSF in the next year.

Analysis

Descriptive and bivariate analyses were done to examine the distribution of variables and to assess the differences between hospitals that did and did not close their HBSNF respectively. Cox regression analysis was conducted to estimate the hazard ratios and 95% confidence interval among hospitals that closed their HBSNFs as compared to the hospitals that did not, adjusting for covariates. Therefore, this model accounts for

whether the HBSNF closes as well as the time-point at which the event occurred (Knudsen, Roman & Ducharme, 2005). This technique has been used extensively in various research studies such as those related to medical treatments (e.g. cancer treatment), laboratory experiments, and financial distress (Laitinen, 2005). For the purpose of this study, the hazard rate was estimated to determine the probability of a HBSNF closing within a specific time period (15-year period), given that it has survived up to that point (Parsa et al., 2011). Time to closure was calculated from the year 1998, when PPS was first implemented, to the year of closure. SAS 9.3 and STATA 12 were used to conduct the analyses. Statistical significance was considered at $p < 0.05$.

RESULTS

The study sample consisted of 17,965 short-term, acute-care hospital-year observations (table 2). During the study period (1998-2012) approximately 1,136 hospitals closed their HBSNFs. A majority of the hospitals in the study sample were not-for-profit (69.5%), system-affiliated (53.1 %) and located in urban areas (95.6 %). Small, medium-sized and large hospitals formed 21.2%, 45.4% and 33.5% of the sample, respectively. More than half of the hospitals (55.9%) did not have any of the two rehabilitation services (physical & cardiac) while only 9.9% had both. The average occupancy rate was 55.3%, length of stay of 17.7 days and total margin of 2%. Medicare patients formed 45.9% of their payer mix. The mean HHI for the hospitals in the sample was 0.75 indicating high market concentration and 11.8% Medicare managed care penetration in the market. The average proportion of skilled nursing facilities to total

number of hospitals in the county was 2.5. These counties had 14.3% of their population in poverty and 37.3 Medicare discharges per 1000 population.

Similarly, bivariate analysis (table 2) indicated that there were significant differences in the organizational and market characteristics of the hospitals that closed their HBSNFs and those that did not. For instance, hospitals that closed their HBSNFs were small (27.0%), for-profit (20.5%), system-affiliated (64.5%) and offered both physical and cardiac rehabilitation services (12.1%). Moreover, they had higher occupancy rate (56.9%), shorter length of stay (10.4), more Medicare patients (51.3%) and smaller proportion of HBSNF beds than the hospitals that did not. Furthermore, hospitals that closed their HBSNFs were located in markets characterized by higher concentration (0.7), lower proportion of SNFs to hospital ratio in the county (2.4) and higher percentage of people in poverty (14.7%) than hospitals that did not. The hospitals that did and those that did not close their HBSNFs were similar with regard to their total margin and urban location.

The Kaplan-Meier curves present the likelihood of HBSNF survival during the 15 year study period (1998-2012). These curves show that the for-profit (figure 2) and small (figure 3) hospitals had higher risk of closure. However, majority of these closures happened during the first five years (1998-2002) after the implementation of PPS. Figure 4 and Figure 5 show the likelihood of HBSNF closure during the first five years study period (1998-2002), after adjusting for ownership status and hospital size respectively.

The Cox regression results (table 3) show that the hazard ratios (HRs) for closure of HBSNFs owned by not-for-profit and non-federal government hospitals were 0.72 (95% CI = 0.60 – 0.87) and 0.76 (95% CI = 0.59 – 0.97) respectively. Therefore hypothesis 1 was supported. Similarly, HRs for closure of HBSNFs in medium and large hospitals were 0.49 (95% CI = 0.40 – 0.59) and 0.29 (95% CI = 0.23 – 0.37) respectively indicating that they were at lesser risk of closure than the HBSNFs in small hospitals; thereby supporting hypothesis 2. Among the market factors, the HBSNFs in hospitals that were located in more concentrated markets had a lower risk of closure (HR = 0.72, 95% CI = 0.57 – 0.91). Therefore hypothesis 4 was supported. Contrary to what we expected, the HBSNFs in hospitals located in markets with greater Medicare managed care penetration were at greater risk of closure (HR = 1.01, 95% CI = 1.0 – 1.01). Therefore, hypothesis 5 was not supported. We did not find significant association between hospitals' total margin and the risk of HBSNF closure. Thus, hypothesis 3 was not supported.

Among the organizational control variables, system-affiliation (HR = 1.34, 95% CI = 1.16 – 1.54), presence of both physical and cardiac rehabilitation services (HR = 1.26, 95% CI = 0.95 – 1.67), higher occupancy rate (HR = 1.01, 95% CI = 1.0 – 1.01) and greater percentage of Medicare patients (HR = 1.01, 95% CI = 1.01 – 1.02) were associated with higher risk of HBSNF closure by hospitals. In contrast, longer length of stay (HR = 0.99, 95% CI = 0.98 – 0.99) and higher proportion of HBSNF beds (HR = 0.34, 95% CI = 0.29 – 0.40) were associated with lower risk of HBSNF closure by hospitals. Among the market-level control variables, SNF to hospital ratio (HR = 0.94,

95% CI = 0.90– 0.99) and Medicare discharges per 1000 population (HR = 0.99, 95% CI = 0.99 – 1.00) were negatively associated with the risk of HBSNF closure.

DISCUSSION

The purpose of this study was to examine the organizational and market factors that could influence the closure of HBSNFs using population ecology theory. This paper hypothesized that hospitals which are located in more concentrated markets, have greater access to slack resources and are in better financial shape would be less likely to close their HBSNFs.

The findings from the Cox regression showed a significant negative association between the risk of HBSNFs closure and not-for-profit status, size, and hospital-level market concentration. These results are consistent with those of the prior studies related to various healthcare organizations (Castle et al., 2009; Hsia, Kellerman & Shen, 2011; Mullner & McNeil, 1986). For instance, Hsia, Kellermann and Shen (2011) found that for-profit ownership of the parent hospital was associated with higher risk of ED closure. Similarly, studies have shown that larger organizations were less likely to close since they would be able to better withstand the adverse environmental changes than smaller organizations irrespective of the healthcare settings such as outpatient substance abuse treatment sector (Wells, Lemak & D'Aunno, 2005), acute care hospitals (Sloan, Ostermann, & Conover, 2003), substance abuse facilities (Johnson & Roman, 2003) and nursing homes (Castle et al., 2009). HBSNFs may have access to more resources

in more concentrated markets. Therefore, HBSNFs in hospitals located in more concentrated markets would be at lower risk of closure.

On the other hand the study results indicated that the hospitals located in markets with higher managed care penetration were more likely to close their HBSNFs. The potential reason for this relationship could be the emphasis on cost-control by managed care organizations (Wells, Lemak & D'Aunno, 2005). Moreover, greater Medicare managed care penetration would allow the managed care plans greater bargaining power; they could negotiate lower payments for HBSNFs services; thereby decreasing the profitability of services offered by HBSNFs and increasing the risk of their closure.

The total margin was not significantly associated with HBSNF closure. These results could be attributed to the fact that total margin indicates the overall financial health of the hospital and not the HBSNF. Although studies have shown that poor financial health is associated with greater likelihood of organizational closure (Bowblis, 2011; Castle et al., 2009), it may not capture its impact on the risk of closure of particular units or services.

Among the organizational control variables, system-affiliation and higher occupancy rate were associated with higher risk of HBSNF closure. These results are in conformity to the findings of prior studies on closure of other healthcare organizations (Qaseem et al., 2008; Johnson & Roman, 2003; Sloan, Ostermann, & Conover, 2003). Closure of their HBSNFs by system-affiliated hospitals may represent excess capacity in a given skilled nursing care market while hospitals with high occupancy rates may close their HBSNFs as a strategy to focus on their core business (acute-care). For instance, Qaseem and colleagues (2008) found that nursing homes with higher occupancy offered

lesser subacute or skilled nursing care. Furthermore, smaller HBSNF size (proportion of HBSNF beds) and higher percentage of Medicare patients were associated with greater risk of HBSNF closure. This could be attributed to the fact that Medicare is the largest payer of HBSNFs' services. Therefore, hospitals with more Medicare patients would be affected more by the decrease in Medicare reimbursement leading to the increase in risk of HBSNF closure. Smaller HBSNF size would also increase the risk of their closure since it would be easier for hospitals to close a small-scale service and divert their resources towards the services that are more profitable due to organizational inertia.

Among the market factors, higher SNF to hospital ratio in the county was associated with lower risk of HBSNF closures, which was contrary to our expectations. However, these results are consistent with those of Qaseem and colleagues (2008). According to them, high acuity patients may benefit from HBSNF care before they are discharged to other sub-acute settings such as the SNFs in the community. Therefore, HBSNFs care may be considered complementary to the care offered by the SNFs and the markets with higher SNF to hospital ratio may experience greater demand for skilled nursing care (Qaseem, Weech-Maldonado & Mkanta, 2008). Therefore, higher SNF to hospital ratios in the county may be associated with lower risk of HBSNF closures.

Hospitals began offering skilled nursing care in HBSNFs in response to the implementation of acute care PPS which created incentives for the hospitals to lower their length of stay. HBSNFs offered an alternative discharge setting because HBSNFs were reimbursed on cost-basis. However, implementation of PPS for SNFs eliminated

this incentive for hospitals leading to HBSNF closures. Given the recent changes in the hospitals' reimbursement system, such as Medicare's hospital readmission reduction program, hospitals will need to build tighter linkages and collaborations across the continuum of care to achieve superior patient outcomes and avoid the penalties (Maly et al., 2013). The presence of HBSNFs could allow the hospitals to better coordinate transitions between different healthcare settings for their patients and reduce their readmission rates (Ouslander, Diaz, Hain & Tappan, 2011).

Moreover, under bundled payments, one entity would be paid for all the covered services delivered to patients during an episode of care (Dummit, 2011). A Medicare Spending per Beneficiary (MPSB) measure will be used to assess the cost of all the services rendered by various healthcare providers during an MSPB episode of hospitalization (McHugh, Trivedi, Zinn & Mor, 2014). If the entity receiving the payment is a hospital, having a HBSNF would allow it to internally transfer the patients needing skilled nursing services. It would allow the hospitals to ensure the continuity of patients' care by minimizing disruptions in care due to transfers between different healthcare settings. Consequently, the hospitals would not only have better control of costs and quality of patients' care, but would also keep more of the payment (Dummit, 2011). Therefore, there could be a business case for hospitals to continue operating their HBSNFs if they have one. Findings of this study indicate that not-for-profit, large and medium-sized hospitals and those operating in highly competitive markets would be in a better position to take advantage of the market opportunities presented by the changes in their environment such as bundled payment since they are less likely to close their HBSNFs.

This outcome of this study was affected by several limitations. First, it utilizes secondary data that limited the scope of the study to the variables which are available in the datasets. Consequently, a variety of factors such as competition at the level of HBSNFs and between HBSNFs and free-standing SNFs in the market were not examined. These factors may significantly influence the hospitals' decision to close their HBSNFs and should be examined as part of future research. Secondly, the independent variable was created from the information related to the presence or absence of HBSNFs in hospitals. Therefore, inaccuracies in the data could have affected the number of hospitals that were considered to have experienced HBSNF closure (event) which could underestimate the impact that various organizational and market factors were shown to have on HBSNF closure. Therefore, unbiased results would indicate an effect greater than that reflected by the study findings.

Although this study had the above mentioned limitations, findings of this study allow for a better understanding of various factors that enabled certain HBSNFs to stay open and identification of factors which could help mitigate the adverse effect of the reimbursement policies on financial viability of healthcare organizations. The study findings also indicate the need for further research into the association between the characteristics of parent hospitals and HBSNF closures utilizing more detailed data about HBSNFs. Availability of details about HBSNFs such as their utilization by hospitals, volume of their patients needing skilled nursing care and cost of keeping a HBSNFs operational could allow for a better evaluation of the profitability of HBSNFs for hospitals. It would also

facilitate future research into the impact of strategic choices related to service delivery on the survival or failure of organizations delivering integrated health care, such as accountable care organizations.

Furthermore, Seagrave and White (2005) showed that HBSNF closures led to a shift in the site of post-acute care as well as increased hospital length of stay. They concluded that Medicare's reimbursement policies for different providers are interconnected and affect utilization and spending among them (Seagrave & White, 2005). Moreover, Rahman, Zinn and Mor (2013), found an increase in readmissions from free standing SNFs in areas which lost HBSNF beds. This has important implications for the hospital-SNF collaborations as well as for the quality of care delivered to patients, given the emphasis on integration of acute and post-acute care in ACA, as well as the reimbursement-related policy changes. Therefore, hospitals with HBSNFs could utilize the findings of this study to evaluate their current and future strategies related to their HBNSFs to lower the risk of their closure. It could also allow policy makers to craft policies incentivizing the factors that reduce the probability of closure among existing HBSNFs and promote better coordination of care.

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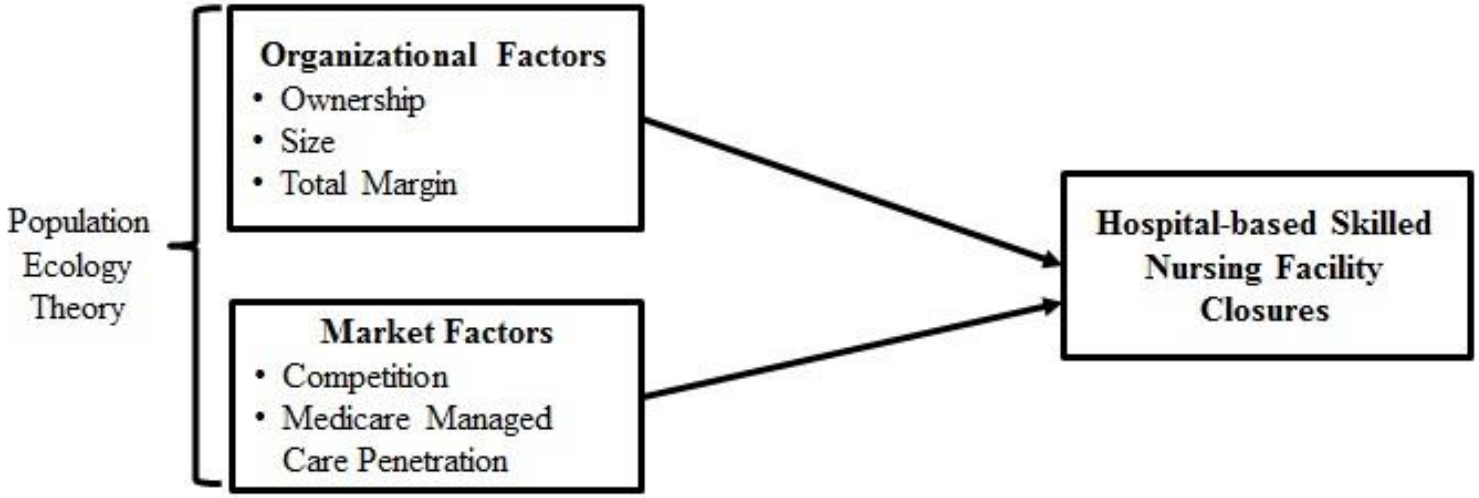

Figure 1. Theoretical framework to study the organizational and market-level predictors of hospital-based skilled nursing facility closures

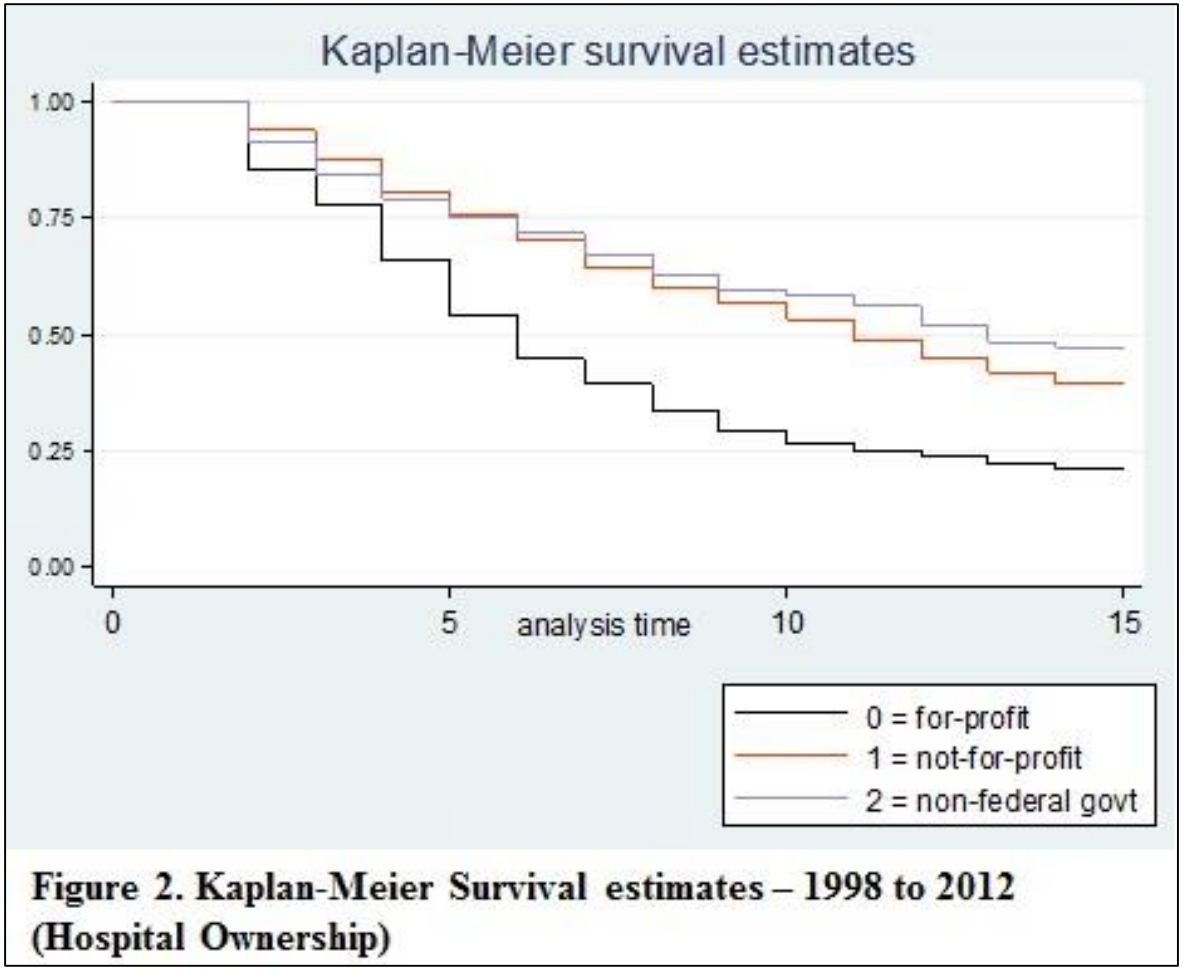

Figure 2. Kaplan-Meier Survival estimates – 1998 to 2012 (Hospital Ownership)

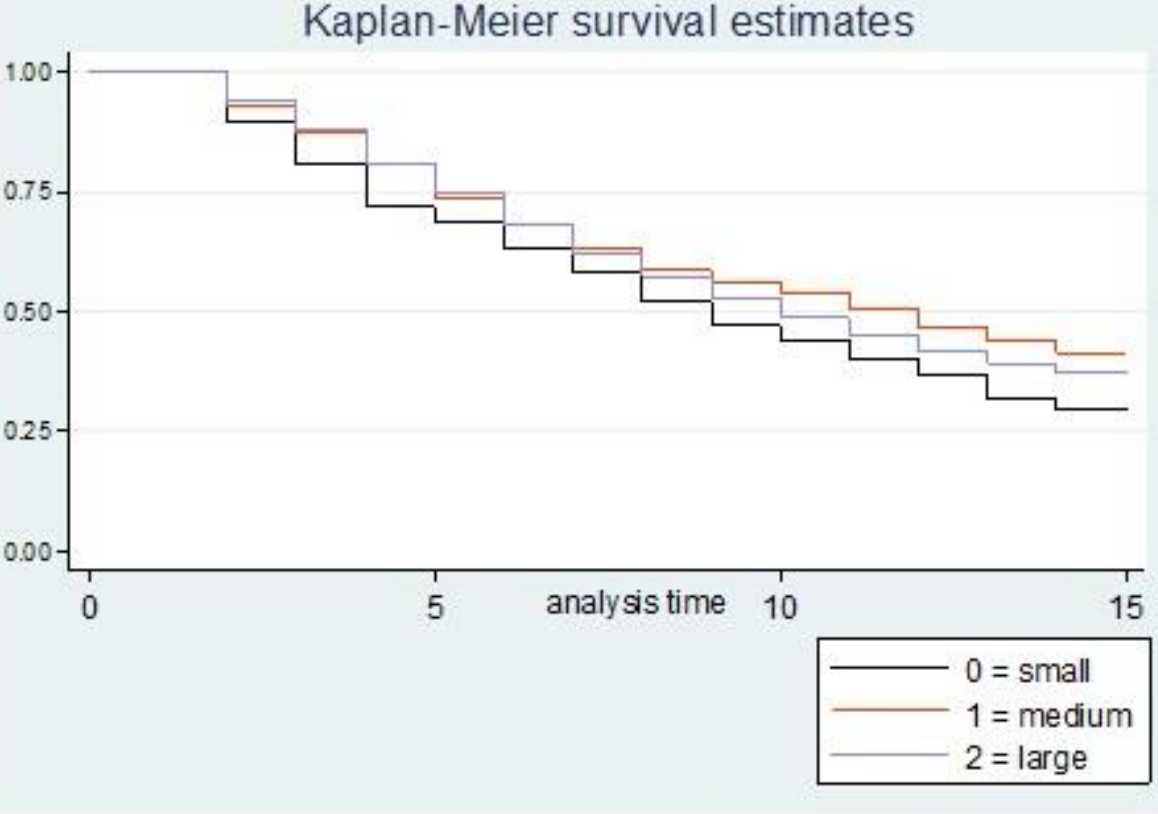

Figure 3. Kaplan-Meier Survival estimates – 1998 to 2012 (Hospital Size)

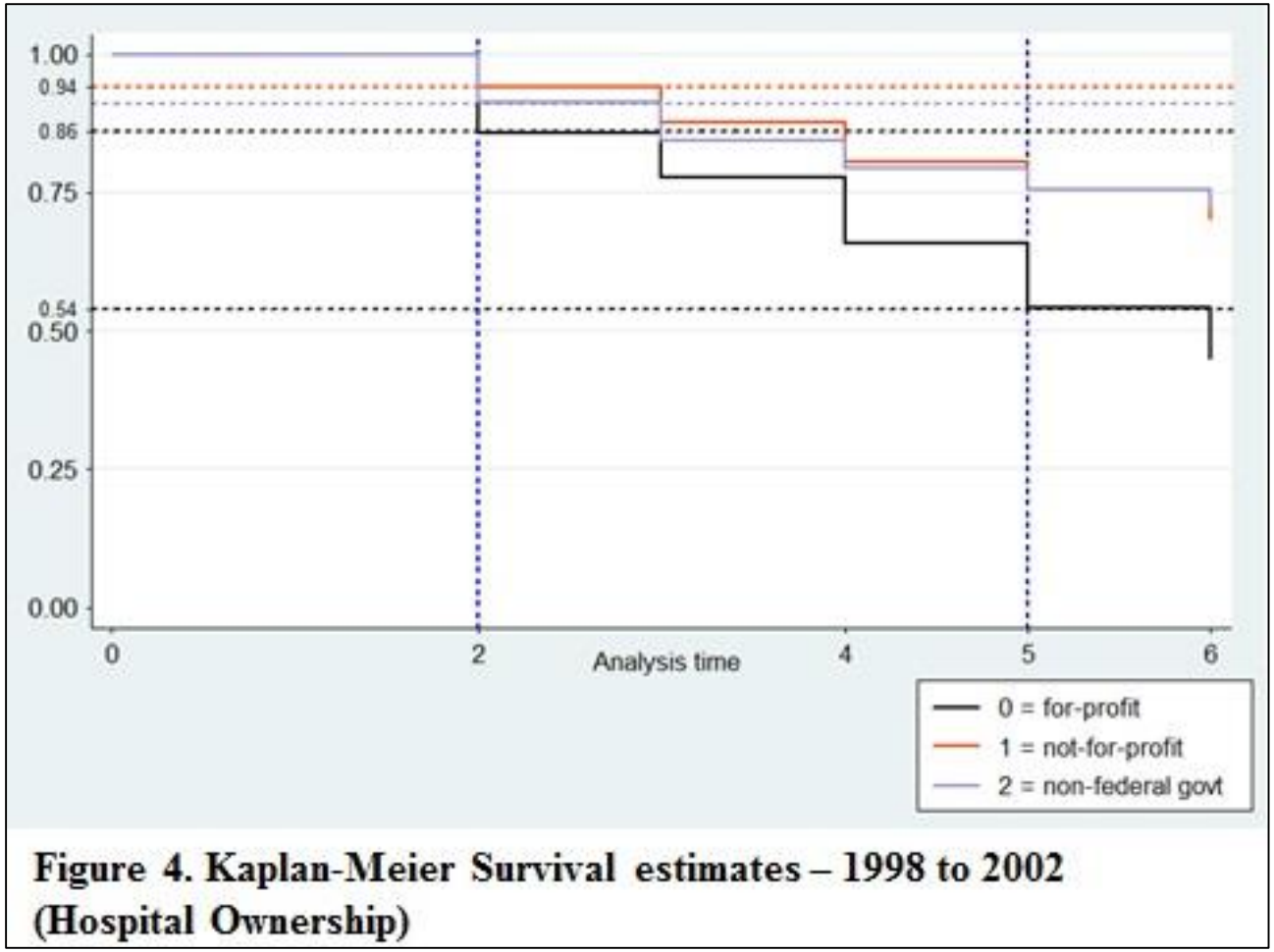

Figure 4. Kaplan-Meier Survival estimates – 1998 to 2002 (Hospital Ownership)

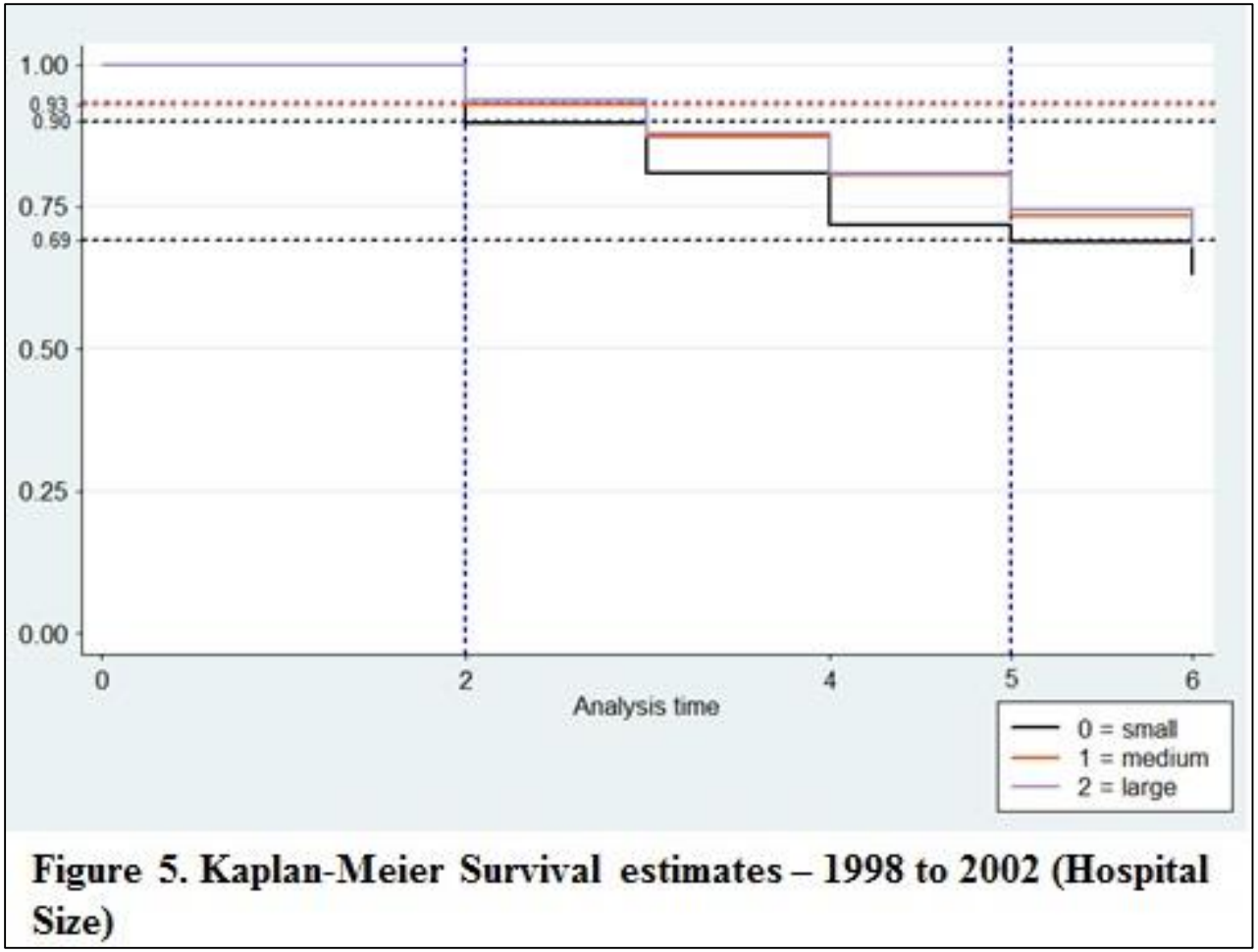

Figure 5. Kaplan-Meier Survival estimates – 1998 to 2002 (Hospital Size)

TABLE 1. Variables Used in the Study

Variable	Definition	Data Source
Dependent Variable		
Time to HBSNF closure	Time to event was measured in years. Event represented if the hospitals closed their HBSNF or not (1= Yes; 0 = No).	AHA; Medicare Cost Reports
Independent Variables		
Organizational Characteristics		
Hospital Size	Categorical variable indicating the size of the hospital: 0 = small ; 1 = medium ; 2 = large	AHA
Ownership status	Categorical variables indicating if the hospital is for-profit, not-for-profit or non-federal government	AHA
Total Profit Margin	Net Income / Total Revenue.	Medicare Cost Reports
Market Characteristics		
Market Concentration (HHI)	Sum of squares of individual hospital's market share in the HSA accounting for system affiliation. HHI values range from 0 to 1; 1 = high market concentration; values close to 0 = low market concentration	AHA
Medicare Managed Care Penetration	(Medicare managed care enrollees / Medicare eligibles in the county) x 100	AHRF
Control Variables		
System affiliation	A dichotomous variable indicating if a hospital is part of a hospital system or not: 1 = yes; 0 = no	AHA
Rehabilitation Services	Categorical variable indicating if the hospital offered physical rehabilitation, cardiac rehabilitation or both	
Occupancy Rate of the hospital	Hospital inpatient days x 100 / number of staffed hospital beds x 365	AHA
Length of Stay	Total Inpatient Days / Total Discharges	AHA

Proportion of HBSNF beds	Categorical variable indicating the proportion of HBSNF beds relative to the total beds in the hospital (tertiles): 0 = lower one-third; 1 = middle one-third; 2 = upper one-third	AHA
Percentage of Medicare Patients	(Total Medicare Inpatient Days / Total Inpatient Days) x 100	AHA
SNF to Hospital ratio	Total no. of SNFs / no. of hospitals in the county	AHRF
Poverty	Percentage of persons in poverty in the county	AHRF
Medicare discharges per 1000 population	(Medicare discharges in the county / Total population) x 1000	AHRF
Urban location	A dichotomous variable indicating (1) if a hospital was located in an urban or (0) rural area	AHRF

Abbreviations: HBSNF: Hospital-based Skilled Nursing Facility; HHI: Herfindahl-Hirschman Index; HSA: Health Service Area; SNF: Skilled nursing Facility; AHA: American Hospital Association Annual Survey; AHRF: Area Health Resource File

TABLE 2. Characteristics of All hospitals; Hospitals with HBSNFs in 1998 and Hospitals without HBSNFs

Variable	All hospitals Mean / Percent	Did close HBSNFs Mean / Percent	Did not close HBSNFs Mean / Percent	p-value
All hospitals (hospital-year observations)	17965 (100%)	1136 (100%)	16829 (100%)	
Organizational				
Ownership				
For-profit	12.49%	20.51%	11.94%	0.001
Not-for-profit	69.45%	64.79%	69.76%	0.001
non-Federal government	18.07%	14.70%	18.30%	0.002
System-affiliation	53.12%	64.53%	52.35%	0.001
Hospital size				
Small hospital	21.20%	27.02%	20.80%	
Medium-sized hospital	45.35%	41.46%	45.61%	0.001
Large hospital	33.45%	31.51%	33.58%	
Rehabilitation services				
Neither physical nor cardiac	55.86%	53.25%	56.04%	
Either physical or cardiac	34.22%	34.68%	34.19%	0.028
Both physical and cardiac	9.92%	12.05%	9.77%	
Occupancy rate of the hospital	55.33	56.94	55.22	0.001
Length of stay	17.733	10.37	18.22	0.001
Total margin	0.02	0.03	0.02	0.327
Percentage of Medicare patients	45.97	51.33	45.61	0.001
Proportion of HBSNF beds to total hospital beds				
Upper one-third	34.02%	0.00%	36.31%	
Middle one-third	32.98%	0.26%	35.18%	0.001
Lower one-third	33.01%	99.74%	28.50%	
Market				
Market concentration (HHI)	0.75	0.69	0.75	0.001
Medicare managed care penetration	11.80	11.74	11.80	0.089
SNF to hospital ratio	14.30	2.37	2.54	0.012
Medicare discharges per 1000 population	37.30	28.33	37.90	0.528
Poverty	14.31	14.72	14.28	0.008
Urban location	95.60%	96.56%	95.53%	0.099

***$p \leq 0.01$, **$p \leq 0.05$

TABLE 3. COX Regression Results with Time-to-closure as a Dependent Variable		
Variables	**Hazard ratio**	**95% Confidence Interval**
Independent variables		
Organizational Factors		
For-profit (reference)		
Not-for-profit	0.72***	0.60 - 0.87
Non-Federal Government	0.76***	0.59 - 0.97
Small hospital (0-99 beds) (reference)		
Medium-sized hospital	0.49***	0.40 - 0.59
Large hospital	0.29***	0.23 - 0.37
Total Margin	0.62	0.20 - 1.87
Market Factors		
Market concentration (HHI)	0.72***	0.57 - 0.91
Medicare Managed Care Penetration	1.01**	1.00 - 1.01
Control Variables		
System-affiliation	1.34***	1.16 - 1.54
Neither Physical or Cardiac Rehabilitation (reference)		
Physical or Cardiac Rehabilitation	1.03	0.89 - 1.20
Both Physical and Cardiac Rehabilitation	1.26	0.95 - 1.67
Occupancy Rate	1.01***	1.00 - 1.01
Length of Stay for Medicare patients	0.99***	0.98 - 0.99
Proportion of HBSNF beds (lower one-third) (reference)		
Proportion of HBSNF beds (upper one-third)	0.34***	0.29 - 0.40
Proportion of HBSNF beds (middle one-third)	0.19***	0.16 - 0.23
Percentage of Medicare Patients	1.01***	1.01 - 1.02
SNF to Hospital ratio	0.94***	0.90 - 0.99
Poverty	1.01	0.99 - 1.02
Medicare discharges per 1000 population	0.99**	0.99 - 1.00
Urban location	0.94	0.62 - 1.42

Total observations (n): 15004
Events (1 = closed; 0 = open): 1062
Censored observations (n): 13942
***$p \leq 0.01$, **$p \leq 0.05$

ASSOCIATION BETWEEN HOSPITAL-BASED SKILLED NURSING FACILITIES AND HOSPITALS' READMISSION RATES

by

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ABSTRACT

Objective: This study examined the association between hospitals' readmission rates and presence of hospital-based skilled nursing facilities, using the concepts of vertical integration and resource-based view.

Data Sources: The data for years 2006-2012 was derived from American Hospital Association (AHA) Annual Survey, Area Health Resources Files (AHRF), Medicare cost reports and CMS Hospital Compare.

Study Design: The dependent variables were 30-day risk-adjusted readmission rates for acute myocardial infarction (AMI), heart failure (CHF) and pneumonia. The independent variable was the presence of HBSNF in a hospital (1 = yes, 0 = no). The control variables included hospital size, length of stay, payer mix, occupancy rate, registered nurse staffing, market competition, Medicare managed care penetration, skilled nursing facility to hospitals ratio in the county, Medicare discharges per 1000 population, poverty and unemployment rate. An ordinary least square regression was done to examine the effect of HBSNFs on overall variation in hospitals' readmission rates. A panel regression with facility and year fixed effects was used to determine the extent to which the variation in readmission rates is due to within versus between hospital variations. The standard errors were corrected for clustering at the hospital level.

Principal Findings: The results of the ordinary least square regression show a significant, negative association between presence of HBSNFs and hospitals' readmission rates. However, the results of the fixed effects regression did not show a similar

association. Among the control variables, shorter length of stay for Medicare patients and a higher proportion of SNFs to hospitals in the county were significantly associated with lower readmission rates while higher occupancy rate for the hospital and greater managed care penetration in the market were associated with higher readmission rates for CHF.

Conclusion: The results show that presence of HBSNFs is associated with decrease in overall variation in the hospitals' readmission rates, However, the extent to which this decrease could be attributed to the within versus between hospital variation is not clear.

INTRODUCTION

Hospital readmissions within 30 days of discharge represent an important quality measure since they represent a preventable adverse outcome: an insufficiently treated health care problem. (Cykert, 2012; Medicare Hospital Compare, 2012; MedPAC, 2007; van Walraven, Bennett, Jennings, Austin, & Forster, 2011) 30-day readmissions drive costs, accounting for 60% of the costs among Medicare beneficiaries (Anderson, Tyler, Helms, Hanson, & Sparbel, 2005). The Medicare fee-for-service program incurs an annual cost of approximately $17 billion with nearly 20% of the beneficiaries getting readmitted within 30 days of discharge from the hospital (Hansen, Young, Hinami, Leung, & Williams, 2011; Jencks, Williams & Coleman, 2009).

A variety of strategies have been proposed and implemented to reduce readmission rates (Dummit, 2011; Ouslander, Diaz, Hain, & Tappen, 2011; Stone & Hoffman, 2010). In October 2012, the Centers for Medicare and Medicaid Services (CMS) embarked on the hospital readmissions reduction program, which reduced Medicare payments to hospitals with "excessive" readmission rates by 1% for heart failure, acute myocardial infarction, and pneumonia (Axon & Williams, 2011; CMS, 2014; Kocher & Adashi, 2011). These penalties increased to 2% and 3% in years 2014 and 2015, respectively (CMS, 2014). Since hospitals' reimbursement is now tied to their readmission rates, they are exploring strategies to effectively reduce their readmissions (Sood, Huckfeldt, Escarce, Grabowski, & Newhouse, 2011).

Prior research has identified many factors along the continuum of care which could lead to higher readmission rates (Minott, 2008). These factors include poor quality of inpatient care, inadequate staffing (Thomas, Mor, Tyler, & Hyer, 2013), inadequate discharge planning and premature discharge, improper transitions of care, insufficient follow up, lack of care coordination, and poor communication between acute and post-acute care (PAC) providers (DeCoster, Ehlman, & Conners, 2013; Kirsebom, Wadensten, & Hedström, 2013; Minott, 2008; Stone & Hoffman, 2010). Several studies have suggested that better coordination of care and communication between acute and PAC providers may exhibit the most potential to reduce readmission rates (Benbassat & Taragin, 2000; Coleman, Parry, Chalmers, & Min, 2006; Epstein, Tsaras, Amoateng-Adjepong, Greiner, & Manthous, 2009; Hansen et al., 2011; King et al., 2013). Therefore, strategies aimed at improving collaboration between providers across the continuum of care could help in lowering hospitals' readmission rates (Minott, 2008).

Establishing a skilled nursing unit within a hospital, i.e. hospital-based skilled nursing facilities (HBSNF), could improve coordination of care and help reducing readmission rates (Anderson et al., 2005). HBSNF refers to a facility which is licensed by the state as a skilled nursing facility (SNF), is located inside a hospital, shares its governing board, is financially integrated with the hospital and the two (i.e. hospital and HBSNF) file their Medicare cost reports together (Deangelis Jr, 1987; Whitman, DeAngelis, & Knapp, 1986). HBSNFs have also been referred to as "sub-acute care units" and "transitional care units" in the literature (Smith, 1996). For the purpose of this study, these terms are used interchangeably. Among Medicare patients, HBSNFs provide care to those who "need short-term skilled nursing or rehabilitation services on an

inpatient basis after a hospital stay of at least three days" (Dummit, 2011; MedPAC, 2014). HBSNFs could allow such patients to have better access to physicians and other auxiliary services (x-rays, laboratory, and the like) on a regular basis, thereby helping in their transition from acute to either post-acute care or into the community (Joseph, 1998).

Although HBSNFs could play a significant role in maintaining the continuum of care for patients, little is known about their association with hospitals' readmission rates. The few studies that have examined this relationship have focused on the effect of HBSNF closures on healthcare utilization and patient outcomes among Medicare fee-for-service beneficiaries (White & Seagrave, 2005), differences in patient outcomes of free-standing SNFs and HBSNFs (Stearns, Dalton, Holmes, & Seagrave, 2006) and the effect of HBSNF beds reduction on readmissions from other SNFs in the area (Rahman, Zinn, & Mor, 2013). For instance, White and Seagrave (2005) found that HBSNF closures were associated with an increase in utilization of alternative PAC settings and hospitals' length of stay. No study, to our knowledge, has explored the association between the presence of a HBSNF in a hospital and its readmission rates.

The purpose of this this paper is to examine whether hospitals that have HBSNFs experience lower readmission rates than hospitals that do not have them, using the concept of vertical integration and Resource-based view (RBV). This study will allow providers, payers and policy makers to better understand the role HBSNFs in coordinating patients' care during the transition from acute to post-acute care or back into the community. It would also allow hospital administrators

to evaluate if having a HBNSF could be a viable readmission reduction in achieving lower readmission rates.

LITERATURE REVIEW

Traditionally, after an acute episode, patients are discharged either to home or PAC setting (Blewett, Kane, & Finch, 1995). Post-acute care could involve a range of services, such as physical rehabilitation and skilled nursing care, as per the needs of the patient (MedPAC, 2014; Murad, 2011). Minimum requirements for Medicare reimbursement of PAC services include 3 or more consecutive days of hospital care and physician-ordered skilled or rehabilitative therapy services for treatment of the same condition as the one treated during their hospitalization. The benefit period is up to a 100 days for an episode of illness (Liu & Black, 2003; MedPAC, 2011b; Phillips, Langmuir, Parmelee, & Weinberg, 2003). Medicare currently reimburses upto 100% for the first twenty days an dpatients are responsible for the $157.50 coinsurance per day for each benefit period for 21 to 100 days. Beyond 100 days patients pays the full cost of PAC treatment (Medicare.gov, n.d.).

Currently, there are four PAC settings that are reimbursed by Medicare and are available to patients upon discharge: y skilled nursing facility [free-standing (FSSNFs) or hospital-based (HBSNFs)], home health care (HHC), inpatient rehabilitation facility (IRF), and long-term care hospitals (LTCHs) (MedPAC, 2011a, MedPAC, 2014). The setting choice has often been based on factors such as patient preferences, insurance, proximity, availability and ownership or contractual arrangements (Dummit, 2011).

Historically, skilled nursing facilities (SNFs) have been the most commonly used PAC sites (MedPAC, 2011b). As mentioned earlier, HBSNFs provide medical and rehabilitation services to patients who are discharged from acute care, but are not well enough to go home and need extended medical supervision or nursing services (McDowell Jr, 1990; Murad, 2011). In 2010, there were 1,058 HBSNFs in the United States with 55,311 residents (American Health Care Association, 2011). HBSNFs primarily differ from FSSNFs in that they are smaller, have more nursing hours (Shaughnessy, Schlenker, Brown, & Yslas, 1983; Whitman, DeAngelis & Knapp, 1986), and are primarily not-for-profit (White & Nguyen, 2011). They also tend to have higher bed turnover rates, relatively shorter lengths of stay, and cater to the Medicare patient population (Donelan-McCall, 2006; Liu & Black, 2003; Stearns, Dalton, Holmes, & Seagrave, 2006). In contrast, FSSNFs are predominantly for-profit, and primarily care for Medicaid and private-pay patients and those who are likely to need long-term care after their SNF stay (White & Nguyen, 2011).

Recent studies exploring the effect of HBSNF closures on readmissions have also suggested that higher acuity patients may benefit more from the presence of HBSNFs. For instance, Rahman, Zinn and Mor (2013) found that HBSNF closures resulted in increased readmissions from other SNFs within a market and this effect was larger for higher acuity patients. The authors attributed this increase to the limited ability of the FSSNFs to serve these complex patients, who were referred to these facilities when HBSNFs closed. These results conform to those reported by Stearns and colleagues (2006) and MedPAC (2011) - that

patients receiving care in HBSNFs had better outcomes (quicker discharge to home and lower readmissions) than those transferred to FSSNFs, indicating better quality of care at HBSNFs. These results may also reflect the case that the patients in hospitals with HBSNFs are predominantly discharged to those HBSNFs while the site of post-acute care of patients from hospitals without HBSNFs varies (White & Seagrave, 2005).

Some of the factors that may allow HBSNFs to better serve high acuity patients include improved access to treating physicians, greater availability of total nursing and aide resources per patient, and immediate and timely availability of resources, such as emergency services and equipment (McDowell Jr, 1990; Shaughnessy et al., 1983). Access to physicians and / or nursing staff and additional care resources, could allow for better coordination of care for patients (Bailis & Shannon, 1995; Tuch, Hiep, & Bruce, 1994), thereby reducing the risk of their readmission.

CONCEPTUAL FRAMEWORK

Readmissions have often been attributed to the breakdown in communication and coordination of the continuum of care associated with treating acute episodes and the post-acute care after the acute episode is over (DeCoster, Ehlman, & Conners, 2013; Minott, 2008; Stone & Hoffman, 2010). Therefore, readmissions are considered an important measure of quality of care (Benbassat & Taragin, 2000; Kocher & Adashi, 2011; Medicare Program, 2011; Minott, 2008). This paper explores the role HBSNFs could play in lowering readmission rates among hospitals, using the concept of vertical integration and the Resource-based view.

Vertical Integration

External environments continuously present organizations with a variety of challenges as well as opportunities (Lawrence, & Lorsch, 1967). In response, these organizations employ various strategies to adapt to the changes in their environment in order to maintain or improve their performance (Child, 1972; Donaldson, 1995). The health care environment in the U.S. has undergone a variety of changes over the years such as advent of managed care, implementation of reimbursement reforms such as the prospective payment system, and the healthcare reform efforts with the Affordable Care Act. In response to the changes in their environment, hospitals could pursue various strategies to achieve, to maintain or to improve their competitive advantage. Vertical integration could represent one such strategic response to the changes in the health care environment.

In healthcare, a vertically-integrated organization represents "an arrangement whereby the organization offers, either directly or through others, a broad range of patient care and support services operated in a functionally unified manner" (Conrad & Dowling, 1990). This range of services offered may include pre-acute, acute, and post-acute care organized around a hospital (Conrad & Dowling, 1990). In health services literature, "forward" vertical integration is the integration between acute and post-acute care, which is directed towards consumers such as patients following hospitalization, is referred to as "forward" vertical integration (Dowling, 1995). Forward vertical integration became a popular hospital strategy after the implementation of prospective payment

systems (PPS) for hospitals in 1983. With PPS, hospitals had incentives to reduce their inpatient length of stay since their reimbursement was set to fixed levels irrespective of the actual costs incurred by the individual hospitals. However, HBSNFs' reimbursement was still cost-based. So, they provided the hospitals with an outlet to discharge the patients from acute care sooner, and an additional revenue stream from the SNF cost-based reimbursement (Rahman et al., 2013).

The concept of vertical integration has been used to study various organizational forms or arrangements adopted by healthcare organizations to deliver care. For instance, Robinson (1996) investigated the decision of hospitals in California to vertically integrate into sub-acute care by developing HBSNFs over two time periods (1982–1986 and 1986–1990). The study showed that hospitals with relatively high Medicare patient mix or not-for-profit ownership were more likely to develop a HBSNF in both periods. Scale economies were an important determinant of integration, whereas capacity utilization had a weak influence in the latter period. Similarly, Lehrman & Shore (1998) found that adjusted Medicare acute length of stay and for-profit and teaching status of the hospital strongly influence the hospitals' decision to have a HBSNF.

Resource-based View of the Firm

Resource-based view (RBV) of the firm seeks to explain the link between the internal characteristics of an organization and its performance. It examines the differences in the performance of different organizations and attributes these differences to the variation in their resources and capabilities (Short, Palmer, & Ketchen, 2002). RBV examines the sources of competitive advantage and superior organizational

performance based on two assumptions: heterogeneity of resources among firms within an industry and immobility of resources leading to long lasting heterogeneity (Barney, 1991). Firm resources are those that are controlled by the firm and allow it to conceive and implement value-creating strategies (Barney, 1991; Daft, 1983). Examples of firm resources include all tangible and intangible assets, capabilities, firm attributes, and knowledge. Integration of acute, transitional and post-acute care in the form of a HBSNF within an acute care hospital represents a tangible resource (Barney, 1991), which could influence the performance of the hospital. HBSNFs could prove valuable to hospitals by facilitating delivery of higher quality patient care through improved communication and better coordination between care providers.

RBV has been used extensively in healthcare to explore issues related to the relationship between staffing and nursing home performance (Weech-Maldonado, Meret-Hanke, Neff & Mor, 2004), differences in the association of nurse staffing with performance between competitive and less competitive markets (Everhart, Neff, Al-Amin, Nogle, & Weech-Maldonado, 2013), and the effects of organizational characteristics and strategic group membership on hospital performance (Short, Palmer & Ketchen Jr., 2002). The theoretical framework in shown in figure 1.

HYPOTHESIS

The association between readmission rates and presence of a HBSNF in a hospital can be explained based on the concept of organizational capabilities. According to RBV,

organizational capabilities are the ability of an organization to create competencies, through coordination of its unique resources, which would allow them to improve their performance (Grant, 1998). It involves coordination between people, people and other resources, or bundles of resources. Moreover, vertical integration allows an organization to either find new uses for existing resources or to fill the gaps in its resource base by using exchanges between different units within a single organization. According to Lawrence and Lorsch (1967), it is easier to coordinate the use of resources, to build organizational capability, within an organization than among multiple organizations. Therefore, vertical integration could facilitate the enhancement of organizational capabilities by reducing the difficulties in coordination of resources (Theuvsen, 2004) and help organizations in achieving and / or maintaining superior performance. For instance, superior performance of a coordination-intensive activity, such as the package-tour sector depends on the organizational capabilities such as successful coordination of various stages in the tourism value chain (Theuvsen, 2004). Similarly, in healthcare 24-hour registered nurse staffing depends on organizational capabilities such as recruitment, training and continuing education, and communication between units to allow excess staff in one related area (intensive care unit) to be deployed to address staff shortages in another related unit (emergency department).

In the context of hospitals, presence of HBSNFs could allow hospitals to successfully coordinate acute and post-acute care and develop capabilities that would influence their readmission rates through clinical integration. Clinical integration is defined as "the extent to which patients' care services are coordinated across people, functions, activities, processes, and operating units so as to maximize the value of

services delivered" (Shortell, Gillies, Anderson, Erickson, & Mitchell, 1996, p.30). Tighter linkages, arising from integration between different levels of care under one organizational umbrella, could allow for better control of patient flow, greater access to patients' health information, standardization of care processes, increased efficiency, and better coordination of care along the continuum (Conrad & Shortell, 1996; Zingmond, 2002).

Similarly, Rahman, Zinn and Mor (2013) found that stronger hospital-SNF referral linkages were associated with lower readmission rates and attributed the results to the ease of communication, adoption of common clinical protocols and information exchange between the hospital and HBSNF staff (Rahman, Foster et al., 2013; Rahman, Zinn & Mor, 2013). For instance, the use of the same electronic health records system platform could minimize errors during transitions between acute and PAC settings, as well as improve the quality of services delivered at each point in the process (Conrad & Dowling, 1990).Therefore, having a HBSNF could allow hospitals to develop unique organizational capabilities to better monitor and control the quality of care delivered to its patients (McDowell Jr, 1990), thereby lowering their readmission rates. Therefore this paper hypothesizes that:

Hypothesis: Hospitals with HBSNFs experience lower readmissions rates than hospitals without them.

METHODS

Data

Data for this study were derived from four sources: the American Hospital Association (AHA) Annual Survey, the Area Health Resources Files (AHRF), CMS Medicare Cost Reports and Hospital Compare. The AHA survey includes information on the organizational characteristics of hospitals, such as organizational structure and inpatient and outpatient utilization (American Hospital Association, 2012). The AHRF data set contains county-level information on socio-economic status, population demographics, and environmental characteristics (HRSA, 2011). It is compiled from a variety of sources, including the AHA, the U.S. Bureau of Census, the Centers for Medicare and Medicaid Services (CMS), the U.S. Bureau of Labor and Statistics, and the National Center for Health Statistics. The CMS Medicare Cost Reports contain the financial information of healthcare organizations and was used to construct the primary independent variable i.e. the presence of HBSNF in the hospital in addition to AHA. The Hospital Compare dataset includes information on the 30-day risk-adjusted readmission rates for Acute Myocardial Infarction (AMI), Congestive Heart Failure (CHF) and Pneumonia (HHS, 2012). The study protocol was approved by the University of Alabama at Birmingham's Institutional Review Board (IRB) (Appendix A).

Study Sample

The study sample consisted of all non-federal, medical/surgical, acute-care hospitals operating in the U.S. between 2006 and 2012. The overall sample consisted of 83,453 hospital-year observations for acute myocardial infarction, heart failure and

pneumonia. The cases with missing provider number and FIPS state and county were deleted since these variables were used to merge the data sets used in the study. In addition, cases with the values in excess of five standard deviations from the mean for the variables hospital size, RN staffing, occupancy rate, length of stay for Medicare patients and ratio of skilled nursing facilities to hospitals in the county and those with calculated payer mix proportions greater than 100 percent were excluded (Weech-Maldonado, Meret-Hanke, Neff, & Mor, 2004). The final overall analytic sample was 73,806 hospital-year observations. Since, the independent variable was lagged by one year and only the cases with complete information were utilized in the regression analyses the final analytic sample was 10,484 hospital-year observations for acute myocardial infarction, 16,980 hospital-year observations for heart failure and 17,820 hospital-year observations were pneumonia.

Measures

Dependent variables. The operational definitions of the dependent, independent and control variables included in the analyses and sources of data are presented in Table 1. The dependent variables represent the 30-day risk-adjusted readmission rates for AMI, CHF and pneumonia. It measures the rate of unplanned readmissions for AMI, CHF or pneumonia to any acute-care hospital within 30 days of discharge from a hospitalization. It includes Medicare beneficiaries aged 65 or more who were enrolled in traditional fee-for-service Medicare for an entire 12 months prior to their hospitalization as well as those who were admitted to Veteran's Health Administration (VA) hospitals. The readmission rates are risk-adjusted for patient characteristics (gender, age, past medical history and

other co-morbidities) which could increase the risk of readmission among the patients irrespective of the quality of care provided by the hospital (HHS, 2012).

Independent variable. The independent variable represents the presence or absence of a HBSNF in the hospital. It was created based on the number of HBSNF beds reported by the hospital in the AHA survey and Medicare Cost Reports. It was assigned value of 1 if the number of HBSNF beds was greater than 0 in either AHA database or Medicare cost reports and 0 if it was 0 or missing (1 = have HBSNF and 0 = do not have HBSNF). The independent variable was lagged by one year to address the potential omitted variable bias due to endogeneity between the dependent and independent variable.

Control variables. The analysis controlled for the organizational and market factors that have been found to be associated with readmissions (Experton, Ozminkowski, Pearlman, Li, & Thompson, 1999; Heggestad, 2002; Joynt & Jha, 2011; Joynt, Orav, & Jha, 2011; Rich & Freeland, 1988) and hospitals' quality of care (Aiken, Clarke, & Sloane, 2002; Propper, Burgess, & Green, 2004; Shah, Fennell, & Mor, 2001). These organizational control variables included hospital size (setup / staffed beds), length of stay, occupancy rate, payer mix, and staffing (full-time equivalent registered nurses (RNs) per 1000 inpatient days). The market-level control variables were market competition among acute care hospitals accounting for system affiliation (measured by Herfindahl-Hirschman Index (HHI)) (Cutler & Morton, 2013), Medicare managed care penetration, SNF to hospital ratio in the county, Medicare discharges per 1000 population in the county, poverty and unemployment rate.

Analysis

Descriptive analysis was done to examine the distribution of the variables. Bi-variate analysis was performed to assess the differences in the organizational and market characteristics between hospitals with and without HBSNFs. The ordinary least squares (OLS) regression was done to examine the effect of HBSNFs on the overall variation in hospitals' readmissions. A fixed effects regression with standard errors corrected for clustering at the hospital level was conducted to determine the extent to which the variation in readmissions is due to with-in versus between hospital variations. Facility fixed effects were used to control for the omitted variable bias resulting from unobserved, time-invariant characteristics which could influence readmission rates of the hospitals. The year fixed effects accounted for the time trends which could influence the hospitals' readmission rates. Both the OLS and fixed effects regression models were run separately for acute myocardial infarction, heart failure and pneumonia. Sensitivity analysis, using the independent variable with and without one-year lag, was done to examine the robustness of the results. The results were interpreted as highly significant for p-value $\leq$ 0.01, significant for p-value ≤ 0.05 and marginally significant for p-value ≤ 0.10. SAS 9.3 and STATA 13 were used to conduct the analyses.

RESULTS

Table 2 exhibits the descriptive statistics of the study sample. Approximately 24.2% of the hospitals in the analytic sample had HBSNFs. The hospitals in the study had, on average, 178 beds, 9 FTE RNs per 1000 inpatient days, an occupancy rate of 55.6%, and length of stay for Medicare patients equal

to 5.7 days per patient. Medicare formed 50.9% of the hospitals' payer mix while Medicaid formed only 18.9%. The mean HHI for the hospitals in the sample was 0.7 0.7 indicating low levels of competition. The average proportion of skilled nursing facilities to total number of hospitals in the county was 1.7 with 130 Medicare discharges per 1000 population. These counties had 16.5% of their population in poverty and an unemployment rate of 7.8 percent.

Table 3 presents the results of the bivariate analysis. The bi-variate analysis showed that there are statistically significant differences between the organizational and market characteristics of the hospitals that had HBSNFs versus those that did not. For instance, hospitals that have HBSNFs were, on average, larger (207 beds), had higher occupancy rate (62.1%), and longer lengths of stay for their Medicare patients (7.5). However, they had lower RN staffing (5.6) and lower percentage of Medicare patients (44.3%) and higher percentage of Medicaid (27.0%) than the hospitals without HBSNFs. Furthermore, hospitals with HBSNFs were located in markets characterized by lower competition (0.8), lower Medicare managed care penetration (21.7), higher number of Medicare discharges per 1000 population (154.1) and lower percentage of people in poverty (16.2%).

The OLS regression results (table 4) show that the hospitals with HBSNFs are associated with lower readmission rates for all three conditions: AMI (-0.16, $p = 0.001$), CHF (-0.24, $p = 0.001$), and pneumonia (-0.26, $p = 0.001$). Among the control variables, higher RN staffing (AMI = -0.04, $p = 0.001$; CHF = -0.04, $p = 0.001$; Pneumonia = -0.03, $p = 0.001$) and greater Medicare managed care penetration (AMI = -0.01, $p = 0.001$; CHF = -0.01, $p = 0.001$; Pneumonia = -0.01, $p = 0.007$) were associated with lower

readmission rates for all three conditions. On the other hand, higher occupancy rate (AMI = 0.01, p = 0.001; CHF = 0.001, p = 0.017; Pneumonia = 0.01, p = 0.001) and higher percentage of Medicare (AMI = 0.01, p = 0.001; CHF = 0.01, p = 0.001; Pneumonia = 0.01, p = 0.001) as well as Medicaid patients (AMI = 0.01, p = 0.001; CHF = 0.01, p = 0.001; Pneumonia = 0.01, p = 0.001) in the hospital were associated with higher readmission rates. Among the market level characteristics, higher unemployment rate (AMI = 0.04, p = 0.002; CHF = 0.06, p = 0.001; Pneumonia = 0.05, p = 0.001) was associated with higher readmission rates for all three conditions while higher levels of poverty was associated with higher readmission rates only for CHF (0.02, p = 0.001) and pneumonia (0.01, p = 0.001).

On the other hand, the fixed effects regression did not show a statistically significant association between presence of HBSNFs and readmission rates for any of the three conditions (Table 5). Therefore, the study hypothesis was not supported. The results were consistent for regression models with the lagged independent variable as well as without the lag.

Among the control variables, higher proportion of SNFs to hospitals in the county (-0.03, p = 0.073) had a marginally significant association with lower readmission rates while occupancy rate (0.01, p = 0.073) had a marginally significant association with higher readmission rates for AMI. Shorter length of stay for Medicare patients (-0.03, p = 0.001) and a higher proportion of SNFs to hospitals in the county (-0.05, p = 0.016) were significantly associated with lower readmission rates while higher occupancy rate for the hospital (0.01, p = 0.002)

and greater managed care penetration (0.023, p = 0.007) in the market were associated with higher readmission rates for CHF. Similarly, higher RN staffing levels (-0.01, p = 0.070) had marginally significant association with lower readmission rates while shorter length of stay for hospitals (-0.01, p = 0.032) and greater managed care penetration (0.014, p = 0.048) in the market were associated with higher readmission rates for pneumonia.

DISCUSSION

The purpose of this study was to evaluate the association between the presence and absence of HBSNFs in hospitals with their readmission rates, using the concept of vertical integration and RBV. This paper hypothesized that hospitals with HBSNFs would experience lower readmission rates, through better coordination of patient care, given that poor communication and coordination of care among providers has been identified as the most common causes for higher readmission rates (Minott, 2008; Stone & Hoffman, 2010). The OLS results indicated significant results whereas fixed effects regression did not.

The findings from the OLS regression showed a significant negative association between the presence of HBSNFs and hospitals' readmission rates. These results could be attributed to the fact that HBSNFs could help in better integration of acute, transitional and post-acute care. Therefore, they could help lower hospitals' readmission rates by facilitating better communication between providers and better coordination of patient care. Rahman and colleagues (2013) also suggested that the HBSNFs may be more

effective in reducing specifically the early readmissions (bounce backs) due to greater access to physicians and other medical resources.

However, the results of the fixed effects regression did not show a similar association. This difference in the results of the OLS and fixed effects regression could be due to the influence of other unobservable factors, in addition to those controlled for in the study, on the hospitals' readmissions such as differences in discharge patterns of hospitals with and without HBSNFs and their utilization of HBSNFs for patients' post-discharge care. Consequently, the negative association between presence of HBSNFs and hospitals' readmission rates shown by the OLS regression results cannot be attributed solely to the presence of HBSNFs in a hospital. For instance, delay in placement of Medicare patients in the SNFs leads to longer length of stay and poor patient outcomes for the hospitals (Lehrman & Shore, 1998). To ensure timely access to skilled nursing services and reduction in the adverse patient outcomes, hospitals may develop an inter-organizational exchange relationship with the SNFs in the market in lieu of owning a HBSNF (Rahman, Zinn & Mor, 2013). The significant association of greater proportion of SNFs to hospitals in the county with lower readmission rates for AMI and CHF in this study may reflect such a relationship. On the other hand, the patients in counties with few SNFs as compared to hospitals may be forced to return home and may bounce back as readmissions.

Among the organizational control variables, higher RN staffing was associated with lower readmission rates in both models, specifically for pneumonia which is in conformity to the findings of prior studies (Jyont & Jha,

2011; Mchugh, Berez & Small, 2013; Mchugh & Ma, 2013). For instance, Jyont and Jha (2011) used staffing to identify hospitals with limited clinical resources in their study. They found that hospitals with high registered nurse staffing ratios had lower readmission rates and were less likely to be poor performers. The results of this study also show that higher occupancy rate is associated with higher readmission rates for AMI and CHF. These results are similar to those of Erdem, Fout, Korda and Abolude (2014) who found that readmission rates increased with hospitals' occupancy rate. This increase may result from premature discharge of patients from hospitals to free up the beds for additional patients.

Among the market-level control variables, greater managed care penetration was associated with lower readmission rates for all three conditions in the OLS regression model but higher in the fixed effects regression model. These results are consistent with prior findings; Medicare HMO enrollees were three to five times more likely to have avoidable readmissions than the Medicare FFS participants. These high readmission rates among the HMO enrollees were attributed to premature hospital discharges (Experton et al., 1999) given the stringent Medicare reimbursement policy related to skilled nursing care. Other socio-economic factors such as unemployment and poverty were also found to be associated with higher readmissions since unemployed and poor people are more likely to have challenges related to transitions in care, such as not being able to afford follow-up care and medications. (Erdem, et al., 2014; Herrin et al., 2014; Jyont & Jha, 2010).

Historically, there have been no incentives for hospitals to manage care after an acute episode. However, changes in the reimbursement system, such as Medicare's

hospital readmission reduction program and the bundled payments based on episodes of care, are creating incentives for acute and post-acute care management (Dummit, 2011). These changes essentially hold hospitals accountable for the quality of acute and post-acute care delivered to patients. Hospitals incur reimbursement penalties for 'excess' readmissions with the implementation of the hospital readmission reduction program (CMS, 2014). Therefore, hospitals will need to build tighter linkages and collaborations across the continuum of care to achieve superior patient outcomes and avoid the penalties (Maly et al., 2013). Similarly, with the bundled payments one entity would be paid for all the covered services delivered to patients during an episode of care (Dummit, 2011). Greater access to HBSNFs or FSSNFs in the markets could allow the hospitals to better coordinate transitions between different healthcare settings for their patients and reduce their readmission rates (Ouslander et al., 2011).

This outcomes of this study were influenced by several limitations. First, it utilizes secondary data which limited the scope of the study to the variables available in the datasets. Secondly, the independent variable is dichotomous which only conveys the information related to the presence or absence of HBSNFs in hospitals. It does not capture the information related to the extent to which the hospitals that have HBSNFs utilize its services. Third, the dependent variable (readmissions rates) is calculated using the hospitals' discharge data for three years and includes hospitalizations only for Medicare beneficiaries, 65 years and above of age, who were enrolled in a traditional fee-for-service Medicare for entire 12 months prior to their hospitalization. Moreover, the fixed effects models do not work well with variables that are slow to change or have minimal within-

cluster variation (Oscar Torres-Reyna, 2007). Therefore, limited variation in the independent variable (the presence or absence of a HBSNF in a hospital) could also have also have influenced the study findings.

Given these limitations, there are a number of directions for future research regarding the relationship between hospitals with HBSNFs and various patient outcomes utilizing more detailed data about HBSNFs. Availability of details about HBSNFs such as their utilization and staffing could allow for a better evaluation of the role HBSNFs might play in the continuum of patient care. The processes related to care coordination among healthcare providers and patients' transition between acute and PAC settings could also be included in future studies. Assessing the care coordination processes may also assist in better evaluation of the association between presence of HBSNFs and improvement in measures of quality of care and patient satisfaction.

Several strategies such as value-based purchasing, bundled payments and accountable care organizations have been proposed and put into practice to hold providers accountable for all the care delivered to patients across the care continuum. Poor information exchange, communication and coordination of care have been identified as the major causes for poor patient outcomes such as avoidable readmissions. Therefore, the findings of this study could be used by healthcare organizations to evaluate their strategies related to their access to PAC services through either HBSNFs or FSSNFs operating in their market and the role it could play in improving patient outcomes. For instance, exploring strategies to improve information exchange processes between providers through a shared EHR platform might be a more effective strategy for hospitals to reduce readmission rates than owning a HBSNF. Similarly, policy makers could utilize

the findings of this study to evaluate the policies that promote and incentivize the vertical or horizontal integration between providers but may not lead to improvement in the care processes related to patients' transition between various healthcare settings and their quality of care.

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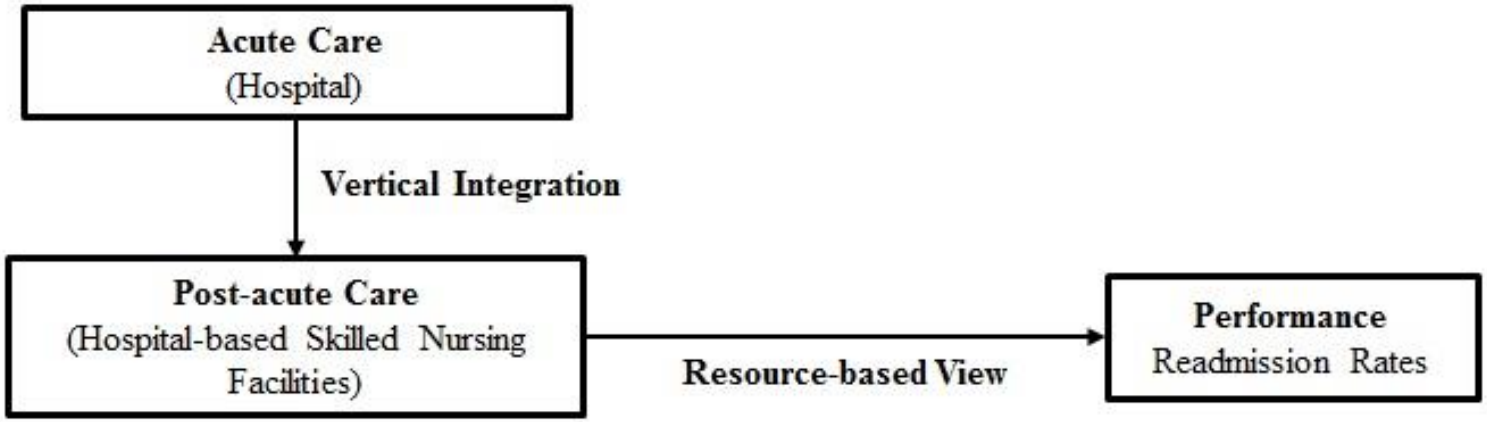

Figure1. Theoretical framework to study if hospitals with hospital-based skilled nursing facilities have lower readmission rates than hospitals without.

TABLE 1. Variables Used in the Study

Variable Name	Definition	Data Source
Dependent Variable		
Risk-adjusted Readmission Rates	Readmission for any cause to any acute care hospital within 30 days of discharge for patients who were initially hospitalized for AMI; Readmission for any cause to any acute care hospital within 30 days of discharge for patients who were initially hospitalized for CHF; Readmission for any cause to any acute care hospital within 30 days of discharge for patients who were initially hospitalized for pneumonia.	CMS Hospital Compare
Independent Variable		
Presence of HBSNF	presence of HBSNF in a hospital: 1 = yes; 0 = no	AHA, CMS Medicare cost reports
Control Variables		
Organizational Characteristics		
Hospital Size	Total number of beds setup or staffed beds in a hospital	AHA
Length of Stay (Medicare)	Medicare Inpatient Days / Medicare Discharges	AHA
Occupancy Rate	Total inpatient days x 100 / total number of staffed beds x 365	AHA
Percentage of Medicare Patients	(Total Medicare Inpatient Days / Total Inpatient Days) x 100	AHA
Percentage of Medicaid Patients	(Total Medicaid Inpatient Days / Total Inpatient Days) x 100	AHA
RN staffing	(Total Number of FTE RNs / Total Inpatient Days) x 1000	AHA
Market Characteristics		
Market Competition (HHI)	Sum of squares of individual hospital's market share in the HSA accounting for system affiliation. HHI values range from 0 to 1; 1 = monopolistic markets; values close to 0 = highly competitive markets.	AHA
Medicare Managed Care Penetration	(Medicare managed care enrollees / Medicare eligibles in the county) x 100	AHRF
SNF to hospital ratio	number of SNFs / number of hospitals in the county	AHRF
Medicare discharges per 1000 population	(Medicare discharges in the county / Total population) x 1000	AHRF
Poverty	Percent persons in poverty	AHRF
Unemployment Rate	Unemployment rate 16 years and above	AHRF

Abbreviations: HBSNF: Hospital-based Skilled Nursing Facility; AMI: Acute myocardial infarction; CHF: Congestive heart Failure; HHI: Herfindahl-Hirschman Index; SNF: Skilled nursing Facility; AHA: American Hospital Association Annual Survey; AHRF: Area Health Resource File: CMS: Centers for Medicare and Medicaid Statistics

TABLE 2. Descriptive Analysis of Variables	
Variable	**Means / Frequency**
Presence of HBSNF	24.19%
Hospital Size	178
Length of Stay (Medicare)	5.70
Occupancy Rate	55.58
Proportion of Medicare Patients	50.89%
Proportion of Medicaid Patients	18.85%
RN staffing per 1000 inpatient days	9.03
Log of RN staffing per 1000 inpatient days	1.95
Market Competition (HHI)	0.74
Medicare Managed Care Penetration	21.89
SNF to hospital ratio	1.74
Poverty	16.48%
Unemployment Rate	7.84
Medicare discharges per 1000 population	130.04
Log of Medicare discharges per 1000 population	3.02

HBSNF: Hospital-based Skilled Nursing Facility; HHI: Herfindahl-Hirschman Index; RN: Registered Nurses
N = 73,806 hospital-year observations (2006-2012)

TABLE 3. Bivariate Analysis of Variables (Means and Percentages)

Variable	Have HBSNFs (n = 17850)†	Do not have HBSNFs (n = 55956)†	p-value
Hospital size	207	169	0.001
Length of stay (Medicare)	7.48	5.14	0.001
Occupancy rate	62.13	53.50	0.001
Percentage of Medicare patients	44.28%	53%	0.001
Percentage of Medicaid patients	27.04%	16.24%	0.001
RN staffing	5.75	10.08	0.001
Market competition (HHI)	0.80	0.72	0.001
Medicare managed care penetration	21.71	21.95	0.053
SNF to hospital ratio	1.75	1.74	0.626
Poverty	16.18	16.57	0.001
Unemployment rate	7.85	7.83	0.415
Medicare discharges per 1000 population	154.1	122.4	0.001

HBSNFs: Hospital-based Skilled Nursing Facilities (lagged by one year); HHI: Herfindahl-Hirschman Index; RN: Registered nurses
*** $p \leq 0.01$, ** $p \leq 0.05$
†hospital-year observations (2006-2012)

TABLE 4. Ordinary Least Squares Regression Results with 30-Day Readmission Rates for AMI, CHF and Pneumonia as Dependent Variables

	AMI (n = 10484) †	CHF (n = 16980) †	Pneumonia (n = 17820) †
Variables	**Coefficient**	**Coefficient**	**Coefficient**
Independent Variable			
Presence of HBSNFs	-0.16***	-0.24***	-0.26***
Control Variables			
Organizational Factors			
Hospital Size	0.01	0.01	0.01***
Length of Stay (Medicare)	-0.01	-0.01	-0.01
Occupancy Rate	0.01***	0.01***	0.01***
Proportion of Medicare Patients	0.01***	0.01***	0.01***
Proportion of Medicaid Patients	0.01***	0.01***	0.01***
RN staffing	-0.04***	-0.04***	-0.03***
Market Factors			
Market Competition (HHI)	-0.05	-0.01	-0.08
Medicare Managed Care Penetration	-0.01***	-0.01***	-0.01***
SNF to hospital ratio	0.01	-0.02	0.01
Poverty	-0.01	0.02***	0.01***
Unemployment Rate	0.04***	0.06***	0.05***
Medicare discharges per 1000 population	0.01	0.01	0.01

*** $p \leq 0.01$, ** $p \leq 0.05$

†hospital-year observations (2006-2012)

TABLE 5. Panel Regression with Facility and Year Fixed Effects Results with 30-Day Readmission Rates for AMI, CHF and Pneumonia as Dependent Variables

	AMI (n = 10484) †	CHF (n = 16980) †	Pneumonia (n = 17820) †
Variables	**Coefficient**	**Coefficient**	**Coefficient**
Independent Variable			
Presence of HBSNF	0.04	0.39	0.01
Control Variables			
Organizational Factors			
Hospital Size	0.01	-0.01	0.001
Length of Stay (Medicare)	-0.02	-0.03***	-0.01**
Occupancy Rate	0.01*	0.01***	0.01
Proportion of Medicare Patients	0.01	0.01	0.01
Proportion of Medicaid Patients	-0.01	0.01	-0.01
RN staffing	-0.01	-0.01	-0.01*
Market Factors			
Market Competition (HHI)	-0.46	0.12	-0.10
Medicare Managed Care Penetration	0.09	0.02***	0.01**
SNF to hospital ratio	-0.03*	-0.05**	-0.01
Poverty	0.01	-0.04	-0.03
Unemployment Rate	0.22	0.08	0.26
Medicare discharges per 1000 population	0.01	0.01	0.01

*** $p \leq 0.01$, ** $p \leq 0.05$, *$p \leq 0.10$
†hospital-year observations (2006-2012)

ASSOCIATION BETWEEN STAFFING AND VARIATION IN QUALITY RATING OF HOSPITAL-BASED SKILLED NURSING FACILITIES

by

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ABSTRACT

Objective: This study examined the association of hospital-based skilled nursing facilities' (HBSNFs) staffing patterns with their health inspections and quality ratings using the resource-based view.

Data Sources: The data on all HBSNFs operating in the U.S. between the years 2008 and 2011 was derived from Nursing Home Compare, Online Survey Certification and Reporting (OSCAR), LTCFocus database and Area Health Resource File (AHRF).

Study Design: The dependent variables represent the health inspection ratings and the quality rating of HBSNFs. The independent variables were staffing intensity, staffing mix and full-time registered nurse staffing. The control variables include ownership, chain-affiliation, use of nurse practitioners and physician assistants, use of agency registered nurses, size, occupancy rate, case-mix index, percentage of minority residents, percentage of residents with Medicare as primary support, percentage of residents with Medicaid as primary support, competition, managed care penetration, older population, poverty and urban location. A logistic regression, with state and year fixed effects, was done with standard errors correcting for clustering at facility level to analyze the association between HBSNFs' staffing patterns and their quality ratings.

Principal Findings: The results show that HBSNFs with greater staffing mix had greater odds of having high quality as well as health inspection ratings. Higher staffing intensity in HBSNFs specifically in terms of higher license practical nurse hours per resident day was associated with high quality ratings. However, higher RN hours per resident lowered

the odds of a HBSNF having high quality rating, after adjusting for the RN skill mix. Full-time RN staffing did not have a significant relationship with either quality or health inspections ratings.

Conclusion: The study results show that greater staffing mix and higher staffing intensity in terms of higher LPN hours per resident day were associated with high quality ratings for HBSNFs.

INTRODUCTION

Historically, post-acute care (PAC) has been characterized by limited involvement of physicians and minimal interdisciplinary input (Kane, Chen, Blewet, & Sangl, 1996; Von Sternberg et al., 1997). The choice of post-acute care site has been based on either the hospitals' ownership of hospital-based SNFs (HBSNFs), contractual arrangements with other skilled nursing facilities (SNFs), or patient preferences such as distance from family (Dummit, 2011). Furthermore, there have been no established standards or evidence-based measures to evaluate the quality of care delivered by various PAC providers (Kolus, 2012; MedPAC, 2007). Consequently, the quality of post-acute care has been compromised by poor communication and coordination of care among providers during and after the patients' transition from acute to PAC settings (Castle & Ferguson, 2010; Grabowski, Feng, Hirth, Rahman, & Mor, 2013; Pesis-Katz, Phelps, Temkin-Greener, Spector, Veazie, & Mukamel, 2013).

Currently, there are four PAC settings that are reimbursed by Medicare and are available to patients after their acute care stay. These settings include skilled nursing facility (free-standing or hospital-based), home health agencies (HHA), inpatient rehabilitation facility (IRF), and long-term care hospitals (LTCHs) (Medicare Payment Advisory Commission, 2011). HBSNFs provide care to those patients who "need short-term skilled nursing or rehabilitation

services on an inpatient basis after a hospital stay of at least three days" (Dummit, 2011). With the increased emphasis on care coordination and implementation of measures such as bundled payments to hold providers accountable for services delivered to patients during an entire episode of care, hospitals will need to pay more attention to the quality of post-acute care received by their patients (Butcher, 2013). Since hospitals form the primary source of patient referrals for HBSNFs, the pressure on HBSNFs to demonstrate higher quality of care has been increasing. Furthermore, measures such as public reporting of the quality of care through websites, such as Nursing Home Compare (NHC), could influence patients' choice of PAC sites (Kolus, 2012). The NHC five-star quality rating system was introduced in the year 2008. The motive was to allow patients and their family members to easily understand the publicly reported quality measures (Centers for Medicare & Medicaid Services (CMS), 2012) and enable them to compare the quality of care delivered by different SNFs when making decisions related to PAC sites (Parenteau, 2009).

Recent studies on HBNSFs' quality of post-acute care have primarily focused on comparisons of the quality of care provided by HBSNFs versus free-standing SNFs (Blewett, Kane, & Finch 1995; MedPAC 2011; Michota, 1995; Shaughnessy, Schlenker, Brown, & Yslas, 1983; Stearns, Dalton, Holmes, & Seagrave, 2006). However, little attention has been paid to the within and between HBSNFs' variation in quality of care and the factors associated with this variation. Moreover, most of these studies were conducted in the 1980s and 1990s (Blewett et al., 1995; Michota, 1995; Shaughnessy et al., 1983), and the healthcare environment of these organizations has changed significantly after the implementation of the prospective payment system (PPS) in 1998.

Staffing levels have been shown to be associated with quality of care in a variety of healthcare settings (Aiken, Clarke, Sloane, Sochalski, & Siber, 2002; Castle, Engberg, & Liu, 2007; Everhart, Neff, Al-Amin, Nogle, & Weech-Maldonado, 2013; Hyer, Thomas, Branch, Harman, Johnson, & Weech-Maldonado, 2011; Kane, Shamliyan, Mueller, Duval, & Wilt, 2007; Konetzka, Stearns, & Park, 2008; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002; Schenelle et al., 2001; Tong, 2011; Weech-Maldonado, Meret-Hanke, Neff, & Mor, 2004). The relationship between staffing and nursing home quality has also been studied extensively (Castle, Engberg, & Liu, 2007; Hyer et al., 2011; Weech-Maldonado et al., 2004). Nevertheless, HBSNFs have mostly been excluded from the study samples since their patient population is considered to be different from that of the free-standing SNFs (; Castle, Engberg, & Liu, 2007; Hyer et al., 2011). As a result, no study to our knowledge has specifically delved into the relationship between HBSNF staffing and the variation in their five-star quality ratings.

The purpose of this paper is to evaluate the association between staffing patterns and the five-star quality ratings of HBSNFs, using the Resource-based View (RBV). RBV posits that a combination of unique resources leads to superior performance (Barney 1991). Given that staffing is a critical resource for healthcare organizations, this study could enhance administrators' and policy makers' understanding of the relationship between staffing and quality ratings of HBSNFs. The findings of this study could be used to craft staffing-related strategies and policy initiatives to reduce disparities in the quality of post-acute care, specifically among poorly performing HBSNFs.

LITERATURE REVIEW

NHC was first introduced in 2002 as part of the Nursing Home Quality Initiative (Werner et al., 2009) to improve the availability of information on quality of care for consumers. However, patients may find it difficult to interpret the measures of clinical quality reported on NHC on their own (Grabowski & Norton, 2012; Pesis-Katz et al., 2013). The NHC five-star quality rating was designed and implemented to address the concerns related to complexity of the information reported on NHC.

The five-star rating captures the information related to three measures of a SNF's quality of care: 1) health inspections or survey ratings (based on number, scope and severity of deficiencies identified from state health inspections), 2) quality ratings (based on 9 quality measures from MDS resident assessments) and 3) staffing (based on staffing levels of SNFs) (CMS, 2012). NHC displays the overall quality rating of a facility as well as the individual ratings for each of the three measures. The simplified quality ratings were expected to allow consumers (hospitals, patients and their families) to easily understand and compare the quality of care between different SNFs. This could enable consumers (patients, families, physicians, and hospitals) to make better informed decisions related to their choice of SNFs for post-acute care (Parenteau, 2009). Since SNFs compete with each other for patients and hospital referrals (Starkey, Weech-Maldonado & Mor, 2005), patients' enhanced ability to compare the SNFs' quality of care could in turn motivate providers to improve their quality.

Although staffing has been shown to be significantly associated with the quality of patient care, and public reporting of the five-star quality ratings could influence consumer's choice of HBSNFs as their post-acute care site (Werner et al., 2009), the association between staffing and the variation in HBSNFs' quality of care remains unclear. This paper addresses this gap by examining the association between staffing and the five-star quality rating of HBSNFs, specifically the health inspection and the quality ratings.

CONCEPTUAL FRAMEWORK

Resource-based view (RBV) seeks to explain the differences in performance of various organizations, operating in the same industry, on the basis of variation in their resources and capabilities (Short, Palmer & Ketchen, 2002). According to Barney (1991), a firm achieves competitive advantage and superior performance over other firms in the same industry when there is heterogeneity of resources among them and this heterogeneity is long lasting due to immobility of resources. Therefore, RBV seeks to explain the link between firm resources and firm performance (Barney, 1991). These resources include all "the assets, capabilities, organizational processes and routines, information and knowledge that are controlled by the firm" (Barney, 1991, p.101) and facilitate the development and implementation of value-creating strategies (Barney, 1991; Barney & Arikan, 2001; Daft, 1983).

Firm resources can be classified into three categories (Barney, 1991), namely physical capital resources (Williamson, 1975), human capital resources (Becker, 1964) and organizational capital resources (Tomer, 1987). Human capital resources include the

knowledge, skills, training, experience, judgment and insights of an organization's workforce. Organizational capabilities refer to the ability of an organization to coordinate these resources to develop unique competencies which would allow it to achieve superior performance (Hill & Jones, 1992; Hitt, Ireland, & Hoskisson, 1999).

RBV has been used extensively in healthcare research to study the association of a variety of factors with differences in organizational performance. For instance, in the nursing home literature, it has been used to study the association of staffing with nursing home performance (Weech-Maldonado et al., 2004), as well as to explain the differences in nursing home performance between competitive and less competitive markets on the basis of nurse staffing (Everhart et al., 2013). Similarly, RBV has been used to examine the effects of organizational characteristics of hospitals and their strategic group membership on their performance (Short et al., 2002), association between staffing levels and inpatient outcomes at military healthcare facilities (Yap, 2002), evidence-based facility design in healthcare (Zengul & O'Connor, 2013), and to study variation in research productivity of pharmaceutical firms (Henderson & Cockburn, 1994).

Several studies have found that nurse staffing patterns could significantly affect the quality of patient care (Castle, Engberg, & Liu, 2007; Everhart, Neff, Al-Amin, Nogle, & Weech-Maldonado, 2013; Hyer, et al., 2011; Konetzka, Stearns, & Park, 2008). This study explores similar relationship between HBSNFs' staffing and quality of care as indicated by their five-star quality rating. According to RBV, HBSNFs could achieve superior quality performance by

utilizing their human capital resources efficiently since they primarily cater to the patients needing higher levels of skilled nursing care. Therefore, HBSNFs with higher staffing intensity, greater staffing skill mix and higher proportion of full-time RNs would be expected to have higher five star quality ratings. The theoretical framework is shown in figure 1.

HYPOTHESES

The association of staffing with the variation in quality of care among HBSNFs could be explained on the basis of the heterogeneity of their resources (Barney, 1991) arising from distinct staffing patterns. In the context of HBSNFs, tacit knowledge is one of the critical resources that could lead to superior performance. Most of this knowledge in HBSNFs resides in their human capital in the form of training, experience and skills of their nurses, who provide majority of the care (Weech-Maldonado et al., 2004). Therefore, nurse staffing patterns could significantly influence HBSNFs' performance. Moreover, HBSNFs would need to develop capabilities that could allow them to effectively harness the skill and knowledge of their nursing staff (resources) to achieve superior performance in terms of higher quality of care. Development of these capabilities would require coordination between people, people and resources and resources and the environment (Grant, 1991). Therefore, differences in both the HBSNFs' resources as well as their capabilities could lead to the differences in their performance.

Organizational routines could be considered one of the organizational capabilities (Hitt & Ireland, 1985; Nelson & Winter, 1982) which allow HBSNFs to standardize care

processes, increase efficiency and improve coordination of care for their patients (Conrad & Shortell, 1996; Zingmond, 2002). For instance, stronger hospital-SNF linkages have been found to be associated with better patient outcomes (readmission rates). The authors attributed these results to the ease of communication, adoption of common clinical protocols and information exchange between the hospital and HBSNF staff (Rahman, Foster et al., 2013; Rahman, Zinn & Mor, 2013). Since organizational routines involve interaction and coordination between individuals (Grant, 1991), they could facilitate the development and adoption of such clinical protocols.

However, differences in skill levels of the nursing staff could influence their understanding of and adherence to these routines as well as the level of care available to patients by virtue of their clinical training (Horn, Buerhaus, Bergstrom, & Smout, 2005; Weech-Maldonado et al., 2004). For instance, BSN registered nurses have been associated with lower mortality and better patient outcomes (Aiken, 2014). Similarly, the type of job arrangement could influence their familiarity with the care processes. For instance, part-time staff may not be as familiar with facility practices and patient needs as the full-time nurses. Their decreased familiarity could lead to errors in patient care, affect the efficacy of organizational routines and interfere with continuity of patient care (Buchan & Secombe, 1995). Since knowledge of and adherence to standardized care processes could minimize errors, and facilitate better control of patient flow and coordination of services delivered at each point in the continuum of care, staffing patterns could significantly influence the HBSNFs quality of care. The association

between the measures of nurse staffing and quality rating of HBSNFs is discussed in the following sections.

Staffing Intensity

According to RBV, performance differentials between organizations occur due to heterogeneity of their resources, and the variation in their routines and capabilities resulting from different allocation of these resources to improve organizational performance (Barney, 1991; Grant, 1991). Similarly, among HBSNFs nurse staffing intensity may reflect the level of care needed by their patients. The nurse staffing intensity measures the actual time and effort expended by nursing staff on direct care of patients (Welton, Unruh, & Halloran 2006). Although all HBSNF patients tend to be more complex, individual patients may need more or less skilled nursing care at a given time (Welton, Unruh, & Halloran 2006). Since nursing staff deliver the majority of patient direct care (Weech-Maldonado et al., 2004), staffing intensity for both licensed (RNs and LPNs) and unlicensed staff (CNAs) could significantly influence the quality of patient care. Castle and Anderson (2011) also found that change more favorable staffing in terms of RNs, LPNs, and CNAs was generally associated with a change to better quality. Therefore, HBSNFs may need to organize their nursing hours in variety of unique combinations to meet the needs of their patient population and deliver higher quality of care. Therefore, we hypothesize that,

Hypothesis 1: HBSNFs with higher nurse staffing intensity will have higher star rating performance.

Staffing Mix

According to RBV, the type, amount and quality of resources could impose constraints on the range of routines an organization could develop and / or implement (Grant, 1991). RN staffing mix could place similar constraints on the range of common clinical protocols and the level of standardization of care processes that can be implemented to ensure high quality of care in HBSNFs. RN Staffing mix is defined as the proportion of RNs relative to the total nursing staff in a HBSNF and is a measure of the nursing staff's expertise (Weech-Maldonado et al., 2004). RNs undergo more extensive clinical training and learn greater problem-solving skills than other nurses. They also gain more experience (tacit knowledge) in a supervisory role while overseeing the care planning processes (Weech-Maldonado et al., 2004; Thomas et al., 2012).

Furthermore, HBSNF patients tend to have clinically complex health conditions and need more skilled nursing care (Thomas et al., 2012). RNs can utilize their educational training and clinical knowledge to cater to the needs of such complex patients. Although, some studies have shown that higher RN staff mix may be associated with lower quality outcomes, the potential reason could be that the those studies may have included the RNs who may have been strictly in administrative or supervisory role and were not involved in direct patient care as part of the RN staffing mix.

On the other hand, higher RN staffing mix could allow the RNs to allocate more time to supervisory activities and providing guidance to other nursing staff. They can then use their experience as care managers as well as participate in in

the decision making related to care planning and implementation of care coordination processes to improve the quality of post-acute care (Dellefield, Castle, McGilton, Spilsbury, 2015). Previous research has also shown that higher RN staffing mix is associated with better patient outcomes such as pressure ulcers and cognitive functioning (Weech-Maldonado et al., 2004) and lower numbers of total deficiencies and the quality of care deficiencies in nursing homes (Hyer et al., 2011; Kim, Harington, & Greene, 2009; Kim, Kovner, Harrington, Greene, & Mezey, 2009) which could be attributed to both their clinical knowledge and experience in supervisory roles. Therefore, we hypothesize,

Hypothesis 2: HBSNFs with higher RN staffing mix will have higher have higher star rating performance.

Full-Time RN Staffing

The organizational routines, knowledge and skills could be developed and sustained over time only through repetition and experience (economies of experience) (Grant, 1991). Full-time RNs, unlike part-time or agency registered nurses, may benefit from these economies of experience and acquire more tacit knowledge related to the organizational routines and patient needs. So, full-time RNs may perform better than part-time or contract RNs in their supervisory roles and direct patient care by virtue of their familiarity with the care processes and protocols of the facility (Weech-Maldonado et al., 2004). Moreover, full-time RNs are more likely to internalize the organizational goals and be involved in the decision making processes as compared to part-time or contract nurses (Weech-Maldonado et al., 2004). Consequently, full-time RNs may be

able to contribute more to the improvement of organizational routines and capabilities needed to deliver higher quality of care to their patients, since HBSNF patients tend to be medically complex and need higher levels of skilled nursing care. We hypothesize that,

Hypothesis 3: HBSNFs with higher full-time RN staffing will have higher star rating performance.

METHODS

Data

The data for this study was derived from Nursing Home Compare, Online Survey Certification and Reporting (OSCAR), Long-term care focus (LTCfocus) and Area Health Resource File (AHRF). Nursing Home Compare dataset includes information on quality of skilled nursing care on all Medicare and Medicaid-certified nursing homes (CMS, 2013). OSCAR database was used to obtain data on staffing of HBSNFs. OSCAR data is collected by surveyors during the inspection survey of SNFs for the Medicare and Medicaid certification (AHCA, 2010, OSCAR, n.d.) and is updated annually. LTCfocus was used to get the provider-level and county-level data on staffing, organizational and market characteristics of the HBSNFs (Long Term Care Focus, 2010). The AHRF data set contains county-level data on socio-economic and demographic characteristics of the markets in which the HBSNFs are located (HRSA, 2011). The study protocol was approved by the University of Alabama at Birmingham's Institutional Review Board (IRB) (Appendix A).

Study Sample

The study sample consisted of all HBSNFs operating in the U.S. between 2008 and 2011 (n = 4250 HBSNF-year observations).Cases more than five standard deviations from the mean for the staffing intensity variables (RN hours per resident day, LPN hours per resident day and CNA hours per resident day) and HBSNF size were excluded from the analysis (Weech-Maldonado et al., 2004) since most of these values seemed improbable. This reduced the analytic sample to 4116 HBSNF-year observations.

Measures

The operational definitions of the dependent, independent and control variables included in the analyses and sources of data are presented in Table 1.

Dependent variable. The dependent variable represents the quality of care delivered by HBSNFs as indicated by their quality ratings. The five-star quality rating has been used in multiple studies as a measure of quality of care among SNFs (Wagner, McDonald, & Castle, 2012; Williams, Straker, & Applebaum, 2014; Unroe et al., 2012). These ratings range from one to five stars with more stars indicating better quality (CMS, 2013). Since the data on the star ratings was available in a monthly format, it was annualized for consistency between all the datasets used for the analyses. For the purpose of this study, the ratings were annualized by taking the average of star ratings for each provider over a period of 12 months. A dichotomous dependent variable was then created from the average five-star ratings of HBSNFs for the health inspections and the quality measures respectively by combining the five stars to form two categories. The HBSNFs with one, two and three stars, representing average and below average quality of care

were assigned a value of 0 (low). The HBSNFs with four and five stars were assigned a value of 1 (high) and represented above average quality of care.

Health inspection ratings are based on the number, severity and scope of deficiencies identified by a team of state health inspectors during their three most recent comprehensive (annual) inspections of SNFs and revisits due to complaints. The health inspection assessments evaluate how well the SNFs are meeting the needs of their residents (Parenteau, 2009). The health inspections quality rating is based on relative performance of SNFs within a state due to differences in survey management, state licensure and Medicaid policy. The top 10 percent (lowest 10 percent in deficiency scores) receive five-stars, middle 70 percent receive two, three or four stars with equal number in each rating category and the bottom 20 percent receive a one-star rating (Centers for Medicare & Medicaid Services, 2012). The health inspections rating is the most heavily weighted component of the over-all star rating (CMS, 2012). The details of the process employed in the calculation of deficiency scores and the star ratings are described in detail in appendix B.

The quality ratings are created by combining the values on ten MDS quality measures derived from the clinical data reported by nursing homes. It included seven long-stay and three short-stay measures from 2009 to 2011 (Abt Associates, 2014). Since 2102, the measures include seven long-stay and two short stay measures (Appendix C) (CMS, 2013). Data from the three most recent quarters is used to calculate these ratings. The five-star rating is calculated on the basis of the summary quality measures score for each facility (Centers for

Medicare & Medicaid Services, 2012). The ten measures included in the five-star rating, the process employed to calculate the summary Quality measure scores and the thresholds for the five-star ratings is described in detail in appendix C (CMS, 2013).

Independent variables. The primary independent variables included staffing intensity, staffing mix and full-time RN staffing. Staffing intensity measures the number of nursing hours per resident day for RNs, LPNs and CNAs (hypothesis 1). Staffing mix is defined as the proportion of RNs relative to all the nursing staff employed by the HBSNFs (hypothesis 2). Full time RN staffing represents the proportion of full-time RNs relative to all RNs employed by the HBSNFs. (hypothesis 3).

Control variables. The analysis controlled for organizational and market factors that have been found to be associated with quality of care in SNFs (Castle, Engberg & Liu, 2007; Comondore et al., 2009; Grabowski et al., 2013; Harrington et al., 2010; Hyer et al., 2011; Starkey, Weech-Maldonado, & Mor, 2004; Weech-Maldonado et al., 2004). The organizational control variables included ownership status, chain-affiliation, size, presence of NPS and PAs, use of agency RNs, occupancy rate, case mix index, percentage of minority residents in the facility, and the percentage of residents whose primary support is Medicaid and Medicare respectively. The market factors included competition (HHI), Medicare managed care penetration, older population (65+ years) in the county, poverty and urban location.

Analysis

Descriptive analysis was conducted to analyze the distribution of variables. Bi-variate analysis was done to assess the differences in the organizational and market

characteristics between HBSNFs with high and low star ratings for health inspection and quality domains of the five-star quality rating system. The association between staffing and quality rating of HBSNFs was examined using the multivariate logistic regression with standard errors corrected for clustering at the HBSNF level. State fixed effects were used to control for the omitted variable bias resulting from unobserved, time-invariant characteristics which could influence the quality of care for all the HBSNFs in the state. The year fixed effects accounted for the time trends which could influence the HBSNFs' quality of care. All the independent and control variables were lagged by one year to address potential endogeneity between the dependent and independent variables. This accounts for the effect of the HBSNFs' staffing patterns on their quality of care, as indicated by their quality and health inspection ratings in the following year. The results were interpreted as highly significant for p-value ≤ 0.01, significant for p-value ≤ 0.05, and marginally significant for p-value ≤ 0.10. SAS 9.3 and STATA 13 were used to conduct the analyses.

RESULTS

Table 2 present the descriptive results. The analytic sample consisted of approximately 4116 HBSNF-year observations. The mean RN hours per resident day were 1.5, 1.2 LPN hours per resident day and 3.1 CNA hours per resident day. Furthermore, RNs, on average, formed more than a quarter (26.7%) of the staffing mix of the HBSNFs in the sample and 73.8% of all RNs were full-time employees. Approximately 12.2% of the HBSNFs in the sample were for-profit,

32.6% were affiliated with a chain, 23.3% had NPs and PAs and 8.8/% employed agency RNs. The mean number of beds for the HBSNFs in the sample was 57. Their average occupancy rate was 79.4%, case-mix index was 1.1 and minority residents formed 13.2% of their resident population. Moreover, 35.3% of the HBSNFs' residents had Medicaid as their primary support while 34.5% residents had Medicare. The mean HHI for the markets in which the HBSNFs in the sample operated was 0.3 and Medicare managed care penetration was 21.7%. On average, 15.9% of the population in the counties, in which the HBSNFs were located was 65 years and older while 16.3% of their population was in poverty. A majority of the HBSNFs in the sample (89.5%) were located in urban areas.

Table 3 presents the bivariate analysis of the organizational and market characteristics of HBSNFs that have high versus low health inspection ratings and quality ratings. The bi-variate analysis showed that there are statistically significant differences between the organizational and market characteristics of these HBSNFs. For instance, HBSNFs with high quality rating, on average, had lower staffing intensity i.e. lower RN (0.9), LPN (1.0) and CNA hours per resident day (2.9). These HBSNFs also had lower staffing mix (19.7) and employed lower percentage of full-time RNs (71.6%) than those with low quality ratings. Furthermore, there were fewer for-profit (9.3%) and chain affiliated (26.7%) HBSNFs among those with high quality ratings but they utilized more NPs and PAs (27.7%). These HBSNFs were on average larger (73 beds), had higher occupancy rate (84.8%) and lower case mix index (1.02) as compared to the HBSNFs with low quality rating.

Also, the HBSNFs with high quality ratings had fewer minority residents (11.8%), significantly higher percentage of residents with Medicaid as their primary support (56.5%) and lower percentage of residents with Medicare (17%). Furthermore, HBSNFs with high quality ratings were located in urban areas (84.2%) and in markets characterized by lower levels of competition (0.4) and higher percentage of older population (16.6%).

In case of the health inspection ratings (table 3), the HBSNFs with high ratings had higher staffing intensity i.e. higher RN (1.8), LPN (1.3) and CNA hours per resident day (3.3). These HBSNFs also had higher staffing mix (28.3) and lower percentage of agency RN staffing (7.6%) than those with low health inspection ratings. HBSNFs with high health inspection ratings, were on average smaller (45 beds) and had lower occupancy rate (77.7%). They had fewer minority residents (12.5%), lower percentage of residents with Medicaid as their primary support (32.01%) and significantly higher percentage of those with Medicare (44.2%). Furthermore, HBSNFs with high health inspection ratings were located in markets characterized by higher competition (0.3), lower percentage of older population (65+ years) (15.8%) and lower percentage of people in poverty (1.58%). Moreover, higher percentage of these HBNSFs were located in urban areas (90.7%).

Table 4 presents the results of the logistic regression in terms of both odds ratios (OR) as well as the marginal effects (ME). These results show that HBSNFs with higher staffing intensity, as measured by higher LPN hours per resident day, had higher odds of a high quality ratings (OR = 1.25; ME = 0.04, p = 0.021), but

the association between LPN hours per resident day and HBSNFs' health inspection ratings was only marginally significant (OR = 1.16; ME = 0.03, p = 0.089). On the other hand, HBNSFs with higher RN hours per resident day had higher odds of low quality rating (OR = 0.71; ME = -0.06, p = 0.003) while there was no statistically significant association between CNA hours per resident and the quality rating. Also, the RN hours per resident day and CNA hours per resident were not associated with HBSNFs' health inspection ratings. Therefore, hypothesis 1 was not fully supported. A higher percentage of RNs in the staffing mix had a marginally significant association with high quality ratings (OR = 1.01; ME = 0.01, p = 0.078), and was significantly associated with high health inspection ratings (OR = 1.02; ME = 0.01, p = 0.007) for HBSNFs. Hence, we failed to reject hypothesis 2. Full-time RN staffing did not have a significant association with either quality ratings or health inspection ratings. Therefore, hypothesis 3 was rejected.

Among the organizational control variables, larger HBSNFs had a marginally significant association with high quality rating (OR = 1.01; ME = 0.01, p = 0.066), but a highly significant association with low health inspection ratings (OR = 0.99; ME = -0.01, p = 0.001). Furthermore, HBSNFs with higher occupancy rates had higher odds of high quality ratings (OR = 1.01; ME =0.01, p = 0.015) as compared to those with lower occupancy rate while higher case mix index (OR = 0.08; ME = -0.43, p = 0.001) and higher percentage of residents with Medicare as their primary support (OR = 0.99; ME = -0.01, p = 0.040) were associated with low quality ratings. In case of health inspection ratings, for-profit HBSNFs had higher odds of a low rating (OR = 0.61; ME = -0.096, p = 0.021).

None of the market characteristics had a significant association with quality ratings. However, the HBSNFs located in counties with greater percentage of people in poverty had higher odds of low health inspection rating (OR = 0.95; ME = -0.10, p = 0.003) than the BBSNFs SNFs located in counties with more affluent people.

DISCUSSION

This paper examined the association between the staffing patterns in HBSNFs and their five-star quality rating, specifically focusing on their quality rating and health inspections rating. We hypothesized that HBSNFs with higher staffing intensity, greater staffing skill mix, and higher proportion of full-time RN staffing would have high quality ratings.

The study findings showed that HBSNFs with greater staffing mix had high quality rating as well as high health inspections rating. These findings are consistent with those of the previous studies focusing on the association between staffing and quality of care in different healthcare settings. For instance, higher RN staffing mix has been found to be associated with better patient outcomes such as pressure ulcers and cognitive functioning (Weech-Maldonado et al., 2004) and lower numbers of total deficiencies and the quality of care deficiencies in nursing homes (Hyer et al., 2011; Kim, Harington, & Greene, 2009; Kim, Kovner, Harrington, Greene, & Mezey, 2009).

Furthermore, findings of this study show that with higher staffing intensity in terms of more LPN hours per resident day was associated with high quality

ratings. LPNs are more involved in direct patient care in HBSNFs (Shaughnessy et al., 1983) and they could provide the skilled nursing care that the clinically complex patients may need by virtue of their extensive clinical training (Thomas et al., 2012; Weech-Maldonado et al., 2004) leading to high quality ratings. However, higher RN hours per resident day lowered the odds of the HBSNFs having a high quality rating, contrary to the study hypothesis. These results could be attributed to additional unobserved acuity-related factors that could be influencing the association between staffing intensity measures (RN and LPN hours per resident day) and HBSNFs' quality ratings even though we controlled for several organizational and market factors including case mix index for patient acuity in our analyses.

For instance, the staffing intensity measures may not capture the education level of the RNs. Aiken (2014) has demonstrated that RNs with a BS degree and higher education levels positively influence patient outcomes. Moreover, the data on RN hours per resident day may include those in supervisory and administrative roles and are not involved in the direct patient care. So, the variable may represent a higher number of RN hours per resident than it actually is and be influencing the results. Lastly, three short stay measures included in the calculation of NHC quality ratings may not be as sensitive to RN hours per day. Therefore, balancing the staffing intensity and staffing skill mix based on the needs of the patients receiving care in the facility at a given time might be one of the strategy to providing higher quality of care to the patients in HBSNFs and achieving high five-star ratings.

Among the control variables, larger HBSNFs and those with high occupancy rate were more likely to have high quality rating. Occupancy rate is an indicator of the

financial status of the facility (Comondore et al., 2009). Therefore, higher occupancy rate may reflect the availability of financial resources that could be utilized to improve the HBSNFs' quality of care leading to the high ratings. On the other hand, lower case mix index and lower percentage of residents with Medicare as their primary support was associated with high quality ratings among HBSNFs. Since, the patients in HBSNFs generally need higher levels of skilled care, lower case mix index may indicate lower patient acuity. Similarly, fewer residents with Medicare may be indicative of fewer high acuity patients and the lowered need for high intensity of care, since Medicare is the primary payer of the skilled nursing services delivered to the medically-complex, short-stay patients. Consequently, HBSNFs may be able to demonstrate higher quality of care with fewer resources as well as divert more resources towards quality improvement initiatives; thereby achieving high quality ratings.

In the case of health inspection ratings, for profit and larger HBSNFs were more likely to have a low rating. Research has shown that not-for-profit nursing homes deliver higher quality of post-acute care to the short-stay patients (Grabowski et al., 2013). The findings of this study reflect a similar relationship between the HBSNFs' health inspection ratings and their ownership status. Public reporting of quality would motivate both for-profit and not-for-profit facilities to improve the observable measures of their quality of care. However, only Not-for-profit HBSNFs are likely to invest in resources to meet their residents' needs related to the unobservable quality measures, given that their primary focus is not profit maximization (Comondore et al., 2009). Since, health inspection ratings

capture the evaluation of areas such as nursing home environment and resident needs, not-for-profit HBSNFs would be more likely to have high ratings.

Among the market characteristics, poverty had a significant association with the low health inspection ratings while none of the market characteristics of the HBSNFs were associated with their quality rating. Poverty represents one aspect of the socio-economic status of the people in a county. It could be indicative of limited availability of resources which could influence the HBSNFs' ability to deliver higher quality care to patients.

Historically, there may not have been strong financial incentives for hospitals to manage patients' care after an acute episode since they had cost-based reimbursement till 1983 and the PPS incentivized shorter lengths of stay more than post-acute care. However, the current changes in the reimbursement system such as Medicare's hospital readmission reduction program and the bundled payments for care improvement program are creating incentives for acute and post-acute care management. These changes essentially aim at holding hospitals accountable for the quality of acute and post-acute care delivered to the patients during an episode of illness.

Moreover, the introduction of NHC and five-star quality ratings, has enabled the hospitals as well as patients and their family members to compare the quality of post-acute care delivered by different SNFs. Since, hospitals are the primary source of their patient referrals, HBSNFs would need to focus on effectively utilizing their resources and developing processes and protocols which could allow them to demonstrate higher quality of post-acute care. Among the various factors that are associated with quality, staffing patterns have been found to significantly influence quality of care in a variety of

healthcare settings (Castle et al., 2007; Hyer et al, 2011; Thomas et al, 2012; Weech-Maldonado et al., 2004). Therefore, HBSNFs could explore strategies related to their staffing mix and intensity to achieve higher quality of care receive continual patient referrals from hospitals.

This study findings were influenced by several limitations. First, secondary data was used to examine the association between staffing and HBSNFs' five-star rating. Therefore, the scope of the study was limited to a short study period of three years and the variables that are available as part of the data For instance, additional research is needed to isolate the data on RNs involved in direct patient care from the ones in only supervisory roles to delve deeper into the results related to the association of RN hours per resident day and HBSNFs' quality ratings.

Secondly, OSCAR staffing measures are not audited and no mechanism to verify the accuracy of the data is currently available. Thirdly, the staffing data reported in Oscar includes information on the staffing levels of the facilities during the last two weeks. Fourth, the five-star ratings data was in a monthly format while AHRF, OSCAR and LTCfocus datasets were annual. In order to maintain the consistency between the datasets used for analyses, the average of each facility's five-star rating over a period of 12 months was used to create the dependent variable. Lastly, dichotomizing the dependent variable captured only the information related to the factors associated with high and low quality rating of HBSNFs. It did not include the detailed information in the analysis such as the movement of HBSNFs between the five rating categories and their progress from

low to high ratings. Exploring these associations using the categorical 5-star variable would be one of the several directions for future research.

Despite these limitations, the study findings indicate the need for further research on the association between the five-star ratings of HBSNFs and their staffing patterns utilizing more detailed data. The findings of this study suggested that staffing mix of HBSNFs and their LPN hours per resident day could influence their quality ratings. Availability of data on the short-stay measures included in the current quality measures as well as additional measures associated with post-acute care specific to HBSNFs could allow for an in-depth analysis of the effect of star-rating and public reporting on HBSNFs' quality of care. Similarly, data related to the processes employed by acute and post-acute care providers to maintain continuum of care for patients could help in studying the association of staffing patterns with the effectiveness of care processes in HBSNFs and other PAC settings. It would also assist in better evaluation of the association of processes and protocols with variation in quality among HBSNFs.

Findings of this study could allow hospital and HBSNF administrators to better understand the impact of staffing patterns on the quality of post-acute care and the role it could play in creating performance differentials as indicated by the quality ratings of the HBSNFs. Given the emphasis on public reporting of quality measures and the rating system, the study findings could be used by hospitals that own a HBSNF to formulate staffing-related strategies to improve their quality of post-acute care. Similarly, this study could help policy makers' in understanding the association between staffing and the quality ratings of PAC sites such as HBSNFs. This understanding would assist them in

crafting policies incentivizing staffing-related initiatives to minimize disparities in the quality of post-acute care, specifically among HBSNFs with low five-star quality ratings.

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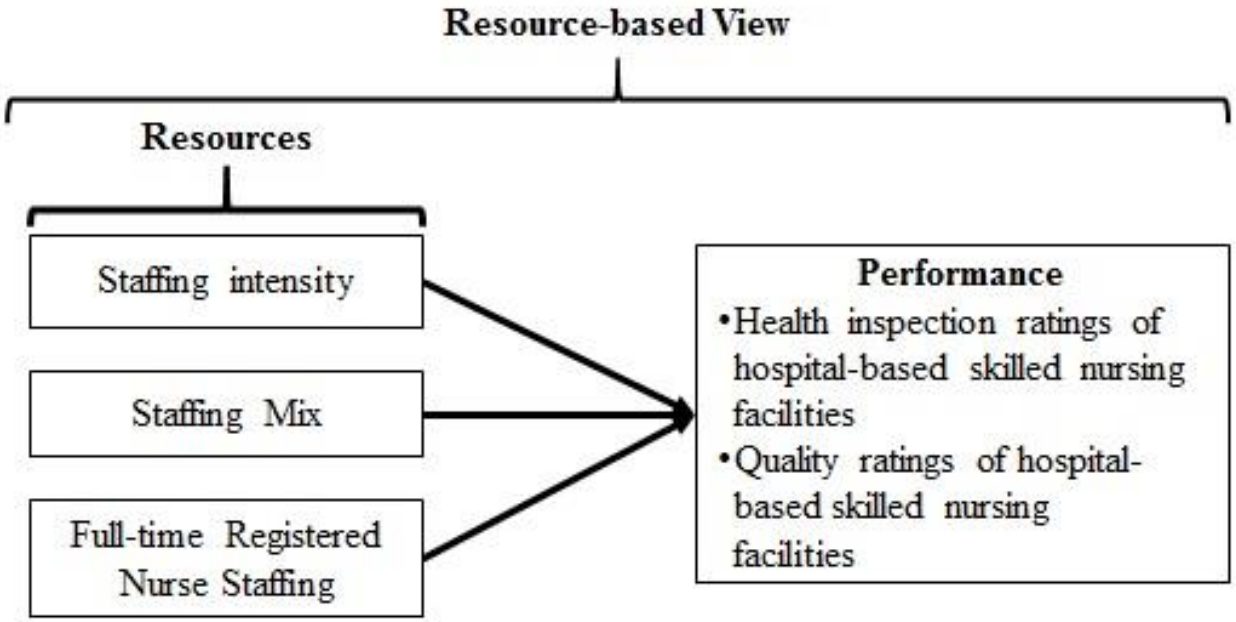

Figure 1. Theoretical framework to study the association between staffing and quality ratings of hospital-based skilled nursing facilities

TABLE 1. Variables used in the study

Variable Name	Definition	Data Source
Dependent Variable		
Quality Ratings	Dichotomous variable indicating if the HBSNFs had high (1) or low (0) health inspection (survey) ratings. Dichotomous variable indicating if the HBSNFs had high (1) or low (0) quality ratings.	Nursing Home Compare
Independent Variables		
Staffing Intensity	RN hours per resident day LPN hours per resident per day CNA hours per resident day	LTCfocus
Staffing Mix	Percentage of RN FTEs relative to total nurse staffing FTEs	OSCAR
Full-time RN staffing	Proportion of full-time RNs relative to all RNs employed by the HBSNFs	OSCAR
Control Variables		
Organizational Characteristics		
Ownership status	Dichotomous variable indicating if the HBSNF was for-profit (1 = Yes; 0 = No)	LTCfocus
Chain-affiliation	Dichotomous variable indicating if the HBSNF was part of a chain (1 = Yes; 0 = No)	LTCfocus
NPs /PAs	Dichotomous variable indicating whether or not the nursing facility has NPs or PAs (1 = Yes; 0 = No)	LTCfocus
Agency RNs	Dichotomous variable indicating whether or not the nursing facility employs agency RNs (1 = Yes; 0 = No)	OSCAR
Size	Total number of beds	LTCfocus
Occupancy Rate	Number of occupied beds in facility / total number of beds	LTCfocus
Case-mix Index	Measures the relative intensity of care of different nursing home populations for all residents admitted to the facility during the calendar year.	LTCfocus
% Minority	Proportion of minority residents (blacks, Hispanics, and others) admitted to the facility in the calendar year	LTCfocus
% White	Proportion of white residents admitted to the facility in the calendar year	LTCfocus
% Medicaid	Percentage of facility residents whose primary support is Medicaid	LTCfocus
% Medicare	Percentage of facility residents whose primary support is Medicare	LTCfocus

TABLE 1. Variables used in the study

Variable Name	Definition	Data Source
Market Characteristics		
Market Competition (HHI)	Sum of squares of SNFs market share in the county. HHI values ranged from 0 to 1; 1 indicating monopolistic markets and values close to 0 indicating highly competitive markets.	LTCfocus
Medicare Managed Care Penetration	The ratio of Medicare managed care enrollees over Medicare eligibles in the county multiplied by 100	AHRF
Older population	Percent of population 65 years and above (Ratio of population 65 years and older over census population multiplied by 100)	AHRF
Poverty	Percent population in poverty	
Geographic location	A dichotomous variable indicating if a HBSNF was located in an urban (1) or rural area (0)	AHRF

Abbreviations: HBSNF: Hospital-based Skilled Nursing Facility; HHI: Hirschman-Herfindahl index; AHRF: Area Health Resources File; LTCfocus: Long Term Care focus; RNs: Registered Nurses; LPNs: Licensed Practice Nurses; NPs: Nurse Practitioners; PAs: Physician Assistants; FTEs: Full-time equivalents

TABLE 2. Descriptive Analysis of Variables

Variable	Means / Frequencies
Staffing Intensity	
RN hours per resident day	1.49
LPN hours per resident day	1.21
CNA hours per resident day	3.10
Staffing mix	26.70%
Full-time RN staffing	73.80%
For-profit	12.18%
Chain-affiliation	32.59%
NPs/PAs	23.34%
Agency RN staffing	8.78%
Size (total beds)	57
Occupancy rate	79.40
Case mix index	1.08
Minority residents	13.18%
Residents with Medicaid as primary support	35.30%
Residents with Medicare as primary support	34.55%
Market Competition (HHI)	0.33
Medicare Managed Care Penetration	21.71%
Old population	15.88%
Poverty	16.28%
Urban location	89.82%

HBSNF: Hospital-based Skilled Nursing Facility; RNs: Registered Nurses; LPNs: Licensed Practice Nurses; NPs: Nurse Practitioners; PAs: Physician Assistants; HHI: Hirschman-Herfindahl index
N = 4,116 HBSNF-year observations (2008-2011)

TABLE 3. Bivariate Analysis of Variables (Means and Percentages)				
Variables	**Quality rating†**		**Health inspections rating†**	
	High	**Low**	**High**	**Low**
Staffing Intensity				
RN hours per resident day	0.85	1.67***	1.84	1.25***
LPN hours per resident day	1.00	1.26***	1.28	1.15***
CNA hours per resident day	2.87	3.16***	3.34	2.93***
Staffing mix	19.74	26.14***	28.29	22.19***
Full-time RN staffing	71.60	74.44***	73.99	73.66
For-profit	9.33	12.94***	11.32	12.69
Chain-affiliation	26.72	34.01***	32.88	32
NPs/PAs	27.68	21.92***	22.51	23.72
Agency RN staffing	8.75	8.79	7.61	9.63**
Size (total beds)	73	53***	44.46	66.13***
Occupancy rate	84.83	77.81***	77.69	80.59***
Case mix index	1.02	1.09***	1.09	1.07***
Minority residents	11.81	13.58***	12.49	13.66**
Residents with Medicaid as primary support	56.48	37.12***	32.01	48.11***
Residents with Medicare as primary support	17.02	39.68***	44.23	27.82***
Market Competition (HHI)	0.40	0.30***	0.28	0.36***
Medicare Managed Care Penetration	21.15	21.87	21.95	21.54
Old population	16.60	15.67***	15.72	16.99**
Poverty	16.11	16.33	15.82	16.60***
Urban location	84.23	90.99***	90.70	88.89**

Abbreviations: HBSNF: Hospital-based Skilled Nursing Facility; RNs: Registered Nurses; LPNs: Licensed Practice Nurses; NPs: Nurse Practitioners; PAs: Physician Assistants; HHI: Hirschman-Herfindahl index

*$p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

†N = 4116 hospital-year observations (2008-2011)

TABLE 4. Logistic Regression Results with Health Inspection Ratings and Quality Ratings for HBSNFs as Dependent Variables

	Quality ratings (n = 2186) †		Health Inspection ratings (n=2172) †	
Variables	**Odds Ratios**	**Margin**	**Odds Ratios**	**Margin**
Independent Variables				
Staffing Intensity				
RN hours per resident day	0.71***	-0.060***	1.038	0.007
LPN hours per resident day	1.25**	0.039**	1.155*	0.028*
CNA hours per resident day	1.07	0.012	1.052	0.010
Staffing mix	1.01*	0.002*	1.017***	0.003***
Full-time RN staffing	0.99	-0.0004	0.998	-0.0003
Control Variables				
Organizational Factors				
For-profit	1.41	0.059	0.606**	-0.096**
Chain-affiliation	0.83	-0.032	0.886	-0.023
NPs/PAs	1.13	0.021	0.927	-0.015
Agency RN staffing	0.92	-0.014	0.993	-0.002
Size (total beds)	1.01*	0.0005*	0.991***	-0.002***
Occupancy rate	1.01**	0.002**	1.005	0.001
Case mix index	0.08***	-0.432***	2.251	0.155
Minority residents	1.01	0.0002	1.001	0.0001
Residents with Medicaid as primary support	1.01	0.004	0.996	-0.001
Residents with Medicare as primary support	0.99**	- 0.001**	1.005	0.001

Market Factors				
Market Competition (HHI)	1.08	0.013	0.632	-0.088
Medicare Managed Care Penetration	0.99	-0.001	0.997	-0.001
Old population	0.98	-0.004	1.012	0.002
Poverty	0.99	-0.002	0.951***	-0.010***
Urban location	0.85	-0.023	0.840	-0.012

Abbreviations: HBSNFs: Hospital-based Skilled Nursing Facility; RNs: Registered Nurses; LPNs: Licensed Practice Nurses; NPs: Nurse Practitioners; PAs: Physician Assistants; HHI: Hirschman-Herfindahl index

*$p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

†hospital-year observations (2008-2011)

DISCUSSION AND CONCLUSIONS

This research examined three research questions related to the HBSNFs' closure after the implementation of PPS in 1998 and the role HBSNFs could play in the smooth trnasition of patients from hospital acute care to home or other post-acute care facilities and coordination of their care post-discharge from acute care setting. The following three research questions were answered in this study:

1) What organizational and market factors are associated with the closure of hospital-based skilled nursing facilities?
2) What is the association between the presence of hospital-based skilled nursing facilities and readmission rates of hospitals?
3) What is the association between the staffing patterns of hospital-based skilled nursing facilities and their quality ratings?

These research questions were important and interesting to examine given the increasing emphasis on provider accountability for the coordination of patient across the entire continuum of care which may range from acute to post-acute care and the transition between them. The findings of this dissertation will provide the hospital and SNF admisnitrators and policy makers insights into the variation in the response of healthcare organizations to environmental changes based on their organizational, market and staffing-related characteristics.

The main findings from examining the first research question show that hospitals with greater access to slack resources and lower competition for resources in their market were

less likely to close their HBSNFs. The main findings may be summarized as 1) Large, not-for-profit hospitals and those located in more concentrated markets had lower odds of closing their HBSNFs; (2) hospitals located in markets with greater Medicare managed care penetration had greater odds of closing their HBSNFs.

The findings from the ordinary least square regression conducted to examine the second research question showed that presence of HBSNFS was significantly associated overall variation the hospitals' readmission rates. But these finding were not reflected by the fixed effects regression. The main findings may be summarized as 1) ordinary least square regression show a significant, negative association between presence of HBSNFs and hospitals' readmission rates; (2) the results of the fixed effects regression did not show a similar association; (3) Shorter length of stay for Medicare patients and a higher proportion of SNFs to hospitals in the county were significantly associated with lower readmission rates.

The analysis of that third research question showed greater staffing mix and higher staffing intensity in terms of higher LPN hours per resident day were associated with high quality ratings for HBSNF. The main findings could be summarized as (1) HBSNFs with greater staffing mix had greater odds of having high quality as well as health inspection ratings; (2) Higher staffing intensity in HBSNFs specifically in terms of higher LPN hours per resident day was associated with high quality ratings. However, higher RN hours per resident lowered the odds of a HBSNF having high quality rating, after adjusting for the RN skill mix.

The findings of this study were presented in the following three papers: Organizational and market-level predictors of hospital-based skilled nursing facility

closures; Association between hospital-based skilled nursing facilities and hospitals' readmission rates; and Association between staffing and the variation in the quality ratings of hospital-based skilled nursing facilities.

The study had several strategic and policy-related implications specifically related to the coordination of patient care among healthcare providers. First, the study findings could be used by administrators to strategically respond to the changes in their environment based on their organizational and market factors. However, the study sample was restricted to the hospitals with an open HBSNF in 1998. So, these findings may not be equally applicable to all healthcare provider. Nevertheless, they could be used by hospital managers to evaluate the changes in their environment and to formulate potential strategic responses related to their sub-providers such as HBSNFs. Second, the study findings related to the role HBSNFs in lowering readmissions may be used with caution by providers, payers and policy makers as a starting point to evaluate their inter-organizational collaborations with HBSNFs and other PAC providers. The results of this study indicated that HBSNFs may have a role in coordination of patient care but it needs more in-depth exploration. Third, the findings allowed for a better understanding of the influence staffing mix could have on the HBSNFs' quality ratings. However, the findings related to the staffing intensity may need to be used carefully. So, the results could be utilized by providers to analyze the balance between staffing mix and staffing intensity as compared to the needs of their patients, since greater RN intensity may not always translate into better quality ratings and needs to be evaluated further.

One of the policies that may be considered is to incentivize development of improved care processes and exchange of information between providers since improving quality of

care may not always need vertical or horizontal integration. The second policy would be to formulate staffing-related initiatives focusing on finding ways of efficiently utilizing staffing mix with staffing intensity to improve the care processes related to the patient transition between healthcare settings and reducing disparities in the quality of post-acute care.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

DATE: 4/9/14

MEMORANDUM

TO: Shivani Gupta
Principal Investigator

FROM: Cari Oliver
Assistant Director
Institutional Review Board for Human Use (IRB)

RE: Request for Determination—Human Subjects Research
IRB Protocol #N140319003 – Hospital-Based Skilled Nursing Facilities (SNFs): Predictors of Survival & Performance

A member of the Office of the IRB has reviewed your Application for Not Human Subjects Research Designation for above referenced proposal.

The reviewer has determined that this proposal is **not** subject to FDA regulations and is **not** Human Subjects Research. Note that any changes to the project should be resubmitted to the Office of the IRB for determination.

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APPENDIX B

HEALTH INSPECTIONS FIVE-STAR RATINGS

Health Inspection Five-Star Ratings

Nursing homes that participate in the Medicare or Medicaid programs have an onsite standard ("comprehensive") survey annually *on average*, with very rarely more than fifteen months elapsing between surveys for any one particular nursing home. Surveys are unannounced and are conducted by a team of health care professionals. State survey teams spend several days in the nursing home to assess whether the nursing home is in compliance with federal requirements. Certification surveys provide a comprehensive assessment of the nursing home, including assessment of such areas as medication management, proper skin care, assessment of resident needs, nursing home administration, environment, kitchen/food services, and resident rights and quality of life. Based on the most recent three standard surveys for each nursing home, results from any complaint investigations during the most recent three-year period, and any repeat revisits needed to verify that required corrections have brought the facility back into compliance, CMS‟ Five-Star quality rating system employs more than 200,000 records for the health inspection domain alone.

Scoring Rules

A health inspection score is calculated based on points assigned to deficiencies identified in each active provider's current health inspection survey and the two prior surveys, as well as deficiency findings from the most recent three years of complaints information and survey revisits.

Health Inspection Results: Points are assigned to individual health deficiencies according to their scope and severity – more points are assigned for more serious, widespread deficiencies, and fewer points for less serious, isolated deficiencies (see Table 1). If the deficiency generates a finding of substandard quality of care, additional points are assigned. If the status of the deficiency is "past non-compliance" and the severity is "immediate jeopardy" (i.e. „J‟, „K‟ or „L‟-level), then points associated with a „G‟ level deficiency are assigned. Deficiencies from Life Safety surveys are not included in calculations for the Five-Star rating. Deficiencies from Federal Comparative surveys are not reported on *Nursing Home Compare* or included in *Five-star* calculations either.

Repeat Revisits - Number of repeat revisits required to confirm that correction of deficiencies have restored compliance: No points are assigned for the first revisit; points are assigned only for the second, third, and fourth revisits and are proportional to the health inspection score (Table 2). If a provider fails to correct deficiencies by the time of the first revisit, then these additional revisit points are assigned up to 85 percent of the health inspection score for the fourth revisit. CMS experience is that providers that fail to demonstrate restored compliance with safety and quality of care requirements during the

first revisit have lower quality of care than other nursing homes. More revisits are associated with more serious quality problems.

We calculate a total health inspection score for facilities based on their weighted deficiencies and number of repeat revisits needed. Note that a lower survey score corresponds to fewer deficiencies and revisits, and thus better performance on the health inspection domain. In calculating the total domain score, more recent surveys are weighted more heavily than earlier surveys; the most recent period (cycle 1) is assigned a weighting factor of 1/2, the previous period (cycle 2) has a weighting factor of 1/3, and the second prior survey (cycle 3) has a weighting factor of 1/6. The weighted time period scores are then summed to create the survey score for each facility.

Complaint surveys are assigned to a time period based on the calendar year in which the complaint survey occurred. Complaint surveys that occurred within the most recent 12 months receive a weighting factor of 1/2, those from 13-24 months ago have a weighting factor of 1/3, and those from 25-36 months ago have a weighting factor of 1/6. There are some deficiencies that appear on both standard and complaint surveys. To avoid potential double-counting, deficiencies that appear on complaint surveys that are conducted within 15 days of a standard survey (either prior to or after the standard survey) are counted only once. If the scope or severity differs on the two surveys, the highest scope-severity combination is used. Points from complaint deficiencies from a given period are added to the health inspection score before calculating revisit points, if applicable.

For facilities missing data for one period, the health inspection score is determined based on the periods for which data are available, using the same relative weights, with the missing (third) survey weight distributed proportionately to the existing two surveys. Specifically, when there are only two standard health surveys, the most recent receives 60 percent weight and the prior receives 40 percent weight. Facilities with only one standard health inspection are considered not to have sufficient data to determine a health inspection rating and are set to missing for the health inspection domain. For these facilities, no composite rating is assigned and no ratings are reported for the staffing or QM domains even if these ratings are available.

Table 1

Health Inspection Score: Weights for Different Types of Deficiencies Severity	**Scope**		
Isolated	**Pattern**		**Widespread**
Immediate jeopardy to resident health or safety	**J** 50 points* (75 points)	**K** 100 points* (125 points)	**L** 150 points* (175 points)

Actual harm that is not immediate jeopardy	**G** 20 points	**H** 35 points (40 points)	**I** 45 points (50 points)
No actual harm with potential for more than minimal harm that is not immediate jeopardy	**D** 4 points	**E** 8 points	**F** 16 points (20 points)
No actual harm with potential for minimal harm	**A** 0 point	**B** 0 points	**C** 0 points

Note: Figures in parentheses indicate points for deficiencies that are for substandard quality of care.
Shaded cells denote deficiency scope/severity levels that constitute substandard quality of care if the requirement which is not met is one that falls under the following federal regulations: 42 CFR 483.13 resident behavior and nursing home practices; 42 CFR 483.15 quality of life; 42 CFR 483.25 quality of care.
* If the status of the deficiency is "past non-compliance" and the severity is Immediate Jeopardy, then points associated with a „G-level" deficiency (i.e. 20 points) are assigned.
Source: Centers for Medicare & Medicaid Services

Table 2

Weights for Repeat Revisits Revisit Number	**Noncompliance Points**
First	0
Second	50 percent of health inspection score
Third	70 percent of health inspection score
Fourth	85 percent of health inspection score

Note: The health inspection score includes points from deficiencies cited on either the standard annual survey or complaint surveys during a given survey cycle.

Rating Methodology

Health inspections are based on federal regulations, national interpretive guidance, and a federally-specified survey process. Federal staff train State surveyors and oversee State performance. The federal oversight includes quality checks based on a 5% sample of the State surveys, in which federal surveyors either accompany State surveyors or replicate the survey within 60 days of the State and then compare results. These control systems are designed to optimize consistency in the survey process. Nonetheless there remains some variation between States. Such variation derives from many factors, including:

Survey Management: Variation between States in the skill sets of surveyors, supervision of surveyors, and the survey processes;

State Licensure: State licensing laws set forth different expectations for nursing homes and affect the interaction between State enforcement and federal enforcement (for example, a few States conduct many complaint investigations based on State licensure, and issue citations based on State licensure rather than on the federal regulations);

Medicaid Policy: Medicaid pays for the largest proportion of long term care in nursing homes. State nursing home eligibility rules, payment, and other policies in the State-administered Medicaid program create differences in both quality of care and enforcement of that quality.

For the above reasons, CMS‟ Five-Star quality ratings on the health inspection domain are based on the relative performance of facilities within a State. This approach helps to control for variation between States. Facility ratings are determined using these criteria:

- The top 10 percent (lowest 10 percent in terms of health inspection deficiency score) in each State receive a five-star rating.
- The middle 70 percent of facilities receive a rating of two, three, or four stars, with an equal number (approximately 23.33 percent) in each rating category.
- The bottom 20 percent receive a one-star rating.

This distribution is based on CMS experience and input from the Project's TEP. The cut points are re-calibrated each month so that the distribution of star ratings within States remains relatively constant over time in an effort to reduce the likelihood that the rating process affects the health inspection process. However, the rating for a given facility is held constant unless new health inspection data (for example, a new health inspection survey, new complaint information or a 2nd, 3rd or 4th revisit) become available. Thus, a facility's rating will not change from month to month without new survey information from the facility, regardless of changes in the State wide distribution due to new surveys in other facilities.

In the rare case that a State or territory has fewer than 5 facilities upon which to generate the cut points, the national distribution is used. Cut points for the health inspection ratings are available in the companion document to this Technical Users‟ Guide: *Nursing Home Compare* – Five-star Quality Rating System: Technical Users‟ Guide – State-Level Cut Point Tables.

Source: Centers for Medicare & Medicaid Services (2012), Design for Nursing Home Compare Five Star Quality rating System: Technical User's Guide

APPENDIX C

QUALITY MEASURES FIVE-STAR RATINGS

Quality Measures Five-Star Ratings

Quality Measure Domain

A set of quality measures has been developed from Minimum Data Set (MDS)-based indicators to describe the quality of care provided in nursing homes. These measures address a broad range of functioning and health status in multiple care areas. The facility rating for the QM domain is based on performance on a subset of 9 (out of 18) of the QMs currently posted on Nursing Home Compare , and, as of July 2012, has been revised to accommodate the quality measures derived from MDS 3.0. The measures were selected based on their validity and reliability, the extent to which the measure is under the facility's control, statistical performance, and importance.

Long-Stay Residents:

- Percent of residents whose need for help with activities of daily living has increased
- Percent of high risk residents with pressure sores
- Percent of residents who have/had a catheter inserted and left in their bladder
- Percent of residents who were physically restrained
- Percent of residents with a urinary tract infection
- Percent of residents who self-report moderate to severe pain
- Percent of residents experiencing one or more falls with major injury

Short-stay residents:

- Percent of residents with pressure ulcers (sores) that are new or worsened
- Percent of residents who self-report moderate to severe pain

Table 6 contains more information on these measures. Values for three of the QMs (catheter, the long-stay pain measure, and short-stay pressure ulcers) are risk adjusted, using resident-level covariates that adjust for factors associated with differences in the score for the QM. For example, the catheter risk-adjustment model is based on an indicator of bowel incontinence or pressure sores on the prior assessment. The risk-adjusted QM score is adjusted for the specific risk for that QM in the nursing facility. The risk-adjustment methodology is described in more detail in the Quality Measure User's Manual available on the CMS website referenced in the last paragraph. It is important to note that the regression models used in the risk adjustment are NOT refit each time the QMs are updated. It is assumed that the relationships do not change, so the coefficients from the most recent "fitting" of the model are used along with the most recent QM data.
Ratings for the QM domain are calculated using the three most recent quarters for which data are available. This time period specification was selected to increase the number of

assessments available for calculating the QM rating, increasing the stability of estimates and reducing the amount of missing data. The adjusted three-quarter QM values for each of the 9 QMs used in the five-star algorithm are computed as follows:

QM3Quarter = [(QM Q1 * DQ1) + (QMQ2 * DQ2) + (QMQ3 * DQ3)]/ (DQ1 + DQ2 + DQ3)

Where QM Q1, QM Q2, and QM Q3 correspond to the adjusted QM values for the three most recent quarters and DQ1, DQ2, and DQ3 are the denominators (number of eligible residents for the particular QM) for the same three quarters.

Table 6

MDS-Based Quality Measures Measure	**Comments**
Long-Stay Measures:	
Percent of residents whose need for help with daily activities has increased1	This measure reports the percent of long-stay residents whose need for help with late-loss Activities of Daily Living (ADLs) has increased when compared to the prior assessment. This is a change measure that reflects worsening performance on at least 2 late loss ADLs by one functional level or on one late loss ADL by more than one functional level compared to the prior assessment. The late loss ADLs are bed mobility, transfer, eating, and toileting. Maintenance of ADLs is related to an environment in which the resident is up and out of bed and engaged in activities. The CMS Staffing Study found that higher staffing levels were associated with lower rates of increasing dependence in activities of daily living.
Percent of high-risk residents with pressure ulcers	This measure captures the percentage of long-stay, high-risk residents with Stage II-IV pressure ulcers**.** High-risk residents for pressure sores are those who are impaired in bed mobility or transfer, who are comatose, or who suffer from malnutrition. The QM Validation Study identified a number of nursing home care practices that were associated with lower pressure sore prevalence rates including more frequent scheduling of assessments for suspicious skin areas, observations on the environmental assessment of residents, and care practices related to how the nursing home manages clinical, psychosocial, and nutritional complications.

Percent of residents who have/had a catheter inserted and left in their bladder	This measure reports the percentage of residents who have had an indwelling catheter in the last 7 days. Indwelling catheter use may result in complications, like urinary tract or blood infections, physical injury, skin problems, bladder stones, or blood in the urine.
Percent of residents who were physically restrained	This measure reports the percent of long-stay nursing facility residents who are physically restrained on a daily basis. A resident who is restrained daily can become weak, lose his or her ability to go to the bathroom without help, and develop pressure sores or other medical complications.
Percent of residents with a urinary tract infection	This measure reports the percent of long-stay nursing facility residents who have had a urinary tract infection within the past 30 days. Urinary tract infections can often be prevented through hygiene and drinking enough fluid. Urinary tract infections are relatively minor but can lead to more serious problems and cause complications like delirium if not treated.
Percent of residents who self-report moderate to severe pain	This measure captures the percent of long-stay residents who report either (1) almost constant or frequent moderate to severe pain in the last 5 days or (2) any very severe/horrible in the last 5 days.
Percent of residents experiencing one or more falls with major injury	This measure reports the percent of residents who experiences one or more falls with major injury (e.g., bone fractures, joint dislocations, closed head injuries with altered consciousness, or subdural hematoma) in the last year (12-month period)
Short-Stay Measures	
Percent of residents with pressure ulcers that are new or worsened	This measure captures the percentage of short-stay residents with new or worsening State II-IV pressure ulcers.
Percent of residents who self-report moderate to severe pain	This measure captures the percent of short stay residents, with at least one episode of moderate/severe pain or horrible/excruciating pain of any frequency, in the last 5 days.
1Indicates ADL QM as referenced in scoring rules Sources: Based on information from the AHRQ Measures Clearinghouse and the NHVBP Draft Design Report and the MDS 3.0 Quality Measures User's Manual.	

Scoring Rules

Consistent with the specifications used for *Nursing Home Compare*, long-stay measures are included in the score if the measure can be calculated for at least 30 assessments (summed across three quarters of data to enhance measurement stability). Short-stay measures are included in the score only if data are available for at least 20 assessments.

For each measure, 1 to 100 points are assigned based on facility performance, with the points determined in the following way. Facilities achieving the best possible score on the QM (i.e. 0 % of residents triggering the QM) are assigned 100 points. The remaining facilities are assigned 1 to 99 points, based on national percentiles of the QM distribution for providers with values greater than 0%, with facilities in the poorest 1% receiving 1 point and facilities in the top 1% (of those with a non-zero value) scoring 99 points. All of the 9 QMs are given equal weight. The points are summed across all QMs to create a total score for each facility. Note that the total possible score ranges between 9 and 900 points.

Note that the percentiles are based on the national distribution for all of the QMs except for the ADL measure. For the ADL measure, deciles are set on a State -specific basis using the State distribution, with facilities assigned points in 10-point increments, based on their decile of performance, with 10 points assigned to the poorest performing decile and 100 points assigned to the top-performing decile, which includes facilities with 0% of residents showing ADL decline. The ADL measure is based on the within-State distribution because this measure appears to be more affected by case-mix variation, particularly influenced by differences in State Medicaid policies governing long term care.

Cut points for the QMs were set based on the QM distributions averaged across the second, third and fourth quarter of 2011 and will be maintained for a period of at least two years, after which CMS will review this decision. Note that the cut points are determined prior to any imputation for missing data (see discussion below). Also, the State-specific cut points for the ADL QMs are created for State s/territories that have at least 5 facilities with a non-imputed value for that QM. In the rare case a State does not satisfy this criterion, the national distribution for that QM is used to set the cut points for that State. The cut points for the QMs are shown in the Appendix (Tables A3-A12).

Missing Data and Imputation

Some facilities have missing data for one or more QM, usually because of an insufficient number of residents available for calculating the QM. Missing values are imputed based on the statewide average for the measure. The imputation strategy for these missing values depends on the pattern of missing data.

For facilities that have data for at least four of the seven long-stay QMs, missing values are imputed based on the statewide average for the measure. Points are then assigned according to the percentile-based cut points described above.

Because there are only two short-stay measures included in the rating, values are not imputed for the short-stay QMs.

The QM rating for facilities with data on three or fewer long-stay QMs is based on the short-stay measures only. Mean values for the missing long-stay QMs are not imputed.

Similarly, the QM rating for facilities with data on zero or one short-stay QM is based on the long-stay measures only. Mean values for the missing short-stay QMs are not imputed.

Based on these rules, after imputation, facilities that receive a QM rating are in one of three categories:

- They have points for all of the QMs.
- They have points for only the 7 long-stay QMs (long-stay facilities).
- They have points for only the 2 short-stay QMs (short-stay facilities)
- No values are imputed for nursing homes with data on fewer than 4 long-stay QMs and fewer than 2 short-stay QMs. No QM rating is generated for these nursing homes.
- So that all facilities are scored on the same 900 point scale, points are rescaled for long and short-stay facilities:
- If the facility has data for only the two short-stay measures (total of 200 possible points), its score is multiplied by 900/200.
- If the facility has data for only the seven long-stay measures (total of 700 possible points), its score is multiplied by 900/700.

For States or territories with a small number of facilities, it may be impossible to impute the State average for a particular QM for which a value would otherwise be imputed, because all the facilities in that State or territory are missing values for that QM. For example, a facility in the Virgin Islands may have information on all of its QMs except for one. In this rare case, the points the facility earned for the 8 QMs it does report are summed, then divided by the total number of points (in this case, 800) the facility could have received for having those 8 QMs, and finally, multiplied by 900 points to calculate its adjusted number of points.

Rating Methodology

Once the summary QM score is computed for each facility as described above, the five-star QM rating is assigned, according to the point thresholds shown in Table 7. These thresholds were set so that the overall proportion of nursing homes in each rating category in July 2012 (when the QM rating based on MDS 3.0 is first reported) would be similar to what it was when the MDS 2.0 QM rating was frozen in March 2011. The cut points associated with these star ratings will be held constant for a period of at least two years, allowing the distribution of the QM rating to change over time.

Table 7

Star Cut points for MDS Quality Measure Summary Score (updated July 2012) 1 star	**2 stars lower**	**2 stars upper**	**3 stars lower**	**3 stars upper**	**4 stars lower**	**4 stars upper**	**5 stars**
<355	356	435	436	507	508	615	>616

Source: Centers for Medicare & Medicaid Services (2012), Design for Nursing Home Compare Five Star Quality rating System: Technical User's Guide